B.V.Raju College

2023-24

3.4.3 Number of research papers published by faculty in the Journals as notified on UGC CARE list/SCOPUS during the year

S.No	Name of the author/s	Title of paper	Department of the teacher	Year of publication	ISSN number	Page Number
2	K Pavan Kumar	Sginificance of Spearman's Rank Correlation Coefficient	International Journal for Multidisciplinary Research (IJFMR)	Aug-23	2582-2160	1 to 4
1	Dr N Prudhvi Raju	The Impact of Mixed Solvents on Protonartion Equilibria of Mercaptosuccinic acid inEthylene Glycol-Water Media	Chemical Review and Letters	Aug-23	2645-4947	5 to 11
3	Kiran Bachina	Lead Zirconium Titanate Nanoceramics And The Impact of Sr Doping on their Electrical Characteristics	International Journal of Applied Science	Aug-23	2454-9940	12 to 21
4	V N V Radha Krishna Murty					
5	Kiran Bachina	Composite films made of Barium Ferrite Fibers and Poly (Vinylidene Fluoride) Have Intersting Magnetic	International Journal of Pure and Applied Science &	Aug-23	2229-6107	22 to 27
6	V N V Radha Krishna Murty					
7	D Radha Krishna	Application of Differntial Transform Method in Dependence of Pressure with Altitude	International Journal of Novel Research and	Aug-23	2456-4184	28 to 31
8	Y Kiran Kumar					
9	D Ravi Kumar	Numerical approach of First OrderDifferential Equations Arising in the Time constant of a Sensor	International Journal of Creative Thoughts (IJCRT)	Aug-23	2320-2882	32 to 35
10	D Satyanarayana	Transfiguring India Agrarian Warehousing Sector with Smart Engineering, Managerial & Environmental Approach	EasyChair Publications	Aug-23	10682	36 to 53
11	D Satyanarayana	BACK GROUND OF INDIAN TAX SYSTEM	International Journal of Scientific Research in Engineering and Management (IJSREM)	Aug-23	2582-3930	54 to 64
12	B V Satya Praksh	Taxation system in India - an Overview on GST	EasyChair Publications	Aug-23	10673	65 to 75
13	N D Someswara Rao	Evaluating the Effectiveness of Different Testing Methods for Spearmans Rank Correlation Coefficient Significance	International Journal of Science and Reseach (IJSR)	Aug-23	2319-7064	76 to 77
14	N D Someswara Rao	Cost Accounting and its Management	EasyChair Publications	Aug-23	10687	78 to 91
15	P Syamala Deepthi	Sole Proprietorship as a soul of Business	EasyChair Publications	Aug-23	10662	92 to 103

16	A Ashok Lakshmana Rao	Analytical Approach to Solving Volterra Integral Equations using the Adomian Decomposition Method	International Journal of Science and Reseach (IJSR)	Aug-23	2319-7064	104 to 106
17	K Eswara Prasad	Analysis of Acoustic Channel Characteristics in Shallow Water Based on Multipath Model	Springer Nature	Sep-23	.....	107 to 116
18	B S Sheshagiri Rao	Revolutionizing Healthcare: A In-Depth Exploration of Advanced Medical Devices and Eelctronic innovations	Journal of Emerging Technologies And Innovative Research (JETIR)	Oct-23	2349-5162	117-131
19	K Satyanaryana Raju	Advanced Forest Fire Alert System with Real-Time GPS Location Tracking	IEEE (ICACRS-2023) 2nd International Conference on Automation, Comupting and Renewable Systems	Dec-23	979- 8-3503 -4023-5	132 to 136
20	B S Sheshagiri Rao	Optimizing Indoor Air Quality: A Fuzzy Logic-Based Control System	IEEE (ICACRS-2023) 2nd International Conference on Automation, Comupting and Renewable Systems	Dec-23	979-8-3503 -4023-5	137-141
21	K Satyanaryana Raju	Design and Development of Dynamic Water Quality Monotering System for Aquaculture	IEEE(IDCIoT-2024)	Jan-24	.....	142-147
22	Dr. K Pavan Krishna	Excess Thermodynamic Parameters of Binary Liquid Mixtures of Dimethyl Malonte with Isomeric Xylenes at	Asian Journal of Chemistry	Mar-24	0970-7077	148-153
23	R L Satyanarayana					
24	KKJ Chakravarthi	Covid-19 Crisis: Exploring Challenges, Opportunities and Cautions	Open peer Review on Qeios	Apr-24	2632-3834	154-161
25	Dr. N Prudhvi Rajuj	Molecular Iodine Catlysed Synthasis ofTetrahydroazepines Frameworks via Silyl AZA-prins Cyclization	Heterocyclic Letters	Apr-24	2231-3087 2230-96	162-170
26	R L Satyanarayana					
27	D Ravi kumar					
28	Dr. K Pavan Krishna					

29	B Kirran	Synthesis, Characterization and evelution of antioxident, antimicrobial and drug likeness properties of indole containing 1,3,4-oxadiazoles	Synthesis, Characterization and evelution of antioxident, antimicrobial and drug likeness properties of indole containing 1,3,4-oxadiazoles	B Kirran	Department of Physics & Electronics	171-179
30	Ch Sartyanarayana	Machine Learning Techniques for Medical Leaf Prediction and Disease Indentification	Machine Learning Techniques for Medical Leaf Prediction and Disease Indentification	Ch Sartyanaray	Department of M	180-187
31	KKJ Chakravarthi	Toxicity Associated with Gold Nono Particles	Toxicity Associated with Gold Nono Particles	KKJ Chakravart	Department of Ph	188-194
32	Khadar Alisha Sheik	Disease Detection In Dental Patients Using Machine Learning Algorithems Through Image Analysis	Algorithems in Advanced Artifical Intelligence(ICAAAI-2023)	Jul-24	ISBN: 9781 032867984	195-202
33	Dr.V.Bhaskara Murthy, Mrs.K.Raja Rajeswari, Mrs.V.Srivallidevi, Mr.Y.Srinivasa Raju	A Retrospective Analysis of Precision Medicine outcomes in Patients with Advanced Cancer Reveals Improved Progression Free Survival Without Increased Health Care Costs.	Industrial Engineering Journal	July 2023	ISSN: 0970-2555	203-215
34	P Madhura Subhashini	Estimated Solutions of Intigral Equations Arising In Some Applications of Science and Engineering	International Journal for Multidisciplinary Research (IJFMR)	July/Aug 23	2582-2160	216-222
35	D.S.Priyadharshini	Appriximate Solutions of Volterra Intigral Equations Arising In Some Applications of Science and Engineering	International Journal for Multidisciplinary Research (IJFMR)	July/Aug 23	2582-2160	223-227
36	U Raju	Advantages of using Digital Media to Teach English	International Journal For Multidisciplinary Research (IJFMR)	Jan-Feb 2024	E-ISSN: 2582-2160	228-233
37	U Raju	SHAKESPEARE'S LITERARY CONTRIBUTION TO ENGLISH	Journal of Nonlinear Analysis and Optimization	VOLUME 15, ISSUE 1	ISSN: 1906-9685	234-238
38	V N.SWAMI PAMARTI					

39	T. Naga Satya Siva Sai Sri	Diasporic Identity in the Select Poems of Meena Alexander	International Journal of Scientific Research in Engineering and Management (IJSREM)	Sep-23	ISSN: 2582-3930	239-248
40	K Meenakshi	An Innovative Machine Learning Based Heart Disease Assessment System by Sequential Feature Selection Approoach	3 rd International Conference on Intelligent Technologies(CONIT 2023)	June 2023		249
41	G Ganga Bhavani	Collaborative Service Recommendations For Data sharing using Blockchain	International Journal of Research	July 2023	ISSN NO:2236-6124	250
42	B Naresh	Efficient Hostel Management System for Multiple Hostels in Academic Institutions	IJNRD	June 2023	ISSN: 2456-4184	251-255
43	G Chakradhara Rao					
44	B Naresh	Predicting Flood Impacts: Analyzing Flood Dataset using Machine Learning Algorithms	IRJET	July 2023	e-ISSN: 2395-0056	256-261
45	G Chakradhara Rao					
46	D.Satyanarayana	Study of Test Study Of Test For Significance Of Pearson's Correlation Coefficient	International Journal of Creative Research Thoughts (IJCRT)	July 2023	ISSN: 2320-2882	262-268

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Significance of Spearman's Rank Correlation Coefficient

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Abstract
In this paper we investigated the experiment of significance of spearman's rank correlation coefficient. It provided an in-depth judgment of dissimilar methods of testing for the significance of spearman's correlation coefficient. It was accomplished that each of the methods provided superior enough test for significance of correlation coefficients, which brings to rest the contrasting views that the SPSS does not provide a test for significance of correlation coefficient. The SPSS was recommended ahead of the t-distribution and z transformation due to its easy, robust, and wide applications. Researchers and academics were charged to expose their mentees to this great scientific discovery,

Keywords: Spearman's rank correlation coefficient, t-distrubution.

INRODUCTION

SPEARMAN'S CORRELATION

Before learning about Spearman's correlation it is important to understand Pearson's Correlation which is statistical measure of the strength of a linear relationship between paired data. Its calculation and subsequent significance testing of it requires the following data assumptions to hold.

Interval or ratio level;

- Linear related;
- Bivariate normally distributed.

If your data does not meet the above assumptions then use Spearman's rank correlation.

Monotonic function

To understand spearman' correlation it is necessary to know what a monotonic is. A monotonic function is one that either never increases or never decreases as its independent variable increases. The following graphs illustrate monotonic functions.

- Monotonically increasing – as the x variable increases the y variable never decreases;
- Monotonically decreases – as the x variable increases the y variable never increases;
- Not monotonic – as the x variable increases the y variable sometime decreases and sometimes increases.

Spearman's correlation coefficient

Spearman's correlation coefficient is a statistical measure of the strength of a monotonic relationship between paired data. In a sample it is denoted by r_s and is by design constrained as follows

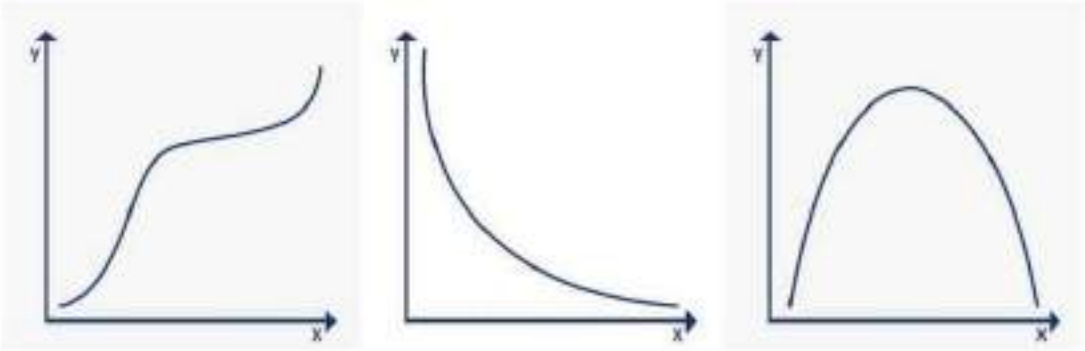
$$-1 \leq r_s \leq 1$$

And its interpretation is similar to that of Pearson's , e.g. the closer r_s is to ± 1 the stronger the monotonic relationship. Correlation is an effect size and so we can verbally describe the strength of the correlation using the following guide for the absolute value of r_s:

- .00-.19 "very weak"
- .20- .39 "weak"
- .40-0.59 " moderate"
- 0.60-0.79 " strong"
- 0.80- 1.0 "very strong"

The calculation of spearman's correlation coefficient and subsequent significance testing of its requires the following data assumptions to hold:

- Interval or ratio level or ordinal;
- Monotonically related.



Example 1: Calculation of rank correlation coefficient

physics	100	95	80	85	100	40	71	75	65	50
Statistics	80	90	85	95	100	50	90	40	60	65

Physics	Statistics	Rank(x)	Rank(y)	d=x-y	d^2
100	80	1.5	6	-4.5	20.25
95	90	3	3.5	-0.5	0.25
80	85	5	5	0	0
85	95	4	2	2	4
100	100	1.5	1	0.5	0.25
40	50	10	9	1	1
70	90	7	3.5	3.5	12.25
75	40	6	10	-4	16
65	60	8	8	0	0
50	65	9	7	2	4
					$\sum d^2 = 58$

$T_x = \frac{M(M^2-1)}{12} = 0.5$

$T_y = \frac{M(M^2-1)}{12} = 0.5$

$\rho = 1 - \frac{6(\sum d^2 + T_x + T_y)}{n(n^2-1)} = 0.6424$

Hence the strength of the correlation is ***Strong***

Example 2. Ten competitors in a debate contest are ranked by three judges in the following order .

Competitors	A	B	C	D	E	F	G	H	I	J
Ranks by 1st judge	6	5	1	10	2	3	4	9	8	7
Ranks by 2nd judge	5	8	3	4	7	10	2	6	1	9
Ranks by 3rd judge	4	8	6	9	3	2	1	10	7	5

Using the spearman's rank correlation method and state which pair of judges have the nearest approach.

Competitors	R_1	R_2	R_3	$D_1 = R_1 - R_2$	D_1^2	$D_2 = R_1 - R_3$	D_2^2	$D_3 = R_2 - R_3$	D_3^2
A	6	5	4	1	1	2	4	1	1
B	5	8	8	-3	9	-3	9	0	0
C	1	3	6	-2	4	-5	25	-3	9
D	10	4	9	6	36	1	1	-5	25
E	2	7	3	-5	25	-1	1	4	16
F	3	10	2	-7	49	1	1	8	64
G	4	2	1	2	4	3	9	1	1
H	9	6	10	3	9	-1	1	-4	16
I	8	1	7	7	49	1	1	-6	36
J	7	9	5	-2	4	2	4	4	16
					$\sum 190$		$\sum 56$		$\sum 184$

N=10

Rank correlation between judge 1 & 2

$r_{12} = 1 - \frac{6\sum D^2}{N(N^2-1)} = -0.1515$

Rank correlation between judge 1&3

$r_{13} = 1 - \frac{6\sum D^2}{N(N^2-1)} = 0.6606$

Rank correlation between judge 2&3

$r_{23} = 1 - \frac{6\sum D^2}{N(N^2-1)} = -0.1152$

As the rank correlation coefficient between judge 1 & judge 3 is highest , thus judge 1 and judge 3 has the nearest approach.

CONCLUSION

This paper has shown that the test of significance of rank correlation coefficients is very export in research because the degree of relationship alone is not sufficient to bring to a close that a computed correlation coefficient is adequate. It further exposed that one of the method of test of significance i.e t-distribution provided good sufficient test for significance of correlation coefficients.

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The Impact of Mixed Solvents on Protonation Equilibria of Mercaptosuccinic Acid in Ethylene Glycol – Water Media

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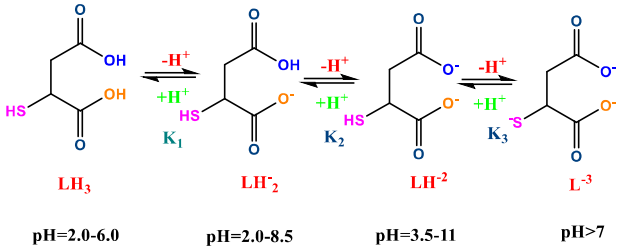
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dielectric constant

ABSTRACT

The protonation constants values of mercaptosuccinic acid were determined in ethylene glycol and water media (0-60% v/v) at 303.0 K at ionic strength of 0.16 M using pH metric technique. The protonation constants were calculated with the computer program MINIQUAD 75 and selection of the best fit chemical models were arrived based on the statistical parameters. the log K values were found to increase with increase of the organic solvent content. The linear variations of the protonation constants with the reciprocal of the dielectric constant of the medium have been attributed to the dominance of electrostatic forces. Distribution of species, protonation equilibria and effect of influential parameters on the protonation constants has also been reported.



Protonation deprotonation equilibria of Mercapto Succinic Acid

1.Introduction

The protonation constants of physiologically active ligands in various media will be informative. Identifying the pH range where the compounds ionise the least allows you to isolate a substance with maximum yield. Protonation of a newly formed molecule can reveal its structure. The proposed structure may be valid if theoretical protonation constants match experimental values. The protonation constants are needed to make pH buffers[1]. They are determined using conductometry, spectrophotometry, and potentiometry [2,3,4]. This method can also be used to calculate complex stability constants of physiologically active metal ligands[5]. Calculating ionised species concentrations at any pH requires knowledge of chemical equilibrium constants. 2-Sulfonylbutanedioic acid (2-Mercaptosuccinic acid or MSA) is a dicarboxylic acid differs from malic acid by having a thiol functional group (-SH group), as illustrated

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in Figure 1a [6]. Organic synthesis relies heavily on this important organic compound, which is used as a multifunctional intermediate. The two carboxyl groups allow MSA to act as a reducing agent, while the thiol derivative allows it to act as a capping agent[7]. Another feature of MSA is its use as a sulfur-containing ligand in pH-metric investigations of several binary and ternary metal complexes [8-17]. MSA works best at physiological pH. MSA has two carboxylic and one thiol functional groups. They are protonated thiol first, then two carboxylic groups.

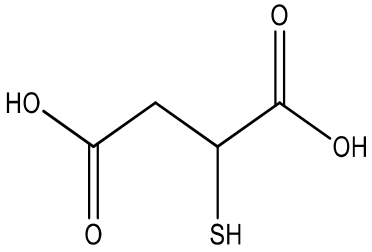


Figure - 1a. Structure of mercaptosuccinic acid

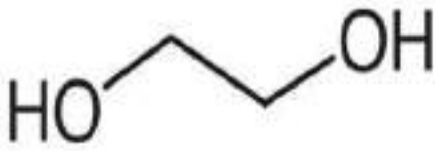


Figure 1b. Structure of ethyleneglycol

There is a wealth of information on bioligand protonation and stability constants[18-31]. But mixed solvent research could add to the body of knowledge on bioligand chemistry in water. Water-organic solvent mixtures are popular due of their versatility. Synthesis, titrations, and liquid chromatographic separations all use these solvent combinations. As proton carriers, solvent molecules are vital in chemical and biological reactions. Data on protonation constants will help us comprehend biology. So, studies in non-water media should help understand bioligand chemistry in living systems.

Aqueous solutions containing Ethylene glycol (EG), a binary mixture commonly used as a solvent in industries, were used to determine the protonation-deprotonation equilibrium of MSA pH-metrically. Enzyme and protein active site cavities can be studied using this type of research.

2.RESULTS AND DISCUSSION

2.1.Protonation Equilibria

Stepwise protonation constants and equilibrium numbers were estimated using secondary formation functions (typical number of protons bound to a mole of ligand). To calculate the protonation constants of a ligand, divide the number of equilibrium states by the number of half integrals in the pH range of interest. Three half integrals (0.5, 1.5, and 2.5) *vs* pH for MSA confirm three protonation–deprotonation equilibria. There are three protons bounded per one MSA molecule in the studied pH range as revealed from Figure 2. Figure 3 shows the presence of LH_3, LH_2^-, LH^{2-}, and L^{3-} for MSA using the best fit protonation constants from Table 1. The protonation – deprotonation equilibria of MSA in 0-60% v/v EG-Water mixture were developed and shown in Figure 4.

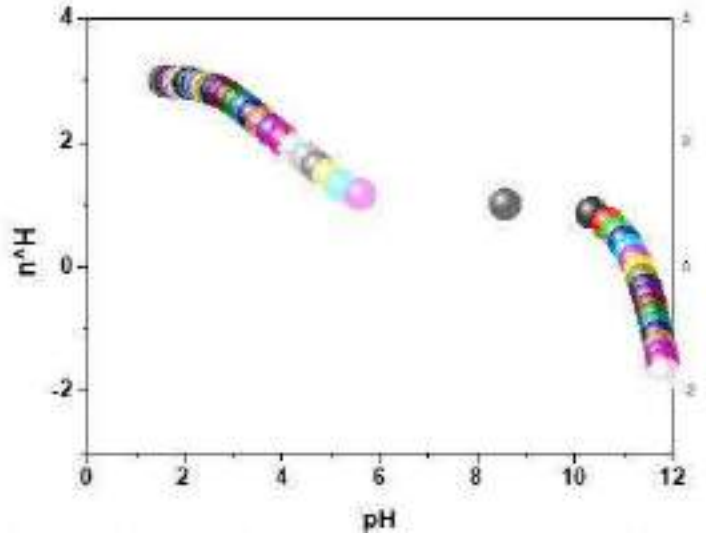


Figure 2. Formation function plots of MSA in 40.0% v/v EG-water mixture

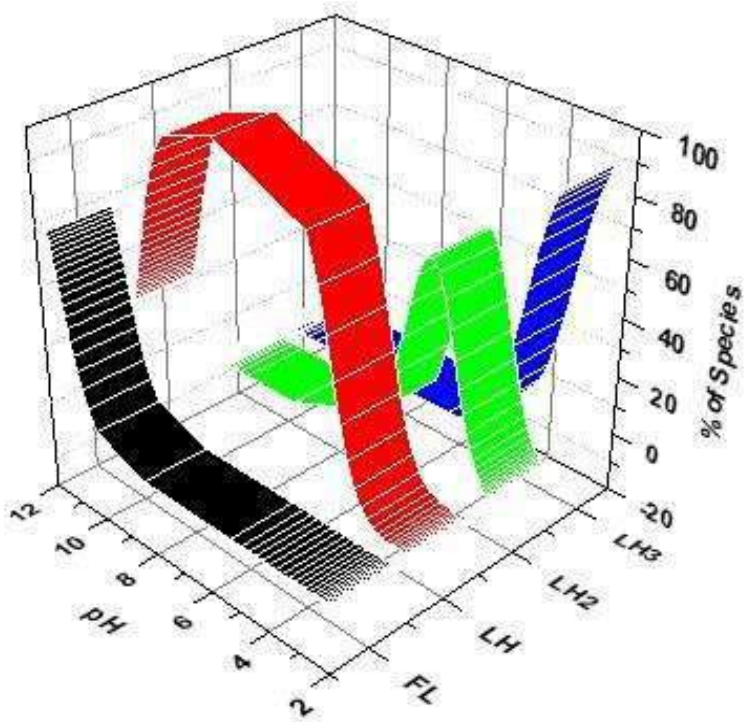


Figure 3. Distribution of diagram of protonated and deprotonated species for MSA in 40.0% v/v EG-water mixture

2.2.Effect of solvent

Equilibrium constants vary depending on the reaction media and must be considered. For acid-base equilibria, electrostatic and non-electrostatic effects are usually explored 38,39,40]. The solvent's structure, effect on protonation constants, and microscopic factors may account for protonation constant fluctuation. With organic solvent concentration, both electrostatic and non-electrostatic variables contribute to protonation constant deviation. Born's equation [41] states that electrostatic energy is inversely proportional to dielectric constant. Thus, the logarithm of stepwise protonation constants (log K) should be directly related to the reciprocal of the medium's dielectric constant. The log K values rise linearly with increasing of percentage of organic content in pure water [42,43,44,45]. Figure 5 show how electrostatic interactions dominate log K values in mixtures. Increasing solvent basicity (acidity) causes the linear increase. The variation in log K values with percentage of solvent for MSA have been calculated using the formula (Eq. 1) and results are tabulated in Table – 3.

$$\begin{aligned} \log K_1 &= \log \beta_3 - \log \beta_2 \\ \log K_2 &= \log \beta_2 - \log \beta_1 \\ \log K_3 &= \log \beta_1 \end{aligned} \qquad \text{------(1)}$$

Table 3. The variation of log K values of MSA in 0-60% v/v EG -Water mixtures

% of Solvent	log K_1	log K_2	log K_3
0	2.89	4.36	10.96
10	2.93	4.39	11.12
20	2.99	4.40	11.28
30	3.04	4.43	11.48
40	3.06	4.52	11.62
50	3.08	4.55	11.85
60	3.14	4.57	12.06

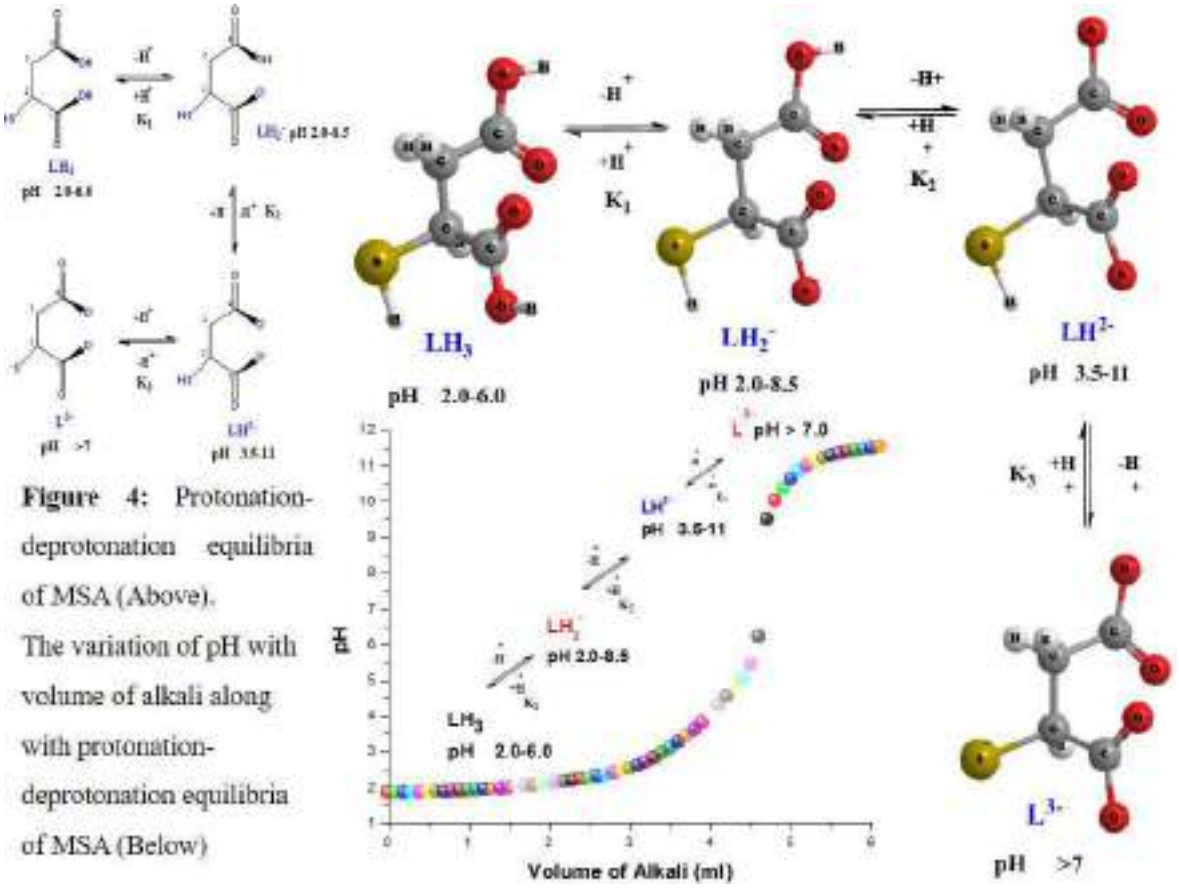


Figure 4: Protonation-deprotonation equilibria of MSA (Above). The variation of pH with volume of alkali along with protonation-deprotonation equilibria of MSA (Below)

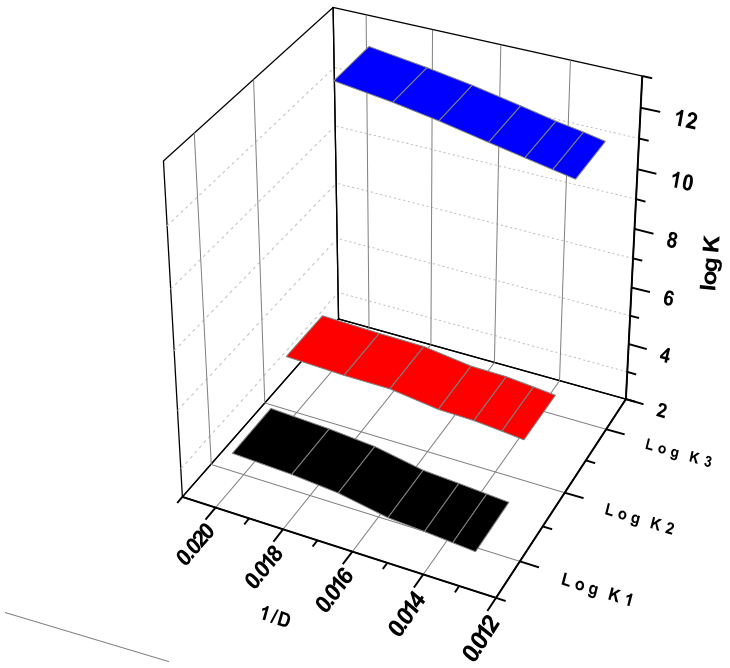


Figure 5. Variation of stepwise protonation constant (log K) of MSA with reciprocal of dielectric constant

3.Experimental

3.1.Preparation of experimental solutions and standardization

An aqueous solution of MSA (Merck India) of concentration 0.05 mol L^{-1} was prepared. In order to increase the solubility of the compound an acidic medium of 0.05M was maintained using HCl. We utilized Ethylene Glycol (Merck, India) as received. Standard approaches were used for preparation and standardization of all solutions. To identify any concentration determination mistakes, data were subjected to ANOVA[32]. These were calculated using the Gran plot approach[33,34].

3.2.Titrations arrangement

During each titration, the titrand was around 1mmol of HCl in 50ml. As for MSA, ranged from 0.25 to 0.50 mmols each. The pH of the resultant solution in aqueous media with organic solvent 0-60% (EG) was measured at 303K, using an Metrohm 877 titrino plus auto-titrator (readability 0.001) combined with pH electrode and a Teflon stirrer. To keep the ionic strength of 0.16 M, a 2M NaCl was used. It was necessary to perform periodic titrations of the strong acid and alkali to ensure that the glass electrode was completely equilibrated before proceeding with the experiment. The details of our laboratory's experimental procedure and titration assembly were taken from literature[35]

3.3.Best suited model

The protonation constants of MSA were calculated using the MINIQUAD75[36]. The Marquardt algorithm's dependable convergence resulted to the chemical model that suit best for each system studied[37]. Interactions between solutes and solvents helped us understand how stepwise constants changed over time. Best-fit models for MSA in EG-water mixtures are shown in Table 1. The experimental data are accurately represented by Ucorr (sum squares of variations at all experimental sites), corrected for degrees of freedom. Low mean, standard deviation, and mean deviation confirm near-zero residuals with limited dispersion.

An ideal normal distribution has three kurtosis and zero skewness. The study's kurtosis findings suggest the residuals are leptokurtic. Table-1 shows skewness values from -1.5 to 3.01. They show that residuals have a normal distribution, allowing for least squares. The low crystallographic R values also show the model's sufficiency. Thus, the best-fit model accurately depicts MSA acid-base equilibrium in EG-water.

Table 1. Model that suit best for protonation study of MSA in 0-60% EG -water mixture

%V/V EG	log β(SD)			NP	U_{Corr} X10^8	Skewness	Kurtosis	χ^2	R-Factor
	LH	LH_2	LH_3						
			In EG	pH Range – 1.5 – 11.00					
0.0	10.96(9)	15.32(9)	18.21(6)	120	0.6	0.16	7.39	29.69	0.0034
10	11.12(2)	15.51(5)	18.44(5)	114	0.71	-0.24	3.95	16.09	0.0024
20	11.28(2)	15.68(2)	18.67(2)	125	1.61	1.72	7.62	12.07	0.0061
30	11.48(2)	15.91(2)	18.95(3)	104	0.23	0.88	3.82	16.41	0.0022
40	11.62(2)	16.14(3)	19.20(4)	114	2.84	-0.89	3.04	12.85	0.0014
50	11.85(2)	16.40(4)	19.48(5)	128	1.94	-0.62	2.86	10.24	0.0018
60	12.06(7)	16.63(9)	19.77(1)	134	1.52	0.24	7.14	20.29	0.0024

Influence of methodical inaccuracies on refined data

Changes in alkali, mineral acid, or ligand concentration impact protonation constants. They can influence other aspects. MINIQUAD75 cannot quantify systematic errors in influential parameters, hence it cannot examine their influence on a protonation constant. With varying data acquisition accuracy and negative error in mineral acid, alkali, and ligand concentrations, the best-fit chemical model was determined.

Lesser deviations in component concentrations confirm the experimental circumstances, as seen in Table 2. The protonation constant (log K) values of the best chemical models should have a low standard deviation. Even with errors, higher protonation constant standard deviation causes rejection. It's vital because the data was obtained under varying experimental circumstances.

Table 2. Influence of errors on protonation constants of MSA in 40%v/v EG-water mixture

Ingredient	% of error	MSA in EG		
		log β_1 (SD)	log β_2 (SD)	log β_3 (SD)
Alkali	0	11.79(09)	16.14(09)	18.97(06)
	-5	11.61(17)	16.08(21)	18.71(09)
	-2	11.69(22)	16.11(31)	18.88(14)
	2	11.77(04)	16.16(08)	18.98(27)
	5	11.81(19)	16.21(14)	-
Acid	0	11.79(09)	16.14(09)	18.97(06)
	-5	11.72(11)	16.08(14)	-
	-2	11.75(21)	16.11(18)	18.94(11)
	2	11.80(09)	16.16(08)	18.99(27)
	5	11.84(17)	16.28(17)	19.08(15)
Ligand	0	11.79(09)	16.14(09)	18.97(06)
	-5	11.77(13)	16.11(18)	18.84(09)
	-2	11.75(16)	16.13(08)	18.92(16)
	2	11.80(08)	16.18(08)	18.99(07)
	5	11.81(07)	16.20(07)	19.03(14)

4.Conclusions

MSA has three dissociable protons exists in LH_3 form at low pH and gets deprotonated with the formation of LH_2, LH^{2-} and L^{3-} species, successively, with increase in pH. The linear variation of log values of stepwise protonation constants with decreasing dielectric constant of the media confirms the dominance of the electrostatic forces in the protonation-deprotonation equilibria of MSA.

Acknowledgements

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LEAD ZIRCONATE TITANATE NANOCERAMICS AND THE IMPACT OF SR DROPING ON THEIR ELECTRICAL CHARACTERISTICS

V N V RADHA KRISHNA MURTY[1] , KIRAN BACHINA [1]

ABSTRACT

Sol-gel synthesis was used to create Pb1-xSrxZr0.52Ti0.48O3 (PSZT) with x D = 0- 10% by mole. Crystals have both rhombohedral and tetragonal symmetry, as seen by the X-ray diffraction (XRD) patterns. Stacking in a lattice Strain, dielectric constant, and piezoelectric coefficient (d33) are all improved by the addition of Sr.PSZT's relaxation period increases from 106 (106 seconds) at 10 mol percent to 107 (107 seconds) at higher temperatures. A rise from 0.21 (0.05) to 0.26 (0.05) may be seen in the spreading factor. For materials at a 10% concentration, the coercive electric field was 15.97 kV/cm and the maximum residual electric polarization was 13.64 mC/cm2.

KEYWORDS:*Synonyms: PSZT, nanocrystalline, ferroelectric, piezoelectric*

Introduction

Lead zirconate titanate (PZT) is an example of a ceramic that contains ABO3. Due to the inclusion of lead zirconate (PbZrO3) and lead titanate (PbTiO3), this compound has both ferroelectric and anti-ferroelectric properties [1]. PZT's Para to ferroelectricity changes with temperature. For a variety of technological applications, its high Curie temperature (Tc) is a desirable quality. There is a lot of sensitivity in the crystal structure to the Zr/Ti ratio. Zr-rich PZT crystallizes into rhombohedra, whereas Ti-rich PZT crystallizes into tetragons

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The morphotropic phase boundary (MPB; Zr/Ti » 52/48; see also [2]) is the dividing line between the rhombohedra and piezoelectric properties, MPB has great potential as a technological material. Uses for the Zr/Ti « 52/48 composition range from sensors and actuators to non-volatile memory and transducers [3-5]. The final properties of PZT may be significantly impacted by both the atoms used to fill the Pb and Zr/Ti sites and the production procedure. Donor doping, acceptor doping, and isovalent doping are the three different substitution types that may occur when an element is doped. When the doped element has a negative charge relative to the host cation in hard PZT, oxygen vacancies form, leading to diminished electrical characteristics, an asymmetric hysteresis loop, and a robust coercive field [6, 7]. To make PZT more pliable, lead vacancies may be introduced by replacing the host metal with one that has a higher positive charge. This material is exceptional due to its small coercive field, high electrical conductivity, and symmetric hysteresis loop [8-12]. When the original action is substituted with an action that has the same charge as the host cation, however, charge neutrality is maintained. When lead is released into the air, oxygen levels drop temporarily [13, 14]. Sr content of strontium-substituted PZT has been investigated in a number of research [13-18].

The tiny size of strontium elongates the lattice [15]. Nasar et al. [16] looked at how adding strontium to PZT changed its atomic structure. The piezoelectricity of PZT is improved by adding strontium [17, 18].

Due to strontium's fluxing activity during sintering, it is possible to utilize isovalent sputtering to replace lead with strontium, which improves density and, by extension, electrical properties. In order to get tetragonal crystal phases. Due to its dielectric, ferroelectric, and

maximum conductivity, oxygen vacancy availability must be present. The way in which the dipole relaxation is affected by this replacement is intriguing.

Research into Sr-doped PZT has mostly focused on its electrical and piezoelectric properties because to the high level of interest in its physics and prospective applications.

Experimental

The sol-gel method was used to synthesis Pb1-xSrxZr0.52Ti0.48O3, with x D = 0-10 mole%. They made use of an alokoxide precursor. Precursors such acetyl acetone, zirconium (IV) isopropoxide, strontium (IV) acetate, nitric acid, and zirconium (IV) isopropoxide were helpful. The powder was claimed at 700 degrees Fahrenheit and took three hours. Using hydraulic pressure, the claimed powders and a binder (Poly vinyl alcohol (PVA)) were compressed into pellets 1 mm thick and 10 mm in diameter. During the three hours it was heated to 1100 degrees Celsius, it got sintered. The pellets are electroplated with a silver paste. Calcined powder samples were analyzed by X-ray diffraction (XRD) at a scan rate of 2°C per minute from 20°C to 70°C using CuKa radiation (D 1.5405A _). An N4L LCR meter (PSM 1735) was used to determine the dielectric constant. Between 35.0 and 450.0 degrees Celsius and 102.0 and 106.0 hertz, the dielectric constant was determined. While being poling (in silicon oil), the samples were subjected to many poling fields at a very high temperature (»1208C). We investigated the P-E hysteresis loop of Pb1-xSrx Zr0.52Ti0.48O3 (PSZT) pellets at room temperature using a state-of-the-art hysteresis device. A SINOCERA YE2730Ad33 meter was used

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to measure the ambient piezoelectric co-efficient (d33) of the poled pellet.

Results and Discussion

Pb1-xSrxZr0.52Ti0.48O3 powder X-ray diffraction patterns are shown in Figure 1 for x D = 0-10 mole%. The two closest matches to the observed peak are PDF No. 11-070-4060 and JSPDS No. b01-073-2022, both of which can be found in the ICDD database. The rhombohedral (R3m) and tetragonal (P4mm) symmetry indices of each peak have been determined. To calculate the FWHM of the XRD peak, a Gaussian fit was utilized. A average crystallite's size was calculated by

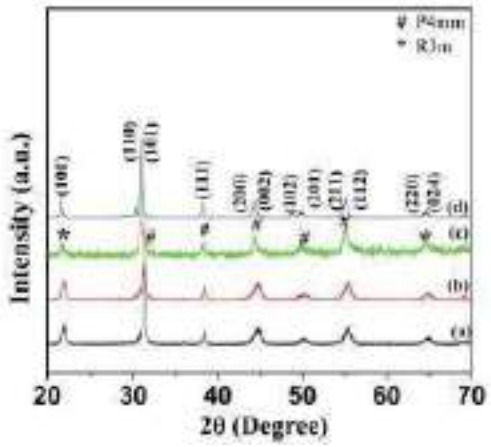


Figure 1. Pb1-xSrxZr0.52Ti0.48O3 X-ray diffraction (XRD) patterns, with (a) x D 0.02, (b) x D 0.04, (c) x D 0.06, and (d) x D 0.10.

The formula for Scherer is given in [19]. The crystals' performance was measured in nanometers. Smaller crystallites form when the Sr concentration is increased in the same synthetic environment (table 1). This is due to the fact that Sr has a smaller ionic radius (0.132 a _) than Pb (0.149 a _). The diffraction angle decreases with increasing strontium content. Table 1 shows that when Sr concentration rises, so does the lattice parameter.

Figure 2 is a scanning electron micrograph (SEM) of a pellet that was sintered at 1100_ C. Incorporating strontium into a material reduces the grain size and softens any rough edges. Micrometer- and nanometer-sized crystallites and grains are revealed by X-ray diffraction examination. That's why it's best to do experiments on polycrystalline samples.

Figure 3 shows the variation of the real part of the dielectric constant with temperature for Pb0.90Sr0.10Zr0.52Ti0.48O3. PZT materials are distinguished by their dielectric dispersion. The fall is sharp up to 1 kHz, flattens out beyond that, and then starts to reverse at extremely high frequencies. Ionic, orientation, space charge, and grain boundary polarizations may all contribute to a high dielectric constant at low frequencies. The effects of ionic and orientation polarizations are minimal at very high frequencies.

Table 1. Pb1-xSrx Zr0.52 Ti0.48O3 lattice parameters (a, b, c) for x D = 0.02, 0.04, 0.06, and 0.10. Inaccuracies are indicated with brackets.

	Rhombohedral	Tetragonal		
$Pb_{1-x}Sr_xZr_{0.52}Ti_{0.48}O_3$	a = b = c (nm)	a = b (nm)	c (nm)	Average crystallite size (nm)
x = 0.02	0.4096 (±0.0002)	0.4087 (±0.0001)	0.4093 (±0.0004)	33
x = 0.04	0.4076 (±0.0005)	0.4053 (±0.0003)	0.4076 (±0.0002)	30
x = 0.06	0.4047 (±0.0004)	0.4049 (±0.0007)	0.4054 (±0.0009)	23
x = 0.10	0.4035 (±0.0001)	0.4042 (±0.0002)	0.4050 (±0.0005)	20

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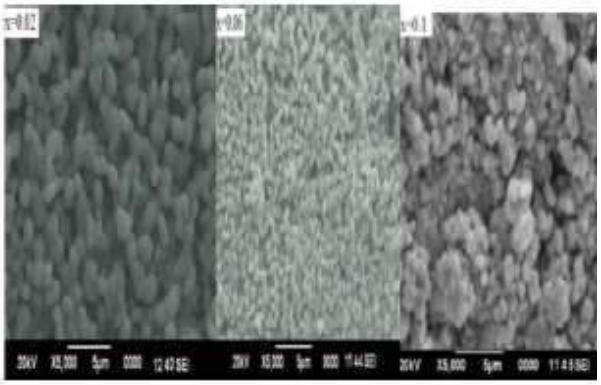


Figure 2. Samples sintered at 1100_C revealing the microstructure of Pb1-x Srx Zr0.52Ti0.48 O3 for x D = 0.02, 0.06, and 0.10.

The value or constant of the dielectric. To determine how much different ions contribute to the overall relaxing process, the Modified Debye's function was used.

$$\varepsilon' = \varepsilon'_{\infty} + \frac{\varepsilon'_{o} - \varepsilon'_{\infty}}{\left[1+(\omega\tau)^{2(1-\alpha)}\right]} \qquad (1)$$

where ε', ε'_{o} and ε'_{∞} We provide you the low-frequency (100 Hz) and high-frequency (10 MHz) dielectric constant measurements we took. If we replace f with the applied frequency, t with the relaxation time, and a with the dispersion factor of the observed relaxation times relative to the mean, we may express the angular frequency of a 1 V signal as vD2pf. The calculated relaxation time and spreading factor (a) are shown in Table 2. This suggests that the calming effect is caused by a synergy of ions. The dielectric constant is mostly determined by the spreading factor, which increases with temperature. Below Tc, the dielectric constant decreases, and the spreading factor decreases with it. As the temperature of a material increases, the number of charge carriers in it decreases below its critical temperature (Tc).

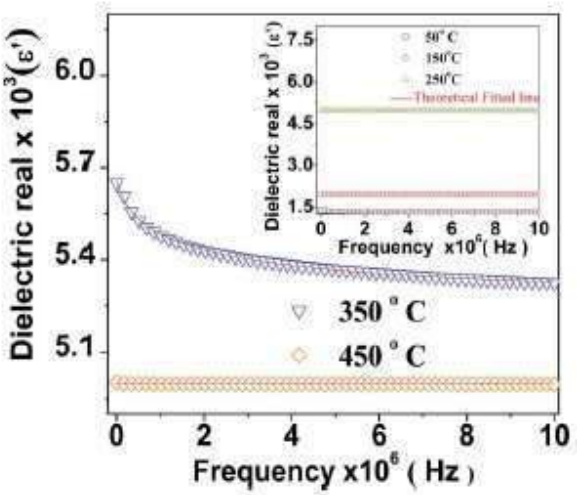


Figure 3. The true dielectric component of Pb0.90Sr0.10Zr0.52Ti0.48O3 as a function of frequency.

Table 2. Samples of Pb0.90Sr0.10 Zr0.52 Ti0.48O3 were measured at different temperatures, and the spreading factor (a) and relaxation time (s) were calculated using a model.

Temperature (°C)	Relaxation time (s)	Spreading factor (a)
50	2.126TE-06	0.20863
150	1.493E-06	0.24564
250	2.620E-07	0.28198
350	1.02E-07	0.27180
450	3.71E-7	0.26504

Has a dampening effect on the rate of spread. As shown by several publications [20, 21], the dielectric constant of the present-day samples changes as the temperature does. Each sample's ac conductivity was determined using the relation,

$$\sigma_{ac} = \omega\varepsilon_{0}\varepsilon_{r}\tan\delta \qquad (2)$$

The free-space permittivity, relative permittivity, and frequency are denoted by e0, err, and f, respectively, in this equation. Pb1-xSrxZr0.52Ti0.48O3 samples' ac

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conductivity below the Curie temperature (at 275_C) is seen in Figure 4. These values represent x D = 2%, 6%, and 10% mole. The middle of the curve may be used to divide it in two. As a result of the activation-induced dispersion of ionic charge carriers, DC conductivity exhibits a low-frequency plateau. Jonscher's power-law analysis of the data points may shed light on the graph's high-frequency dispersion.

$$\sigma(\omega) = \sigma_0 + A\omega^n \quad (3)$$

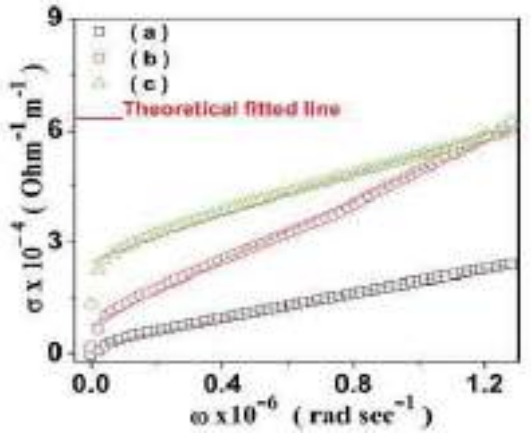
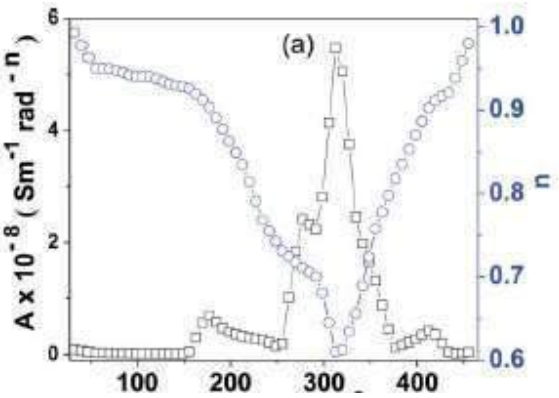


Figure 4. Pb1-xSrxZr0.52Ti0.48O3 ac conductivity at 2758C varies as a function of (a) x D 0.02, (b) x D 0.06 and (c x D 0.10.



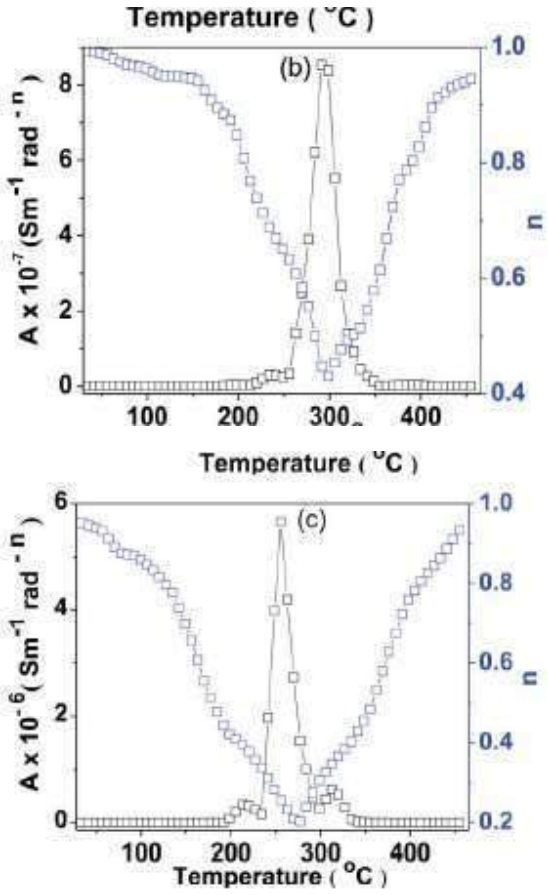


Figure 5. Temperature dependence of A and n in Pb1-x Srx Zr0.52 Ti0.48 O3 at (a)x D = 0.02, (b)x D = 0.06, and (c)x D = 0.10.

Zero represents the constant conductivity s0, a stands for the pre-exponential component that varies with temperature, and n stands for the frequency-dependent exponent. n may take on values between zero and one [22]. Figure 5 depicts the sensitivity of the A-to-n relationship to temperature. A, a ferroelectric parameter, increases with temperature.

A gets its highest value at the Curie temperature. The critical temperature for a par electric activity decreases with increasing a [23]. The frequency exponent n, defined in [24-26], characterizes the stability of the mobile ion-lattice interaction. Several mechanisms and their temperature

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dependences are shown [27-31]. As dipole-dipole interactions are absent or very weak, n = 1, but as temperatures increase, n = 0, and

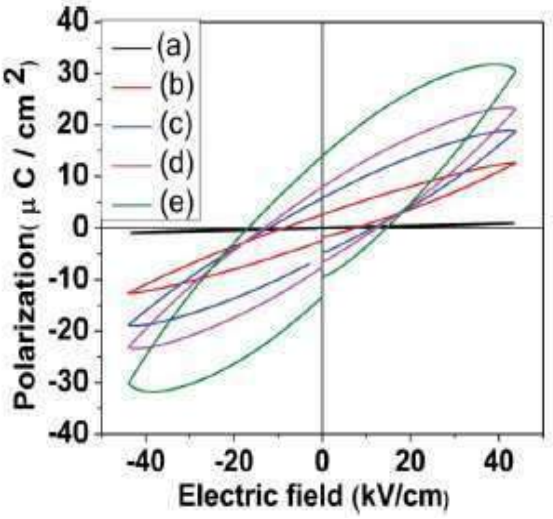


Figure 6. P-E diagram for Pb1-xSrxZr0.52Ti0.48O3 for various values of x D, from 0.00 in (a) to 0.06 in (e).

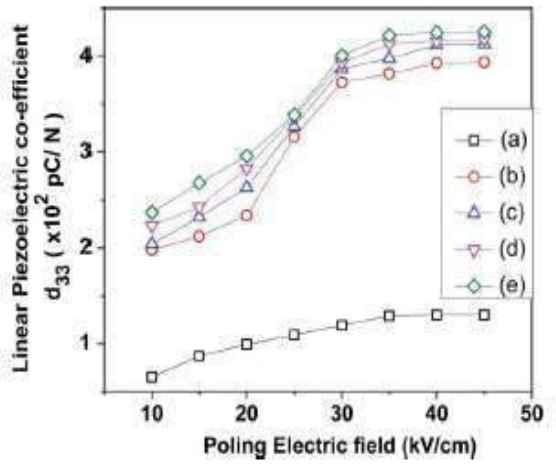
Heat, with very high temperatures being the norm. When the Curie temperature is the lowest possible. Oligomer large polaron tunneling (OLPT) is shown by the intersecting lines.

Figure 6 displays the power-efficiency (P-E) curves for Pb1-xSrxZr0.52Ti0.48O3 ceramics with x D = 0-10 mol%. As Sr concentration rises, the P-E loop enlarges. Table 3 displays the coercive fields and residual polarization of Sr-doped PZT. Ferroelectric polarization develops due to the ant symmetric atomic arrangement. An increase in polarization causes strain to partition the rhombohedral and tetragonal phases of PZT. The strain is increased when strontium (132A _) is used in place of lead (149A _). The residual polarization and coercive field are both improved by an increase in lattice strain.

Pb1-xSrxZr0.52Ti0.48O3 (x D 0-10 mole%) was tested in a variety of poling fields to determine its linear piezoelectric co-efficient (d33). Pb0.90Sr0.10Zr0.52Ti0.48O3, with a charge coefficient of 435 pC/N at 4.5 kV/cm (1 mol%, or x D 0.10), exhibits piezoelectric characteristics. When ferroelectric ceramics are polarized, their piezoelectric properties are activated. Both internal and external influences may have an impact on the piezoelectric behavior. When an electric field is applied to a ferroelectric material, a domain shift occurs. The lattice strain generates the intrinsic contribution. Increased piezoelectric activity results from ferroelectric domain alignment along the poling field direction. The ferroelectric characteristics of Sr-doped PZT were shown at the MPB.

Table 3. Remanent polarization (Pr) and coercive field (Ec) in Pb1-xSrx Zr0.52 Ti0.48O3 at x D = 0.00, 0.02, 0.04, 0.06, and 0.10.

$Pb_{1-x}Sr_xZ$ $_{0.52}Ti_{0.48}O_3$	Remnant polarization ($\mu C/cm^2$)	Coercive Field (kV/cm)
x = 0.00	0.11	4.74
x = 0.02	2.56	8.62
x = 0.04	5.26	12.01
x = 0.06	7.70	12.86
x = 0.10	13.64	15.97



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Figure 7. The linear piezoelectric co-efficient (d33) of Pb1-xSrxZr0.52Ti0.48O3 for different values of xD, from (a) xD = 0.00 to (e) xD = 0.10.

The free energy profile flattens during a structural phase transition. The ferroelectric state of nanocrystallite samples undergoes a symmetry change due to elastic clamping of the crystalline structure [31]. This has led to significant developments in piezoelectric characteristics.

Conclusion

$Pb_{1-x}Sr_xZr_{0.52}Ti_{0.48}O_3$ with x = 0.02, 0.04, 0.06 and 0.10

Create a crystal by combining rhombohedra and tetrahedra. To examine how charge carriers modify dielectric properties, a modified Debye's function is used. Large-scale polar tunneling superimposes itself over the conduction process, as seen by the ac conductivity. Sr doping enhanced ferroelectric and piezoelectric characteristics because of lattice strain.

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COMPOSITE FILMS MADE OF BARIUM FERRITE FIBERS AND POLY (VINYLIDENE FLUORIDE) HAVE INTERESTING MAGNETIC AND DIELECTRIC CHARACTERISTICS

KIRAN BACHINA[1], V N V RADHA KRISHNA MURTY[2]

Abstract

To make composite films, poly(vinylidene fluoride) (PVDF) resin was dissolved in N,N-dimethylformamide, and then different amounts of M-type barium ferrite fibers (1, 5, 10, 20, 30 wt%) were added. Composite films of BaFe12O19 and polyvinylidene fluoride (PVDF) were analyzed using a combination of scanning electron microscopy and X-ray diffraction. It is shown that 1 m diameter BaFe12O19 fibers with an aspect ratio (length/diameter) of 50 experience a structural transition from the to the phase when they are immersed in PVDF resin. Magnetization measurements performed on sheets of BaFe12O19/PVDF composite material using a magnetometer that vibrates demonstrate the material's unusual magnetic characteristics. Increasing the BaFe12O19 concentration of the composite films raises the saturation level of magnetization and dielectric loss, but has no effect on the coercion and dielectric constant. Composite films made of BaFe12O19 and polyvinylidene fluoride (PVDF) may display electrical, mechanical, and magnetic characteristics of both phases.

Keywords : Fibers made of barium ferrite. PVDF stands for poly(vinylidene)fluoride. Mixture flicks. Possessing a magnetism. Dielectric property

Introduction

The extraordinary piezoelectric and piezoelectric characteristics of poly(vinylidene) fluoride (PVDF) and its copolymers have attracted a lot of attention during the last three decades [1-3]. Polyvinylidene fluoride (PVDF) is more varied than the majority of polymeric materials [4, 5] owing to the existence of at least four crystalline phases. The -PVDF phase significantly improves piezoelectric, pyroelectric, and dielectric properties. As a matrix material, PVDF has showed tremendous promise. Magalhes et al. [6] used an isothermal crystallization technique to create electro active -PVDF membranes. Despite differences in nano clay form and composition, Dillon et al. [7] shown that PVDF-nano mud nanocomposites that may be produced. Crystallization is and melting temperatures of PVDF have been shown to increase once nano clay is included into the molecular structure. There is a wealth of information on PVDF's creation and characterization, however current PVDF compounds don't have the right mix of qualities needed by the IT industry.

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Stable hexagonal magneto plum bite (M-type) structure in barium ferrite (BaFe12O19) is responsible for the material's high magnetic loss tangent, coercive force and energy, and degree of uniaxial magneto crystallographic anisotropy. The magnetic mechanisms of hysteresis loss, domain wall resonance, and residual loss make barium ferrite a strong candidate for application in millimeter-wave devices such circulators and isolators [8, 9]. Isolators and circulators serve vital tasks, but they may be difficult to implement in preexisting microwave systems. To get over this problem, you may either employ blocks or make thin or substantial films with identical performance as blocks. Chen et al. [11] employed screen printing to produce thick, durable sheets of barium ferrite. Thick sheet with a eminence ratio of 0.95 and a strong saturation magnetization may be made by hot press sintered barium ferrite at 1,200 °C. Barium ferrite is a ceramic, which makes it difficult to create continuous films out of it.

The development of combinations of an inorganic and polymeric substances is crucial if films are to perform a wide range of functions. Nano hybrid of barium titanate (BaTiO3) and polyvinylidene fluoride (PVDF) were produced by Kobayashi et al. [12] to create thin films with a high dielectric constant. These BaTiO3/PVDF composite sheets exhibited a dissipation factor of 0.05 despite their high dielectric value (104 hertz). Unfortunately, BaFe12O19/PVDF composite film research is still in its infancy. According to our findings, the dielectric and magnetic characteristics of composite films made of solution-cast BaFe12O19 and polyvinylidene fluoride (PVDF) are enhanced. SEM (scanning electron microscopy) and X-ray diffraction (XRD) were used to examine the structure and morphogenesis of the composite films. Researchers looked at their dielectric and magnetic qualities. There are likely several sensing uses for these BaFe12O19/PVDF composite sheets.

Experimental

Barium ferrite fiber spinning has begun. In our prior work [13], we outlined the steps necessary to turn organic gel precursor into beryllium ferrite fibers and provided examples of each. The primary analytical reagents used were citric acid, sodium citrate, and nitric and fulvic acids. Using magnetic stirring, the citric acid and metal nitrates in the deionized water were brought to the correct stoichiometric ratio. After 20-24 hours of magnetic stirring at room temperature, the solution's excess water had evaporated in a state of vacuum at 60-70 °C. After extracting the gel fibers, they were dried in a vacuum oven at 80 degrees Celsius for approximately 24 hours. To create the ferrite fibers, the material was calcined in an alumina crucible devoid of nitrogen for two hours at 900 degrees Celsius. Fibers in calcined barium ferrite have a diameter of about 1 m and a length-to-diameter ratio that is around 50, as shown in scanning electron micrographs (SEMs) (Figure 1).

Composite films are made by fusing two separate films together; in this case, a BaFe12O19 film and a polyvinylidene fluoride (PVDF) film. After purchasing the PVDF from Shanghai's East The element fluorine Chemicals Co., Ltd., I never again had to worry about maintaining its pristine condition. DMF (N,N-dimethyl formamide) was used to produce chemical solubility. Following these steps, films of BaFe12O19 and PVDF were created. The combination of high-quality PVDF powder and DMF heated to 50 C using a magnetic stir bar.

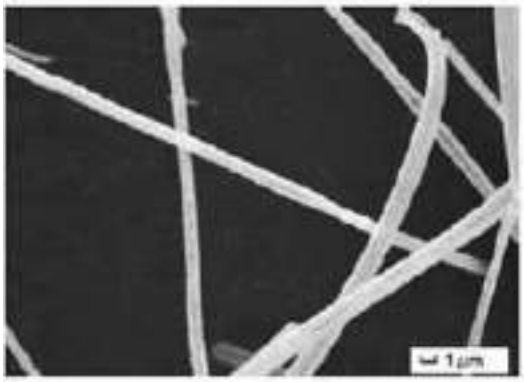


Fig. 1 SEM morphology of barium ferrite fibers calcined at 900 °C

Twenty percent by weight of PVDF was applied initially. The first use of ultrasonic energy to this method was the dispersion of barium ferrite fibers in dimethylformamide (DMF). Shaking the mixture for 5 hours helped guarantee that the barium ferrite fibers used to make BaFe12O19/PVDF were evenly distributed throughout the PVDF solution. Composite film compositions varied widely, with BaFe12O19 contributions ranging from 0 to 30 percent by weight. After casting the BaFe12O19/PVDF suspension onto a mold, the solvent was evaporated for an hour in a vacuum oven at 70 °C. Varying the BaFe12O19 concentration results in BaFe12O19/PVDF film composites with a thickness of 0.5 mm to 0.7 mm.

Characterization

Using CuK radiation with a BrukerD8 Advanced powder diffractometer, XRD patterns of fibers and

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composite films were made. Through scanning electron microscopy (SEM) analysis of fibers and composite films, we identified many intriguing morphological features utilizing a Jeol JSM-5600LV. A room-temperature vibration sample magnetometer (VSM) was used to examine the magnetic characteristics of the composite films. Under regulated conditions, the dielectric characteristics of composite films were evaluated at 1 kHz utilizing a Huizhou TH2828 LCR digital meter.

Results and discussion

Validation of X-Ray Diffraction's Usefulness Three different materials, (a) pure BaFe12O19, (b) BaFe12O19/PVDF composite films with 30 wt.% BaFe12O19, and (c) PVDF, are shown in XRD patterns in Figure 2. The X-ray diffraction patterns (Fig. 2a) of fibers made from barium ferrite exhibit the characteristic peaks at 2=30.3, 32.2, 34.1, 37.1, 40, 5,65, and 63.0 for M-type BaFe12O19 (JCPDF No.84-0757), confirming the formation of a single M-type ferrite phase.

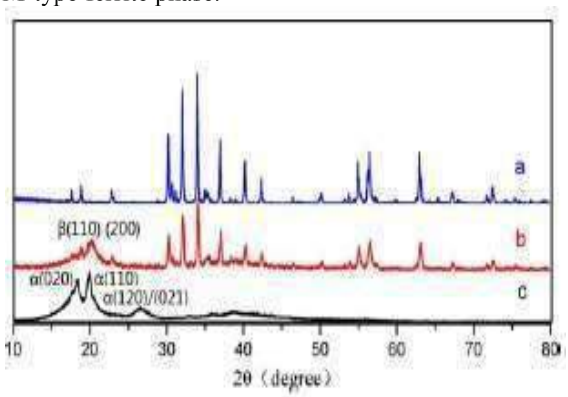


Fig. 2 XRD patterns of BaFe12O19 (a), BaFe12O19/PVDF composite films with 30 wt% of BaFe12O19 (b), and pure PVDF (c)

Two hours of intense heat at 900 degrees Fahrenheit. Figure 2c shows that the three prominent peak at 18.4, 19.9, and 26.6 correspond well to -phase PVDF [7]. Narrow peaks in PVDF indicate a large crystallite size. Figure 2b shows that the barium ferrite fibers, which may contain -PVDF [14], have a high peak at a value of 20.4. The composite film consists of the binary phases for M-type barium ferrite & -PVDF. The distributed barium ferrite fibers have been linked to a peculiar phenomenon: a phase change from - to -PVDF within the PVDF matrix. A similar effect was found by Dillon et al. [7] when studying PVDF/nano clay nanocomposites.

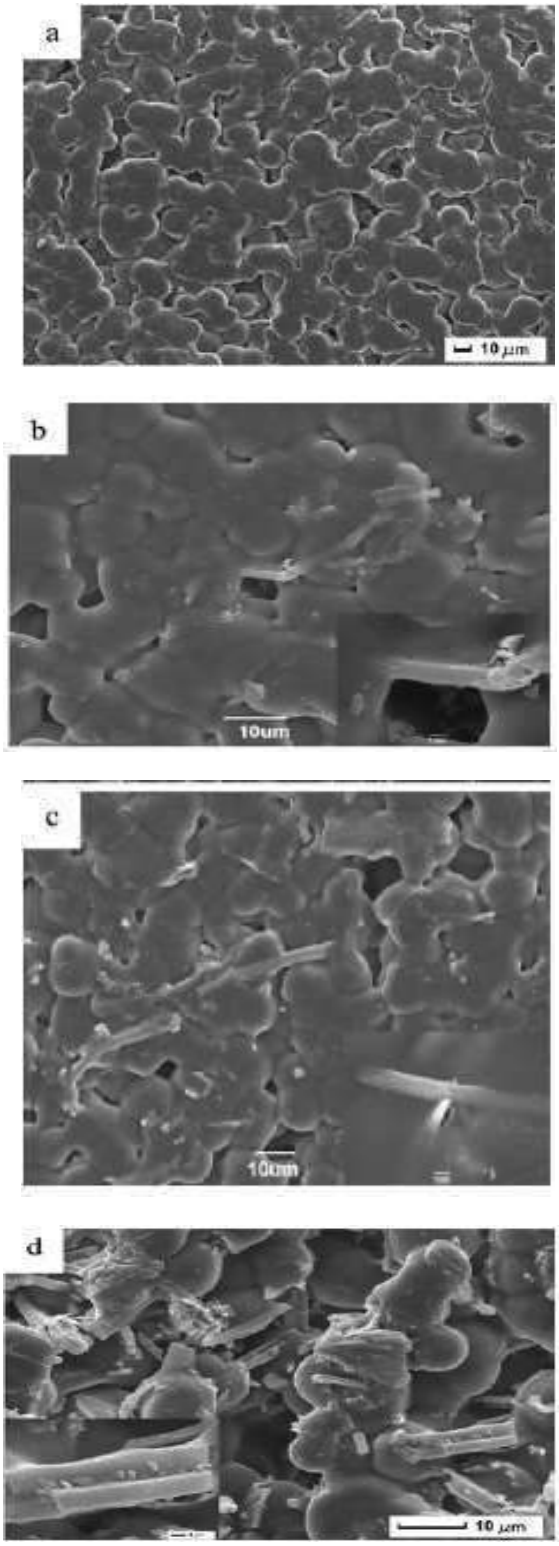


Fig. 3 Scanning Electron Micrographs of Polyvinylidene Fluoride (a) and Barium Ferrite (BaFe12O19)-Containing

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Composite Films (b) of Varying Weight Percentages 5 (b); 10 (c); 30 (d)

Composite films of Ba Fe 12 O 19 and PVDF with 0%, 5%, 10%, and 30% barium ferrite are shown by SEM (scanning electron micro in Figure 3. Uncoated PVDF film (Fig. 3a) consists of spheres with spaces between them. When the amount of barium ferrite is decreased to 5 wt.% and 10 wt.%, the amount of film surfaces voids decreases (Fig. 3b, c), demonstrating a high degree of compatibility among the barium fibers with the PVDF matrix. However, if a lot of BaFe12O19 fibres (30 wt.%) are added to the composite film, the surface becomes rougher (Fig. 3d).

Magnetic properties

Figure 4 depicts the hysteresis loops for BaFe12O19/PVDF film composites with varying ferrite concentrations. Composite films made of BaFe12O19 and PVDF are distinguished by their high magnetic quality. Films having 30 wt.% barium ferrite fibres have a saturation magnetic field (Ms) of 13.1 emu g1, which is a linear rise from 1 to 30 wt.%. Consistent with the findings of Makled et al., the link among the two variables may be explained by the equation ms = ms.

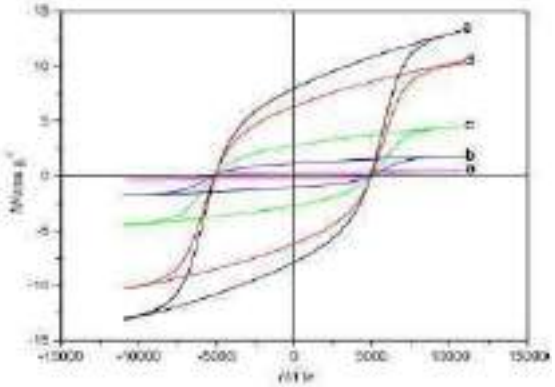


Fig. 4 Hysteresis loops of BaFe 1 kHz 12O19/PVDF composite films with different barium ferrite contents (wt%): a 1; b 5; c 10; d 20; and e 30

Values and percentages for partial saturation of magnetic fields (ms) [16]. In PVDF composite films, the saturation magnetization is significantly affected by the percentage of magnetic BaFe12O19 fibers. The magnetic fibers are easy to isolate because the nonmagnetic PVDF disturbs the ferromagnetic order of the ferrite from a parallel structure. The PVDF matrix significantly weakens the magnetic field. The specific saturation magnetization of the composite increases with the addition of additional barium ferrite fibers, although it is still lower than that of pure barium ferrite. Although the coercivity (Hc) of the composite films increases from around 5,045 to 5,144 Oe (Hc=5,001 Oe for pure BaFe12O19), the magnetization at saturation increases from 0 to 30% barium ferrite fiber content. There are several factors [17] that influence the coercivity of a composite film. These include the film's interfacial structure, composition, particles size and shape, magnetic asymmetry, and magnetostriction. The coercivity of the composite films is greater than that of pure BaFe12O19. The interface structure helps to shield the PVDF fibers from coming into touch with the barium ferrite ones. Similar to how adding not magnetic oxides to ferrites [18, 19] inhibits domain contact and domain misalignment, the not magnetic phase in PVDF increases coercivity.

Dielectric properties

Figure 5 displays the relationship between BaFe12O19 concentration and the dielectric constant as well as the dielectric loss of BaFe12O19/PVDF composite films. having just minute quantities of BaFe12O19

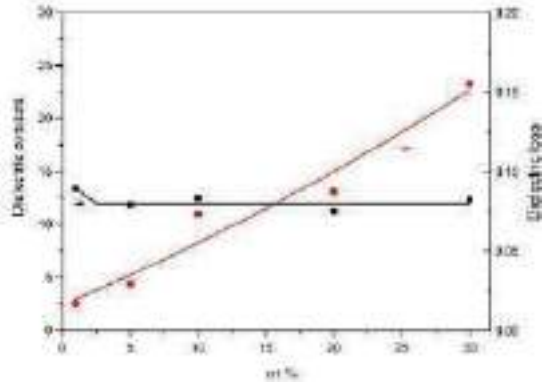


Fig. 5 Effect of barium ferrite content on dielectric constant and dielectric loss of BaFe12O19/PVDF composite films, measured at 1 kHz

Composite film dielectric constants are around 12.8 [20], much higher than pure PVDF's 7.7. It's well acknowledged that -phase PVDF possesses unrivaled dielectric characteristics. The aforementioned XRD analysis demonstrates that the collaboration among barium ferrite fibers for the PVDF phase change is responsible for this advancement. However, increasing the BaFe12O19 content up to 30 wt.% has no effect on the dielectric constant of the composite films, but has a significant impact on the dielectric loss, presumably because of the interaction between the interface and the porosity in BaFe12O19/PVDF composite films [21].

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Figure 6 shows the frequency-dependent (log f) variations in both the dielectric constant and the dielectric loss of BaFe12O19/PVDF composite film containing 10 wt.% barium ferrite fibers, from 50 Hz to 1 MHz It has been shown that composite films with dielectric constant may Interface polarization reduces frequency dependence [22]. On the other hand, the dielectric loss obviously rises from 50 kHz to 1 MHz, then progressively decreases to a minimum at about 10 kHz.

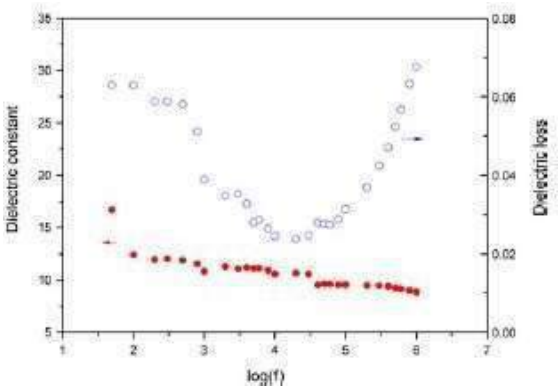


Fig. 6 Frequency dependence of dielectric constant and dielectric loss of BaFe12O19/PVDF composite films (10 wt% of BaFe12O19)

Conclusions

Using a solution casting approach, a BaFe12O19/PVDF composites film with tunable BaFe12O19 composition was successfully fabricated using M-type barium ferrite fibers & PVDF resin. Barium ferrite microfibers are dispersed throughout the PVDF matrix, as shown by scan electron microscopy and X-ray diffraction analyses. The composite films have a coercively of around 5,045 Oe, which is more than the coercively of pure BaFe12O19 (Hc=5,001 Oe). In composite films, the saturation specific magnetism and dielectric loss are enhanced by increasing the BaFe12O19 content, whereas their coercivity and dielectric value are decreased.The dielectric loss is small between 10 kHz and 1 MHz because the dielectric value drops off sharply at higher frequencies.

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APPLICATION OF DIFFERENTIAL TRANSFORM METHOD IN DEPENDENCE OF PRESSURE WITH ALTITUDE

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Abstract : In this paper, we bring out a comparative study between Differential Transform Method (DTM) and analytical method in dependence of pressure with altitude. It is shown that DTM has an advantage over the analytical method which takes very less time to solve the non linear Riccati equation. Also DTM is more effective and powerful technique.

INDEXTERMS - DIFFERENTIAL TRANSFORM METHOD(DTM), IN DEPENDENCE OF PRESSURE WITH ALTITUDE

INTRODUCTION AND PRELIMINARIES

The French mathematician Liouvillein 1841 provided Riccati equation was the one of the simplest non linear first order differential equation. This paper outlines a reliable comparison among the powerful methods that were recently developed. Differential Transform Method (DTM) was introduced by Zhou in 1986.The main advantage of this method is that it can be applied directly to nonlinear ordinary and partial differential equations without requiring linearization, discretization or perturbation and also it is able to limit the size of computational work while still accurately providing the series solution with fast converge rate. It has been studied and applied during the last decades widely.It was further extended to stochastic systems by using the Ito integral.DTM is used to find the solution of various kinds of Riccati differential equation such solution of first order , second order and system of Riccati equations [1], solving linear and non linear system of ordinary differential equations[2], solving system of differential equations [3], solution of Non-Linear Differential equations[4], Solution of Riccati equation with variable co-efficient[5], Quadratic Riccati Differential Equation [6], on the solutions of Nonlinear Higher Order Boundary value problems [7].

DIFFERENTIAL TRANSFORM METHOD

The transformation of the k th derivative of a function y(x) in one variable is defined as follows

$$Y(k) = \frac{1}{k!}\left[\frac{d^k(y(x))}{dx^k}\right]_{x=0} \qquad (1)$$

and the inverse transform of Y(k) is defined as

$$y(x) = \sum_{k=0}^{\infty} Y(k)x^k \qquad (2)$$

The following are the important theorems of the one dimensional differential transform method

Theorem 1: If $y(x) = m(x) \pm n(x)$, then $Y(k) = M(k) \pm N(k)$

Theorem 2: If $y(x) = \alpha m(x)$, then $Y(k) = \alpha M(k)$

Theorem 3: If $y(x) = \frac{dm(x)}{dx}$, then $Y(k) = (K+1)Y(k+1)$

Theorem 4: If $y(x) = m(x)n(x)$, then $Y(k) = \sum_{r=0}^{k} M(r)N(k-r)$

Theorem 5: If $y(x) = x^l$, then $Y(k) = \delta(k-l) = \begin{cases} 1, \text{if } k = l \\ 0, \text{if } k \neq l \end{cases}$

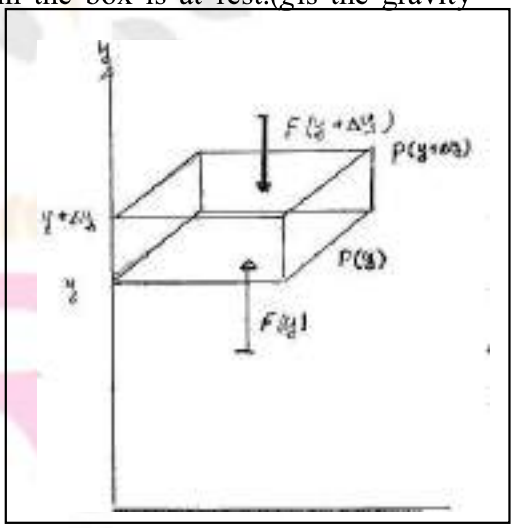
1. DEPENDENCE OF PRESSURE WITH ALTITUDE

We consider a rectangular horizontal section of the atmosphere. The area of the two end faces are A. The box is situated in the hight y over the ground. The height of the boxis Δy. The pressure on the upper and the lower side are $p(y+\Delta y)$and $p(y)$ respectively.

The density of the air in the height$y$is

The force on a flat piece with area is $F=pA$, where p is the pressure on the flat.

We then express that the difference in the force on the upper and the lower side is equal to the gravitational force on the air in the box, assuming that the air in the box is at rest.(gis the gravity acceleration)



$p(y)A-p(y+\Delta y)A=m_{air}g=\rho(y)V_{air}g=\rho(y)A\Delta yg$

So $p(y)A-p(y+\Delta y)A=\rho(y)A\Delta yg$

Divding by $A\Delta y$:

$\frac{p(y+\Delta y)-p(y)}{\Delta y} = -\rho(y)g,$ and replacing $\frac{p(y+\Delta y)-p(y)}{\Delta y}$ by $\frac{dp}{dy}$ we find (3)

$\frac{dp}{dy} = -\rho(y)g$

To solve this differential equation we need to know another relation between This can how ever be obtained by:

1. The equation of state for ideal gasses: $PV = n_M RT$ (n_M is the number of moles)
2. Definition of the mole mass M : $m = n_M M \Leftrightarrow n_M = \frac{m}{M}$
3. The definition of density ; $\rho = \frac{m}{V} \Leftrightarrow m = \rho V$

Insertion of the two equation in (1) in the equation of state gives (4)

$PV = n_M RT = \frac{m}{M} RT = \frac{\rho V}{M} RT \Rightarrow \rho = \frac{M}{RT} P$

This expression for the density is then used in (3).

$\frac{dp}{dy} = -\frac{Mg}{RT} p$ (4)

It is well known that the temperature decreases roughly by one centigrade for every 200 meters increase i altitude over the ground but Initially, we shall assume that the temperature is constant up through the atmosphere.

The differential equation(1.3) has the well known solution:

$P(y) = p_0 e^{\frac{Mg}{RT}(y)}$ (5)

Using the known values: M_{air} =29 *g/mol*, g = 9.82 *m/s*^{2}, R= 8.31 J/(*mol K*) and T = 273 *K*,wefind:

$p(y) = p_0 e^{-1.2610^{-4} y}$

Where should be measured in meters

This results in a pressuredrop of 1.3% per100*m*and a drop of12% per1000 *m*.

Next we shall look at the solution to the differential equation, where we take into account that the temperature drops linearly 1^0C per200 *m* increase in altitude.

We put the temperature on the ground at 20 ^0C = 293 *K*. The temperature in the altitude *y* then becomes

$T = T(y) = 293 - y/200$. Then the differential equation becomes:

$\frac{dp}{dy} = -\frac{Mg}{R(293 - \frac{y}{200})} p$

The equation is solved in the us always by separating the variables and integrating

$\int_{p0}^{p} \frac{dp}{p} = -\frac{Mg}{R} \int_0^y \frac{1}{293 - \frac{y}{200}} dy$

$\int_{p0}^{p} \frac{dp}{p} = \frac{Mg}{293} \int_0^y \frac{1}{1 - \beta y} dy$ where $\beta = \frac{1}{293.200}$

$\ln(\frac{p}{p0}) = \frac{Mg}{293R\beta} \ln(1 - \beta y)$

$$\Rightarrow p = p_0 (1 - \beta y)^{\frac{Mg}{293R\beta}}$$

When M_{air} =29 *g/mol*, g = 9.82 *m/s*^{2}, R= 8.31 J/(*mol K*) and T = 273,$p_0 = 1, y = 1$

P = 0.889

Although it looks rather different from (1.5), it turns out that it only causes a deviation from (1.5)ofabout0.1 – 0.2 %.

Using DTM , **P= 0.882**

CONCLUSION:

In this paper, we compared the solution of Riccati equation by DTM.The result of DTM and Exact solution are in strong agreement with each other. DTM is reliable and powerful technique. We believe that the efficiency of DTM gives it much wider suitability which needs to be excavated further.

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NUMERICAL APPROCH OF FIRST ORDER DIFFERENTIAL EQUATIONS ARISING IN THE TIME CONSTANT OF A SENSOR

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Abstract: Many processes and phenomena in chemistry, and generally in sciences, can be described by first-order differential equations. These equations are the most important and most repeatedly used to illustrate natural laws. Even though the math is the same in all cases, the student may not always easily understand the similarities because the relevant equations appear in different topics and contain different quantities and units. This text was written to present a unified view on various examples; all of them can be mathematically described by first-order differential equations. The following example is discussed like time constants of sensors.

Index Terms - **Differential equations , Time constants of sensor**

THE TIME CONSTANT OF A SENSOR

Sensors measure a physical or chemical quantity and transduce it to an output signal which is read, monitored or stored. Possible physical quantities are temperature, pressure, radiative flux, magnetic field strength, etc. Chemical quantities are mainly concentrations and activities of molecules, atoms and ions. The recorded signals
are usually voltages or currents. The most typical feature of a signal is that the results are one dimensional, e.g. the output signal is a single quantity, i.e. one measures only that signal and not a dependence of that signal on another given quantity. Most devices for chemical analysis produce two-dimensional read-outs, e.g. optical spectra in which the absorbance is displayed as a function of wavelength (E $= f(\lambda)$, voltammograms in which currents are displayed as function of electrode potential or X-ray diffractograms, in which the intensity of diffracted rays is displayed as function of diffraction angle, etc. In modern Instrumentation, one has even expanded the

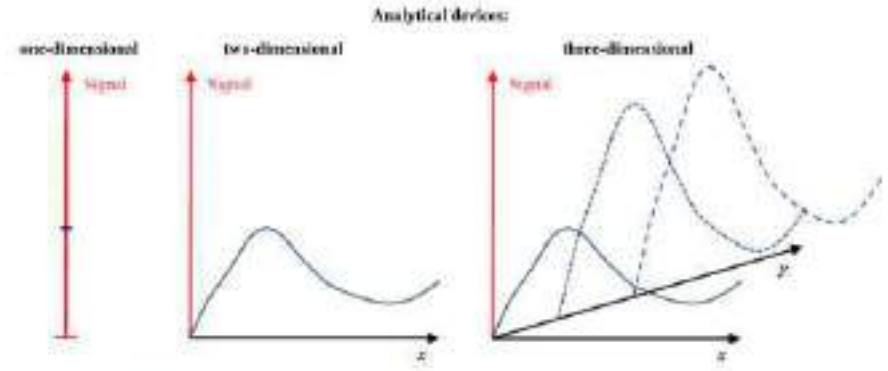
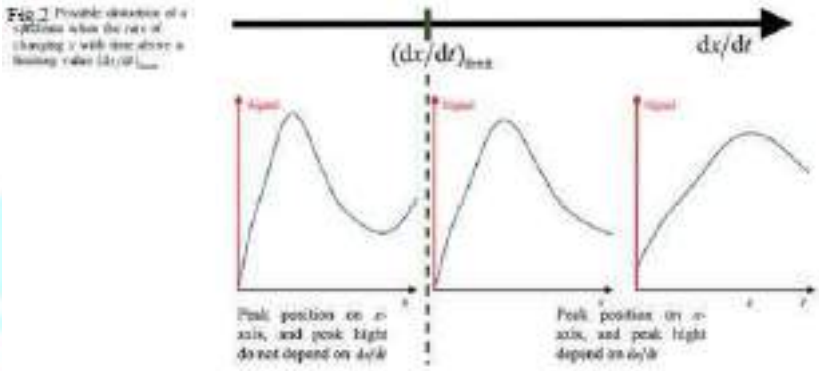


Fig.1 A comparison of the three common dimensionalities of analytical devices



dimensionality to three, when, as an example, optical spectra (E= $f(\lambda)$) (or mass spectra, i.e. ion intensities versus the mass-to-charge ratio of ions) are displayed as a function of elution time of a chromatogram. Figure 1 gives a comparison of the common dimensionalities of analytical measurements.

Since any measurement needs time, there is nothing like an instantaneous establishment of a signal. This is easy to see when using a sensor, e.g. a pH electrode: There is always a certain time period in which the reading changes until we finally have the impression that a constant end value is reached. The same is true also for two- or three dimensional measurements, but we cannot easily detect it because the variation of the measured signal (e.g. the absorbance) anyway changes as a function of the varied quantities (e.g. the wavelength) and thus with time. Normally, the wavelength is changed with the so-called scan rate $\frac{d\lambda}{dt}$ (rate of recording the spectrum), and generally (see Fig.2), the quantity x is varied with a scan rate $\frac{dx}{dt}$ (which may be also zero). Whether we measure at each wavelength really the end value of the absorbance can be only seen if we decrease the rate at which the wavelength is changed (in the extreme even keeping the wavelength constant). Referring to Fig. 2, this means in general terms, that a variation of the scan rate $\frac{dx}{dt}$ may give a reproducible and identical response only below a certain limiting rate $(\frac{dx}{dt})_{limit}$. If that rate is exceeded, the signal cannot establish its true value and the spectra are distorted (the signal lags behind) (cf. Fig. 2).

Figure 2 shows impressively that it is important to know the rate at which the signal is established for a given x value. In case of a sensor, i.e. a one-dimensional device where no parameters like x or y are changed, the time change of the signal can be studied following a concentration step. The introduction of the sensor into a solution can be regarded as a concentration step. Figure 3 depicts two different kinds of response of a sensor on a concentration step. Figure 3 depicts two basic types of time responses of sensors. The different sensor behaviours shown in B and C can be modelled with the help of different differential equations. Whereas the response curve shown in B can be modelled with a first-order differential equation; the curve shown in C needs higher-order differential equations. At this point, it is necessary to note that it is impossible to realize a concentration step with infinite rate of concentration rise, as shown in Fig. 3a. This means, when the temporal response properties of a sensor are studied, this concentration rise has to be much

quicker than the response of the sensor. Further, also the response shown in Fig. 3b is to some extend an idealization, and in reality there may be always a sluggish response at the start, but it may be on such short time scale that it escapes our recognition.

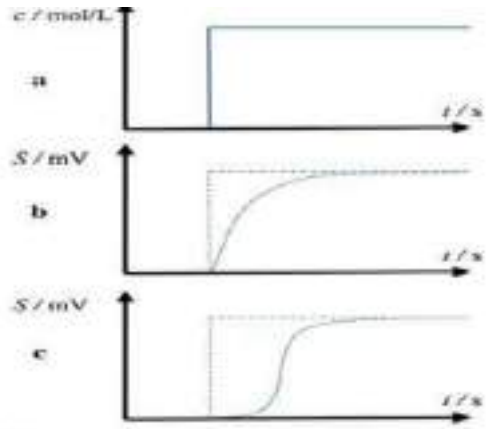


Fig 1 a The concentration is stepped from zero to a constant value. b The signal of the detector starts to respond immediately when the step is made, and the slope of the response over time continuously decreases until it finally approaches a constant final value. The response curve has no turning point. c The sensor starts slowly to respond (but with *increasing steepness*), and after a turning point the response slows down (*decreasing slope*) until it approaches the final value

The response curve shown in fig.3b can be modeled as follows

$$S = S_{max} - w(t) \quad (1)$$

w is a time dependent quantity for which we write the first order differential equation

$$p_1 \frac{dw}{dt} + p_2 w(t) = 0 \quad (2)$$

Integrating, we get

$$\int_{w_0}^{w} \frac{dw}{w(t)} = -\frac{p_2}{p_1} \int_0^t dt \quad (3)$$

$$ln \frac{w(t)}{w} = -\frac{p_2}{p_1} t \quad (4)$$

$$\frac{w(t)}{w_0} = e^{-\frac{p_2}{p_1} t} \quad (5)$$

$$w(t) = we^{-\frac{p_2}{p_1} t} \quad (6)$$

So eqn.(1) follows that

$$S = S_{max} - we^{-\frac{p_2}{p_1} t} \quad (7)$$

Obviously , w_0 should be equal to S_{max}

So eqn.(7) becomes $S = S_{max} - S_{max} e^{-\frac{p_2}{p_1} t} = S_{max}(1 - e^{-\frac{p_2}{p_1} t})$ (8)

Since the term $(1 - e^{-\frac{p_2}{p_1} t})$ should not have a unit, it follows that the ratio $\frac{p_2}{p_1}$ must be a reciprocal time and we may write eqn.(8) using the definition $\frac{p_1}{p_2} = \tau$ i.e $\frac{p_2}{p_1} = \frac{1}{\tau}$

$$S = S_{max}(1 - e^{-\frac{1}{\tau}}) \quad (9)$$

The quantity τ is called the time constant of the sensor.

At $t = \tau$ the signal has the value

$$S = S_{max}(1 - e^{-1}) \approx 0.6325$$

In other words , after elapse of τ, the signal has reached 63.2% of its final value.

Conclusion:

In this paper, we discussed the importance of first order differential equations in many areas such as physics, chemistry and engineering.It should be mentioned that there are many other processes in science, which are based on first-order differential equations, e.g.the time constant of sensor

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Transfiguring Indian Agrarian Warehousing Sector with Smart Engineering, Managerial & Environmental Approaches

Dasari Satyanarayana and Pamidakula Jyothirmayi

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August 7, 2023

Transfiguring Indian Agrarian WarehousingSector with Smart Engineering, Managerial & Environmental Approaches

Abstract: The storage and marketing facilities in agricultural sector have imperative linkages, which in turn, cares farmers & traders to gain more from their agricultural trade. Providing appropriate storage and value adding facilities for food grains/fruits/vegetables/fisheries/poultries/other-farm-produces is emerging as a giant issue for farm engineers, managers, environmentalists, growers, buyers and also the policy planners. Apart from ensuring grading, cleaning and packaging facilities at farm gate; the timely bringing of agricultural products to market, happens to be a vital & sensitive issue, which invites serious concern towards good governance and effectual strategic interventions on several key aspects. It includes storage, material handling, logistic, marketing infrastructure, communications, smart information, and many environmental considerations; to fetch best possible and balanced profits for growers, suppliers, and buyers with reduced risks & uncertainties. Realizing vast production potential of massive crops & commodities, and being top ranker in world, Indian agriculture has arrived at cross roads, where above described anxieties have gained very high impetus to indorse smarter and profitable cultivation/trading. At this juncture, agrarian warehousing is emerging as a subtle & imperative linkage, to support farmers & traders for securing optimum connectivity among storage and marketing facets of their trade/business. Present paper is focused towards plethora of such issues, which are reviewed, realized and researched to retrieve realistic inferences on strengths, weaknesses and futuristic potential for enriching agrarian warehousing sector in the country. Comprehensive sets of secondary data/observations are placid & analysed, offering valued food for thought for desirable schedules/plans from engineering, managerial, environmental, market, and policy points of concerns. It encompasses updated information & inferences on prevailing status & types of agrarian warehouses, their shortcomings/potentials/opportunities with probable discretionary rectifications/ modifications. It also touches the role of innovative enviro-friendly technological options (green materials during construction, greener supply chains, energy savings, other environmental dimensions) during construction, operation & maintenance of warehouses & logistic essentials, to achieve superlative transformations of Indian warehousing & marketing sector.

Keywords: Warehouses, Cold Storage, Policy, Negotiable Warehouse Receipts, Logistic

INTRODUCTION

India has tremendous inherent strength in this regard, producing world‟s highest production volumes and being globally 1st ranked nation in regards to products like milk, rice, fruits, and vegetables. The level of produced volumes of many other

agricultural commodities too remained very high, foretelling India among top 3 ranks at world level. Indian farmers offer 17 % of whole world‟s milk production, > 250 million metric tons (MMT) food grains, >165 MMTs vegetables, and > 80 MMTs fruits, together with sharply ascending volumes of many other innovative products like flowers, fishes, eggs etc in recent time. With these the ultimate economics of agrarian sector in country is marching ahead with high projectiles (Hazell and Haggablade, 1991; GOI, 2013). Existence of plentiful agrarian warehouses is emerging as one of the most vital and sensitive subjects for India, where agriculture continues to be a deep-seated tool to accomplish sustainable growth and poverty diminution (Birthal, et al., 2014; Bathla, 2014). Yet the pecuniary constraints in regards to warehousing, remain highly persistent as they are pricey, inequitably distributed, and sternly frontier with small farmers or trade holder‟s ability to contend. Country is having only 2% of world geographical area, but encompasses 16% of world population, and has agrarian people to the tune of 65 crores, covering more than 6 lakhs villages under 127 agro climatic zones, where agricultural activities are largely carried out by poor farmers on 121 million operational holdings, 80 % of which are marginal & small having less than 2 ha land holdings (Gaur, 2015).

In spite of all such exceptional end deliveries with extreme production potential, an average Indian farmer still remains deprived, socio-economically disadvantaged, and far away from grown economy and markets. Majority of his due benefits/income gets either dampened or percolated to middlemen or vanished on farm itself, because of poor storage/logistic/market element. Majority of farmers and small agricultural traders operates their business, under extreme unfavourable circumstances, where neither the climate nor the financial sphere remains compassionate towards them; rather it tenders high magnitude of uncertainties and constraints. Owing to towering inefficiencies in warehousing, marketing, and supply chain, often they feel themselves handicapped and so suffer invariably, with heavy losses of income & commodities due to improper storage/transportation/market facilities. Only due to insufficient storage and logistics, around 20 to 30 % of total food grain harvest is estimated to be wasted, as on an average each grain bag is often handled at least 5 to 6 times before it is finally opened for processing. Also due to lack of proper cold storage facilities, a cumulative loss of about 550 million Indian rupees is projected in recent time (ASSOCHAM, 2014). Prevailing scenario towards agrarian warehousing is becoming more multifarious owing to huge gap between demand & supply of logistic services, asking an effective integration of logistics with warehousing & marketing. It is of utmost importance as more recently country is emerged as leading producer of exportable variety products like wheat, cotton, groundnut, lentils, sesame seed, sorghum, millet, jute, spices, sugarcane, cashew nut, silk worm, tea, potatoes, onions, garlic, tropical gingers, cauliflower,

peas, cabbage, pumpkin, squash/gourds, bananas, mango, guava, and enormous flowers. Owing to strengths cited above country has vast potential, where warehousing and marketing aspects could be easily made smart (Gaur, 2015) and result producing. Environmental engineering principles happens to be another big opportunity at this crucial stage, where just substituting some of the prevailing materials, mechanisms, modalities, methods; with their smarter technological versions (ICT & IT, digital, environmentally responsive) at varied stages of warehousing policy planning/executions/operations/maintenances could highly decline emissions & overall environmental adverse impacts (Rai et al., 2011). Present paper is focused in and around to this crucial issue, where plethora of emerging issues are reviewed & researched to arrive at few important inferences in regards to relevant strengths, weaknesses and futuristic potential for enriching agricultural warehousing & marketing sector of country.

METHODOLOGICAL DESCRIPTION

The historical ingredients of Indian agriculture and its periodic updates with in-depth analysis of all relevant sub sectors is performed by visualizing, analysing, and interrelating the observations and remarks of enormous professional experts, researchers, and R&D agencies. The set of available information and other secondary data sets were accordingly utilized herein. A vast volume of such data and information is excavated, moreover only few bits are being incorporated herein, owing to paucity of space and scope of this particular research paper. Secondary data on basics of agricultural policies with periodic reforms, generalized warehousing policies and actions, major agencies to deal with these kinds of interventions, ways to arrive on updated status of farmer and his agriculture-based issues are compiled and compared. Leading institutions, schemes, projects, missions, plethora of problems & issues as relieved/released from time to time are too observed and correlated there upon, to offer many meaningful inferences of practical significance. Attempts are made to follow, standard protocols and reliable sources while deriving/extracting such observations and their treatments at later stages. Observed secondary data, were made with a level of quality & quantity, where it can be said/designated a most updated and reliable kind of information bits.

A. **Prevailing Features of Warehousing:** The exact function of storage can be carried out successfully, provided an appropriate warehouse is opted for storing the goods in good condition. Some time, warehousing is also demarcated as “assumption of responsibility for the storage of goods throughout the year and releasing them as and when they are needed and thus creating time utility”. Warehousing has enormous importance in development of agricultural trade,

commerce, and net profits from real ground farming. In real sense, it refers to the "holding and preservation of goods until they are dispatched to the consumers". In accordance to prevailing situation in India, there exists a „time gap" between the production and consumption of products, which could be easily bridged with a good warehousing at micro scales. In principal, any good warehousing is often judged by comparing delivery of five specific functions, namely; storage, price-stabilization, risk-bearing, financing, and gradin/packing. If these functions are attained satisfactorily, then only benefits from warehouses are assured. Overall warehousing gives many clues & guidelines towards cost break

ups. A generalized thumb rule-based relationship between physical circulation of agricultural commodities and relevant wastages along with the wider variabilities of region wise distribution of warehouses in the country is illustrated in Fig.1 which is self-explanatory to depict the levels of disparities and adversities of prevailing warehousing domain in the country.

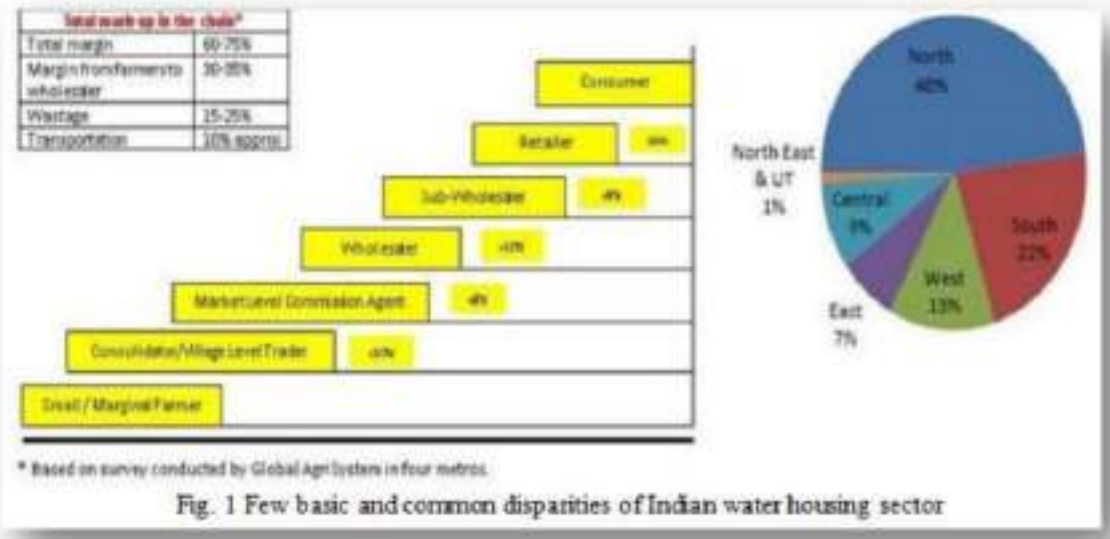


Fig. 1 Few basic and common disparities of Indian water housing sector

With a view to upsurge the involvement of private sector and development & directive of warehousing industry, Government of India introduced „The Warehousing (Development and Regulation) Act", with a major focus to establish a regulated environment for issuance of Negotiable Warehouse Receipt (NWR) under Warehousing Development and Regulatory Authority (WDRA) which was constituted in October 2010. There remained several bottlenecks, because of which at least 20-30% of the total food grain harvest is wasted due to inadequate storage capacity, regional imbalance in warehouses, lack of adequate scientific storage and inefficient logistic management in the country. It is said that each grain bag is handled at least six times before it is finally opened for processing which leads to higher storage & transportation charges and also increases to wastage of food grain during transit & handling. With all these issues, much needs to be done to physique

additional storage capacity with cost & environmental considerations, renovating existing warehouses and implementing an ICT & IT based smart and robust system of NWR to make available added funds to farm producers and simultaneously provide security to the lenders. The need of hour is to enhance the regionally balanced erection of modern warehouses keeping in view the fusion of high-tech materials, methods and management, and following due protocols of environmental laws and principles. Some of the other necessities are equal importance to get focused on wider agricultural commodities and developing a network or clusters of warehouses in a fashion where more warehouses issues NWRs for growers.

B. **Predominant Form of Warehouses:** By looking into the complete spectrum of agricultural warehousing sector in India (Chand, 2012), the existing warehouses can be broadly categorized in four specific types,

1. Private Warehouses: They are owned and operated by big manufacturers/ merchants to fulfil their own storage needs. The goods manufactured or purchased by the owner of warehouses have a limited value or utility as businessmen in general cannot make use of them because of the heavy investment required in the construction of a warehouse, some big business firms which need large storage capacity on a regular basis and who can afford money, construct and maintain their private warehouses.
2. Public Warehouses: A public warehouse is a specialized business establishment that provides storage facilities to the general public for a certain charge. It may be owned and operated by an individual or a cooperative society, but has to work under a license from the government in accordance with the prescribed rules and regulations.
3. Public Warehouses: These are very important in marketing of agricultural products specifically in cooperative sector, sometime known as duty-paid warehouse, being very useful to business community. They provide storage facilities to small manufacturers and traders at low cost, and are well constructed/guarded round the clock to ensure safe custody of goods, and usually located near junctions of railways, highways and waterways.
4. Bonded Warehouses: These are licensed by government to accept imported goods for storage until the payment of custom duty, and are often located near the ports. These warehouses are either operated by government or work under control of custom authorities, having supportive provision for importers & exporters, who can withdraw goods in install 0lments by paying customs duty proportionately.

C. **Dynamic Roles of Warehousing:** Methodological reviewing has well

established that the warehousing use to be the backbone for developing any trade or commerce (GOI, 2011), being more valid for agrarian sector, owing to sharp rise in agro-processing and agri-business industry. Agrarian warehousing always looks to play a very decisive role in strengthening agricultural supply chain, ensuring food security, price stabilization, and net income of farmers/traders. It also solves the problems of glut and scarcity by maintaining uninterrupted supply of agricultural commodities in all season. Under the changed era, the function of a warehouse does not remain confined only up to a storage or as a godown, rather it needs to incorporates manifold functions namely, receiving, inspection, repacking, put away, storage, order picking/selection, quality grading, packing, shifting, cross docking, and replenishing. These functions remained specific for a given situation in regards to either the commodity to be taken/dealt or the exact type/category of existing warehouses.

D. **Key Warehousing Agencies**: Available data and searching methods show that in India there are many

I. SALIENT UPSHOTS AND DELIBERATIONS

Based upon plethora of observations and reviews from results and secondary source information, efforts were made by authors to deeply traverse the issues and portraying a suitable canvas being perceptive to target the important gaps and their cause-effect relationships. The focused inferences keeping small and marginal farmers of India as target, are synthesized and being offered herein under broad categories to reflect the warehousing-based interventions in both the agrarian as well as environmental domain. Some of the key information and logical discussions in this regard are presented below, to touch and realize the constraints and possible ways for Indian conditions.

A. **Echelon of Warehousing Competitiveness:** In the complete logistics value chain, warehousing forms a very important link. Warehousing, which forms 20% of the total logistics market, was traditionally used as god owns to store goods from the time of production till the time of consumption. Over time and with the changing role of the sector, traditional warehouses have transformed to collection and storage points, where raw material, intermediate and manufactured goods are collected, assorted, stored and distributed to the point of consumption/sale. The warehousing market in India is expected to grow at a rate of 35 to 40% annually, displaying high potential for growth over the next few years. Currently, the sector is

highly fragmented with small players holding small units distributed across states with many challenges. Table 1, depicts some of the benchmark digits in terms of physical and financial targets and achievement as found across different Five Years Plans (FYP) in India. special purposes.

B. **Emerging Challenges and Issues:** The level of infrastructure and financial organization, very deeply influences the net outputs, which is found truer in agricultural sector in accordance to many assessments (Binswanger, et al., 1993; Roy and Pal, 2001). Prevailing policies & reforms as undertaken have not yielded due outputs matching with projected results owing to sectoral short comings like,

- Prevailing policies could not fully address the issue of insufficient storage infrastructure. Existing storage potential of leading agencies like FCI, CWC, SWC‟s etc are extremely short and unevenly distributed (Table-1). Policies are inappropriate to ensure farmers‟ market linkages (both backward & forward), private trade, poor invest in marketing infrastructure due to excessive regulatory framework/dominances.

- Tackling logistic/transport sector on agricultural commodities is another big gap with cast scope. It is interesting to note that of the estimated 25000 vehicles in use, 80% transport dairy products (wet milk); only 5000 refrigerated transport vehicles are available for all other commodities. If we compare globally, the % of movement of fruits & vegetables through cold chain in U.S. is around 80 to 85 %, in Thailand 30 to 40 % but in India it is insignificant. Such situation invites deeper sensitivities of planners on policy framework in this regard (Gaur, 2015; Gulati and Ganguli, 2010).
- Even the highest body on warehousing, WDRA feels hurdles to mandatorily regulate all warehouses except those who intend to issue NWRs. Other than cancelling registration of those willingly registered with it, WDRA does not have ample coercive powers to impose penalties against those who are issuing NWRs in violation of WDRA acts.

Table 1. Approved plan expenditure/physical capacity vis-à-vis achievement for erection of godowns under plan scheme of last 6 five years plans of India

FYP	Physical (In Lakhs MT)	Financial (Rs in Crores)

	Target	Achievements	Target	Achievements
VIth	28.65	24.63	156.25	180.22
VIIth	27.30	24.84	247.50	265.42
VIIIth	5.51	4.54	103.61	113.72
IXth	4.54	3.96	111.40	110.61
Xth	3.62	3.67	87.61	86.62
XIth	0.955	0.45	124.875	86.74

Source : FCI (2018)

Table 2 Storage capacity for central pool stocks for the last five years in India

As on	Overall storage capacity (lakhs metric tons)		
	with FCI	with other Agencies	Total
01-04-2011	316.10	291.32	607.42
01-04-2012	336.04	341.35	677.39
01-04-2013	377.35	354.28	731.63
01-04-2014	368.90	379.18	748.08
01-04-2015	356.63	352.59	709.22
01-04-2016	357.89	456.95	814.84
01-04-2017	352.71	420.22	772.93
01-04-2018	362.50	480.53	843.03

Source : FCI (2018)

c. **Engineering and Environmental Design Considerations**: Environmental design not only considers the building, structural, mechanical, electrical and other constituents of a warehouse system, but equally put attention to care climatic, weather based and other environmental entities like storm water management, drainage, humidity & moisture, and many other indirect essentials (Meneghetti and Monti, 2014,2015) in efficient environmental design always allowed to maximize the useable area while avoiding and minimizing environmental constraints. Warehouses are now a days critically seen from the angle of environmental justice issue. For example, when we ponder of locally unwanted land uses, we often think of large power plants, puffing single clouds of pollution. But many clouds of pollution from trucks & tractors traveling to and from warehouses can have equally large impacts on health. These automobiles travel frequently to deliver the produces/goods to warehouses, and further move them from those facilities to customers/markets at variety of time and spaces. This altogether advocates to consider warehouse system in a holistic manner, by coming out of the four walls and

giving best possible environmental considerations; while planning, designing or even expanding the prevailing warehousing systems.

Environmentally responsive design using eco-friendly construction materials remains the first and foremost step, tocontemplate a truly smart & modern warehouse; ensuring effectual abilities in terms of energy efficiency, low cost, easy operation & maintenance, weather & climate resistant, and environmentally welcoming. Engineering & environmental parameters are thereafter made parts of other constituents inside the warehousing sector; which includes storages, internal & external movements, inventories, and IT & ICT enabled trades & tracks. In a general setting, the supply chains and logistics constitutes the biggest warehousing challenges which needs to be overcome by smart versions of man, machine, management and marketing. Automation with energy efficient smarter & digital elements has high potential to govern below given major challenges (Tappia et al., 2015; Fichtinger et al., 2015).

- Inventory accuracy to ensure full visibility to avoid/minimize unfulfilled orders and unhappy customers.
- Inventory location to improve efficiencies within warehouse avoiding slows operations & cost increases
- Ensuring optimized space utilization within available warehouse layout to avoid unnecessary labour.
- Ample & effective redundant processes like barcode technology for reducing time loss.
- Picking optimization for shipment with system-directed automated routing to pick/ put away, reducing wear andtear on equipment and the workforce.

1. Specified Design Components/Considerations: Special-designed warehouses meeting strict requirements can also provide liquid storage (fuel and non-propellants), flammable and combustible storage, radioactive material storage, hazardous chemical storage, and ammunition storage. Features already now common in warehouse designs are higher bays, sophisticated materials-handling equipment, broadband connectivity access, and more distribution networks. A wide range of storage alternatives, picking alternatives, material handling equipment and software exist to meet the physical and operational requirements of the warehouse. Warehouse spaces must also be flexible to accommodate future operations and storage needs as well as mission changes.

- Building Attributes: Ample utilitarian facilities delivering functional, efficient, safe, and comfortable environment for workers to increase productivity & control, reduce operating costs, and improve customer service with proper aesthetics, landscaping.

- Categorical Forms of Spaces: storage Space, office space, loading docks, light industrial space, computer centres
- Space Configurations : to meet current & future needs, facilitate changes in business/agency growth,

,accommodate need for future loading docks, truck space, and parking spaces , addressing material handling technologies, proper roof design using solar aspects, fire protection capacity, adequate circulation paths , higher bays to take advantage of height allowances, optimized configurations ,relating interior and exterior receiving and shipping operations to the process flow of goods, properly separated receiving/shipping to avoid congestion ,other material handling methods.

D. **Policy Related Trepidation & Solution Keys:** A deeper analysis of obtainable situations invariably projects that exists in India, showed that the agricultural warehousing has plethora of troubles. Even till now, there remains wider gap and thus lack of unrelenting due investment in warehousing sector. One of the most influential reasons for it is the fact, that private sector initiatives in agricultural warehousing sector remained extremely small & sporadic, when compared the scenario of warehousing of other industrial sectors. Fuel is added to fire, with associated shortcomingsand other important reasons like, (1) available warehousing capacities are inadequately small, (2) Often they are not of good quality and (3) they are located in fragmented manner. In recent past one of the „Government of India Working Group" on ware housing development & regulation for the 12th plan period, observed and established the need for formulating a comprehensive post-harvest scheme for the farmers at the national level, because a substantial quantity of food grains (6 - 10 % of total production) are damaged due to moisture, insects, rodents and fungi alone. Some prominently emerging issues in regards to warehousing remains as follows,

- Proportionate efforts/infrastructure/allocation/importance towards agricultural warehouses is extremely diluted and it is almost ignored if one compares it in relation to industrial sectors. Hardly 12-14 % of total warehouse capacity accounts for agricultural commodities, even when warehousing market, is growing at 9 % annually and is expected to cross Rs 35000 Crore market in 2015-16 (ASSOCHAM, 2014).
- Logistic scenarios in regards to agricultural ware housing are not favourable. More than 80 % of agricultural commodities for domestic consumption are transported by road with poor share of rail owing to shortage of rakes, which was reported 6 to 17 % short in 2012.
- Issues of poor handling & service at railway terminals are another burning issue.
- The continuous supply of fruits, vegetables and other essential commodities to consumers ensures food security in country. A study by Global AgriSystem of

Fruit & Vegetable supply chain (Patnaik, 2011) in 4 metros (Delhi, Mumbai, Bangalore and Kolkata) revealed that, on an average there are 5-6 intermediaries between the primary producer and consumer.

E. Application Issues of Warehouse Policies

1. Prevailing Inadequacies: Even if we add other scattered storage options (farmers, or private), in no case total storage capacity exits above 110- 120 MMTs, while at prevailing point of time India has already reached to a situation where the total food grain production is more than 250 MMTs. 21 MMTs of wheat and about 40 MMTs of fruits &

vegetables is lost between the grower and the consumer due to shortcomings like lack of refrigerated transport, poor roads, improper storage & marketing avenues. If growth in agricultural warehousing, storage & transportation facilities fails to match above cited realistic demands, this problem is likely to be further accentuate, because the development and modernization of agrarian sector is always projected to deliver elevated volumes of commodities. Existing warehousing capacities as cited above are not only in-sufficient but in truer sense their spatial spread more often, reflects a cosmic heterogeneity as far as their want is measured over space & time. It becomes evident from an example, when we look into the national spectrum of available storage space say with FCI. It is quite flagrant that so called storage space remains strenuous mainly in the pouring nucleus located in Northern Zone (about 65 % of total) followed by Southern Zone (15 %), Western Zone (12 %), Eastern Zone (7 %) and North Eastern Zone (1%) of country. Around 69 % of cargo space is resolute in 8 major procuring states i.e. Punjab, Haryana, Uttar Pradesh, Andhra Pradesh, Telanagana, Madhya Pradesh and Chhatisgarh, while only about 7 % exists in 4 newly emerging procuring states of Bihar, Odisha, Jharkhand and West Bengal. Cluster of ware houses & marketing facilities in an around farmers field, small producers/traders is a crucial need of present time, for which there remains vast opportunities. It could extend benefit in two ways, firstly generating warehouse at farmers door step to safeguard their time, net come and profit margins; and secondly to accommodate about additional 40-50 MMT of agricultural commodity by 2020, which are expected/projected from Indian farms owing to technological applications thereupon.

2. Innovative Efforts: There are plenty of new innovative efforts for promoting warehousing and logistic related improvement in agricultural sector. Discussion on all these is beyond scope here, moreover one extremely imperative effort was the concept of Negotiable Ware House Receipts (NWRs), which has been deeply and effectually applied in India to facelift the warehousing sector, making it as a

platform to offer multiple benefits to farmers, traders, and agricultural sector as a whole. These benefits encompass many valuable things like, increased liquidity in rural areas, encouragement of scientific warehousing of goods, lowering cost of financing, shorter and more efficient supply chains, enhanced rewards for grading and quality, and a better price risk management for majority of situations during farming as well as trading.

3. Negotiable Warehouse Receipts (NWR) as a New Dimension: Concept of NWR is being recommended as one of the most successful intervention in agricultural marketing, as NWR documents are issued by warehouses to depositors against the commodities deposited in the warehouses, for which the warehouse remains the bailee. It could be either non-negotiable or negotiable both, and often remains transferable by simple endorsement /signature. NWRs are transferred by endorsement and delivery; i.e., either the original depositor or the holder in due course (transferee) can claim the commodities from the warehouse. These can be traded, sold, swapped or used as collateral to support borrowing. Basically, the term NWR is most appropriately defined under Warehousing (Development and Regulation) Act, 2007. In spite of it, the Indian agriculture is almost in the grip of a debt trap, where overall market failure is resulting from regulation point of view. Several studies have revealed a strong recommendation for negotiable ware house receipt (NWR) case for market reforms, by encompassing all critically emerged issues like, current policy & regulatory frameworks which impede growth, need for a broader legal framework to facilitate growth of NWR, and integration of national spot exchanges with commodity exchanges etc. So framed new NWR system could offer several benefits for trading by farmers like,(i) easing storing of their produce in nearest registered warehouse, (ii) encouraging them to take NWR to nearest physical market („spot market" or virtual market i.e. „spot exchange") and selling it to a trader or vice-versa, and (iii) ensuring more credibility to NWRs, facilitating paper based direct trading by farmers adopting grading of commodities & scientific storage in nearby accredited warehouse (i.e. 3rd party). A global analysis on success and failures of such NWRs based applications have shown comparative attractiveness of field & public warehousing, as a function of the borrower"s logistics needs and the external environment. No more than 3 levels of headings should be used. A functional flow diagram (Fig. 2) of NWR concept reflects its various ingredients, which have enormous plus points, moreover, the truer ground verifications of NWRs have shown its own shortcomings as given below,

- Crop loan interest subvention scheme to improvise the NWRs in order to discourage distress sell by farmers, gave many impediments during its active implementation. Only those farmers who have obtained crop loan are entitled for post-harvest loan on NWRs, that too for a period of another 6 months only,

releasing adverse impacts on small & marginal farmers.

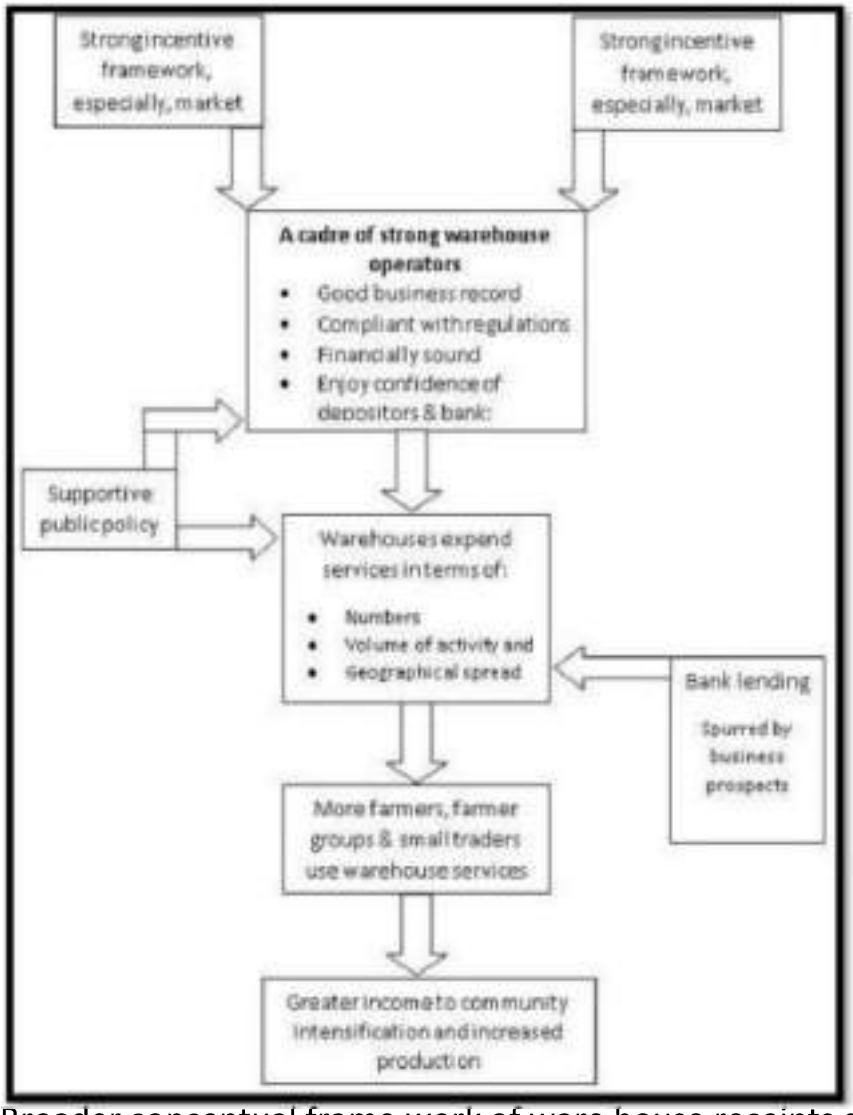


Fig. 2. Broader conceptual frame work of ware house receipts system

F. **Futuristic Elucidations from Famer's Perspectives:** Farmers under Indian conditions often need a timely credit which is habitually provided by a trader either by holding the farmer produces as collateral; or in kind i.e. in form of inputs (seeds, fertilizers, supplements etc). Situation becomes grimmer for small and poor farmers when storage facility is either not available with them, or it is owned by the trader, who never encourage such needy farmer to get credit from other sources. It gives 3 major cases,

1. Either trader sells farmers produce & deducts principal & interest, (price received by farmers is not competitively discovered & thus forcing farmer to sell through trader only)
2. Distress sales by farmers to square off debts soon after harvesting, even loosing capital.

3. Improper support service providers like, extension, market intelligence, credit, inputs.

Multiple roles performed by traders allow them to exploit farmer, who finds himself in a debt trap (Chand, 2012). Only viable solution in this regard looks to be efficient & better regulated (structurally & environmentally) warehouses located nearby farmers and thus facilitating a supply chain and good alternatives with growers to fetch best possible benefits from their crops/commodities. Further promoting warehousing with intensive applications of NWRs is going to greatly benefit the small and marginal farmers. If warehousing sector is improved it is well established by the published results and practical exposures and experiences of many nations that it is a win-win situation both for growers, traders and consumers who so ever deals with agricultural crops and commodities. Some of the far-sighted benefits to an average small and marginal famer are,

- Better linking of farmers to markets & strengthening of value chains, to improve market access & trade, and also easy up challenges for most agricultural commodities.
- Positive agri-business with ensured profit to small & marginal producers.

- Training and awareness for yielding relevant quality HR for warehousing
- Additional storage capacity to the tune of at least 35 MMT giving better extent of agri-business options at national and regional scales.
- Downsized post-harvest losses, additional support to improve infrastructure, information technology, post-harvest handling, easy access to finance via NWRS, improved rural investment climate, skills development, risk management, and transparency in markets.
- Traditional knowledge & wisdom of farmers could be better valued & translated to achieve location specific climate-smart post-harvests, functioning & maintenance of the physical storage structures, market information/transport options, collective leanings, reduced asymmetry in access to key commodity information & efficient marketing, enabling farmers to negotiate better prices, free trade being important part of this value chain.

SUMMARY AND CONCLUSION

If we put down the issue of prevailing shortage, even than it is another astonished fact to realize that for world‟s premier agrarian nation and agrarian economy like India, about 80% handling and warehousing facilities are still not fully automated or

even mechanized. Traditional manual methods for loading, unloading and handling of food grains and other commodities are still common. However, the warehouses which are mechanized have just forklifts or hydraulic hand pallet trucks. The observation and statistics clearly indicate that there is an acute shortage of organized and good quality warehousing and storage infrastructure in the country. Warehousing in India has been linked to food security and agricultural growth Warehousing is now seen as an integral part of the supply chain where goods are not only stored for safekeeping, but also where other value processes are implemented, thereby minimizing wastage and costs. Warehousing in agriculture is part of the larger agricultural ecosystem. Just like agriculture, the warehousing market is local, unorganized, and fragmented. National standards have not yet been uniformly adopted or mandated, and the quality of warehousing and the contractual obligations that Warehouse Service Providers (WSPs) enter into, vary widely across regions. Under modernized agriculture the intended role of warehouses has been amplified due to wider product range, emphasis on shorter lead times and constant changes in customer demand with varied quality and quantity fronts. The increased demands force agricultural traders or farmers to improve upon their storage operationsfor better service level with decreased costs. Transportation and agricultural logistic factors are being appeared equally important and most relevant factors in this regard, where they deeply influence the overall warehousing capability and competence in various regions of the country. The available options in terms of new technologies, logistics and supply chain management, IT & ICT based handling, electronic linkages of warehouses and markets, organized operations & management, collaborative efforts among all stakeholders (Government agencies, policy makers, entrepreneurs, investors; logistics services providers, manufacturers, farmers and sellers) are the potential prospects in this regard.

Key issues which needs to be realized and rectified are, government policy for warehousing, public-private partnership in Warehousing development, financing & modernization of warehousing, scale and quality of warehousing infrastructure , various regional & national constraints and Impediments in setting up of new warehouses, integration of warehouses with complete supply chain, better strategies to leverage modern technology, studying key trends and future plans, availability and access to funding, capacity building and operational efficiency of warehouses, higher investment opportunities, improved R&D and sector investments, and creating smart and sensitive human resources. The food for thought offered in present paper happens to be a preliminary contemplation of author which might have some deficiencies and in appropriateness. Moreover, the findings obtained herein present alarming indications to consider agricultural warehousing very sensitively and putting converged efforts to facilitate better net

profits for agricultural farmers and traders. Managerial issues of Indian agrarian warehousing sector inevitably need a comprehensive scenario analysis from not only physical infrastructural point of views but also from environmental understandings & perspectives. Smarter upright strategy, viable competitiveness reforms, managerial & environmental regulators/bottlenecks, green supply chains, climate warming impacts, energy saving methodologies, and integrated inventory/warehouse management will certainly reduce adverse environmental impacts. Ample thoughts are to be given at policy planning level, to ensure the adoption of innovative perceptions like greening the food supply chain, reducing greenhouse gas emissions during operation & supply chain management, Incorporating environmental dimension in automated warehouses, applying environmentally sustainable solutions to take care of agricultural product loads and warehouse failures, inventory accuracy, location & space utilization during warehouse layouts and commodity picking optimization.

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BACK GROUND OF INDIAN TAX SYSTEM

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ABSTRACT:

The world's 12th-largest economy at market exchange rates and the fourth largest in purchasing power, India has a quasi-federal form of government. India's Constitution is the longest and the most exhaustive constitution of any independent nation in the world. India has a three-tier federal structure, com- prised of the union or central government, the state governments, and the local bodies, all of which have the authority to levy taxes. Besides direct taxes such as the income tax, indirect forms of tax are collected such as the sales tax, VAT, service tax, stamp duty, customs,and excise duty.

INTRODUCTION

Tax is a fee charged by a Government on a product, income or activity. If tax is levied directly on personal or corporate income, then it is a direct tax. If tax is levied on the price of a good or service, then it is called an indirect tax. The purpose of taxation is to finance public goods and services, such as street lighting, street cleaning, road, dams, utility services etc. Since public goods and services do not allow a non-payer to be excluded, or allow exclusion by a consumer, there cannot be a market in the goods or services, and so they need to be provided by the Government or a quasi- Government agency, which tend to finance themselves largely through taxes.

The word tax is derived from the Latin word ‘taxare’ which means ‘to estimate’. “A tax is not a voluntary payment or donation, but an enforced contribution, exactly pursuant to legislative authority" and is any contribution imposed by Government whether under the name of toll, tribute, impost, duty, custom, Excise, subsidy, aid, supply, or other name.” (*Black’s Law Dictionary*)

In India, the tradition of taxation has been in force from ancient times. It finds its references in many ancient books like 'Manu Smriti' and 'Arthasastra' "A comprehensive VAT widens tax net, as it makes tax evasion difficult. Going by the experience of other countries, VAT has proved beneficial and leads to revenue buoyancy."

India can be globally competitive as a fully integrated marketin the Value Added Tax regime."

- Raja Chelliah, the architect of the VAT system in India.

Introduction of VAT by Indian States has been hailed as one of the biggest taxreforms in several decades. The Empowered Committee (EC) of State Finance Ministers was the Central body which coordinated the design and implementation of VAT. Currently, all Indian States have implemented VAT and the transition to VAT has been fairly smooth.

The main motive of VAT has been the rationalization of overall tax burden and reduction in general price level. Thus, it seeks to help common people, traders, industrialists as well as the Government. It is indeed a move towards more efficiency, equal competition and fairness in the taxation system. The main benefits of implementation of VAT are:-

Minimizes tax evasion as VAT is imposed on the basis of invoice/ bill at each stage, so tax evaded at first stage gets caught at the next stage;

- A set-off is given for input tax as well as tax paid on previous purchases;
- Abolishes multiplicity of taxes, that is, taxes such as turnover tax, surcharge on Sales tax, additional surcharge, etc. are being abolished;
- Replaces the existing system of inspection by a system of built-in selfassessment of VAT liability by the dealers and manufacturers (in terms of submission of returns upon setting off the tax credit);
- Tax structure becomes simpler and more transparent;
- Improves tax compliance;
- Generates higher revenue growth;
- Promotes competitiveness of exports; etc.

NEED FOR THE STUDY

VAT has been implemented in good spirit. The Centre has started to compensate the States for their revenue losses. It was really tough for the Centre to implement VAT in different States as most of the States were purely dependent on the grants from the Centre. Though. there were opposition from many State Governments, it was possible for the Centre to implement VAT. VAT is a step towards the implementation of GST. GST is a comprehensive structure of both goods and services. It is perceived by the general public that VAT is necessary to curb tax evasion and to contribute to the National exchequer sizeable revenue.

This study analyzes the main reason for taxevasion by the traders, and the general public on VAT system. VAT compels the traders to maintain books of accounts and regular filing of returns. In this scenario, it is necessary to know the extent of difficulties undergone due to the implementation of VAT. Puducherry being a small State depends on the Centre for its main source of revenue. It has to generate more revenue out of its own resources. So, it necessary to know how the revenue of this State has increased or decreased due to the implementation of VAT. This study reviews the administrative difficulties of the tax department undergoes in administering VAT and its preparedness and expectations under the proposed GST. Also, study attempts to know the expectations of the traders in the forthcoming GST scenario. More than 150 countries in the world have been experiencing the VAT/GST regime. India is now moving towards GST to be rolled out in April/Oct 2012. Hence, this study is very relevant in India in the especially Puducherry context of transition from erstwhile tax regime to VAT and further GST.

SCOPE OF THE STUDY

The study was conducted to analyze the effectiveness of implementing VAT. It covered the opinions of the professionals, traders, manufacturers and the general public, consumers. It brought to light the beneficial impacts of VAT. This study emphasizes the reason for transition from VAT to GST. This study was conducted with regard to the State of Puducherry which includes Karaikal, Mahe and Yanam regions.

SIGNIFICANCE OF THE STUDY

VAT is the most important tax revenue for States, contributing more than one-half of their own tax receipts. It is expected to bring down the incidence of harassment and corruption that trade and industry encounter. The introduction of VAT has brought great apprehensions in the minds of many and the same will be passed on to the consumers. There was fear among the contributors of tax that the cost of goods might go up, harassment would be more and so on. VAT was introduced in Puducherry in the year 2007. The VAT will not provide full set off for input tax but also abolish the burden of several existing taxes viz, turnover tax, surcharge on Sales tax, additional surcharge,special additional tax etc.

The State level VAT will be self-policing, improving tax compliance and reducing prices and all these will increase tax buoyancy This study is an attempt to examine the pre and post VAT regime and, the pros and cons of old as well as the new system. It is very important in this context to find out the possibility, practicability and prospects and constraints of the transition from VAT to GST (Goods and Service tax). This study is very relevant in the context of the administration of VAT in India with special reference to Puducherry State. Puducherry is being a Union Territory with little scene for increasing tax revenues which hitherto setting more of Central funds. Now, the State is forced to raise more funds (OTRs) to get an equated Central fund. Hence this study assumes greater significance.

OBJECTIVES OF THE STUDY

The present study is carried out with the following objectives:

- To study various aspects of VAT system in India and to analyze the aspects of VAT system in developed countries.
- To examine responses from the experts regarding implementation and administration of VATin Puducherry State.
- To elicit the opinion of traders (business men) relating to their perception about VAT in Puducherry State.
- To evaluate the opinion of General Public regarding the VAT in Puducherry State.
- To analyze the current Sales tax form and its impact in the administration of VAT.

LIMITATIONS OF THE STUDY

- The inherent weakness of primary source of data applies to this research study only.
- The inadequate knowledge of the respondents about VAT policies, procedures andmethods likely to affect the response of general public.
- The samples and the data collection are based on the willingness and reactions of therespondents.
- The process of administration of VAT is an ongoing process and the inference andconclusions based on collected information may not reflect the future course of action.
- As the reforms are continuous in nature, the findings of the study in the right of evaluationof data may change from time to time.

INDIAN TAX SYSTEM BACKGROUND

TAXATION IN INDIA

The world's 12th-largest economy at market exchange rates and the fourth largest in purchasing power, India has a quasi-federal form of government. India's Constitution is the longest and the most exhaustive constitution of any independent nation in the world. India has a three-tier federal structure, com- prised of the union or central government, the state governments, and the local bodies, all of which have the authority to levy taxes. Besides direct taxes such as the income tax, indirect forms of tax are collected such as the sales tax, VAT, service tax, stamp duty, customs,and excise duty.

INCOME TAX ACT — BACKGROUND

Historians have argued that modern ideas and institutions of law, medicine, and criminal justice were first tested in the colonies and later implemented in metropolitan areas.[2] The tax system was first introduced in India during the British rule. Today, the Income Tax Act, 1961 (Act 43 of 1961) — the primary legislation dealing with taxability of income — is self-contained legislation. The Income Tax Act empowers the Central Board of Direct Taxes to formulate rules for implementing the provisions of the ITA.[3] Income tax is a tax payable under section 139 of the ITA by filing a return (form/declaration) of income,[4] at the rate enacted by the Union Budget (Fi- nance Act) for every year on the total income earned in the previous year by every person (individual or company) who is a resident, nonresident, or resident who is not ordinarily resident. Residents are taxable for all their income, including income arising outside India.

The division of tax and expenditure powers is spelled out in the constitution. Article 366(29) defines tax on income as including tax in the nature of an excess profits tax.

Thus, the Indian Parliament has the exclusive power to levy a tax on income other than agricultural income. The Indian Parliament also has the power to make laws regarding any other matters not enumerated, including any tax not mentioned. While agriculture plays a dominant role in the economy, a government task force recommended that agricultural income be taxed.

The share of revenue generated from agriculture has been declining while the IT and outsourcing services sector has become a major catalyst for the Indian economy given its effects on income generation and job creation.

Any Government gets its revenue for expenditure purpose from three different sources i.e. income from taxes, income from services rendered to the general public and various grants and contributions received from foreign countries and international organizations. Mostly each and every government collects its major revenue by way of taxes, which is a compulsory charge imposed by the government without rendering any service to tax-payer. By taking into account on whom the money burden of the tax will fall, the taxes are classified into direct tax i.e. taxes on income received and indirect taxes i.e. taxes on expenditure incurred.

Income-tax i.e. tax on all types of income received by an individual in a given period comes under the direct tax segment which has proved to be the major source of revenue to the government of majority of the countries in the world and an ideal tax from the point of view of equity. In India, income-tax contributes up to 57.72% to the total revenue of the central government. It is levied under Income-Tax Act, 1961. The tax rates change according to financial bill passed by the Central Government in each year in its budgetary session. Though income-tax is one of the important sources to the government finance, it is an evil to tax-payer. Because of compulsion element, each tax-payer faces the problem of how to find golden means between minimizing tax liability and maximizing their savings. In this context, tax consultants who are professionals in the areas help them by way advising on tax matters as well as finalizing their tax proposals by charging certain fees in the form of service charges. They also provide some other ancillary services on demand of customers by charging separately for it.

STATEMENT OF THE PROBLEM :

Income-tax which is one of the major direct taxes has got much importance due to rising level of income in the recent years. In last few decades the number of income-tax consultants as well as income-tax payers has been increased by many folds. Though the relation between tax consultants and tax-payers is cordial, there are some difficulties on both the sides in maintaining cordial relationship. Tax consultants have formed their associations, which deal with their problems. Tax-payers do not form such types of associations. They deal with their difficulties on individual levels. It is seen that the cordial relationship between the two has been hampering due to these difficulties in recent years.

As such, the researcher decided to study the problem under the title of '**A Critical Study of the Services Provided by the Income-Tax Consultants to the Selected Individual, Firm and Company Assessees in the Sangli- Miraj-Kupwad Corporation Area.'**

Taxes in India are levied by the Central Government and the state governments Some minor taxes are also levied by the local authorities such as the Municipality.

The authority to levy a tax is derived from the Constitution of India which allocates the power to levy various taxes between the Central and the State. An important restriction on this power is Article 265 of the Constitution which states that "No tax shall be levied or collected except by the authority of law".Therefore, each tax levied or collected has to be backed by an accompanying law, passed either by the Parliament or the State Legislature. In 2015-2016, the gross tax collection of the Centre amounted to ₹14.60 trillion (US$220 billion).

HISTORY:

India has abolished multiple taxes with passage of time and imposed new ones. Few of such taxes include inheritance tax,interest tax, gift tax, wealth tax, etc. Wealth Tax Act, 1957 was repealed in the year 2015.

Direct Taxes in India were governed by two major legislations, Income Tax Act, 1961 and Wealth Tax Act, 1957. A new legislation, Direct Taxes Code (DTC), was proposed to replace the two acts. However, the Wealth Tax Act was repealed in 2015 and the idea of DTC wasdropped.

SERVICE TAX:

It is a tax levied on services provided in India, except the State of Jammu and Kashmir. The responsibility of collecting the tax lies with the Central Board of Excise and Customs(CBEC). From 2012, service tax is imposed on all services, except those which are specifically exempted under law(e.g. Exempt under Negative List, Exempt as exclusion from Service definition as per Service Tax, Exempt under MEN(Mega exemption notification)). In budget presented for 2008- 2009, it was announced that all small service providers whose turnover does not exceed ₹10 lakh (US$15,000) need not pay service tax.

Service tax at a rate of 14 percent(Inclusive of EC & SHEC) will be imposed on all applicable services from 1 June 2015.From 15th November 2015, Swacch Bharat cess of 0.5% has been added to all taxable service leading the new Service Tax rate to be 14.5 percent (Inclusive of EC, SHEC & Swacch Bharat cess). On 29 February 2016, Current Finance Minister Mr. Arun Jaitley announces a new Cess, Krishi Kalyan Cess that would be levied from the 1st June 2016 at the rate of 0.5% on all taxable services. The purpose of introducing Krishi Kalyan Cess is to improve agriculture activities and welfare of Indian farmers. Thus, the new Service Tax rate would be 15% incorporating EC, SHEC, Swachh Bharat Cess and Krishi Kalyan Cess. From 2015 to currently, the gross tax collection of the Centre from service tax has amounted in excess of ₹2.10 trillion (US$32 billion).

CENTRAL EXCISE

Logo of Customs and Central Excise

In 2015-2016, the gross tax collection of the Centre from excise amounted to ₹2.80 trillion (US$43 billion).

1. ***Central Excise Act*, 1944**, which imposes a duty of excise on goods manufactured or produced in India;
2. ***Central Sales Tax, 1956*,** which imposes sales tax on goods sold in inter-state trade or commerce in Indisale of property situated within the state[12]

In the 2016 Union budget of India, an excise of duty of 1% without input tax credit and 12.5% with input tax credit was imposed on articles of jewellery with the exception of silver jewellery. The government had earlier proposed an excise duty in the Budget 2011-12, which had to be rolled back after massive protests by jewellers.

- Central Excise Tariff Act, 1985
- Central Excise Valuation (Determination of Price of Excisable Goods) Rules, 2000.

CONSTITUTIONALLY ESTABLISHED SCHEME OF TAXATION:

Article 246 of the Indian Constitution, distributes legislative powers including taxation, between the Parliament of India and the State Legislature. Schedule VII enumerates these subject matters with the use of three lists:

- List - I entailing the areas on which only the parliament is competent to make laws,
- List - II entailing the areas on which only the state legislature can make laws, and
- List - III listing the areas on which both the Parliament and the State Legislature can make laws upon concurrently.

Separate heads of taxation are no head of taxation in the Concurrent List (Union and the States have no concurrent power of taxation). The list of thirteen Union heads of taxation and the list of nineteen State heads are given below:

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EasyChair Preprint

№ 10673

Taxation System in India- an Overview on GST

B.V.Satya Prakash

EasyChair preprints are intended for rapid dissemination of research results and are integrated with the rest of EasyChair.

August 6, 2023

TAXATION SYSTEM IN INDIA --GST OVERFVIEW

B.V.SATYA PRAKASH

- ***ABSTRACT***

India has well -developed tax structure with clearly demarcated authority between Central and State Governments and local bodies. Central Government levies taxes on Income Tax (except Agricultural Income), Customs Duties, Central Excise and Service Tax. Value Added Tax (VAT TAX) , Stamp Duty, State Excise and Land Revenue Tax are levied by the State Governments. Local bodies are levy tax on properties, Octroi, and for utilities like water supply, drainage etc., In the last decade, Indian taxation system has undergone tremenmdous reforms. The tax rates have been rationalized and tax laws have been simplified, resulting in ease of tax payment and better enforcement. After introducing GST the above Central Government taxes collected are sunsumed in Goods and act

- ***Keywords***

Indian taxation system

Central Government Taxes

State Government Taxes

No tax on Agricultural Income

Taxes are sunsumed in GST

- ***INTRODUCTION***

Taxes are two types. They are 1. Direct Taxes 2. Indirect taxes. Direct Taxes means taxes collected directly from the Person Eg: Income Tax. Indirect taxes are collected from the persons indirectly.Just like Sales Tax etc., Before introducing GST in India various taxes collected, just like Excise Duty, Customs Duty, Service Tax, Securities Transaction Tax, Vat Tax etc., these taxes are sunsumed in the GST.

According to Prof.E.A.R.Seligman, A tax is a compulsory contribution from the person . Income Tax Act 1961 does not given any definition. The Government collected taxes and the amount is utilised for different welfare schemes in the country.



- ***Subject***

- ***Goods and services tax***

In India, GST came into existence on 1st Jult,2017. However the seeds of GST have been started in 1970s. Despite the fail and raise of various Governments, the journey continued its path. Constitution has been amended multiple times. First of all to know the history and development of GST in India through various time lines.

At first in 1970s the first step to GST can be tracked back to mid 1970s. In 1986 Sri V.P.Singh (Financial Minister) introduced MODVAT, Modified Vat . Few years later, Dr.Manmohan Singh extended MODVAT to all most all the commodities and reduced excise duty rates. In 1999 Yashwanth Singh introduced full pledged Vat. In 2003 the Kelkar Task Force on Indirect Tax had suggested a comprehensive Goods and Services Tax (GST) based on vat principle.

In the year 2009-2010 a proposal to introduce a National Level Goods and Services Tax (GST) was first brought up in the budget speech for the financial year 2006-2007. In November 2009 various discussions started for the implementation of GST in India. In 2011 to amend the Constitution (115th amendment) Bill was introduced in the Lok Sabha in March 2011. The Union Finance Minister and the empowered committee of State Finance Minister on 8th November 2012, a Committee on GST design, consisting of the officials of the Government Of India, State Governments and the Empowered Committee was constituted. This Committee did a detailed discussion on GST design including the constitution (115th) Amendment Bill and submitted its report in January, 2013. Based on this report the EC recommended certain changes in the Bill in their meeting held on January 2013 in Bhubaneswar.

In June 2014, the draft Constitution Amendment Bill was sent to the empowered committee after approval of the new Government. The GST Bill was introduced in Lok Sabha in 19.12.2014. The bill was passed on 06,05.2015 by the Lok Sabha. 21 members select committee was formed to look into the proposed GST laws were passed by all the States and Union Territories of India exc ept Jammu and Kashmir.

The Goods and Services Tax (GST) was launched on the mid night of 30th June 2017 by the President of Sri Pranab Mukharjee and the Prime Minister of Sri Narendra Modi. The launch was marked by a historic midnight (June 30th-1stJuly,2017) session of both the houses of Parliament convened at the Central Hall of the Parliament. So the Goods and Services Act came into existence in India on 1st July 2017.

- ***Materials and Methods***

India has come up with GST with effect from 1st July 2017. GST is a comprehensive based tax . Taxes are levied by the Central Government and 50% amount paid to the respective state governments in the form of GST.

Goods and Services Tax (GST) is destination based tax and levied at single point at the time of consumption of mgoods and services by the ultimate consumer. It iks based on the principle

of Value Added Tax (VAT). GST is a comprehensive indirect tax on manufacture sale and consumption of goods and services.

- ***Types of GST***



There are 4 types of new terms shall be used for levying and collecting GST.

1. CGST : Central GST

2. SGST : State GST

3. IGST : Integrated GST

4. UTGST : Union Territory GST

- ***Analysis***

Goods and Services Tax (GST) is the single point tax. It is simple and good tax system. ONE COUNTRY ONE TAX SYSTEM IS APPLICABLE.

- ***Major features of GST Act :***

1. GST (Goods and Services Tax) is primarily levied at 5 rates. : 0%,5%,12%, 18% and 28% Government can levy and collect taxes at exceptional rates (Eg: Gold 3%)

2. GST is mandatory for persons whose aggregate Turnover is above Rupees 20 Lakhs.

3. If a sale is intra-state (within the state) and the product is Red Chillies which comes under 5% tax. CGST 2.5% Central GST, and SGST 2.5% State GST.

4. Alcohol for human consumption is left out of GST. Petrol and Diesel also left out of GST.

5. Input Tax Credit can be availed from all the purchases.(Inter State or Intra State)

6. E-Commerce operators to collect Tax at Source (TCS of 1%) at the time payment to suppliers of goods or services.

7. Assessment of the taxes payable is to be made self.

8. GST officers would have the power to inspect,search,seize and arrest.(in case malpractices made by the traders)

9. Central Government to establish GST Appellate Tribunal for hearing Appeals.

10. GST is PAN based registration. A business dealer has to apply for seperate GSTN ID in all the states where it has business activities.

- ***ADVANTAGES OF GST :***

Goods and Services Tax (GST) is destination based tax and levied at a single [point at the time of consumption of Goods and Services by the ultimate consumer. The following are the major advantages of Goods and Services Tax (GST) for various persons.

- ***ADVANTAGES OF GST FOR CITIZENS :***

1. GST is a simpleTax system. One Country One Tax System is applicable.

2. Reduction in price of goods and services due to elimination of tax evasion.

3. Uniform prices through out the Country.

4. Transparency in Tax system in India is also possible.

5. Increase in Taxation Department income through the GST.

- ***ADVANTAGES OF GST TO TRADE AND INDUSTRY :***

1. Reduction in multiple tax system due to implementation of GST, various taxes Excise Duty, Service Taxes, Surcharge etc., are sunsumed iin GST.

2. Minimization of Double Taxation System through the establishment of GST .

3. More efficient of taxes especially for Exports and exports promotion.

4. Development of common national markets in India through GST only.

5. Simple and Good Tax System and fewel tax rates and exemptions are applicable through GST only.

- ***ADVANTAGES OF GST TO CENTRAL/STATE GOVERNMENT :***

1. A unified common national market to boost foreign investment and Make-in-India Campaign.

2. Goods to exports (or) manufacturing activity, generation of more employment leading to reduce poverty and increased GDP growth in India.

3. Improving the overall investment in the country which will benefit in the development of states.

4. Uniform SGST and IGST relates to reduce the tax evasion to which fetch the Government revenue through GST.

5. Reduction in cost mainly advantage to consumers and development of individual sector also ultimately advantage for the State and Central Government.

- ***REGISTRATION UNDER GST***

Under Gst Regimed, business whose turnover exceeds Rs.40 Lakhs is required to register as a normal taxable person. This process of registgration is called GST Registration.

For certain business, registration under GST is mandatory. If the Organisation carries on business without registering under GST, it will be an offence under GST and heavy penalities will apply.

CBIC has notified the increase in threshold turnover from Rs. 20 Lakhs to 40 Lakhs. The notification will come into effect from 1st April 2019.

- ***DOCUMENTS REQUIRED FOR GST REGISTRATION***

PAN of the Applicant.

Aadhaar Card

Proof of Business Registration of Incorporation Certificate.

Identity and Address proof of Promoters/Director with Photographs

Address proof of the place of business

Bank Account Statement /Cancelled Cheques

Digital Signature and Letter of Authorization/Board Resolution for Authorized Signatory.

- ***Voluntary Tax Payment***

A Person can pay tax along with interest, based on his own calculations (or the Department calculations). Before the notice/statement is issued and inform the officer in writing of the same. The office er will not issue any notice in this case.

- ***NO PENALITY***

If the tax payer pays all the dues within 30 days from date of notice, then the penalty will not be applicable. All proceedings regarding the notice will be closed.

Notice when there is Fraud for tax short (Section 74)

Fraud

Willful misstatement

Suppression of facts.

- ***RESULTS***

This results in

unpaid/short paid tax or,

wrong refunds or,

wrongly availed/utilized input tax credit.

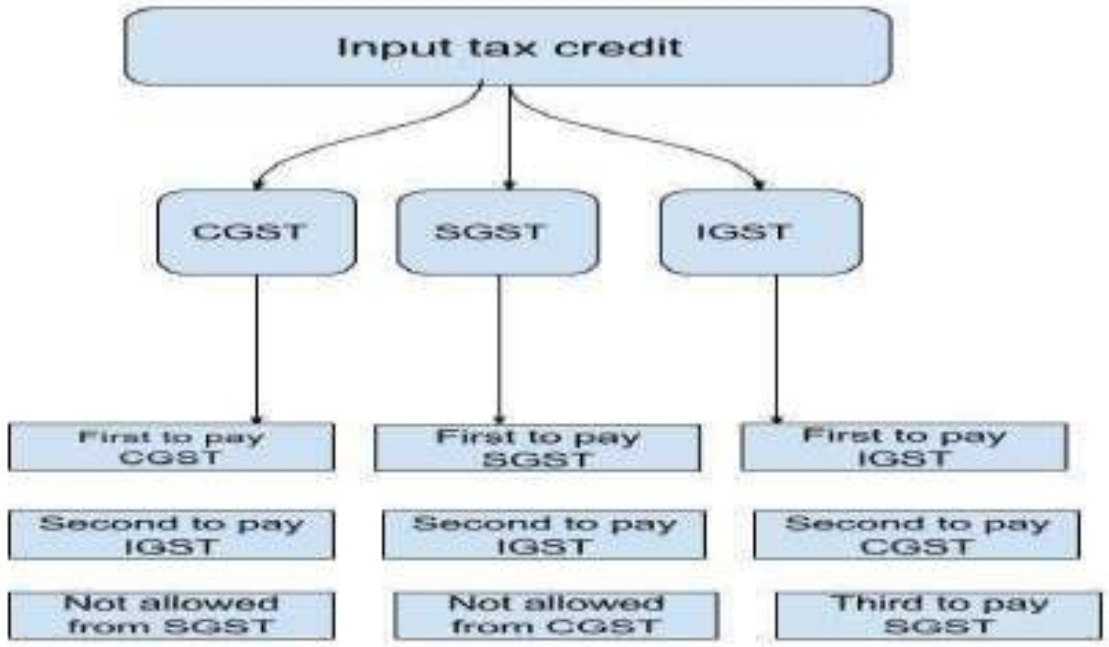
- ***Discussions***

GST *is a unified tax system that replaced tax multiple indirect taxs levied by both the Central Government and State Governments. Under GST, both Central and state governmentgovernments share the authority to levu and collect taxes on goods and services*

- *INPUT TAX CREDIT*

Tax credit means the tax a produce r was able to reduc e while paying his tax on output.

Input tax credit means that when a manufacturer pays the tax on his output, he can deduct the tax he previously paid on the input he purchased. Here, while paying the tax on his output, he can deduct or take credit for the tax he paid while purchasing inputs.



- *CONCLUSION*

Gst is a destination based tax system which is introduced to have a Uniform tax system throughout the country. GST will bring in transparant and corruption-free tax administration.,

removing the current shortcomings in indirect tax structure. GST is business friendly as well as consumer friendly . GST in India is drastically improve the positions of each of these stakeholders. It will benefit the entire value chain and make it easier for both businessmen and consumers. GST will allow India to better negotiates its terms in the international trade forums . Its main aim is increasing the tax payer base by bringing SMEs and the un organized sector under its compliance. Anyhow GST is useful for all traders. Consumers and the society. So it is SIMPLE AND GOOD TAX SYSTEM IN INDIA.

- *Acknowledgement*

I hereby declare that the above information provided in the paper if fair and there is now change in the above stated. I discussed in the paper are truly obtiand by mymyself and not attained from any books or references

I hereby declare that this paper is submitted to easy chair only and truly it is not under any site or publishment reference.



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Evaluating the Effectiveness of Different Testing Methods for Spearmans Rank Correlation Coefficient Significance

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Abstract: ***In this paper we investigated the experiment of significance of spearman's rank correlation coefficient . It provided an in - depth judgment of dissimilar methods of testing for the significance of spearman's correlation coefficient. It was accomplished that each of the methods provided superior enough test for significance of correlation coefficients, which brings to rest the contrasting views that the SPSS does not provide a test for significance of correlation coefficient. The SPSS was recommended ahead of the t - distribution and z transformation due to its easy, robust, and wide applications. Researchers and academics were charged to expose their mentees to this great scientific discovery,***

Keywords: Spearman's rank correlation coefficient, t - distribution

1. Introduction

Spearman correlation coefficient: Definition

The Spearman's rank coefficient of correlation or Spearman correlation coefficient is a nonparametric measure of rank correlation (statistical dependence of ranking between two variables).

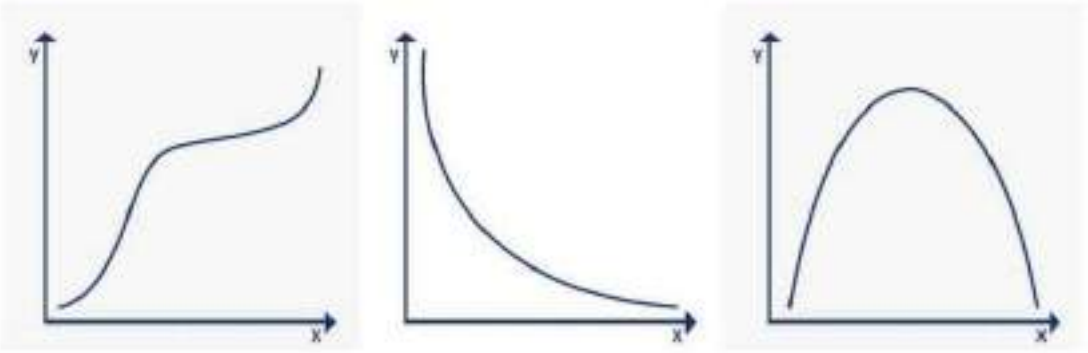
Named after Charles Spearman, it is often denoted by the Greek letter **'ρ' (**rho) and is primarily used for data analysis.

It measures the strength and direction of the association between two ranked variables. But before we talk about the Spearman correlation coefficient, it is important to understand Pearson's correlation first. A Pearson correlation is a statistical measure of the strength of a linear relationship between paired data.

For the calculation and significance testing of the ranking variable, it requires the following data assumption to hold true 1. Interval or Ratio level 2. Linearly related 3. Bivariant distributed

If your data doesn't meet the above assumptions, then you would need Spearman's Coefficient. It is necessary to know what monotonic function is to understand Spearman correlation coefficient.

A monotonic function is one that either never decreases or never increases as it is an independent variable increase. A monotonic function can be explained using the image below:



The image explains three concepts in monotonic function:

1) Monotonically increasing: When the 'x' variable increases and the 'y' variable never decreases.
2) Monotonically decreasing: When the 'x' variable increases but the 'y' variable never increases
3) Not monotonic: When the 'x' variable increases and the 'y' variable sometimes increases and sometimes decreases.

Monotonic relation is less restraining when compared to a linear relationship that is used in Spearman's coefficient. Although monotonicity is not the ultimate requirement for Spearman correlation coefficient, it will not be meaningful to pursue Spearman's correlation without actually determining the strength and direction of a monotonic relationship if it was already known that the relationship between the variable is non - monotonic.

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Example 1: Calculation of rank correlation coefficient

Entry - 1	A	B	C	D	E	F	G	H	I	J
Judge 1	2	4	7	6	5	9	8	1	3	10
Judge 2	3	5	6	4	7	10	8	2	1	9

Entry	Judge - 1 (x)	Judge - 2 (y)	x. y
A	2	3	6
B	4	5	20
C	7	6	42
D	6	4	24
E	5	7	35
F	9	10	90
G	8	8	64
H	1	2	2
I	3	1	3
	10	9	90
N=10	$\sum X = 55$	$\sum Y = 55$	$\sum XY = 376$

$$r_s = \frac{\frac{1}{N}[\sum xy - \bar{x}.\bar{y}]}{S_x.S_y}$$

$$\bar{x} = \bar{y} = \frac{55}{10} - 5.5$$

$$S_x = S_y = \sqrt{\frac{385}{10} - (5.5)^2} = \sqrt{8.25}$$

$$r_s = S_y \frac{\frac{1}{10}[376 - 5.5^2}{\sqrt{8.25}.\sqrt{8.25}}$$

$$r_s = 0.891$$

Spearman correlation coefficient: Formula and Calculation with Example

$$r_s = 1 - \frac{6\sum D^2}{N(N^2-1)}$$

Here,
N= number of data points of the two variables
D = difference in ranks of the "ith" element

The Spearman Coefficient, ρ , can take a value between +1 to - 1 where,

- A ρ value of +1 means a perfect association of rank
- A ρ value of 0 means no association of ranks
- A ρ value of - 1 means a perfect negative association between ranks.

Closer the ρ value to 0, weaker is the association between the two ranks.

We must be able to rank the data before proceeding with the Spearman's Rank Coefficient of Correlation. It is important to observe if increasing one variable, the other variable follows a monotonic relation.

At every level, you will need to compare the values of the two variables. Here is how the calculations work:

Entry	Judge - 1	Judge - 2	D= (1 - 2)	D^2
A	2	3	- 1	1
B	4	5	- 1	1
C	7	6	1	1
D	6	4	2	4
E	5	7	- 2	4
F	9	10	- 1	1
G	8	8	0	0
H	1	2	- 1	1
I	3	1	2	4
J	10	9	1	1
N=10				$\sum D^2$ =18

$$r_s = 1 - \frac{6\sum D^2}{N(N^2-1)}$$

$$r_s = 1 - \frac{6(18)}{10(100-1)}$$

$$r_s = 1 - 0.109$$

$$r_s = 0.891$$

2. Conclusion

This paper has shown that the test of significance of rank correlation coefficients is very export in research because the degree of relationship alone is not sufficient to bring to a close that a computed correlation coefficient is adequate. It further exposed that one of the method of test of significance i. e t - distribution provided good sufficient test for significance of correlation coefficients

.

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COST Accounting and it's management

N.Durga Someswara Rao

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August 14, 2023

EasyChair Preprint

№ XXX

COST Accounting and it's management

N.Durga Someswara Rao

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August 7, 2023

Cost Accounting and it's management

Abstract: Cost accounting is used internally by management in order to make fully informed business decisions.

Unlike financial accounting, which provides information to external financial statement users, cost accounting is not required to adhere to set standards and can be flexible to meet the particular needs of management.

As such, cost accounting cannot be used on official financial statements and is not GAAP-compliant.

Cost accounting considers all input costs associated with production, including both variable and fixed costs.

Types of cost accounting include standard costing, activity-based costing, lean accounting, and marginal costing.

KEYWORDS: Cost,Price,Variable Cost,Fixed Cost,Overheads,Wages,Machine and materials, Product control and cost control.

METHODS AND MATERIALS: Cost accounting is used by a company's internal management team to identify all variable and fixed costs associated with the production process. It will first measure and record these costs individually, then compare input costs to output results to aid in measuring financial performance and making future business decisions. There are many types of costs involved in cost accounting, which are defined below.

Types of Costs

Fixed costs are costs that don't vary depending on the level of production. These are usually things like the mortgage or lease payment on a building or a piece of equipment that is depreciated at a fixed monthly rate. An increase or decrease in production levels would cause no change in these costs.

Variable costs are costs tied to a company's level of production. For example, a floral shop ramping up its floral arrangement inventory for Valentine's Day will incur higher costs when it purchases an increased number of flowers from the local nursery or garden center.

Operating costs are costs associated with the day-to-day operations of a business. These costs can be either fixed or variable depending on the unique situation.

Direct costs are costs specifically related to producing a product. If a coffee roaster spends five hours roasting coffee, the direct costs of the finished product include the labor hours of the roaster and the cost of the coffee beans.

Indirect costs are costs that cannot be directly linked to a product. In the coffee roaster example, the energy cost to heat the roaster would be indirect because it is inexact and difficult to trace to individual products.

Types of Cost Accounting

Standard Costing

Standard costing assigns "standard" costs, rather than actual costs, to its cost of goods sold (COGS) and inventory. The standard costs are based on the efficient use of labor and materials to produce the good or service under standard operating conditions, and they are essentially the budgeted amount. Even though standard costs are assigned to the goods, the company still has to pay actual costs. Assessing the difference between the standard (efficient) cost and the actual cost incurred is called variance analysis.

If the variance analysis determines that actual costs are higher than expected, the variance is unfavorable. If it determines the actual costs are lower than expected,

the variance is favorable. Two factors can contribute to a favorable or unfavorable variance. There is the cost of the input, such as the cost of labor and materials. This is considered to be a rate variance.

Additionally, there is the efficiency or quantity of the input used. This is considered to be a volume variance. If, for example, XYZ company expected to produce 400 widgets in a period but ended up producing 500 widgets, the cost of materials would be higher due to the total quantity produced.

Activity-Based Costing

Activity-based costing (ABC) identifies overhead costs from each department and assigns them to specific cost objects, such as goods or services. The ABC system of cost accounting is based on activities, which refer to any event, unit of work, or task with a specific goal, such as setting up machines for production, designing products, distributing finished goods, or operating machines. These activities are also considered to be cost drivers, and they are the measures used as the basis for allocating overhead costs.

Traditionally, overhead costs are assigned based on one generic measure, such as machine hours. Under ABC, an activity analysis is performed where appropriate measures are identified as the cost drivers. As a result, ABC tends to be much more accurate and helpful when it comes to managers reviewing the cost and profitability of their company's specific services or products.

For example, cost accountants using ABC might pass out a survey to production-line employees who will then account for the amount of time they spend on different tasks. The costs of these specific activities are only assigned to the goods or services that used the activity. This gives management a better idea of where exactly the time and money are being spent.

Lean Accounting

The main goal of lean accounting is to improve financial management practices within an organization. Lean accounting is an extension of the philosophy of lean manufacturing and production, which has the stated intention of minimizing waste while optimizing productivity. For example, if an accounting department is able to cut down on wasted time, employees can focus that saved time more productively on value-added tasks.

TRADE

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CORPORATE FINANCE ACCOUNTING

Cost Accounting: Definition and Types With Examples

By ALICIA TUOVILA Updated March 09, 2023

Reviewed by ANDY SMITH

Fact checked by YARILET PEREZ

Cost Accounting

Investopedia / Theresa Chiechi

What Is Cost Accounting?

Cost accounting is a form of managerial accounting that aims to capture a company's total cost of production by assessing the variable costs of each step of production as well as fixed costs, such as a lease expense.

Cost accounting is not GAAP-compliant, and can only be used for internal purposes.

KEY TAKEAWAYS

Cost accounting is used internally by management in order to make fully informed business decisions.

Unlike financial accounting, which provides information to external financial statement users, cost accounting is not required to adhere to set standards and can be flexible to meet the particular needs of management.

As such, cost accounting cannot be used on official financial statements and is not GAAP-compliant.

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Types of cost accounting include standard costing, activity-based costing, lean accounting, and marginal costing.

Cost Accounting

Understanding Cost Accounting

Cost accounting is used by a company's internal management team to identify all variable and fixed costs associated with the production process. It will first measure and record these costs individually, then compare input costs to output results to aid in measuring financial performance and making future business decisions. There are many types of costs involved in cost accounting, which are defined below.

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Cost Accounting vs. Financial Accounting

While cost accounting is often used by management within a company to aid in decision-making, financial accounting is what outside investors or creditors typically see. Financial accounting presents a company's financial position and performance to external sources through financial statements, which include information about its revenues, expenses, assets, and liabilities. Cost accounting can be most beneficial as a tool for management in budgeting and in setting up cost-control programs, which can improve net margins for the company in the future.

One key difference between cost accounting and financial accounting is that, while in financial accounting the cost is classified depending on the type of transaction, cost accounting classifies costs according to the information needs of the management. Cost accounting, because it is used as an internal tool by management, does not have to meet any specific standard such as generally accepted accounting principles (GAAP) and, as a result, varies in use from company to company or department to department.

Cost-accounting methods are typically not useful for figuring out tax liabilities, which means that cost accounting cannot provide a complete analysis of a company's true costs.

Types of Cost Accounting

Standard Costing

Standard costing assigns "standard" costs, rather than actual costs, to its cost of goods sold (COGS) and inventory. The standard costs are based on the efficient use of labor and materials to produce the good or service under standard operating conditions, and they are essentially the budgeted amount. Even though standard costs are assigned to the goods, the company still has to pay actual costs. Assessing the difference between the standard (efficient) cost and the actual cost incurred is called variance analysis.

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Traditionally, overhead costs are assigned based on one generic measure, such as machine hours. Under ABC, an activity analysis is performed where appropriate measures are identified as the cost drivers. As a result, ABC tends to be much more accurate and helpful when it comes to managers reviewing the cost and profitability of their company's specific services or products.

For example, cost accountants using ABC might pass out a survey to production-line employees who will then account for the amount of time they spend on different tasks. The costs of these specific activities are only assigned to the goods or services that used the activity. This gives management a better idea of where exactly the time and money are being spent.

To illustrate this, assume a company produces both trinkets and widgets. The trinkets are very labor-intensive and require quite a bit of hands-on effort from the production staff. The production of widgets is automated, and it mostly consists of putting the raw material in a machine and waiting many hours for the finished good. It would not make sense to use machine hours to allocate overhead to both items because the trinkets hardly used any machine hours. Under ABC, the trinkets are assigned more overhead related to labor and the widgets are assigned more overhead related to machine use.

Lean Accounting

The main goal of lean accounting is to improve financial management practices within an organization. Lean accounting is an extension of the philosophy of lean manufacturing and production, which has the stated intention of minimizing waste while optimizing productivity. For example, if an accounting department is able to cut down on wasted time, employees can focus that saved time more productively on value-added tasks.

When using lean accounting, traditional costing methods are replaced by value-based pricing and lean-focused performance measurements. Financial decision-making is based on the impact on the company's total value stream profitability. Value streams are the profit centers of a company, which is any branch or division that directly adds to its bottom-line profitability.

Marginal Costing

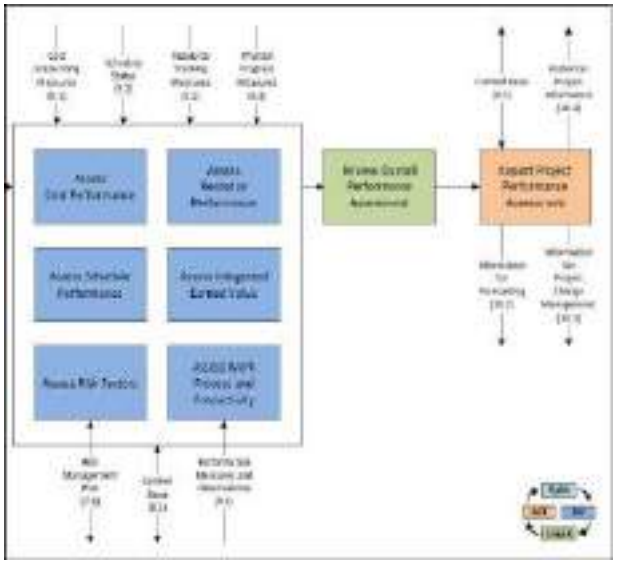
Marginal costing (sometimes called cost-volume-profit analysis) is the impact on the cost of a product by adding one additional unit into production. It is useful for short-term economic decisions. Marginal costing can help management identify

the impact of varying levels of costs and volume on operating profit. This type of analysis can be used by management to gain insight into potentially profitable new products, sales prices to establish for existing products, and the impact of marketing campaigns.

The break-even point—which is the production level where total revenue for a product equals total expense—is calculated as the total fixed costs of a company divided by its contribution margin. The contribution margin, calculated as the sales revenue minus variable costs, can also be calculated on a per-unit basis in order to determine the extent to which a specific product contributes to the overall profit of the company.







Cost management is the process of planning and controlling the costs associated with running a business. It includes collecting, analyzing and reporting cost information to more effectively budget, forecast and monitor costs.

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Sole Proprietorship as a Soul of Business

Pemmaraju Syamala Deepthi

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SOLE PROPRIETORSHIP AS A SOUL OF BUSINESS

ABSTRACT

Business is a dream for every one who always want to be their own boss and who always aspire for the wings to fly high and fulfill their dreams in a fruitful manner. We all learn and grown up that business is made with a profit motive and can withstand in the competition and in the market with an unique idea that stands out from the crowd. Business starts with a single person's wish and desire to start a firm and wants to rise the standards of his/her life as well the living standards of customers with the availability of organisations products or services with a motto of customer's satisfaction by following the traditional gesture called "Best Product at cheapest Price". Even it is a joint venture , partnership or JHFB there is one sole proprietor behind the foundation of the business and the growth and development of the firm is possible only with the continuous supervision, consistency in efforts and dreaming big of that proprietor . The sole proprietor has no seperate legal entity as he is not divided and seen as an individual he himself/herself is the organization on whose name the agreements,contracts or any form of business activities are done under the guidance and control of sole proprietor who is responsible for all the decisions taken and he is the person who invest capital , enjoys profit and bares risks and losess alone with utmost wish and belief that his/her business is going to be in long run in the market . This is why we state that sole proprietor is the soul of the business firm.

KEYWORDS

Sole proprietor is the soul of the business

Business and it's management

Sole proprietorship

Forms of business organization

Firm's products and services

Capital and investment ability of a sole proprietor

Risk bearing nature and unlimited liability

Limited capital and limited resources

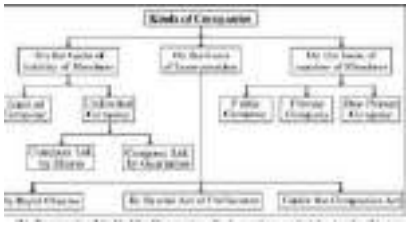
Traditional manufacturing concepts and practices

Technology and trend changing concepts.

INTRODUCTION

From the earlier days of the living being there was the concept of exchange of goods or services with the products or services holding by other people in the particular area.As the trade and commerce spread wider in India since 2600 BC as Indians are more fortune and gold is the main trader of the country. I dia is in trade mainly on textiles,spices,sugar and many precious stones. The ruling of British in India which started from the era of 1858 until the independence of India and Pakistan in 1947 made our Indians more familiar with the concept of buying and selling of goods and services with monetory value that is not with the exchange of products but with the exchange of money according to the value of that particular good or service is valued. That is the era of sole proprietor who paved path for business establishment and making product introduction in the market . People got to know that there are products and services that can be offered which are not done by ourself as well as those things which are difficult to produce in single peices or in small quantities. We have to talk about the producers or the manufacturers of products who are the limited sources of manufacturing goods and made the things possible. Rareness and incompetitive form of market is the heart of the business in earlier days. Producer is the king and customer satisfaction is the least priority for producers. Sole proprietor is the person who do one man show from beginning of product purchasing ,ordering and

delivering of product to the retailing destination where customer gets the end product. The whole responsibility is taken by the sole proprietor who invests the capital and always try to expand his business in a successive manner. To attain the growth and development of the business he always strive to have the qualities of strong decision making system, good analysis and market surveys.



MATERIALS AND METHODS

The sole proprietor can be into any form of business that may be raw materials,production house,reatilng,wholesale, transportation,textiles,furnishing,food and beverages,devices and control machines, accessories,groceries,provisions, jewellery,gems and stones, vegetables and fruits,flowers and designed fashion sets,leather industry,stationery,plant and machinery or even buildings or publications. There are numerous forms of businesses and ideas that can be basic foundation to start a business and the innovative ideas are the fuel for the success of the business firms. Sole proprietor is the single owner who decides about the type of business he is going to establish. The preparation of a product or service plan that is going to provide should be on his own decisions where he can easily form a business.

Methods a sole proprietor use

1. Advertising

Sole proprietor uses advertising as the key component for the business to circulate the message that he's going to launch a product. He always wants to create an impression in the sight of customers that the product he introduced is very useful and might bring a rapid change in their living standards. The previous and traditional concept of advertising is by oral communication an opinion about a product which is shared among people in a large extent. In the modern era of

business world advertising is the key factor in circulating the brand image of an entrepreneur he/she created with inherint efforts from years. Creating the attractive and unique content is the heart of today's advertising where many companies hire advertising agencies to promote their products and services according to the scale of organization they run. Sole proprietors are also enjoying the fortune of status called "old traditional form of business from generations" this was an empire build on honesty and consistency in the products and services the sole proprietor provides to customers. Sole proprietors too handle their promotions by using developed advertising patterns that may be print media, television,Magazines,palm plates, Announcements,and many other channels of advertising upto approaching celebrities or sports person in order to increase the demand or reach of their product as well as fame of the company.

2. SALES PROMOTION

Sales promotion is the technique or an attpt to increase sales of a particular product or service in the market in a framed period of time specially in the festivals,holy days,occassions and divine days of nation. The sales promotion techniques include discounts,coupons,offers,combo packs and buy one get one sales to rise the demand in the sale of the product.

For Example: All the business persons starting from a sole basic shop keeper to the brand profile company introduces theme of festival according to the traditional practices and customs of various religious beliefs. Say it's a festival of Diwali where every business firm tries to make people believe that their home decores, electricity filled lights,sweets and new fashioned dressess are the craziest combo to make our Diwali more brighter. If we had anational festive say Independence day companies create newly designed short vedios that portray patriotism in small children to old people where hearts of every indian feel the same sense irrespective of their caste,creed ,sex and religion.

3. SALES FORCE

Sales force are nothing but the frontline employees who directly involves in the product promotion and sale to reach customers with their communicative and

convincing skills . Sole proprietor he himself act as a sales force in reaching the customers and convincing people to improve his sales. He must maintain good customer relationship management and bring customers in every span of period irrespective of occassions and events. The primary advantage of a sole proprietor is having direct contacts and communications with producers and customers so that he can act as a great bridge in providing a clear view about the likes and dislikes of a customer in the products he offer and what are the necessary or precautionary needs or changes customers expecting in those goods or surveys. Here sole proprietor can useful to have good analysis on sale and survey for companies.

4. FORMATION OF CAPITAL AND INVESTMENT

Capital investment is the main hurdle to a sole proprietor as he alone cannot able to create a whole sum of huge capital of he is thinking to expand his own business in other areas of market. Here sole proprietor can adopt those type of partners like sleeping or dormant partner,Secret partner, as well as partner by holding forms of businesses management to hold the sole proprietorship in all acts and decisions of business and it's management so that capital creation and risk bearing will be ease with mutual consent where these types of partners won't enter or interior in the functioning of the business or on the share of profits or losess. This can be a precautionary measure and a helpful method for a sole proprietor to run his business and expand his business in a proper manner but that is completely based on the decision and consent of sole proprietor and the person who are willing to enter into these type of business pattern.

5. CONTINUITY

The sole proprietorship is a type of business where the continuity of the business depends and shows a negative or positive impact on the existence and smooth run of business. The sole proprietor may face the challenges of risks losess or any form of insane conditions which throw his business into trouble . In those situations a

sole proprietor can handover his business to his next generations and ask them to maintain the standards of business by which they recognised in the market. The generations who take the responsibility of the business will definitely try to stable the business and fame of the business in the market as it is little ease to run an already established business when compared to business that start over from the first step. As we discussed earlier this also can be a pure consent and will of sole proprietor but not the regulation he can obtain.

RESULTS

Some of the great business personalities whose journey starts with sole proprietorship and continuous their journey in an incredible manner are the real examples for the result of having the sole proprietorship as a soul of business. They are Coco-Cola, Walt Disney,Star bucks,Flipkart,Apple and many more historical companies and new trend revolutionary firms are existed in the market as sole proprietors and created a brand mark for their loyalty and customer centric services or goods they offer in the Indian market.

DISCUSSIONS

In order to prove our concept sucessful soul of sole proprietorship we can have our Agricultural sector as best evidence for sole proprietorship. The farmers themselves start the business in farming,decides alone and make things happen till the end product reach to distributors through proper chanel and this their produced products and services will rule the every field of business as agricultural products are the main sources of manufacturing goods or services. The farming may be crop or cattle or any type of minerals ,metals and materials. Sole proprietor is a great warrior who fights the battle alone face the crisis alone deal the challenges alone and accompained by the rewards of his efforts alone. But sole proprietors are the true inspiration for other companies in attaining corporate social responsibility just like doctors and freelancers who work for themselves but directly involves in the best part of social activities even in tough times that rembers me the hard times of COVID pandemic where no doctor no farmer and no

individual got a step back in providing and rendering their services to the socitey and worked hard in their own streamlines and standed for the people in all possible ways and means.

ACKNOWLEDGEMENT

I here by declare that the information provided in the beginning of the paper is fair and there is no change in the above stated. The entire content and concept of the

paper and topic I discussed in the paper are truly obtained by my self illustrations and not attained from any form of references,books or e-contents.

I here by declare that this paper is submitted to easy chair only and truly it is not under any site or publishment reference.

Reference

The above written information is the essence extracted from the things I have learned in the graduation and post graduation. Some of the content references

may include statistical and graphical representation of data and image are the extracted contet of internet and I can truly say it is the extraction or reference of self thoughts on sole proprietorship that I learned from books ,lessons and market analysis.

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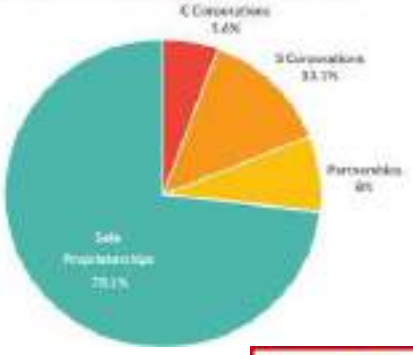
Don't sell make them buy by R.Mukund

Tables

Name of the organization	*Establish year*	*Age of the organization*	*Percentage of sucess rate according to statistics of 2022*
Coco-Cola	*1886, in Georgia*	*125 years*	*11%grew in revenue* *16% grew in organic revenues*
Walt Disney	*October 16,1923*	*99 years*	*13.05% increase in revenue for year-on-year*
Flipkart	*2007*	*15 years*	*31% revenue in year - on - year*

FIGURES

Figure 3. Sole Proprietorships Are a Majority of All Businesses







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Analytical Approach to Solving Volterra Integral Equations using the Adomian Decomposition Method

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Abstract: ***This paper explores the application of the Adomian Decomposition Method ADM in providing numerical solutions to Volterra Integral Equations. The ADM, a powerful tool for solving nonlinear equations, is presented as an efficient method that approximates the solution as an infinite series, converging to the exact solution. The paper demonstrates the efficacy and precision of the ADM through several numerical examples, highlighting its potential in solving first, second, and third order differential and integral equations. The study underscores the versatility of the ADM in solving linear and nonlinear problems across various fields such as Mathematics, Physics, Biology, and Chemistry.***.

Keywords: Adomian Decomposition Method, Integral Equations, Volterra Integral Equations, Numerical Example

1. Adomian Decomposition Method

The Adomian Decomposition method (ADM) is very powerful method which considers the approximate solution of a nonlinear equation as an infinite series which actually converges to the exact solution in this paper, ADM is proposed to solve some first order, second order and third order differential equations and integral equations. The Adomian Decomposition method (ADM) was firstly introduced by George Adomain in 1981. This method has been applied to solve differential equations and integral equations of linear and nonlinear problem in Mathematics, Physics, Biology and Chemistry upto know a large number of research paper have been published to show the feasibility of the decomposition method.

Proposed method for solving the Volterra Integral Equation.

The type of integral equation in which the limits of the integration are not constant, in which 0 and x are variables are called the Volterra Integral equations, and is given as

$$\emptyset(x) = f(x)+\lambda\int_0^x K(x,t)\,\emptyset(t)dt \qquad (1)$$

Where the function and the kernel are given in the advance, and λ is a parameter. In this part, the process of the Adomian decomposition method is used. The Adomian decomposition method involving the decomposing of the unknown function $\phi(x)$ of any equation into a addition of an infinite number of constituents defined by the decomposition series

$$\emptyset(x) = \sum_{n=0}^{\infty}\emptyset_n(x) \qquad (2)$$

Or equivalently $\emptyset(x) = \emptyset_0(x) + \emptyset_1(x) + \emptyset_2(x) + \cdots$

When the constituents $\emptyset_n(x)$,≥0 will be resolved. The Adomian decomposition method investigate itself with discover the components $\emptyset_0(x), \emptyset_1(x), \emptyset_3(x), \ldots$

To organize the recurrence relation, we substitute (2) into the Volterra integral equation (1) to get

$$\sum_{n=0}^{\infty}\emptyset_n(x) = f(x)+\lambda\int_0^x K(x,t)\sum_{n=0}^{\infty}\emptyset_n(t)dt \qquad (3)$$

Or equivalently

$$\emptyset_0(x) + \emptyset_1(x) + \emptyset_2(x) + \cdots = f(x) + \int_0^x K(x,t)[\emptyset_0(t) + \emptyset_1(t) + \emptyset_3(t) + \cdots]dt$$

The zeroth component $\emptyset_0(x)$ is spotted by all terms that are not comprises under the integral sign. This signifies that the components $\emptyset(x)$,≥0 of the unknown function $\emptyset(x)$are totally resolved by the recurrence relation $\emptyset_0(x) = f(x)$, $\emptyset_{n+1}(x) = \int_0^x K(x,t)\emptyset_n(t)dt,\ n \geq 0$

Or equitably

$$\emptyset_0(x) = f(x)$$

$$\emptyset_1(x) = \int_0^x K(x,t)\emptyset_0(t)dt$$

$$\emptyset_2(x) = \int_0^x K(x,t)\emptyset_1(t)dt$$

$$\emptyset_3(x) = \int_0^x K(x,t)\emptyset_2(t)dt$$

$$\emptyset_4(x) \int_0^x K(x,t)\emptyset_3(t)dt$$

And soon the other constituents

Thus the constituents $\emptyset_0(x), \emptyset_1(x), \emptyset_3(x), \ldots$ are resolved totally.

Thus the solution of the Volterra integral equation (1) is easily acquired in a series form by utilize the series as assumption in (2).

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2. Applications Volterra Integral Equations

Example1. Consider the linear Volterra integral equation given as

$$\emptyset(x) = x - \int_0^x (x-t)\emptyset(t)dt \quad (4)$$

$$\text{Let } \emptyset(x) = \sum_{n=0}^{\infty} \emptyset_n(x)$$

Then by applying the Adomian decomposition method, equation (4) becomes

$$\sum_{n=0}^{\infty} \emptyset_n(x) = x - \int_0^x (x-t) \sum_{n=0}^{\infty} \emptyset_n(t)dt \quad (5)$$

To determine the components of $\emptyset$(x), we use the recurrence relation

$$\emptyset_0(x) = x$$
$$\emptyset_{n+1}(x) = -\int_0^x (x-t)\emptyset_n(t)dt$$
$$\emptyset_1(x) = -\frac{x^3}{3!}$$
$$\emptyset_2(x) = \frac{x^5}{5!}$$
$$\emptyset_3(x) = -\frac{x^7}{7!}$$

And so on

Now by using equation (2) we obtain

$$\emptyset(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} + \ldots.$$

Thus the solution will be $\emptyset(x) = sinx$

Which is converges to exact solution by the method of successive approximations $(x) = sinx$

Example2.

Consider the Volterra Integral equation given as

$$\emptyset(x) = \frac{x^2}{2} + x - \int_0^x \emptyset(t)dt$$
$$\emptyset_0(x) = 1$$
$$\emptyset_{n+1}(x) = -\int_0^x \emptyset(t)dt$$
$$\emptyset_1(x) = -x$$
$$\emptyset_2(x) = \frac{x^2}{2!}$$
$$\emptyset_3(x) = -\frac{x^3}{3!}$$

Now by using equation (2) we obtain

$$\emptyset(x) = 1 - x + \frac{x^2}{2!} - \frac{x^3}{3!} + \ldots. = e^{-x}$$

Thus the solution will be $\emptyset(x) = e^{-x}$

Which is converges to exact solution by the method of successive approximations $(x) = e^{-x}$

Example 3: Consider the Volterra Integral equation given as

$$\emptyset(x) = 2x^2 + 2 - \int_0^x x\,\emptyset(t)dt \quad (6)$$
$$\emptyset_0(x) = 2x$$

Then by applying the Adomian decomposition method, equation (6) becomes

$$\emptyset_{n+1}(x) = -\int_0^x x\,\emptyset(t)dt$$
$$\emptyset_1(x) = -x^3$$
$$\emptyset_2(x) = \frac{x^5}{4}$$
$$\emptyset_3(x) = -\frac{x^7}{24}$$

And so on

Now by using equation (2) we obtain

$$\emptyset(x) = 2x - x^3 + \frac{x^5}{4} - \frac{x^7}{24} + \ldots.$$

Which converges to exact solution by the method of successive approximations

3. Conclusion

The paper successfully demonstrates the application of the Adomian Decomposition Method ADM in solving Volterra Integral Equations. The ADM proves to be a robust and effective tool, providing solutions that converge to the exact solution through successive approximations. The study also reveals that the ADMs efficiency increases with the order of the equation, resulting in a decrease in error. The findings suggest that the ADM holds significant potential for solving linear Volterra Integral Equations and other complex mathematical problems.

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Analysis of Acoustic Channel Characteristics in Shallow Water Based on Multipath Model

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Abstract. In the shallow water environment, the water surface, and the seafloor act as reflective boundaries for the sound waves. When a sound wave encounters these boundaries, it undergoes reflection, bouncing back and forth between the surface and the bottom. As a result, the sound energy is distributed among various paths, leading to multipath arrivals at the receiver. The repeated reflections contribute to the complexity of the sound propagation in shallow water. This multipath propagation can cause interference and fading, making the received signals challenging to decode, interpret accurately, and transmission losses. Therefore, proper modelling of channel is essential inoreder to deploy a network with high accuracy. In this work, we have developed and analyzed an acoustic multipath channel model to investigate the impact of mixed layer depth and near field anomaly on transmission losses in underwater environments. The main focus is on understanding how various underwater medium parameters, such as temperature, salinity, depth, and pH, affect the transmission losses. It is evident from simulation results; acoustic velocity has increased by 30 m/s when the temperature reduced from 30 °C to 14 °C and 7 m/s when the salinity increased from 30 ppt to 35 ppt. Transmission losses are increased by 58.8% when the mixed layer depth (*MLD*) increased from 10 m to 95 m. Whereas, these losses are reduced by 43.7% when the near field anomaly (K_L) increased from 7 dB to 20 dB.

Keywords: Acoustic Channel · Multipath · Reflection · Sound Speed · Temperature · Transmission Loss · Salinity

1 Introduction

Underwater Acoustic Sensor Networks (UASNs) are specialized networks that utilize underwater acoustic communication for data gathering, monitoring, and collaboration in underwater environments [1]. UASNs consist of a collection of autonomous or semi-autonomous underwater sensor nodes that work together to perform various tasks such

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as oceanographic data collection, environmental monitoring, underwater surveillance, and underwater exploration [2]. UASNs play a crucial role in expanding our understanding of underwater ecosystems, oceanography, and marine resources. They enable real-time monitoring of underwater phenomena, such as temperature, salinity, water quality, marine life, and seabed conditions. By collecting and transmitting data from diverse underwater locations, UASNs provide valuable insights into underwater processes and enable timely decision-making for various applications [3]. The unique characteristics of underwater environments pose significant challenges for UASNs [4, 5]. Underwater acoustic communication is the primary means of data transmission in UASNs since radio frequency signals do not propagate efficiently in water due to high absorption and attenuation. Acoustic signals can travel long distances, but they suffer from limited bandwidth, high propagation delays, multipath fading, and significant signal attenuation, which can affect the performance and reliability of underwater communication systems [6, 7].

To address these challenges, UASNs require specialized hardware and networking protocols [8]. Acoustic modems are used as communication interfaces, employing techniques such as frequency modulation, spread spectrum, and advanced error correction coding to enhance the reliability and data rate of underwater acoustic communication. UASNs also employ advanced signal processing algorithms and networking protocols specifically designed for underwater environments to mitigate the effects of multipath propagation, interference, and limited bandwidth. Multipath propagation is a significant phenomenon that affects UASNs and their communication performance [9]. It is primarily caused by the interaction of sound waves with the underwater environment, including factors such as reflections, refractions, and scattering. Through a sequence of repeated reflections from both the water's surface and the seabed, sound travels vast distances in shallow water. Due to these reflections, sound waves might propagate through many routes before they are detected by a receiver.

The seabed and the water surface serve as sound waves reflecting limits in an environment with shallow water. These barriers cause a sound wave to reflect, causing it to bounce back and forth between the surface and the bottom. The sound energy is thus dispersed along a number of routes, resulting in multipath arrivals to the receiver. Sound transmission in shallow water is difficult due to the recurrent reflections. The arrival timings, amplitudes, and phases of the signals that are received can vary depending on the trajectories that the sound waves follow, as well as their lengths and travel periods [10]. The interference and fading that might result from this multipath propagation make it difficult to decode and correctly understand the signals that are received. Designing and enhancing underwater communication systems and acoustic signal processing algorithms requires an understanding of and consideration for the multipath propagation phenomena in shallow water [11].

2 Related Work

The emergence of Underwater Acoustic Sensor Networks (UASNs) has garnered considerable interest in various fields, thanks to their wide range of applications in underwater monitoring, environmental sensing, marine exploration, and military surveillance. In the context of UASNs, understanding and addressing transmission losses are vital for

achieving reliable and efficient communication in underwater environments. Extensive research papers and studies have been dedicated to exploring the factors that influence transmission losses in UASNs. These include path loss models, absorption and scattering effects, multipath propagation phenomena, channel estimation and equalization techniques, as well as network topology and routing considerations. By investigating and comprehending these factors, researchers aim to enhance the performance and effectiveness of UASNs by mitigating transmission losses and optimizing communication strategies.

This research contributes to the advancement of underwater communication systems, enabling them to operate successfully in challenging underwater conditions and fulfill their potential in diverse applications. In [12], the authors have investigated the fundamental physics of wave propagation, specifically focusing on acoustic, electromagnetic (EM), and optical communication carriers. In [13], the authors have extensively studied the impact of propagation characteristics on underwater communication. In [14], the authors have focused on the relationship between propagation loss, ambient noise, and channel capacity in underwater communication. To address inaccuracies in sound speed estimation in oceans and seas, a mathematical model [15] has been proposed. This model provides a conversion framework between atmospheric pressure and depth, as well as depth and atmospheric pressure, aiding in sound speed determination. In [16], the authors have presented an experimental setup that investigates the impact of underwater medium parameters.

A method [17] has been proposed to enhance localization accuracy in underwater environments. To simulate underwater networks effectively, a specifically developed acoustic channel model [18] is employed. In [19], researchers have conducted real-time measurements of route loss in underwater acoustic channels. In [20], a deep learning-based framework has been introduced to enhance accuracy and throughput in channel modeling. The authors have provided a detailed account of the statistical properties of the channel model in [21]. Moreover, a novel technique for frame boundary estimation in UASN has been proposed in [22]. In [23], the authors especially address the clustering in UASN by focusing on the integration of three essential approaches in the context of IoT applications. In [24], the authors investigated how water absorption affected the hybrid phenol formaldehyde (PF) composites' mechanical characteristics.

3 Methodology

This comprehensive approach provides valuable insights into the complex acoustic environment of shallow and deep water, and enabling better understanding and modeling of underwater acoustic propagation.

3.1 Sound Speed

The transmission of sound through water differs significantly from electromagnetic (EM) waves, primarily due to its slow speed [25, 26]. Mackenzie's empirical formula, denoted by (1), provides a means to calculate sound velocity.

$$c(T, S, z) = a_1 + a_2T + a_3T^2 + a_4T^3 + a_5(S - 35) + a_6z + a_7z^2 + a_8T(S - 35)a_9Tz^3 \quad (1)$$

3.2 Acoustic Propagation loss

Propagation loss of sound refers to the reduction in the strength or intensity of sound waves as they travel through a medium or propagate in a given environment [27]. The loss associated with cylindrical spreading is expressed using Eq. (2), while spherical spreading loss is represented by Eq. (3).

$$L_{CS} = 10 \times \log(R_t) \tag{2}$$

$$L_{SS} = 20 \times \log(R_t) \tag{3}$$

3.3 Absorption Loss

Sound waves in a medium, such as air or water, experience absorption, where the energy of the sound wave is converted into heat [28]. The absorption is frequency-dependent, with higher frequencies generally being absorbed more rapidly which is represented using (4). Where, α is absorption coefficient in underwater, it represents the rate at which sound energy is converted into other forms, such as heat, due to the inherent properties of the water medium. The absorption coefficient is frequency-dependent, meaning that different frequencies of sound waves are absorbed to varying degrees. Higher frequencies generally experience greater absorption than lower frequencies. The absorption coefficient is represented using (5). Where, A_1 and A_2 represent the contributions of boric acid and magnesium sulphate components, respectively, in sea water. Similarly, P_1, P_2, and P_3 denote the depth pressure components for boric acid, magnesium sulphate, and pure water, respectively. The relaxation frequency for boric acid, denoted as f_1 (in kHz), is given by Eq. (6). In Eq. (6), S represents salinity (in parts per 1000), and T represents temperature in degrees Celsius. The relaxation frequency for magnesium sulfate, denoted as f_2 (in kHz), is given by Eq. (7).

$$L_{ab} = (\alpha \times R_t) \times 10^{-3} \tag{4}$$

$$\alpha = \frac{A_1 P_1 f_1 f^2}{f^2 + f_1^2} + \frac{A_2 P_2 f_2 f^2}{f^2 + f_2^2} + A_3 P_3 f^2 \tag{5}$$

$$f_1 = 2.8\left(\frac{S}{35}\right)^{0.5} \times 10^{[4-1245/(273+T)]} \tag{6}$$

$$f_2 = \frac{8.17 \times 10^{[8-1990/(273+T)]}}{1 + 0.0018(S - 35)} \tag{7}$$

3.4 Transmission Loss

In shallow water, sound travels a long way by repeatedly reflecting off the bottom and surface, a process known as multipath propagation [29]. This phenomenon introduces transmission losses. The equation employed in this analysis accounts for the horizontal

separation distance (r) between the sound source and receiver, specifically when r is within a range of up to 1 times H (skip distance). In this context, H represents the average water depth of the acoustic study area, which serves as a conservative definition for the purposes of this analysis (skip distance). The skip distance H can be defined by using (8). The transmission losses due to multipath in shallow water is defined using (9) for the case, when r is within the range of H, (10) for the case when $H \leq r \leq 8H$ and (11) when $r > 8H$. Where, d is the mixed layer depth, z is the scenario depth, K_L is the near field anomaly, α_T is the shallow water attenuation coefficient [30].

$$H = \sqrt{\frac{1}{3}(d+z)} \tag{8}$$

$$TL_{Multipath} = 20 \times \log(r) + \alpha \times r + 60 - K_L \tag{9}$$

$$TL_{Multipath} = 15 \times \log(r) + \alpha \times r + \alpha_T(r/H - 1) + 5 \times \log(H) + 60 - K_L \tag{10}$$

$$TL_{Multipath} = 10 \times \log(r) + \alpha \times r + \alpha_T(r/H - 1) + 10 \times \log(H) + 60 - K_L \tag{11}$$

4 Simulation Parameters

To simulate the transmission losses of an UASN, several parameters need to be considered for the simulation model which helps in accurately predicting the transmission losses. Table 1 provides the detailed list of parameters used for simulation along with their ranges.

Table 1. Execution Parameters

Parameter	Range
Depth (meters)	0–100
Temperature (°C)	30–12
Salinity (ppt)	30–35
Frequency(kHz)	0.1–100
pH	7.8
R_t (meters)	100
MLD (meters)	10–95
K_L(dB)	7–20

5 Simulation Results

The transmission of underwater acoustics is significantly influenced by the acoustic velocity in shallow water. The speed at which sound travels through water varies with temperature changes. Figure 1 illustrates this relationship, showing that sound speed increases with greater depth but decreases as the water temperature decreases. For instance, at a specific depth of 10 m and a temperature of 30 °C, the initial sound speed is measured to be 1510 m/s. However, when the temperature is lowered to 14 °C while keeping the depth constant, the sound speed increases to 1540 m/s, as shown in Fig. 1. Interestingly, as the depth increases, the sound speed becomes more closely associated with changes in water salinity rather than changes in temperature.

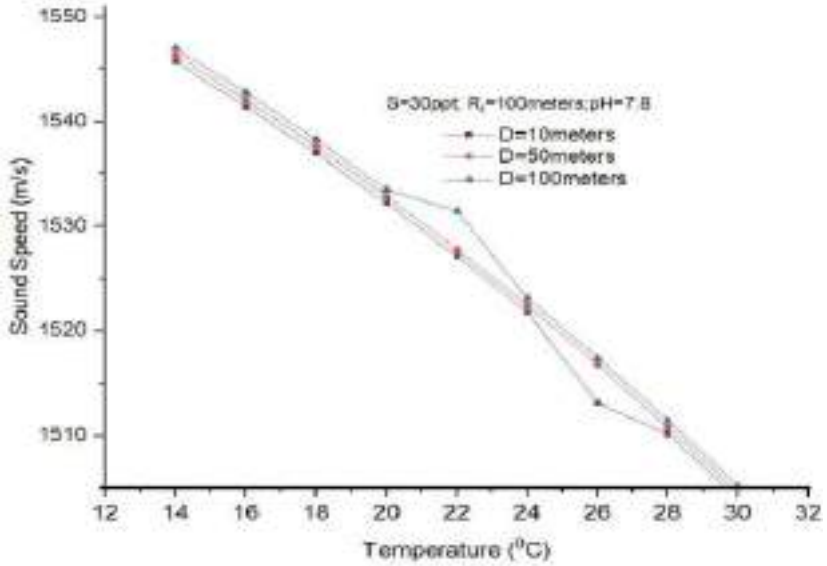


Fig. 1. Acoustic velocity disparities in accordance with temperature in shallow water.

It is observed from Fig. 2, that the salinity variations are also directly proportional to sound speed variations. Higher salinity levels typically result in increased sound speed, while lower salinity levels correspond to decreased sound speed. As the depth increases and salinity levels rise, the sound speed also increases. At a specific salinity ($S = 33$ppt), different sound speed profiles are observed along the depth, ranging from 1534 m/s to 1542 m/s, as depicted in Fig. 2.

The presence of different chemicals in underwater environments can lead to sound absorption. Chemical components such as dissolved gases, salts, and organic matter have distinctive absorption characteristics, influencing the propagation of sound waves in the water medium. These chemicals interact with sound waves, absorbing energy at specific frequencies and resulting in a reduction in sound intensity over distance (see Fig. 3).

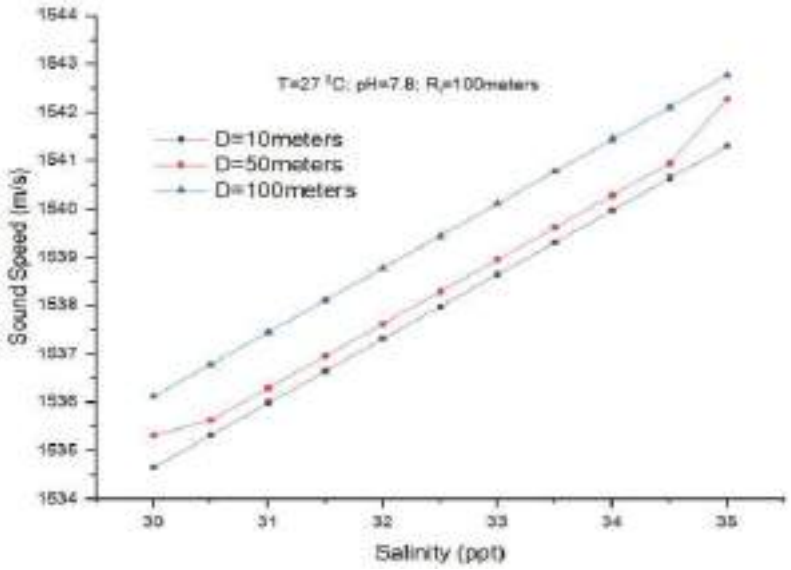


Fig. 2. Acoustic velocity disparities in accordance with salinity in deep water.

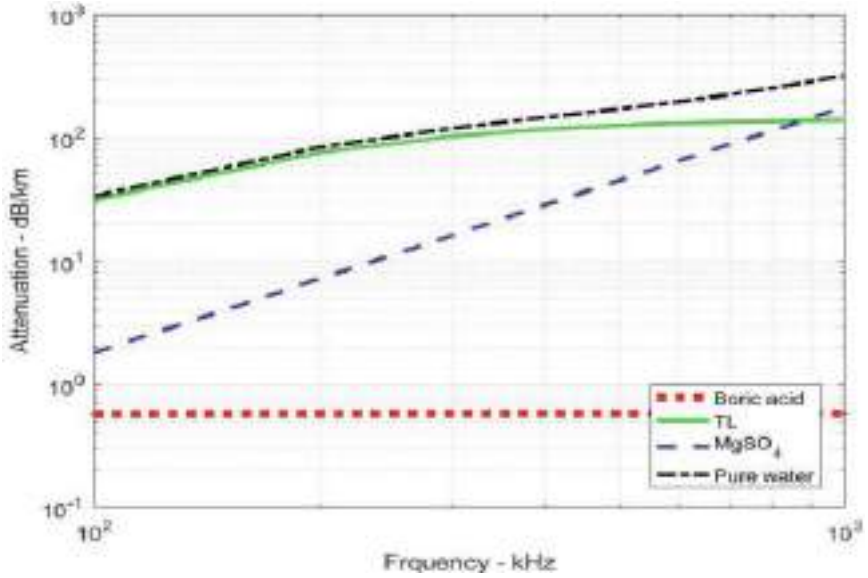


Fig. 3. Frequency *vs* attenuation due to various chemical compositions.

When the mixed layer depth is shallow, it can lead to transmission losses due to high attenuation. Specific impact of mixed layer depth on transmission losses depends on various factors, such as the frequency of the sound waves, the composition of the mixed layer, the characteristics of the seafloor, and the environmental conditions. It is depicted from Fig. 4, that the impact of mixed layer depth on transmission losses under various medium parameters. As the mixed layer depth increase, the transmission losses are also increase for the case of $H \leq r \leq 8H$.

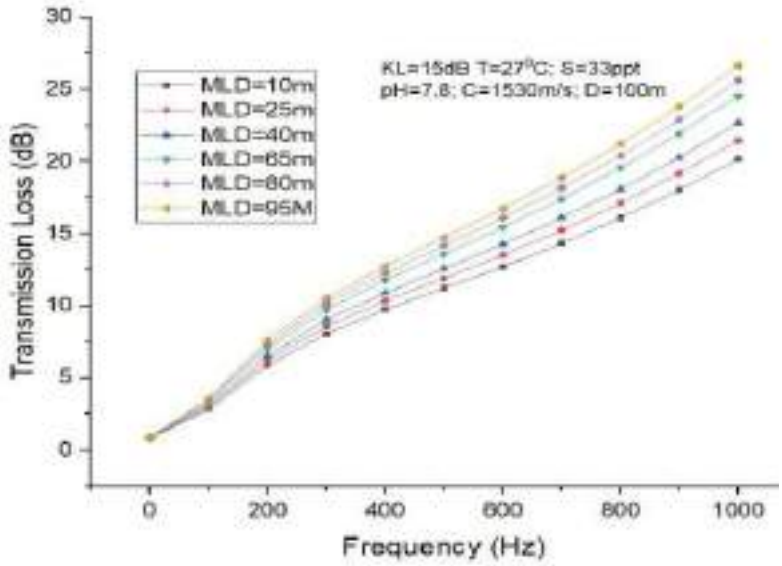


Fig. 4. Transmission Losses in shallow water for multipath model by varying *MLD*.

Near field anomalies occur when sound waves interact with abrupt changes in the water column, such as changes in depth, temperature, salinity, or bottom topography. These anomalies can cause the sound waves to deviate from their expected behavior, resulting in transmission losses. As the value of near field anomaly increase, the transmission losses are reducing gradually (see Fig. 5).

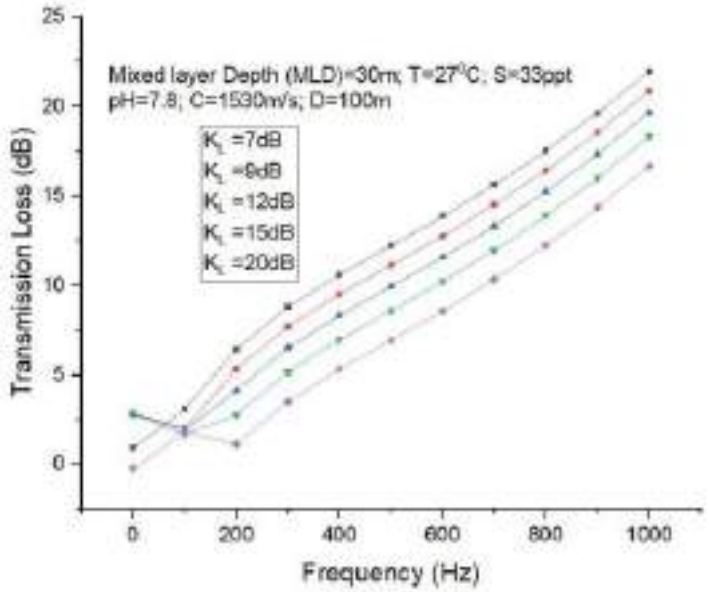


Fig. 5. Transmission Losses in shallow water for multipath model by varying K_L.

6 Conclusion

In this study, we have formulated and examined an acoustic multipath channel model to explore how the mixed layer depth and near field anomaly impact transmission losses in underwater environments. The primary objective is to comprehend the influence of various parameters of the underwater medium, including temperature, salinity, depth, and pH, on transmission losses. Our simulation results reveal intriguing findings. When the temperature decreased from 30 °C to 14 °C, the acoustic velocity increased by 30 m/s. Similarly, a salinity increases from 30 ppt to 35 ppt led to a 7 m/s rise in acoustic velocity. Furthermore, transmission losses surged by 58.8% with an increase in mixed layer depth (*MLD*) from 10 m to 95 m. Conversely, when the near field anomaly (K_L) increased from 7 dB to 20 dB, these losses decreased significantly by 43.7%.

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Development of Cost-Effective Water Quality Monitoring for Potable Drinking Water Using IoT

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Abstract. One of the main substances that significantly affects ecosystems is water. Unfortunately, with increased urbanization, sewage, abstraction of chemical fertilizers and pesticides in agriculture, which contaminate water, is now widely exploited. To monitor quality of the water across wide region, like rivers, lakes, or hydroponics, it is thus required to install a system. According to the state of world today, IoT and distant sensing methods are utilized in a variety of study fields to monitor, collect and analyze data from distant locations. The proposed system-DCWQM includes a wide variety of sensors interfaced to ESP-32 for measuring physical and chemical parameters of drinking water. This method allows analyzing of data that has been posted online through Blynk App and the real-time assessment of water body quality.

Keywords: IoT · water quality · ESP-32 · real time assessment · Blynk app

1 Introduction

All living things require water to survive, and it is not possible to live without it. Environmental pollution has grown to be a big issue as a result of technological development and industrialization. The most significant kind of pollution is water pollution. Our survival depends on the standard of the water we drink in a variety of forms, including juices made by the private sector. Any variation in quality of the water would have a negative impact on human health and disrupt ecological balance among all animals. In India among 1.3 billion population 6% of them does not have access to pure water and 54% of them are facing health issues due to lack of awareness about purifying and consuming the healthy drinking water [1]. Due to increased population most of the smart cities implement water reused system, reducing the dependency on fresh water. SiGeSn/GeSn based inter band multiple quantum well infrared photo detectors can provide better results in designing smart cities [2]. The characteristics of the water's chemical, radiological, and biological composition are referred to as its quality. Depending on how water is used, different important characteristics of the water quality apply. To protect the safety of the fish within an aquarium, for instance, it is required to keep the water's temperature, pH level,

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"Revolutionizing Healthcare: An In-Depth Exploration of Advanced Medical Devices and Electronic Innovations"

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Abstract: Implantable medical electronic devices, such as pacemakers, implantable cardioverter defibrillators, and neurostimulators (e.g., spinal-cord stimulators, deep-brain stimulators, and cochlear implants), play a pivotal role in managing and treating various physiological conditions like cardiac arrhythmia, chronic pain, Parkinson's disease, and profound deafness. The demand for these devices has surged significantly over the past decade due to the rising expectations of patients seeking improved life quality.

The core components of these devices consist of microelectronic circuits, meticulously encapsulated within a hermetically sealed metal or ceramic container. The hermetic sealing is a critical requirement for ensuring their safe implantation in the human body, serving as a protective barrier against the infiltration of bodily fluids that may lead to harmful moisture-induced failures in the microelectronic circuits.

In the context of commercially distributed implantable medical electronic devices, dependability and reliability take precedence over factors like performance, size, and cost. Ensuring the highest level of reliability in the device assemblies is paramount to instill confidence among patients and healthcare professionals alike. Therefore, manufacturers prioritize meticulous engineering and stringent quality controls processes to ensure that these devices function flawlessly and maintain their integrity throughout their intended lifespan within the human body.

Key words : Implantable medical electronic devices, pacemakers, implantable microelectronic circuits, , Ake Senning, medical device engineering, biocompatibility, hermeticity, wireless communication, sterilization resistance, autoclave, gamma radiation, dry heat, gamma rays,

Introduction: Implantable medical devices represent a remarkable technological advancement, being partially or completely embedded in the human body through surgical or medical procedures, intended to remain there after the process [1-2]. Notably, a significant proportion of the population in the United States (8% to 10%) and industrialized countries (5% to 6%) have benefited from implantable medical devices for the purpose of restoring bodily functions, enhancing the quality of life, or extending lifespan, as reported by Jiang and Zhou [3].

The evolution of implantable medical devices over the past six decades owes its progress to groundbreaking developments in science and engineering, particularly in the fields of microelectronics, biotechnology, and materials science. From the early report by Zoll [4] on electrical heart stimulation in 1952 to Cardiomems' groundbreaking wireless blood pressure measurement system in 2010, medical experts have dedicated significant efforts to enhance patients' lives through an array of medical devices. These include implantable cardiac defibrillators, cochlear implants, implanted bladder stimulators, and implantable wireless pressure sensors [5-17]. The primary objectives of such devices are real-time physiological reaction detection and organ physiological control. Recent advancements have enabled researchers to focus on creating implantable real-time vital monitoring devices that operate continuously at subsecond intervals [18-21]. By employing these cutting-edge devices, medical systems have shifted from reactive responses to proactively managing incidents before they occur, exemplified by Cardiomems' EndoSure, which detects intraoperative leaks of aortic stent grafts during endovascular aortic aneurysm repair.

In the early stages, the implantable pacemakers utilized Araldite epoxy glue for encapsulation. These pioneering devices comprised hermetically sealed 60 mAh nickel-cadmium battery cells and low-power consumption silicon transistors, enclosed within polymer encapsulation. Subsequent advances in semiconductor technology, particularly the development of the metal-oxide-semiconductor field-effect transistor and the proliferation of clean room facilities in the 1960s, facilitated the race for transistor size reduction. The adoption of 10-m manufacturing techniques by Intel in 1971 and the 22-nm line width technology used in the Xeon E3-1230 in

2012 exemplify the strides made in miniaturization. The downsizing of electronic circuits and mechanical structures has led to the creation of smaller, lighter, and more versatile electronic devices, resulting in extended battery lifetime and enhanced capacity. Moreover, lithium-iodine batteries, introduced by Greatbatch and Holmes in 1973, offer desirable characteristics for compact electronic devices, such as prolonged lifetime, low current drain, and stable voltage output.

Early pacemaker implants utilized stainless steel leads to transmit artificial cardiac pulses to the myocardium. However, issues like high fracture rates, dislodgement, electromagnetic interference, and corrosion necessitated the exploration of alternative materials. The adoption of silicone or polyurethane-insulated noble metal coils of platinum, iridium, or titanium eventually mitigated lead-related concerns. The early pacemaker's epoxy resin coating, while initially protective against bodily fluid penetration and tissue invasion, proved to be insufficient, leading to expansion and disintegration within the human body. Subsequent advancements addressed these challenges by using ceramics and titanium for housing materials and employing titanium laser welding for the packaging of electrical elements and batteries, providing enhanced mechanical hardness, corrosion resistance, biocompatibility, and durability.

The pioneering surgeon Ake Senning performed the first pacemaker implantation, suturing 9-mm diameter electrodes onto the left side of the myocardium during an open thoracotomy, allowing electrical control of heart rate for three hours. Subsequent procedures have evolved remarkably, with the modern pacemaker implantation process taking only 1 to 2 hours, utilizing 4- to 5-mm diameter electrodes on the right ventricle and right atrium. The small size and lightweight design of contemporary pacemakers enable non-invasive implantation, and the flexible platinum lead coils facilitate easy and efficient procedures, allowing patients to resume normal activities soon after the surgery [7].

The design of implantable medical devices is a collaborative effort involving patients, medical professionals, and engineers. Patient demands, medical practitioners' preferences, and engineering feasibility all play significant roles in shaping the device's development. Patients who undergo device implantation, whether temporarily or permanently, seek comfort, swift and painless medical procedures, and seamless healing processes. Addressing these concerns requires substantial research and innovation. Minimally invasive procedures and advancements in device miniaturization have rendered insertion sites imperceptible, facilitating

subconscious restoration. High-power-density batteries like lithium-iodine polyvinylpyridine, lithium-carbon monofluoride, or lithium-polycarbon fluoride offer prolonged device replacement intervals [33-35]. Implantable medical devices now operate automatically, fulfilling preset or planned functionalities, eliminating the need for patients to undergo additional medical procedures like magnetic resonance imaging or X-rays to assess device performance. As a result of these advancements, patients' quality of life is significantly enhanced.

Medical professionals play a crucial role in evaluating, utilizing, and researching medical gadgets. Their understanding of how, where, when, and why to implant devices is essential. Physicians' experiences with patients and their knowledge of the human body's unique characteristics often contribute to initial design suggestions. The device's size and shape must align with the intended implantation location and in cases where it may not fit entirely, innovative approaches like dividing the device into components or utilizing discrete elements may be adopted [36]. Delivery methods, such as incision surgery or minimally invasive procedures, are determined by the device's size and design.

Engineers face unique challenges in designing medical devices due to the complex and dynamic environment of the human body. Constantly changing electrical and chemical processes, along with precise temperature regulation at 36.5°C, necessitate extreme caution, rationality, and scientific rigor. The aim of medical device engineering is to restore bodily functions, detect body signals, or mechanically and electrically assist human organs. Engineers must thoroughly comprehend the body's surroundings, structure, functionality, and biological responses to build their expertise in various engineering disciplines, such as biocompatibility, electronic circuits, micro-electro-mechanical systems, hermeticity, wireless and wired communications, security, batteries, and insertion tools. Modeling and realistic testing are essential to verify the manufacturing feasibility of a unique device. Engineers face challenges in areas like biocompatibility, hermeticity, structural design, power management, detection, and wireless communication during the development process.

In the context of applications, adhesives are extensively employed in assembling various medical electronic devices, both internal and external to the body. The stringent requirements for medical devices, particularly those that are implanted or in contact with the body, necessitate adherence to specific standards and regulations set by the medical industry, often requiring FDA approval. These devices serve a wide range of functions,

including pacemakers, defibrillators, drug-releasing pumps, hearing aids, and diagnostic equipment for measuring, monitoring, and recording physiological functions such as heartbeat and brain activity.

Miniaturization:

Medical electronics, akin to space electronics and other specialized applications, highly prioritize miniaturization, low weight, and compact volume. In the domain of pacemakers and defibrillators, hybrid microcircuits have long been favored due to their compact dimensions and lightweight attributes. Employing conductive and insulative adhesives to attach and package bare-chip devices has significantly contributed to reduced weight and space requirements compared to traditional printed-wiring-board methods. Furthermore, the hermetic sealing achieved through welding has ensured the impervious protection of the electronic components from moisture, bodily fluids, outgassing, and potential pollutants, thereby safeguarding their integrity and reliability.

The latest generation of hearing aids demands even greater miniaturization. This endeavor is accomplished by embedding a thinner silicon integrated circuit (IC) and coupling it with a flexible polyimide circuit, which is subsequently folded to optimize volume reduction in specific designs. Such innovative approaches exemplify the relentless pursuit of compactness and lightweight characteristics in medical electronics, enhancing patient comfort and convenience while delivering advanced functionality.

Reliability:

The efficacy of implanted electronic devices is of utmost importance as any malfunction or dysfunction can have grave consequences, even leading to fatal outcomes. To ensure the utmost reliability of these devices, qualification testing and accelerated tests, commonly employed in military and space applications, are also applied to hybrid microcircuits and multichip modules. However, it should be noted that certain shock and vibration tests, while essential for aerospace and military applications, may not be practically applicable to human subjects.

To address the safety and reliability concerns specific to medical devices, the FDA plays a crucial role in testing and meticulously assessing data. These evaluations encompass toxicity analysis, compatibility assessments with human bodily fluids, and the investigation of failure modes and mechanisms. Early instances of pacemaker

failures necessitating removal and replacement highlighted issues such as moisture outgassing from adhesives and polymer materials, as well as impurities that were inadequately eliminated during the cleaning process. Consequently, corrosion within hermetically sealed hybrid circuits posed significant challenges.

It is crucial to recognize that for externally used diagnostic electronics, reliability is a life-or-death matter. Ensuring that these instruments consistently deliver accurate and reliable information is paramount, as any compromise in their performance could have severe consequences for patient health and well-being. Medical professionals and regulatory authorities strive to maintain the highest standards of reliability and safety to safeguard the lives of patients relying on these critical medical electronics.

Toxicity and biocompatibility: Adhesives employed in implants or in contact with the human body undergo rigorous testing and must demonstrate non-toxicity, physiological inertness, and compatibility with blood and other bodily fluids. Of particular significance is their compatibility with blood, as any adverse interaction can lead to coagulation or clotting, posing critical risks. The qualification testing process adheres to the ISO-10993[37] or USP Class VI standards, which ensure the highest safety standards for medical devices and materials.

The testing procedures outlined in these standards encompass a range of evaluations. Intracutaneous injection tests are conducted to assess the potential for irritation, while acute systemic injection tests aim to identify any adverse systemic effects. Additionally, monolayer cell cytotoxicity experiments are employed to evaluate the adhesive's impact on cells. These comprehensive assessments, guided by the ISO-10993 standard, are more expansive and universally adopted compared to the USP standard, encompassing a bundle of 12 documents to ensure exhaustive scrutiny of the adhesive's safety and biocompatibility.

In conclusion, the meticulous testing and evaluation of adhesives are essential in guaranteeing their biocompatibility and non-toxic nature, assuring their suitability for use in medical implants and applications in contact with the human body. By adhering to stringent standards and conducting a comprehensive array of tests, medical professionals can confidently employ adhesives that meet the highest safety criteria, thereby enhancing patient care and outcomes.

Blood compatibility:

Indeed, certain adhesive providers present test data showcasing compliance with the ISO-10993 standard and are willing to issue a certificate of conformance for their products. While passing these ISO or USP Class VI tests is a significant milestone in demonstrating the adhesive's low toxicity, it is crucial to note that this does not guarantee FDA approval.

The FDA often necessitates more comprehensive and stringent testing to thoroughly assess the safety and suitability of adhesives for medical applications. Meeting the ISO or USP Class VI standards represents an essential starting point, demonstrating adherence to essential biocompatibility criteria. However, the FDA requires additional in-depth evaluations to ascertain the adhesive's compatibility and safety when used in specific medical devices or implantable applications.

Obtaining FDA approval involves a thorough review of comprehensive data that encompasses detailed information on the adhesive's performance, biocompatibility, toxicity levels, and potential adverse effects. Rigorous testing and meticulous documentation are essential to satisfying the FDA's stringent regulatory requirements. This ensures that only adhesives with a proven track record of safety and reliability gain approval for use in medical devices, guaranteeing the well-being of patients and the effectiveness of medical treatments.

Sterilization: All medical devices implanted in the body or that come into contact with body fluids or blood must undergo sterilization to ensure their safety and prevent infection. Sterilization is essential to eliminate any potential pathogens or contaminants that could cause harm to the patient.

Adhesive-bonded parts used in these medical devices are usually enclosed within hermetically sealed, encased, or shielded electronic modules to prevent direct contact with body fluids. However, the internal adhesive-attached components must still maintain their integrity and performance during the sterilization procedures employed for the entire module. Some adhesives, such as cyanoacrylates and UV-cured acrylics, can degrade under the increased temperatures and high humidity experienced during dry heat and autoclave sterilization. As a result, it is crucial to thoroughly examine and qualify adhesives based on their resistance to the specific sterilization technique that will be used, even if they are not directly exposed to body fluids.

Common sterilization methods for medical devices include gaseous ethylene oxide, autoclave, and gamma radiation. Each method presents unique challenges, and adhesives must be carefully assessed to ensure their compatibility and resilience during the sterilization process. By selecting adhesives that can withstand the chosen sterilization technique, medical device manufacturers can confidently create reliable and safe products for patients' well-being and improved healthcare outcomes.

Gaseous ethylene oxide (EtO): Indeed, ethylene oxide (EtO) sterilization is one of the most widely used methods in the medical industry. It involves admixing ethylene oxide with a carrier gas, such as carbon dioxide or a chlorofluorocarbon, to facilitate the sterilization process. This method is preferred because it has minimal detrimental effects on materials and devices, making it a suitable choice for a wide range of medical products. Additionally, EtO sterilization is relatively inexpensive, making it a cost-effective option for medical device manufacturers.

One of the key advantages of EtO sterilization is that it can be conducted at room temperature. This feature is especially beneficial for delicate and sensitive electronic modules and components that may not withstand high-temperature sterilization methods. The low-temperature process helps preserve the integrity and functionality of the internal components, ensuring the device's performance remains uncompromised.

Moreover, EtO sterilization predominantly affects the external surfaces of the module, which is advantageous as it avoids direct exposure to internal adhesive-attached components. This safeguard ensures that the adhesives used inside the module are not adversely affected, maintaining their bonding strength and reliability.

Due to its effectiveness, relatively low impact on materials, and compatibility with a wide range of medical devices, EtO sterilization continues to be a preferred choice for ensuring the safety and quality of medical implants and devices used in contact with body fluids and blood.

Autoclave: Autoclave sterilization is a widely used method for sterilizing medical devices, particularly those that can withstand high temperatures and moisture exposure. In an autoclave, the pieces to be sterilized are exposed to saturated steam in a pressurized vessel. The steam, at temperatures ranging from 121°C to 132°C and pressures of up to 2 atmospheres, effectively kills microorganisms and ensures the safety of the medical devices.

However, autoclave sterilization can pose challenges for certain polymer materials used in medical devices. Under these high-temperature and high-moisture conditions, some polymer materials may undergo hydrolysis, breaking down into their monomers and losing their adhesive strength. This phenomenon, known as reversion, can compromise the integrity of adhesive bonds in medical devices.

Polyurethanes, acrylics, and silicones are among the polymer materials that are particularly prone to reversion during autoclave sterilization. These materials may not be suitable for applications where strong and long-lasting adhesive bonds are required after sterilization.

On the other hand, epoxies are known for their durability and resistance to reversion. They tend to maintain their adhesive strength even under the harsh conditions of autoclave sterilization, making them a preferred choice for medical devices that require reliable bonding capabilities after sterilization.

In conclusion, while autoclave sterilization is an effective method for sterilizing medical devices, it is essential to carefully consider the adhesive materials used in the devices. For long-lasting and robust adhesive bonds, epoxy-based materials are a suitable option, as they can withstand the challenging conditions of autoclave sterilization without compromising their adhesive performance.

Dry heat: Dry heat sterilization, involving subjecting the pieces to elevated temperatures of 165°C–170°C for 2–3 hours, is a method used for sterilizing medical devices. However, it is essential to be aware that dry heat sterilization is considered the least effective method and poses a higher risk of damaging materials and electrical components in the devices.

During dry heat sterilization, materials and adhesives within the medical devices may be subjected to prolonged exposure to high temperatures, potentially leading to adverse effects. While some adhesives may have been cured at 165°C or higher temperatures before the hermetic packaging process, the additional temperature exposure within the sealed package can induce outgassing of moisture and corrosive volatiles. These outgassing effects can lead to electrical failures within the device, undermining its reliability and functionality.

Furthermore, if the adhesive was cured at a temperature below 165°C, the risk of outgassing becomes even more pronounced during the dry heat sterilization process. The potential for adverse effects on the adhesive and its surrounding components increases in such cases.

In conclusion, while dry heat sterilization is utilized for certain medical devices, it is important to consider the potential risks associated with high-temperature exposure on adhesive materials and electrical components within the devices. Proper adhesive selection, curing processes, and consideration of sterilization compatibility are crucial to ensuring the long-term performance and safety of medical devices used in contact with the human body or bodily fluids.

Gamma radiation: sterilization using gamma radiation or other high-energy radiation sources, such as beta or electron beam, is a highly effective method for ensuring the sterility of medical devices. However, it does come with certain challenges and considerations.

Gamma rays possess exceptional penetrating power, which is advantageous for sterilization purposes, as they can effectively reach and eliminate microorganisms in various materials and devices. However, this same penetrating property can also harm materials and electronic components contained within the sterilization container. Particularly, electronic components, especially bare semiconductor devices, may be susceptible to damage, either temporarily or permanently, due to their sensitivity to radiation.

Furthermore, implementing sterilization with gamma radiation requires expensive equipment and adherence to stringent safety procedures. The handling and management of the radiation source necessitate specialized facilities and expertise to ensure the safety of personnel and the public.

While gamma radiation sterilization offers advantages in terms of its effectiveness in achieving sterility, it may not be suitable for all medical devices, especially those containing sensitive electronic components. For devices with such components, alternative sterilization methods that are more compatible with electronic materials may be preferred.

In summary, sterilization with gamma radiation and other high-energy radiation sources is a powerful method for ensuring medical device sterility. However, it requires careful consideration of the device's materials and components, particularly electronic elements, to minimize any potential adverse effects and ensure the continued functionality and safety of the medical devices.

Conclusion: The article covers various engineering considerations involved in the development of implanted medical devices. It highlights the historical progression of medical devices, using the example of pacemakers,

from their early iterations in 1958 to the advanced devices available today. Medical device development requires collaboration between three key parties: users, medical staff, and engineers, each contributing valuable insights and expertise.

From a user perspective, there is a strong emphasis on less intrusive procedures that enable quick recovery and cost-effectiveness, prompting a demand for minimally invasive and efficient medical devices.

Medical staff plays a pivotal role in advocating for the need for medical devices, leveraging their extensive knowledge of the human body's size, functionality, positioning, and medical techniques to influence the device's development.

Engineers bring their technical expertise to the table, translating the requirements and insights from users and medical staff into practical design solutions. They meticulously develop electrical power sources that meet the desired specifications, ensuring continuous and reliable operation.

Real-time monitoring of the human body is achieved through active or passive wireless communication technologies, with careful consideration given to packaging materials, power supply, and detection intervals.

The inside of the human body presents a novel and relatively unexplored environment for engineers compared to more familiar settings like atmospheric and oceanic environments. Understanding the intricacies and complexities of the human body is essential for developing safe and effective medical devices tailored to the unique needs of each individual.

Overall, the successful development of medical devices for implantation requires a comprehensive understanding of user needs, medical requirements, and engineering expertise, all working in tandem to create innovative and life-changing solutions for patients' well-being and improved healthcare outcomes.

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***Abstract*— The advanced forest fire alert system with real-time GPS location tracking is a cutting-edge solution designed to enhance forest fire detection and response capabilities. This system leverages state-of-the-art technology to provide real-time monitoring of forested areas, enabling the rapid identification of potential fire outbreaks. By integrating GPS location tracking, the system ensures accurate and timely positioning data, facilitating swift deployment of firefighting resources to the exact location of the fire. This paper presents the architecture, components, and operational workflow of this innovative system, highlighting its potential to revolutionize forest fire management. The proposed system primarily centers around the development of a fire detection system utilizing the ESP 32 microcontroller, which is interconnected with an MQ3 sensor, a flame sensor, and a Neo 6m GPS module. Initially, these two sensors will be deployed within forested areas to identify occurrences of fire and smoke. Upon detection of fire or smoke, the GPS module will be activated to pinpoint the location. Through the utilization of the GPS module, the detected location of fire or smoke is transmitted via the Blynk app, and an alarm is triggered. In contrast to the current method, wherein sensors transmit information about potential forest fire locations to an Arduino for subsequent GPS-based detection and SMS alerting via GSM, this proposed system streamlines the process by integrating real-time GPS tracking and immediate alerting through the Blynk app.**

Keywords*— *Forest Fire Detection, Firefighting Resources, Real-time GPS Location Tracking, Global positioning system, Sensor Integration, Forest Fire Management, Emergency Preparedness.

I. INTRODUCTION

Forest fires represent one of the most pressing disasters, primarily exacerbated by the effects of global warming. Environmental degradation further compounds this menace, posing a significant risk to both nature and humanity [1-2]. Organizations responsible for forest management and wildlife preservation are grappling with numerous challenges, including the rehabilitation of wild animals and the encroachment of wildlife into residential areas [3]. The vitality of the trees has notably declined, resulting in an unhealthy forest ecosystem. Annual surveys reveal that a staggering 85% of forest calamities are attributable to wildfires [4]. India witnessed an alarming surge in forest fires, with a staggering 345,989 incidents reported between November 2020 and June 2021, as per the findings of the State of Forests Report, 2021 (SoFR, 2021) released on January 13, 2022. This marked a distressing record for the country during this period. Comparatively, during the corresponding period in 2018-19, at least 258,480 forest fires were documented, making it the second-highest number of such incidents recorded in India to date.

Forest fires in India occur annually from November to May, driven by a combination of natural and human factors. These factors encompass the accumulation of highly flammable materials, such as dry leaves, twigs, pine needles, and more. The incidence of forest fires during this period has seen a striking surge, registering 2.7 times more cases than those reported between November 2019 and June 2020. This surge includes not only isolated incidents but also extensive and recurring forest fires. This notable increase follows a period of declining forest fire occurrences during the two most recent forest seasons, spanning from November 2018 to June 2019 and from November 2019 to June 2020 [4].

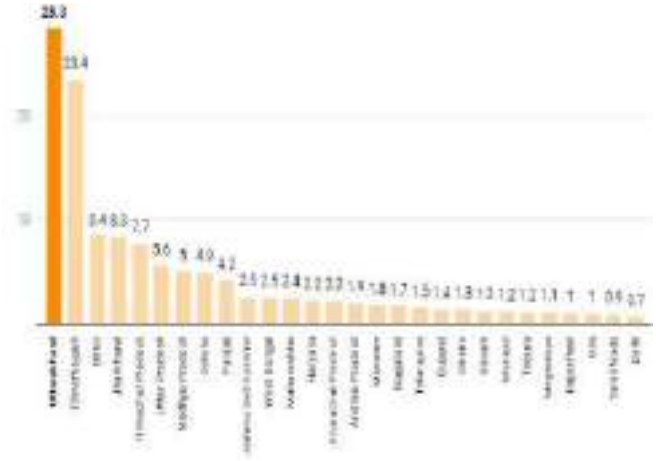


Fig. 1. Increase in forest fire incidences between Nov 2019-June 2020 and Nov 2020-June 2021[4].

Therefore, it is necessary to develop and deploy an IoT-based system that operates autonomously in order to detect the exact fire location along with the GPS coordinates. The proposed system is designed to anticipate and identify forest fires, subsequently relaying the precise location to relevant authorities. This proactive approach empowers firefighting personnel to respond swiftly and effectively, thereby containing and extinguishing the fire at its point of origin. The core concept of the proposed system revolves around the creation of a fire detection system, leveraging the ESP32 microcontroller. This system interfaces with an MQ3 sensor, a flame sensor, and a Neo-6m GPS module.

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II. LITERATURE REVIEW

Safeguarding the environment has become an imperative task, as the world evolving rapidly. Across the globe, a multitude of both human-induced and natural disasters have been occurring. Among these, forest fires stand out as a significant ecological catastrophe. Once ignited within the depths of a forest, these fires consume and devastate everything in their path, rapidly spreading throughout the woodland. Particularly on scorching days, when dry conditions peak in forested regions, these fires pose an even greater threat. It is paramount to take action to mitigate and prevent such forest fire disasters in order to preserve the habitats of the diverse plant and animal life that call these forests home.

The authors of [5] has created and deployed a self-sustaining IoT-based system that can anticipate and detect forest fires. This system will then promptly relay the precise fire location to relevant authorities, aiding firefighting personnel in effectively controlling and extinguishing the fire as it begins to spread. Extensive research into the destruction wrought by forest fires has led to the development of a monitoring and alert system in [6]. The authors in [7], developed a solution based on Wireless Sensor Networks (WSN), featuring visualization and alert generation schemes for forest fire detection. An advanced Convolutional Neural Network (CNN) model, based on Deep Learning [8], has been put forward for the detection of forest fires. In [9], forest fire detection is accomplished using an IoT-based device. The authors of [10], has introduced an IoT-Fog-based Forest fire monitoring system designed to monitor and provide alerts for the protection of trees and wildlife in forested areas.

Forest fires pose a recurring threat to wooded areas, causing substantial harm to wildlife and the ecosystem. To prevent such disasters, the implementation of a comprehensive fire detection and alert system in forested regions can play a vital role in promptly notifying firefighting authorities and enabling timely intervention. The authors of [11], has developed a real-time fire detection system based on the IoT, capable of identifying fires and promptly transmitting emergency alerts to relevant authorities. An IoT-based framework known as the Anti-poaching and Fire Alarm System (IAFS), which incorporates three key sensors: a temperature sensor, a smoke sensor, and Light Dependent Resistors (LDR) sensor has been developed in [12]. The development of an intelligent system aimed at early detection of forest fires, thereby preventing their rapid spread and extensive damage has been presented in [13]. In addition, the evaluation of IOT into various aspects of inventions in order to enabling alerting [14-15], management [16], security [17], and societal applications [18-19] have been developed by various authors. Hence, this work focused on developing a prototype for forest fire detection based on IOT.

III. PROPOSED MODEL

A. Block Diagram

The proposed system consists of various sensors for detecting the fire/smoke caused by various environmental consequence and human mistakes [20]. The proposed is a complex system designed to detect forest fires and efficiently alert authorities for swift response. It consists of ESP32 module (serves as the central processing unit of the system and handles the communication with the Blynk app and the GPS module), fire sensor (critical component that detects the presence of flames or a rapid increase in temperature, indicating the outbreak of a fire), smoke sensor (responsible for detecting the presence of smoke, which is an early indicator of a fire), pump motor(activated in the event of a fire detection and can be connected to a water supply source and used to spray water or fire-retardant materials to extinguish or control the fire), GPS(provides real-time location data and determine the exact geographic coordinates of the fire incident), relay (a switching device that controls the pump motor and when a fire is detected, the relay activates the pump motor to initiate fire suppression actions), dashboard (an interface, either a physical control panel or a software interface on a computer, that provides information and control options for the system operators and emergency responders), and Blynk app (a mobile application that allows users, such as firefighters or system operators, to remotely monitor the system and receive alerts. It receives data from the ESP32 and displays it on a user-friendly interface. Users can receive real-time alerts and remotely control the system through this app).

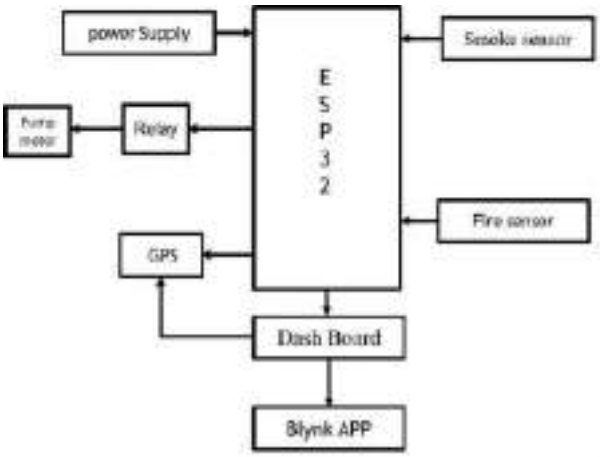


Fig. 2. Block diagram of proposed model.

B. Circuit Diagram

Figure 3 shows the circuit implementation of proposed system for forest fire detection, where the fire sensor or smoke sensor detects a potential fire, the ESP32 processes this information [21-23]. If a fire is confirmed, it triggers the relay to activate the pump motor for fire suppression. Simultaneously, the GPS module captures the precise location data, which is then transmitted to the Blynk app. The dashboard provides system operators and responders with real-time information on the situation, allowing them to make informed decisions and take swift actions to combat the forest fire.

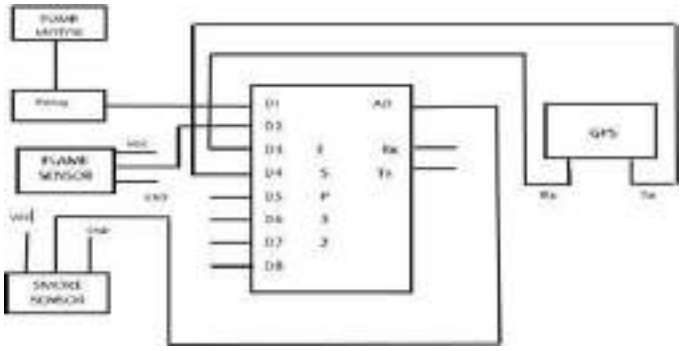


Fig. 3. Circuit diagram of proposed model.

C. *Proposed Hardware Prototype*

The proposed hardware prototype consists of various sensors interfaced with NodeMCU which is depicted using Fig. 3.

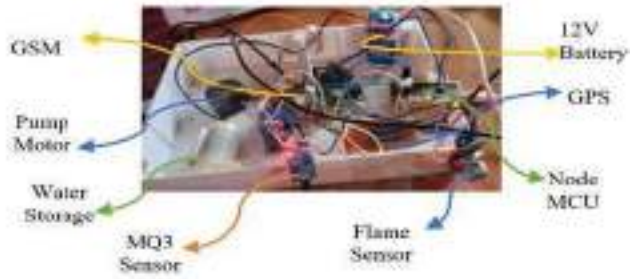


Fig. 4. Prposed Hardware Model.

IV. Procedure

A flow chart for understanding the working principal of proposed prototype has been created and is represented using Fig.5.

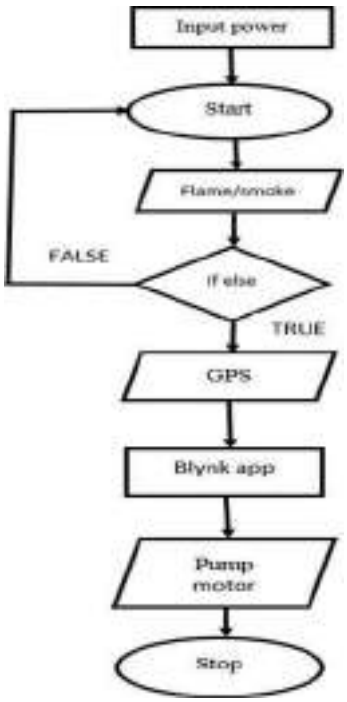


Fig. 5. Flow chart.

- Step1: Power supply will be given to the circuit and start the process.
- Step2: Node MCU ESP32 will be activated.
- Step3: GPS location will be activated.
- Step4: When smoke senor detects the smoke in the forest it will send the information to esp32.
- Step5: If in case it is true the alarm will be on condition to alert the living beings in the forest.
- Step6: When the forest will be in firing condition the flame sensor will be activated.
- Step7: Flame sensor send the information to the esp32 for analyse the situation.
- Step8: Then GPS is automatically connected in the ESP32 for track the location where the fire will be occurred in the forest.
- Step9: If IP address is matched with the NodeMCU then the information sends to the dashboard.
- Step10: We show the abnormal area is in the dashboard through blink app respectively.
- Step11: In the abnormal situations, automatically pump motors will be on condition to control the fire in the forest.

V. Experimental Results

The programming for the proposed system was performed using Arduino IDE (version R3, 5Watts, 7-12V), while Blink App has been utilized for creating the user interface. The proposed system has been devised with the primary objective of facilitating early detection of smoke and fire in forests, thereby mitigating the severity of forest fires. To achieve this, two vital sensors have been integrated into the project: the flame sensor and the smoke sensor. When these sensors detect signs of fire (see Fig.6) or smoke (see Fig.7) within the forest, the information they capture is promptly relayed to the NODEMCU, which is powered by the ESP32 microcontroller. These controllers then engage in a meticulous analysis of the situation to determine its accuracy.



Fig. 6. Hardware prototype when subjected to smoke.



Fig. 7. Hardware prototype when subjected to fire.

Upon verification of the situation, if it is indeed a forest fire (see Fig.8) or the presence of smoke (see Fig.9), the system seamlessly connects to the GPS module to establish the precise location of the incident. Subsequently, this location data is transmitted to a cloud-based platform, in this case, the Blynk App. In the unfortunate scenario of abnormal conditions, where the forest is engulfed in flames, the system activates the pump motors automatically within the fire-stricken area. Alternatively, if no fire is detected, the system triggers a buzzer to alert and caution living beings.

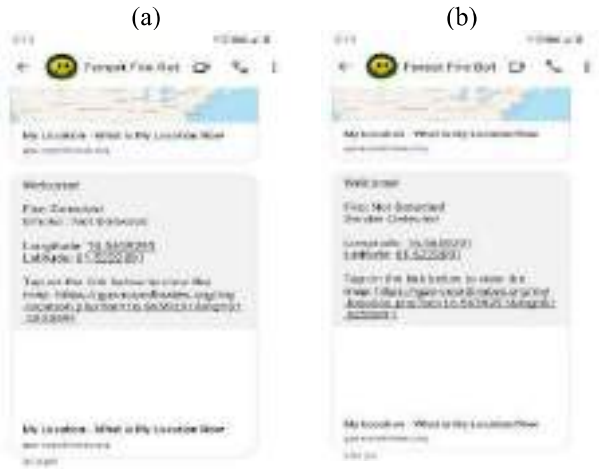


Fig. 8. GPS tracking with coordinates (a) when fire detected (b) when smoke detected .

VI. Conclusion

The primary objective of the System is to detect the early stages of forest fires and alerting the respective agencies with accurate location coordinates. By integrating cutting-edge technology, such as the ESP32 microcontroller, fire and smoke sensors, and real-time GPS tracking, this system offers a proactive and comprehensive solution to combat the devastating impact of forest fires. This innovative system not only provides early detection and precise location tracking of forest fires but also facilitates swift communication with emergency responders through platforms like the Blynk App. By doing so, it empowers firefighters and decision-makers to make informed, timely interventions, ultimately reducing the scope and intensity of forest fires and safeguarding the environment. Furthermore, the system's ability to autonomously activate fire suppression mechanisms, like pump motors, in response to abnormal conditions, adds an extra layer of protection, ensuring the safety of both wildlife and human populations.

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Optimizing Indoor Air Quality: A Fuzzy Logic-Based Control System

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***Abstract*— In the current context, ensuring and maintaining high indoor air quality is of paramount importance for all individuals, as indoor pollution levels often surpass those found outdoors. The consequences of indoor air pollution can manifest immediately after exposure or emerge years later, leading to various health issues. Enhancing indoor air quality through proper ventilation is essential, as it not only improves the quality of the air but also mitigates health risks associated with indoor pollution. Given the fast-paced lifestyles of people today, monitoring and automating the indoor air-refreshing process is crucial. This work introduces a system designed to monitor and regulate indoor air quality, temperature, and humidity by utilizing Arduino technology and a fuzzy logic controller. Additionally, the system can detect LPG gas leaks and issue SMS alerts to users via GSM technology. Furthermore, it incorporates an HEPA filter to purify the air. The system employs the MQ-135 sensor to measure air quality and the DHT-11 sensor to gauge temperature and humidity, while LPG gas detection is achieved with the MQ-2 sensor. The data from these sensors is used to modulate the speed of the ventilation fan through the fuzzy logic controller. This integrated system demonstrates exceptional performance in controlling and monitoring air quality within indoor environments, thereby effectively reducing indoor air pollution and decreasing power consumption associated with the ventilation mechanism.**

Keywords*— *Indoor Air Quality, Fuzzy Logic, Ventilation, Air Purification, Environmental Optimization, Energy Efficiency.

I. INTRODUCTION

Indoor air quality (IAQ) plays a pivotal role in determining the well-being and comfort of individuals within enclosed spaces. As people spend a significant portion of their lives indoors, the quality of the air they breathe becomes a paramount concern. The need for maintaining optimal IAQ is particularly pronounced in the face of rising urbanization and increasing instances of indoor air pollution. The presence of contaminants, such as volatile organic compounds (VOCs), particulate matter, and biological agents, can lead to various health issues, including allergies, respiratory problems, and overall discomfort [1].

Indoor air quality (IAQ) stands as a critical determinant of the well-being and comfort experienced by individuals inhabiting enclosed spaces. Given the substantial amount of time people spend indoors, the quality of the air they respire emerges as a paramount concern [2]. This concern is further underscored by the escalating trend of urbanization and the corresponding increase in indoor air pollution incidents. The presence of contaminants, ranging from volatile organic compounds (VOCs) and particulate matter to biological agents, can give rise to a spectrum of health-related issues, encompassing allergies, respiratory ailments, and an overall sense of discomfort [3]. To grapple with these multifaceted challenges and elevate IAQ, there is a growing trend towards the development and deployment of advanced control systems. This paper spotlights a state-of-the-art methodology for optimizing indoor air quality, accomplished through the implementation of a Fuzzy Logic-Based Control System.

The advent of Internet of Things (IoT) technology [4] has brought about transformative advancements across various domains, and one such area is enhancing the safety of individuals by maintaining air quality in the indoor environments. The proposed system utilizes fuzzy logic to regulate the velocity of the ventilation fan. Fuzzy logic encompasses multiple logical values, and these values represent the truth values of a variable or problem within the range of 0 to 1. In the structure of the Fuzzy Logic system (see Fig.1), every component assumes a vital role. The architecture comprises four distinct components: the rule base, fuzzification, inference engine, and defuzzification.

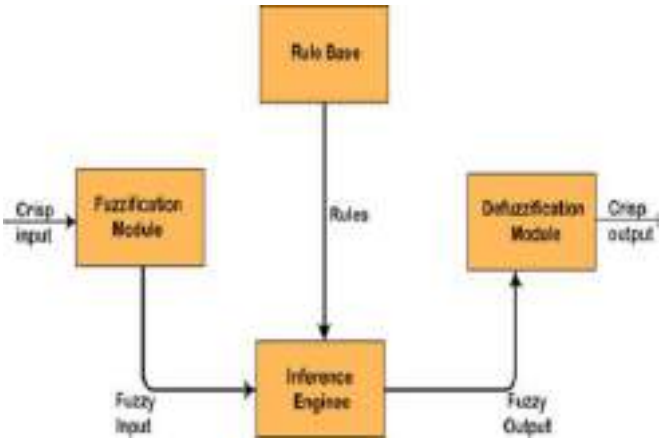


Fig. 1. Architecture of fuzzy logic system.

II. LITERATURE REVIEW

Air pollution stands as a significant global health concern. Surprisingly, indoor air pollution often surpasses outdoor pollution by a factor of 2 to 5, yet it doesn't receive the attention it deserves. Hence, the implementation of automation becomes imperative to consistently maintain optimal indoor air quality. Indoor air pollution has profound and detrimental consequences for human well-being. The authors of [5], has introduced an Internet of Things (IoT)

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system utilizing Bolt technology to continuously monitor fundamental indoor pollutants such as carbon dioxide, carbon monoxide, and particulate matter within a university's indoor environment. The Bolt-based IoT system offers real-time pollution level data directly accessible on smart devices.

The authors in [6] aimed to analyse the relationship between indoor environmental quality and indoor air quality by employing IoT devices. Building upon this analysis, we present a set of criteria for effectively managing indoor air quality. In [7], introduced the iAQ system, a cost-effective wireless sensor network designed to gather data on indoor air quality. The system was created utilizing Arduino, XBee modules, and miniature sensors to ensure the real-time collection and storage of monitoring data. In [8], a comprehensive range of sensors is employed to assess indoor air quality. Collected data is transmitted to the cloud for storage, and real-time data is graphically represented for enhanced visualization. Additionally, the system alerts the user in the event of subpar indoor air quality. In [9], the authors have Suggested the development of an Indoor Air Quality Monitoring System (IAQMS) capable of conducting real-time measurements for a broad spectrum of ambient air parameters, including carbon monoxide (CO) and carbon dioxide (CO_2).

Employing an air purification system effectively eliminates indoor air pollutants; however, this leads to elevated electricity consumption, potentially contributing to a broader environmental impact. To investigate the balance between energy usage and achieving healthier indoor air, the authors of [10], has introduced the Indoor Air Sensing and Automation (IASA) system, an Internet of Things (IoT) solution. In response to the demand for an accessible, uncomplicated, and effective indoor air quality device suitable for widespread use in residential, commercial, and similar confined spaces, a sensor node equipped with wireless sensor networking capabilities has been introduced in [11]. The authors in [12], outlines the design and creation of an affordable and portable Internet of Things (IoT) Indoor Air Quality (IAQ) monitoring system boasting a remarkable 30-hour battery life. In [13], the authors have introduced the IAQML (Indoor Air Quality Monitoring Lab), a web-based system for monitoring indoor air quality. In addition, the evaluation of IOT into various aspects of inventions in order to enabling alerting [14-15], management [16], security [17], and societal applications [18-19] have been developed by various authors.

III. Proposed Model

A. Block Diagram

The block diagram of proposed system for indoor air quality monitoring based on fuzzy logic has been depicted in Fig.2. it consists of three major sensors such as: MQ-135, DHT-11, and MQ-2. The MQ-135 is an air quality sensor capable of detecting a variety of gases such as ammonia, carbon dioxide, and various volatile organic compounds. It's commonly used to monitor air quality and assess potential health risks in indoor [20]. The DHT-11 is a basic digital temperature and humidity sensor. It provides accurate readings of temperature and relative humidity, making it useful for climate control and weather monitoring applications [21].

The MQ-2 is a gas sensor that primarily detects the presence of flammable gases and smoke. It's widely employed in gas leak detection systems and smoke detectors to enhance safety in homes and industrial settings. The L293D is a popular motor driver IC has been used for enabling the direction and speed of DC motors [22-23]. A HEPA (High Efficiency Particulate Air) filter is a type of air filter designed to remove extremely small particles, including dust, pollen, and microorganisms has been incorporated. It's crucial for maintaining clean indoor air quality. A DC ventilation fan employed for air circulation and cooling purposes in various devices and equipment.

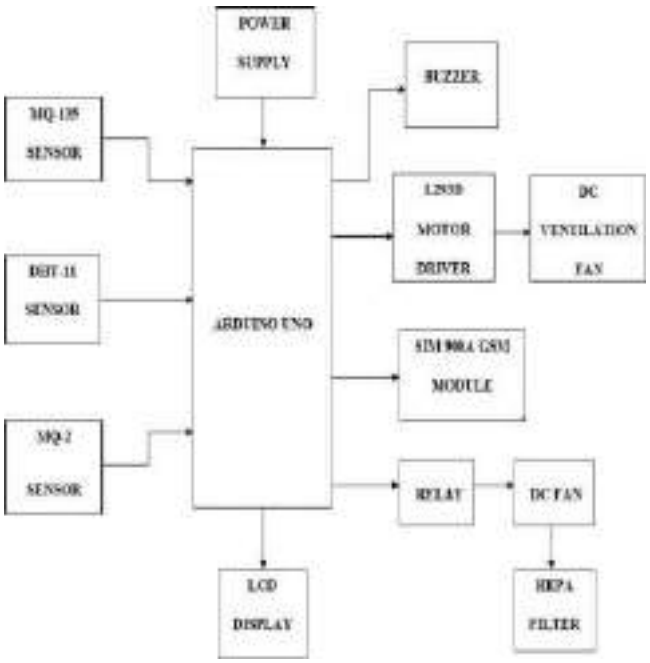


Fig. 2. Block diagram of proposed model.

B. Proposed Hardware Prototype

The proposed hardware prototype consists of various sensors interfaced with Arduino UNO which is depicted using Fig. 3.

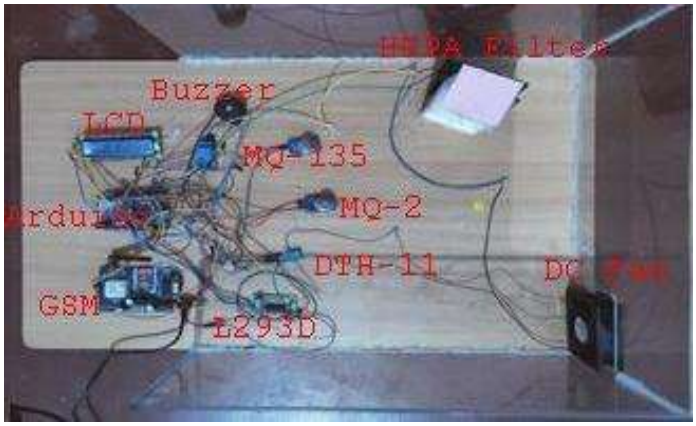


Fig. 3. Prposed Hardware Model.

IV. Procedure

A flow chart has been developed to understand the work flow of proposed system which is depicted in Fig.4. DHT and MQ-135 Sensors give the humidity, temperature and air quality. If air quality is low then Fan speed increases and if High then Fan speed Decreases and MQ2 Sensors are constantly checking the suspicious gas or leakages if it detects then HEPA filter removes the particles and Buzzer gives buzzer

sound at that location and GSM module gives the location of that leakage place. The step-by-step procedure for better understanding of proposed system has been given below.

- Power up all components and the Arduino unit using the power supply unit.
- Set up the MQ-135 and DHT-11 sensors to measure air quality, relative humidity, and temperature.
- Configure the MQ-2 sensor to detect LPG gas leakage.
- Position the GSM module, LCD display, buzzer, DC ventilation fan, and a HEPA filter with a DC fan at the output of the Arduino Uno.
- Connect the MQ-135 and DHT-11 sensors to the Arduino Uno to collect data on air quality, relative humidity, and temperature.
- Display these sensor readings on the LCD display using the Arduino Uno.
- Utilize fuzzy logic based on the sensor readings to control the speed of the DC ventilation fan for optimal air quality.
- Wire the MQ-2 sensor to the Arduino Uno to detect LPG gas in case of leakage.
- When the MQ-2 sensor detects LPG gas, activate the buzzer and the GSM module to send warning messages to the user.
- Connect the HEPA filter to the DC fan, and when the system detects LPG gas or any harmful gas, activate the relay to turn on the DC fan with the HEPA filter. This will help purify the air and mitigate the potential hazards.

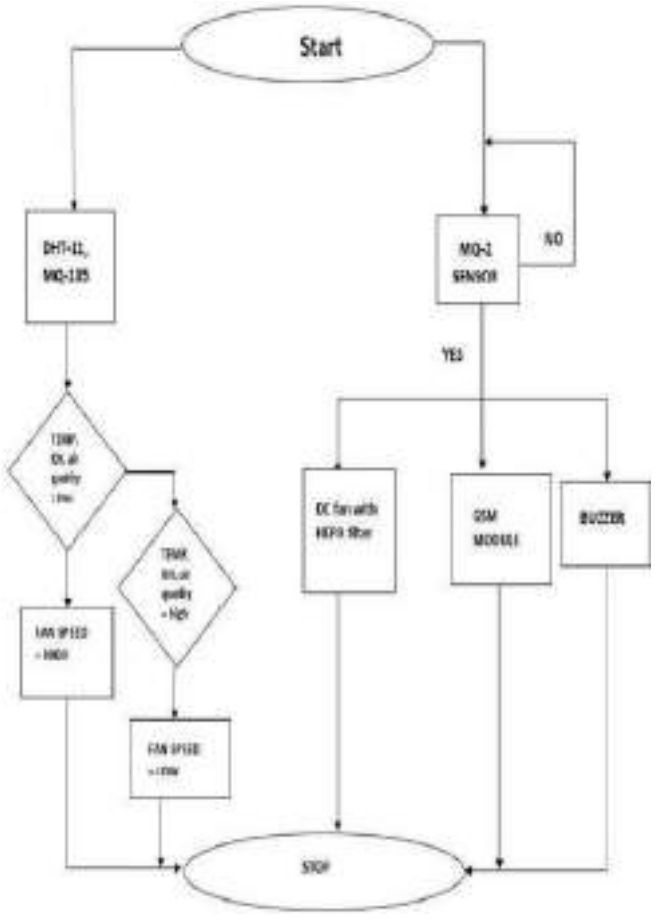
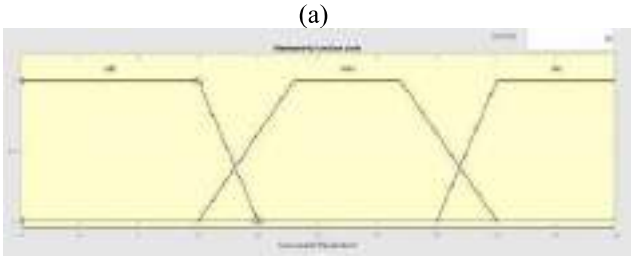


Fig. 4. Flow chart for transmitter section.

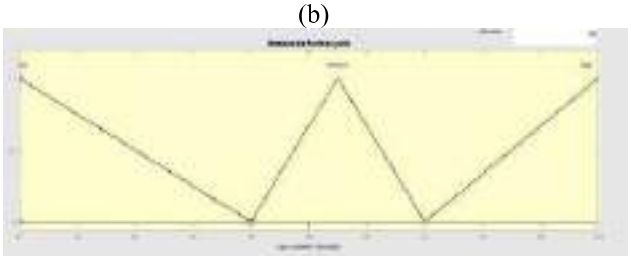
V. Fuzzy Logic Implementation

Initially, three distinct membership functions for inputs: temperature, relative humidity, and air quality have been created, each encompassing varying ranges. Subsequently, membership function for the output parameter, specifically the ventilation fan speed has been developed which are depicted in Fig.5. Following the design of membership functions for different inputs and the output, the next step involves incorporating the necessary rules to implement fuzzy logic and regulate the ventilation fan speed. Various rules can be established to control the ventilation fan speed. Once the rules are integrated, the system's design will resemble the illustration depicted in Fig.6.

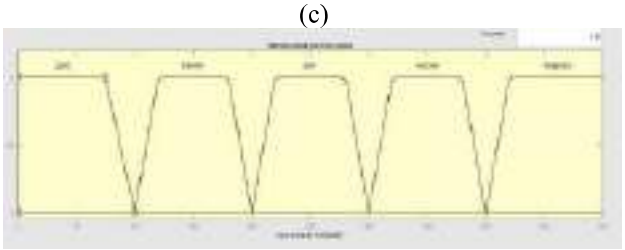
(a)



(b)



(c)



(d)

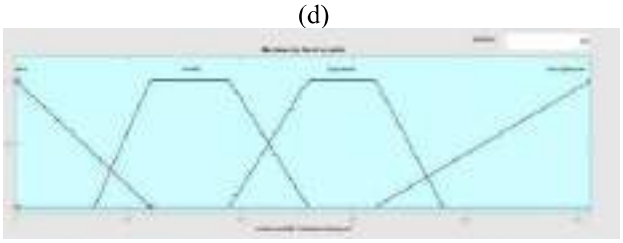


Fig. 5. Membership function (a) temperature (b) humidity (c) air quality (d) vantilation fan speed.

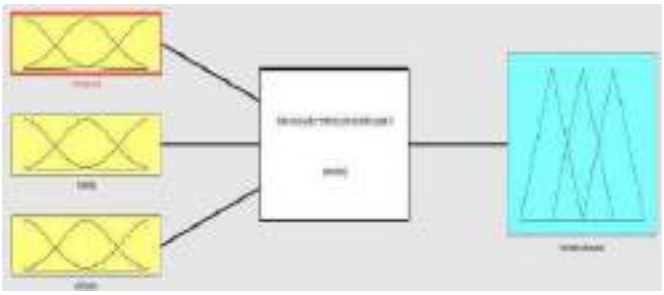


Fig. 6. Developed fuzzy logic system after declaring all the rules.

VI. Experimental Results

The simulation results fall into four distinct cases. When there is no air pollution, the LCD display portrays standard readings for temperature, humidity, and air pollution levels (see Fig. 7 (a) and 7 (b)). However, in the presence of anomalies in these parameters, the LCD displays corresponding altered values (see Fig. 7(c)). Over time, the LCD returns to displaying the typical range as a result of the ventilation system. Meanwhile, the DC fan equipped with a HEPA filter purifies the air. In the event of a detected LPG gas leakage, an audible alert via a buzzer is triggered, and an SMS alert is sent to notify the user (see Fig.7(d)).

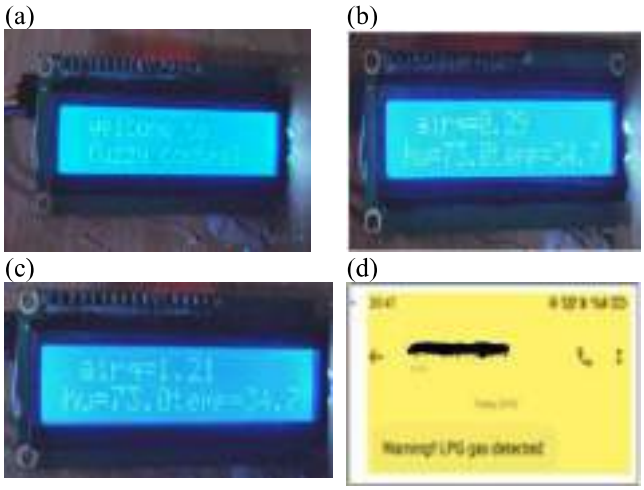


Fig. 7. Proposed system LCD display demonistrating (a) welcome messeage (b) no air pollution vaules (c) air pollution values (d) waring messeage for gas detection.

Based on the readings obtained in LCD, the system implements a fuzzy logic to control the speed of DC ventilation fan. The final outputs of fuzzy logic implementation for ventilation fan speed control which is implemented using MATLAB has been depicted in Fig.8.

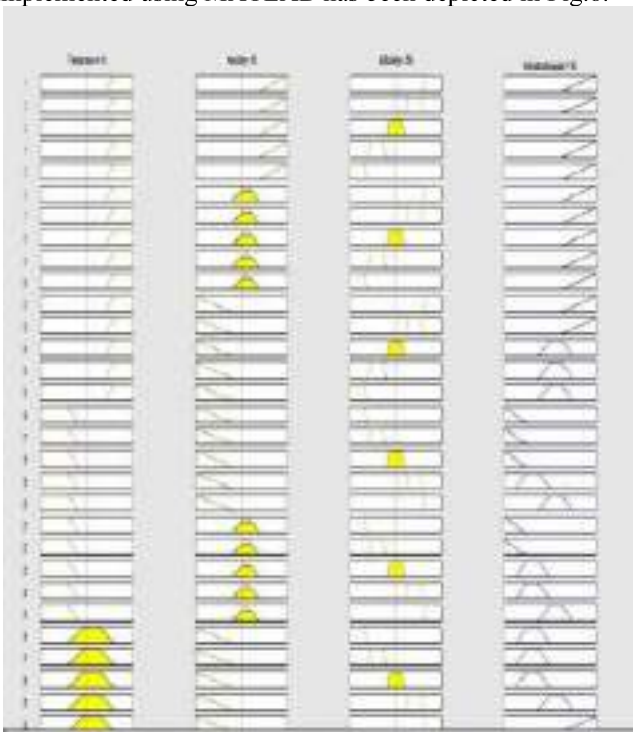


Fig. 8. Fuzzy logic implementation for all membship functions.

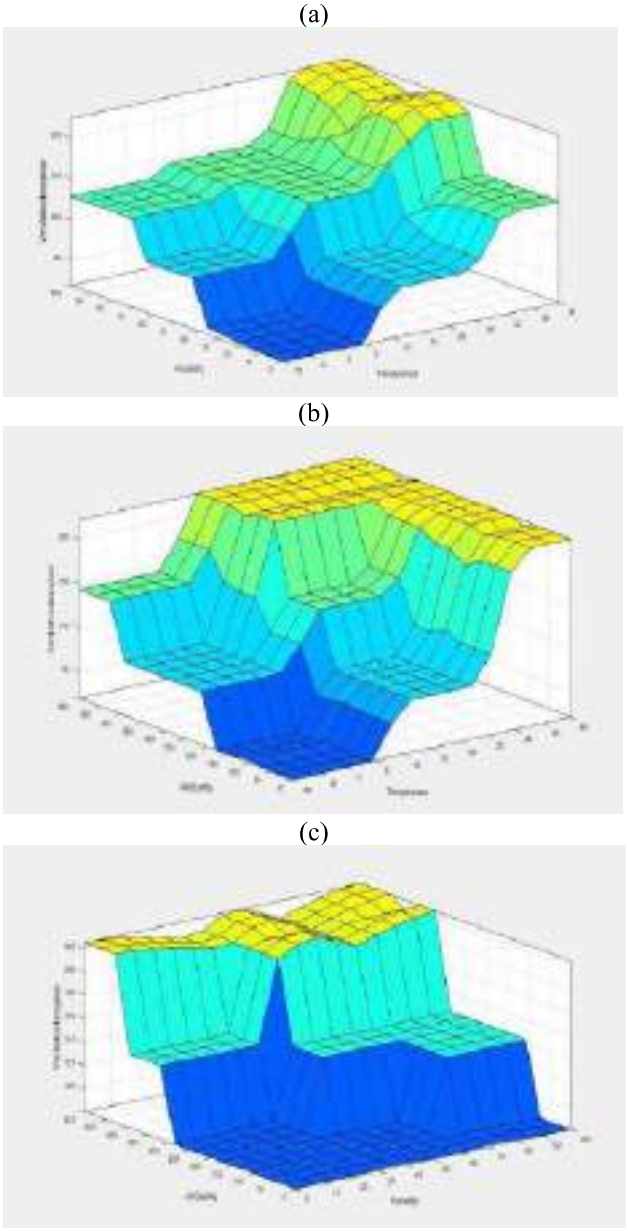


Fig. 9. Variation of membship functions with respect to (a) humidity and temperature (b) air quality and temperature (c) humidity and air quality.

The DC fan speed variatuions have been estimated for the various cases, where the fan speed variation with respect to temperature and humidity has been depicted in Fig. 9(a), air quality and temperature has been illustrated in Fig.9(b), and the variation in fan speed with respect to air quality and humidity has been plotted in Fig.9(c).

VII. Conclusion

Indoor air pollution can have both immediate and long-term consequences on health. It can lead to a range of health problems that may become evident shortly after exposure or develop over time. Improving indoor air quality through effective ventilation is crucial, as it not only enhances the air's quality but also helps reduce the health hazards linked to indoor pollution. This work presents a system that has been created to oversee and manage indoor air quality, temperature, and humidity. Furthermore, the system is capable of identifying LPG gas leaks and can promptly notify users via SMS alerts using GSM technology.

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***Abstract*— Aquaculture plays a vital role in meeting the increasing global demand for seafood. However, maintaining water quality in aquaculture systems is paramount for the health and growth of aquatic organisms. Hence, this work is focused on developing a monitoring system for aquaculture ponds to address this critical need. The system integrates state-of-the-art sensors, wireless communication, and data analytics to provide real-time monitoring and management of water quality parameters. By continuously assessing factors such as dissolved oxygen, pH, temperature, ammonia, and turbidity, aqua culturists can make informed decisions to optimize environmental conditions. The proposed system automatically, adjust the motor from ON to OFF and OFF to ON whenever there is an abnormality has been observed from the above-mentioned parameters and also sending alerts to the user. Additionally, the system incorporates predictive modeling to anticipate potential issues and automate corrective actions. Ultimately, this study contributes to sustainable aquaculture practices and improved yields while reducing environmental impact.**

Keywords*— *Aquaculture, Aquatic Health, Predictive modeling, Temperature, Turbidity, Salinity, Water Quality Monitoring.

I. INTRODUCTION

Aquaculture, the farming of aquatic organisms such as fish, shrimp, and other aquatic species, has become an indispensable component of the global food industry. With the ever-increasing demand for seafood and the depletion of natural fisheries, aquaculture has emerged as a sustainable solution to meet this demand. However, the success and profitability of aquaculture operations depend largely on the maintenance of optimal environmental conditions within aquatic systems. Key among these conditions is water quality, as it directly impacts the health, growth, and survival of the cultivated species [1].

The quality of water in aquaculture systems is a dynamic parameter influenced by various factors, including dissolved oxygen levels, pH, temperature, ammonia concentration, turbidity, and other water quality indicators. Variations in any of these parameters can lead to detrimental effects on aquatic life, reduced growth rates, increased susceptibility to diseases, and even catastrophic mass mortality events [2]. As a result, aqua culturists face the continuous challenge of maintaining ideal water quality conditions to ensure the well-being of their aquatic stocks. Traditionally, the monitoring of water quality in aquaculture systems has been a manual and periodic process, relying on labor-intensive methods that are both time-consuming and prone to human error. These limitations make it difficult to respond promptly to fluctuations in water quality, potentially causing significant economic losses and environmental impact [3]. To address these challenges, there is an increasing need for advanced technological solutions that offer continuous, real-time monitoring of water quality parameters in aquaculture systems [4]. The core idea behind the proposed system is to addresses this pressing need by proposing the creation of a state-of-the-art system that leverages cutting-edge technology, including the Internet of Things (IoT), to provide real-time, continuous monitoring of critical water quality parameters in aquaculture ponds and tanks [5].

The proposed system aims to enable aquaculturists to make informed decisions regarding water quality management, optimize environmental conditions for their aquatic species, and ultimately contribute to the sustainable growth of the aquaculture industry. IoT plays a vital role in the proposed system by revolutionizing how water quality is monitored and managed in aquaculture. It provides real-time data, remote monitoring, data analysis, automation, and scalability, all of which contribute to improved aquaculture productivity, sustainability, and the well-being of aquatic organisms. Hence, in this work a dynamic water quality monitoring system has been developed based on IOT for aquaculture.

II. LITERATURE REVIEW

The overall survival and aquaculture productivity of habitats are significantly influenced by the quality of the pond water. Currently, the process of checking prawn pond water quality is typically a manual task conducted by the cultivator. Therefore, there is a pressing need for a system that can provide continuous and precise monitoring of pond conditions, assisting cultivators in real-time data acquisition. The proposed system endeavors to design and implement an IoT-based system which not only monitors the water quality in prawn ponds but also proactively alerts users when the water quality deteriorates beyond acceptable levels, ensuring optimal conditions for aquaculture.

The author of [6], has created an aquaculture water quality parameter monitoring system utilizing the Internet of Things (IoT) for reducing time-consuming and labour-intensive for monitoring aqua ponds. In [7], the authors have introduced a prototype and provide a proof of concept for a distributed monitoring system designed to track critical variables in aquaculture water quality. The monitoring of water quality in freshwater pond fish farming holds great significance, as the well-being and quality of fish directly rely on the conditions within their aquatic environment. Poor water conditions can disrupt fish behavior and lead to significant mortality, ultimately diminishing the productivity of freshwater fish farming operations. Among the key parameters, temperature, pH level, and turbidity of the fish pond water serve as crucial indicators of optimal water quality. The research in [8], aims to contribute to the development of water quality monitoring instruments capable of generating continuous and real-time data on water quality. For the purpose of monitoring aquaculture pond water quality, the authors of [9], have designed and developed a monitoring system that utilizes LoRaWAN technology. The researchers in the study presented in [10] have developed an Internet of Things (IoT) system for monitoring and controlling water parameters in aquaculture.

The authors of [11], have meticulously planned and implemented the monitoring of aquaculture water quality by integrating a combination of technologies, including Raspberry Pi, Arduino microcontrollers, an array of sensors, a smartphone camera, and an Android application. In traditional small-scale pond aquaculture, most individual farmers rely on their experience, making it challenging to accurately monitor the breeding environment and achieve cost-effective and profitable operations. To address this issue, a design for aquaculture monitoring system based on Narrow-Band IoT (NB-IoT) technology has been introduced in [12]. Water stands as a fundamental element for life on our planet. Its quality demands vigilant scrutiny and management. Within the scope of this research, we have envisioned an automated water quality monitoring and alert system. In response to this imperative, the authors of [13] have presented a comprehensive solution, an integrated system for water quality monitoring and reporting, aimed at addressing this critical concern. In addition, the evaluation of IOT into various aspects of inventions in order to enabling alerting [14-15], management [16], security [17], and societal applications [18-19] have been developed by various authors.

III. PROPOSED MODEL

A. Block Diagram

The block schematic of dynamic water quality monitoring system for aquaculture based on IoT technology has been proposed, and as depicted in Fig 1.

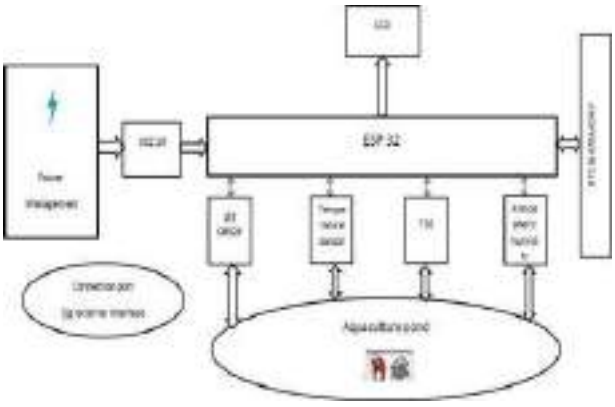


Fig. 1. Block diagram of proposed model.

This system consists of various sensors such as pH, temperature, TDS, and humidity. These sensors are interfaced with EESP32 microcontroller for continuously monitoring water quality in the aquaculture ponds. [17-19]. The pH sensor plays a crucial role in aquaculture ponds by monitoring and regulating the acidity or alkalinity of the water, which is essential for maintaining the health and well-being of aquatic organisms. Maintaining the appropriate water temperature is essential for the overall health and growth of aquatic species in aquaculture ponds. Different species have specific temperature requirements, and the sensor helps ensure that these requirements are met.

B. Circuit Diagram

The circuit connection for the proposed model incorporates numerous sensors for aquaculture ponds monitoring integrated with NodeMCU has been depicted in Fig.2.

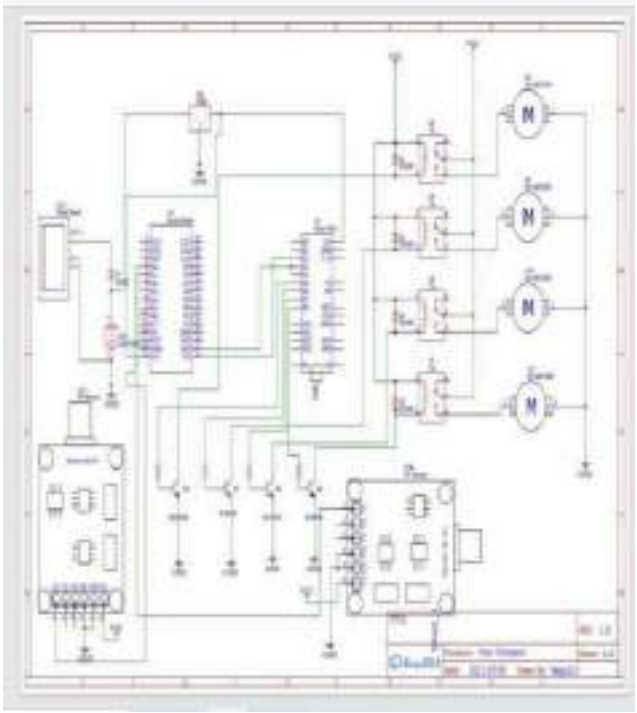


Fig. 2. Circuit diagram for prposed hardware model.

C. Proposed Hardware Prototype

The proposed hardware prototype consists of various sensors interfaced with NodeMCU which is depicted using Fig. 3.

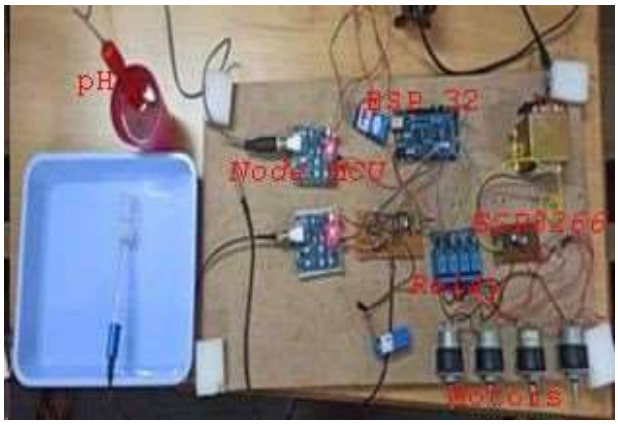


Fig. 3. Prposed Hardware Model.

IV. Procedure

To comprehend the functioning of the proposed hardware model, the step-by-step working operation is explained below. A flow char has been created for understanding the flow of work for the proposed system and is depicted in Fig.4.

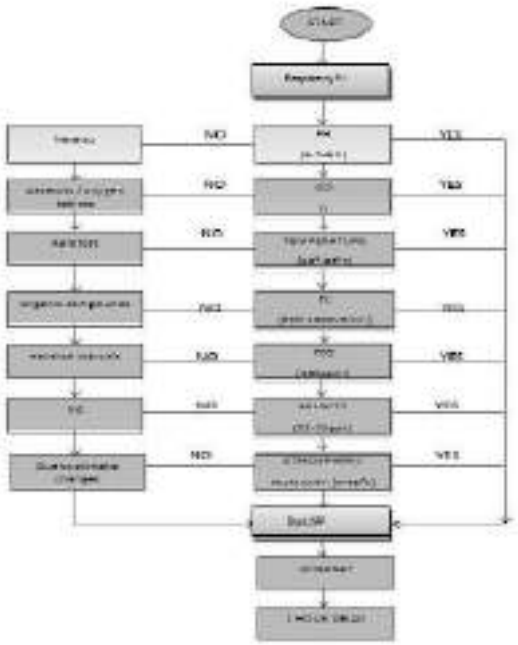


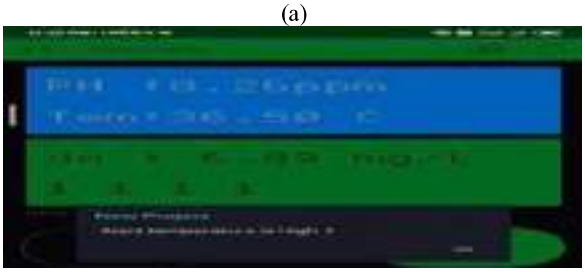
Fig. 4. Flow chart for transmitter section.

- Step1: Initialize all the hardware components.
- Step2: Initially, it checks the pH of the water, if it is in the range of threshold value, then it will directly pop-up a message in the blynk app and send it to the user via internet. If the pH is out of the range of prescribed range, then it will suggest adding Sodium hydrosulfite to the aqua pond in order to balance the pH.
- Step3: Similarly, it checks DO, and recommends include aerators or oxygen tablets to the pond, whenever there is an abnormality.
- Step4: Check for temperature, and suggest activation of aerators whenever there is an abnormality.
- Step5: Check for EC, and suggest inclusion of organic compounds whenever there is an abnormality.
- Step6: Check for TDS, and suggest reverse osmosis process whenever there is an abnormality.
- Step7: Check for salinity, and suggest inclusion of ice whenever there is an abnormality.
- Step8: Check for salinity, and suggest inclusion of ice whenever there is an abnormality.
- Step9: Check for humidity, and suggest inclusion and activation of aerators and inclusion of organic compounds.
- Step10: The process ends.

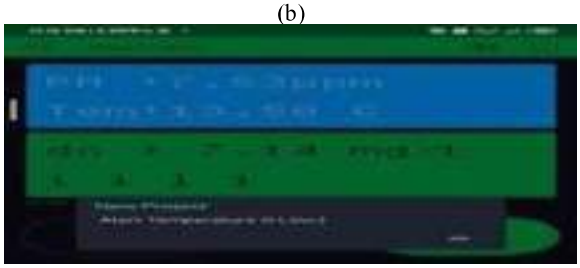
V. Experimental Results

The prototype has been developed for monitoring the DO, pH, salinity and temperature of the aqua pond regularly. Here, a DC power supply has been utilized for operating the motors because of easy controlling, operation and expense. In typical circumstances, temperature measurement is facilitated through the use of a temperature sensor. The motor operates in the ON state when the temperature falls within the range of 28 to 35 degrees Celsius (see Fig.5(a)). When the temperature surpasses 35 degrees Celsius, the application displays a high temperature alert, and the aerator begins rotating after a brief delay. Conversely, if the temperature drops below 28 degrees Celsius, the application displays a low temperature alert (see Fig.5(b)). It is indicating in Fig. 5(c), that the temperature falls within the range of 28 to 35 degrees Celsius. Consequently, the motors remain in the OFF position until they reach the predefined threshold, which is either below 28 degrees Celsius or above 35 degrees Celsius. The motors are in ON position as the temperature is below 28 degrees Celsius (see Fig.5(d)).

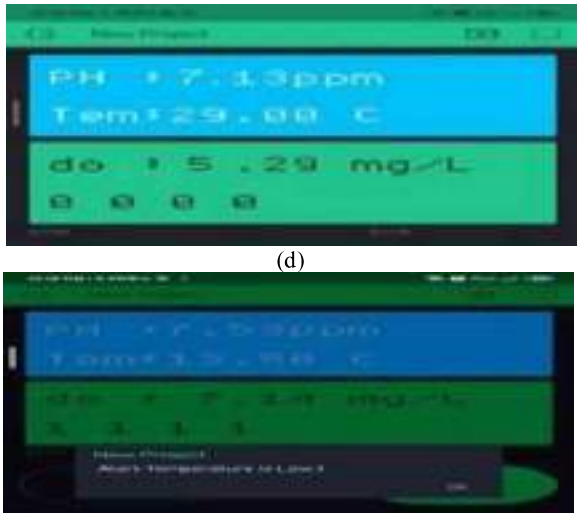
(a)



(b)



(c)

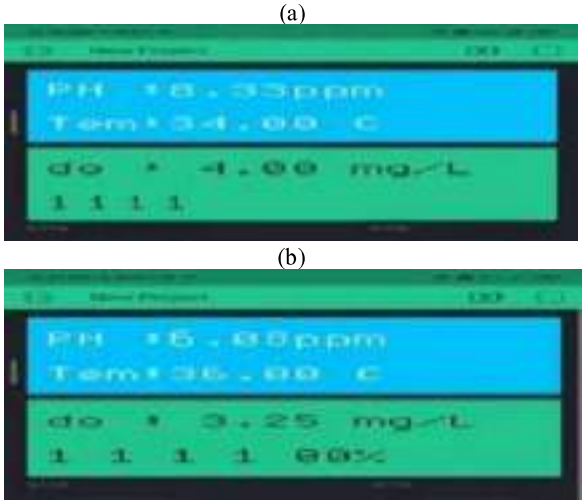


(d)

Fig. 5. Motor working condition depends on temperature when (a) temperature is above 35 ^{0}c (b) temperature is below 28 ^{0}c (c) temperature is above 28 ^{0}c and below 35 ^{0}c (d) temperature is below 28 ^{0}c.

Figure 6(a) illustrates the pH level in regular water, typically ranging from 7 to 9. The adjacent figure displays a pH value of 8.33 at a temperature of 34 degrees Celsius. Figure 6(b) depicts the pH level in a water solution. The choice of this solution depends on whether the goal is to raise or lower the pH level in the water. In this case, sodium bicarbonate solution is employed to lower the elevated pH value to 6.08, which falls within the optimal growth range of 6 to 9.

(a)

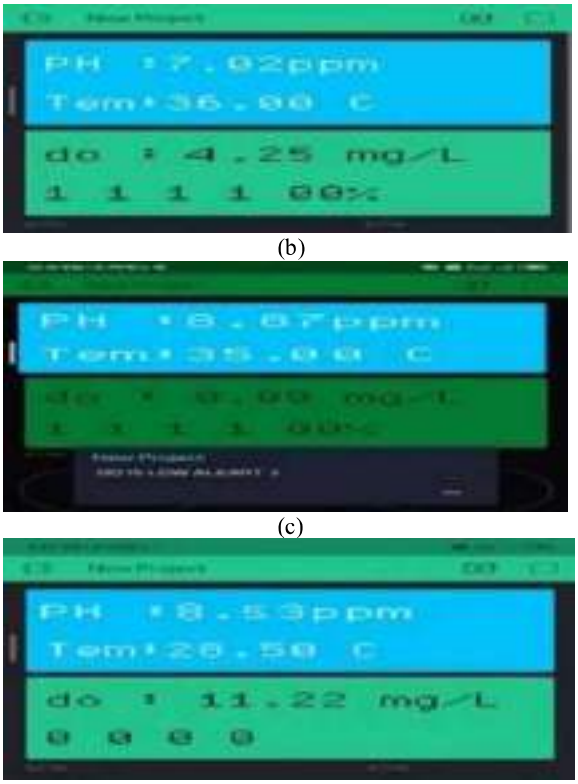


(b)

Fig. 6. Addition of external soultion to the pond when the pH (a) with in the thershold range (b) out of range with threshold.

The measurement of dissolved oxygen (DO) levels in water is accomplished using a DO sensor. Figure 7(a) illustrates DO levels below 4.25 mg/L, triggering a message: DO is low.

(a)



(b)

(c)

Fig. 7. Activating areators when (a) DO level is bellow thereshold (b) when DO is zero (c) when DO is above threshold.

In Figure 7(b), the dissolved oxygen (DO) level is recorded as 0.00 mg/L, which activates the aerators, putting them in the ON position. In Figure 7(c), the dissolved oxygen (DO) value exceeds the predefined threshold, resulting in the aerators being in the OFF position, as the water contains an ample amount of DO. The subsequent figure displays a DO level of 11.22 mg/L at a temperature of 28.50 degrees Celsius.

VI. Conclusion

In this work, a comprehensive system that continuously evaluates and maintains water quality parameters critical for the health and growth of aquatic organisms has been developed. The water quality has been monitored consciously by measuring pH, temperature, dissolved oxygen (DO), and salinity. The proposed system automatically, adjust the motor from ON to OFF and OFF to ON whenever there is an abnormality has been observed from the above-mentioned parameters and also sending alerts to the user. The proposed system's ability to ensure water quality parameters are maintained within desired ranges contributes to the well-being of aquatic life and the success of aquaculture businesses, while also promoting environmental responsibility. This study represents a significant step forward in enhancing the aquaculture sector and its long-term viability.

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Excess Thermodynamic Parameters of Binary Liquid Mixtures of Dimethyl Malonate with Isomeric Xylenes at Different Temperatures

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Over the complete composition range of mole fractions, densities and ultrasonic velocities of binary liquid mixtures of dimethyl malonate with *o*-xylene, *p*-xylene and *m*-xylene were investigated at 303.15-318.15 K. These parameters were chosen to investigate the impact of substituents and specific locations on several thermodynamic characteristics of binary mixtures. The deviation in adiabatic compressibility ($\Delta\beta_{ad}$), excess molar volume (V^E) and excess intermolecular free length (L_f^E) were estimated using the experimental measurements. These extraneous parameters are fitted to a polynomial equation of the Redlich-Kister type. Along with the obtained parameter values, the standard deviation (σ) was also determined.

Keywords: Dimethyl malonate, Isomeric xylenes, Adiabatic compressibility, Excess molar volume, Excess inter molecular free length.

INTRODUCTION

The most significant purpose for studying the thermophysical characteristics of liquids and liquid mixtures is to learn more about the molecular interactions that take place in these systems [1], which are crucial for both theoretical and practical considerations. The literature studies shows of preferred relations of polymers, polymer phase diagrams and mixed solvents are just a few of the fields in which the binary mixtures of aromatic hydrocarbons are particularly valuable [2,3]. One of the unique classes of compounds, esters has a sweet scent and a less harmful.

The octane of automobile fuels is routinely increased by adding aromatic compounds like xylenes. Therefore, it is highly intriguing to investigate the different xylene mixtures at various temperatures affect the physical and chemical characteristics of dimethyl malonate. The occurrence of significant effects caused by intermolecular interactions can be highly predicted by observing the excessive properties of binary liquid mixtures [4,5]. Theoretical models for determining and predicting fluid phase equilibria can be improved by providing experimental background; secondly, a wide range of options for continuously modifying the physical properties of the solvent can be uncovered through an exhaustive investigation of this interaction [6]. A thorough review of the literature revealed that several combinations of xylenes have been studied at various temperatures in order to determine their excess characteristics.

However, experiments with dimethyl malonate combination have only been undertaken at 303.15 K and 313.15 K, and the ultrasonic investigations have not yielded any results. Therefore, considering the ultrasonic velocities and their related parameters, this system was chosen to under a better knowledge of the nature of interactions between dimethyl malonate and isomeric xylenes. An extensive study on the excess qualities has been reported on the properties of *o*-xylene with propan-2-ol, butan-2-ol and pentan-2-ol [7], 2-butanol + *m*-xylene [8], poly(propylene glycol) + toluene/*o*-xylene/*m*-xylene/*p*-xylene [9], isomeric xylenes and diethyl malonate [10], methanol with *o*, *m* and *p*-xylenes [11], cyclohexane with toluene, *o*-xylene and mesitylene [12], xylene and certain alkanols (C4-C8) [13], dimethyl formamide (DMF) with benzene, *o*-xylene, 1,4-dioxane and tetra hydrofuran [14], 1,4-dioxane with *o*-, *m*-, *p*-xylene, toluene,

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benzene and mesitylene [15], benzene, toluene, *o*-, *m*-, *p*-xylene and mesitylene with 1,4-dioxane [16], ethylbenzene + *p*-xylene [17], quinolone + *m*-xylene [18] and *o*-xylene with ethyl oleate [19].

As already known, dimethyl malonate has several applications in industries, similarly isomeric xylenes are also one of the key chemicals for industrial applications. These reasons led us to compare the molecular interactions between three distinct xylenes and dimethyl malonate. In this work, the excess molar volume (V^E), deviation in the adiabatic compressibility ($\Delta\beta_{ad}$) and excess intermolecular free length (L_f^E) of the binary systems of dimethyl malonate with *ortho*, *meta* and *para*-xylene is presented. These results have been utilized to investigate the inductive effect in terms of induced dipole-dipole interaction in the xylene interaction with dimethyl malonate. The current study also aimed to investigate the effect of the position of CH_3 group in different thermodynamic functions which can affects the sign and magnitude in the presence of dimethyl malonate.

EXPERIMENTAL

The chemicals used in the current investigation dimethyl malonate, *o*-xylene, *p*-xylene and *m*-xylene were purchased from Loba Chemicals of analytical grade with > 99% purity. Ultrasonic velocities were determined in pure liquids and their binary mixtures using a single crystal variable-path multi-frequency ultrasonic interferometer operated at 3 MHz. The double-arm pycnometer was calibrated using conductive water at a density of 995.61 kg m^3 at 303.15 K using a thermostat to maintain a consistent temperature. All the chemicals were weighed using a Mettler Toledo digital balance with an accuracy of ±0.01 mg.

Density measurement: In this investigation, the density (ρ) of all liquid mixtures and pure liquids was measured at 303.15 using a 105 mL double-arm pycnometer as reported by Nikkam *et al.* [20,21]. In order to calibrate the pycnometer, water with a conductivity and a density of 995.61 kg/m^3 was employed. By using a moving microscope with a resolution of 0.01 mm the locations of the liquid levels in the two arms of air bubble free pycnometer were noted. With a measurement uncertainty of two parts in 10^4, the density values derived from triplicate replication at each temperature were repeatable to within 2×10^{-1} kg/m^3.

RESULTS AND DISCUSSION

Table-1 clearly shows a high agreement between experimental results and values found in the literature. To prove the existence of molecular interactions, it is important to examine the excess parameters. Excess liquid mixture properties were used to calculate deviations from ideal behavior in liquid mixtures. To understand the molecular interactions, both the positive and negative contributions of the excess parameters were taken into account. The following standard relations were used to compute the excess values of molar volume (V^E), intermolecular free length (L_f^E) and variation in adiabatic compressibility ($\Delta\beta_{ad}$)

Excess molar volume (V^E):

$$V^E = (V-(V_1X_1 + V_2X_2)) \quad (1)$$

Deviation in adiabatic compressibility ($\Delta\beta_{ad}$):

$$\Delta\beta_{ad} = \beta_{ad1}X_1 + \beta_{ad2}X_2 \quad (2)$$

Excess intermolecular free length (L_f^E):

$$L_f^E = L_f - (L_{f1}X_1 + L_{f2}X_2) \quad (3)$$

The investigational values of sound speed and densities, deviation in adiabatic compressibility, excess molar volume and excess inter molecular free length expressed in mole fraction X_1 of dimethyl malonate ($0 \le X_1 \le 1$), at various temperatures, are listed in Tables 2-4 for liquid mixtures of dimethyl malonate with *o*-, *m*- and *p*-xylene.

The relative degree of the contractive and expansive effects that result from the mixing of liquid components will determine the sign and magnitude of the extra molar volume. Negative variations in excess molar volume (V^E) are observed in these three systems (Fig. 1), which is attributed due to the strong interactions between dissimilar molecules. Two polar bonds, C-O-C and >C=O, are present in dimethyl malonate molecules, whereas xylenes have two +I (methyl) groups. Despite *p*-xylene having a zero dipole moment, the +I (methyl) groups cause partial charges in xylene molecules, allowing dipole-induced dipole interactions between dimethyl malonate and xylene molecules. However, the presence of two adjacent methyl groups on the *o*-xylene molecules prevents other molecules from approaching them (steric hindrance; dimethyl malonate) [24,25]. The patterns for excess acoustic impedance (Z^E) and excess ultrasonic velocity (U^E) provide additional support for the observations.

The substituent attached to the benzene ring influences the electron density in its derivatives. Electron pairs on the carbonyl group of ester and the π-electrons of benzene ring in *p*-xylene molecules can interact in several manners (Fig. 2), which can be utilized to elucidate the divergence in adiabatic compressibility [26,27]. For example, (i) molecules become slower and more compressible as a result of changes in their sizes and shapes as well as the loss of dipole-dipole interaction, and (ii) the formation of hydrogen-bonded complexes or dipole-dipole interactions between molecules with opposite charges, results in an increase in the sound velocity and a decrease in the compressibility.

TABLE-1
COMPARISON OF EXPERIMENTAL VALUES WITH LITERATURE VALUES DATA AT 303.15 K

Liquid	Ultrasonic velocity (m/s)		Density (Kg/m^3)	
	Experimental	Literature	Experimental	Literature
Dimethyl malonate	1365.2	1365.20 [22]	1.1423	1.1423 [22]
o-Xylene	1328.2	1329.40 [23]	0.8627	0.8671 [23]
m-Xylene	1301.5	1302.46 [23]	0.8524	0.8526 [23]
p-Xylene	1286.3	1287.30 [23]	0.8466	0.8488 [23]

TABLE-2
ULTRASONIC VELOCITY (U), DENSITY (ρ), DEVIATION IN ADIABATIC COMPRESSIBILITY ($\Delta\beta_{ad}$), EXCESS MOLAR VOLUME (V^E) AND EXCESS INTERMOLECULAR FREE LENGTH (L_f^E) OF DIMETHYL MALONATE + *o*-XYLENE

X_1	U (m s^{-1})	ρ (kg m^{-3})	$\Delta\beta_{ad}$ (10^{-10} m^2 N^{-1})	V^E (10^6 m^3 mol^{-1})	L_f^E (10^{-11} m)	U (m s^{-1})	ρ (kg m^{-3})	$\Delta\beta_{ad}$ (10^{-10} m^2 N^{-1})	V^E (10^6 m^3 mol^{-1})	L_f^E (10^{-11} m)
			303.15 K					308.15 K		
0.0000	1328.2	0.8627	0.0000	0.0000	0.0000	1313.5	0.8645	0.0000	0.0000	0.0000
0.1052	1332.1	0.8918	-1.1777	-1.9577	-0.0683	1316.8	0.8935	-1.4388	-2.0330	-0.0884
0.2092	1335.9	0.9206	-2.0056	-3.3340	-0.1168	1321.1	0.9222	-2.2344	-3.4615	-0.1360
0.3120	1339.7	0.9491	-2.5251	-4.1977	-0.1478	1325.3	0.9506	-2.7308	-4.3573	-0.1662
0.4136	1343.5	0.9772	-2.7718	-4.6078	-0.1630	1329.5	0.9787	-2.9627	-4.7822	-0.1808
0.5141	1347.2	1.0051	-2.7765	-4.6156	-0.1639	1333.6	1.0064	-2.9601	-4.7895	-0.1815
0.6135	1350.9	1.0326	-2.5660	-4.2657	-0.1521	1337.7	1.0338	-2.7492	-4.4257	-0.1695
0.7117	1354.5	1.0598	-2.1638	-3.5970	-0.1288	1341.7	1.0609	-2.3527	-3.7314	-0.1462
0.8089	1358.1	1.0867	-1.5903	-2.6437	-0.0950	1345.7	1.0878	-1.7905	-2.7421	-0.1127
0.9050	1361.7	1.1133	-0.8637	-1.4359	-0.0518	1349.6	1.1143	-1.0803	-1.4891	-0.0698
1.0000	1365.2	1.1396	0.0000	0.0000	0.0000	1354.5	1.1405	0.0000	0.0000	0.0000
			313.15 K					318.15 K		
0.0000	1297.0	0.8918	0.0000	0.0000	0.0000	1284.2	0.8603	0.0000	0.0000	0.0000
0.1052	1298.9	0.9206	-1.5959	-2.0917	-0.0992	1285.0	0.8894	-1.7469	0.0000	-0.1102
0.2092	1302.5	0.9491	-2.3014	-3.5609	-0.1399	1288.1	0.9182	-2.4494	-2.1188	-0.1505
0.3120	1305.8	0.9772	-2.8155	-4.4817	-0.1711	1290.7	0.9466	-2.9725	-3.6068	-0.1825
0.4136	1308.9	1.0051	-3.0555	-4.9180	-0.1862	1293.5	0.9748	-3.1512	-4.5393	-0.1931
0.5141	1312.1	1.0326	-3.0526	-4.9249	-0.1869	1296.0	1.0026	-3.1592	-4.9809	-0.1947
0.6135	1315.2	1.0598	-2.8339	-4.5503	-0.1746	1298.4	1.0301	-2.9697	-4.9876	-0.1847
0.7117	1318.2	1.0867	-2.4231	-3.8360	-0.1505	1301.0	1.0572	-2.5309	-4.6080	-0.1587
0.8089	1321.3	1.1133	-1.8409	-2.8187	-0.1158	1303.4	1.0841	-1.9555	-3.8845	-0.1247
0.9050	1324.3	1.1396	-1.1055	-1.5306	-0.0716	1306.2	1.1107	-1.1159	-2.8542	-0.0724
1.0000	1328.3	0.8627	0.0000	0.0000	0.0000	1309.7	1.1370	0.0000	-1.5498	0.0000

TABLE-3
ULTRASONIC VELOCITY (U), DENSITY (ρ), DEVIATION IN ADIABATIC COMPRESSIBILITY ($\Delta\beta_{ad}$), EXCESS MOLAR VOLUME (V^E) AND EXCESS INTERMOLECULAR FREE LENGTH (L_f^E) OF DIMETHYL MALONATE + *m*-XYLENE

X_1	U (m s^{-1})	ρ (kg m^{-3})	$\Delta\beta_{ad}$ (10^{-10} m^2 N^{-1})	V^E (10^6 m^3 mol^{-1})	L_f^E (10^{-11} m)	U (m s^{-1})	ρ (kg m^{-3})	$\Delta\beta_{ad}$ (10^{-10} m^2 N^{-1})	V^E (10^6 m^3 mol^{-1})	L_f^E (10^{-11} m)
			303.15 K					308.15 K		
0.0000	1301.5	0.8524	0.0000	0.0000	0.0000	1297.0	0.8454	0.0000	0.0000	0.0000
0.1068	1308.2	0.8834	-1.1915	-2.7930	-0.0023	1299.2	0.8768	-1.4766	-2.9010	-0.0030
0.2121	1314.8	0.9139	-2.0098	-4.7270	-0.0039	1302.2	0.9078	-2.4507	-4.9080	-0.0051
0.3157	1321.2	0.9439	-2.5572	-5.9170	-0.0050	1305.5	0.9383	-2.9835	-6.1420	-0.0062
0.4178	1327.8	0.9735	-2.7716	-6.4590	-0.0055	1309.2	0.9683	-3.1216	-6.7040	-0.0065
0.5184	1334.1	1.0027	-2.7883	-6.4370	-0.0055	1312.8	0.9979	-2.9906	-6.6790	-0.0062
0.6176	1340.3	1.0314	-2.6023	-5.9190	-0.0052	1316.0	1.0271	-2.7360	-6.1410	-0.0057
0.7153	1346.5	1.0598	-2.2040	-4.9680	-0.0044	1318.8	1.0558	-2.3413	-5.1530	-0.0049
0.8116	1352.8	1.0877	-1.6064	-3.6350	-0.0032	1321.5	1.0842	-1.7261	-3.7690	-0.0037
0.9065	1358.9	1.1152	-0.8917	-1.9660	-0.0018	1324.5	1.1121	-0.9830	-2.0380	-0.0021
1.0000	1365.2	1.1423	0.0000	0.0000	0.0000	1328.3	1.1396	0.0000	0.0000	0.0000
			313.15 K					318.15 K		
0.0000	1281.0	0.8493	0.0000	0.0000	0.0000	1241.0	0.8420	0.0000	0.0000	0.0000
0.1068	1287.5	0.8804	-1.7637	-3.0980	-0.0034	1245.5	0.8735	-1.8950	-3.1960	-0.0041
0.2121	1294.4	0.9111	-2.8216	-5.2390	-0.0054	1251.6	0.9046	-2.9330	-5.4040	-0.0064
0.3157	1301.7	0.9413	-3.3974	-6.5540	-0.0065	1258.4	0.9352	-3.4482	-6.7590	-0.0075
0.4178	1309.4	0.9710	-3.5234	-7.1500	-0.0067	1265.7	0.9653	-3.5508	-7.3720	-0.0077
0.5184	1317.2	1.0003	-3.3836	-7.1210	-0.0064	1272.8	0.9950	-3.4649	-7.3410	-0.0075
0.6176	1324.7	1.0292	-3.0895	-6.5450	-0.0059	1279.5	1.0242	-3.2665	-6.7460	-0.0072
0.7153	1331.9	1.0576	-2.6652	-5.4900	-0.0051	1286.5	1.0530	-2.8076	-5.6580	-0.0062
0.8116	1339.3	1.0856	-2.0581	-4.0150	-0.0040	1293.8	1.0814	-2.1104	-4.1370	-0.0047
0.9065	1346.7	1.1133	-1.1960	-2.1700	-0.0024	1300.2	1.1094	-1.4700	-2.2360	-0.0034
1.0000	1354.5	1.1405	0.0000	0.0000	0.0000	1309.7	1.1370	0.0000	0.0000	0.0000

TABLE-4
ULTRASONIC VELOCITY (U), DENSITY (ρ), DEVIATION IN ADIABATIC COMPRESSIBILITY ($\Delta\beta_{ad}$), EXCESS MOLAR VOLUME (V^E) AND EXCESS INTERMOLECULAR FREE LENGTH (L_f^E) OF DIMETHYL MALONATE + *p*-XYLENE

X_1	U (m s^{-1})	ρ (kg m^{-3})	$\Delta\beta_{ad}$ (10^{-10} m^2 N^{-1})	V^E (10^6 m^3 mol^{-1})	L_f^E (10^{-11} m)	U (m s^{-1})	ρ (kg m^{-3})	$\Delta\beta_{ad}$ (10^{-10} m^2 N^{-1})	V^E (10^6 m^3 mol^{-1})	L_f^E (10^{-11} m)
	303.15 K					308.15 K				
0.0000	1286.3	0.8466	0.0000	0.0000	0.0000	1265.6	0.8455	0.0000	0.0000	0.0000
0.1073	1294.3	0.8783	-1.2438	-3.1190	-0.0025	1273.7	0.8777	-1.5522	-3.8880	-0.0033
0.2129	1302.5	0.9095	-2.0425	-5.2690	-0.0041	1282.0	0.9092	-2.5887	-6.4630	-0.0056
0.3167	1310.4	0.9403	-2.5978	-6.5830	-0.0053	1291.3	0.9400	-2.9878	-7.9410	-0.0064
0.4190	1318.5	0.9705	-2.7782	-7.1740	-0.0057	1300.5	0.9703	-3.1559	-8.6310	-0.0068
0.5196	1326.0	1.0002	-2.8762	-7.1370	-0.0059	1309.2	1.0003	-3.2403	-8.9300	-0.0070
0.6187	1334.0	1.0295	-2.6136	-6.5530	-0.0054	1318.3	1.0293	-2.9098	-8.0240	-0.0063
0.7162	1341.7	1.0584	-2.2338	-5.4910	-0.0046	1326.8	1.0578	-2.5590	-6.6600	-0.0056
0.8123	1349.5	1.0868	-1.6439	-4.0120	-0.0034	1336.5	1.0862	-1.7845	-5.1420	-0.0039
0.9068	1357.3	1.1148	-0.9149	-2.1670	-0.0019	1345.6	1.1140	-0.9963	-3.2070	-0.0022
1.0000	1365.2	1.1423	0.0000	0.0000	0.0000	1354.5	1.1405	0.0000	0.0000	0.0000
	313.15 K					318.15 K				
0.0000	1249.8	0.8426	0.0000	0.0000	0.0000	1229.7	0.8398	0.0000	0.0000	0.0000
0.1073	1256.4	0.8754	-1.7767	-4.5930	-0.0038	1236.0	0.8730	-1.9326	-5.1950	-0.0043
0.2129	1263.6	0.9069	-2.8314	-7.0160	-0.0061	1243.1	0.9046	-3.0286	-7.7020	-0.0067
0.3167	1271.2	0.9380	-3.4153	-8.5760	-0.0074	1250.8	0.9355	-3.5693	-9.0390	-0.0079
0.4190	1279.4	0.9685	-3.5486	-9.2380	-0.0077	1259.0	0.9662	-3.7575	-9.9130	-0.0084
0.5196	1287.7	0.9987	-3.4585	-9.5640	-0.0076	1267.6	0.9963	-3.6042	-10.0740	-0.0081
0.6187	1295.6	1.0281	-3.1856	-8.8180	-0.0070	1275.5	1.0256	-3.3666	-9.1940	-0.0076
0.7162	1303.7	1.0573	-2.7278	-7.9110	-0.0060	1283.9	1.0549	-2.8785	-8.3380	-0.0065
0.8123	1311.3	1.0856	-2.1559	-6.0760	-0.0048	1291.2	1.0835	-2.4436	-6.6920	-0.0057
0.9068	1320.2	1.1140	-1.2019	-4.4180	-0.0027	1300.4	1.1119	-1.4884	-5.0260	-0.0035
1.0000	1328.3	1.1396	0.0000	0.0000	0.0000	1309.7	1.1370	0.0000	0.0000	0.0000

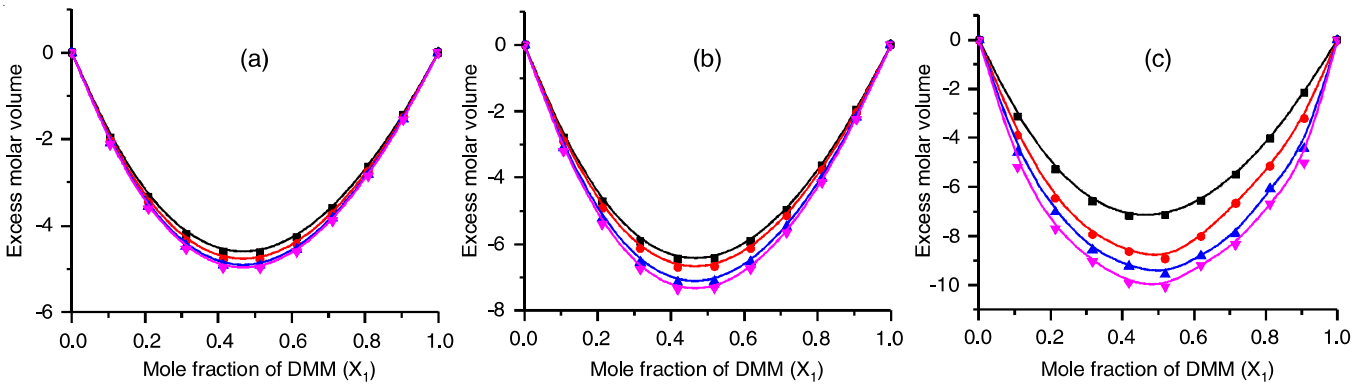


Fig. 1. Variation of excess molar volume with X_1 of DMM for the systems (a) dimethyl malonate + *o*-xylene, (b) dimethyl malonate + *m*-xylene and (c) dimethyl malonate + *p*-xylene

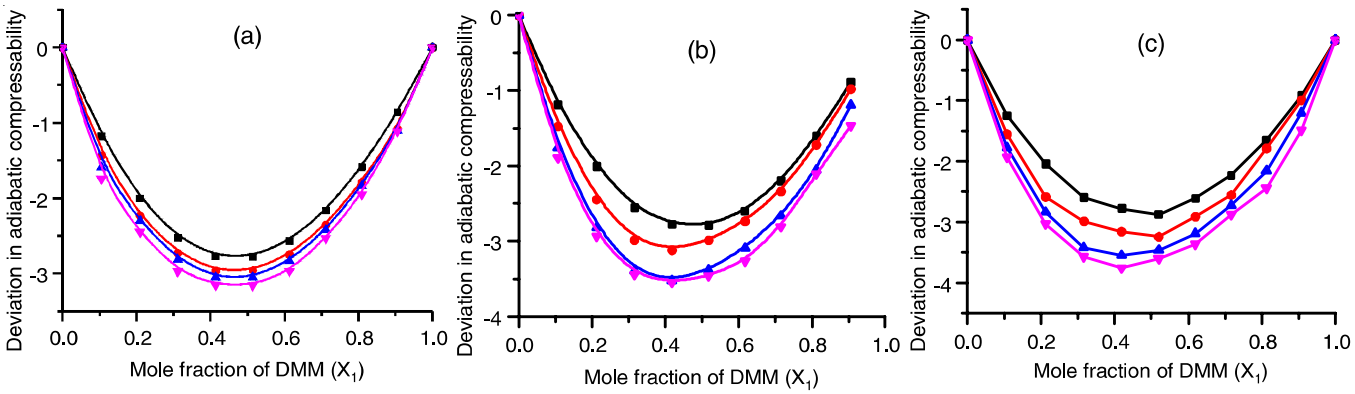


Fig. 2. Variation of deviation in adiabatic compressability with X_1 of DMM for the systems (a) dimethyl malonate + *o*-xylene, (b) dimethyl malonate + *m*-xylene and (c) dimethyl malonate + *p*-xylene

When excess values tend to shift from being increasingly positive to being increasingly negative, the strength of the interaction between the components expand or decreases. This can be qualitatively explained by the closer proximity of dissimilar molecules, which results in a decrease in compressibility and volume. The negative intermolecular free length (L_f^E) values show that the distance over which the sound wave must travel is smaller (Fig. 3). It occurs because the interactions between molecules with different molecular properties are more common. The similar concentrations of the $\Delta\beta_{ad}$ and L_f^E minima provide more evidence for the presence of molecular interactions.

The excess parameters determined were fitted into the Redlich-Kister equation and the standard deviation (σ) values are also included with the obtained parameter values in Table-5. The sign of the volumetric expansion (V^E) for a system is determined by the relative size of the expansion and contraction of the two liquids when mixed [28]. The following reasons are deduced for the volume increase after mixing: (i) steric hindrance caused by chain branching, (ii) division of either one component or all components, and (iii) weak solute-solvent bonds are formed rather than solute-solute and solvent-solvent bonds. Whereas the other reasons lead to a decrease in volume when mixed are (i) intense and specialized interaction, usually invol-ving chemical processes; (ii) strong physical interactions such as those involving dipoles or inducing the formation of dipoles; and (iii) when there is a significant disparity in the molecular sizes of components, one component may occupy the empty spaces of another component.

A sound propagation model put forth by Eyring & Kincaid led to the development of the relationship between intermolecular free length and ultrasonic velocity. Once the components have been mixed, the ultrasonic velocity in the solution will be affected by the change in intermolecular free length. The current study for the systems dimethyl malonate + *p*-xylene >

TABLE-5
THE VALUES OF COEFFICIENT AND STANDARD DEVIATIONS (σ) OF DIMETHYL MALONATE (X_1) + *o*-XYLENE (X_2), DIMETHYL MALONATE (X_1) + *m*-XYLENE (X_2) DIMETHYL MALONATE (X_1) + *p*-XYLENE (X_2) SYSTEM

	Temp. (K)	A_0	A_1	A_2	A_3	A_4	α
				ortho-Xylene			
Excess molar volume (V^E)	303.15 K	-25.9214	-3.7678	-0.5399	-0.0805	-0.0289	0.0003
	308.15 K	-26.8968	-3.9331	-0.5718	-0.0994	-0.0224	0.0002
	313.15 K	-28.6789	-4.2522	-0.6266	-0.0988	-0.0164	0.0003
	318.15 K	-29.5658	-4.4094	-0.6572	-0.0971	-0.0120	0.0003
Deviation in adiabatic compressibility ($\Delta\beta_{ad}$)	303.15 K	-11.1578	-1.5292	-0.2058	-0.0257	-0.0125	0.0001
	308.15 K	-11.8948	-1.6200	-0.9235	-0.3002	-3.5689	0.0104
	313.15 K	-12.2598	-1.4269	-0.7358	-2.0162	-5.4432	0.0310
	318.15 K	-12.6883	-1.5322	-2.3048	-3.2964	-4.1159	0.0484
Excess inter molecular free length (L_f^E)	303.15 K	-0.6583	-0.0764	-0.0107	-0.0012	0.0006	0.0000
	308.15 K	-0.7289	-0.0829	-0.0601	-0.0075	-0.2665	0.0007
	313.15 K	-0.7501	-0.0672	-0.0484	-0.1290	-0.4040	0.0022
	318.15 K	-0.7813	-0.0720	-0.1683	-0.2260	-0.2992	0.0035
				meta-Xylene			
Excess molar volume (V^E)	303.15 K	-25.9208	-3.7681	-0.5501	-0.0801	-0.0402	0.0005
	308.15 K	-26.8962	-3.9334	-0.5824	-0.0990	-0.0341	0.0006
	313.15 K	-28.6783	-4.2525	-0.6380	-0.0984	-0.0288	0.0007
	318.15 K	-29.5652	-4.4097	-0.6689	-0.0968	-0.0248	0.0007
Deviation in adiabatic compressibility ($\Delta\beta_{ad}$)	303.15 K	-11.2165	-1.3493	-1.1134	0.1910	1.0012	0.0201
	308.15 K	-12.0952	-3.3388	-4.5826	1.4267	3.6135	0.0247
	313.15 K	-13.6875	-3.8636	-5.4072	1.6439	2.0440	0.0194
	318.15 K	-14.0017	-3.5531	-5.4166	2.7183	-2.7230	0.0798
Excess inter molecular free length (L_f^E)	303.15 K	-0.0221	-0.0021	-0.0024	0.0005	0.0024	0.0001
	308.15 K	-0.0251	-0.0070	-0.0106	0.0045	0.0091	0.0000
	313.15 K	-0.0259	-0.0077	-0.0121	0.0046	0.0041	0.0001
	318.15 K	-0.0303	-0.0077	-0.0140	0.0083	-0.0053	0.0002
				para-Xylene			
Excess molar volume (V^E)	303.15 K	-28.7591	-4.2889	-0.6276	-0.0900	-0.0095	0.0007
	308.15 K	-36.0095	-5.5364	11.6057	5.1185	-25.9422	0.1510
	313.15 K	-38.4155	-2.6080	-0.7653	6.7471	-27.0251	0.2155
	318.15 K	-40.4747	-2.9420	1.2557	7.4266	-41.5821	0.1920
Deviation in adiabatic compressibility ($\Delta\beta_{ad}$)	303.15 K	-11.5715	-1.2325	0.4433	-0.2534	-1.5670	0.0403
	308.15 K	-13.0269	-1.2233	-1.5312	-2.4825	-0.1836	0.0815
	313.15 K	-13.9808	-3.3880	-4.6952	0.9380	1.4062	0.0328
	318.15 K	-14.5800	-3.7814	-4.5874	3.0150	-3.3037	0.0571
Excess inter molecular free length (L_f^E)	303.15 K	-0.0237	-0.0023	0.0011	0.0000	-0.0031	0.0001
	308.15 K	-0.0281	-0.0019	-0.0038	-0.0054	0.0003	0.0002
	313.15 K	-0.0307	-0.0069	-0.0084	0.0028	0.0006	0.0001
	318.15 K	-0.0327	-0.0077	-0.0081	0.0076	-0.0125	0.0002

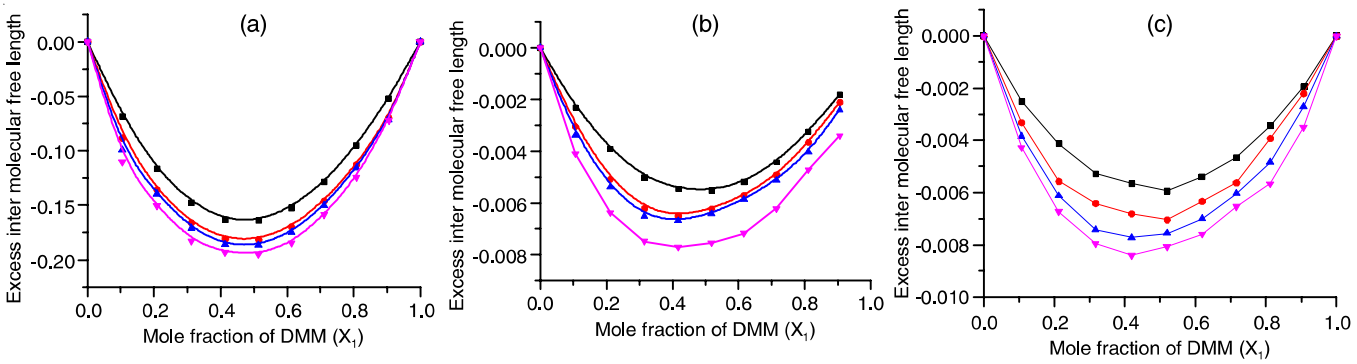


Fig. 3. Variation of excess intermolecular free length with the X_1 of DMM for the systems (a) dimethyl malonate + *o*-xylene, (b) dimethyl malonate + *m*-xylene and (c) dimethyl malonate + *p*-xylene

dimethyl malonate + *o*-xylene > dimethylmalonate + *m*-xylene has confirmed this finding. Additionally, it has been found that velocity at any concentration decreases as the temperature increases which is due to the breakup of hetero and homo molecule clusters at high temperatures [29].

Conclusion

For binary mixtures of dimethyl malonate with *o*-, *m*- and *p*-xylene, the ultrasonic velocities and densities in the temperature range of 303.15-318.15 K have been established. Excess molar volume (V^E), excess intermolecular free length (L_f^E) and deviation in adiabatic compressibility ($\Delta\beta_{ad}$) were computed from the experimental data. For the studied binary mixtures at the different temperatures range, the excess values and deviations were found to be negative, which indicated that binary mixtures exhibit strong interactions.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this article.

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COVID-19 Crisis: Exploring Challenges, Opportunities, and Cautions

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Abstract

The COVID-19 pandemic has thrust unprecedented challenges upon societies, economies, and healthcare systems globally. This paper meticulously examines the myriad challenges brought forth by the pandemic while also delving into the innovative, adaptive, and resilient responses that have surfaced. Through a synthesis of recent literature and empirical evidence, we dissect the pandemic's impact on public health, the economy, education, and social dynamics. Comprehensive discussions on the necessary precautions to combat COVID-19 and the ensuing pandemics are also meticulously laid out in this article. Additionally, we conduct a survey-based study to explore the cyclical nature of pandemics using a Neutrosophic logic-based classification, revealing intriguing insights into their recurrence patterns, potentially occurring approximately every century.

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1. Introduction

The COVID-19 pandemic has been a global crisis that has affected millions of people worldwide. Previous research has explored the impact of the COVID-19 pandemic on various aspects of society, including healthcare systems, economies, and social structures. Despite the existing knowledge on the impact of the COVID-19 pandemic, there is still a lack of understanding of the specific challenges, opportunities, and strategies for resilience during this crisis. The importance of this research lies in the fact that understanding the challenges, opportunities, and strategies for resilience during the COVID-19 pandemic can help us better prepare for future crises. This study, therefore, aims to address the knowledge gap by exploring the challenges, opportunities, and strategies for resilience during the COVID-19 pandemic.

The emergence of the novel coronavirus SARS-CoV-2 and the subsequent COVID-19 pandemic have unleashed unprecedented challenges across the globe [Mok. et al., 2023]. From overwhelming healthcare systems to disrupting economies and altering societal norms, the pandemic has necessitated swift and comprehensive responses at individual, organizational, and governmental levels. However, amidst these challenges lie opportunities for innovation, adaptation, and collaboration that can catalyze positive change and enhance resilience in the face of future crises. This paper examines the myriad challenges posed by COVID-19 and explores the opportunities that have arisen in its wake.

Further, the idea that pandemics occur on a cyclical basis, approximately every 100 years, is a hypothesis that has been proposed by some researchers and historians. While historical records do show significant pandemics occurring roughly a century apart, such as the Spanish flu pandemic of 1918 and the COVID-19 pandemic in 2020, it may be an important aspect needs to be tackling with great caution. We made a survey on this hypothetical concept with diversified questionnaire that revealed several interesting aspects and these results could be used to understand the triggering of the ensuing and old pandemics with new mutations.

The structure of this brief paper unfolds as follows: Section 1 underscores the study's necessity, while Section 2 delves into the manifold challenges confronting humanity post-COVID-19. Section 3 explores the opportunities emerging in the pandemic's aftermath, followed by Section 4 emphasis on imperative precautions to navigate potential future pandemics. Section 5 presents empirical data addressing the recurring question of why pandemics occur roughly every century. Finally, Section 6 offers conclusive insights.

2. Myriad of Challenges Posed to Humanity in the Wake of COVID-19

a. *Public Health Challenges*

The COVID-19 pandemic has strained healthcare systems worldwide, leading to shortages of medical supplies, overwhelmed hospitals, and unprecedented demands on healthcare workers [Miyah et al, 2022]. Additionally, the rapid spread of the virus has highlighted disparities in access to healthcare and exacerbated existing health inequalities. Furthermore, misinformation and conspiracy theories have hindered public health efforts, making it challenging to implement effective prevention and control measures. Despite these challenges, the pandemic has spurred

collaboration among scientists, accelerated vaccine development, and emphasized the importance of robust public health infrastructure in pandemic preparedness.

b. *Economic Impacts*

The economic ramifications of COVID-19 have been profound, with widespread job losses, business closures, and disruptions to global supply chains. Vulnerable populations, including low-income workers and small businesses, have been disproportionately affected, exacerbating inequalities and deepening poverty. However, the pandemic has also prompted innovation in remote work, e-commerce, and digital finance, creating new opportunities for economic growth and transformation. Moreover, government stimulus packages and support measures have helped mitigate some of the worst economic effects of the pandemic, underscoring the importance of targeted interventions in times of crisis.

c. *Challenges in Education*

The closure of schools and universities in response to the pandemic has disrupted learning for millions of students' worldwide, exacerbating existing educational inequalities and widening the digital divide. Remote learning has presented challenges in terms of access to technology, digital literacy, and social interaction, particularly for marginalized communities. However, the pandemic has also accelerated the adoption of online learning platforms and innovative teaching methods, paving the way for more flexible and personalized education models in the future. Moreover, the crisis has highlighted the importance of resilience and adaptability in education systems and the need for greater investment in digital infrastructure and teacher training.

As far as the Indian education is concerned, the COVID-19 pandemic has brought significant challenges to the education system in India, but it has also created opportunities for innovation and resilience. For instance, Byju's, an Indian educational technology (EduTech) company, experienced several benefits from the COVID-19 crisis, which accelerated the adoption of online learning platforms. The COVID-19 crisis provided Byju's with an opportunity to demonstrate the value of its online learning platform and accelerate its growth trajectory. By adapting to the changing educational landscape and addressing the needs of students, parents, and educators during the pandemic, Byju's solidified its position as a key player in India's digital education ecosystem.

d. *Social Dynamics and Mental Health*

The social isolation and uncertainty brought about by COVID-19 have taken a toll on mental health, leading to increased levels of anxiety, depression, and stress. Vulnerable populations, including the elderly, frontline workers, and individuals with pre-existing mental health conditions, have been particularly affected. Moreover, social distancing measures have disrupted social interactions and community cohesion, exacerbating feelings of loneliness and isolation. However, the pandemic has also fostered solidarity and empathy within communities, with people coming together to support one another and address shared challenges. Additionally, the widespread adoption of telehealth services has expanded access to mental health support and counselling, signalling new opportunities for delivering care remotely.

3. Opportunities for Innovation and Resilience

It's an undeniable fact that over the past century, significant advancements have been made in public health

infrastructure, vaccination programs, disease surveillance, and medical treatments. These advancements have helped mitigate the impact of infectious diseases and reduce the likelihood of large-scale pandemics. However, new challenges, such as antimicrobial resistance and zoonotic diseases, continue to emerge.

The interconnectedness of the modern world, characterized by extensive global travel and trade, facilitates the rapid spread of infectious diseases. This interconnectedness also presents opportunities for early detection, surveillance, and coordinated responses to outbreaks. However, it also poses challenges in terms of containing the spread of diseases across borders. Climate change and environmental degradation can influence the prevalence and distribution of infectious diseases by altering ecosystems, vector habitats, and human-wildlife interactions. Understanding the complex relationship between environmental factors and disease emergence is critical for predicting and mitigating future pandemics.

Despite the immense challenges posed by COVID-19, the pandemic has catalysed innovation and adaptation across various sectors [Heinonen and Strandvik, 2021]. From the rapid development of vaccines to the deployment of digital technologies for remote work and healthcare delivery, the crisis has spurred creative solutions to complex problems. Moreover, collaborative research efforts and international cooperation have accelerated scientific progress and knowledge sharing, laying the groundwork for more effective pandemic preparedness in the future. Furthermore, the resilience demonstrated by individuals, communities, and organizations in responding to the pandemic underscores the human capacity to adapt and thrive in the face of adversity.

4. Cautions to be practiced to tackle the ensuing pandemics

As far as the cautions to be practised are concerned while dealing with pandemics, a mush room of research articles have been published and most important research works are cited hereunder.

It was cautioned in year 2010 that it was important to note the past pandemics, such the swine flu brought on by the H1N1 influenza outbreak in 1918–1919, give us indications that a pandemic might last for around two years and reappear more than three times in that time [Graham and Baric, 2010]. The spread of influenza appears to be accelerated and amplified by air travel [Zeev Zelevsky, 2022]. Transmission takes place in airports, at the destination, and on board aircraft. In order to lower morbidity and mortality, control measures to stop influenza transmission on cruise ships are required. Sea transportation does not appear to be hastening the spread of the coronavirus or influenza to new regions.

It was emphasized that preventive precautions to limit the spread of COVID-19 include wearing facemasks, social distancing, and avoiding large gatherings, as highlighted in the study on public perception of safety measures [Andrew et al., 2023]. A research published in American Journal of Tropical Medicine and Hygiene, it was stressed that key cautions include patient isolation, cohorting suspected cases separately, dedicated healthcare worker teams, visitor restrictions, visitor screening, and education on hand hygiene and PPE procedures in healthcare facilities [Natalie et al., 2021]. Post-COVID-19 precautions include social distancing, mask-wearing, avoiding gatherings, and hand hygiene. Lessons from past pandemics emphasize these measures to reduce cases and ease hospital burdens [Prakash et al., 2020].

Our own paper discusses the role of nanomaterials in identifying and offering protection against the COVID-19 virus, as well as their use in the treatment of infected patients [Brahmanandam et al., 2020]. It presents databases of COVID-19, showing decreasing trends in most Western countries and increasing trends in Asian countries, emphasizing the need for effective measures to fight against the virus. The paper elaborates on the challenges faced in dealing with coronaviruses and provides feasible solutions to eradicate the pandemic. It includes a schematic on "flattening the curve (***for example, see Figure 1***)" by considering various factors that may help lessen or eradicate the spread of the virus. It discusses the development of nanofilters and masks using nanomaterials to restrict the entry of infections, capturing airborne COVID-19, and providing reusable options.

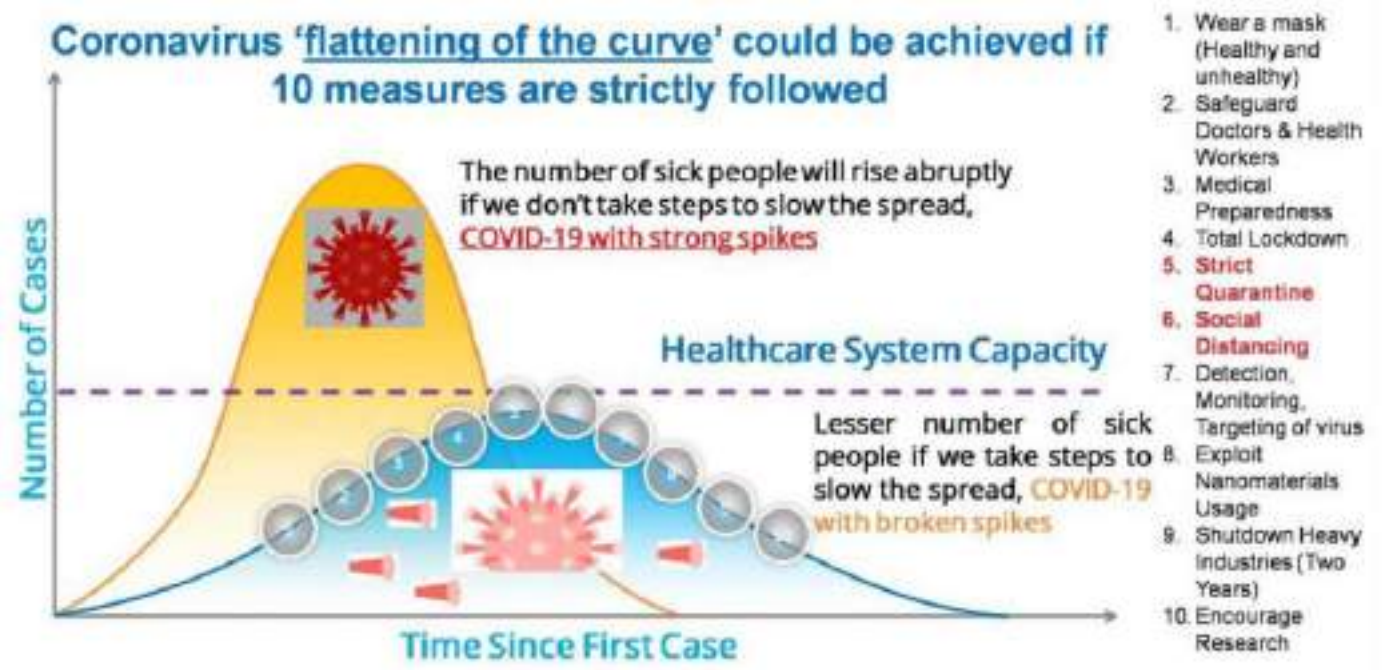


Figure 1. Flattening of the curve could be achieved if ten measures are followed [Source: Brahmanandam et al., 2020 published in ***Trends in Biomaterials and Artificial Organs***]

5. Major pandemics occur roughly at century intervals, a myth or a mere coincidence?

Previous studies have shown that pandemics tend to occur at century intervals, with the most recent example being the COVID-19 pandemic. Despite this pattern, there is still much to be learned about the factors that contribute to pandemics and how they can be prevented. Major pandemics have indeed occurred at approximately century intervals throughout history.

For instance, the 1918 H1N1 influenza pandemic infected one-third of the global population, causing over 50 million deaths [Liang et al., 2021]. The study suggests that the 6th and 7th cholera pandemic clones emerged independently, with a recalibrated molecular clock estimating their divergence around 1880, supporting major pandemics occurring at century intervals. This study concluded that the 2 pandemic clones gained pandemic potential independently, and overall there were 29 insertions or deletions of one or more genes in the major integron, attributed to gain of individual cassettes

including copying from within, or loss of blocks of cassettes.

Similarly, the cholera pandemics, including the 6th (1899–1923) and 7th (1961–present) pandemics, demonstrate a pattern of major outbreaks separated by roughly a century [Hunasanahally et al., 2021]. The insights of this study are the major pandemics have occurred at roughly century intervals throughout history, shaping human experiences and teaching valuable lessons on managing infectious diseases for the future. It is critical for tracking pathogenicity, designing useful interventions, developing drug and vaccine, and innovating the technology to produce the necessary medicines and vaccines in bulk quantity rapidly to understand the origin and evolution of the novel human emerging infectious diseases.

Additionally, historical accounts highlight pandemics like the plagues of Athens, justinianic plague, and medieval plagues, which caused millions of deaths at different intervals [Huremovic, 2019]. These cyclical occurrences underscore the periodic nature of major pandemics throughout human history, emphasizing the importance of preparedness and understanding the evolution of infectious diseases to mitigate their impact on global health and society. This researcher has strongly argued that evidence from past pandemics like the 1918 influenza outbreak and SARS suggests major pandemics have occurred roughly at century intervals, as seen in the history of pandemics.

These cyclical occurrences underscore the periodic nature of major pandemics throughout human history,***emphasizing the importance of preparedness and understanding the evolution of infectious diseases*** to mitigate their impact on global health and society. Understanding these historical patterns is crucial for implementing effective public health measures and surveillance programs to prevent and control future pandemics. Nevertheless, it's crucial to note that historical patterns do not guarantee future occurrences, and the interval between pandemics can vary widely. On flip side, the emergence and spread of pandemics are influenced by a multitude of factors, including changes in human behavior, population density, global travel, urbanization, environmental changes, and microbial evolution. Predicting the timing and severity of future pandemics based solely on historical patterns oversimplifies the complex interplay of these factors.

To gather statistical insights, we conducted a survey to gauge opinions on the cyclical nature of pandemics. Our survey encompassed diverse demographics, including men and women, young and old, individuals with varying levels of education, and residents from both urban and rural areas of India, predominantly in the southern region. Utilizing ***Neutrosophic Logic-based Classification*** [Remani et al., 2022], we categorized responses into three groups: 'True,' 'False ‘and’ I do not know,' and visualized the findings in Figure 2. The results are striking: The 'True' category prevails at 71%, while 'False' accounts for 25%, and 'I do not know' a mere 4%. This overwhelming consensus suggests a strong belief among respondents in the cyclical nature of pandemics, likely occurring with a periodicity of around 100 years.

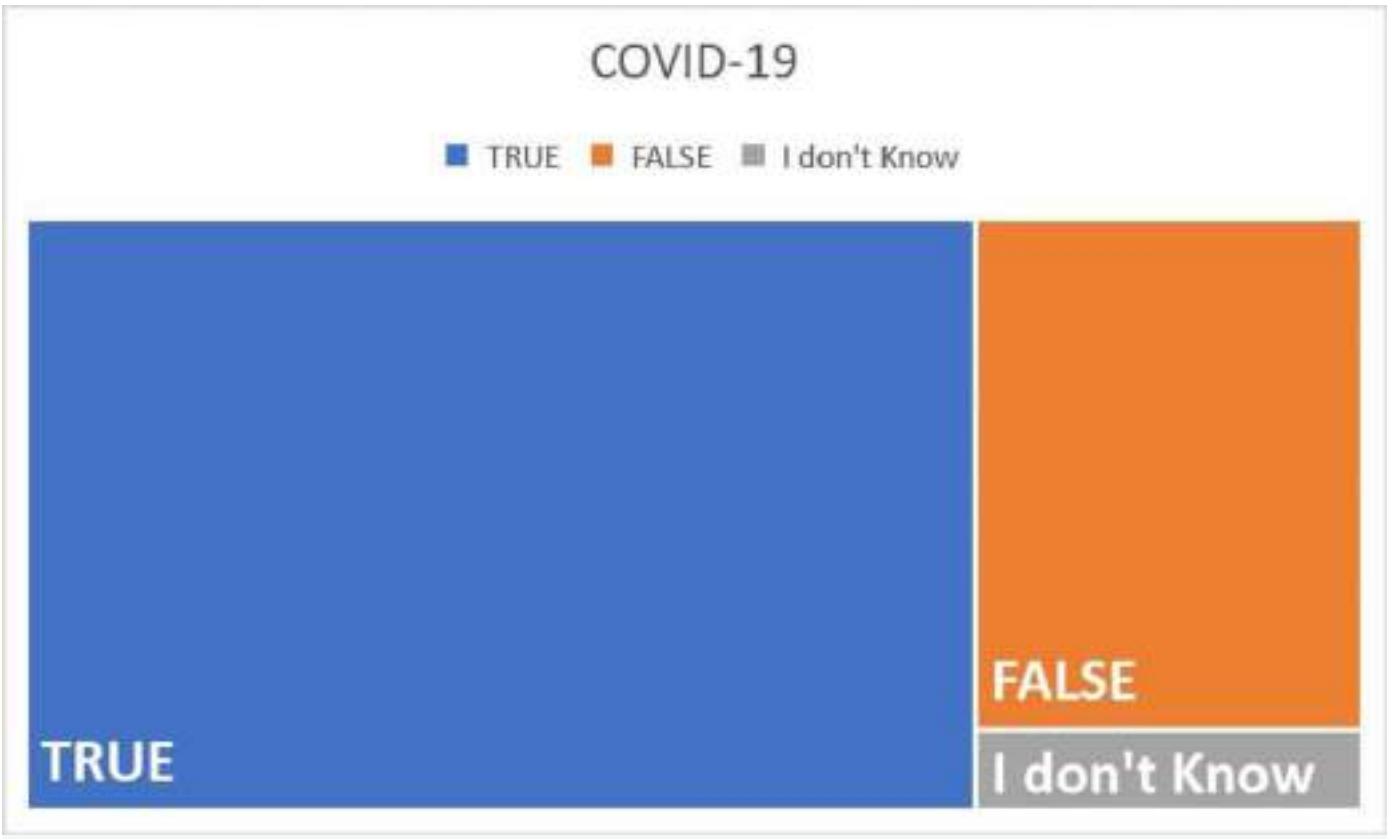


Figure 2. Neutrosophic logic-based classification to know the cyclic nature of the pandemics

6. Conclusion

The COVID-19 pandemic has presented unprecedented challenges to societies, economies, and healthcare systems worldwide. However, amidst these challenges lie opportunities for innovation, adaptation, and resilience that can pave the way for a more sustainable and equitable future. By leveraging the lessons learned from the pandemic and harnessing the power of collective action, we can build more resilient systems and communities capable of effectively addressing future crises. In conclusion, while historical patterns may suggest a periodicity to pandemics, it's essential to recognize the limitations of this hypothesis and consider the myriad factors that contribute to the emergence and spread of infectious diseases. Preparedness, surveillance, research, and collaboration are key components of a proactive approach to managing pandemics, regardless of their timing or frequency.

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MOLECULAR IODINE CATALYSED SYNTHESIS OF TETRAHYDROAZEPINES FRAMEWORKS *VIA* SILYL AZA-PRINS CYCLIZATION

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ABSTRACT: A new methodology for the synthesis of seven- membered unsaturated aza cycles (tetrahydroazepines) was developed. It is based on the powerful Aza-Prins cyclization in combination with the Peterson-type elimination reaction. In a single reaction step, a C–N, C– C bond and an endocyclic double bond are formed. Under mild reaction conditions, using Molecular Iodine as sustainable catalysts, tetrahy- droazepines with different degrees of substitution are obtained directly and efficiently. DFT calculations supported the proposed mechanism.

KEYWORDS: Tetahydroazepines, Silyl Aza Prins, Molecular Iodine

INTRODUCTION:

Unsaturated seven-membered ring azacycles (tetrahydroazepines) are found in numerous natural and non-natural products with remarkable pharmaceutical activity.[i] Also, they serve as substructures of more complex molecules or as precursors of hydroazepines with different biological proper- ties.[ii] Most of these natural products come from terrestrial sources such as balanol (1), an unusual metabolite isolated from fungus *Verticillium balanoides*, which is a potent inhibitor of PKC[1] or (−)-galanthamine (2), commercially known as Reminyl and used for the symptomatic treatment of Alzheimer's (Figure 1).[iii] The unnatural azepane **3** proved to be an excellent agent against lung cancer, where the heterocyclic nitrogenous core is essential for its bioactivity (IC50 of 4.18 nM) (Figure 1).

Classical methods to synthesize this type of heterocycles include Bronsted or Lewis acid-mediated cyclizations, atom transfer radical cyclization (ATRC), cycloadditions,[iv] conjugate addition cyclizations, ring expansions (cyclopropanes, aziridines, azetidines, 2-cyano-6-oxazolopi- peridine [v]), and ring-closing metathesis.[vi] Among the different types of acid-mediated cyclizations, the aza Prins cyclization is a powerful tool for obtaining nitrogenated heterocycles. It has been widely used for the synthesis of piperidines and pyrrolidines.[vii] However, there are few examples of synthesis of tetrahydroazepines through this methodology[viii, ix] .In 2016, Barbero and co- workers achieved the synthesis of azepane rings, with an exocyclic double bond, through a diastereoselective silyl aza-Prins cyclization mediated by Incl3 Nevertheless, this reaction, inspired by the work of the Dobbs' group, is a relatively high energy demanding reaction[x].

Therefore, new methods for the synthesis of seven-membered azacycles via Prinscyclizations remain challenging and highly desirable.

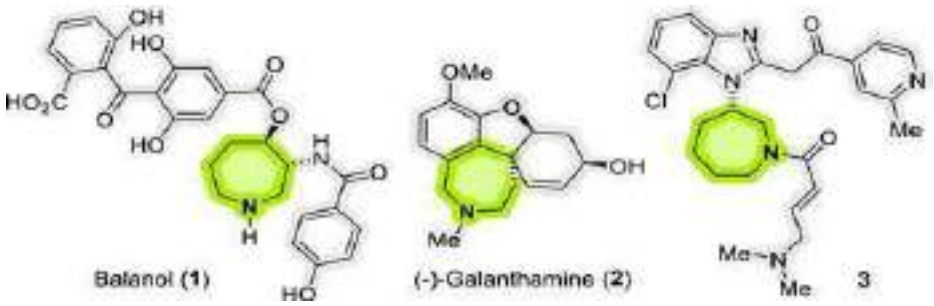


Figure 1. Representative bioactive hydroazepines/tetrahydroazepines.

EXPERIMENTAL SECTION:

Reagents were obtained from commercial sources (Sigma-Aldrich, Merck, Alfa Aesar), without further purification. Solvents (DCM, Et_2O, THF, and DMF) were used from the Pure Solv system. The dispensing system allows easy access to the anhydrous solvents. EtOH was purified by distillation and dried following the procedurein the literature.[35] Chemical reactions and the separation of the crudes were monitored by thin-layer chromatog- raphy(TLC). TLC was performed on aluminum foil sheets 60 F254 manufactured by MERCK. The solvent or solvent mixture was *n*- hexane/ethyl acetate (EtOAc) in different ratios. Flash column chromatography was performed using silica gel (0.015−0.04 mm) and *n*-hexane/EtOAc solvent systems. Automated flash column chromatography was performed using the Biotage Isolera System (Isolera Prime). It includes simultaneous UV detection on all wavelengths and baseline correction, which enable detection of poor UV absorbing compounds. NMR spectra were recorded on Bruker Avance instruments. ^{1}H NMR spectra were recorded at 400, 500, and 600 MHz, and ^{13}C NMR spectra wererecorded at 100, 125, and 150 MHz, VTU 298.0 K. The residual solvent peak was used as an internal reference ($CDCl_3$:δH 7.26, δC 77.0). High-resolution mass spectra were recorded on an LCT Premier XE mass spectrometer. It is provided with different ionization sources: electrospray (ESI), an atmospheric pressure chemical ionization (APCI)source, and an orthogonal acceleration time of flight analyzer that provides high sensitivity, resolution, and accurate mass measurement.

GENERAL PROCEDURE:

FOR SILYL AZA-PRINS CYCLIZATION OF 1-AMINO-3-TRIPHENYLSILYL-4-PENTENES (4 A−B):

To a solution of amines 6a−b (0.30−0.12 mmol, 1.0 equiv) in dry DCM (3.0−1.2 mL, 0.1 M) at 0°C were added the aldehyde (0.45−0.18 mmol,1.5 equiv) and the catalyst (0.030−0.012 mmol, 0.1 equiv). Once the reaction was complete, checked by TLC, it wasquenched with water. The layers were separated, and the aqueous phase was extracted three times with DCM. The combined organic layers were dried over anhydrous $MgSO_4$, filtrated, and concentrated under reduced pressure. The residue was purified by flash silica gel column chromatography (n-hexane/EtOAc solvent system).

2-ISOBUTYL-1-TOSYL-2,3,6,7-TETRAHYDRO-1H-AZEPINE (5A):

Following the general procedure (1), to a solution of amine 4a (80 mg, 0.16mmol, 1.0 equiv) in 1.6 mL of dry DCM (0.1 M) at 0 °C were added isovaler aldehyde (21 μL, 0.19 mmol, 1.2equiv) and I_2 (4.8 mg, 0.019 mmol, 0.1 equiv) to obtain 45 mg of tetrahydroazepine 5a as a pale yellow oil (0.147mmol, 92%). *R*f = 0.63 (*n*-hexane/EtOAc 80:20), ^{1}H NMR ($CDCl_3$, 400 MHz): δ =

7.69 (d, *J* = 8.1 Hz, 2H), 7.26(d, *J* = 7.3 Hz, 2H), 5.70 (m, 1H), 5.55 (m, 1H), 4.13 (m, 1H), 3.66 (brddd, *J* = 14.5, 4.8 & 3.4 Hz, 1H), 3.14 (brddd,*J* = 14.0, 11.0 & 2.2 Hz, 1H), 2.40 (s, 3H), 2.38−2.27 (m, 2H), 2.15 (m, 2H), 1.37(m, 3H), 0.82 (d, *J* = 6.4 Hz, 3H),0.80 (d, *J* = 6.3 Hz, 3H); $^{13}C\{^{1}H\}$- NMR ($CDCl_3$, 125 MHz): δ = 142.8 (C), 138.6 (C), 130.7 (CH),129.5 (2× CH),127.2 (CH), 127.1 (2× CH), 53.4 (CH), 41.2(CH), 40.2 (CH), 32.5 (CH), 30.3 (CH), 24.6 (CH), 22.9(CH_3),22.3 (CH_3), 21.5 (CH_3); HRMS (ESI^+): *m/z* $[M + Na]^+$ calcd for $C_{17}H_{25}NO_2NaS$, 330.1505; found, 330.1504.

2-HEXYL-1-TOSYL-2,3,6,7-TETRAHYDRO-1H-AZEPINE (5B):

Following the general procedure (1), to a solution of amine 4a (0.150 mg, 0.30 mmol, 1.0 equiv) in 3.0 mL of dry DCM (0.1 M) at 0 °C were added heptanal (51 μL, 0.36 mmol, 1.2 equiv)and I_2 (9.0 mg, 0.030 mmol, 0.1 equiv) to obtain 81 mg of tetrahydroazepine 5b as a pale yellow oil (0.24 mmol,80%). *R*f = 0.57 (*n*-hexane/EtOAc 80:20); ^1H NMR ($CDCl_3$, 400 MHz): δ = 7.70 (d, *J* = 8.2 Hz, 2H), 7.26 (d, *J*= 8.3Hz, 2H), 5.69 (m, 1H), 5.56 (m, 1H), 4.03 (m, 1H), 3.68 (brddd, *J* = 14.5, 5.1 & 3.1 Hz, 1H), 3.14 (brddd, *J* = 13.3,10.9 & 2.1Hz, 1H), 2.41 (s, 3H), 2.38−2.28 (m, 2H), 2.19 (m, 2H), 1.46 (m,2H), 1.29−1.11 (m, 6H), 1.10−0.98 (m,2H), 0.85 (t, *J* = 7.0 Hz,3H); $^{13}C\{^{1}H\}$-NMR ($CDCl_3$, 100 MHz): δ = 142.7 (C), 138.5 (C),130.6 (CH), 129.4 (2×CH), 127.0 (CH), 126.9 (2× CH), 55.4(CH), 41.3 (CH_2), 32.3 (CH_2), 31.6 (CH_2), 31.2 (CH_2), 30.5(CH_2), 29.0 (CH_2), 26.1 (CH_2), 22.5 (CH_2), 21.4 (CH_3), 14.0 (CH_3); HRMS (ESI^+): *m/z* $[M + Na]^+$ calcd for C19H29NO2NaS, 358.1817; found, 358.1821.$C_{19}H_{29}NO_2NaS$, 358.1817; found, 358.1821.

2-(BUT-3-EN-1-YL)-1-TOSYL-2,3,6,7-TETRAHYDRO-1H-AZEPINE (5C):

Following the general procedure (1), to a solution of amine4a (0.150 mg, 0.30 mmol, 1.0 equiv) in 3.0 mL of dry DCM (0.1 M) at 0 °C were added 4-pentenal (61 μL, 0.60 mmol,2.0 equiv) and I_2 (9.0 mg, 0.030 mmol, 0.1 equiv) to obtain 61 mg of tetrahydroazepine 5c as a pale yellow oil (0.20 mmol, 67%). *R*f = 0.54 (*n*-hexane/EtOAc 80:20); ^1H NMR ($CDCl_3$, 400 MHz): δ = 7.68 (d, *J* = 8.4 Hz, 2H), 7.26 (d,*J* = 7.8 Hz, 2H), 5.71 (m, 2H), 5.54 (m, 1H), 4.94 (m, 2H),4.06 (m, 1H), 3.65 (ddd, *J* = 14.5, 5.4 & 3.3 Hz, 1H), 3.18(ddd, *J* =14.6, 10.6 & 2.4 Hz, 1H), 2.40 (s, 3H), 2.37−2.26 (m, 2H), 2.18 (m,2H), 1.90 (m, 2H), 1.59 (m, 2H); $^{13}C\{^{1}H\}$-NMR ($CDCl_3$, 100MHz): δ = 142.8 (C), 138.3 (C), 137.8 (CH), 130.8 (CH), 129.5(2× CH), 127.0 (2× CH), 126.7 (CH), 114.8 (CH_2), 55.2 (CH),41.5 (CH_2), 31.8 (CH_2), 30.7 (CH_2), 30.3 (CH_2), 30.2 (CH_2), 21.4 (CH_3);HRMS (ESI^+): *m/z* $[M + Na]^+$ calcd for $C_{17}H_{23}NO_2NaS$, 328.1347; found, 328.1349.

2-BENZYL-1-TOSYL-2,3,6,7-TETRAHYDRO-1H-AZEPINE (5D):

Following the general procedure (1), to a solution of amine 4a (0.150g, 0.30 mmol, 1.0 equiv) in 3.0 mL of dry DCM (0.1 M) at 0 °C were added phenyl acetaldehyde (43 μL, 0.36 mmol,1.2 equiv) and I_2 (9.0 mg, 0.030 mmol, 0.1 equiv) to obtain 67 mg of tetrahydroazepine 5d as a pale yellow oil (0.195 mmol, 65%). *R*f = 0.46 (*n*-hexane/EtOAc 80:20); ^1H NMR ($CDCl_3$, 400 MHz): δ = 7.62 (m, 2H), 7.23 (m,5H),7.12 (m, 2H), 5.73 (m, 1H), 5.55 (m, 1H), 4.30 (m, 1H), 3.64(ddd, *J* = 14.4, 5.7 & 3.4 Hz, 1H), 3.33 (ddd, *J* = 14.4,10.4 & 2.6 Hz, 1H), 2.84 (m, 2H), 2.47−2.34 (m, 4H), 2.26 (m, 2H), 2.09 (m, 1H); $^{13}C\{^{1}H\}$-NMR ($CDCl_3$, 100 MHz):δ = 142.8 (C), 138.5 (C), 137.9(C), 130.8 (CH), 129.5 (2× CH), 129.2 (2× CH), 128.4 (2× CH), 127.0 (2× CH), 126.5 (CH), 126.4 (CH), 58.1 (CH), 41.9 (CH_2), [M + Na] calcd for $C_{20}H_{23}NO_2NaS$, 364.1347; found, 364.1349.

2-ISOBUTYL-1-(METHYLSULFONYL)-2,3,6,7-TETRAHYDRO-1H-AZEPINE(5E):

Following the general procedure (1), to a solution of amine 4b (0.500 g, 1.19 mmol, 1.0 equiv) in 12 mL of dry DCM (0.1 M) at 0°C were added iso valeraldehyde (0.19 mL, 1.79mmol, 1.5 equiv) and I_2 (35 mg, 0.12 mmol, 0.1 equiv) to obtain 0.201 g of tetrahydroazepine 5e as a pale yellow

oil (0.87 mmol, 73%). *R*f =0.49 (*n*-hexane/EtOAc 70:30); ^{1}H NMR ($CDCl_3$, 400 MHz): δ =(dt, *J* = 14.9 & 4.0 Hz, 1H), 3.21 (ddd, *J* = 14.6, 11.5 & 2.9 Hz, 1H),2.87 (s, 3H), 2.48 (m, 2H), 2.28 (m, 2H), 1.53 (m, 2H), 1.38(m,1H), 0.93 (brd, *J* = 1.6 Hz, 3H), 0.91 (brd, *J* = 1.6 Hz, 3H); ^{13}C{^{1}H}-NMR ($CDCl_3$, 100 MHz): δ = 130.5 (CH),127.1 (CH), 54.1 (CH),41.3 (CH_2), 40.6 (CH_3), 40.5 (CH_2), 33.1 (CH_2), 30.7 (CH_2), 24.7(CH), 22.9 (CH_3), 22.3 (CH_3); HRMS (ESI$^+$): *m*/*z* [*M* + Na]$^+$ calcd for $C_{11}H_{21}NO_2NaS$, 254.1191; found, 254.1191.

2-HEXYL-1-(METHYLSULFONYL)-2,3,6,7-TETRAHYDRO-1H-AZEPINE (5F):

Following the general procedure (1), to a solution of amine4b (50 mg, 0.12 mmol, 1.0 equiv) in 1.2 mL of dry DCM (0.1 M) at 0 °C were added heptanal (25 μL, 0.18 mmol,1.5 equiv) and I_2 (3.6 mg, 0.012 mmol, 0.1 equiv) to obtain 25 mg of tetrahydroazepine 5f as a pale yellow oil (0.097 mmol, 81%). *R*f = 0.62 (*n*-hexane/EtOAc 70:30); ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 5.76 (m, 1H), 5.68 (m, 1H), 3.95 (m, 1H), 3.68 (dt, *J* = 14.9 & 4.1 Hz, 1H), 3.22 (ddd, *J* =14.7, 11.5 & 3.0 Hz, 1H), 2.86 (s, 3H), 2.47 (m, 2H), 2.31 (m, 2H),1.66 (m, 1H), 1.52 (m, 1H), 1.27 (m, 8H), 0.89 (t, *J* = 6.8 Hz, 3H); ^{13}C{^{1}H}-NMR ($CDCl_3$, 125 MHz): δ = 130.5 (CH), 126.9 (CH),56.3 (CH), 40.7 (CH_2), 40.4 (CH_3), 32.7 (CH_2), 32.5 (CH_2), 31.8(CH), 30.8 (CH), 29.2 (CH), 26.2 (CH), 22.6 (CH), 14.1(CH_3); HRMS (ESI): *m*/*z* [*M* + Na] calcd for $C_{13}H_{25}NO_2NaS$: 282.1504; found, 282.1506.

2-(BUT-3-EN-1-YL)-1-(METHYLSULFONYL)-2,3,6,7-TETRAHYDRO-1H-AZE- PINE (5G):

Following the general procedure (1), to a solution of amine 4b (50 mg, 0.12 mmol, 1.0 equiv) in 1.2 mL of dry DCM (0.1 M) at 0°C were added 4-pentenal (18 μL, 0.18mmol, 1.5 equiv) and I_2 (3.6 mg, 0.012 mmol, 0.1 equiv) to obtain 19 mg of tetrahydroazepine5g as a pale yellowoil (0.084 mmol, 70%). *R*f = 0.51 (*n*-hexane/ EtOAc 70:30); ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 5.79 (m, 2H), 5.68(m,1H), 5.04 (dq, *J* = 17.1 & 1.6 Hz, 1H), 4.98 (dd, *J* = 10.3 & 1.6Hz, 1H), 3.98 (dq, *J* = 7.0 & 4.2 Hz, 1H), 3.70 (dt, *J* =15.0 & 4.3 Hz,1H), 3.25 (ddd, *J* = 14.6, 11.4 & 3.0 Hz, 1H), 2.87 (s, 3H), 2.48 (m,2H), 2.33 (m, 2H), 2.04 (m, 2H),1.79 (m,1H), 1.63 (m,1H);^{13}C{^{1}H}-NMR ($CDCl_3$, 125 MHz): δ = 137.7 (CH), 130.6 (CH),126.7 (CH), 115.1(CH_2), 55.9 (CH), 40.8 (CH_2), 40.4 (CH_3), 32.4(CH_2), 31.8 (CH_2), 30.7 (CH_2), 30.3 (CH_2); HRMS (ESI$^+$): *m*/*z* [*M*+Na]$^+$ calcd for $C_{11}H_{19}NO_2NaS$, 252.1034; found, 252.1035.

2-BENZYL-1-(METHYLSULFONYL)-2,3,6,7-TETRAHYDRO-1H-AZEPINE (5H):

Following the general procedure (1), to a solution of amine 4b (50mg, 0.12 mmol, 1.0 equiv) in 1.2 mL of dry DCM (0.1 M) at 0 °C were added phenylacetaldehyde (20 μL, 0.18 mmol, 1.5 equiv) and I_2 (3.6 mg, 0.012 mmol, 0.1 equiv) to obtain 20 mg of tetrahydroazepine 5h as a pale yellow oil (0.076 mmol, 63%). *R*f =0.44 (*n*-hexane/EtOAc 70:30); ^{1}H NMR ($CDCl_3$, 400 MHz): δ = 7.33−7.27 (m, 2H),7.25−7.19 (m, 3H), 5.81 (m, 1H), 5.69 (m, 1H), 4.25 (dq, *J* = 7.0 & 4.2 Hz, 1H), 3.64 (dt, *J* = 15.0 & 4.1 Hz, 1H), 3.28(ddd, *J* = 14.5, 11.4 & 2.9 Hz, 1H), 3.03 (dd, *J* = 13.4 & 7.0 Hz,1H), 2.82 (dd, *J* = 13.5 & 7.5 Hz, 1H), 2.56−2.44 (m,4H), 2.43−2.26 (m, 3H); ^{13}C{^{1}H}-NMR ($CDCl_3$, 125 MHz): δ = 138.4 (C),130.7 (CH), 129.3 (2× CH), 128.5 (2×CH), 126.7 (CH), 126.6(CH), 58.5 (CH), 41.0 (CH_2), 39.3 (CH_3), 39.1 (CH_2), 32.4 (CH_2),30.9 (CH_2); HRMS (ESI$^+$): *m*/*z* [M + Na]$^+$ calcd for$C_{14}H_{19}NO_2NaS$, 288.1034; found, 288.1036.

1-(METHYLSULFONYL)-2-PHENETHYL-2,3,6,7-TETRAHYDRO-1H-AZEPINE (5I):

Following the general procedure (1), to a solution of amine 4b (50 mg, 0.12 mmol, 1.0 equiv) in 1.2 mL of dry DCM (0.1 M) at 0°C were added hydro cinnamaldehyde (26 μL,0.18 mmol, 1.5 equiv) and I_2 (3.6 mg, 0.012 mmol, 0.1 equiv) to obtain 20 mg of tetrahydroazepine 5i as a pale yellow (0.072 mmol, 60%). *R*f = 0.39(*n*-hexane/EtOAc 70:30); ^{1}H NMR ($CDCl_3$, 500 MHz): δ = 7.28 (m, 2H), 7.19 (m, 3H), 5.79 (m, 1H), 5.70 (m, 1H), 4.04 (dq, *J* = 6.9 &4.1 Hz, 1H), 3.74 (dt, *J* = 14.8 & 4.2 Hz, 1 Hz), 3.29 (ddd, *J* = 14.7,11.5 & 3.0 Hz, 1H), 2.86 (s, 3H), 2.61 (m,

2H), 2.51 (m, 2H), 2.39(m, 1H), 2.36−2.28 (m, 1H), 2.01 (m, 1H), 1.86 (m, 1H); $^{13}C\{^1H\}$-NMR ($CDCl_3$, 125 MHz): δ = 141.4 (C), 130.7 (CH), 128.4 (2×CH), 128.2 (2× CH), 126.6 (CH), 126.0 (CH), 56.0 (CH), 40.9(CH_2), 40.4 (CH_3), 34.3 (CH_2), 32.5 (CH_2), 30.6 (CH_2); HRMS(ESI$^+$): *m/z* [*M*+ Na]$^+$ calcd for $C_{15}H_{21}NO_2NaS$, 302.1191; found,302.1193.

2-CYCLOHEXYL-1-(METHYLSULFONYL)-2,3,6,7-TETRAHYDRO-1H-AZEPINE (5J):

Following the general procedure (1), to a solution of amine 4b (50 mg, 0.12 mmol, 1.0 equiv) in 1.2 mL of dry DCM (0.1 M) at 0°C were added cyclohexane carbox aldehyde (36μL, 0.30 mmol, 2.5 equiv) and I_2 (3.6 mg, 0.012 mmol, 0.1 equiv) to obtain 16 mg of tetrahydroazepine 5j as a pale yellow oil (0.064 mmol, 53%). *R*f = 0.56 (*n*-hexane/EtOAc 70:30); ^1H NMR ($CDCl_3$, 500 MHz): δ = 5.82 (m, 1H), 5.72(m, 1H), 3.72−3.66 (dt, *J* = 15.1 & 3.9 Hz, 1H), 3.65−3.60(m, 1H), 3.09 (ddd, *J* = 14.6, 11.9 & 2.5 Hz, 1H), 2.88 (s, 3H),2.53−2.44 (m, 2H), 2.44−2.38 (m, 1H), 2.25 (m, 1H), 1.78−1.63 (m, 6H),1.16 (m, 3H), 0.92 (m, 2H); $^{13}C\{^1H\}$-NMR($CDCl_3$, 125 MHz): δ =131.1 (CH), 127.5 (CH), 60.8 (CH), 41.3 (CH_2), 40.7 (CH_3), 37.2(CH), 30.8 (CH_2), 30.6(CH_2), 30.1 (CH_2), 29.3 (CH_2), 26.2(CH_2), 26.1 (CH_2), 26.0 (CH_2); HRMS (ESI$^+$): *m/z* [M + Na]$^+$calcd for $C_{13}H_{23}NO_2NaS$, 280.1347; found, 280.1348.

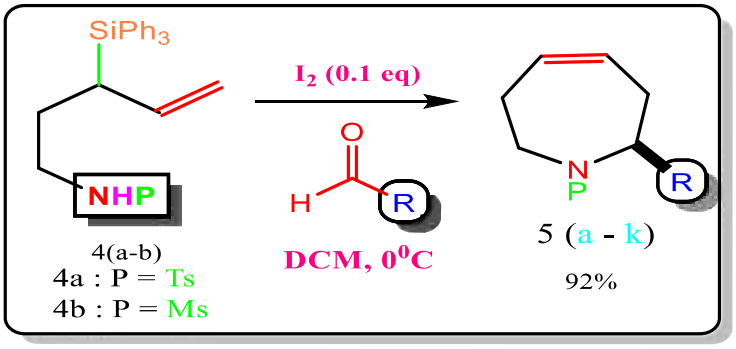
3-(1-(METHYLSULFONYL)-2,3,6,7-TETRAHYDRO-1H-AZEPINE-2-YL)PROPYL BENZOATE (5K):

Following the general procedure (1), to a solution of amine 4b (50 mg, 0.12 mmol, 1.0 equiv) in 1.2 mL of dry DCM (0.1 M) at 0 °C were added aldehyde 4- oxobutyl benzoate (34 mg, 0.18 mmol, 1.5 equiv), synthesized following the procedure described in the literature,[35] and I_2 (3.6 mg, 0.012 mmol, 0.1 equiv) to obtain 25 mg of tetrahydroazepine 5k as a pale yellow oil (0.074 mmol, 62%). *R*f= 0.29 (*n*-hexane/EtOAc 70:30); ^1H NMR ($CDCl_3$, 400 MHz): δ = 8.03 (m, 2H), 7.56 (m, 1H), 7.44 (m,2H), 5.77 (m, 1H),5.68 (m, 1H), 4.3(m,2H), 4.03 (m, 1H), 3.72 (dt, *J* = 15.0 & 4.3Hz, 1H), 3.23 (ddd, *J* = 14.8, 11.6& 3.2 Hz, 1H), 2.88 (s, 3H), 2.55−2.43 (m, 2H), 2.41−2.27 (m, 2H), 1.89−1.73 (m, 3H), 1.71−1.60(m, 1H); $^{13}C\{^1H\}$-NMR ($CDCl_3$, 100 MHz): δ = 166.5 (C), 132.9(CH), 130.6 (CH), 130.2 (C), 129.5 (2× CH), 128.3 (2× CH),126.5(CH), 64.5 (CH_2), 56.0 (CH), 40.8 (CH_2), 40.4 (CH_3), 32.5(CH_2), 30.4 (CH_2), 29.2 (CH_2), 25.5 (CH_2); HRMS (ESI$^+$): *m/z* [M+ Na]$^+$ calcd for $C_{17}H_{23}NO_4NaS$, 360.1245; found, 360.1241.

RESULTS AND DISCUSSION:

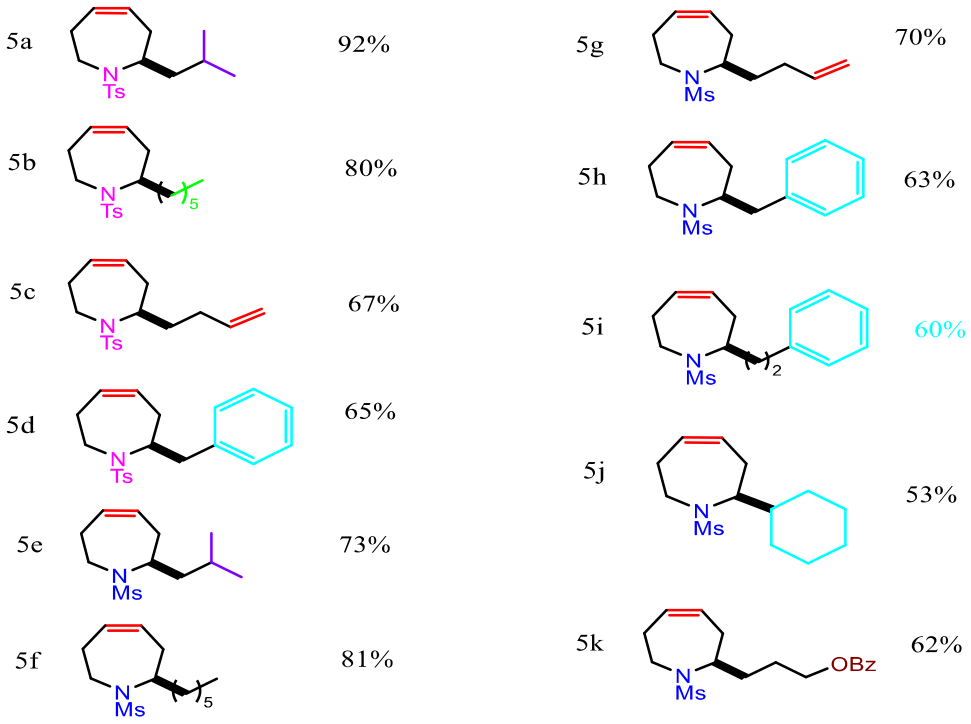
Based on our previous work, which allowed the diastereoselective synthesis of oxepenes through the Prins-Pinacol Cyclization (PPC) strategy, we decided to approach the nitrogen version and thus synthesize different tetrahydroazepines. If successful, it would constitute a direct and straightforward method that, using a sustainable Iron(III) catalyst, builds a C−N, C−C bond and an endocyclic double bond in a single reaction step (Scheme 1).

We started with the simplest tetrahydroazepines, that is, bearing a single substituent that comes from the correspondingaldehyde. 1-Amino-3-triphenylsilyl-4-pentenes (6a-b), precursors of the silyl aza-Prins cyclization (SAPC), could be accessed in three reaction steps (see Supporting Information). Next, the SAPC assays were performed with different sustainablemetal catalysts, based on our previous experience for oxepene synthesis, affording the desired tetrahydroazepine.Thebest results were obtained using substoichiometric amounts (0.1 equiv) of I_2, the yield and ratio being slightly higherwhen the former was used.



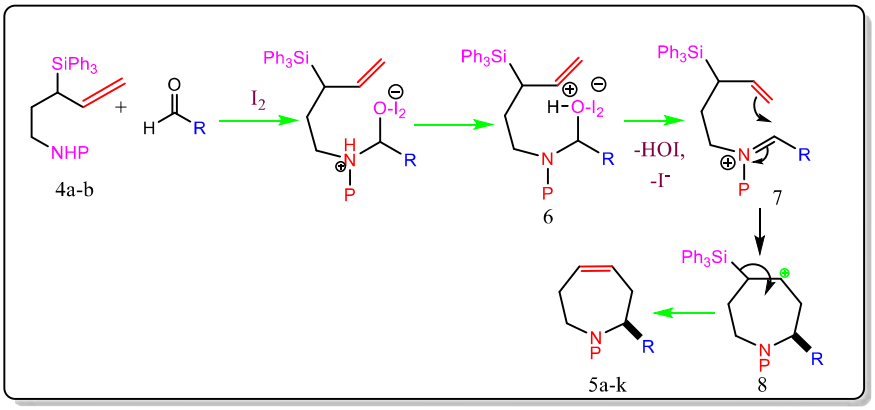
Scheme 1. Preparation of Unsaturated Seven-Membered Ring Azacycle

Table 1. ***Scope of Monosubstituted Tetrahydroazepines 7 Synthesis from SAPC***



[a]Reaction conditions: 4a–4b (0.20 mmol), aldehyde (0.24–0.40 mmol), I_2(0.02, mmol), dry DCM. Isolated yield. The conversion in all cases was 100%.
[b]2 g scale of 4a (4.0 mmol) afforded 60% yield of 5a (741 mg, 2.41 mmol).

Systems with aliphatic chains such as isovaleraldehyde and heptanal, with both tosylated and mesylated 1-amino-3-triphenylsilyl-4-pentenes 4a–b, respectively, gave yields of 92, 80, 73, and 81% (tetrahydroazepines 5a, 5b, 5e, and5f. Likewise, good results were observed with 4-pentenal, which led to tetrahydroazepines 5c and 5g with an endocyclic and an exocyclic olefin. Reaction with phenyl acetaldehyde and hydro cinnamaldehyde allowed a phenylsubstituent to be incorporated into the heterocycles 5d, 5h, and 5i in 65, 63, and 60% yield, respectively. Our SAPC protocol also worked when using an aldehyde with a benzoate carrier chain, so future derivatizations of tetrahydroazepine 5k are feasible However, there was no reactivity with aromatic aldehydes.



Scheme 2. Mechanistic Proposal for SAPC

The mechanistic proposal for this transformation is based on that reported for the analogous process forming oxepenes (Scheme 2). First, a condensation occurs between the 1- amino-3-triphenylsilyl-4-pentene 4a and the Lewis acid– activated (Molecular Iodine) aldehyde. The zwitterionic species 6 leads to the amino-alcohol 13 and evolves to the iminium ion 7. This last species is intra molecularly trapped by the double bond, generating the carbocation 8, stabilized by the presence of the silyl group (β effect). Intermediate 8 undergoes a Peterson-type elimination, leading to tetrahydroazepines 5.

CONCLUSIONS:

we have developed an efficient and straightforward approach for the formation of mono and disubstituted seven-membered Δ^4-unsaturated azacycles. A variety of mono- and disubstituted tetrahydroazepines can beaccessed through SAPC, and in a single reaction step, C–C, C–N, and endocyclic C-C bonds are formed. In addition,it has been shown that the functionalization of the precursor amines determines their reactivity. Increasing the substitution of tetrahydroazepine up to three substituents is currently ongoing in our laboratory.

ACKNOWLEDGMENTS:

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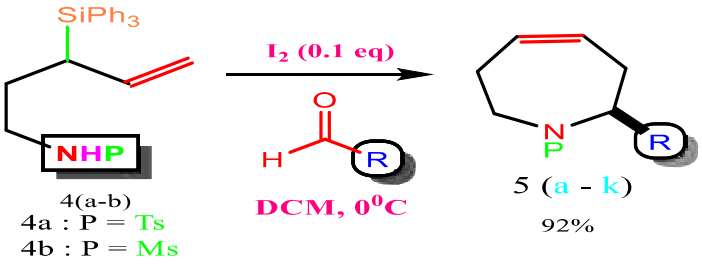
Graphical Abstract

Molecular Iodine Catalysed Synthesis Of Tetrahydroazepines Frameworks *Via* Silyl Aza-Prins Cyclization

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Based on the powerful Aza-Prins cyclization in combination with the Peterson-type elimination reaction,. a C–N, C– C bond and an endocyclic double bond are formed. Under mild reaction conditionsusing Molecular Iodine as sustainable catalysts, tetrahy- droazepines with different degrees of substitution are obtaineddirectly and efficiently



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Synthesis, characterization, and evaluation of antioxidant, antimicrobial and drug likeness properties of indole containing 1,3,4-oxadiazoles

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ABSTRACT

We have synthesized fourteen new 1,3,4-oxadiazole hybrid compounds (**68a-68n**) that contain indole. The characterization of fourteen new indolo-3,4-oxadiazoles derivatives (**68a-68n**) was performed using techniques such as Proton Nucelar Magnetic Resonance (^{1}H NMR) and Liquid Chromatography – Mass spectrometry (LC-MS). All indolo-3,4-oxadiazoles derivatives (**68a–68n**) were examined for its antioxidant and antibacterial properties in *in-vitro* conditions. The scavenging activity was measured in order to assess their antioxidant capabilities. Among 14 compounds, **68a**, **68i** and **68n** showed better scavenging activity. The antibacterial activity of all indolo-3,4-oxadiazoles derivatives (**68a–68n**) was tested against *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeroginosa* and *Klebsiella pneumonia*. All of the compounds (**68a-n**) exhibited moderate to significant activity. The indolo-3,4-oxadiazoles derivatives **68b, 68e, 68h** and **68j** shown more effectiveness against *Staphylococcus aureus, Escherichia coli, Pseudomonas aeroginosa*. The drug-likeness property of all indolo-3,4-oxadiazoles derivatives (**68a–68n**) was tested following Lipinski's policies. The compounds (**68a–68n**) are all in accordance with Lipinski's policies and proved to have enhanced oral bioavailability.

Introduction

Oxadiazole is a highly significant heterocyclic molecule that includes two nitrogen atoms along with an oxygen atom arranged in a five-membered ring [1]. The 1,2,3-oxadiazole, 1,2,4-oxadiazole, 1,2,5-oxadiazole, and 1,3,4-oxadiazoles are the four different isomers of oxadiazole that are known so far (Fig. 1).

The physicochemical and pharmacokinetic characteristics of the whole molecule are influenced by the occurrence of the 1,3,4-oxadiazole ring. In pharmaceutical chemistry, the 1,3,4-oxadiazole ring is attracting attention as a bioisostere for carbonyl-containing compounds, including esters, amides and carboxylic acids [2]. Additionally, the oxadiazole ring contributes a big role in the pharmacophore's ability to bind to a ligand [3]. As a result, 1,3,4-oxadiazole is now a necessary component (Fig. 2) for the synthesis of novel pharmaceutical molecules [4–7].

In the past twenty years, there has been a surge in the synthetic production of novel 1,3,4-oxadiazole derivatives, exploration of their chemical characteristics and biological behaviour [8–10]. Furthermore, many biological activities of 1,3,4-oxadiazole derivatives were resulted from the coupling of oxadiazole with additional heterocyclic ring systems such as pyrrole/pyrazole rings [11–13]. Thus, it is reasonable to say that 1,3,4-oxadiazole is a major pharmacophore with multiple types of significant biological impacts and have a significant functioning in pharmaceutical chemistry. The important biological performances of 1,3,4-oxadiazole included anti-inflammatory [14], anti-bacterial [15], anti-cancer [16], anti-malarial [17], anti-tubercular [18], anti-convulsant [19], anti-allergic agent [20], vasodilator [21] and analgesic [22].

Based on the significance of 1, 3, 4-oxadiazoles and their derivatives, a considerable research was done to synthesis various classes of 1, 3, 4-oxadiazoles molecules utilizing different approaches of synthesis [23,24]. The literature has documented novel and innovative synthetic techniques and procedures for generating compounds of 1, 3, 4-oxadiazoles that are both symmetrical and asymmetric [25]. The literature review has disclosed that just a slight systemic change in the organization of groups in the 1,3,4-oxadiazole might result in both qualitative and quantitative changes in the functioning of the 1,3,4-oxadiazole

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derivative. This encouraged us to begin synthesising numerous new 1,3,4-oxadiazole compounds with the objective of investigating their activities. It is anticipated that the newly developed hybrid molecules would display a wide range of biological characteristics.

The 1,3,4-oxadiazole-imidazole hybrid [26,27], oxadiazole-benzimidazole hybrid [28] and 1,3,4-oxadiazole-imidazole hybrid [29] with anticancer activity were reported. The 1,3,4-oxadiazole-quinolone hybrid [30], 1,3,4-oxadiazole-benzothiazepine hybrid [31], 1,3,4-oxadiazole-benzothiazepine hybrid [31] with antimicrobial activity were reported. The hybrid of 1,3,4-oxadiazole with thiazole and pyridine were also reported with antitubercular activity [32]. The 1,3,4-oxadiazole-aspirin derivatives having analgesic and anti-inflammatory activities was also reported [33]. Till date 1,3,4-oxadiazole-indole hybrid was not reported.

The objective of this research was to synthesize novel nitrogen-containing heterocyclic molecules with a broad spectrum of biological activities. To achieve this, we focused on creating innovative structural hybrids combining indole and oxadiazole moieties. Our research led to the development of new methodologies for synthesizing 1,3,4-oxadiazole-indole derivatives, representing a significant advancement in the field of heterocyclic chemistry. The novel hybrid molecules were systematically designed, synthesized, and evaluated for their biological activities. Specifically, we tested these indole-1,3,4-oxadiazole hybrids for antioxidant and antimicrobial properties, demonstrating their potential therapeutic applications. Additionally, the compounds were assessed for compliance with Lipinski's rule, confirming their drug-like characteristics.

All synthesized compounds were thoroughly characterized using advanced techniques including ^{1}H NMR Notably, several compounds exhibited significant biological activities, highlighting the success and novelty of our approach. This work not only introduces new bioactive molecules but also contributes to the development of novel synthetic methodologies in the realm of nitrogen-containing heterocycles.

In our study, we have synthesized fourteen **(68a- 68n)** new 1,3,4-oxadiazole hybrid compounds that has indole (indolo-,3,4-oxadiazoles derivatives). Our major goal was to obtain hybrid molecules (indolo-3,4-oxadiazoles derivatives) with potential antimicrobial as well as antioxidant properties. Techniques such as Proton Nuclear Magnetic Resonance (^{1}H NMR) and Liquid Chromatography – Mass spectrometry (LC-MS) were employed to characterize those newly generated 14 indolo-,3,4-oxadiazoles derivatives (**68a- 68n)**.

Materials and methods

Chemicals

All of the chemicals were purchased from "Sigma Aldrich" India and were of the grade of analytical reagents. Indole (99.0 % purity), dimethylsulfoxide (99.7 % purity), potassium bromide (99.0 % purity), tetramethylsilane (97.0 % purity), toluene (99.8 % purity), phosphorus oxy chloride (99.0 % purity), methyl *tert*-butyl ether (99.8 % purity), butylated hydroxy anisole (99.0 % purity), ascorbic acid (99.0 % purity), nitrofurazone (97.0 % purity), methanol (99.85 % purity), and sulphuric acid (95–97 % purity) were used in this study. Water of ultrapure quality was acquired from a Millipore, India.

Microorganisms

Organisms including *Staphylococcus aureus* (Gram positive species), *Escherichia coli* (Gram negative species), *Pseudomonas aeroginosa* (Gram negative species) and *Klebsiella pneumonia* (Gram negative species) were employed in our investigation. Gram positive and Gram negative bacteria were among the microorganisms acquired from "National Centre for Cell Science", Pune, India.

Instrumentation and conditions

A Büchi (model B-545) melting point determination apparatus, with a highest heating capability of 400 °C, was used to verify the melting points of newly generated 14 indolo-,3,4-oxadiazoles derivatives. The ^{1}H NMR spectra of newly generated 14 indolo-,3,4-oxadiazoles derivatives have been captured using a Varian 400 MHz inova NMR spectrometer functioning at room temperature using tetramethylsilane as the internal standard. The samples of indolo-,3,4-oxadiazoles derivatives for 1H NMR based characterization were prepared in DMSO-d_6 solvent. The LC-MS spectra of the newly generated 14 indolo-,3,4-oxadiazoles derivatives were obtained using Waters® Micromass® Q-Tof micro™ apparatus. The ionizing energy used for electron impact ionization was 70 eV. The UV–visible spectrophotometer (Shimadzu, model Uv-1800) was employed to evaluate the antioxidant activity of novel indolo-,3,4-oxadiazole derivatives.

General approach for synthesis of a series of novel indolo-,3,4-oxadiazole derivatives ***(68a-68n)***

Equimolar blend of substituted indole carboxylic acid **(67a-67b)** (1.61 g) and substituted benzoic acid hydrazides **(66 a-66 g)** (1.36 g) were dissolved in toluene (20 mL). To this mixture added phosphorus oxychloride $POCl_3$ (2.8 mL). The above blend was heated under reflux for 3–4 hr. Thin layer chromatography (TLC) was performed utilizing 60 F254 pre-coated silica and 0.25 mm aluminium plates to monitor the reaction progress. Following the successful completion of the reaction, the reaction mixture was cooled and swirled for two hr. The resulting solid was then filtered out and given a hot water wash. Methyl *tert*-butyl ether was then used to wash the product in order to extract the necessary pure compounds **(68a-68n)** with a good to excellent yield (47–86 %). By utilizing the instruments and specifications described in the preceding section, ^{1}HNMR, and LC-MS were used to analyse the spectral features of the produced compounds and validated their structures.

Antioxidant activity evaluation

Using the "2,2-diphenyl-1-picrylhydrazyl" (2-DPH) approach, the antioxidant activity of the synthesized indolo-,3,4-oxadiazoles derivatives (**68a-68n**) was investigated [34]. 1.0 mL of 0.1 mM 2-DPH ethanolic solution was added to 3 mL of test (indolo-,3,4-oxadiazoles derivatives – 50 μg/mL) sample. After giving the reaction mixture a good shake, it was left in the dark at ambient temperature to stay for one hour. The absorbance of resultant solution was assessed at 517 nm against reagent blank (0.1 mM 2-DPH ethanolic solution without test compound). For reference compound (50 μg/mL), the same approach was carried out once again. As reference substances, butylated

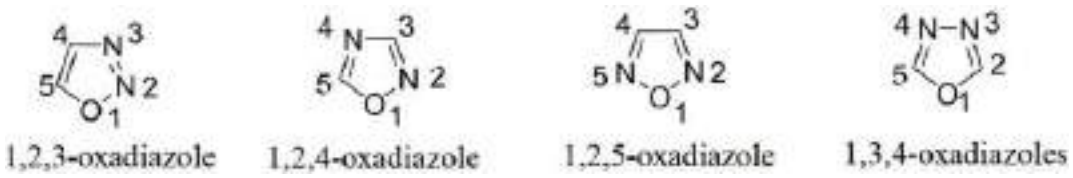


Fig. 1. Isomers of Oxadiazole.

hydroxyanisole, butylated hydroxyl toluene, and ascorbic acid were used. The following formula was adopted to figure out the percentage of scavenging efficiency of synthesized indolo-,3,4-oxadiazoles derivatives **(68a-68n)**.

% Scavenging activity (%SA) = $(A_0\text{-}A_1)/A_0 \times 100$

In above equation, "$A_0^{"}$ = Absorbance blank (0.1 mM 2-DPH ethanolic solution), "$A_1^{"}$ = Absorbance of indolo-,3,4-oxadiazoles derivative.

Antibacterial activity evaluation

Four different types of bacteria were the targets to check antibacterial activity of indolo-,3,4-oxadiazoles derivatives **(68a-n)**. The selected microorganism species were *Staphylococcus aureus* (Gram positive species), *Escherichia coli* (Gram negative species), *Pseudomonas aeroginosa (*Gram negative species) and *Klebsiella pneumonia* (Gram negative species). The bacterial strains were preserved on nutrient agar slants and cultivated at 37 °C. Employing the micro broth dilution approach [35], the antibacterial activity of the generated indolo-,3,4-oxadiazoles derivatives **(68a-68n)** were assessed by establishing the "Minimum Inhibitory Concentration" (MIC). Dimethylsulfoxide (DMSO) served to dissolve sample being tested (indolo-,3,4-oxadiazoles derivatives **68a-68n)** and create a stock solution (1 mg/mL). In Mueller-Hinton (MH) broth, stock sample was successively diluted to provide levels of 3.125, 6.25, 9.375, 12.5, 15.625, and 18.75 μg/mL of indolo-,3,4-oxadiazoles derivatives. Subsequently, a final concentration of between 3.125 to 18.75 μg/mL was achieved by adding 100 μL of every indolo-,3,4-oxadiazoles derivatives sample concentration to the corresponding wells (96-well micro plate) that contained 90 μL of MH broth plus 10 μL of inoculum. The microbial suspensions used here had the ultimate concentration of 10^6 CFU/mL. As a positive control, dilutions of Nitrofurazone (50 μg/mL; Sigma-Aldrich) in broth was used. A negative control consisting of 10 μL of DMSO was added to broth. The minimum concentration of indolo-,3,4-oxadiazoles derivative compounds **(68a-68n)** at which there was little to no growth was determined visually was used for assessing the "MIC" of indolo-,3,4-oxadiazoles derivatives.

Drug likeness feature evaluation

Using Christopher Lipinski's recommendations, the drug resemblance feature of the investigated indolo-,3,4-oxadiazoles derivatives (**68a-68n**) was assessed [36,37]. These guidelines were designed to evaluate whether the molecule under investigation had the necessary physical characteristics to be physiologically active in humans. The values determined in this study are expressed as multiples of five. According to Lipinski's principle, an oral active ingredient needs to fulfil at least any one of three requirements given below:

- An investigational molecule's mass may not exceed 500 Daltons.
- There should not be more than five bonds formed between hydrogen atoms and oxygen or nitrogen atoms (hydrogen bond donors).
- A maximum of ten oxygen or nitrogen atoms (hydrogen bond acceptors) should be present.
- log P coefficient (clogP) value should be smaller than 5. This represents a compound's water solubility as contrasted to its oil solubility.

The molinspiration tool was utilized to illustrate the indolo-,3,4-oxadiazoles derivatives (**68a-68n**) drug-like characteristics [36,37].

Results and discussion

Chemistry of recent synthesized 1,3,4-oxadiazole hybrid derivative compounds (68a-n)

In order to synthesize new molecules of indole containing 1,3,4-oxadiazole derivatives **(68a-68n)**, we adopted strategy as disclosed in Schemes 1 and 2. The fundamental intermediates for synthesizing indolo-,3,4-oxadiazoles derivatives **(68a-68n)** are *p*-substitutedbenzoic acid hydrazides **(66a-66 g)** and substituted indole carboxylic acids **(67a-67b)**.

We initially synthesized *p*-substituted benzoic acid hydrazides **(66a-66 g)** based on the literature reports as shown in Scheme 1. *p*-substituted aromatic carboxylic acids **(64a-g)** were heated with methanol and concentrated H_2SO_4 to produce corresponding esters **(65a-65 g)**. The obtained compounds **(65a-65 g)** were converted to corresponding *p*-substituted benzoic acid hydrazides **(66a-66 g)** by using hydrazine hydrate in ethanol under reflux condition as represented in the Scheme 1.

Further, we synthesized new molecules of indolo-,3,4-oxadiazoles derivatives **(68a-68n)** as shown in Scheme 2. The obtained *p*-substituted benzoic acid hydrazides **(66a-66 g)** were allowed to react with substituted indole carboxylic acids **(67a-67b)** by using phosphorus

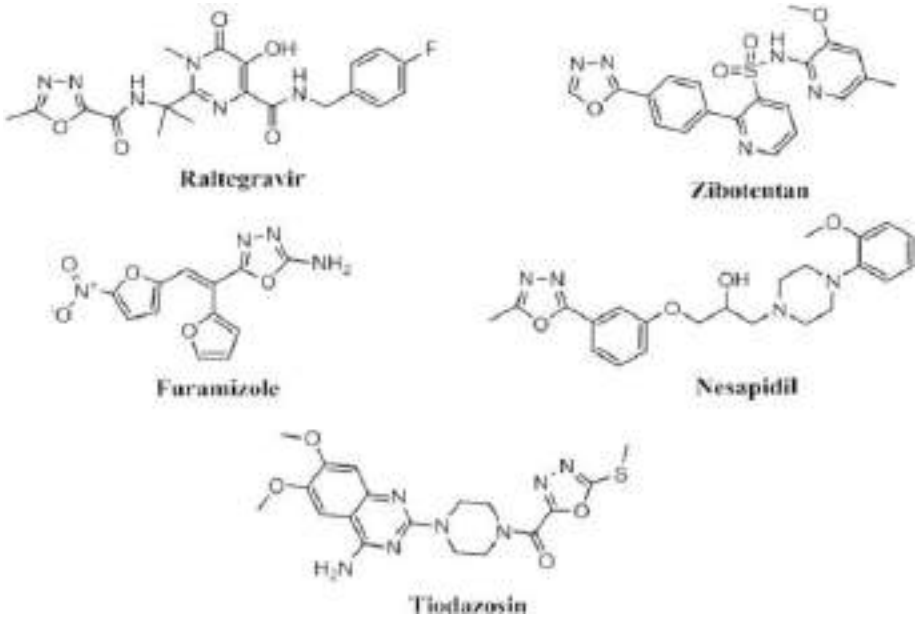
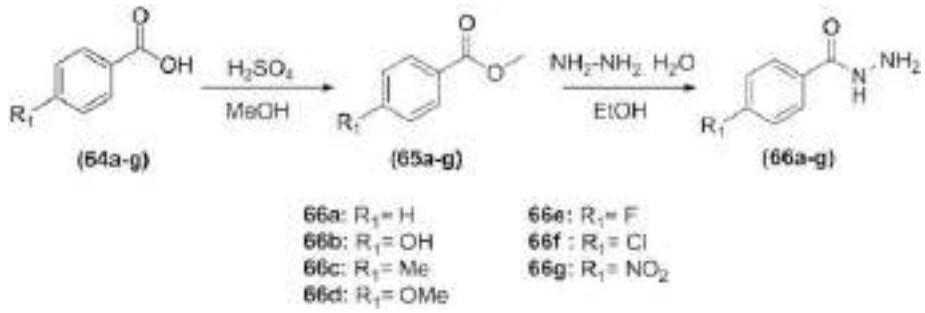
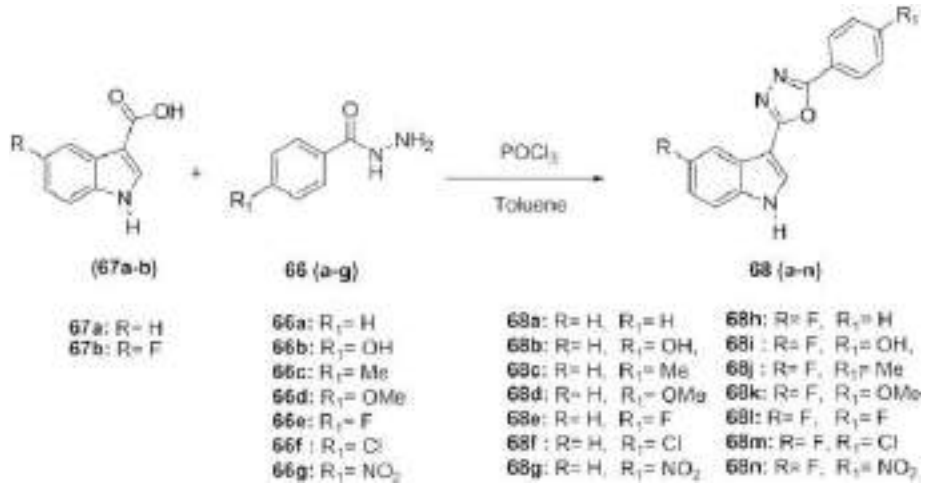


Fig. 2. Drug molecules containing 1,3,4-oxadiazole moiety.



Scheme 1. Synthesis of *p*-substituted benzoic acid hydrazides.



Scheme 2. Synthesis of indole containing 1,3,4-oxadiazoles derivatives.

oxychloride $POCl_3$ and toluene to obtain the desired indolo-,3,4-oxadiazoles derivatives with good yields. Methyl *tert*-butyl ether was employed for purifying the crude products (**68a-68n**) that were derived from Scheme 2. Table 1 provided the yield percentage and the physical form of the finished and purified indolo-,3,4-oxadiazoles derivatives (**68a-68n**).

Structural characterization of synthesized indolo-,3,4-oxadiazoles derivative compounds (68a-n)

Techniques such as LC-MS and ^{1}H NMR were employed to characterize the structures of those newly generated 14 unique indolo-,3,4-oxadiazoles derivatives (**68a-68n**).

MS analysis

The mass spectrum of indolo-,3,4-oxadiazoles derivatives (**68a-68n**) were obtained. The *m/z* at which the indolo-,3,4-oxadiazoles derivatives (**68a-n**) had a molecular ion peak was identified from mass spectrum data (Table 1). The possible chemical formula (Table 1) and probable molecular weight (Table 1) of the indolo-,3,4-oxadiazoles derivatives (**68a-68n**) were then determined using those data.

NMR analysis (^{1}H NMR based characterization)

*Compound **68a**.* ^{1}H NMR (400 MHz; DMSO-d_6) δ: 12.08 (s, 1H, N-H), 8.32 (d, *J*=3.2 Hz, 1H, Ar-H), 8.19–8.16 (m, 1H, Ar-H), 8.15–8.13 (m, 2H, Ar-H), 7.65–7.63 (m, 3H, Ar-H), 7.57–7.55 (m, 1H, Ar-H), 7.31–7.26 (m, 2H, Ar-H).

*Compound **68b**.* ^{1}H NMR (400 MHz; DMSO-d_6) δ: 12.19 (s, 1H, N- H), 10.47 (s, 1H, O-H), 8.36 (s, 1H, Ar-H), 8.03–8.01 (m, 1H, Ar-H),

Table 1
Yield, MS spectral data and physical forms of newly synthesised indolo-,3,4-oxadiazoles derivatives compounds (**68a-n**).

Test Compounds	Yield (%)	*m/z*	Molecular weight	Molecular formula	Physical form
68a	86	261.8 $[M+H]^+$	261.28	$C_{16}H_{11}N_3O$	Pale brown solid
68b	51	277.8 $[M+H]^+$	277.28	$C_{16}H_{11}N_3O_2$	Off-white solid
68c	78	275.8 $[M+H]^+$	275.31	$C_{17}H_{13}N_3O$	Off-white to pale
68e	78	279.8 $[M+H]^+$	279.27	$C_{16}H_{10}FN_3O$	brown solid
68f	74	295.7 $[M+H]^+$	295.73	$C_{16}H_{10}ClN_3O$	
68j	73	293.8 $[M+H]^+$	293.30	$C_{17}H_{12}FN_3O$	
68k	84	309.8 $[M+H]^+$	309.30	$C_{17}H_{12}FN_3O_2$	
68l	76	297.8 $[M+H]^+$	297.26	$C_{16}H_9F_2N_3O$	
68d	81	291.8 $[M+H]^+$	291.31	$C_{17}H_{13}N_3O_2$	Off-white to pale
68h	83	279.8 $[M+H]^+$	279.27	$C_{16}H_{10}FN_3O$	yellow solid
68i	47	295.8 $[M+H]^+$	295.27	$C_{16}H_{10}FN_3O_2$	
68m	81	313.7 $[M+H]^+$	313.72	$C_{16}H_9ClFN_3O$	
68g	77	306.8 $[M+H]^+$	306.28	$C_{16}H_{10}N_4O_3$	Orange color solid
68n	79	324.7 $[M+H]^+$	324.27	$C_{16}H_9FN_4O_3$	Yellow solid

7.93–7.91 (m, 2H, Ar-H), 7.57–7.53 (m, 2H, Ar-H), 7.37 (d, *J*=8.4 Hz, 1H, Ar-H), 7.26–7.23 (m, 2H, Ar-H).

*Compound **68c***. ^{1}H NMR (400 MHz; DMSO-d_6) δ: 12.08 (s, 1H, N-H), 8.30 (d, *J*=2.4 Hz, 1H, Ar-H), 8.17–8.15 (m, 1H, Ar-H), 8.02 (d, *J*=8.4 Hz,2H, Ar-H), 7.56–7.54 (m, 1H, Ar-H), 7.44 (d, *J*=8 Hz, 2H, Ar-H), 7.30–7.25 (m, 2H, Ar-H),2.43 (s, 3H, CH_3).

*Compound **68d***. ^{1}H NMR (400 MHz; DMSO-d_6) δ: 12.06 (s, 1H, N-H), 8.28 (d, *J*=2.8 Hz, 1H, Ar-H), 8.17–8.14 (m, 1H, Ar-H), 8.06 (d, *J*=8.8 Hz, 2H, Ar-H), 7.56–7.54 (m, 1H, Ar-H), 7.30–7.24 (m, 2H, Ar-H), 7.16 (d, *J*=8.8 Hz, 2H, Ar-H), 3.87 (s, 3H, OCH_3).

*Compound **68e***. ^{1}H NMR (400 MHz; DMSO-d_6) δ: 12.08 (s, 1H, N-H), 8.31 (d, *J*=2.8 Hz, 1H, Ar-H), 8.21–8.16 (m, 3H, Ar-H), 7.57–7.55 (m, 1H,Ar-H), 7.49 (t, *J*=8.8 Hz, 2H, Ar-H), 7.31–7.26 (m, 2H, Ar-H).

*Compound **68f***. ^{1}H NMR (DMSO-d_6, 400 MHz) δ: 12.09 (s, 1H, N-H), 8.32 (d, *J*=2.8 Hz, 1H, Ar-H), 8.20–8.13 (m, 3H, Ar-H), 7.71 (d, *J*=8.4 Hz, 2H, Ar-H), 7.58–7.55 (m, 1H, Ar-H), 7.31–7.25 (m, 2H, Ar-H).

*Compound **68g***. ^{1}H NMR (DMSO-d_6, 400 MHz) δ: 12.19 (s, 1H, N-H), 8.47–8.45 (m, 2H, Ar-H), 8.38–8.36 (m, 3H, Ar-H), 8.19–8.17 (m, 2H, Ar-H), 7.58–7.56 (m, 1H, Ar-H), 7.32–7.27 (m, 2H, Ar-H).

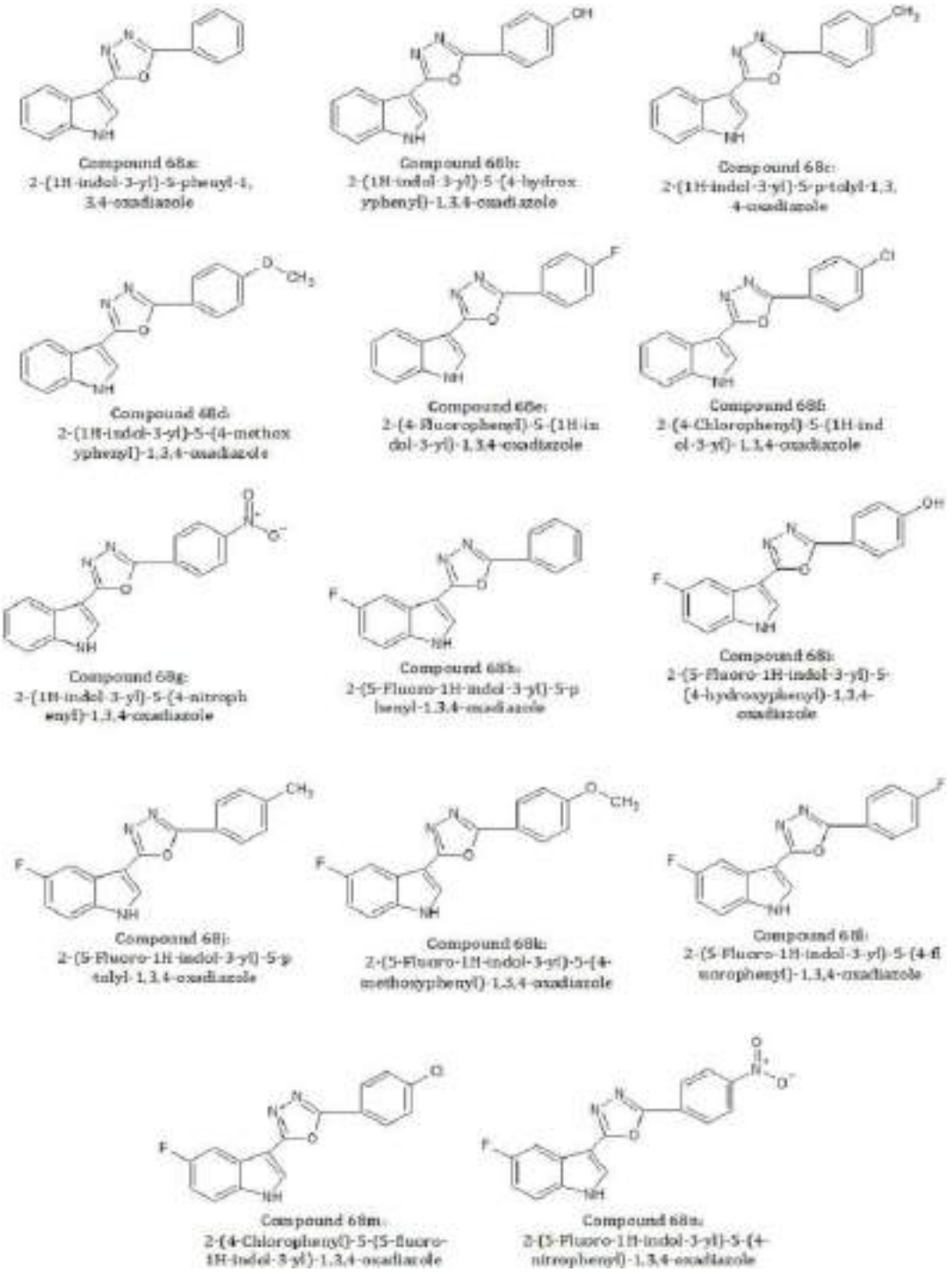


Fig. 3. Structures and chemical names of newly synthesized fourteen indolo-,3,4-oxadiazoles derivatives (**68a-68n**).

*Compound **68h**.* ^{1}H NMR (DMSO-d_6, 400 MHz) δ: 12.20 (s, 1H, N-H), 8.38 (d, *J*=3.2 Hz, 1H, Ar-H), 8.14–8.12 (m, 2H, Ar-H), 7.84–7.81 (m, 1H,Ar-H), 7.64 (t, *J*=3.2 Hz, 3H, Ar-H), 7.58 (dd, *J*=7.6, 4.4 Hz, 1H, Ar-H), 7.15 (td, *J*=9.6, 2.4 Hz, 1H, Ar-H).

*Compound **68i**.* ^{1}H NMR (DMSO-d_6, 400 MHz) δ: 12.39 (s, 1H, N-H), 11.48 (s, 1H, O-H), 8.38 (d, *J*=3.2 Hz, 1H, Ar-H), 8.06–8.01 (m, 2H, Ar-H), 7.86–7.82 (m, 1H, Ar-H), 7.63–7.55 (m, 2H, Ar-H), 7.44–7.08 (m, 2H, Ar-H).

*Compound **68j**.* ^{1}H NMR (DMSO-d_6, 400 MHz) δ: 12.17 (s, 1H, N-H), 8.35 (d, *J*=3.2 Hz, 1H, Ar-H), 8.0 (d, *J*=6 Hz, 2H, Ar-H), 7.80 (dd, *J*=10, 2.4 Hz, 1H, Ar-H), 7.57–7.54 (m, 1H, Ar-H), 7.43 (d, *J*=7.6 Hz, 2H, Ar-H), 7.13 (td, *J*=9.2, 2.4 Hz, 1H, Ar-H), 2.40 (s, 3H, CH_3).

*Compound **68k**.* ^{1}H NMR (DMSO-d_6, 400 MHz) δ: 12.14 (s, 1H, N-H), 8.34 (d, *J*=2.8 Hz, 1H, Ar-H), 8.04 (d, *J*=8.8 Hz, 2H, Ar-H), 7.80 (dd, *J*=10, 2.4 Hz, 1H, Ar-H), 7.55 (dd, *J*=8.8, 4.4 Hz, 1H, Ar-H), 7.18–7.10 (m, 3H, Ar-H), 3.85 (s,3H, OCH_3).

Compound 68l. ^{1}H NMR (DMSO-d_6, 400 MHz) δ: 12.19 (s, 1H, N-H), 8.38 (d, *J*=3.2 Hz, 1H, Ar-H), 8.19 (dd, *J*=8.8, 5.6 Hz, 2H, Ar-H), 7.82 (dd, *J*=10, 2.4 Hz, 1H, Ar-H), 7.57 (dd, *J*=8.8, 4.4 Hz, 1H, Ar-H), 7.49 (t, *J*=8.4 Hz, 2H, Ar-H), 7.13 (td, *J*=9.2, 2.4 Hz, 1H, Ar-H).

*Compound **68m**.* ^{1}H NMR (DMSO-d_6, 400 MHz) δ: 12.21 (s, 1H, N-H), 8.39 (d, *J*=1.6 Hz, 1H, Ar-H), 8.13 (d, *J*=8.8 Hz, 2H, Ar-H), 7.82 (dd, *J*=10, 2.4 Hz, 1H, Ar-H), 7.71 (d, *J*=8.4 Hz, 2H, Ar-H), 7.57 (dd, *J*=8.6, 4.4 Hz, 1H, Ar-H), 7.15 (td, *J*=8.8, 2.4 Hz, 1H, Ar-H).

*Compound **68n**.* ^{1}H NMR (DMSO-d_6, 400 MHz) δ: 12.27 (s, 1H, N-H), 8.47–8.43 (m, 3H, Ar-H), 8.38–8.33(m, 2H, Ar-H), 8.16 (d, *J*=8.4 Hz, 1H, Ar-H), 7.85–7.82 (m,1H, Ar-H), 7.59 (dd, *J*=9.0, 4.2 Hz, 1H, Ar-H), 7.16 (td, *J*=9.0, 2.4 Hz, 1H, Ar-H);

The ^{1}H NMR spectrum of indolo-,3,4-oxadiazoles derivatives **(68a-68n)** shows indole NH at *δ* 12.10 ppm. The aromatic protons of indole and phenyl ring attached to oxadiazole appeared at *δ* 8.32, 8.19, 8.15, 7.65, 7.57 and 7.31 ppm. The ^{1}H NMR spectral data confirms the below given structures (Fig. 3) for new indolo-,3,4-oxadiazoles derivatives **(68a-68n)**.

Antioxidant activity

A stable free radical is 2-DPH. The synthesized fourteen indolo-,3,4-oxadiazoles derivatives are tested for their antioxidant properties using ethanolic 2-DPH solution. When an indolo-,3,4-oxadiazoles derivative reacts with 2-DPH, it gives an electron or a hydrogen atom and neutralizes the free radical nature of the 2-DPH. The intensity of scavenging behaviour is indicated by a shift in colour from purple to yellow. The antioxidant capacity of indolo-,3,4-oxadiazoles derivatives has been established by evaluating the increase or decrease in absorbance at 517 nm.

The antioxidant capacity of fourteen recently synthesized indolo-,3,4-oxadiazoles derivatives (**68a–68n**) was assessed. Among them compounds **68a**, **68i** and **68n**, showed more % of scavenging activity. Compound (**68i**) showed more percent of inhibition than L-ascorbic acid, **68a** and **68n** shown the activity close to L-ascorbic acid. Table 2 is a tabulation of the scavenging activity results of 14 indolo-,3,4-oxadiazoles derivatives.

The efficacy of antioxidants has been demonstrated to be impacted by the existence of indole structure. The heterocyclic nitrogen atom operates as a dynamic indole redox center because of the free electron pair that is present on it [38–41]. Consequently, the antioxidant potential of indole-based compounds appears to be significantly dependent on the migration of this electron pair within the aromatic system.

Table 2
Antioxidant activity of tested indolo-,3,4-oxadiazoles derivatives (**68a-68n**) by 2-DPH method.

Test Compounds	Concentration	Scavenging activity %
68a	(50 μg/mL)	39.15 ± 1.113
68b	(50 μg/mL)	29.19 ± 1.023
68c	(50 μg/mL)	22.50 ± 0.761
68d	(50 μg/mL)	29.11 ± 1.102
68e	(50 μg/mL)	24.22 ± 1.108
68f	(50 μg/mL)	32.23 ± 0.412
68g	(50 μg/mL)	22.20 ± 0.356
68h	(50 μg/mL)	32.22 ± 1.121
68i	(50 μg/mL)	45.11 ± 1.136
68j	(50 μg/mL)	26.18 ± 0.203
68k	(50 μg/mL)	28.80 ± 0.018
68l	(50 μg/mL)	35.10 ± 1.119
68m	(50 μg/mL)	22.16 ± 0.201
68n	(50 μg/mL)	39.03 ± 0.324
L-Ascorbic acid	(50 μg/mL)	40.77 ± 1.216
Butylated hydroxyl toluene	(50 μg/mL)	50.62 ± 0.803
Butylated hydroxyanisole	(50 μg/mL)	56.57 ± 0.216

All values are expressed in mean ± SEM of triplicate reading, n = 3).

Antibacterial activity

The antimicrobial efficacy of the recently synthesized indolo-,3,4-oxadiazoles derivatives (**68a-68n**) towards four bacterial species [*Staphylococcus aureus* (Gram positive species), *Escherichia coli* (Gram negative species), *Pseudomonas aeroginosa (*Gram negative species) and *Klebsiella pneumonia* (Gram negative species)] was assessed and compared to that of the well-established antibacterial pharmaceutical molecule, nitrofurazone. A 1 % dimethyl sulfoxide (DMSO) solvent control is used. Table 3 presents the findings of establishing the minimal inhibitory concentration (MIC, μg/mL).

Of the fourteen indolo-,3,4-oxadiazoles derivatives, eight compounds (**68a, 68b, 68d, 68e, 68f, 68 h, 68i, and 68j**) exhibited substantial activity (MIC 6.25 μg/mL) against the *Staphylococcus aureus*, while the other six compounds had a moderate degree of activity (MIC 12.5 μg/mL). With MIC of 6.25 μg/mL, compounds **68b**, **68e**, **68 h**, **68j**, **68 k**, **68 l**, **68 m**, and **68n** demonstrated notable inhibition against *Escherichia coli*, whereas the rest of the six compounds shown moderate inhibition (MIC 12.5 μg/mL). With MIC of 6.25 μg/mL, compounds **68b**, **68c**, **68e**, **68f**, **68 h**, **68j**, and **68n** shown noteworthy efficiency against *Pseudomonas aeroginosa*, whereas the remaining compounds demonstrated considerable efficiency at MIC of 12.5 μg/mL. Comparably, the MIC values of 6.25 μg/mL for six compounds (**68a, 68c, 68f, 68i, 68j,** and **68 k**) and 12.5 μg/mL for the remaining seven compounds indicated considerable efficacy towards *Klebsiella pneumonia*. Overall, all the indolo-,3,4-oxadiazoles derivatives (**68a-68n**) exhibited moderate to considerable activity against each of the four species tested. Though most of the indolo-,3,4-oxadiazoles derivatives are effective against particular species, some of them, particularly, compounds **68b, 68e, 68 h** and **68j** found effective against *Staphylococcus aureus, Escherichia coli,* and *Pseudomonasaeroginosa*.

The following factors could possibly be responsible for the antibacterial activity of novel fourteen indolo-,3,4-oxadiazoles derivatives (**68a-68n**) [42–48]:

- The oxadiazole moiety in the produced indolo-,3,4-oxadiazoles derivatives will make them more lipophilic, leading to the assumption that this lipophilicity may make it easier for the chemicals to pass through bacterial membranes.
- Altering the 1,3,4-oxadiazole nucleus by adding a phenyl ring or other substantial aromatic groups.
- The nitro group at the ortho and para positions of the phenyl ring and the presence of electron-withdrawing halogen groups.

Table 3
Antibacterial activity (expressed as MIC in μg/mL) of tested newly synthesized indolo-,3,4-oxadiazoles derivative compounds (**68a-n**).

Test Compounds	*Staphylococcus aureus*	*Escherichia coli*	*Pseudomonas aeroginosa*	*Klebsiella pneumoniae*
68a	6.25	12.5	12. 5	6.25
68b	6.25	6.25	6.25	12.5
68c	12.5	12.5	6.25	6.25
68d	6.25	12.5	12.5	12.5
68e	6.25	6.25	6.25	12.5
68f	6.25	12.5	6.25	6.25
68g	12.5	12.5	12.5	12.5
68h	6.25	6.25	6.25	12.5
68i	6.25	12.5	12.5	6.25
68j	6.25	6.25	6.25	6.25
68k	12.5	6.25	12.5	6.25
68l	12.5	6.25	12.5	12.5
68m	12.5	6.25	12.5	12.5
68n	12.5	6.25	6.25	12.5
***Nitrofurazone**	< 6.25	< 6.25	< 6.25	< 6.25
****DMSO (1 %)**	00	00	00	00

*Standard drug used: nitrofurazone, (50 μg/mL); ** Control.

- The antibacterial effectiveness of the indolo-,3,4-oxadiazoles derivatives can often be enhanced by methoxy substituents on the aromatic ring.

Drug likeness property

The drug resemblance features of the investigated indolo-,3,4-oxadiazoles derivatives (**68a-68n**) were assessed following Christopher Lipinski's rules. These guidelines aid in assessing a compound's drug-likeness by letting one know whether it is hydrophilic enough to dissolve in the stomach as well as lipophilic sufficiently to be absorbed through cell membranes. Table 4 is a tabulation of the drug likeness evaluation results of fourteen indolo-,3,4-oxadiazoles derivatives. The indolo-,3,4-oxadiazoles derivatives (**68a-68n**) have a "mass" below 500 Daltons, less than five number of "hydrogen bond donors", fewer than ten number of "hydrogen bond acceptors", and the "clogP" score of below five.

Conclusion

We have successfully synthesized fourteen novel scaffolds of 1,3,4-oxadiazole derivatives **(68a-n)** based on indole. In the field of medicinal chemistry, these derivatives are now undergoing extensive research. The newly synthesized fourteen indolo-,3,4-oxadiazoles derivatives (**68a-68n**) were evaluated for their antioxidant, antimicrobial and drug likeness properties. The antioxidant study was done by using 2-DPA method. Compound **68i**, which has fluoro functional group at 5th position of indole ring and *p*-hydroxy group on phenyl ring showed more inhibition (45.11 % scavenging) compared to ascorbic acid (40.77 % scavenging activity). But in case of compound **68a**, which has no functional group at indole as well as phenyl ring, and compound **68n** having fluoro substitution at 5th position of indole and *p*-nitro group at phenyl ring showed less inhibition (39.15 % and 39.03 % scavenging activity, respectively) compared to compound **68i**. However, these values are closer to ascorbic acid. The result shows that the compounds **68a** and **68n** possess antioxidant property close with respect to ascorbic acid and **68i** possess significant activity compared to ascorbic acid standard. The antibacterial activity of fourteen indolo-,3,4-oxadiazoles derivatives (**68a-68n**) were evaluated and most of them found effective against particular species, but some of them, particularly, four derivatives **68b**, **68e**, **68 h** and **68j** found effective against three bacterial strains *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeroginosa*.

Table 4
Drug like properties of newly synthesized indolo-,3,4-oxadiazoles derivative compounds (**68a-n**).

Compounds	Mass	clogP	Hydrogen bond	
			Donors	Acceptors
68a	261.28	3.88	4	1
68b	277.28	3.40	5	2
68c	275.31	4.33	4	1
68d	291.31	3.93	5	1
68e	279.27	4.04	4	1
68f	295.73	4.55	4	1
68g	306.28	3.83	7	1
68h	279.27	3.04	4	1
68i	295.27	2.56	5	2
68j	293.30	3.49	4	1
68k	309.30	3.10	5	1
68l	297.26	3.21	4	1
68m	313.72	3.72	4	1
68n	324.27	3.00	7	1

Future scope of this investigation

The promising results of our research on the new indolo-,3,4-oxadiazoles derivatives **(68a-68n)** pave the way for several future directions:

Further Optimization: Future studies could focus on optimizing the synthesis of these compounds to improve yield and purity.

- *Advanced Characterization:* Employing additional advanced techniques such as X-ray crystallography could provide deeper insights into the molecular structures and conformations.
- *In-vivo antioxidant activity studies:* The high scavenging activity observed for compounds 68a, 68i, and 68n suggests that further *in-vivo* studies are warranted to explore their potential as therapeutic agents in oxidative stress-related conditions.
- *Mechanistic studies:* Investigating the underlying mechanisms of the antioxidant activity could help in understanding how these compounds interact at the molecular level.
- *Antibacterial activity-broad-spectrum testing:* Expanding the range of tested bacterial strains, including resistant species, could provide a broader understanding of the antibacterial efficacy.
- *Combination therapy:* Exploring the potential of these compounds in combination with existing antibiotics might enhance antibacterial effects and overcome resistance.
- *Drug-likeness-pharmacokinetics and toxicology:* Detailed pharmacokinetic and toxicological studies are essential to evaluate the safety and efficacy of these compounds in clinical settings.
- *Formulation development:* Developing suitable formulations and delivery systems to enhance bioavailability and therapeutic effectiveness will be a critical next step.

CRediT authorship contribution statement

Aravinda Kumar Madugula: Investigation, Conceptualization. **Bachina Kiran:** Formal analysis. **B.N. Suresh Varma Dendukuri:** Validation. **T.V.N. Kishore:** Writing – original draft. **P. Srinivasa Rao:** Writing – review & editing. **Gururaja Ranagaih:** Supervision. **K. Jagadeesh:** .

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Machine Learning Techniques for Medicinal Leaf Prediction and Disease Identification

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Abstract: Trees have been a crucial component in humans' lives for hundreds of years, providing food, shelter, and medicine. Some trees have a lot of medicinal properties that cure many diseases. In the old days, Ayurvedic methods were popular for various treatments, but nowadays, the demand for foreign medicine is increasing gradually, which also has side effects. This paper addresses this issue by deciding on the medical conditions corresponding to a symptom and predicting an herb leaf that can be treated it using some modern machine learning techniques. We have used three machine learning methods to accomplish this goal: Multinomial Naive Bayes, Gradient Boosting and Random Forest. These techniques were then used to assess the symptoms and decide the name of the disease and which leaf is appropriate for medicine. The highest accuracy (92%) was produced by the Multinomial Naive Bayes algorithm, thereby showing its capability to predict the right medicinal leaf based on given symptoms. The results show that machine learning algorithms, especially Multinomial Naive Bayes, can identify diseases and recommend suitable medicinal leaves. This approach holds promise for integrating traditional Ayurvedic knowledge with modern technology to offer alternative treatments with potentially fewer side effects.

Introduction

A growing number of plants are being employed as medications thanks to our evolving interaction with them. As medical knowledge expanded rapidly, so did the availability of medicines derived from plants. The medicinal applications of plants mentioned in the Indian Vedas Traditional medical practices are being used today (Shi et al., 2021). Traditional medical practices based on plants are still very important in today's medical landscape (Rao et al., 2023). Herbal medicine, health goods, medicines, food supplements, nutraceuticals, and cosmetics are all experiencing rising demand. In the 21st century, natural products have accounted for more than 50% of all medications used in clinical practice.

The treatment of mental illness, skin illnesses, TB, diabetes, jaundice, high blood pressure, and cancer all make use of medications produced from plants (Sarris et al., 2021). In this study, we are going to determine which type of leaf can be utilized to treat human ailments in a specific manner (Rao et al., 2023). Prevention of Illnesses Machine learning is a method for predicting illness by evaluating the user's symptom data and arriving at a

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diagnosis. It also accurately predicts the user's illness based on the symptoms and information entered into the system. This is achieved using gradient boosting, random forest, and multinomial naive bayes algorithms to forecast disease based on symptoms. These algorithms are also used to predict the name of the leaves based on the condition. A proposed model can predict the sickness by considering a wide range of symptoms as input. Classifiers based on gradient-boosting decision trees, multinomial naive Bayes, and random forests are utilized in the recommended procedure for illness prediction. The mode of all of these machine learning models will be the final outcome.

Existed System

Many different systems are currently being used for disease forecasting. Only disease predictions can be made using the current systems.

The system cannot recommend leaves to treat the anticipated sickness.

Machine learning and a supervised learning algorithm, which require training data annotated with labels to provide accurate predictions, are commonly used in conventional disease risk models (Uddin et al., 2019).

Proposed System

The suggested system uses machine learning to construct a disease prediction model. This algorithm is selected from the following options: the Random Forest algorithm, the Gradient boost algorithm, the Multinomial algorithm, and the naive Bayes algorithm.

The user or patient can provide a minimum of two symptoms and a maximum of four symptoms to anticipate the output based on the input symptoms.

The name of the leaf, which indicates which diseases are treatable with certain leaves, can be used to predict the ailment and the corresponding medicine.

The leaves that can be used to treat a human disease are predicted by our method after the disease has been predicted.

Literature Survey

Integrating machine learning (ML) and deep learning (DL) based methods improves medicinal leaf prediction and disease identification, which can be used as a potential breakthrough for addressing many of the agriculture challenges concerning the traditional medicine field. Appropriate identification of medicinal plants is a prerequisite for employing them in traditional medicine, and modern computer vision techniques, together with machine learning (ML), have enabled the evolution of smart systems for this purpose. For example, the Medicinal Plant Leaf Identification System uses computer vision to extract a wealth of features from leaf images that are then analyzed by ML algorithms to accurately classify medicinal plants (Patil et al., 2023). Convolutional Neural Networks (CNNs) have been remarkably effective in this domain. The proposed way extracts and combines the textural features of the leaf images taken by a cell phone camera to improve plant identification accuracy with an instance classification method using CNN classifiers (S et al., 2024).

Fatima, M. et al. (2017) proposed a study that discusses the methodologies used for machine learning in the diagnosis of diseases such as hepatitis, dengue, diabetes, liver disease, and heart disease. Due to their effective attribute recognition, many algorithms have proven their worth. Using SVM increases the accuracy of heart disease detection by 94.60%, according to previous studies. Naive Bayes is effective in diagnosing diabetes. With a 95% accuracy rate in categorization, it is the best there is. The diagnostic accuracy of FT for liver illness is 97.10 percent. Using RS theory, we can detect dengue fever with a perfect rate of success. The feed-forward neural network successfully diagnoses hepatitis with 98% precision.

A disease prediction system based on machine learning algorithms in general is presented by D. Dahiwade et al. (2019). The rapid growth of medical data today requires us to use KNN and CNN algorithms to categorize patient data, which will correctly predict the disease based on the symptoms presented. It allowed them to model a sick or well state accurately if the arrival had patient record data as an input, so we now have some idea of how much such generalized risk could be accurate. This approach could speed up and require fewer supplies for illness prediction as well as risk evaluation. Compared with the results of the KNN algorithm, it was discovered that letting the CNN method classify for data can get better classification performance in a shorter processing time. Consequently, they concluded that CNN was better than KNN in terms of efficiency and precision having completed the project.

Raj and Masood (2020) suggested a range of ML and DL methods applied to autism spectrum disorder diagnosis. In order to test the models trained in a non-clinical context, we utilised multiple performance evaluation metrics for children, adolescents and adults with ASD. Furthermore, the results obtained from the multiclass CNN classifier were compared with another recent work of stock prediction based on support vector machine (SVM) and it was found that after handling missing values in our data set, the performance of SVM can be exceeded by using the proposed system. Both the

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SVM and CNN-based models achieve virtually comparable prediction accuracy of around 98.30% when missing values are handled for the ASD child dataset.

Recent evolutionary research on aloes' plant uses and leaf succulence has provided new information about the plant's astounding commercial dominance, according to Grace et al. (2015). Perhaps the plant's widespread acclaim in the industry might be attributed to its early introduction to trade and cultivation, its closeness to important old trade routes, or both. Medicinal usage of Aloes is most strongly correlated with the presence of mature succulent leaf mesophyll tissue, whereas declines in medicinal use are often associated with evolutionary losses of succulence. It appears that the genus Aloe was partially successful in its environment because of its succulent leaves, which have well-developed mesophyll tissue. Phylogenetic analyses of plant use shed light on the significance of plant diversity on a worldwide scale.

The first step to purify the crude ethanolic extract of S. grandiflora leaves is separating the different compounds according its solubilities by Nafisa et al. (2016). Some of the solvents used are ethyl acetate, petroleum ether, carbon tetrachloride chloroform and water. Researchers searched for antibacterial, anti-inflammatory membrane stabilizing, and antidiarrial effects in the extract. The drugs that served as standards were those for which the respective mode of action had already been clarified: for example, thrombolysis by streptokinase (platelet clearing), maintenance membrane stability improved with acetylsalicylic acid kanamycin produced a prophylactic effect in case of infection and loperamide was used to improve modulatory therapy.

Using a patient's symptoms, age and gender Manikanta et al. (2019) proposed methods to forecast the disease. Diseases could be predicted with a 93.5% degree of certainty utilizing the aforementioned criteria and the weighted KNN model. The accuracy values returned by the ML models were generally high. Some models failed to predict the disease and had a low accuracy rate because they relied too much on parameters. If we could forecast diseases, we could more efficiently allocate the drugs needed to treat them by Keniya, Rinkal et al., (2020). Using this technique would reduce the financial burden of treating the condition and speed up the healing process.

Materials and Methods

Data Collection: Data preparation is the initial stage in tackling any machine learning problem. Kaggle data and our own custom data will be used in this study. One CSV(Comma Separated Values) file is used for training, while the other is used for testing; the second CSV file has three columns: disease, leave name, and scientific name.

Cleaning the Data: In machine learning, cleaning is the first and foremost requirement. Our machine-learning algorithm can only produce accurate results if we use high-quality data. Therefore, data cleansing is always required before using it to train a model. All of our data's columns contain numbers, making them ideal for use as a target column.

Normalization: Symptom data were normalized to contribute equally to all features of prediction models.

Feature encoding: Categorical variables (like symptoms and disease names) were encoded using one-hot encoding techniques to be compatible with machine learning algorithms.

Model Building: In order to train a machine learning model, data must first be gathered and cleaned. The cleansed data will train decision trees, Multinomial Naive Bayes Classifiers (MNB), Gradient Boosting, and Random Forest Classifiers. The models' accuracy will be evaluated using a confusion matrix.

Multinomial Naive Bayes Algorithm: Multinomial Naive Bayes is a subset of the Naive Bayes method used when the features being considered are nominal by Rao et al. (2022). Applications of this algorithm include spam filtering, sentiment analysis, and subject classification. An enormous amount of training data is needed to estimate the probability of the characteristics in each class reliably.

$$P(A/B) = \frac{P(B/A)P(A)}{P(B)} \text{ ---------- (1)}$$

The Naive Bayes algorithm in machine learning has many variants, and one of the most helpful is Multinomial Naive Bayes, which can be used for a dataset with a multinomial distribution by Rao et al. (2023). When there are several classes into which to sort data, this method can be useful because, to determine what the text's label will be, it first determines the likelihood of each label for the input text and then produces the label with the highest probability.

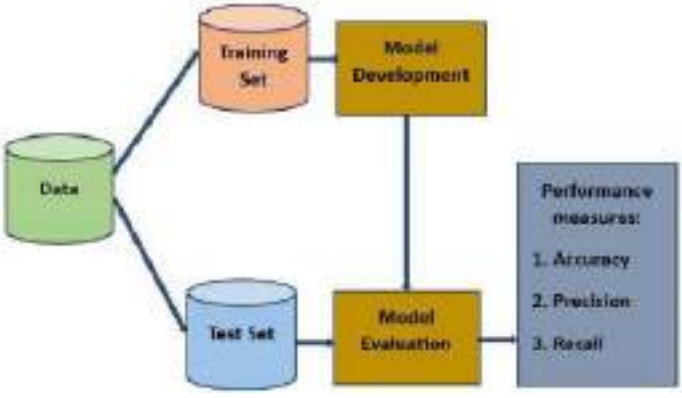


Figure 1. Multinomial Naïve Bayes Model.

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Gradient Boosting Algorithm: It is possible to use the robust machine learning approach called Gradient Boosting to address classification and regression issues. It is a form of ensemble approach that creates a strong learner by combining numerous weak learners, which are often decision trees.

$$\hat{y}_i = \phi(x_i) = \sum_{k=1}^{n} k = f_k(x_i), f_k \in F\# \quad (2)$$

$$F = f(x) = w_{q(x)}(q : R^m \to T, w \in R^t) \quad (3)$$

$$L(\phi) = \sum_i l(\hat{y}_i, y_i) + \sum_k \Omega(f_k) \quad (4)$$

Where L is the loss function to find the difference between the predicted value $\hat{y}_i$ and the target value y_i. Ω represents the complexity of the model (Mishra et al., 2020). The capacity of Gradient Boosting to handle complex interactions between variables and to automatically accommodate missing values is one of its most appealing features proposed by Salehi et al. (2019) and Parnami et al. (2018). In natural language processing, fraud detection, and predictive modeling, gradient boosting is a technique that is frequently utilized.

Random Forest algorithm: Random Forest, a popular machine learning technique, falls under the umbrella term of supervised learning. Application to machine learning problems such as classification and regression is encouraged.

$$Gini\ Index = 1 - \sum_{i=1}^{n} (P_i)^2 = 1 - [(P_+)^2 + (P_-)^2] \quad (5)$$

The Random Forest classifier averages the results of numerous decision trees trained on various subsets of the input data. As a result, the dataset's anticipated accuracy improves instead of relying on only one set of rules or decision trees. The random forest takes in all of the predictions from the trees, counts up the votes, and then produces its own prediction based on the most popular answers.

System Architecture:

The above Figure.4 is a First of all, we collect symptoms from users or patients. The patients are possible to give minimum of 2 and maximum of 4 symptoms. The system predicts disease by applying ML algorithms by Rao et al. (2023). Here, we used 3 algorithms: Random Forest, Multinomial Naive Bayes, and Gradient Boosting. To predict the medicinal leaf and identify disease, we need two datasets where one is collected from Kaggle and another one is prepared by us using Ayurvedic books. We predicted the medicinal leaf to cure the disease using the disease-identified and prepared dataset.

Result and Discussion

Machine learning methods have been used in diverse ways for plant disease recognition and identification. Different machine learning algorithms (such as random forest, k-nearest neighbor, and support vector machine) have been validated through several studies for plant disease diagnosis (Hang et al., 2019). In this work, we tried random forest, multinomial Naive Bayes algorithm (MNB), gradient boosting algorithms on Kaggle data and our own custom data.

Performance Evaluation Metrics

The following metrics evaluate the performance of the proposed model.

Accuracy: The ratio of correctly predicted medical images to total images is used to calculate accuracy.

$$Accuacy = \frac{TP + TN}{TP + FP + FN + TN} \quad (6)$$

Precision: The precision of medicinal leaf images is determined by calculating the ratio of true positive counts to the total number of true positive and false positive medicinal leaf images.

$$\text{Precision} = \frac{TP}{TP + FP} \quad (7)$$

Recall: To find the recall, add up all the positive and negative images, then divide the total by the sum of the two.

$$\text{Recall} = \frac{TP}{TP + FN} \quad (8)$$

F1-score: The F1-Score is the ratio of true positive values to the sum of true positive and false positive values in an image collection.

$$F1 - score = 2 * \frac{\text{Precision} * \text{Recall}}{\text{Precision} + \text{Recall}} \quad (9)$$

Where TP-True Positive, TN-True Negative, FP-False Positive and TP-True Positive

Above Figure 5 is the program interface, which lets the user give symptoms of the disease as input.

Figure 6 shows the accuracy of prediction with various algorithms. MNB gives better accuracy than others.

Comparative Analysis

The comparative analysis of the three models is summarized in Table 1. The Multinomial Naive Bayes model outperformed the Gradient Boosting and Random Forest models in terms of overall accuracy.

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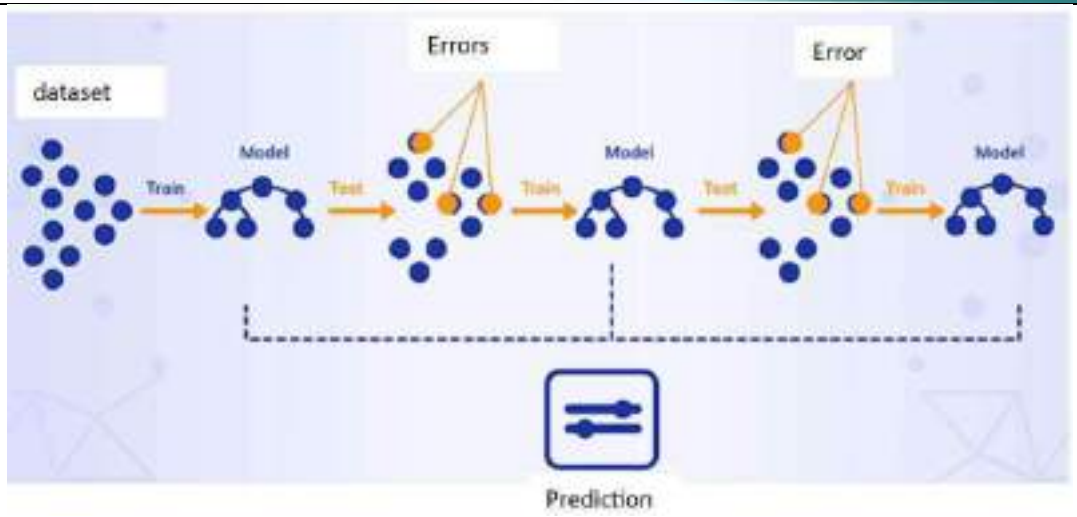


Figure 2. Gradient Boost Model.

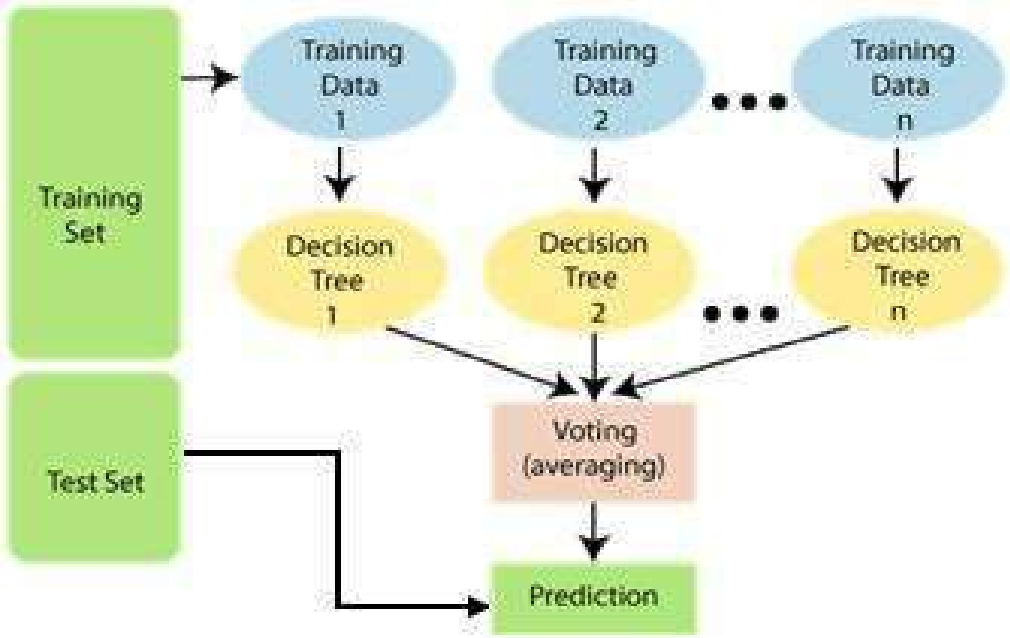


Figure 3. Random Forest Model.

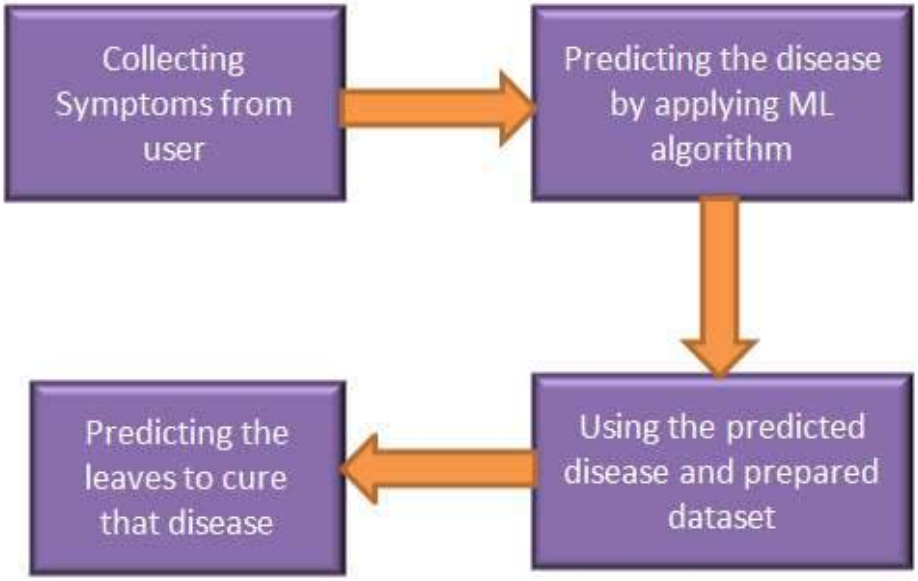


Figure 4. Architecture Diagram.

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Figure 5. List of Symptoms.

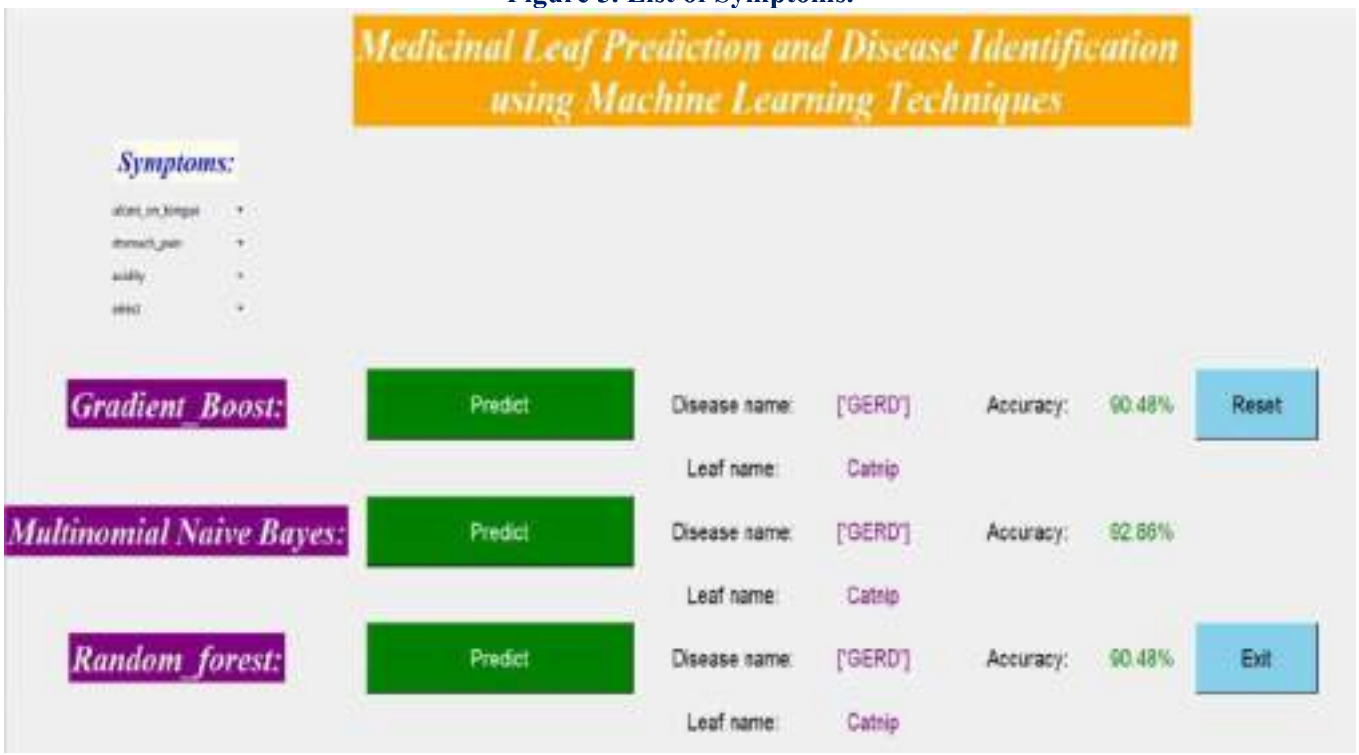


Figure 6. Prediction of disease.

Table 1. Comparative Analysis of three ML Models

Algorithm	Precision	Recall	F1-score	Accuracy
Multinomial Naive Bayes	91%	90%	90.5%	92%
Gradient Boosting	87%	86%	86.5%	88%
Random Forest	84%	83%	83.5%	85%

Disease Recognition Performance

However, the performance of models was quite different in identifying individual diseases. The Multinomial Naive Bayes model best predicted diseases with a clear set of symptoms. The Gradient Boosting model performed best in modeling diseases with complex and overlapping symptom patterns, while the Random Forest model outperformed others on specific symptom-patterned disease models.

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Due to the high accuracy, flexibility and robust nature of Multinomial Naive Bayes model, it becomes very useful in integrating Ayurvedic practices with modern technology. This provides an opportunity for less harmful treatments with lower side effects to act as a complementary force against mainstream medicine. The model can be integrated into mobile applications, which will assist users in far-flung regions to access ancient medicinal knowledge.

Conclusion and Future Scope

This paper predicts the disease suffered by humans based on symptoms given by using ML algorithms, namely Random Forest, Gradient Boost and MNB. It takes symptoms as input, it predicts and generates disease name and leaf name to cure that disease as output. In this paper MNB algorithm provides a high accuracy of 92%, compared to other algorithms, giving better prediction than the remaining.

Future Scope

In the future, we can extend this paper by taking input as images of symptoms like MRI CT scans.

Display of leaf images can also be added as an output.

Conflicts of Interest

According to the authors, there is no conflict of interest.

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Review Article

Toxicity Associated with Gold Nanoparticles: A Review

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Gold nanoparticles (AuNPs) are by far the most studied nanomaterials by the scientific fraternity, possibly due to their immense potential in medical applications. Nevertheless, there is a disparity of opinion that prevailed concerning the toxicity of AuNPs. This study, therefore, presents a systematic review concerning toxicity related to AuNPs with the help of recently published databases. The disparity is due to the fact that the adoption of various protocols in the assessment of toxicity over the years that led to divergent views about the actual safety of AuNPs. This paper has considered a few recent research works and their databases to assess the toxicity of AuNPs *in vivo* and *in vitro*. Further, this paper also discussed the possible approaches that could effectively minimize the lethal effects of AuNPs and elaborated on the future scope of this interesting and highly useful research. For time being, it is concluded here that nanomaterial safety data are scarce, and it is not even an exaggeration to say that that is even scarcer than reported.

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Introduction

Ever since the term nanotechnology was coined by Norio Taniguchi, a professor at Tokyo University, Japan in the year 1974, several prominent research and development (R&D) organizations, academic and non-academic institutions, and others have ventured their efforts across the globe to gain benefits out of this ever-growing field. The growth of nanomaterials and nano-products synthesized (engineered) using nanoscience and nanotechnology has been phenomenal and non-linear, as rightly predicted by Richard Feynman in his speech at the American Physical Society (1959) at Caltech that 'There's Plenty of Room at the Bottom'. Nanomaterials' widespread use and success can be attributed to their distinct qualities compared to their bulk counterparts, such as lightweight, low cost, small size, and more durability, to mention a few.

Other properties such as chemical (reactivity and reaction rates), electrical (conductivity), magnetic, optical (colour and transparency), and physical (hardness and boiling point) have altered significantly as a result of nanoscience and nanotechnology and are now extremely valuable in the manufacture of high-end products. It may not be an exaggeration that there are no scientific, research, medical, aerodynamics, space, and other industrial fields that have not used nano-enabled products. For instance, engineered nanomaterials (ENMs) find potential applications in medicine, pharmaceutics, biotechnology, energy production, environmental sciences, crop protection, transportation, housing, and electronics. Still, there is a considerable proliferation of ENMs and nanocomposites in the market, thanks to this ever-increasing field on a day-by-day basis. The nanoscience enabled nanomaterials/products were successfully used in the eradication of corona virus disease-2019 (COVID-19) [1].

Researchers, on the other hand, have proposed two schools of thought. One school believes there are no risks related to nanomaterials, while the other institution disagrees. Certain characteristics of anthropogenic origin nanomaterials, such as their size, mobility, and significant interaction with the host where they are deposited and dispersed, may make them dangerous. After recognizing this potential distinction, a few research groups have

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Figure 1: Most common gold nanoparticle assemblies and morphologies (After Freitas et al., 2018, Reference [11])

already initiated significant research under the name of "nanotoxicology research". In order to adequately address nanotoxicology and its detrimental implications, if any, on humans, animals, the environment, and other living species, it is necessary to examine and understand recent technical advancements in the field of nanotechnology.

Nanomaterials found in the human environment may have the potential for toxicological effects. However, the current literature on the toxicological effects of nanomaterials is diverse. The current data are presented from studies without harmonization [2]. These studies have used different in vitro and in vivo test models, different sources of test nanomaterials, different methods for nanomaterial characterization, and different experimental conditions. Therefore, these data are hard to interpret. More research on nanomaterial characterization, biological interaction, bio distribution, toxicity, and health effects are needed. The test methods need to be validated. Positive and negative controls for nanotoxicity need to be identified. Toxicity data harmonization needs to be done. Therefore, general information is not currently available for risk evaluation of certain nanomaterials that might be present in consumer products or that may enter the market in the future. Standardized and validated methods are necessary for the toxicity assessment of nanomaterials. Therefore, in the absence of standardized validated methods, any specific regulatory testing requirements for nanomaterials are currently premature. The benefits of nanomaterials found currently in the human environment are many, but their overall adverse effects on human health are limited [3].

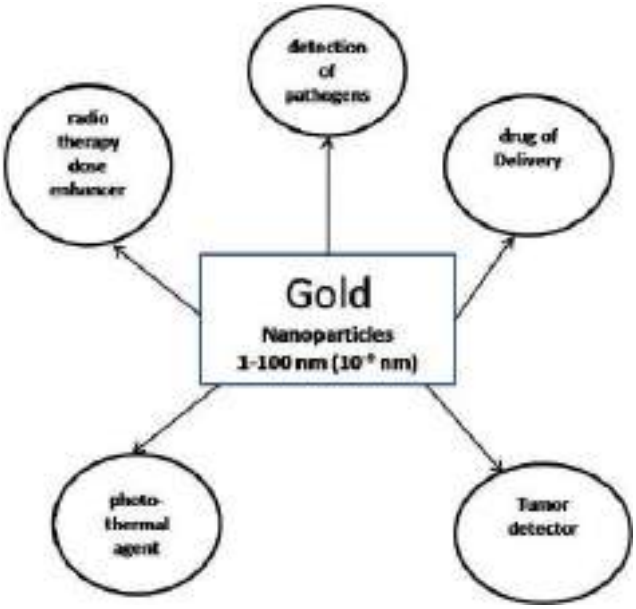


Figure 2: Gold nanoparticles medical applications (After Gerber et al., 2013, Reference [13])

In recent years, various studies have been conducted to determine the potential toxicity of nanoparticles in response to significant concerns regarding nanotechnology's safety. Nanomaterials' distinctive qualities, such as their extremely small size, high reactivity, and unique tensile property, as well as their considerable magnetic properties, have sparked a great deal of interest in their use in biological, environmental, and industrial applications. As a result, concerns regarding the impact on the environment, human health, and safety have been raised. For example, there was a lot of debate about the toxicity of carbon nanotubes (CNTs), which are thought to induce tissue damage in animals [4]. On the other hand, various research investigations on the toxicity of CNTs have come up with conflicting results [5].

Unlike CNTs, the variety of AuNPs and their biomedical uses continues to grow daily. Biosensorics, bioimaging, photothermal treatment, targeted drug delivery, and mushroom growth are some of the applications of AuNPs. Therefore, human safety problems are becoming increasingly prominent. As a result, a deeper understanding of the potential toxicity hazards of current AuNPs and the resulting AuNPs has become critical. With the aforementioned considerations in mind, this research highlighted two crucial issues: a comprehensive recent review of AuNPs nanotoxicity, as well as feasible approaches to reduce or eliminate the lethal consequences of AuNPs toxicity.

Recent Studies of Gold Nanoparticles Toxicity: *In vivo* and *In vitro*

Numerous AuNPs shapes and topologies have been fabricated using various synthetic approaches. Nanospheres, nanoshells, nanorods, nanoclusters, nanocages, and nanostars are some of the diverse shapes of AuNPs [6-10]. The most common gold nanoparticle assemblages and morphologies are depicted in figure 1 (after Freitas et al., 2018, [11]). AuNPs are widely utilized across the medical field due to their excellent biocompatibility, because of their high chemical and physical stability and ease to functionalize with biologically active organic molecules or atoms [12]. Various medical applications of AuNPs can be found in figure 2 (after Gerber et al., 2013 [13]). AuNPs can directly conjugate and interact with diverse molecules containing proteins, drugs, antibodies, enzymes, nucleic acids and fluorescent dyes on their surfaces for diverse medical applications and biological activities [14-16].

Figure 3 shows how various molecules conjugate with AuNPs (after Hu et al., 2013 [10]). As previously indicated, there is a wide divergence of opinion among researchers on the toxicity of AuNPs. This paper initially, therefore, presents the literature survey of AuNPs toxicity, followed by summarizing a few studies associated with AuNPs toxicity (*in vivo* as well as *in vitro*) in table 1 and table 2, respectively.

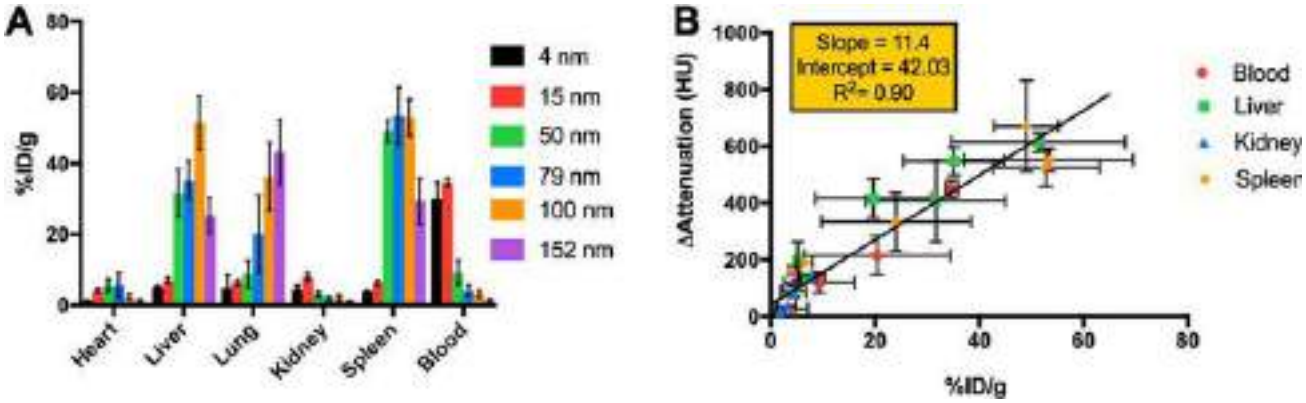


Figure 3: (A) Biodistribution of AuNP in different organs at 2hours post-injection. A Tukey's multiple comparisons test was done to compare the interactions between each AuNP size. (B) Comparison between the attenuation change in different organs derived from CT scans performed at 2hours post-injection and biodistribution of AuNP in different organs at 2hours post-injection (After Dong et al., 2019, Reference [49])

Biological Eeffects of AuNPs: A Comprehensive Viewpoint

As already stated in the introduction, as AuNPs have been widely used in various biomedical fields, human health may get affected through nanoparticle-protein interaction, immunogenicity, and cytotoxicity.

It was righteously articulated by Saptarshi et al. [37] that the interaction of nanoparticles with proteins is the basis of nanoparticle bio-reactivity, and this interaction gives rise to the formation of a dynamic nanoparticle-protein corona. The protein corona may influence cellular uptake, inflammation, accumulation, degradation and clearance of the nanoparticles. The nanoparticle surface can induce conformational changes in adsorbed protein molecules, which may affect the overall bio-reactivity of the nanoparticle. In depth understanding of such interactions can be directed toward generating bio-compatible nanomaterials with controlled surface characteristics in a biological environment [37].

Gold nanoparticles synthesized using citrate and *Z. officinale* extract demonstrated very low protein adsorption, as reported by [38]. Both nanoparticles were non-platelet activating and non-complement activating on contact with whole human blood. They also did not aggregate other blood cells. However, nanoparticles synthesized with *Z. officinale* extract were highly stable at

Table 1: Recent studies of AuNPs *in vivo* toxicities

Organism	Possible Effects	Type of synthesis	References
Mice	High concentrated AuNPs induced decreases in body weight, red blood cells, and hematocrit.	Water-soluble gold nanoparticles	[17]
Mice	Alteration in cell shape, inhibition of proliferation, or mutation in DNA	Polyethylene glycol (PEG)-coated AuNPs	[18]
Swiss Mice	Trans-placental size-dependent clastogenic and epigenetic effects	Water-soluble gold nanoparticles	[19]
Rats	DNA damage in the cerebral cortex	Water-soluble gold nanoparticles	[20]
Sprague-Dawley rats	No threats were found	Water-soluble gold nanoparticles	[21]
Wistar Rats	Potentially safe (no cardio toxic effects, echocardiography, arterial pressure, biochemical and histopathological analyses were found)	Biodegradable lipid-core nanocapsules	[22]
Albino rats	Histological changes in the lung tissue	Water-soluble gold nanoparticles	[23]
Rats	Mild changes in kidney, liver and testis	Biological and Fusarium oxysporum	[24]
Rats	Lung retention was found	Bio-persistent gold nanoparticles	[25]
Male albino rats	Ultra-small AuNPs showed low or no toxicity	Green synthesized ultra-small gold nanoparticles (Egyptian propolis extract)	[26]

Table 2: Recent and significant studies of AuNPs *in vitro* toxicities

Organism	Possible Effects	Type of synthesis	References
Cervix carcinoma epithelial cells (HeLa)	Necrosis	Water-soluble gold nanoparticles	[27]
Small airway epithelial cells (SAECs)	Oxidative stress-related cytotoxicity and genotoxicity in SAECs	Water-soluble gold nanoparticles	[28]
Human primary lymphocytes and murine macrophages	Proliferative activity, mitotic, apoptotic, necrotic markers, chromosomal damage	Spherical citrate-capped Au NPs	[29]
Bronchial epithelial cell line BEAS-2B, Human embryonic kidney cell line	Chinese hamster ovary cell line CHO damage	Citrate stabilized gold nanoparticles	[30]
Somatic and tumor cells	No significant cytotoxic effects found	Chitosan based gold nanoparticles	[31]
Chinese hamster ovary cells	No genotoxic effects found	Citrate-stabilized gold nanoparticles	[32]
Heart, kidney and lung	Larger sizes (42.5 and 61.2 nm) and smaller size (6.2 and 24.3 nm) AUNPs induced oxidative stress	Water soluble AuNPs	[33]
Human Cancer Cells	Toxic threat found	Biomimetic gold nanoparticles	[34]
Cholesterol molar ratio, Span 60: Tween 60 M ratio	Showed dose-dependent cytotoxicity and significant up-regulation of mRNA expression	Green synthesis AuNPs	[35]
Gastric buffer	Showed lesser toxicity	Cabotegravir - biodegradable gold nanoparticles	[36]

physiological conditions compared to citrate capped nanoparticles, which aggregated.

Ajdari et al. [39] investigated AuNPs interactions in blood using thromboelastography as a rapid screening tool to monitor their influence on blood coagulation. The 1.2 nM colloidal AuNPs ranging from 12 to 85 nm do not affect the blood. However, 5 nM AuNPs demonstrate pro-thrombogenic concentration-dependent effects with a reduction in clot formation.

To better understand the interaction of AuNPs with common human blood proteins, [40] performed absorbance, fluorescence quenching, circular dichroism, dynamic light scattering, and electron microscopy measurements on surface-functionalized water-soluble AuNPs having a diameter range from 5 to 100 nm in the presence of common human blood proteins: albumin, fibrinogen, ã-globulin, histone, and insulin. It was found that the gold NPs strongly associate with these essential blood proteins where the binding constant, *K*, and the degree of cooperativity of particle"protein binding (Hill constant, *n*), depends on particle size and the native protein structure. Further, is also found tentative evidence that the model proteins undergo conformational change upon association with the NPs and that the thickness of the adsorbed protein layer (bare NP diameter <50 nm) progressively increases with NP size. These effects have potential general importance for understanding NP aggregation in biological media and the interaction of NP with biological materials broadly.

While studying the protein adsorption, blood cell aggregation, and C3 adsorption onto AuNPs to evaluate their complement activation potential and blood compatibility, it has been observed that these nanoparticles do not induce any complement activation or blood cell aggregation [41]. It has also been reported that particles were non-hemolytic, and the adsorptions of proteins were negligible, further validating its significance in drug delivery and gene delivery applications.

An attempt has been made to evaluate the protein adsorption, blood compatibility and complement activation potential of two batches of Swarna bhasma preparation, along with its physicochemical characterization [42]. Red blood cell hemolysis, aggregation studies with blood cells, protein adsorption, complement C3 adsorption, platelet activation and tight junction permeability in the Caco-2 cell line were investigated. It was reported that the Swarna bhasma preparations with a crystallite size of 28-35 nm did not induce any blood cell aggregation or protein adsorption. The activation potential of these preparations towards the complement system or platelets was negligible. These particles were also non-cytotoxic. Swarna bhasma particles opened the tight junctions in Caco-2 cell experiments. The results suggest the application of Swarna bhasma preparations as a therapeutic agent in clinical medicine from a biological safety point of view.

He et al. [43] investigated the possible effects of polyethene glycol-coated AuNPs (PEG@AuNPs) and citric acid-coated AuNPs (CT-AuNPs) on the blood cell function and distribution of those nanoparticles in blood components including erythrocytes, leukocytes, platelets (PLTs) cells and plasma. It was found that the amount of CT-AuNPs engulfed by leukocytes was four folds more compared to PEG@AuNPs, indicating that PEGylation might have the ability to escape the immune system. It is also reported that each leukocyte uptake more AuNPs particles than individual platelet.

Ma et al. [44] described a universal bio-conjugation approach that uses a new recombinant fusion protein combining two distinct domains. These researchers have identified and characterized the remarkable ability to bind gold nanoparticles (GNPs) by forming

gold–sulfur bonds (Au–S). The C-terminal part of this multi-domain construct is the SpyCatcher from *Streptococcus pyogenes*, which provides the ability to capture recombinant proteins encoding a SpyTag. It was shown that SpyCatcher could be immobilized covalently on GNPs through GST without losing its full functionality. It was also demonstrated that GST-SpyCatcher activated particles can covalently bind a SpyTag modified protein by simple mixing through the spontaneous formation of an unusual isopeptide bond.

Once nanoparticles enter the bloodstream, they become in contact with the different components of the blood and can potentially interfere with normal platelet function leading to bleeding or thrombosis [45]. As metallic NPs have already been used for diagnosis and treatment due to their unique characteristics, the potential interactions between metallic NPs and platelets have not been widely studied and reported. This review article focuses on the factors that can affect platelet activation and aggregation by metal NPs and the nature of such interactions, providing a summary of the effect of various metal NPs on platelet function available in the literature [45].

A first-time investigation on the effects of polymeric, metallic and nonmetallic nanoparticles on red blood cells' hemocompatibility was done by Mehrizi [46]. The authors reviewed the reported impacts of polymeric, metallic and carbon-based nanoparticles on Red Blood Cells (RBCs). Their study results have shown that using negatively charged dendrimers, unsaturated/uncharged liposomes, and PEGylated forms of NPs and RBCs are the best approaches to improve the hemocompatibility conditions of red blood cells. However, large cationic dendrimers, liposomes composed of saturated lipid with long acyl chains, and cationic chitosan nanoparticles have less RBC compatibility. In addition, polymeric nanoparticles have more surface modification capacity, making it possible to make more hemocompatible derivatives. Among metallic nanoparticles, gold and iron nanoparticles were more RBC compatible. However, the smaller size, higher concentration and longer exposure time of these nanoparticles can induce hemolysis and morphological changes in RBCs. On the other side, nonmetallic nanoparticles mostly had poor RBC compatibility, but their effects on RBCs strongly depended on their concentration and physicochemical properties and could be controllable. As a result, the use of polyethene glycol (PEG), gold, polymeric, and iron nanoparticles in the design of protocols to maintain the survival, structure and activity of red blood cells for improving hemocompatibility can be more effective.

Is it possible to alter nanoparticles from the toxic nature to make non-toxic nature?

Since nanoparticles have a wide range of applications in biomedicine and as drug delivery carriers, developing biocompatible and non-toxic nanomaterials is critical. Understanding the mechanism of nanoparticle toxicity will help researchers create nanoparticles that are less harmful to the environment. The redesign techniques must be chosen based on the principal mechanism of toxicity, as well as what changes to the nanomaterial can be made without affecting its ability to perform in its intended use. Nanomaterials can be constructed to have a negative surface charge, employ ligands like polyethylene glycol to inhibit protein binding, or have a shape that discourages binding with a cell surface to limit interactions with the cell surface. The toxic species can be replaced by less harmful components with similar characteristics to reduce nanoparticle dissolution to toxic ions. The nanoparticle can be capped with shell material, and the nanoparticle's morphology can be chosen to reduce surface area and therefore disintegration.

In addition, a chelating agent can be co-introduced or functionalized into the nanomaterials' surface. The band gap of the material can be modified either by utilizing various elements or by doping, a shell layer can be added to prevent direct contact with the core, or antioxidant molecules can be attached to the nanoparticle surface to limit the generation of reactive oxygen species. It's critical to examine whether a redesign method minimizes toxicity to species in relevant environmental compartments while redesigning nanoparticles. It's also important to make sure the nanomaterial retains the crucial physicochemical features that led to its inclusion in a product or device.

Conclusion

Undoubtedly, gold nanoparticles (AuNPs) are by far the most studied nanomaterials, primarily due to their immense potential in biomedical applications. As a consequence, it is obvious that huge demands surfaced to evaluate the health impact of these materials. Certain aspects could force us to believe the toxicity threat of AuNPs.

For instance, small-sized AuNPs may have been associated with toxicity, due to fact that their high surface area relative to their volume. This leads to enlarged absorption capacity and may increase the chance of interacting with biomolecules, effectively [47]. Secondly, AuNPs are believed to be the least toxic, and thus the most appropriate for biological/medical applications. However, due to their low rate of clearance from circulation streams and tissues, they may lead to health problems [48]. Further, the toxicological behavior of gold nanoparticles can be influenced by the physicochemical properties, including size, shape, surface charge, and other factors, such as methods used in the synthesis of gold nanoparticles, models used, dose, *in vivo* route of administration, and interference of gold nanoparticles with *in vitro* toxicity assay systems.

Most engineered nanoparticles are far less toxic than household cleaning products, insecticides used on family pets, and over-the-counter dandruff remedies. Certainly, the nanoparticles used as drug carriers for chemotherapeutics are much less toxic than the drugs they carry and are designed to carry drugs safely to tumors without harming organs and healthy tissue. Most importantly, this review points towards the toxicological aspect of AuNPs, albeit a few studies are denying that important fact. For time being, it may be reasonable to conclude here that more *in vivo* studies are necessary to precisely examine the effects of nanoplastics in human physiology, together with accurate quantification of environmental nanoparticle loads and a more standardized methodology to address the confounding variability of in vitro approaches.

Future scope

There is a great scope for this ever-increasing research. To elaborate, the toxicity and biodistribution profile of differently sized AuNPs still remains controversial and incomplete, thus hindering their further applications. But, the positive ray of hope is that several results of the biodistribution show that AuNPs with larger sizes, approximately 42.5 and 61.2 nm, accumulated mainly in liver and spleen while little or none were found in heart, kidney and lung.

On the other hand, smaller ones, approximately 6.2 and 24.3 nm, are distributed not only in liver and spleen but also in other organs. Additionally, most of the AuNPs were excreted out in less than 30 days, whereas there were still bits of remains in liver and spleen up to 90 days, especially for the 42.5 and 61.2 nm Au NPs. These findings are meaningful for the design of the AuNPs in the biomedical fields in the ensuing days.

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Disease Detection In Dental Patients Using Machine Learning Algorithms Through Image Analysis

6

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Abstract: The teeth are the hardest substance to work with inside the human body. The intricacy of the operation experience, low efficiency, and higher user involvement of current approaches for diagnosing dental issues. Older methods of oral disease detection were laborious, manual, and required a dentist to examine and assess the illness. We suggest a unique method for identifying and categorizing dental caries, the most prevalent issue with teeth, in order to allay these worries. Cavities come in three varieties: while root cavities form on the surface over the roots of your teeth, smooth surface cavities form on the smooth sides of your teeth. On the chewing surface of your teeth, there are pit and fissure cavities. In order to identify the dental cavity issues previously described, to identify these disorders, we gathered information from the Vishnu Dental Hospital in Bhimavaram and subsequently created a dataset of Dental Intra Oral Periapical Radiograph (IOPA) pictures. In this regard, we employed the YOLO (You Only Look Once) version 3 deep learning model to develop a robotic system that can recognize and classify dental abnormalities, like by using IOPA images to recognize various cavity problems. Last but not least, the technology for automatically detecting and classifying dental problems will help with early illness detection and maybe stop tooth loss.

Keywords: Dental caries, Deep learning, IOPA, Tooth, YOLOV3, Dentistry, Annotation, Augmentation

1. Introduction

A relatively new area of dentistry called dental informatics supports and enhances the diagnostic processes used in dental practices, decreases time and stress in people's daily lives [1]. Restorative dentistry, endodontics, orthodontics, dental surgery, and periodontology are the primary branches of dentistry. Any dental operation that restores or replaces a tooth is referred to as restorative dentistry. One example of a restorative procedure is dental work including root canals. The area of dentistry known as endodontics deals with the pulp of the teeth and the tissues that surround their roots. The area of dentistry known as orthodontics deals with dental irregularities and methods to treat. Dental surgery includes various broad medical procedures that incorporate deliberate alteration of dentition. For example, operations on gums, jawbones, and teeth.

Dentistry's branch of periodontology treats conditions affecting the alveolar bone, gums, and other supporting and enclosing tissues of the teeth, including cementum and periodontal ligaments [2]. Cavities, which result in places with irreversible damage to the tooth's hard surface that manifest as tiny holes or gaps, are the most prevalent dental disease.

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Diagnosis of dental issues is now the responsibility of dentists. They examine the teeth and gently move them to look for probable dental issues. The automatic detection of dental issues has not made much progress. Manual study of tooth issues is necessary for disease classification and identification, and it takes time and expertise. Human mistakes can cause manual analysis to produce inaccurate predictions. The computerized approach for identifying and categorizing dental issues will help in the early diagnosis of diseases and could stop tooth loss. It will help to do away with labor-intensive, time-consuming manual clinical evaluation. Medical imaging techniques like CT scans and X-rays have historically been very helpful in the treatment and diagnosis of a wide range of disorders [2].

A radiographic X-ray generator can create radiographic X- rays that pass through the mouth when tissues absorb radiation. The projective-radiography technique creates 2D images of the internal anatomy of the human body [3]. It is challenging to assign computer specialists to dentists because the introduction of sensor pictures with high- resolution biosensors has produced enormous data that can be analyzed using software programs to help dentists in making diagnosis decisions [4].

In our proposed methodology, we present a deep learning-based approach to assist dentists in accurately recognizing dental abnormalities in patients utilizing IOPO Images.

The suggested strategy for oral health care can be implemented in the clinic to help find dental issues. It is a reliable, effective, and cost-effective solution that will considerably improve oral healthcare. For the classification and detection of diseases, manual investigation of dental issues demands time and competence. Additionally, manual analysis runs the risk of making incorrect predictions as a result of human error or misunderstanding. However, the computerized approach for identifying and categorizing dental issues will facilitate early detection and could stop serious issues like tooth loss. Additionally, it will help with the elimination of laborious, time-consuming, and manual examinations. Due to these factors, we suggest the YOLOv3 deep learning model. We will train and test using the gathered data set.

Our proposed work's primary contributions are as follows:

- The dataset has to be cleaned up and improved as a first step. Vishnu Dental Hospital provided a small dataset that was used to identify dental diseases. We will produce a special dataset for the investigation of dental diseases. For the processing of this domain's dataset, data labeling is done by a qualified dental surgeon. Different kinds of classes are present in the databases. A dataset of intraoral panoramic radiograph (IOPA) images of various patients was gathered from secondary and tertiary care facilities throughout this phase.

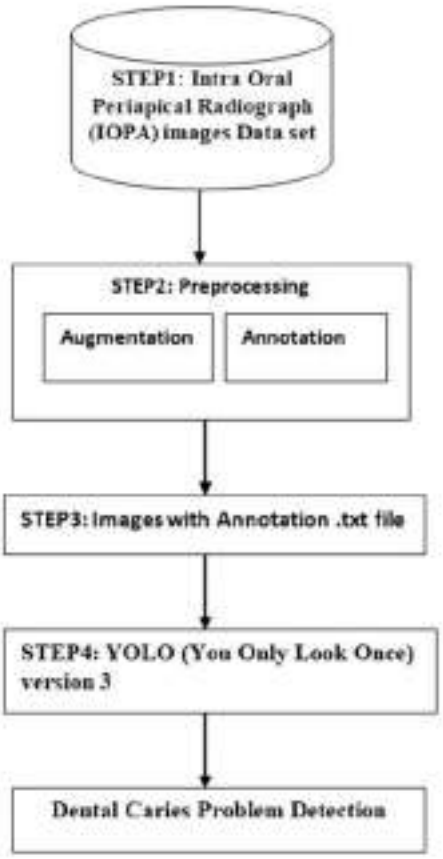


Fig. 6.1 Proposed architecture work flow for the teeth disease

- The augmentation process, which comprises numerous image variants. The last step in image annotation is to utilize the LabelImg application, which generates a.txt file with annotations for each image. Using the dataset from the second phase, the third iteration of the YOLO deep learning model was trained.

2. YOLO V3

This research presents the YOLO V3 deep neural network model for the classification of dental issues. The suggested method uses IOPA images to identify various oral issues.

YOLO V3 is an object identification algorithm that recognizes particular objects in real-time in movies, live streams, or pictures. It is capable of predicting several things in a single image. The deep convolutional neural network characteristics learned by the YOLO machine learning system are used to recognize objects.. It will anticipate the object only once without repeating it. Versions 1-3 of YOLO were created by Ali Farhadi and Joseph Redmon.

The architecture of YOLO V3 is shown in Fig. 6.2. A matrix of pixel values that is used to feed an image into the model

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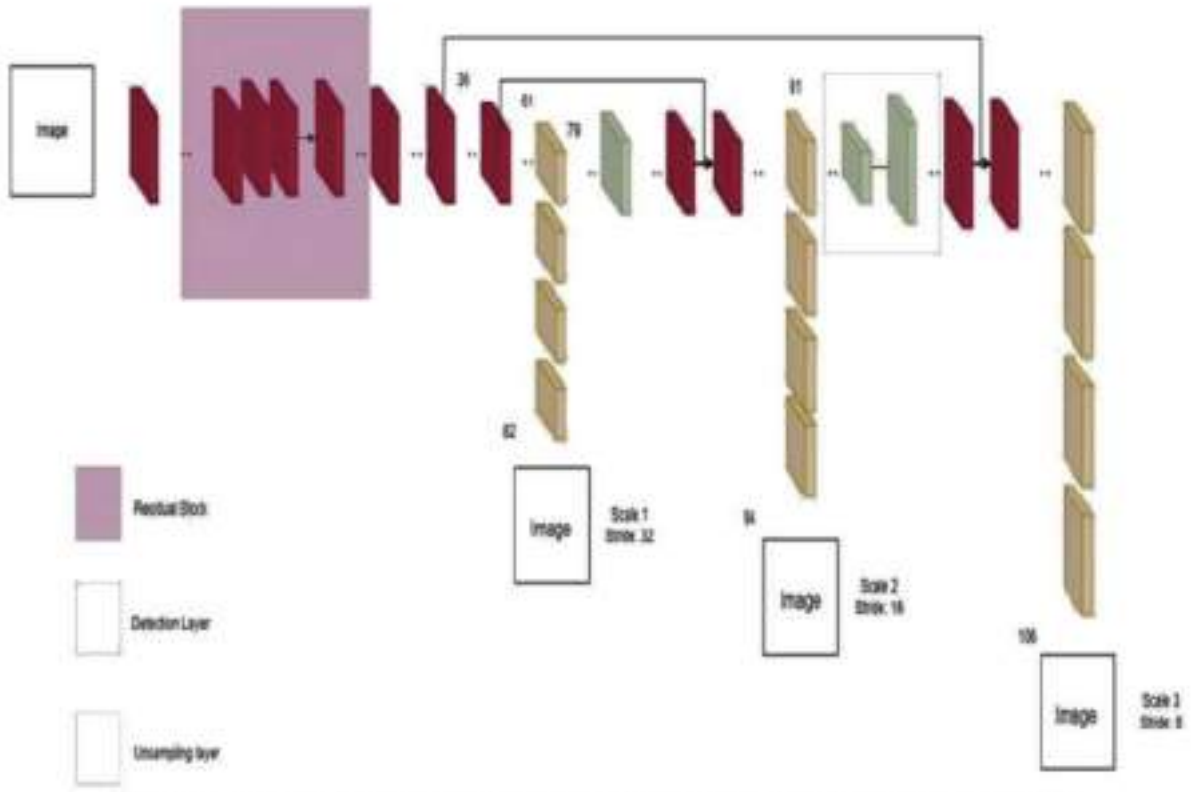


Fig. 6.2 The foundation for feature extraction in YOLO V3 is the Darknet-53 architecture

[5]. In the image, the convolution network looks for patterns. Based on similarities to previously learnt data, this model "scores" a region. High-scoring regions receive positive detections for the class they most closely resemble. This technique works by creating grids out of the image. Given a high score value, the bounding box count that will encircle the object will be predicted by the grid cells. Each bounding box is assigned a confidence value that represents the accuracy of the forecast [6].Only one object can be detected by each bounding box. In order to identify which shapes and sizes are the most comparable, to create the bounding box, the dimensions of a number of ground truth boxes obtained from the training data are combined.

This method's foundation for feature extraction is what makes it viewed as quick. The facility is known as Darknet-53. Two completely linked layers and 24 convolutional layers make up this structure. The twenty convolutional layers are joined by a pooling layer and a fully linked layer. An ImageNet dataset was used to train this base before. Three convolutional layers and one reduction layer make up the layers. The model is trained using four convolutional layers and two fully linked layers. Forecasting the likelihood of each and the bounding box is done using the final layer. Each layer is activated using ReLu, and the top layer is activated using linear.

3. The Proposed Methodology

A methodology has been put forth to address the issue of identifying dental caries. The dataset was made up of about 100 photos, of which about 80 served as training data and 20 served as testing data.

It is an efficient technique for object detection and classification that uses an object detection model. In accordance with this approach, a single neural network will be able to forecast the bounding boxes and class probabilities for the image in a single evaluation. The complete detection pipeline is contained within a single network, enabling end-to-end adjustment of the detection performance metric. But because they employ a pipeline execution architecture, the network must be forced to interact with each component independently. Various methods have been employed to find items. Training takes longer as a result, and optimization is more difficult. The YOLO V3 approach uses a neural network to create an output vector containing bounding box and class probability coordinates from an input image. This method uses Darknet-53. It was educated using Imagenet, as depicted in Fig. 6.2. After 53 additional layers are added to the framework to do detection, our 106-layer network is currently supporting the design. The M x N grid cells with a size of N are divided into the YOLO V3 algorithm from the input image. Every grid

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has the ability to find and recognize the image. Using class labels and class probabilities, all grid cells may then predict the object's bounding box coordinates. Implementing a 1x1 kernel on a feature map made up of variously sized features at various points across the structure allows for detection. Dimensions of the detection kernel are 1x1x(Bx(5+C)). The letter B stands for the bounding box prediction capability of the featured map cells. Five bounding box features and one confidence item make up the number "5". Last but not least, "C" denotes the quantity of classes. Binary cross-entropy is utilized to quantify classification loss, while estimations of object probability and class probability are obtained using logistic regression. The YOLO V3 commonly converts a picture entered into an output vector, as was already said.

The following parameters make up the output vector:

1. *Class probabilities:* This shows the possibility that an object will be found inside the bounding box and that it belongs to a Single class.
2. *Values of bounding boxes:* The Cartesian position, width and height of the bounding boxes are all given.
3. *Prediction probability:* A probability is used to depict the various bounding boxes that contain a detectable object.

The following procedures were used to detect objects using the YOLO V3 model:

(a) *Data collection:* 100 dental pictures in all were collected, of which 25% were utilized for testing and 75% were used for training.

(b) *Data labeling:* Each and every image is labeled using the LabelImg tool. This also generates a ground truth box for every channel of the image. The whole dataset is produced as a text file at the conclusion of the process. The file contains data about the image id and bounding box coordinates.

(c) *Feature extraction:* The darknet-53 framework was used to identify the key components of the photos and train the model. The training was expected to take 7 hours, and almost 2000 iterations were completed. Two files with the names "yolov3_training.weights" and "yolov3_test.cfg" were generated at the conclusion of the training. The main element for carrying out real-time detection is these files.

(d) *Testing object detector:* Real-time object detection is carried out on the test images using the OpenCV library and the files produced during the feature extraction procedure.

(e) *Anchor boxes:* When multiple objects' midpoints land on the same grid cell,it can be difficult to locate some of them. As a remedy for this problem, each object in the same grid is connected to an anchor box. Two forecasts would appear in the same grid, for instance, if the two items are each linked to two anchor boxes. For the item, the IoU ratio is determined. The object will not be taken into consideration for detection if the result is less than a certain threshold, let's say 0.2.

(f) *Suppression that is not maximum:* The final stage of YOLO v3 is to resolve the issue that occurs when many bounding boxes are found for the same object. The goal of non-maximum suppression is to select the best bounding box from those that frequently overlap. Each bounding box's IoU is calculated, and the outcome is then evaluated against the threshold. A lower-than-acceptable IoU in a bounding box results in its rejection. If all the bounding boxes have IoU ratios higher than the threshold, the bounding box with the highest IoU ratio is taken into account. As done by the author Zhao et al.[7], performance measures have been mentioned in order to evaluate how well the object detection model is doing.

1. Precision

The percentage of correctly identified objects to all detected objects is how precision is determined. It is symbolized by

$$\text{Precision} = \frac{TP}{TP + FP} \tag{1}$$

FP stands for False Positive, whereas TP is for True Positive.

2. Specificity

It displays the percentage of accurately determined true negatives. This suggests that there will be more true negatives, which might equate to false positives, than true positives, which were previously thought to be positive. A model with high specificity will successfully identify the undesirable consequences.

$$\text{Specificity} = \frac{TN}{TN + FP} \tag{2}$$

TN stands for True Negative.

3. Sensitivity

The sensitivity of the model refers to how effectively it can predict the positive test cases. By giving an idea of how many cases were correctly classified as positive, it evaluates the model's performance.

Sensitivity boosts the accuracy of positive event forecasting.

$$\text{Sensitivity} = \frac{TP}{TP + FN} \tag{3}$$

In this case, FN stands for False Negative.

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4. Accuracy

This is the percentage of items out of the complete collection of items that have precise labels.

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FN + F} \quad (4)$$

5. IoU

The angle between the actual ground truth box and the anticipated bounding box is how it is defined. Figure 3 displays the reflection of the performance metric IoU from Equation (5). The bounding boxes of the prediction and the ground truth box are denoted here by the letters A and B, respectively.

$$\text{IoU} = \frac{A \cap B}{A \cup B} \quad (5)$$

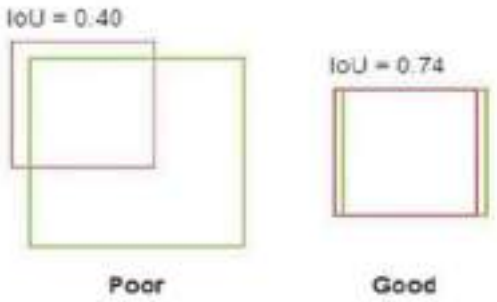


Fig. 6.3 Intersection is depicted instead of the union ratio

Table 6.1 Demonstrates the outcomes of object detection using the YOLOV3 algorithm

Model	Precision	Specificity	Sensitivity	Accuracy
YOLOV3	74%	72%	76%	75%

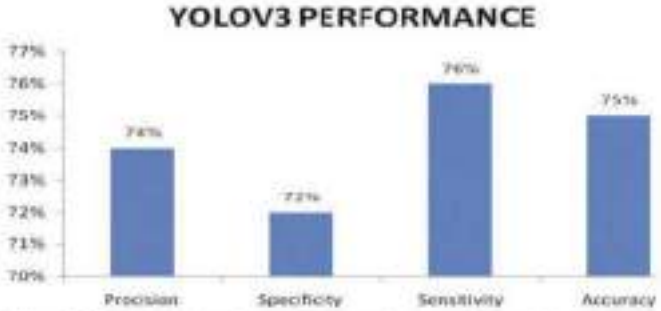


Fig. 6.4 Displaying the model as a bar graph in relation to the four performance metrics

4. Implementation

Steps for YOLOv3 Custom Object Detection using IOPO Images:

Step 1: Prepare dataset

(a) The dataset is created with IOPO images for which you want to perform its detection.

(b) The collection cleaned by deleting undesirable or pointless pictures.

Additionally, ensure that all of the photographs are in the .jpg format.

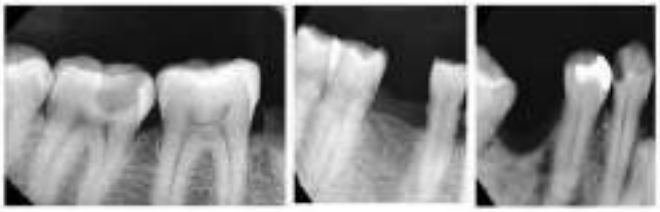


Fig. 6.5 Sample dataset

Step 2: Data Annotation

Each and every image is labelled using the LabelImg Tool, which also creates an Annotated Text File.



Fig. 6.6 Labelimg tool

The list of all the classes that we have annotated in our dataset is generated in a file called classes.txt. Each annotated image file has a corresponding.txt file that contains the metadata.



Fig. 6.7 Classes.txt

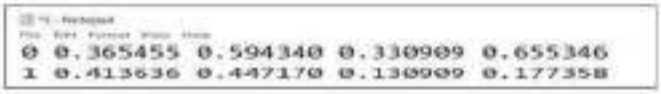


Fig. 6.8 3.txt(metadata)

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The following is part of the metadata: [obj_id cen_x cen_y width height]

Obj_id is the identifier for the object category that was previously listed in "classes.txt".

The center of the bounding box is represented by Cen_x and Cen_y. However, they are normalized by dividing by the width and height of the image to make them fall between 0 and 1.

The bounding box's width and height are represented by the variables width and height. The image's original width and height were first calibrated once again to the range of 0 to 1, then those values were removed.Step 3: Setting up model.

Step 3: Training phase

After labeling the entire dataset, we proceed to the model's real training phase.

(a) Datasets were uploaded to Google Drive.

(i) We created a ZIP file called pictures.zip it includes our dataset's whole collection of *.jpg images, *.txt annotations, and *.txt classes files.

(ii) We launched Google Drive after logging into our Google accounts. We uploaded the photographs to a new folder named "yolov3."zip archive within it.

(b) Establishing Google Colab

We'll be using Google Colab for our model training because it offers free GPU access and an environment that makes it simple to install all the necessary requirements.

(i) Clone the model on our local machine by using GitHub Repository.

(ii) The required Python object detection file should be added after starting Google Colab.

(iii) Mounted Google Drive on Google Colab.

(iv) Clone, configure and compile Darknet.

(v) Set up the yolov3.cfg file.

By using the name yolov3_training.cfg, this cell copies the yolov3.cfg

If there are 'N' classes in our custom object recognition model, then max_batches is equal to 2000 * 'N' and filters is equal to (N + 5) * 3.

(vi) dot names and dot data files were produced.

we created the obj.names and obj.data files. These files provide metadata, such as the titles of the classes and the number of classes needed for training.

(vii) Save the obj.names and yolov3_training.cfg files to our Google Drive.

(viii) Decompress the image dataset.

(ix) Create the file train.txt.



Fig. 6.9 Clone Darknet, set it up, and put it together



Fig. 6.10 Configure yolov3.cfg file



Fig. 6.11 Creating obj.names and obj.dada

The code produces a train.txt file, that lists all of the *.jpg files that are stored inside the darknet/data/obj directory, along with their locations.

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Fig. 6.12 Create train.txt file

In other words, during training, photos will be retrieved from the location indicated in this file.

(x) Download the convolutional layers file's pre-trained weights. Transfer learning is the process of adding our own layers to a model that has already been trained. The pre-trained weights are obtained from darknet53.conv.74. Therefore, rather than using weights that were randomly initialized, our own model will be trained using these previously taught weights, which will save a significant amount of time and calculations.



Fig. 6.13 Download pre-trained weights

(ix) We are now prepared to begin training our model.

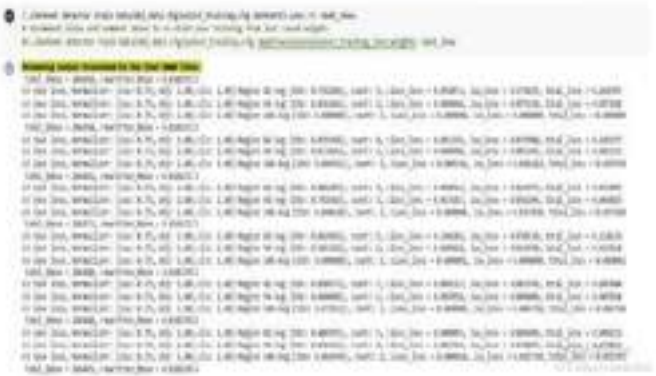


Fig. 6.14 Training our model

Depending on the size of the dataset and the number of classes, the model will take some time to train. While the model is working out, go grab a coffee or go for a stroll. Depending on the size of your dataset and the number of courses, you may estimate the approximate time required for training your own custom model; for example, training 2 classes at a time with a training sample size of 100 people should take about 6 hours.

Step 4: Model testing.

Once the model is fully trained, depending on the size of the model, on our Google Drive, at least three files will be downloaded into the yolov3 folder. The illustration below demonstrates this.



Fig. 6.15 Showing files in YOLOv3 folder

(i) Download the YOLOv3_Custom_Object_Detection arsenal and save the files yolov3_training_last.weights, classes.txt, and yolov3_testing.cfg there.

(ii) In YOLOv3_Custom_Object_Detection arsenal, make a new folder called test_images and add some images inside that you want to test the model on.

(iii) Following algorithm will test the image which given by the user, it Creates image containing tooth and cavity.

The Algorithm can be broken down into several steps:

1. Impon libraries such as "numpy" (as "np") for numerical operations, "cv2" (OpenCV) library for computer vision operations, etc.
2. Open the picture and obtain its dimensions:
   - Use the 'cv2.imread()' function to load an image.
   - Using the image's '.shape' property, determine the loaded image's height and width.
3. Image preparation for the neural network:
   - Use the function "cv2.dnn.blobFromImage()" to create a blob (binary large object) from the image. By resizing, scaling, and removing the mean values from the image, this function gets the image ready for input to the neural network.
4. Give the neural network input and get the output:
   - Using "net.setInput()," set the preprocessed blob as the neural network's input.
   - Use 'net.getUnconnectedOutLayersNames()' to get the names of the output layers.
   - Use 'net.forward()' to forward propagate the input across the network to get predictions in the 'layerOutputs'.
5. Analyze the forecasts:
   - Repeat the process for each output detection:
   - Extract the class rankings and locate the top-scoring class ('class_id').
   - Verify whether the discovered class's confidence level exceeds a predetermined cutoff point (0.2 in this example).

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- Calculate the bounding box coordinates and dimensions based on the network output if the confidence is higher than the threshold.
- Save the class ID, confidence, and bounding box coordinates.

6. Use non-maximum suppression: - Use 'cv2.dnn. NMSBoxes()' to remove duplicate and overlapping boxes before applying non- maximum suppression (NMS).
   - After NMS, obtain the selected boxes' indices.
7. Draw bounding boxes and labels by iterating through the chosen NMS indexes.
   - Get the color, class label, confidence, and bounding box coordinates.
   - Using 'cv2.rectangle()', draw a rectangle around the object, and 'cv2.putText()', add the class label and confidence.
8. Display the image:
   - Using the function "cv2_imshow ()," which is not part of OpenCV by default and may need to be changed depending on your environment, display the image with bounding boxes and labels.
9. Do some cleanup.
   - Use the cv2.destroyAllWindows() function to close the image display window.

4. Result



Fig. 6.16 Dental cavities detection using YOLOV3

5. Conclusion

By looking at the teeth and gently moving them, a dentist can identify potential dental issues. IOPA photos can be used to automatically classify dental diseases, which can help doctors make precise diagnoses. Such tooth issues are found using panoramic dental radiography. We propose a novel method based on the deep learning model YOLOv3 for detecting and classifying the most typical tooth problems, namely cavities, in order to address the low efficiency, the complexity of the experiential operation, and the high level of user intervention in existing methods of tooth problem detection. Due to the dearth of easily accessible annotated medical information, many automated systems for identifying and categorizing dental problems face significant obstacles. Deep learning is employed in this work to create an automated method that can identify and classify dental abnormalities on IOPA pictures. The collection comprises panoramic dental pictures from several clinics that have dental issues, like cavities. The proposed method has numerous applications for dental treatment using computers and diagnostics and performs better in terms of accuracy than current state-of-the-art methods. After training, the YOLOv3 model was evaluated using test images, where it performed best and with the highest degree of accuracy [8]. For the purpose of finding dental anomalies, a real-time methodology is proposed.

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A Retrospective Analysis of Precision Medicine Outcomes in Patients With Advanced Cancer Reveals Improved ProgressionFree Survival Without Increased Health Care Costs

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Abstract

Purpose

Cutting edge sequencing and different advances in hereditary diagnostics have opened the entryway for accuracy medication to be utilized to direct customized treatment for malignant growth patients.The clinical outcomes of precision cancer therapy, such as patient survival and healthcare costs, have proved difficult to quantify and are underreported.

Patients and Methods

We concentrated on 72 patients with metastatic disease of various subtypes utilizing a matched partner plan in an enormous, coordinated medical care conveyance framework. Genomic testing and designated therapy (accuracy disease medication) were contrasted with customary chemotherapy (n = 29) and ideal steady consideration (n = 7) in a review investigation of 36 patients treated between July 1, 2013, and January 31, 2015.

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Results

At the point when patients were matched for age, sex, histologic determination, and earlier lines of treatment, those in the accuracy medication bunch had a middle movement free endurance of 22.9 weeks contrasted with 12.0 weeks in the benchmark group (P =.002). This meant a danger proportion of 0.47 (95% CI, 0.29 to 0.75) for the accuracy medication bunch. Per patient week by week expenses were 4,665 in the accuracy treatment bunch and 5,000 in the benchmark group in an assessment of patients who got all of their consideration inside the Intermountain Medical services framework (n = 44; P =.126).

Conclusion

As indicated by these outcomes, accuracy malignant growth medicine can possibly increment endurance rates for those with stubborn disease without driving up medical care consumptions. While additional examination is expected to affirm these discoveries, this accuracy medication system might merit investigating for individuals with cutting edge disease.

1.INTRODUCTION

Disease patients who go through accuracy malignant growth medication have their cancers dissected for physical changes like inclusions/erasures (indels), single nucleotide varieties (SNVs), movements, and duplicate number irregularities, and afterward get treatments that focus on the alterations.1-7 inside and out hereditary symptomatic examination is costly and consumes most of the day to finish, which has dialed back the accuracy medication approach. Cutting edge sequencing (NGS) and bead advanced polymerase chain response are just two instances of the improvements in genomic innovation that have made extensive genomic investigations of human diseases both in fact and monetarily workable for application in clinical practice.8-10 Together, these improvements in genomic advancements have prompted huge advancement in two covering areas of disease research, the two of which have significant clinical ramifications: 1) a more profound comprehension of the sub-atomic systems and basic genomic changes of malignant growth, and 2) the production of novel remedial specialists and biomolecules that focus on these variations.11-16 These developments support the new clinical paradigm of precision cancer therapy.17 By distinguishing specific hereditary anomalies in malignant growth related qualities, specialists and patients might pursue more educated therapy decisions in the accuracy medication way to deal with disease. The thought is that better clinical outcomes might be accomplished by suggesting designated disease treatment after a customized indicative technique. In any case, while past examination showed that accuracy medication can further

develop endurance in a solitary malignant growth type, this approach has just been applied to single growth types with foreordained genomic variations, like EGFR-positive non-little cell cellular breakdown in the lungs (NSCLC)18-20 and BRAF-positive melanoma14,21,22.23 Past exploration recommended that people whose growths had specific changes would profit from designated treatment.24 However, it is yet unclear how the use of advanced diagnostic technologies like NGS will affect the price of cancer treatment, or how precision medicine will compare to current medicines in terms of survival rates.

Our clinically-proven precision cancer medicine programme began in one part of the Intermountain Healthcare network. Genomic testing, top to bottom translation of the outcomes from a multi-institutional sub-atomic growth board, and a rundown of therapy choices were given to patients progressed, recalcitrant disease who were alluded to the accuracy medication facility. Here, we present information contrasting patients in the main associate of the accuracy disease medication program, who got designated treatment, with patients in the benchmark group, who got standard chemotherapy or best steady consideration, for movement free endurance (PFS), absolute expenses, and cost each seven day stretch of endurance.

PATIENTS AND METHODS

All currently-living individuals submitted written informed permission before enrolment, and the exploration was supported by the Intermountain Medical care Institutional Survey Board. The need for permission was waived for the deceased by the Board.

Study Design

Research objectives

The reason for this observational, review examination was to look at the distinctions in results between a verifiable control companion treated with a nontargeted strategy and patients with disease who were given accuracy malignant growth designated treatment.

Participants in a Study

Adults (both sexes) with detectable recurrent or metastatic solid tumours who had previously had conventional first-line therapy (as per NCCN recommendations) were eligible for participation. Patients additionally expected to have typical renal, hepatic, and bone marrow capability and an Eastern Agreeable Oncology Gathering execution status of 0, 1, or 2. Rejected from the review were patients with exclusively

mind metastases, those whose cerebrum metastases had not been overseen for.3 months, and the people who were participating in a clinical preliminary of an investigational medication. Ladies who were pregnant or nursing were similarly precluded.

The Intermountain Medical care Multi-Institutional Atomic Growth Board (MTB) deciphered cancer sub-atomic irregularities for all patients in the accuracy medication bunch.To be considered "actionable," mutations have to be confirmed in the scientific literature and have a corresponding targeted medication. The MTB only included mutations that may potentially be treated in the clinic or in preclinical studies. Patients in the benchmark group got essentially the norm of care concerning hereditary testing, with no further understanding from the MTB or microscopically designated drug.

The size of the sample

A 100,000-simulation power study was conducted using a Cox proportional hazards model. Our study's sample size was based in part on Tsimberidou et al.'s research approach.24

Picking Destinations

Radiographic assessment of tumour progression and the Response Evaluation Criteria in Solid Tumours, Version 1.1 (RECIST 1.1) were used to calculate PFS as the major end goal. Computed tomography CT imaging measures of the tumour were taken initially and then every 8 weeks throughout therapy. Care-related expenses were a secondary outcome measure.

Blinding

Researchers in the clinical setting were not privy to the control group members' identities. The statistician for the research (A.M.B.) was given information on the control group, which had been chosen by cancer registrars.

Techniques in Statistics

PFS was modelled using a Cox proportional hazards regression. This model considered factors, for example, therapy, sex, age, malignant growth type, and the presence of at least three treatment lines. To do this, we ran a test contrasting the entire model with a treatment-just model utilizing the probability proportion. This test exhibited that the worked on model gives an adequate fit to the information, and that main treatment must be incorporated into the model (P =.508).In order to examine the expense of treatment,

we developed basic demographics, tests based on two samples, and linear regression models. By collecting demographic characteristics and using the Cox model, we were able to account for potential confounders.

Analysing Expenses

Payer considerations were included in the final patient cost tally. Estimates of patient expenses were made using the usual Intermountain Healthcare payer rates. The estimated final costs for each patient only include those that occurred throughout the treatment line's active duration. Treatment, toxicity testing, patient sequencing, and individualised medication therapy were all included into the final tally for each individual patient's bill. All expenses related with providing care, such as those for chemotherapy, drugs, imaging, and laboratories, were covered for both the target population and the control group. The cost of palliative care was capped at the per-day payment rates set by Medicare and Medicaid. All expenses incurred by the patient for the management of treatment-related toxicities were included as part of the total toxicity cost. Test provider sequencing prices for prospective patients were calculated using expected payer reimbursement rates. Information on medicine prices was gathered from regional specialty pharmacies and pharmaceutical companies, and was calculated using expected payer reimbursement rates and projected patient co-payments. The worth of money over time was not accounted for by applying a discount rate to the budget. PFS weeks were not quality changed on the grounds that to the shortage of personal satisfaction information for control patients. The whole PFS-week uses were accumulated for every patient, and afterward that total was partitioned by the all out number of patients to show up at a PFS-week cost per patient. The Wilcoxon rank aggregate test was utilized to look at the costs of accuracy medication and a benchmark group measurably.

Molecular Diagnostic Testing

Formalin-fixed, paraffin-inserted (FFPE) or new examples were utilized for all examinations.The analysis of the patient samples was performed at a facility accredited by the Clinical Laboratory Improvement Amendments. With the end goal of this review, we utilized cutting edge sequencing (NGS)- based oligoselective exon sequencing to inspect the accompanying 96 malignant growth related qualities: ABL1, AKT1,ALK,APC,ATM,AURKA,AURKB,AXL, BCL2, BRAF, BRCA1, BRCA2, CCND1, CDH1, CDK2, CDK4, CDK5, CDK6, CDK8, CDK9, CDKN2A, CEB Board-ensured anatomic pathologists affirmed a base growth grouping of 40% in the examples dissected. For formalin-fixed paraffin-inserted (FFPE) tests, we utilized the ReliaPrep FFPE g DNA miniature prep unit (Promega, Madison, WI), and for new

examples, we utilized the Puregene blood center Pack A (Qiagen, St Nick Clarita, CA). A M220 ultrasonicator (Covaris, Woburn, Mama) was utilized to shear DNA to a typical length of 500 bp. The TOMAseq unit (connector, expansion, and catch sets; TOMA Biosciences, Encourage City, CA) was utilized to embrace further example handling, library planning, and NGS as per the producer's convention and guidelines. The Bio-Rad q200 bead advanced polymerase chain response analyzer (Bio-Rad, Hercules, CA) was utilized to evaluate the libraries. Illumina's MiSeq stage (San Diego, CA) was utilized to do the sequencing. Free bayes was utilized for variation calling, while verifiable procedures were utilized for information curation, understanding, arrangement, and quality checks. Hereditary varieties, for example, duplicate number changes, point transformations, outline shift changes, movements, and single nucleotide polymorphisms were found by contrasting patient examples with a reference genome. Outer labs (Caris Biosciences, Establishment Medication, and TOMA Biosciences) performed beginning testing on specific examples, and those with enough numbers were then retested with the 96-quality board referenced previously.

RESULTS

They were paired with patients receiving treatment based on characteristics such as tumour type, age, gender, and number of prior treatments. We looked through our institution's enterprise data warehouse to find standard-of-care-treated patients who were comparable to precision medicine patients in terms of age, sex, diagnosis, and number of prior therapies (Fig. 1). This was done between July 2010 and January 2015. There were 61 individuals who had received precision medicine for an actionable mutation; 36 of them had a historical match at their institution. A total of 72 patients were studied, including 36 who were given precision medicine and 36 who were given conventional treatment, which included routine molecular testing (Fig. 1). In Table 1, we see the demographics of our patients broken down by modality of care. Patients in the accuracy medication arm were all white (n = 36), while those in the control arm were generally white (83.3%; n = 30), with 2.8% (n = 1) being non-Hispanic dark, 11.1% (n = 4) being white and nonwhite Hispanic, and 2.8% (n = 1) being of another race or identity. Patients in the accuracy medication bunch had a mean time of 67.8 years, though those in the benchmark group found the middle value of 67.0 years (P =.748). Men made up 61% (n = 44) of each gathering. Due to precision medicine's late matching, the precision medicine group averaged 3.1 treatment lines, whereas the control group averaged 2.9 lines (P =.168). Both groups included individuals with a wide range of solid tumour forms, and the cancer types were a perfect match. Informed assent was gotten from 61 patients with a noteworthy transformation who

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had gotten designated treatment in view of the change (accuracy disease medication). Noteworthy changes were characterized as realized variations approved in peer-surveyed writing for which a designated treatment was accessible.We aimed to compare the results of the treatment cohort to those of the control cohort despite the fact that the treatment group was demographically and sex-diversely diverse.

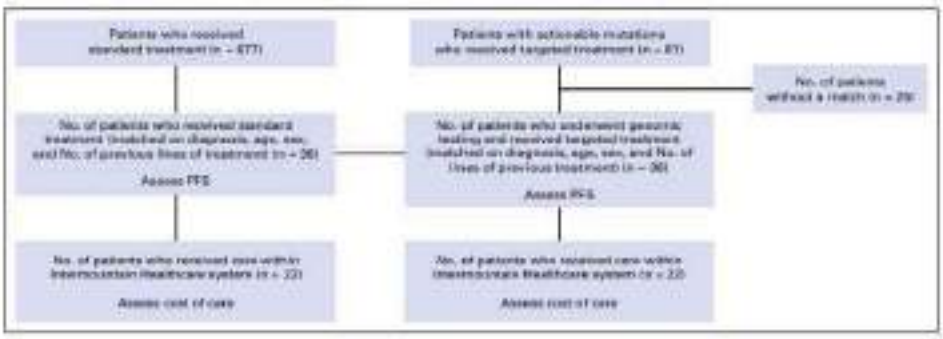


Table 1. Patient Characteristics

Characteristic	Patients Who Received Precision Medicine		Control Patients	
	No.	%	No.	%
Mean age, years	67.0		67	
Sex				
Male	22	61.1	22	61.1
Female	14	38.9	14	38.9
Race				
Non-Hispanic white	36	100	30	83.3
Non-Hispanic black	0	0	1	2.8
White and nonwhite Hispanic	0	0	4	11.1
Other	0	0	1	2.8
Line of treatment				
1st	0	0	1	2.8
2nd	19	52.8	19	52.8
3rd	9	25	10	27.8
4th	1	2.8	1	2.8
5th	2	5.6	1	2.8
6th	4	11.1	3	8.3
7th	1	2.8	1	2.8
Mean	3.1		2.9	
Type of cancer				
Bladder	2	5.6	2	5.6
Breast	5	13.9	5	13.9
Cholangiocarcinoma	1	2.8	1	2.8
Colon	8	22.2	8	22.2
Gastric	1	2.8	1	2.8
Head and neck	4	11.1	4	11.1
Lung	11	30.6	11	30.6
Melanoma	1	2.8	1	2.8
Ovary	1	2.8	1	2.8
Pancreas	2	5.6	2	5.6

Ten different histologically distinct tumour kinds. Table 1 shows that in both groups, NSCLC was the most common kind of lung cancer. Supplement Table A1 (online just) subtleties the significant variety and designated treatment for each understanding in the accuracy medication accomplice. Standard sub-atomic testing was performed at the hour of determination for patients in the verifiable benchmark group, as

suggested by NCCN proposals. Among the NSCLC patients in the accuracy medication accomplice, three were found to have EGFR transformations that had not been perceived at the hour of beginning analysis and were treated with erlotinib (Table A1). The review included five patients with bosom malignant growth who were treated with a designated treatment in light of MTB translation. These patients had either chemical negative (n = 2) or chemical hard-headed (n = 3) ailment.

Contrasted with the benchmark group, the accuracy medication bunch had an extensively longer PFS (Fig 2), as estimated by the convention's significant ultimate objective (mean PFS, 22.9 v 12.0 weeks; P =.002). While considering variables like age, sex, histologic determination, and the quantity of earlier lines of treatment, accuracy medication was connected with a 53% lower chance of movement (changed risk proportion, 0.47; 95% CI, 0.29 to 0.75; P =.002). Four patients (11% of the aggregate) in the accuracy medication bunch had not yet progressed toward the finish of the exploration (Fig. 2). A responsiveness examination (Reference section Fig A1, online just) uncovered that the distinction in PFS was not because of an adjustment of patient execution status between the two gatherings.Twenty-five patients who did not share an institution with the control group also had a significantly longer PFS (19.3 weeks vs. 7.3 weeks; P =.026).

We did a health care cost comparison to see how much each treatment option would cost. We took a gander at every one of the patients in every companion and found 22 pairings where the two patients had gotten treatment totally inside the Intermountain Medical services framework and full expense information was accessible (Fig. 1). PFS was essentially better in the accuracy medication bunch contrasted with the customary treatment partner (21.4 versus 11.0 weeks; P =.004; Table 2) while examining this example of 22 matched patient sets. Costs related with treating patients utilizing accuracy medication were altogether more prominent than those related with the benchmark group ($91,790 versus $40,782 per patient; P =.002; Table 2).Precision medicine patients incurred an average of $59,259 in additional expenses (compared to $20,189 for those not receiving the treatment) due mostly to the greater cost of drugs. Costs per movement free endurance week were lower in the accuracy medication bunch because of longer endurance terms ($4,665 v $5,000 each week; P =.126) (Table 2).However, this difference did not achieve statistical significance.

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Estimated Solutions of Intigral Equations Arising In Some Applications of Science and Engineering

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Abstract:
We present the numerical solution of the Fredholm Integral Equations by using the analytic method (Adomian Decomposition Method). To exhibit the correctness and efficacy of the projected method (ADM), some numerical examples have been performed. A Fredholm integral equations is solved by ADM which gives us the fairly accurate solution of the problem that tends to the exact solution of the problem.

Keywords:Adomian Decomposition Method, Integral Equations,Fredholm Integral Equations, Numerical Example. Adomian Decomposition Method

Adomian Decomposition Method

The Adomian Decomposition method (ADM) is very commanding technique which considers the inexact solution of a nonlinear equation as an infinite series which essentially converges to the exact solution in this paper, ADM is proposed to solve some first order, second order and third order differential equations and integral equations. The Adomian Decomposition method (ADM) was firstly introduced by George Adomain in 1981. This method has been applied to solve differential equations and integral equations of linear and nonlinear problem in Mathematics, Physics, Biology and Chemistry up to know a large number of research paper have been published to show the possibility of the decomposition method.

Proposed method for solving the Fredholm integral equation.

The type of integral equation in which the restrictions of the integration are constant, in which a and b are constant are called the Fredholm Integral equations, and is given as

$$\emptyset(x) = f(x) + \rho \int_a^b K(x,t)\emptyset(t)(t)dt \quad (1)$$

Where the function and the kernel are given in the advance, and ρ is a parameter. In this division, the procedure of the Adomian decomposition method is used. The Adomian decomposition method connecting the decomposing of the unknown function (x) of any equation into a addition of an infinite number of constituents defined by the
decomposition serie

$$\emptyset(x) = \sum_{n=0}^{\infty} \emptyset_n(x) \quad (2)$$

Or In the same way

$$\emptyset(x) = \emptyset_1(x) + \emptyset_2(x) + \emptyset_3(x) \pm \cdots$$

When the constituents $\emptyset_n(x), n \geq 0$ will be resolved.
The Adomain decomposition method analyze itself which discover the components $\emptyset_0(x)$, $\emptyset_1(x)$,, $\emptyset_2(x)$…

To classify the recurrence relation , we substitute (2) into the Fredholm integral equation (1) to get

$$\sum_{n=0}^{\infty} \emptyset_n(x) = f(x) + \int_a^b K(x,t) \sum_{n=0}^{\infty} \emptyset_n(t)dt \qquad (3)$$

The zeroth component $\emptyset_0(x)$ is spotted by all terms that are not comprises under the integral sign. This signifies that the components $\emptyset_n(x), n \geq 0$ of the unknown function $\emptyset(x)$ are totally resolved by the recurrence relation.

$\emptyset_0(x) = f(x)$, $\emptyset_{n+1}(x) = \int_a^b K(x,t) \sum_{n=0}^{\infty} \emptyset_n(t)dt$, $n \geq 0$

Or correspondingly

Thus the solution of the Fredholm Integral equation (1) is easily acquired in a series form by make use of he series as assumption in (2)

Applications of Fredholm Integral Equations:
Consider the linear Fredholm integral equation

$$\mathbf{1.}\emptyset(\mathbf{x}) = \mathbf{sinx} + \mathbf{1} + \int_{\mathbf{0}}^{\boldsymbol{\pi}} \sum_{\mathbf{n=0}}^{\infty} \emptyset(\mathbf{t})\mathbf{dt}$$

Let $\emptyset(x) = \sum_{n=0}^{\infty} \emptyset_n(x)$

$$\emptyset_0(x) = \sin x + 1$$

$$\sum_{n=0}^{\infty} \emptyset_n(x) = sinx + 1 + \int_0^{\Pi} \sum_{\pi=0}^{\infty} \emptyset_{n-1}(t)\, dt$$

Now $\phi_{n+1}(x) = \int_0^{\Pi} \sum_{\pi=0}^{\infty} \emptyset_{n-1}(t)\, dt$

$$\emptyset_1(x) = \int_0^{\pi} \emptyset_0(t)dt$$

$= \int_0^{\pi} (sint + 1)dt$
$= \int_0^{\pi} sint + \int_0^{\pi} dt$
$= (-cost)_0^{\pi} + (t)_0^{\pi}$
$= (-cos\pi - cos0) + (\pi - 0)$
$= (-1 - 1) + (\pi - 0)$

$$\emptyset_1(x) = -2 - \pi$$

$$\emptyset_2(x) = \int_0^{\pi} \emptyset_1(t)dt$$

$= \int_0^{\pi}(-2-\pi)dt$
$= (-2-\pi)(t)_0^{\pi}$
$=(-2-\pi)(\pi-0)$

$$\emptyset_2(x) = -2\pi - \pi^2$$

$$\emptyset_3(x) = \int_0^{\pi} \emptyset_2(t)dt$$

$= \int_0^{\pi}[-2\pi-\pi^2]dt$
$= [-2\pi-\pi^2](t)_0^{\pi}$
$= [-2\pi-\pi^2](\pi-0)$

$$\emptyset_3(x) = -2\pi^2 - \pi^3$$

$$\emptyset\ \ (x) = sinx + 1 + (-2-\pi-2\pi-\pi^2-2\pi^2-\pi^3+\cdots)$$

$$\emptyset\ \ (x) = sinx - 1 + (\ -3\pi-3\pi^2-\pi^3+\cdots)$$

2).$\emptyset(x) = x + e^{-x} + x^2 \int_0^1 \sum_{n=0}^{\infty} t\emptyset(t)dt$

$$Let\ \emptyset(x) = \sum_{n=0}^{\infty} \emptyset_n\,(x)$$

$= \sum_{n=0}^{\infty} \emptyset_n(x) = x + e^{-x} + x^2 \int_0^1 \sum_{n=0}^{\infty} t\emptyset(t)dt$
Where $\emptyset_0(x) = x + e^{-x}$
$= \emptyset_{n+1}(x) = x^2 \int_0^1 \sum_{n=0}^{\infty} t\emptyset(t)dt$

$$\emptyset_1(x) = x^2 \int_0^1 t\emptyset_0(t)dt$$

$= x^2 \int_0^1 t(t+e^{-t})dt$
$= x^2[\int_0^1 t^2\,dt + \int_0^1 te^{-t}dt]$
$= x^2[\left(\frac{t^3}{3}\right)_0^1 + (-te^{-t})_0^1 - (-e^{-t})_0^1]$
$= x^2[\left(\frac{1}{3}-\frac{1}{0}\right) + (-e^{-1}-0e^0) - (-e^{-1}-e^0)]$
$= x^2(\frac{1}{3}-e^{-1}+e^{-1})$

$$\emptyset_1(x) = \frac{x^2}{3}$$

$$\emptyset_2(x) = x^2 \int_0^1 t\emptyset_1\,(t)dt$$

$= x^2 \int_0^1 t(\frac{t^2}{3})dt$
$= \frac{x^2}{3}\int_0^1 t^3 dt$
$= \frac{x^2}{3}\left(\frac{t^4}{4}\right)_0^1$

$= \frac{x^2}{3}\left(\frac{1}{4} - \frac{0}{4}\right)$

$$\emptyset_2(x) = \frac{x^2}{12}$$

$$\emptyset_3(x) = x^2 \int_0^1 t\emptyset_2(t)dt$$

$= x^2 \int_0^1 t\left(\frac{t^2}{12}\right)dt$

$= \frac{x^2}{12}\left(\frac{t^4}{4}\right)_O^1$

$= \frac{x^2}{12}\left(\frac{1}{4} - \frac{1}{0}\right)$

$$\emptyset_3(x) = \frac{x^2}{48}$$

$: \emptyset(x) = x + e^{-x} + \left(\frac{x^2}{3} + \frac{x^2}{12} + \frac{x^2}{48} + \cdots\right)$

$$\emptyset(x) = x + e^{-x} + \frac{x^2}{3}\left(1 + \frac{1}{4} + \frac{1}{16} + \cdots\right)$$

3) $\emptyset(x) = \frac{2}{3} + 5x + x\int_0^1 t\emptyset(t)dt$

$$Let\ \emptyset(x) = \sum_{n=0}^{\infty} \emptyset_n(t)$$

$$\emptyset_0(x) = \frac{2}{3} + 5x$$

$$\emptyset_{n+1}(x) = x\int_0^1 \sum_{n=0}^{\infty} t\emptyset(t)dt$$

$$\emptyset_1(x) = x\int_0^1 t\emptyset_0(t)dt$$

$= x\int_0^1 t\left(\frac{2}{3} + 5t\right)$

$= \frac{2}{3}x\int_0^1 tdt + 5x\int_0^1 t^2dt$

$= \frac{2}{3}x\left(\frac{t^2}{2}\right)_1^0 - 5x\int_0^1 t^2\,dt$

$= \frac{2}{3}x\left(\frac{t^2}{2}\right)_0^1 + 5x\left(\frac{t^3}{3}\right)_0^1$

$= \frac{2}{3}x\left(\frac{1}{2} - \frac{0}{2}\right) + 5x\left(\frac{1}{3} - \frac{0}{3}\right)$

$= \frac{2}{6}x + \frac{5}{3}x$

$= \frac{2x+10x}{6}$

$= \frac{12x}{6}$

$= \emptyset_1(x) = 2x$

$$\emptyset_2(x) = x\int_0^1 t\emptyset_1(t)dt$$

$= x\int_0^1 t(2t)dt$

$= x2\int_0^1 (t^2)\,dt$

$= 2x\left(\frac{t^3}{3}\right)_0^1$

$= 2x\left(\frac{1}{3} - 0\right)$

$= \emptyset_2(x) = \frac{2x}{3}$

and so on

$$\emptyset(x) = \frac{2}{3} + 5x + 2x + \frac{2x}{3} + \cdots$$

4) $\emptyset(x) = e^x + 1 + \int_0^1 \emptyset t\,dt$

$$Let\ \emptyset(x) = \sum_{n=0}^{\infty} \emptyset_n(x)$$

$$\emptyset(x) = \emptyset_1(x) + \emptyset_2(x) + \emptyset_3(x) + \cdots$$

$$\sum_{n=0}^{\infty} \emptyset_n(x) = f(x) + J_a^b k(x,t) \sum_{n=0}^{\infty} \emptyset_n(t)dt$$

$$Let \emptyset_0(x) = e^x + 1$$

$$\emptyset_{n+1}(x) = \int_0^1 \sum_{n=0}^{\infty} \emptyset_n(t)dt$$

$$This\ implies\ \emptyset_0(x) = e^x + 1$$

$$\emptyset_1(x) = \int_0^1 \emptyset_0(t)dt$$

$= \int_0^1 (e^t + 1)tdt$

$= \int_0^1 (te^t + t)dt$

$= \int_0^1 te^t dt + \int_0^1 tdt$

$= t\int_0^1 e^t dt - \int_0^1 e^t + \int_0^1 tdt$

$= [te^t - e^t + \frac{t^2}{2}]_0^1$

$= (1.e^1 - e^1 + \frac{1}{2} - 0 + 1 - 0)$

$= 1 + \frac{1}{2}$

$= \frac{2+1}{2}$

$$\emptyset_1(x) = \frac{3}{2}$$

$$\emptyset_2(x) = \int_0^1 \emptyset_1(t)dt$$

$= \int_0^1 t \cdot \frac{3}{2} dt$

$= \frac{3}{2}\int_0^1 t\,dt$

$= \frac{3}{2}\left(\frac{t^2}{2}\right)_0^1$

$= \frac{3}{4}(1)$

$$\emptyset_2(x) = \frac{3}{2^2}$$

$$\emptyset_3(x) = \int_0^1 \emptyset_2(t)dt$$

$= \int_0^1 \frac{3}{4} t dt$

$= \frac{3}{4}\int_0^1 t dt$

$= \frac{3}{4}(\frac{t^2}{2})_0^1$

$= \frac{3}{8}$

$$\emptyset_3(x) = \frac{3}{2^3}$$

$$\emptyset(x) = \emptyset_1(x) + \emptyset_{2(x)} + \emptyset_3(x) + \cdots$$

$$\emptyset(x) = e^x + 1 + \frac{3}{2} + \frac{3}{2^2} + \frac{3}{2^3} + \cdots$$

Conclusion

The aspire of this paper is to employ the Adomain Decomposition Method for solving the Fredholm Integral Equation . It can be visibly seen that decomposition method for the Fredholm Integral Equation is equivalent to consecutive approximation method.Even though the Adomain decomposition method is very burly and useful tool for solving the integral equations.

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Appriximate Solutions of Volterra Intigral Equations Arising In Some Applications of Science and Engineering

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Abstract:
In this paper we present the numerical solution of the Volterra Integral Equations by using the analytic method (Adomian Decomposition Method). To demonstrate the exactness and efficacy of the proposed method (ADM), some numerical examples have been performed. A Volterra integral equation is solved by ADM which gives us the comparatively accurate solution of the problem that tends to the exact solution of the problem.

Keywords: Adomian Decomposition Method, Integral Equations, volterra Integral Equations, Numerical Example. Adomian Decomposition Method

ADOMIAN DECOMPOSITION METHOD

The Adomian Decomposition method (ADM) is very powerful technique which considers the in exact solution of a nonlinear equation as an infinite series which essentially converges to the exact solution in this paper, ADM is proposed to solve some first order, second order and third order differential equations and integral equations. The Adomian Decomposition method (ADM) was firstly introduced by George Adomain in 1981. This method has been applied to solve differential equations and integral equations of linear and nonlinear problem in Mathematics, Physics, Biology and Chemistry up to know a large number of research paper have been published to show the possibility of the decomposition method.

PROPOSED METHOD FOR SOLVING THE VOLTERRA INTEGRAL EQUATION.

The type of integral equation in which the restrictions of the integration are constant, in which a and b are constant are called the Fredholm Integral equations, and is given as

$$\emptyset(x) = f(x) + \rho \int_0^x K(x,t)\emptyset(t)(t)dt \quad (1)$$

Where the function and the kernel are given in the advance, and ρ is a parameter. In this division, the procedure of the Adomian decomposition method is used. The Adomian decomposition method connecting the decomposing of the unknown function $\emptyset(x)$ of any equation into a addition of an infinite number of constituents defined by the
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Or In the same way

$$\emptyset(x) = \emptyset_1(x) + \emptyset_2(x) + \emptyset_3(x) \pm \cdots$$

When the constituents $\emptyset_n(x), n \geq 0$ will be resolved.

The Adomain decomposition method analyze itself which discover the components $\emptyset_0(x)$, $\emptyset_1(x)$,, $\emptyset_2(x)$…

To classify the recurrence relation , we substitute (2) into the Volterra integral equation (1) to get

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The zeroth component $\emptyset_0(x)$ is spotted by all terms that are not comprises under the integral sign. This signifies that the components $\emptyset_n(x), n \geq 0$ of the unknown function $\emptyset(x)$ are totally resolved by the recurrence relation.

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Or correspondingly

Thus the solution of the Volterra integral equation (1) is easily acquired in a series form by make use of the series as assumption in (2)

APPLICATIONS OF VOLTERRA INTEGRAL EQUATIONS:
Consider the linear volterra integral equation

1. $\Phi(x) = x + \int_0^x (t-x)\Phi(x)\,dt$

$\Phi_0(x) = x$

$\Phi_1(x) = \int_0^x k(x,t)\emptyset_0(t)dt$

$= \int_0^x (t-x)t\,dt$

$= \int_0^x (t^2 - xt)dt$

$= \left(\frac{t^3}{3} - x\frac{t^2}{2}\right)_0^x$

$= \left(\frac{x^3}{3} - \frac{x^3}{2}\right) = \frac{-x^3}{6}$

$\therefore \Phi_1(x) = \frac{-x^3}{6}$

$$\Phi_2(x) = \int_0^x (t-x)\frac{-t^3}{6}\,dt$$
$$= -\frac{1}{6}\int_0^x (t^4 - xt^3)\,dt$$
$$= -\frac{1}{6}\left(\frac{t^5}{5} - x\frac{t^4}{4}\right)_0^x$$
$$= -\frac{1}{6}\left(\frac{x^5}{5} - \frac{x^5}{4}\right)$$
$$= -\frac{1}{6}\left(\frac{-x^5}{20}\right)$$
$$= \frac{x^5}{120}$$
$$\therefore \Phi_2(x) = \frac{x^5}{120}$$

$$\therefore \Phi(x) = \Phi_0(x) + \Phi_1(x) + \Phi_2(x) + \ldots\ldots\ldots\ldots$$
$$= x - \frac{x^3}{6} + \frac{x^5}{120} - \ldots\ldots\ldots\ldots$$
$$= x - \frac{x^3}{3!} + \frac{x^5}{5!} - \ldots\ldots\ldots\ldots$$
$$\Phi(x) = \sin x$$

2.Consider the volterra integral equation

$$\Phi(x) = e^x + \int_0^x e^{x-t}\ \Phi(t)\,dt$$
$$\Phi_0(x) = e^x$$
$$\Phi_1(x) = \int_0^x k(x,t)\,\emptyset_0(t)\,dt$$
$$= \int_0^x e^{x-t}\,e^t\,dt$$
$$= \int_0^x e^x\,dt$$
$$= e^x(t)_0^x = x\,e^x$$
$$\therefore \Phi_1(x) = x\,e^x$$
$$\Phi_2(x) = \int_0^x k(x,t)\ \emptyset_1(t)\,dt$$
$$= \int_0^x e^{x-t}\ t\,e^t\,dt$$
$$= \int_0^x t\,e^x\,dt$$
$$= e^x\left(\frac{t^2}{2}\right)_0^x = \frac{x^2}{2}e^x$$
$$\therefore \Phi_2(x) = \frac{x^2}{2}e^x$$
$$\Phi_3(x) = \int_0^x k(x,t)\ \emptyset_2(t)\,dt$$
$$= \int_0^x e^{x-t}\ \frac{t^2}{2}\,e^t\,dt$$
$$= \int_0^x e^x\,\frac{t^2}{2}\,dt$$
$$= \frac{e^x}{2}\left(\frac{t^3}{3}\right)_0^x = \frac{x^3}{6}e^x \qquad \therefore \Phi_3(x) = \frac{x^3}{6}e^x$$

$$\therefore \Phi(x) = \Phi_0(x) + \Phi_1(x) + \Phi_2(x) + \ldots\ldots\ldots\ldots$$
$$= e^x + x\,e^x + \frac{x^2}{2}e^x + \frac{x^3}{6}e^x + \ldots\ldots\ldots\ldots$$

$$= e^x \left[1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots\ldots\ldots\ldots\ldots\right]$$
$$= e^x . e^x = e^{2x}$$

3. Consider the volterra integral equation

$\Phi(x) = e^x - \int_0^x e^{x-t}\ \Phi(t)\, dt$

$\Phi_0(x) = e^x$

$\Phi_1(x) = \int_0^x k(x,t)\,\emptyset_0(t)dt$

$= \int_0^x -e^{x-t}\, e^t\, dt$

$= -\int_0^x e^x\, dt$

$= -e^x(t)_0^x = -x\, e^x$

$\therefore \Phi_1(x) = -x\, e^x$

$\Phi_2(x) = \int_0^x k(x,t)\ \emptyset_1(t)dt$

$= \int_0^x -e^{x-t}\,(-t\, e^t)\, dt$

$= \int_0^x t\, e^x\, dt$

$= e^x \left(\frac{t^2}{2}\right)_0^x = \frac{x^2}{2} e^x$

$\therefore \Phi_2(x) = \frac{x^2}{2} e^x$

$\Phi_3(x) = \int_0^x k(x,t)\ \emptyset_2(t)dt$

$= \int_0^x -e^{x-t}\ \frac{t^2}{2}\, e^t\, dt$

$= \int_0^x -e^x \frac{t^2}{2}\, dt$

$= -\frac{e^x}{2}\left(\frac{t^3}{3}\right)_0^x = -\frac{x^3}{6} e^x$

$\therefore \Phi_3(x) = -\frac{x^3}{6} e^x$

$\therefore \Phi(x) = \Phi_0(x) + \Phi_1(x) + \Phi_2(x) + \ldots\ldots\ldots\ldots$

$= e^x - x\, e^x + \frac{x^2}{2} e^x - \frac{x^3}{6} e^x + \ldots\ldots\ldots\ldots$

$= e^x \left[1 - x + \frac{x^2}{2!} - \frac{x^3}{3!} + \ldots\ldots\ldots\ldots\ldots\right]$

$= e^x . e^{-x} = 1$

Conclusion:

The aim of this paper is to employ the Adomain Decomposition Method for solving the Volterra Integral Equation . It can be visibly seen that decomposition method for the Volterra Integral Equation is equivalent to consecutive approximation method. Even though the Adomain decomposition method is very burly and useful tool for solving the integral equations.

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Advantages of Using Digital Media to Teach English

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Abstract:
Utilizing digital media as a pedagogical tool for English instruction presents a multitude of benefits in the contemporary landscape influenced by technology. It facilitates involvement and interactivity in the educational experience. The purpose of this study is to examine the advantages connected with the use of digital media as an educational instrument for the training of the English language. The primary focus of this study is to investigate how students interpret digital media within the framework of English Language Teaching (ELT). The information is obtained using a questionnaire administered by the studies. This study employed an empirical case study design. The data obtained from the questionnaire is subjected to descriptive analysis. The findings of this study indicate that the students exhibited a strong inclination toward digital media as a viable resource for English reading materials. The questionnaire yielded a mean score of 3.49, indicating a classification of "High" when interpreted. In addition to encountering challenges related to the utilization of digital media, students and teachers have experienced several obstacles. These include limited access to mobile phone facilities, restricted online containers and issues with insufficient connectivity.

Keywords: English language Teaching, questionnaire, digital media.

1. Introduction

In modern society, digital media is characterized by advances and dependence on technology, the incorporation of digital media in the field of education is acquiring significant traction, leading to transformative effects on language instruction and development [1]. The field of English language instruction has experienced significant advantages as a result of the digital revolution [2]. One primary benefit of incorporating digital media into English language instruction is its capacity to engage and attract learners [3]. Traditional instructional methods have frequent challenges in sustaining pupils' focus in a contemporary context marked by decreased attention spans. Digital media, encompassing interacting language software, films and online activities, provide the capacity to establish a dynamic and captivating milieu conducive to the acquisition of proficiency in the English language [4-5]. The incorporation of interactive tools enables learners to participate in instructing languages that simulate authentic contexts, utilizing sensory and visual elements. This serves to enhance the attractiveness and effectiveness of the educational experience [6]. The aim of the research is to examine the advantages connected to the use of digital media as a pedagogical tool for teaching English language. The purpose of the current study [7] investigated young students and EFL teachers to evaluate the advantages and disadvantages of digital competence. The findings show that digital proficiency has advantages and

disadvantages for younger students of English. The study [8] explained the instructional method employed for the instruction of the English language during the COVID-19 epidemic.

Study [9] illustrated the significant advantages associated with the utilization of "Information and Communication Technology (ICT)" in the process of acquiring proficiency in English. A study [10] examined the effectiveness of using educational instruction approaches during the covid-19 pandemic. The study findings elucidate the concept of blended learning, where Google Classroom is proposed as an alternative pedagogical approach for teaching English. The study [11] examined the efficacy of the online learning system in the context of English language instruction. The investigation encompassed an analysis of the institutional support provided for the online learning system as well as the perspectives of the instructors regarding their utilization of this system. The study examined [12] students' perceptions regarding the utilization of movies as a means to enhance their vocabulary proficiency. The study's findings suggest that students hold a favorable impression of the integration of movies into their classroom instruction as a means to enhance their understanding of vocabulary.

Study [13] investigated the preferences of students, encompassing their perceptions and viewpoints regarding the utilization of platforms and applications in the context of remote teaching. The study [14] addressed the existing gap in knowledge by examining the extent to which social media platforms such as instagram, pinterest, snapchat and whatsApp have been included in the educational process in higher education and how they contribute to teaching and learning. A study [15] explored the utilization of YouTube as an instructional tool for enhancing speaking skills in an educational setting. The aim is to introduce a novel, engaging and enjoyable approach to teaching, with the additional goal of fostering a classroom environment that promotes student comfort and enthusiasm towards the learning process. A study [16] discovered the usefulness of using technology in learning English. However, few studies have proven the usefulness of technology in English capabilities such as speaking, listening, reading and writing skills.

2. Methodology

The questionnaire is employed as the primary data collection instrument. The questionnaire was conducted using the Mentimeter platform. We performed multiple steps during the data collection process. The initial step involved the preparation of the research instrument, a questionnaire. The subsequent step entailed administering the questionnaire to participants using the Google Form implementation. The questionnaire consists of 10 items and respondents are instructed to indicate by choosing the correct reply on a scale, we can express a sense of satisfaction or dissatisfaction regarding every subject, ranging from "strongly agree" to "strongly disagree." The data are acquired by the process of assigning scores to the participants' responses, with "strongly agree (SA) assigned a value of 4, agree (A) a value of 3, neutral (N) a value of 1, disagree (D) a value of 1 and strongly disagree (SD) a value of 1". Next, the data obtained from the questionnaires is subjected to analysis. The research findings are subjected to analysis, leading to the derivation of inferences based on the collected data. We employed descriptive evaluation techniques to examine the data. The following Table 1 is an analysis of the average score representing students' perceptions.

Table 1. The calculation of the average rating depends on the intervals.

No	1	2	3	4	5
Range median rating	1.00–1.79	1.80–2.59	2.00 -3.39	3.40–4.19	4.20 –5.00
Analysis of the average value	Extremely low	Low	Intermediate	Supreme	Extremely high

3. Results and discussions

The subsequent part presents the findings derived from the conducted study. The Likert Rating Scale is utilized for evaluating the questionnaire items, with responses ranging from 4"(Strongly agree) to 1 (Strongly disagree)". The study results for each indication are displayed in Table 2 and Figure 1. Figure 1 demonstrates the scores ranging from 3.04 to 4, the Likert scale evaluations for a set of statements revealed that respondents agreed with the assertions. Statement 7 has the highest average level of agreement, scoring a 4, while statements 3 and 9 have lower levels of agreement, scoring 3.04 and 3.11, respectively. A modest level of agreement is indicated by the majority of comments receiving ratings around 3.5.

Table 2. Statistical descriptions of students' attitudes regarding digital media in ELT

Statement	1	2	3	4	5	6	7	8	9	10
Interpretation	Supreme	Supreme	Median	Median	Supreme	Median	Supreme	Supreme	Median	Supreme

[**Note**: Statements 1-The process of instruction for English is simplified by digital media, 2-The English teaching metric is practical for achieving educational objectives related to digital media, 3-Digital media makes learning English enjoyable, 4-Using techniques to get started in studying will help to focus and concentrate while taking up a book, 5-The perception of pupils learning English may be improved via digital media, 6-The desire to start reading cannot be increased by learning to read through the use of digital media, 7-Using digital media to learn can assist to concentrate better, 8-Students encounter difficulties when using digital material due to limited cell phone coverage, limited web bundles and helpless sign concerns, 9-Digital media might be challenging to use since students are unsure how to utilize it effectively, 10-It is less difficult to modify the things learned after beginning to read through digital media.]

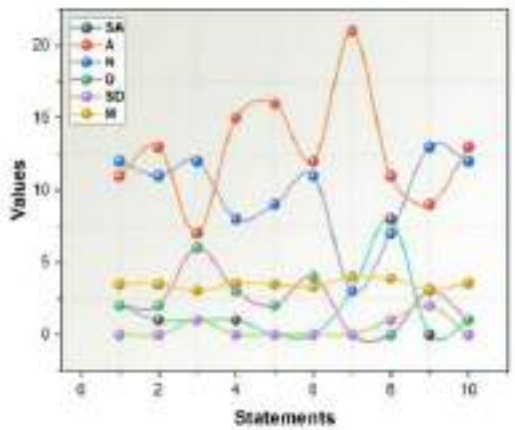


Figure 1. Statistical analysis of which students feel about using digital media in ELT

While performing an analysis of the data derived from the administered questionnaire, it was determined that a significant majority of students enrolled in the field of English education possess a favorable view of utilizing digital media as a means of accessing English reading materials. This conclusion is supported by the calculated mean score of 3.49, indicating a positive attitude towards the aforementioned practice. Nevertheless, despite the utilization of digital media, numerous students encountered certain challenges. It is determined that the average difficulty level is 3.43, placing it into the fourth category, which can be read as "High". According to the findings presented in Table 3 and Figure 2, it was observed that students agreed to encounter several challenges when utilizing digital media, with average scores ranging from 3.13 to 3.92. The replies to the given statements on a Likert scale show a modest level of agreement or disagreement with each assertion. These challenges encompassed limited availability of mobile phone resources, restricted internet packages and issues with weak signal strength. The analysis determined that the average value obtained is 3.43, falling in the fourth group, which can be read as "High". The data provided above illustrates the students' impressions of the five indications described before, namely: very low, low, medium, high and very high.

Table 3. Statistical analysis of the issues students see with using digital media as English reading material

Statement	Interpretation
1	Average
2	High
3	Average
4	Average
Total	High

[**Note**: Statements 1-Using digital media to focus while reading won't help students feel motivated to start reading, 2-Students have trouble using digital media because of limited cell phone coverage, limited online packages and problems with useless signs, 3-Due to pupils' lack of awareness of how to use websites, digital media is challenging to use, 4-Internet data is wasted when using digital media.]

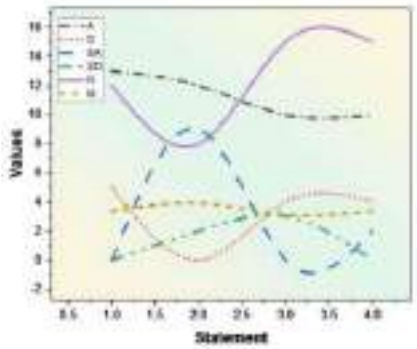


Figure 2. Evaluation of the problems students observe when using digital media as reading material for English

3.1. Discussion

The revolutionary power of digital media is capable of generating a positive impact on our society. Positive perception refers to the process by which humans create favorable evaluations and

interpretations when evaluating their immediate environment, resulting in advantageous consequences. Individuals that possess a favorable perspective are inclined to adopt and engage with the many offerings of digital media. Digital media has created a transformative impact on language learning in the field of education, resulting in increased accessibility and effectiveness. This technological advancement has improved students' comprehension abilities and language skills. The process of integration facilitates introspection and the cultivation of various competencies. The cost associated with engagement in digital media is indicative of the capacity for individuals to acquire knowledge, disseminate information and foster consciousness. It facilitates the cultivation of a profound comprehension of the universe and interpersonal relationships. The accessibility and cost-effectiveness of digital media across several platforms facilitate the process of English language acquisition, resulting in time and energy savings for learners. However, the advancement of blended learning with digital media necessitates the use of innovative approaches. Efforts are required to enhance the enjoyment of studying English through digital media and investigate its potential for augmenting reading proficiency. It is imperative to acknowledge the pupils' poor comprehension of proficient utilization of digital media, as well as the need to mitigate the squandering of internet data in the context of digital media consumption. In the dynamic context of our current environment, it is imperative that we utilize the capabilities of digital media while addressing the obstacles it presents.

4. Conclusion

This study has demonstrated that the utilization of digital media in English teaching and learning is perceived to be advantageous. The mean score of 3.49 falls within the "High" category, indicating that the use of digital media facilitates the learning process of reading and enhances the excitement of learners. The inadequate connectivity to the internet had an impact on the utilization of digital media. The aforementioned circumstances result in a direct inclination towards boredom among students and at times, the comprehension of the material becomes challenging. The measured mean of 3.43 falls in the fourth category, denoted as "High" in terms of interpretation.

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SHAKESPEARE'S LITERARY CONTRIBUTION TO ENGLISH

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Abstract:
Shakespeare's literary contributions are mainly poetry and plays. He had written few poems and 154 Sonnets. And he wrote 39 plays. His first two poems are Venus and Adonis and The Rape of Lucrece. Most of his poems are written in blank verse. His 154 Sonnets discuss the love for young man and the dark lady who whether lived or not a question mark. These Sonnets are as a meditation, nature of love, sexual passion, procreation, death and time. The poetry of Shakespeare is fully evident that he is not just a writer of enthusiasm or commercial but wanted to guide himself and everyone to the right path. Most of his Sonnets speak about love, and it is mentioned that there is nothing greater than love in this world. Love does not mean the relationship between two partners but between anybody in this world until the end of the world.

Shakespeare's plays are divided into four parts, comedy, tragedy, historical plays and tragicomedy. His comedy plays have a happy beginnings and happy endings. Tragedy plays have a great beginning and sad ending with lesson to be learnt from it. His historical plays are to tell the greatness of the kings in order to encourage everyone to do the best for the nation. The tragicomedy is introduced to bring the happy ending in the tragical life of the protagonist.

1. Introduction:

William Shakespeare was an English playwright, poet and actor. He is the greatest writer. His poems and plays have brought him name and fame. His tragic plays brought him much more fame. His way of using English has become ladder between the old English and the new. Most of his plays are translated into different languages. He has become the most influential writer in the world. His works are being read and have been used for university courses. Shakespeare had written many appreciable plays which are comedies, histories, tragedies and tragicomedies. He also acted in many of his plays as one of the characters. Most of his dialogues were remembered. They stand as the best dialogues of all time.

The comedies are fully filled with fun, love and sexuality. They are even taken for movies in the present times. They just make the audience happy and they go home all laughing. But the tragedies in contrast bring lot of bitterness, fear and death. His most famous tragedies are Hamlet, King Lear, Othello and Macbeth. He is the best writer at all time in English literature. His ideas and his thoughts for all generations makes him the man of all time. Many writers have copied and taken the help of Shakespeare's works. Those who read his works were automatically influenced by them and if at all they are to produce something new he works naturally in them. That is the beauty of Shakespeare's works. And ultimately, he will not be forgotten by the world. The world always thanks him for his service.

Poetry:

In poetry Shakespeare was famous for his sonnets. He had written 154 sonnets in total and they were divided into two parts. The first 126 sonnets were dedicated to a young man and the last 28 were dedicated to the dark lady. Most of times the first 126 sonnets and their meaning confuse audience that some take it as Shakespeare has a boyfriend and some take it as he is grateful to a young man who helped him out to grow to that stage. At times it also was understood that some woman might have taken his name for her works. The person could be his wife or any. The second part could be of a woman in whom he has lot of affection. And some of the sonnets could be discussed here for the better understanding of his sonnets. Sonnet 18, talks about the young man compared to the Summer's Day which is lovely and temperate. So, he is compared to the climate of the summer which is loved by the Europeans unlike us. He says that summer is very short but tells that the young man should live long and should never die. And he should continue in prosperity.

Finally, he says that the young man should live till the end of the world. Through this poem it is evident that the speaker loves the young man more than anything else. Shakespeare explained what love is in sonnet116, that love is eternal. If there's love it will never change, neither tempests nor time can shake or change love. Even at the time of death love stands firm like the light house that guides the ships. And Shakespeare asked them reader that no one can prove love to be false. Yes, love is true, nothing in the world can change love.

Time may change and generations and their habits may change but love always remains the same. Through sonnet 55 Shakespeare says that neither riches nor wars can prevail or destroy this rhyme. It will remain till the end of the world. Poetry lives in the lover's eyes. In sonnet 129 Shakespeare discussed the role of lust in the world. Whole world lives depending upon lust. Lust is that having strong desire for intercourse and even for other worldly things. So, Shakespeare says that thoughts of people are being lustful is a shame. For this the world becomes cruel, rude, savage and untruthful to each other. Though people have many things, they still want something more. Even if they get something they want more and more. Everyone wants to earn and become rich. No one wants to be in poverty. People have a desire to do something great in life. People don't know that they know nothing but they feel that they know everything. Finally, everyone has to leave this world.

So, Shakespeare through his poetry wanted to convey the message of love. Though many things in our life occupy the most of time, the short time with love energies us and strengthens is to have hope in

life. Life cannot be beautiful without love, neither good nor riches can fill the place of love. They all fade away but love remains forever.

Drama:

Drama Shakespeare was famous for all his tragedies and comedies. His four great tragedies have brought him all the name and fame. They are Hamlet, Othello, King Lear and Macbeth. In Hamlet the main theme is procrastination. Which means being late in action. After being visited by his father's ghost, Hamlet was fully disturbed and was not able to distinguish things around. Hamlet's father was killed by his brother Claudius who usurped his throne and married his wife in a short span of time. Hamlet who went for abroad studies was unaware of all these things but when he comes to know everything, he planned to avenge his father's death. But the fate was that postponing the murder bright Hamlet a foul death. Hamlet got many opportunities to kill his uncle Claudius but just waited for another day. And finally in dual he was murdered by the opponent. Through this play Shakespeare conveys the message that not to postpone anything.

Otherwise, the consequences will be more dangerous. Because of Hamlet's mistake there were more murders than expected. Claudius, Gertrude, Polonius, Rosencrantz, Guildenstern, Ophelia and Laertes all killed in the process of his quest and finally he too died of the poisonous sword. The problem is that Hamlet was very much confused in taking decisions, he showed hesitation and delay in killing Claudius. If he might have killed Claudius earlier, he could have saved many others. Shakespeare shows the most characters of the world through his plays, specially he emphasized the character of Hamlet like whom most of us postpone things to be done. Many people become dull if something goes against them and could think no more as Hamlet was. We don't need to take revenge on our enemy. Enemy will have his own time to face the pain. We always should be clear to our dear ones which was lacking in Hamlet. Hamlet had no good understanding either with his mother or with his love. He didn't even take the help of his friends to avenge his father's death. All these things lead his fatal and foul death. On the other hand, the delay by Hamlet had a great meaning. That, the ghost was really his father's or not was unsure. He thought that it could be someone else who wanted to destroy his kingdom. Hamlet according to the play was an existentialist who not just thinks of avenging but also to save his kingdom from evil hands. But he recognized the truth very lately that the ghost was his father's and in process many were murdered. Ultimately, Shakespeare's Hamlet is an epic drama to be remembered and to be recollected.

His Othello, was quite opposite to his Hamlet, that Hamlet was full of procrastination and Othello was hasty in action. Othello was a great Moorish military commander of Venice army. He loved and married Desdemona a young and beautiful Venetian lady without her father's consent. Desdemona's father Brabantio Complains the marriage to the Duke of Venice which finally turns in favor of Othello. But the love that Othello had for Cassio his loyal captain was hated by Iago his most trusted soldier. And he conspires to kill Cassio by a trick. Iago tells Othello that Desdemona committed adultery with Cassio. In order to prove that he shows the handkerchief at Cassio's lodgings. Enraged Othello orders Iago to attempt Cassio's murder. And he went to kill Desdemona. Othello questions Desdemona of her unfaithfulness but she denies. Then he smothered her to death, meanwhile Emilia comes and tells that the handkerchief was taken by Iago. Then he stabs Iago after which Iago stabs Emilia to death. However, Othello commits suicide and Iago was punished. In fact, the punishment was unsatisfactory.

And the play is still a famous that a commander murdered his wife just because of seeing his gifted handkerchief found in another person's house, which could be foolishness. The characters in the drama teach everyone a great lesson that one should not believe everything just seeing something with bear eyes. One should always investigate and confirm with all wisdom. Otherwise, many innocent lives will have to be lost like those of Desdemona and Emilia.
There are many Iago's in this world, who discriminate people by their color, caste, religion, class and place. One should avoid such kind of people otherwise have to become another Othello or Desdemona.

Coming to Shakespeare's comedies, it is very important to discuss the comedy play As You Like It. The theme of the play is Love. The play is about two youth who were treated badly by their family members. Orlando treated harshly by his elder brother Oliver and Rosalind by her uncle Duke Frederick who deposed her father Duke senior. Knowing his brother's plot to kill him, Orlando escaped to the forest of Arden. At the same time Rosalind was banished by her uncle Duke Frederick without any reason and Rosalind along with her sister Celia moved to the same forest of Arden. They were accompanied by Touchstone, the court fool. At the same place closer to them was living Duke Senior along with his fellow courtiers a simple and merry life whom Orlando meets. Orlando fell in love with Rosalind and was roaming everywhere to find his love.

Rosalind in the guise of Ganymede and proposes to cure Orlando of his love. Orlando didn't know who Ganymede was. Orlando meets Ganymede every day. As the time passes Oliver also comes to the forest to kill his brother Orlando but was in a danger from which Orlando saves him in which Orlando gets hurt. This Oliver tells to Ganymede and she runs to Orlando and reveals herself as Rosalind and Oliver falls in love with Rosalind's sister Celia. The play ends with the marriages of Orlando and Rosalind, Oliver and Celia and some other characters, which were celebrated by Duke Senior. Duke Frederick comes to the scene fully changed and gives back the kingdom to his elder brother Duke Senior. And the play ends in a happy note. The play began with good losing to the bad but as it continued there rose love amongst the characters that was love at first sight. And the love changed everything and all bad had become good. Shakespeare took it very light comparing to his tragedies. That is the reason the comedies are not as popular as tragedies but the present time film industries are following the comedy trend. Mostly it could be tragicomedy trend.

Critique:
Shakespeare produced great many works in his life time and I have taken very few of them to explain. These examples may not be sufficient but they could tell us the greatness of Shakespeare. He lived not just the Elizabethan period but all the periods. He is applicable to all centuries. For his works speak of that. Moreover, Shakespeare with his poetry gave great examples of life. He made love the center of everything in life. He said that there's nothing but love is truth. And with his tragedies he brought all the fear, tears and the reality of world being exposed.

Those portrayed tragic incidents are still happening around the world. Shakespeare's villains are everywhere in the world and his tragic heroes too. There are many Hamlets in the world who are stuck with the problems and take lot of time to come out and end their life miserably. There are many Othello's in the world, who listening to others have killed their own dear ones. There are many Macbeths who for the sake of wealth have killed other families and finally ended up in the same

situation. But his comedies are very rare in reality. They won't really happen around the world. He created them only for the sake of amusement. In his tragedies he highlights male characters and, in his comedies, he highlights female characters.

2. CONCLUSION:

Shakespeare's contributions are many to the literature of English. And they made many learn English by their beauty. They brought the development to the English. The works of Shakespeare helped many universities to come up with new ideas and conclusions on his works. Many writers were influenced by his writings that they too write like him. And some of those works have become greats of all time.

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Diasporic Identity in the Select Poems of Meena Alexander

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ABSTRACT:

The present topic is concerned primarily concerned with this analysing some poems composed by meena Alexander who is considered one of the prominent South Asian American migrant women writers. From a migrant perspective, we shall focus on recurrent themes in Alexander Writing: Diaspora, Identity, Alienation and the other themes, Straddlingbetween cultures and countries. From India, through Sudan, England and America, is a poignant experience initiating multiplicity and dislocation in Alexanders past and present and consequently reframing both her life and writing career. Against a backdrop of dissimilar geographical territories, Alexander depicts several migratory experiments to convey numerous literary language expressions of hybrid languages expressions of the hybrid condition.

INTRODUCTION:

Indian English literature

Indian English Literature refers to the body of works by authors in India who write in Englishand whose native or co-native language could be one of the numerous languages of India. It is also associated with the works of members of the Indian diaspora. Indian writing in Englishhas come into force only in the last couple of decades or so, as far as literature goes.

History of Indian English Literature

Indian English literature is also called Indo-Anglican Literature. It is a term used for Indian writers who write in English. Those writers are called Indo- Anglian writers.The tavels of Dean Mahomet' was the first book that was written by an Indian in English. It was written by Dean Mohamet and published in England. Rajmohan's wife' was the first novel written by Bankimchandra Chattopadhyay who was an Indian and was published in 1864.'Kisari MohanGanguli' who is credited for translating Mahabhorat in English.

The Dawn of Indian English writing arrived with sake of Dean Mahomet (1759-1851). Hewas a traveler, surgeon, and entrepreneur who introduced the Indian curry house restaurant on Britain, and was the first Indian to have written a book in English.

His fame chiefly lies with his work, the travels of dean Mahomet I an eigh tenth centuaryjourney through India Indian English literature refers to the body of work by writers in india who write in English language and whose native and co-native language could be one of the numerous languages of india. It is also associated with the works of Desai, Jhumpa Lahiri, Agha SahidAli, Rohinton Mistry and Salman Rushdie who are of Indian descent.

Writers like Rabindranath Tagore, Kazi Nazrul Islam and Bankim Chandra Chatopadhayay inspired the millions of Indians to strive for freedom. In later ages theinfluences of British English built the track for Indian English writing.

Tagore's translation of Gitanjali which earned him a Nobel prize for literature set theficker for English writing which in turn burst into flames.

Writers:

1. Bankim Chandra Chatopadhayay
2. Raja Rao
3. R.K Narayan
4. Mulk Raj Anand
5. Rabindranath Tagore
6. Adita desai
7. Salman Rushdie
8. Nirad C. Chaudhuri
9. Ram Nath Kak
10. Nayantara sahgal

The first Indian English novel is Bankinchandra Chattopadhyay's Rajmohan's wifepublished in the year 1864.

Toru Dutt, first Indian poetess, who often referred to as the Keats of Indian English literature.Indian poets writing have succeeded to nativize or Indianize English in order to reveal typicalIndian situation.

Henry Louis Vivan Derozio is considered as the first poet in the lineage of Indian Englishpoetry followed by Rabindranath Tagore, Sri Aurobindo, Sarojini Naidu, Michael Madhusudan Dutt, and Toru Dutt among others.

It's a literature which for me opend the mysterious and decisive doors of imagination and understanding . to see the Why others see, to think the way other think. And above all to feel.

-Salman Rushdie

INDIAN ENGLISH POETRY

Henry Louis Vivian Derozio (1809-31) is considered the first Indian English poet. Poems (1827) and The Fakeer of Jungheera A Metrical Tale and Other Poems (1828) are his published volumes of poetry. Derozio was influenced by the British romantic poets in theme,imagery, diction and sentiment in his shorter poems. At the same time, a little bit of influenceof the neo-classical poets like Alexander Pope was also evident in his poems.

On the other hand, influence of Byron was visible in his satirical verse and long narrative verse. The Fakeer of Jungheera is a long narrative poemwritten on the plight of a young Hindu widow Nuleeni. On the verge of her jump into the funeral pyre, she was rescued by ayoung leader of a robber group. Her rescuer who became her lover soon lost his life in the battle fought by her relatives to reclaim her. Nuleeni breathed her last in sorrow.

The striking feature of the poem is its use of different metres for various occasions. Anothernoteworthy feature of Derozio as a poet is his burning nationalistic zeal. "To-India-My
Native Land", "The Harp of India", "To thePupils of Hindu College" etc. are some suchpoems where we can observe un mistakable authenticity of patriotic utterances.

Indian English poetry came to the mature phase with Toru Dutt (1856-1877). Her A Sheaf Gleaned in French Fields (1876) is a translation of 165 French lyrics into English. Even her sister Aru Dutt also translated a few lyrics. Ancient Ballads and Legends of Hindustan (1882)was published posthumously. The poems of this volume carry discernible influence of Keats. Ballads of Sita and Savitri—two most prominent archetypal figure of Indian woman are included in the collection. Toru Dutt was the first Indian English poet who extensively used Indian myths and legends in her poetry.It was remarkable that her poetry was virtually free from imitation Rabindranath Tagore's fame as an Indian English poet certainly lies on Gitanjali (1912)—a collection of songs which were translated from Bengali into English and for which he got the Nobel Prize for literature.

Indian poetry

Evolution of Indian English Poetry

- Roja Rammohan Roy

Though directly he is not connected with Indian English writing we read him because he wascalled the Father of Bengal Renaissance. He wrote Some essays in English and was the founder of Hindu College Kolkata

A Henry Louis Derozio

A lecturer in Hindu College. His father was on Indo-portugal and mother was a British. So, he was an Indian poet born in kolkata. He published two famous volumes of poems. They are

- The Fakeer of Jungheera
- A Metrical late and Other poems.

He was influenced by British Romantic poets and wrote Sonnetsand also wrote Some patriarchal works.

Romesh Chunder Dutt

He used to write novels in Bengali language and after that

he worked on some historical works especially Rigved. He also translated Ramayan andMahabharat.

Sri Aurobindo

He had a long poetic career. He used to write religious type of poetry which was called Narayan Darshan. He wrote Lyrical, Narrative, philosophical and Epic poems in his career.His famous poem was **Savitri**

Rabindranath Tagore

Mahatma Gandhi called Tagore, the "Great Sentinel" . He was a poet, dramatist, novelist,short story writer, Composer, painter and thinker , educationalist, Nationalist and Internationalist. Before 1912, he used to write bengali

After reading some of Tagore's self translated poems, W.B. Yeats was instrumental in getting the collection published. Perhaps most importantly, Yeats wrote the Introduction toTogare's Githanjali, which first appeared in 1913. and also received Nobel prize which wasrecomended by yeats. Then he understood the value of writing in English.

Treatment of nature

- **Sarojini naidu**

Her mother was Bengali poet. Sarojini Naidu was influenced by English Romantic poetslike John Keats, Lord Byron. She is called the 'nightangle of India'.

- **Keki N. Daruwalla**

He was a police officer by profession and he published his twelve Volumes of poetry.

- **Toru Dutt**

She studied at France with her sister. She believe that French language is her mothertongue. She wrote her first volume of poetry in French.

She passed away in 1977 because of Tuberculosis at a very young age, but she left a deep mark in English literature. In Indo-Anglian literature she is compared with John Keats as hertalent is like Keats and also her death.

Feminism and female imagination

- Eunice De Souza

She taught English at St. Xavier's College, Mumbai. Indian English Language poet, literary critic and novelist. She is one of the most famous confessional poets of Second halfof the twentieth century.

kamala Das

- She wrote in both Malayalam and English languages.

She was well Known after receiving Asian Poetry Prize in 1963. She wrote about feminismand also involve autobiographical elements in her works.

- Imtiaz Dharker

She is a pakistan- British poet, artist, and video film maker. Won Queen Cold Medal forher English poetry and was appointed Chancellor of Newcastle University from Jan 2020.

Memory Musice

- AK. Ramanujan

He was an Indian poet and Scholar of Indian literature and Linguistics. He was also aprofessor of Linguisties at university of Chicago. His poetry was philosophical. He won Padma Sri award in 1976.

- Agha Shahid Ali

He was born in kashmir and immigrated to the United States. He was a finalist for theNational book Award in 2001. He also wrote about the partition of India Pakistan.

- Jayanta Mahapatra

He is an an Indian English poet. He is the first Indian poet to win Sahitya Akademi award forEnglish poetry. He was a physics teacher. He started his writing career lately.

Diasporic Identity in the select poems of Meena Alexander

In this chapter I would like to give an account of the elements that can be considered as the elements of diasporic identity in the works of Meena Alexander. Particular in a few poems that were written by Meena Alexander. In her works we will come across the dislocation and alienation she felt. Alienation in all sort of things like alienation from thehomeland land which can be seen in her works, she look back for a imaginary homeland,and how she felt being alienated in the new home.

In order to give an account of the elements of diasporic identity in the Poems of Meena Alexander, I will take some of the poems in which I can be able to trace the elements ofdiasporic identity. For that purpose I would like to select five poems and trace out the diasporic identity. The poems are :

Muse

The poems "Muse" reflects the world of personal loss of meditated by memory and exile.The composition of poems in the early age saves the poet from burning and she turns intothe molten thing.

"Each thing rings it's turn"

Meena Alexander uses this line in her poem "Muse" to talk about her past life and shesays, each thing that happened is still clear and fresh in her memory. We can sense thenostalgia in the line. This we can consider as an element of diasporic identity.

"Girl was penne, hair drawn back,

Pusthakam pages parted

Spreading fire in a tree marram".

In the above lines she uses some words like penne, pusthakam and marram. These are the

Tamil words and in this poem she uses some words in Tamil. This mentioning of the Tamil word scan be considered as an element of diasporic identity, as she felt alienatedfrom her mother tongue. This is also a key element in diaspora which is alienation fromthe mother tongue.

" Girl was penne, hair drawn back,Gleaming on the scalp"

Here, in these two lines in the poem, we can get an image of a typical school-going girl inIndia. Hair drawn back, which means she tightly braided her hair back and the other line gleaming on the scalp, this means that the girl oiled her hair and then braided her hair back. This image exactly reflects the image of a school-going girl in India. This also gives the picture of her nostalgia. She remembered all the things of her childhood.

" Write in the light Of all the languages."

In these lines the poet is talking about her own identity. As she know many languagesthrough her travelling. This we can interpret as she is not able to write in her mother tongue but she writes in other languages, she says write in light of all languages.

Eventhough she is not able to write in her own language she writes in the light of alllanguages.

" Dressed like a convent girl-White socks, shoes,

Dark blue pinare, white blouse."

These lines describes the accessories or the things that are worn by Indian students and she describes about her friend in her school. By this description we can assume that as thepoet is describing her, she might be her good friend from her childhood when she studied in Kerala. This we can be considered as the nostalgia of her past.

" Write in the lightOf all languages

You know the earth contains Youmurmur in my ear."

Through these lines we can connect the life of Meena Alexander, as she travelled to manyplaces and learnt many languages and her works also published into many languages. In these lines she says that write in all the languages that earth has.

In the poem "Muse" Meena Alexander laments the ruin of 'Our language' and the sense ofhaving 'no home.'

The poem is about how the poet came across her muse in childhood while she was staying in Kerala, India and who made her familiar with the world of creativity. So, we can say that the poem includes the diasporic elements like nostalgia of her childhood andwe can also observe the language she uses is also Tamil which is her mother tongue.

Conclusion

Meena Alexander is better known as a poet, but she has touched other genres of literature also. Herpoems have been translated into several languages such as Malayalam, Hindi, Arabic, Persian, Italian, Spanish and German. She is internationally recognised, well known and reputed poet. Sheis one of the prominent diasporic poets of South Asia. In her poetry she expresses or reflects her own diasporic life. She is well known to be having rich multi-cultural experience. Her poetry revolves around uprooting, alienation, migration, trauma, separation and loneliness all the way from India to Sudan and USA.

Her poems are well composed and have minimum words. Meena Alexander's poetry is marked bydiasporic sensibility which is highly emotional, consists of sensual expression, lyrical and metamorphic in language. She has undergone multiple identities in multiple places. Her poems express the places in which she lived and her experiences. She asks herself : Who am I ?, Where am I ?, When am I ? . These are the questions which all diasporic writers incorporate in their works.In modern world, the biggest challenge for a creative writing to make a real integration between one's personal, history and the experiences of alien countries.

As she travelled from one place to another, her sense of feeling of belonging "no where" can be seen in her poems.

In many of her poems, we can see the burden of English in one's own language. Although she is apolyglot and knows many languages such as Malayalam, Hindi, Arabic, French, and English, butshe felt that the language in which she writes that is English had alienated her from what she wasborn to. The language of intimacy. In the poem "Muse" she laments the ruin of 'Our language' andthe sense of having 'no home'.

Meena Alexander tells how migrant memory shaped and gave birth to her poems.

Meena Alexander poetry represents her old cultural identity through story, myth, language and memory. In her poetry, she reflects vital issues such as identity, belonging and racism that she feltwhenever she tries to locate herself. Alexander mingles her past to reveal the complexity of her memories. Her poems convey the fragmented experience of the traveller, for whom home is botheverywhere and nowhere.

Her poetry is a complex interweaving of the Indian and immigrant experiences. Her poetry seemsto be a self-searching. It represents her personal experience, disposition, feelings and judgements.Her writing revolves around the theme of establishing an identity.

Language in Alexander's poems linerates, empowers and eventually becomes a place in which to live and thus " a short incantation " ends up becoming a " long way home."

In her poems we can find her struggles to make a position of her own. The personal journey of thepostcolonial diasporic writer and traveller can be seen in her poems. The poems shows Meena Alexander's journey of practical border crossing. Cultural experiences from childhood to maturityalong with her traditional homely experience.

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Some writers about Meena Alexander

" Underlying her fiction is uprootedness, nostalgia for a past which is itself a fiction. Her mind moves back and forth between India and rooms, hotels, streets in New York, never really at home."

" Alexander's power comes from poems resonating upon each other within a volume or aa her workis followed from book to book. She has written about phenomenology and women in the self, especially the famine self and what it means to be Indian if you live abroad."
-Bruce King

" Meena Alexander songs of countries, foreign and familiar places where the heart and spirit live,and places for which one needs a passport and visas. Her voice guides us far away and back home.The reader sees her visions and remembers and is uplifted."
-Maxi Hong Kingston

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"COLLABORATIVE SERVICE RECOMMENDATIONS FOR DATA SHARING USING BLOCKCHAIN"

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Efficient Hostel Management System for Multiple Hostels in Academic Institutions

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Abstract: "Efficient Hostel Management System for Multiple Hostels in Academic Institutions" is a web based software application developed for managing various activities in multiple hostels in an academic organization. In the olden days the number of students in an educational institution is very less and it is enough to use a single hostel for all those students. But now-a-days the number of educational institutions and the students staying at hostels is increasing rapidly.

Hostels are becoming more prevalent in order to accommodate the enormous number of students. As a result, the person in charge of overseeing hostel operations has a lot of responsibility, and software is not utilized in this situation. With the help of this web application, issues with handling various hostel students' data are resolved, and issues with maintaining manually are avoided.

The development of new software applications that will be compatible with the existing system and also have with better user friendly and more GUI focused results from identifying the shortcomings of the present system (here manual). We need to increase the proposed system's efficiency and accuracy in order to address the shortcomings of the current system.

Keywords: Hostel, Students, web application, academic organization, educational institution etc.

1. Introduction

1.1. Brief introduction

The web-based multi-hostel management system was developed to better effectively house college students on campus. Additionally, this project maintains information on every student living in an organization's many dorms. The coordinator for the hostel who made the call is in charge of it. He will serve in that capacity. It makes sense to organize the housing of numerous hostels on a campus to accommodate a big number of students. Through online visibility of available rooms in various hostels, this document aims to reduce the amount of manual work required for hostel allocation and simplify the task for hostel officials. Students can learn more about their roommates' personal information.

1.2. Project Objectives

- Separately list the students who have moved out of residence as hostellers.
- When the admin confirms the allocation, the student's information is automatically added to the hosteller's record.
- It is also added to the empty student's record when vacating is verified or after the course finish date.
- Admin can look up students using their student IDs, names, or phone numbers.

2. Related Work

In this[1] paper The Hostel Management System (HOMASY) is a computerized solution developed using PHP programming language and MySQL database application. The system aims to provide a stress-free, reliable, and efficient process for both students and staff involved in registration and hostel management.

By utilizing PHP and MySQL, HOMASY offers a user-friendly interface and automated functionalities that streamline various hostel management processes. The system ensures a hassle-free experience for students during registration and provides comprehensive tools for staff to effectively manage hostel operations.

In this[2] hostel management system framework aims to automate all activities occurring in a hostel. It addresses the major drawbacks of the current scenario by providing data security, integration, and efficient data retrieval, resulting in smooth operations and saving human effort and time.

By implementing the proposed framework, hostel activities such as registration, room allocation, fee management, attendance tracking, and complaint management can be automated. This automation eliminates manual processes and reduces the chances of errors, ensuring smoother and more efficient operations.

In this[3] hostel management system solution, it aims to enhance and advance the existing system by incorporating modern technologies such as HTML, CSS, JavaScript, PHP, MySQL, and Bootstrap. This project is designed as a hybrid platform where multiple hostels can register themselves, and students can conveniently book accommodations based on their specific requirements. Additionally, grievance management and filter functionality have been incorporated into the project to further enhance user experience and satisfaction. The solution also considers future scope and scalability to ensure its long-term usefulness and effectiveness.

The goal of this project[4] is to create a system for recording information and displaying it in or around a hostel. This approach will make it easier for the hostel officer to run the hostel's business. A student's whole profile will be available thanks to this technology. It will display the number of persons in each room as well as whether or not a room is available. This will also reveal which pupils have paid in whole or still owe money. Additionally, this system would give a summary of the fees and bills that students are owed. A user module for staff or the hostel officer is also included.

3. Existing System

There is no particular software application to manage the students at multiple hostels and at present the thing is done through manual process which requires a lot of efforts and which consumes a lot of time. In the existing system we can manage the students of one particular hostel in which the students can apply for the hostel online but the allotment processes are done manually, which may lead to problems in the allocation process.

Disadvantages

- More human strength.
- The hostel coordinator is under more stress and pressure.
- Repeating the same process.
- Minimal security.
- Redundancy in data.
- A challenge to manage.
- The challenge of updating data.
- Keeping records is challenging.

4. Proposed System

This project is mainly developed for keeping records and showing information about the students located in various hostels. This system will help the hostel coordinator to be able to manage the students of the hostels in an organization. This system will provide full information like student name, student id, college he/she belongs to, father and mother mobile numbers etc., about a student in the hostel.

The coordinator can also view the room's availability and the number of students in a particular room. It provides the reports of the students based on college wise or hostel wise and it can also shows the students of all the hostels in a single report. There will also be an administrator module which will accessed by the administrator and has the ability to add, delete and update hostel and room details. This system will be developed with PHP and XAMPP server. PHP and MySQL are good for the development and design of web based applications whiles XAMPP is good for databases because of its security and its advanced features and properties.

5. Hardware Requirements

It is important to choose the suitable and compatible hardware configuration to the development of software. The low configured hardware may effect on the efficiency and speed of the developed software. We need to keep the operations of our application in mind while choosing the hardware for the development of any kind of software application.

1. Users Processor: Pentium III and above Processor speed: 1.2 GHz Onwards
2. System Memory: 256 MB minimum (512 MB recommended)
3. RAM: 512 MB (Minimum)
4. Network Card: Any card can provide a 80mbps speed Network connection: UTP or Coaxial cable connection
5. Hard disk: 100 GB
6. Keyboard & Mouse: 104 keys US Key Serial, USB or PS/2 and an Optical Mouse

6. Software Requirements

The selection of compatible software is a major element in the development of a software application since the software in the market is experiencing in geometric progression. The selected software should be acceptable by the users who are interacting with the system. The software requirement specification describes how a system should act, appear or perform.

Technology Implemented	: Apache Server
Language Used	: HTML, Bootstrap, PHP, JAVA SCRIPT.
Database	: MySql XAMPP Server
User Interface	: HTML, CSS, Bootstrap.
Web Browser	: Internet Explorer 7(or newer) or Mozilla Firefox, Google Chrome.
Software	: MySQl Server & XAMPP
Operating System	: Windows XP or Higher Versions

7. System Overview

Multi Hostel Management System makes hostel students data maintenance easy and requires less man power and less time as well as cost for maintaining it. HTML, CSS and Bootstrap are used for designing front end development of the system.

For web development the JavaScript, PHP is also implemented having the major role in validation and for whole processing. The MySQL is used as the backend for this application.

HTML (Hypertext Markup Language) [5] is a text-based language used to describe the organization of material in an HTML file. A webpage's markup gives web browser instructions on how to display text, images, and other multimedia.

On a web server, PHP code is often processed by a PHP[6] interpreter, which can be implemented as a module, daemon, or Common Gateway Interface (CGI) executable. The output of PHP code that has been interpreted and executed on a web server may make up all or part of an HTTP response, and this output could take the shape of any type of data (such as produced HTML or binary image data).

MySQL [7] is a key component of many of the most widely used software stacks for creating and sustaining anything from robust, data-driven B2B services to customer-facing web apps. Due to MySQL's open-source nature, dependability, and broad feature set, as well as continued development and support from Oracle, it is used as the backend by a number of key websites, including Facebook, Flickr, Twitter, Wikipedia, and YouTube.

It has mainly one module that is Admin module.

#Admin Module

The admin in other terms the hostel coordinator has all the privileges to add or delete or update the students in different hostels. He/she has also capable to change the room/hostel of a student. He/she can take the reports of the hostellers based on student wise or hostel wise or college wise in a campus. It is efficient to handle more number of students in multiple numbers of hostels. By using the student id it get all the details of the student when we required.

8. Database Design

Data design in the hostel management system involves the structuring and organization of data to effectively store and retrieve information related to students, rooms, payments, and other relevant data. The data design ensures efficient data management, accurate reporting, and smooth system operations.

The following are the different table structures using in this project.

hostelroom	
Field	Type
room_no	varchar(5)
floor	varchar(5)
room_type	varchar(10)
no_beds	varchar(10)
beds_occ	varchar(10)

hostel	
Field	Type
hid	varchar(20)
hname	varchar(50)
no_floors	int(5)
ac_rooms	int(5)
non_ac_rooms	int(5)
warden_name	varchar(100)
warden_mobile	bigint(10)

Student	
Field	Type
hid	varchar(50)
rno	int(10)
sid	varchar(50)
sname	varchar(150)
clg	varchar(100)
spec	varchar(50)
branch	varchar(10)
year	varchar(10)
gender	varchar(10)
smobile	bigint(15)
email	varchar(100)
fname	varchar(100)

fmobile	bigint(15)
address	varchar(300)
photo	varchar(100)
status	varchar(10)
dov	date

9. Result Analysis

Figure 1: Login Page



Figure 2: Home Page



Figure 3: Room Availability Page



Research Through Innovation

Figure 4: Hostel wise Report



10. Conclusion

In conclusion, the "Multi Hostel Management System" is a web-based software application designed to address the challenges faced by academic institutions in managing multiple hostels. The system offers a range of features and benefits, including accommodation management, student information management, room and inventory management, attendance and leave management, fee management, complaints and maintenance tracking, and comprehensive reporting capabilities.

By implementing this system, academic institutions can significantly improve the efficiency and accuracy of their hostel management processes. The system eliminates the need for manual record-keeping and streamlines various administrative tasks, ultimately saving time and effort for hostel administrators. It provides a user-friendly interface and a centralized platform for managing student accommodation, ensuring accurate records, efficient resource allocation, and timely communication with students.

Overall, the "Multi Hostel Management System" contributes to a more organized, systematic, and hassle-free management of hostels in academic institutions. It enhances the overall student hostel experience, promotes transparency, and enables administrators to make data-driven decisions. With this software application, academic institutions can effectively manage their hostel facilities and meet the growing demands of student accommodation in a more efficient and effective manner.

11. Future Work

For future work, there are several potential enhancements and additions that can further improve the functionality and usability of the system. Some areas of focus could include:

Integration with payment gateways: Adding the capability to facilitate online fee payments by integrating the system with popular payment gateways, ensuring convenient and secure transactions.

Mobile application: Developing a mobile application that allows students, hostel staff, and administrators to access the system and perform various tasks on their mobile devices, providing greater flexibility and convenience.

Integration with access control systems: Integrating the system with access control systems, such as smart cards or biometric systems, to automate hostel entry and ensure enhanced security.

Communication and notification features: Implementing features that enable effective communication between hostel staff, students, and parents/guardians, such as automated notifications for important updates, announcements, and emergency situations.

By incorporating these future enhancements, the "Multi Hostel Management System" can further streamline hostel operations, improve communication and transparency, and enhance the overall efficiency and effectiveness of hostel management in academic institutions.

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Predicting Flood Impacts: Analyzing Flood Dataset using Machine Learning Algorithms

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Abstract - *Floods are one of the most destructive and challenging to anticipate natural catastrophes. The frequency or severity of floods has grown in recent years due to climate change and urbanization, as have the associated fatalities and financial losses. Machine learning-based flood forecasting models have slowly started to appear as a result of the fast expansion of computing power. Rich information is included in these models since they were trained on historical data, which is advantageous for data analysis and use. Machine-learning-based models are more effective than the conventional physical flood forecasting model in achieving satisfying results. This study provides a summary of contemporary machine learning-based flood prediction techniques to illustrate recent developments in flood forecasting.*

We list a range of current works in flood prediction and construct the model based on several methodologies.

For flood warnings, flood reduction, or flood prevention, machine learning (ML) models are useful. Machine-learning (ML) addresses have become more well-liked in this regard because to their minimal computing demands and predominance of observational data.

Key Words: Flood, human injure, urbanization, Random Forest, Support Vector, Neural Network etc.

1.INTRODUCTION

The number of natural and man-made disasters has grown globally in recent years. The most common natural catastrophe is a flood, which happens when an excess of water submerges normally dry ground. Floods are typically caused by protracted periods of intense rain, rapid snowmelt, storm surges from tropical cyclones, or tsunamis in coastal areas.

Floods may wreak havoc across a large area, causing fatalities as well as damage to private property and vital public health facilities. Worldwide, more than 2 billion people were impacted by floods between 1998 and 2017. Most at risk from floods are those who reside in floodplains, in non-flood proof structures, lack access to warning systems, or are unaware of the risk of flooding [1].

75% of those who pass away in flood catastrophes drown. Disasters caused by flooding are occurring increasingly often, and this tendency is predicted to continue. Flooding increases the danger of drowning, especially in low- and middle-income nations where residents live in flood-prone locations and flood warning, evacuation, and protection systems are still underdeveloped or insufficient [2].

2. LITERATURE SURVEY

The author of this research analyzed several machine learning-based flood forecasting systems, including linear regression, decision trees, and SVM-based approaches, as well as deep learning-based algorithms like BP and LSTM models. The study shows that the applicability of various approaches varies. Furthermore, since the most recent algorithms are largely influenced by the sophisticated models in deep learning, this paper's conclusion from the current research is that the advancement of deep learning technology has a significant impact on further improving the accuracy of flood prediction performance [3].

Based on historical rainfall datasets spanning 33 years, the goal of this project was to develop a machine learning model that can forecast floods in Kebbi state so that it may be applied to other Nigerian states with high flood risk. In this study, three machine learning algorithms—Decision Tree, Logistic Regression, and Support Vector Classification (SVR)—were assessed and their Accuracy, Recall, and Receiver Operating Characteristics (ROC) scores were compared. When compared to the other two methods, logistic regression yields more accurate findings and offers excellent performance accuracy and recall. The Decision Tree fared better than the Support Vector Classifier as well. Due to Decision Tree's above-average accuracy and below-average recall ratings, it did pretty well [4].

This study introduces an innovative method for using the ensemble model to estimate water level in relation to flood

severity. Our method makes advantage of the most recent advancements in machine learning and the Internet of Things (IoT) to automate the analysis of flood data that might be valuable in the mitigation of natural catastrophes. According to research findings, ensemble learning is a more accurate method of predicting the severity of flooding. With sensitivity, specificity, and accuracy of 71.4%, 85.9%, and 81.13%, respectively, the experimental findings show that ensemble learning utilising the Long-Short Term Memory model and random forest outperformed individual models [5].

The various model architectures and their performances are shown in this research. Based on IoT data and weather forecasts, machine learning models using deep learning neural networks have been constructed to identify potential risks [6].

3. PROPOSED METHODOLOGY

Based on your dataset and the goal of flood prediction, here is a proposed methodology for analyzing and predicting flood-related outcomes using machine learning:

Training Phase: The system is trained using the data from the data set and the correct method of model fitting.

Testing Phase: The system is given inputs before its functionality is evaluated. It is put to the test.

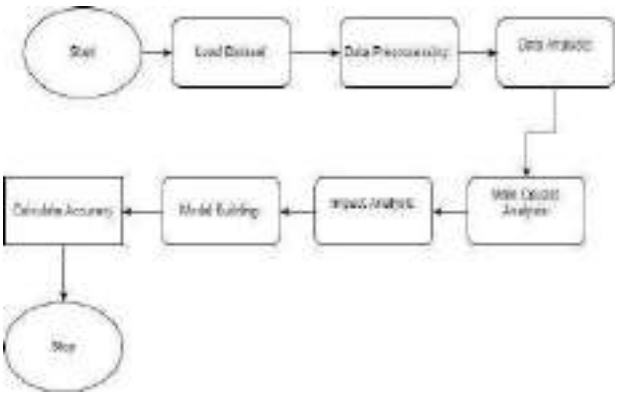


Fig: 1 System Architecture of flood

3.1. TECHNOLOGIES USED:

3.1.1 Python:

For building websites and apps as well as doing data analysis, Python is a widely-liked and approachable programming language. We can readily reuse code thanks to the distinctive features of this high level programming language. Python is not limited to any one area of study and may be used to develop a wide range of original projects and programmes that are dynamic and interesting. Both the dynamic typing and garbage collection are done [7]. Some of its characteristics include simple sharing and collaboration, free access to computer resources.

3.1.2 Google Colab

Python projects and programmes may be written and run using Google Colab, also referred to as Collaborator. We can perform high-level programming, data analysis, and machine learning algorithms thanks to it [8].

3.2 DATASET COLLECTION, PRE-PROCESSING, AND ANALYSIS

3.2.1 Data Collection

In this paper the data is collected from Kaggle. The data set cointains a lot of information like starting date and end date of floods and heavy rainfall occurred. And also the data set cointains the information about number of days rain fall, number humans injured, number of death occurred.

3.2.2 Pre-processing of Data

Pre-processing refers to changing or eliminating unclean and raw data by detecting missing or unnecessary elements of the data and subsequently. Encoding Categorical Variables like "maincause," are encode them into numerical values for the machine learning algorithms to understand. One common approach is one-hot encoding, where each category is represented by a binary value (0 or 1) in separate columns.

3.2.3 Data Analysis

In this dataset, many columns data from across India has collected. By using these columns data it is used to predict the human injured, human deaths, animal deaths can be predicted. By using this data set it is analysied how many human injured, human deaths, animal deaths can be forecasted.

4. IMPLEMENTATION

The model is tested in this stage using the predefined machine learning classifiers. There have been a few models created, and their correctness has been confirmed. For this project, we're using the four classifiers indicated below.

- **Decision Tree:** Calculate the accuracy of the Decision Tree model by comparing the predicted labels to the true labels of the test data. Additionally, you can compute metrics such as precision, recall, and F1-score for a more comprehensive evaluation.
- **Random Forest:** Similar to the Decision Tree, compute the accuracy, precision, recall, and F1-score of the Random Forest model based on the predictions and true labels of the test data.

- **SVM:** For SVM, use the accuracy metric to measure how well the model performs in classifying the test data.
- **Gradient Boosting:** Calculate the accuracy, precision, recall, and F1-score for the Gradient Boosting model using the predicted labels and true labels of the test data.
- **Neural Network:** Evaluate the Neural Network model's accuracy by comparing its predicted labels to the true labels of the test data. Additionally, you can compute other metrics such as precision, recall, and F1-score.
- **Isolation Forest:** For Isolation Forest, the typical evaluation metric used is the Mean Squared Error (MSE). This metric measures the average squared difference between the actual values and the predicted anomaly scores generated by the Isolation Forest algorithm.

5. RESULTS

The data from various cities in India, such as Arunachal Pradesh,Assam,Bihar,Chattisgarh,Himachal Pradesh,Jammu & Kashmir, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Punjab, Rajasthan, Sikkim, Tamilnadu, Telangana, Uttar Pradesh, Uttarakhand, West Bengal, Puducherry, Andhra Pradesh, Chhattisgarh, Gujarat, Jharkhand, Mizoram, Tripura, Nagaland, Andaman & Nicobar Islands, New Delhi, were collected. The data includes different variables, such as start date ,end date, Duration, Main_Cause, Districts, State, Human_fatality, Human_injured, Animal_Fatality, Description_of_Casualties/injured, Extent_of_damage.

The correlation coefficients between two sets of variables are shown graphically in a correlation map.

Some Insights:

- According to a heatmap, Human_injured and Animal_Fatality have a significant positive linear link with a correlation coefficient of 0.83 between them.
- A heatmap's Human_Injured and Main_Cause correlation coefficient of 0.072 indicates that there is a marginally positive linear association between these two variables.
- According to a heatmap, there is a somewhat positive linear link between Animal_Fatality and Human_injured , with a correlation value of 0.83.

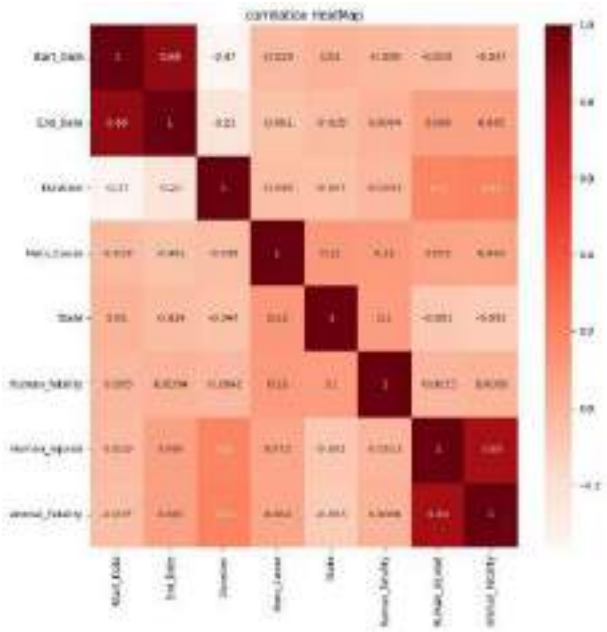


Fig:2 Correlation Heat Map for Flood Dataset

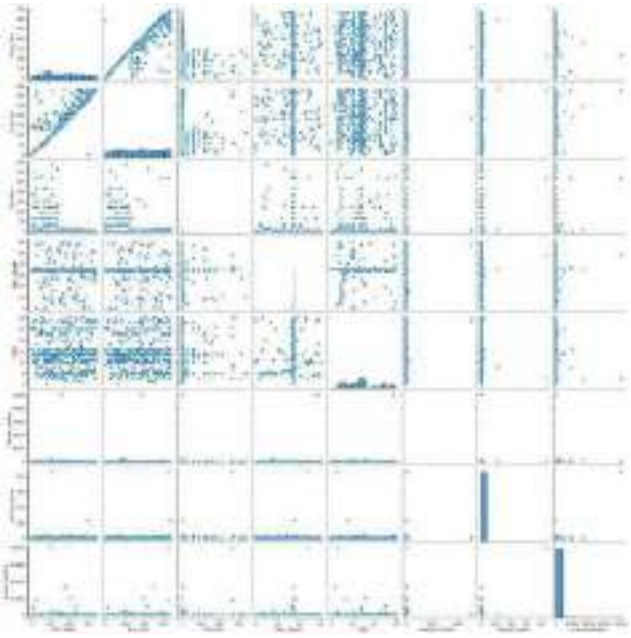


Fig:3 Pair Plot for flood dataset

From the above graph it shown the different columns data in the graph

A pair plot is a graphical representation that allows you to visualize the relationships and patterns between pairs of variables in a dataset. It provides a matrix of scatter plots, where each scatter plot represents the relationship between

two variables. Here's a description of the pair plot for the flood dataset columns you provided:

1. 'Start_Date' vs. 'End_Date': This scatter plot will show the relationship between the start and end dates of the flood events. It can help identify any patterns or trends in the duration of the floods.

2. 'Start_Date' vs. 'Duration': This scatter plot will display the relationship between the start date of the floods and their duration. It can reveal whether there is a correlation between the start date and the length of the flood events.

3. 'Start_Date' vs. 'Human_fatality': This scatter plot will show how the number of human fatalities varies with the start date of the floods. It can help identify if there are any time-specific factors that contribute to higher or lower human fatalities.

4. 'Duration' vs. 'Human_fatality': This scatter plot will illustrate the relationship between the duration of the floods and the number of human fatalities. It can indicate whether longer-lasting floods are associated with a higher likelihood of human casualties.

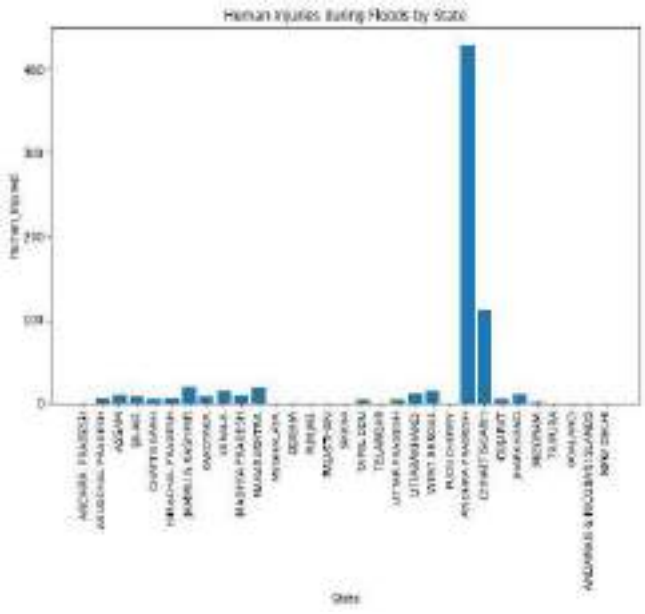


Fig:4 Human Injuries during flood by state

The bar chart displays the number of human injuries during floods, categorized by state. The x-axis represents the different states, while the y-axis represents the count of human injuries. Each bar represents a state and its corresponding value indicates the number of human injuries reported in that state during flood events.

The height of each bar represents the magnitude of human injuries, allowing for a visual comparison between states. The bar chart provides insights into the states that experienced a higher number of human injuries during floods, helping identify regions that were more severely affected.

By examining the chart, you can identify states with the highest and lowest counts of human injuries, facilitating a better understanding of the impact of floods on human populations across different regions.

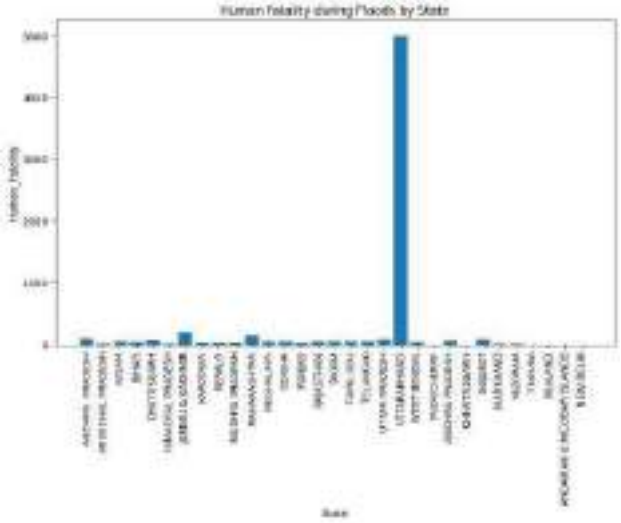


Fig:5 Human Fatality during Floods by State

The bar chart illustrates the number of human fatalities during floods, categorized by state. The x-axis represents the different states, while the y-axis represents the count of human fatalities. Each bar corresponds to a state, and its height represents the number of human fatalities reported in that state during flood events.

The bar chart allows for a visual comparison of the magnitude of human fatalities across different states. It provides insights into the states that experienced a higher number of human fatalities during floods, enabling the identification of regions that were more severely impacted.

By examining the chart, you can identify states with the highest and lowest counts of human fatalities, gaining a better understanding of the impact of floods on human life in different regions.

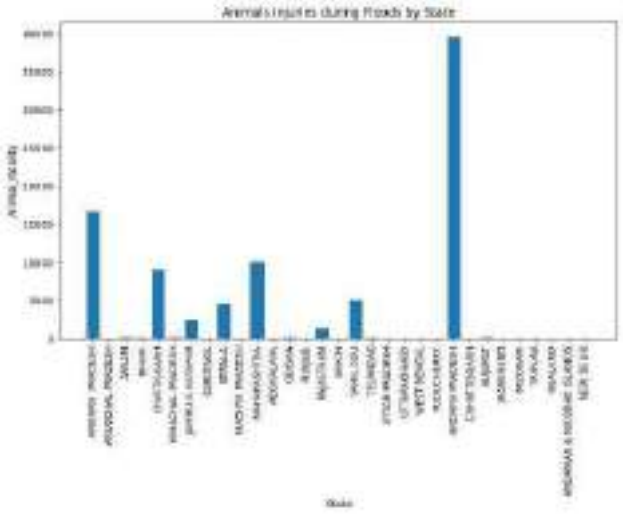


Fig:6 Animals injuries during flood by state

The bar chart depicts the number of animal fatalities during floods, categorized by state. The x-axis represents the different states, while the y-axis represents the count of animal fatalities. Each bar corresponds to a state, and its height indicates the number of animal fatalities reported in that state during flood events.

The bar chart facilitates a visual comparison of the impact of floods on animal life across different states. It provides insights into the states that experienced a higher number of animal fatalities during floods, enabling the identification of regions where animals were more severely affected.

By examining the chart, you can identify states with the highest and lowest counts of animal fatalities, gaining a better understanding of the impact of floods on wildlife in different regions.

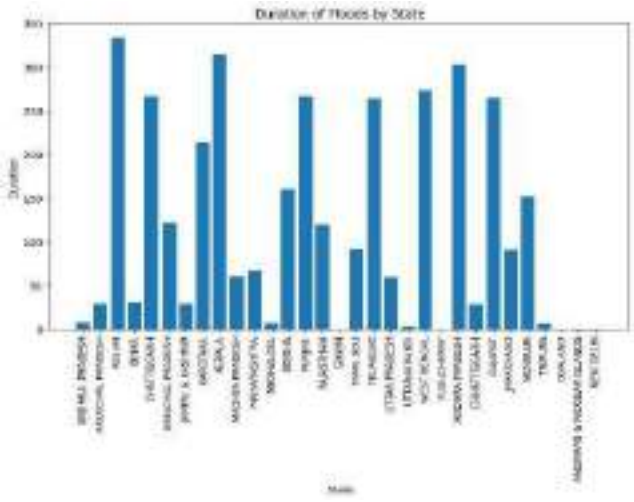


Fig 7: Duration of flood by state

The x-axis displays the different states, while the y-axis represents the duration of the floods in terms of days. Each bar corresponds to a state, and its height indicates the average or total duration of floods reported in that state.

The bar chart allows for a visual comparison of the duration of floods across different states, providing insights into regions that experienced longer or shorter flood events. It helps identify states with the highest and lowest average or total duration of floods, highlighting areas that were more or less affected by prolonged flooding.

By examining the chart, you can identify states with the most extended or shortest durations of floods, facilitating a better understanding of the temporal impact of floods in different regions.

6. COMPARISON

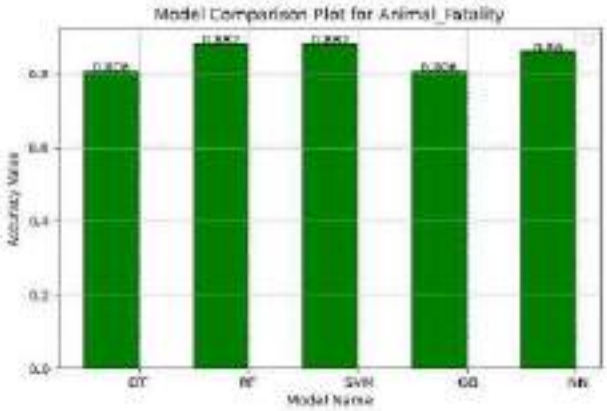


Fig:8 Model Comparison for animal fatality

By observing the below bar chat, the Random Forest Classifier and SVM gives the best accuracy 88.2% among all the remaining algorithms.

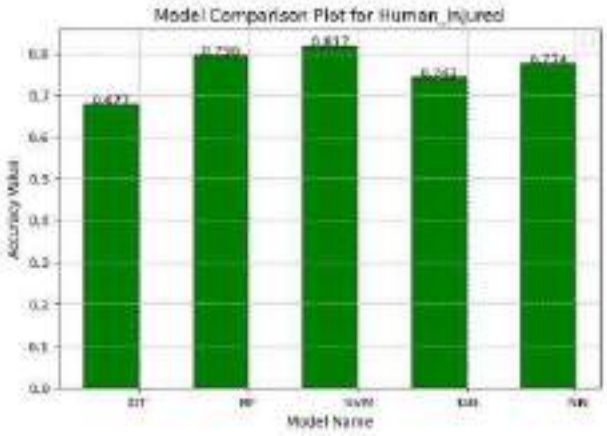


Fig:8 Model Comparison for human injured

By observing the below bar chat, the SVM gives the best accuracy 81.7% among all the remaining algorithms.

7. CONCLUSION

In conclusion, the project demonstrates the effectiveness of machine learning algorithms in analyzing flood datasets and predicting flood impacts. The findings emphasize the importance of using advanced algorithms to inform decision-making processes in flood management and response, ultimately aiding in reducing the adverse effects of floods on human life, animal welfare, and infrastructure.

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Social Entreprenuership And The Role Of Cbo S And Ngo S

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Abstract

Social entrepreneurship potentials of community – based organizations (CBOs) linked to nongovernmental organizations (NGOs) in the implementation of development programs the conceptual frame work of the study draws on the existing literature on social entrepreneurship. the research findings reveal that NGO - CBO PARTNERSHIP help to transform CBOs in to social enterprises by creating revenue generation streams .social entrepreneur may seek to produce environmentally –friendly products ,serve an understand community or focus on philanthropic activities .

Introduction

Social entrepreneurship is a relatively new term , but the underlying concept can be traced back much earlier .before the term social entrepreneurship was coined ,there were already many entrepreneurs who worked children's rights women's empowerment ,socio economic development ,environment issues and more two note worthy entrepreneurs who established social ventures as early as the 19TH century are Robert Owen (1771-1858).the founder of the co-operative movement and Florence nightingale (1820-1910), who found the first nursing school and developed various nursing practices.

The term ‘’ social entrepreneurship’’ has been tossed around since the 1960s , but it has thanks to 2006 Noble prize winner Muhammad Yunus that it has gained its place in the spotlight .in 1976,yunus founded the Grameen bank ,an institution in Bangladesh that provides microcredit loans to low- income earners to encourage economic growth at the gross root levels and foster financial self-sufficiency .yunu’s Noble prize winning enterprise has proven to be hugely successful and helped great deal in bringing social venture to the fore.

Now a days ,the concept of social entrepreneurship is widely used and supported .organizations such as the Skoll foundation , the Schwab foundation Ashoka :innovators for the public ,Echoing green and Omidyar network were established to enhance and encourage social entrepreneurship .these organizations identify ,highlight and (financially)support social enterprises all over the world ,creating networks in which social entrepreneurs can exchange insights , strategies ,form partnerships and learn how to improve their ventures.

Social entrepreneurship is without a global affair . with 260 social entrepreneurs in its community ,the Schwab Foundation , which is under legal supervision of the Swiss government , has representatives all around the globe . the nearly 3000 Ashoka fellows work in over 70 countries in every area human need . the US –based Skoll foundation has invested approximately 400 million USD in social entrepreneurship on all five continents eBAY founder Pierre Omidyar’s Omidyar network has offices in Sillicon valley, Mumbai ,London Johannesburg, Washington DC and there are many more similar organizations that support social entrepreneurship worldwide.

The process of social entrepreneurship

The social entrepreneurship has a beginning like any other enterprises .it starts with the idea generation of the entrepreneur or group of entrepreneurs .once the social enterprise is launched monitor the growth. A key challenge for social entrepreneurs is to resist the powerful demand –pull for growth and to be more deliberate about planning a long term impact strategy . thus social entrepreneurship development is equally responsible task like commercial enterprise development . the difference is only in the output and outcome .be attentive in developing various sectors such as economic , marketing , employment and environment . social enterprise impact is predicated on the organization’s mission , the social objectives intends to achieve , and what impacts can be measured .social enterprises , like all social programs , have direct as well as indirect impacts .it is measured based on indicators corresponding to each impact. For ex- the impact is livable wages earned by for low income workers and corresponding indicators is amount of wages (proxy –minimum wage/inflation/cost of living).In the entire process sustainability of the programme need special attention both economic and social

This supports a more sustainable economy, stronger civil society and improves over all social well-being

Methodology of social enterprise

Social enterprises methodology centers on achieving social impact through socio economic value creation. it means the social enterprise incorporates commercial forms of income generation in to non profit organizations as a means accomplish mission (social value) and financial sustainability (economic value),how ever lies in specifies of its dual objectives –depth and breadth of social impact to do earned as well as its capacity to

deliver on both accounts .mission drives social value creation , which is delivered through financial models-business or income generation the non profit organizations must build organizational capacity , in order that both can be managed effectively . the organization must integrate business tools and practice strengthen effectiveness and performance. in doing so, the traditional non profit undergoes a culture transformation and emerges as a more entrepreneurial, market –driven ‘’business like ‘’organization.

Another lens through which we can view social enterprise is a group of four linked aspects of successful value creation

1. Problem strategy for affecting social impact and mission accomplishment (social value creation)

2. Financial strategy for generating income through commercial activities as a means to achieve sustainability

3. Capacity building strategy, for strengthening organizational capacity, performance and efficiency

4. Cultural strategy to transform organizational culture in to being more entrepreneurial innovative , and market-driven

Perspective for studying social entrepreneurship

A recent report , published by Global Entrepreneurship Monitor (GEM), shows as the prevalence of social entrepreneurial activity around the globe GEM utilized two definitions for its research .the broad definition covers any kind of activity ,organization, or initiative that has a particularly social, environmental or community objective . the narrow definition focuses specifically on organizations that are driven by social impact for their society and the environment rather than potential financial impact for the organization ,and are market –rather than non-market based .

Using the broad definition, 3.2 percent of the adult population (18-64 years old) across 58 GEM economies is engaged in a social venture that’s in the start-up phase , with the highest rates of activity in Peru, Hungary and Burkina Faso. The average rate of post-start-up, operating social enterprises is 3.7 percent of the adult population, ranging from 0.4 percent in Iran to `14.0 percent in Senegal.

Using the narrow definition, which arguably fits the concept of social entrepreneurship better, sees 11 percent of the adult population across 31 GEM countries active in start –up social entrepreneurship and 1.2 percent working in operational entities .countries such as the Philippines, Australia ,Colombia chile, Luxembourg and Israel score the highest in this regard. Social entrepreneurs are individuals with innovative solutions to society’s most pressing, social, cultural and environmental challenges.

Social entrepreneurship is growing trend , alongside socially responsible investing and environmental , social and governance (ESG) investing

The wealth of nations, the economist Adam smith explained . it is not from the benevolence of the butcher , the brewer or the baker that we expect our dinner , but from their regard to their own self interest Smith believes that when individuals pursued their own best interests they would be guided towards decisions that benefit others .

the baker , for ex wants to earn a living to support his family . to accomplish this , they produce a product – bread – which feeds and nourishes hundreds of people

one example of social entrepreneurship is micro finance institutions , these institutions provide banking services to unemployed or low-income individuals or groups who other wise would have no other access to financial services

how social entrepreneurs create market that changes the world (2008) john elkingston and pamela hartigan distinguish three types of social entrepreneurs

leveraged non-profit ventures the entrepreneur engages across section of society, including private and public organizations, to realize particular social innovation .leveraged non-profit ventures depends on outside philanthropic funding, but since their partners have a vested interest in their continuation longer-term sustainability is often enhanced.

hybrid non-profit ventures a non-profit type organization as well , but this model includes some cost – recovery by means of selling goods and services to be able to sustain their activities , entrepreneur must mobilize other sources of funding besides public or philanthropic sectors. grants or loans offer a solution to money shortages .these loans, however, need to paid back at a certain point

social business ventures social business ventures are for –profit entities that provide a social or ecological product or service although financial profits are an underlying goal here, accumulating wealth is not the main objective. the focus of the entrepreneur is to grow as a social venture in order to reach more people in need and positively impact one or multiple sectors of society hence , a great deal of the profits is reinvested in the enterprise to fund expansion . the entrepreneur of this type of venture seeks investors who are interested in combining financial and social return on their investment

Partnership between non –governmental organizations(ngos) and community based organizations :

(cbos) have become a significant force in efforts to address social issues through collective means

1) in facing the challenges of attaining sustainability and other social objectives , ngos are increasingly adopting an entrepreneurial approach the most significant approach that emerged in recent decades is the ‘’social entrepreneurship ‘’ model in which small enterprises are established to provide goods and services directly tailored to local needs and sustainability goals

2) such affiliated cbos play important development roles in the rural and low- income areas of pooere –income countries, where the government is unable or unwilling to provide necessary social services

ngos have been the basis of study of social entrepreneurship .according to dart , ‘’ social enterprise ‘’ can be viewed as asset of strategic responses to a variety of environmental and social challenges that ngos typically

address .these responses lead ngos to develop strategic partnership with institutions based at the local community level

both ngos and cbos perform different functions within a partnership ngos are well placed to explore opportunities and identify key resources as well as to provide service such as a start – up funds, institution building , business networking and marketing , innovation and knowledge transfer , technical training ,research legal support , infrastructure , and community health and social services that cbos need to become self-sufficient . in the partnership process .cbos place their organizational capacity , bring local perspective , and use social capital to carry out the partnership goals and ngo –developed developmental responsibilities

social innovation refers to traditional innovation in terms of 'value creation ' it entails new strategies, concepts , ideas and organizations that meet social needs of all kinds – from working condition and education to community development and health –and that extend and strengthen civil society.

Micro credits flagship in social entrepreneurship

The idea behind Rang De emerged in 2006, the same year when Muhammad yunus won the Nobel peace prize for his work in the field of micro credit we felt that credit could be a powerful tool to help people fight poverty in India as well as we explored the idea , we realized that there was a already a lot of micro finance in the country . however we stumbled up on a article that spoke about borrowers of a micro finance intuition having ended their lives because they were unable to repay their loans . Rang De is a not profit online organizations in india that lends small loans to individuals planning to start a new or grow their existing business .it is successful attempt to bring together the two parts of india one of which successfully progressing while one is left out due to shortage of resources

founded in the year 2006 by ramakrishna nk and smitha ram rang de, today is major online platform in the country

crowd funding it raising for a cause or project from a large number of people , who contribute small amounts usually via the internet . it is mostly seen as an act of charity

rang De enables social investing through our peer to peer social investment plat form , the asocial investor is investing in the sustainable growth of an individual . this is no charity, the invested money comes back to the social investor , and the process is clear and transparent

micro finance in institutional financing for the poor . in the micro finance model , a borrower needs to become a part of a group 's lending cycle

other p2p platforms in the p2p lending landscape today in india ,most platforms are catering to the non-priority sector. the majority of them promise a higher return for the investment made quite contrary to the purpose of social investment the existing platforms are expensive for both borrowers and lenders

rand De makes credit affordable & accessible we work solely with the priority sector .our single minded focus is to make credit affordable and accessible to the millions , who are excluded to take a holistic approach and work with our partners to deliver entrepreneurship and financial literacy content on the ground Rang De .org has performed with a number of micro finance institutions (MFI) & NGOs to identify and screen borrowers at the gross root level these field partners prepare and post the profiles of prospective borrowers on the website these profiles are available on the site and a lender may allot either part or the entire loan amount to the

borrowers of one's choice . once the loan amount is raised , the involved MFI receives the money and disburses it to the borrowers the investor can keep a track of the progress made by the borrower online

Rang De was launched as a platform in 2008 with the mission of providing access to low cost and affordable credit . we soon realized that , while cost of credit was an important aspect , the entire serve design of delivery had to be revisited if it had to enable communities to take charge of their lives towards this aim ,we designed several initiatives –including swabhimaan - a state of the art digital financial literacy platform and habba –an artisan centric fair market place designed to enhance their incomes

The current state of the credit system for millions of unbanked and semi banked individuals across the world is predominantly informal. Where formal credit has been extended . it has been marked by complete lack by agency . lack of access to information and more importantly a lack of financial literacy and awareness have prevented individuals and communities from taking control over their lives

Rang De's flagship project swabhimaan ,has been built to address this issue of lack of Agency by empowering them to make active informed decisions when it comes to financial management and loan decision making

DISCUSSIONS: SOCIAL ENTREPRENUERSHIPS

CBOs working in concert with NGOs for natural resource management is are relatively new practice in the fields of community – level development efforts .social missions concern the community or collective interests of the members where as the economic mission deals with the economic needs of the organization members and revenue generation for the organization 's sustenance . There are embedded ecological missions within the economic and social ones. Which have hardly been streamlined towards revenue generation by developmental mechanism. It is the NGO - CBO partnership that leveraged those ecological missions of CBOs.

The leveraged missions became goals more specifically entrepreneurial goals, of CBOs that helped, them generated revenue and thereby turned them in to entrepreneurial entities. In all the studies cases, it was apparent that CBOs exhibited natural social entrepreneur ships potential .with exploitation of that potential , the partner helped to reinforce the capacities of CBOs for self-sufficiency. The NGO helped CBOs to access a range of services, such as endowment credit fund facilities for venture start-up , technical training on capacity building and skills development ,innovation and knowledge transfer ,and networking and cooperation

Conclusion

Social entrepreneurship is a solution that is rising popularity as the movement towards sustainability becomes more mainstream . it begins with identifying a social problem in a community , or the world at large , and setting out to solve it by innovating products , providing employment or education , disrupting an industry, or taking a new approach to failing methodologies .

Social entrepreneurs is built around well-being in all aspects from the internal operations of the business to its impact on stack holders .and the ultimate result of positive social impact.

Social entrepreneurs make a valuable contribution to society because they fill a gap in satisfying social needs .they help create evaluation in industry through a values –driven approach that looks like :

Collaboration over competition

Purpose over profit

Well-being over destruction

They disrupt the status quo and combine human ingenuity , technology and business principle to uplift humanity .social entrepreneurs ignite social innovation , which is hugely beneficial to the development of industry ,systems and policy

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HOW LONG WILL YOU GO ?

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Assistant Professor

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From an innocent baby to a child with dreams

The nights were not bright with the stars but I always find my own way

To make all possible things to make my mother's face brighter with smile

All I wanted to do is grow up,have job and made my mom proud

Hope every child have these wishes at their childhood. Those are the days where

You laugh without hesitation people won't humiliate for what you are not and

You no need to worry about the sarcastic behaviours around you as u are unaware

Slowly as you turn into child you slowly recognise the changing behaviours from whom

You didn't expected the wicket.learning about the game of truth and lie is the most dangerous and exciting part you have. Between the very innocent to the child with dreams we all believe that after having a job or as a grown up adult everything will get finish the sufferings, the finances,the pains and the sad faces ... But on one sudden night you realise life is not yet came

And you are supposed to make yourself ready in your court waiting for those unexpected wickets remaining more harder to ignore and more complex to digest .

From a Child to teen feels like queen

Teenage is the thing like butterfly which make yourself too tough to handle and made stable at one emotion but keep trying hard is the only option you have to set everything on their own parts.

People around you will judge you only after making you realise you have to accept wether it is right or wrong. You will learn to study and work hard for a better future just because you feel your parents didn't done enough work to make your lifestyle better in their teens.

Actually the problem is with the mindset we create by ourselves as well as by society around us where teens should be active creative and beautiful. Many of the girls or even boys fell on that societal stereotypes to examine what they are here they ignore what is inside them but can't realise what they are sending from outside yes the impression we have the perception we have and the thought process we carry plays a vital role in designing one's conduct and made it visible which can be considered as a great guy to face world remaining how they are in real. Many of us feel frustrated by the system,things,laws and regulations of our country our home or our religion which can stop us from being anything to everything. If we want to lead a life in our own terms definitely it is not at all an issue to face the consequences but when the minute we decide to live the life in those structured formats like all other in the world it will effect our capability to face those same consequences but with a broken heart where we always try to prove the point that we didn't mean it. Why we have to prove is that really matter what others think about us how we have to handle the unbalanced emotions which make us fool infront of everyone in this big world. Knowing what you are building self consciousness and making things happen with a calm mind is very important to teenagers to follow the norms one's family have to respect the differences the elder have to play with patience with those younger one's and above all to deal with the sudden and gradual changes you need to aware about your physical and mental appearances. To make this work out one should have a habit of learning and listening. One must have that patience to sit and listen not to judge others but to analyse what they delivered. It is important to make all those things that encourage you to learn and find new ways to grow up with your careers. One must improve that potentiality to identify and harmonize the situations they face with others. Having a proper and clear view about your career and having the capability to put your career life separate from all the odds you are facing and going to face in further life will make you able to stand in the wind and give that strength to sail.

From a teen to a young champ

Either you are a girl or a boy you are the one who can create the world full of dreams passionate affirmations you can have in your life whether it is personal or professional lives one should master the art of dealing of it is for things you should know what is the right and simple way to handle those machines and techniques but if it comes to people we should always remember that dealing with people is nothing but dealing with emotions. One should know how to articulate things and appreciate the efforts of others even it is a small deed or a great contribution they gave for us. This is the age where we feel much passionate about the truth of world called love which we misguided and manipulated the actual meaning for our own comforts. Choosing a partner is the very different and difficult part of our life which requires some patience but young generation won't take much time to give their hearts to others and then always wishes and tries to bring change on their own heart. The process of falling in love is as fascinate as an imaginary fairy world but the journey of love requires a lot of work hard work and smart work by both sides to make it bloom throughout life. If your love is filled with blossom everyday you are not loving you are manipulating you should find love on others differences,others pain and others love everything should be cared not a pretty much but as a partner enough. The amount of effort should be from both sides and remember if it is hurting your self respect think thrice you are not in love you are in shit. Before the things go wrong and people mess you up realise the worth of your relationship because relationships are all what matters at the end of the day you are your emotions and feelings you carry for others not the branded shoes or diamonds you wore. A marriage or a live in a love or a friendship a family or a relative everyone you have in your life should be carefully dealed and it is needed to take necessary actions to implement peace with those to live a fulfilled life as you have only one life and all these will exist only when you decide not to give up. So messy or crazy you should find your own way to respect yourself as well as others. Unity team work team spirit unbroken bounds all are bullshit there are misunderstandings there are problems there are stupidness there are ups and downs and how well you go through with that he'll is nothing but how you celebrated your life at the end.

Having emotional damages are not anyone's cup of tea but it is the truth of life the world designed with feelings and emotions we created money and machines so it is absolutely fine to be not ok just have a pause for yourself give some time for your inner self to get heal give youself some space and let your body mind and soul get rejuvenate. It is not a film or a classy world that idlf you feel depressed you will become a world tour tourist to rejuvenate your life it is a harsh fact that we can't escape from our daily duties and responsibilities which can be done by us only. So with a clear thoughts and guts try to take pause in those differences try to be ok in those not oks and made yourself rejuvenate with the whole process of healing self with all possible tools you have it may be people,things or any action that speak with you whole heartedly and remember you are not supposed to regret the decisions you take. So again you should be a great learner to lead the life game.

From a person with Dreams to a person with Responsibilities

Everyone in this world start their life or a day in their life with full of grace and hope that their wishes are going to come true in future. But the worst neglect one can do in their life is they forget the reality and always try to make things happen according to the other's life scenario. One can have that ability to accept the truth of one's life and circumstances and should have that stubborn nature to deal with those incapabilities by shaping self consciousness. It is important to be conscious and give some respect to the emotions we carry and responding to the unnecessities occur is the primary duty to every individual. Most of the cases we have dream which cannot suit into our actions or stages of our life but people who succeed even in those reality are the persons who take responsibility towards their dreams l, aspirations and steps they take in that journey. Completing a task with perfection won't make you fulfill your dreams taking responsibility and opting the strategies one can apply in order to tackle the success or failure makes you different from others. Many famous personalities in real life are successful just because they took their dream as a responsibility but not as a duty. Having wishes and having patience are the two important tools to lead a meaningful life than life that go with flow. The simple steps to make your life more organised but not too serious is identifying the needs of your dream but not the wants of your dream. This realisation creats a great difference where you can be able to stop the unwanted errors in your project implementation and also be aware about the failures you are going to deal with. Always try to explore the possibility of opportunities you have in your desired field and focus on the important skills to develop or constantly learn with updated knowledge. Having master in one program or one skill won't make you stand long in the race but willingness to know about the developments and new trends will make you one in the race. It's the saddest truth that life is a race but the more sadest truth one cannot digest is not having enough knowledge or not investing enough time even in the things they love more it may be in work or relationship or choosing a cup of coffee from the restaurant menu. So for the sake of your love in that particular thing be responsible take time to travel with it have more options to invest for development and most importantlyake yourself comfortable with the learning process but not making your journey too hard that you lost interest in achieving anything in your life also on your dream which is not at all a part of your dish. Feel free to take responsibility towards life then you will be very comfortable in failures too.

Is your behaviour decides who you are or your actions decides

Coming from a very innocent stage of life as a new born to the stage where you receive many rewards from people whom you love most and care about by questioning you about your capabilities to earn and possibilities how you can handle those responsibilities in a very young age. At the same time you meet people who are also your family and friends who stands in opposition every time who questions you why you didn't get things done in a proper manner? Why you doesn't have that maturity? And finally why you love someone else rather than respecting our words? It seems to be very crazy and all the answers are just a silence where we cannot explain why those things happened as well we cannot question them where you are at the times I needed?! Many of the possibilities end with emotional manipulation the people do us by taking advantage of the conditions we have and many of the opportunities we missed are just because of the emotions we accepted to take away that enthusiasm or passion to do the things and

keep those so called love and care in the very first place even in the place of God and always wishes that our blunders are going to be magical moments which turn our lives into worthful moments.As we are humans whenever we have to face any consequences raised by our mistakes we are already to blame the persons or situations around us as a reason for those failures and our hearts won't realise the truth that our own uncontrolled emotions are the reason for our present sorrows... We try to figure out things that s a good sign but we try to figure out all the things in one shot at a time and wants to free from all odds and negatives just in seconds but it can be done by a genie or God with love on you so try to be your own genie love yourself accept your mistakes don't try to learn everything from everything you did. Have a pause relax and start nurturing your body,mind and soul. Self conscious and self respect are the two factors which keep you in confidence if you give atleast a least priority to them in your lives journey.

How Long will you be sad

Sadness is a season where it come and changes our emotions and play a deadly game with our feelings. Many of us are very blind to see the clear picture of sorrow in a manner how it is. Sadness starts with the human mind which does not allow him to hear 'No' from anyone and also insist us to feel pride about all the little things we do and make us blind to consider even bigger things others do to us. Why our thought process is shaped in such manner inspite our own culture teaches us to respect everyone and accept the way they are. Most of the times we really don't want to admire the beauty we have in our lives because we are much more busy in finding the things which are not meant for us. People feel sad and be in misery for all the negativities they have in their life and all the positivities others have in their lives. These conditions can be considered as root causes for the season of sadness. Expecting more from the people around us and not even we question ourself that are we doing same effort to fulfill their expectations? Realise the importance of gratitude in your life in order to maintain harmony in our sadness. We should be aware about the emotions which are not in our control and how to take charge about the feelings which can be controlled. Having mood swings and seasonal changes leave a drastic change in environment as well as human body then just think how these seasons of happy, sad, anger, brutal and all sources of emotional manipulations leave their worst and best foot prints in our lives? Have you ever questioned yourself about the stuff you carry on your head? Have you ever identified the heart melting pain in the story of sad people? Emotions are common feeling low and sad is very very common but what not normal here is the way we respond to this sadness season.Many great people have number of ups and downs in their life but they still fought for their dreams and make the whole scenario different. They set an example for the generations who can't tolerate little disturbances in their lives and who cannot open up for their dreams in front of anyone. The attitude we carry and the response we give to life is the major thing that decides whether this sad season will ruin your life or else it give you a smooth experience in order to gain your life back.

Is things are really transparent as your emotions

Transperancy has the biggest role to play with our emotions which are moderate with the persons we like hard with the persons we hate and blind with the persons we love. Yes the concept of transperancy in one's opinions and desires are the main contents everyone want to be in a manner just like how they feel...but we have to know about the things of manipulation and choices one choose to make his/herself comfortable in all possible ways and means. Let's talk about why transperancy is important you see relationships are very beautiful and dangerous in their context they are very complicated to resolve and easy to made but difficult to deal and trust me they are unforgettable in life. We struggle alot to meet the one we love we try to talk as sweet as we can and be supportive in all their odds and try our best to assure them they are the only one who existed like oxygen for our senses and you are not ready enough to see them in any sort of pain or sorrow. But inspite of giving all the love beyond our capabilities people turn out into what we are unaware and in a manner we hate ...can you think why it happens? Let me give you an explanation which may convince your heart. Darlings we are humans and our ultimate goal or desire is to be happy in the way how we want but not in the way how the things really done. We feel very comfortable with lovely and soft thoughts about our beloved one's which are imaginatively true in our hearts. At the time when the truth hits hard your imaginary world

your mind will accept it as it warned in your every moment but not your heart which made you blind in every thought of your emotional journey. We invest money in stocks and fill ok to handle with failures and success in those returns because your heart and mind know that there will be a risk in investing and dealing with market and you train yourself in such a way you can handle the failed attempts and also accept the things which are unexpected in your plan. But as we invest in relationship we don't even comfortable with the warned signs or thoughts about how it could be? What if it turns cold? Can I overcome? Should I need this? Is it be a suitable part of my plan!? And so on... But we don't even allow our mind and heart to even think about these questions and answering them is a mission impossible for us. Just because we love that person we allow him/her to rule us, guide us, protect us and love us in all their lovable ways but not ours. Ignoring the lost individuality and sense of sensitivity with self is the major loss one can have in their relationships and this is the basic root and rock foundation to loose transperancy. So my dear one's don't lost your self in others in such a deep where you end up with holy shit which cannot be altered,deleted or avoided. Remember my friend your yesterday will be your today your today will be your past and future fruit which can be designed by only you not by any other. So make those day the right choice which your past can be recollect with peace and future can be live with hope. It's not transperancy it's you reasonable for what you have in relations.

The dark side of Emotions

God has given emotional intelligence to humans in a high range of manner when compared to another creatures in this entire world. Emotions are those ingredients and flavours by whom the taste of the dish can change either into best or into worst. One of the common mistake we do in our emotional journey is to play with those emotions rather than preserving them. One can give utmost interest and attention towards ones emotional feelings but can easily judge and conclude things in others pain and perspectives. Joyous are those who are innocent with their emotions they are genuine and if they become insane with heavy heart breaks they rediscover themselves into transformed souls that resist in any odds of life. This tramission is based on how we nurture our things during those tough times as many people fail to feed their emotional balance with optimistic thoughts and misuse the opportunities they have to change their standards. Being confident and genuine to our own thought process is the key to remain emotionally balance . We can see a clear view of a picture when the water is still but on the continuous effort and practice of making our mind still we can have a clear view of picture in raising storm too.... Emotional intelligence comes with good perception level as well emotional balance comes with good control on heart. Mind and heart of a person should work coordinatively and make sure no one can cross or break the good bound we have with our body and mind this process is nothing but protection towards Self Respect.

**** WHETHER YOU ARE A MEN OR WOMEN YOU ARE THE REASON FOR THE STATE YOU ARE IN****

Let's educate our minds,empower our hearts and love the journey of life we are living. Hurting self or hurting others may not give you any satisfaction or result that show good impact . Before openup your eyes try to open up your mind and create the best bond between you and self so that u can openup your heart to learn comfortable adjustment to go through the flow of family,flow of friends,flow of love,flow of society and the flow of nation.

@@@ JUDGEMENTS WON'T ADD JOY AND OPINIONS WON'T CHANGE LIFE @@@

It's we who can make a difference... afterall it's our life our own one life....

EasyChair Preprint

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Sole Proprietorship as a Soul of Business

Pemmaraju Syamala Deepthi

EasyChair preprints are intended for rapid dissemination of research results and are integrated with the rest of EasyChair.

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SOLE PROPRIETORSHIP AS A SOUL OF BUSINESS

ABSTRACT

Business is a dream for every one who always want to be their own boss and who always aspire for the wings to fly high and fulfill their dreams in a fruitful manner. We all learn and grown up that business is made with a profit motive and can withstand in the competition and in the market with an unique idea that stands out from the crowd. Business starts with a single person's wish and desire to start a firm and wants to rise the standards of his/her life as well the living standards of customers with the availability of organisations products or services with a motto of customer's satisfaction by following the traditional gesture called "Best Product at cheapest Price". Even it is a joint venture , partnership or JHFB there is one sole proprietor behind the foundation of the business and the growth and development of the firm is possible only with the continuous supervision, consistency in efforts and dreaming big of that proprietor . The sole proprietor has no seperate legal entity as he is not divided and seen as an individual he himself/herself is the organization on whose name the agreements,contracts or any form of business activities are done under the guidance and control of sole proprietor who is responsible for all the decisions taken and he is the person who invest capital , enjoys profit and bares risks and losess alone with utmost wish and belief that his/her business is going to be in long run in the market . This is why we state that sole proprietor is the soul of the business firm.

KEYWORDS

Sole proprietor is the soul of the business

Business and it's management

Sole proprietorship

Forms of business organization

Firm's products and services

Capital and investment ability of a sole proprietor

Risk bearing nature and unlimited liability

Limited capital and limited resources

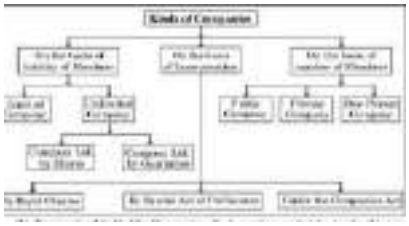
Traditional manufacturing concepts and practices

Technology and trend changing concepts.

INTRODUCTION

From the earlier days of the living being there was the concept of exchange of goods or services with the products or services holding by other people in the particular area.As the trade and commerce spread wider in India since 2600 BC as Indians are more fortune and gold is the main trader of the country. I dia is in trade mainly on textiles,spices,sugar and many precious stones. The ruling of British in India which started from the era of 1858 until the independence of India and Pakistan in 1947 made our Indians more familiar with the concept of buying and selling of goods and services with monetory value that is not with the exchange of products but with the exchange of money according to the value of that particular good or service is valued. That is the era of sole proprietor who paved path for business establishment and making product introduction in the market . People got to know that there are products and services that can be offered which are not done by ourself as well as those things which are difficult to produce in single peices or in small quantities. We have to talk about the producers or the manufacturers of products who are the limited sources of manufacturing goods and made the things possible. Rareness and incompetitive form of market is the heart of the business in earlier days. Producer is the king and customer satisfaction is the least priority for producers. Sole proprietor is the person who do one man show from beginning of product purchasing ,ordering and

delivering of product to the retailing destination where customer gets the end product. The whole responsibility is taken by the sole proprietor who invests the capital and always try to expand his business in a successive manner. To attain the growth and development of the business he always strive to have the qualities of strong decision making system, good analysis and market surveys.



MATERIALS AND METHODS

The sole proprietor can be into any form of business that may be raw materials,production house,reatilng,wholesale, transportation,textiles,furnishing,food and beverages,devices and control machines, accessories,groceries,provisions, jewellery,gems and stones, vegetables and fruits,flowers and designed fashion sets,leather industry,stationery,plant and machinery or even buildings or publications. There are numerous forms of businesses and ideas that can be basic foundation to start a business and the innovative ideas are the fuel for the success of the business firms. Sole proprietor is the single owner who decides about the type of business he is going to establish. The preparation of a product or service plan that is going to provide should be on his own decisions where he can easily form a business.

Methods a sole proprietor use

1. Advertising

Sole proprietor uses advertising as the key component for the business to circulate the message that he's going to launch a product. He always wants to create an impression in the sight of customers that the product he introduced is very useful and might bring a rapid change in their living standards. The previous and traditional concept of advertising is by oral communication an opinion about a product which is shared among people in a large extent. In the modern era of

business world advertising is the key factor in circulating the brand image of an entrepreneur he/she created with inherint efforts from years. Creating the attractive and unique content is the heart of today's advertising where many companies hire advertising agencies to promote their products and services according to the scale of organization they run. Sole proprietors are also enjoying the fortune of status called "old traditional form of business from generations" this was an empire build on honesty and consistency in the products and services the sole proprietor provides to customers. Sole proprietors too handle their promotions by using developed advertising patterns that may be print media, television,Magazines,palm plates, Announcements,and many other channels of advertising upto approaching celebrities or sports person in order to increase the demand or reach of their product as well as fame of the company.

2. SALES PROMOTION

Sales promotion is the technique or an attpt to increase sales of a particular product or service in the market in a framed period of time specially in the festivals,holy days,occassions and divine days of nation. The sales promotion techniques include discounts,coupons,offers,combo packs and buy one get one sales to rise the demand in the sale of the product.

For Example: All the business persons starting from a sole basic shop keeper to the brand profile company introduces theme of festival according to the traditional practices and customs of various religious beliefs. Say it's a festival of Diwali where every business firm tries to make people believe that their home decores, electricity filled lights,sweets and new fashioned dressess are the craziest combo to make our Diwali more brighter. If we had anational festive say Independence day companies create newly designed short vedios that portray patriotism in small children to old people where hearts of every indian feel the same sense irrespective of their caste,creed ,sex and religion.

3. SALES FORCE

Sales force are nothing but the frontline employees who directly involves in the product promotion and sale to reach customers with their communicative and

convincing skills . Sole proprietor he himself act as a sales force in reaching the customers and convincing people to improve his sales. He must maintain good customer relationship management and bring customers in every span of period irrespective of occassions and events. The primary advantage of a sole proprietor is having direct contacts and communications with producers and customers so that he can act as a great bridge in providing a clear view about the likes and dislikes of a customer in the products he offer and what are the necessary or precautionary needs or changes customers expecting in those goods or surveys. Here sole proprietor can useful to have good analysis on sale and survey for companies.

4. FORMATION OF CAPITAL AND INVESTMENT

Capital investment is the main hurdle to a sole proprietor as he alone cannot able to create a whole sum of huge capital of he is thinking to expand his own business in other areas of market. Here sole proprietor can adopt those type of partners like sleeping or dormant partner,Secret partner, as well as partner by holding forms of businesses management to hold the sole proprietorship in all acts and decisions of business and it's management so that capital creation and risk bearing will be ease with mutual consent where these types of partners won't enter or interior in the functioning of the business or on the share of profits or losess. This can be a precautionary measure and a helpful method for a sole proprietor to run his business and expand his business in a proper manner but that is completely based on the decision and consent of sole proprietor and the person who are willing to enter into these type of business pattern.

5. CONTINUITY

The sole proprietorship is a type of business where the continuity of the business depends and shows a negative or positive impact on the existence and smooth run of business. The sole proprietor may face the challenges of risks losess or any form of insane conditions which throw his business into trouble . In those situations a

sole proprietor can handover his business to his next generations and ask them to maintain the standards of business by which they recognised in the market. The generations who take the responsibility of the business will definitely try to stable the business and fame of the business in the market as it is little ease to run an already established business when compared to business that start over from the first step. As we discussed earlier this also can be a pure consent and will of sole proprietor but not the regulation he can obtain.

RESULTS

Some of the great business personalities whose journey starts with sole proprietorship and continuous their journey in an incredible manner are the real examples for the result of having the sole proprietorship as a soul of business. They are Coco-Cola, Walt Disney,Star bucks,Flipkart,Apple and many more historical companies and new trend revolutionary firms are existed in the market as sole proprietors and created a brand mark for their loyalty and customer centric services or goods they offer in the Indian market.

DISCUSSIONS

In order to prove our concept sucessful soul of sole proprietorship we can have our Agricultural sector as best evidence for sole proprietorship. The farmers themselves start the business in farming,decides alone and make things happen till the end product reach to distributors through proper chanel and this their produced products and services will rule the every field of business as agricultural products are the main sources of manufacturing goods or services. The farming may be crop or cattle or any type of minerals ,metals and materials. Sole proprietor is a great warrior who fights the battle alone face the crisis alone deal the challenges alone and accompained by the rewards of his efforts alone. But sole proprietors are the true inspiration for other companies in attaining corporate social responsibility just like doctors and freelancers who work for themselves but directly involves in the best part of social activities even in tough times that rembers me the hard times of COVID pandemic where no doctor no farmer and no

individual got a step back in providing and rendering their services to the socitey and worked hard in their own streamlines and standed for the people in all possible ways and means.

ACKNOWLEDGEMENT

I here by declare that the information provided in the beginning of the paper is fair and there is no change in the above stated. The entire content and concept of the

paper and topic I discussed in the paper are truly obtained by my self illustrations and not attained from any form of references,books or e-contents.

I here by declare that this paper is submitted to easy chair only and truly it is not under any site or publishment reference.

Reference

The above written information is the essence extracted from the things I have learned in the graduation and post graduation. Some of the content references

may include statistical and graphical representation of data and image are the extracted contet of internet and I can truly say it is the extraction or reference of self thoughts on sole proprietorship that I learned from books ,lessons and market analysis.

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Tables

Name of the organization	*Establish year*	*Age of the organization*	*Percentage of sucess rate according to statistics of 2022*
Coco-Cola	*1886, in Georgia*	*125 years*	*11%grew in revenue* *16% grew in organic revenues*
Walt Disney	*October 16,1923*	*99 years*	*13.05% increase in revenue for year-on-year*
Flipkart	*2007*	*15 years*	*31% revenue in year - on - year*

FIGURES

Figure 3. Sole Proprietorships Are a Majority of All Businesses

