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International Scientific Research Conference

(Date: 28 - 29 November, 2022)

Jaipur, Rajasthan, India

Conference Special Issue - 40 November - 2022

Organized by :
Apex University, Jaipur, India
Scientific Research Association
Research Culture Society
&
Institute of Science and Technology, Eurasian University (EU)

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International Scientific Research Conference

Date: 28 - 29 November, 2022

Apex University, Jaipur, Rajasthan, India

Conference Special Issue - 40

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(Research Culture Society and Publication)

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Organized by :
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About the organizing Institutions:

Apex University (AU), Jaipur; The University has been established by Rajasthan State Legislature Act No. 27 of 2018. The main campus of the University is spread over a sprawling 30 acres campus in an eco-friendly environment at Achrol on Jaipur-Delhi National Highway and is one of the best campuses in the region. AU has world class infrastructure, including state-of-the art research facilities and modern library. In line with Sanjay Shiksha Samiti's legacy of providing quality education, the university uses the latest and innovative methods and technology to impart education.

Institute of Science and Technology (EU) ; Institute of Science & Technology is a self financed institute, sponsored has been started in the year 2011 with a noble aim of imparting technical education. The institution enables them to be placed as the best professionals in industries and make them enter into high level programs with competence and confidence. Institute trains specialists in Physical Science, Life Science and Computer Science,

Eurasian University is one of the largest education institutions of the central region of EU, for qualified personnel training in science, management and technological specializations. Scientific subjects performed by the university aimed to increasing the efficiency of production and control processes, power saving and environmental protection.

'Research Culture Society' is a Government Registered International Scientific Research organization. Society is working for research community at National and International level to impart quality and non-profitable services. Society has successfully organized 100+ conferences, seminars, symposiums and other educational programmes at national and international level in association with different educational institutions.

'Scientific Research Association' (Scientific Research Organization) is an esteemed research organization working on to promote scientific research studies, activities at international level, also coordinate with other research organizations for the educational research events.

Objective of the International Conference:

- Our main objective is to promote scientific and educational activities towards the advancement of common citizens' life by improving the theory and practice of various disciplines of science and engineering.
- To meet and discuss the practical solutions, scientific results and methods in solving various problems with people who are actively involved in emerging research fields.
- To organize lectures by scientists and experts and to disseminate their ideas and concepts among the science and technology community.
- Provide the delegates to share their new ideas and the application experiences face to face.
- The aim of the conference is to provide platform to students, scholars, academicians and industry persons to converse and share the ideas.

About the Conference :

International Scientific Research Conference Date: 28 - 29 November, 2022 at Jaipur, Rajasthan, India aims to bring together students, scholars, researchers, academicians and industry persons to deliberate on contemporary issues concerning Science, Agriculture, Engineering and Technology research and applications.

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About the Special Issue Book:

Science, Engineering and Technology cross nearly every facet of modern life and, as problem solvers, engineers are perfectly capable of managing technical activities, mastering innovative ways of science and engineering field, when they spend time and efforts understanding and acting in the field. Scientific and technological innovation, as strategic support to improve social productivity and overall national strength, must be placed at the center for development of any country.

The framework includes engineering and technology as they relate to applications of science. Engineering is used to mean engagement in a systematic design practice to achieve solutions to particular human problems. Technology is used to include all types of human-made systems and processes.

The edited issue book is a collection of peer-reviewed scientific papers submitted by active researchers in the International Conference on Science, Engineering & Technological Innovation. This edited issue book can be helpful to understand the various concepts of Science and Technological Innovation to the researchers and academia.

Dr K. D. Gupta
Head, Department of Computer Science & ISRC-2022 Coordinator
Apex University, Jaipur.

Message

Dear All researchers, scholars and colleagues,

I extend a very warm welcome to all the delegates and participants presented of two days for the International Conference on the subject "**Engineering, Science, Computer and Agriculture" jointly organized by Scientific Research Association and Apex University** Jaipur. This has borne the mantle of excellence, committed to ensure the students their own space to learn, grow and broaden their horizon of knowledge by indulging into diverse spheres of learning.

In our endeavor to raise the standards of discourse, we continue to remain aware in order to meet with the changing needs of our stakeholders. Research Culture Society and Apex University organized this two day conference on "**Engineering, Science, Computer and Agriculture.**"

There are various pillars of the Education System in a nation. We have invited eminent dignitaries from different sectors to get a better understanding of these pillars of the Education System and the several strategies involved.

We would like to thank **Research Culture Society and affiliated Publication Association** for providing us with the platform for online publication.

Thank You!!!

Dr K.D.Gupta

Head, Department of Computer Science & ISRC-2022 Coordinator

Apex University, Jaipur.

Dr.C. M. Patel

Director, RESEARCH CULTURE SOCIETY

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Message

Dear Professional Colleagues,

It is gratifying to note that 'Apex University, Jaipur, India; 'Scientific Research Association'; & Institute of Science and Technology Eurasian University (EU) in collaboration with 'Research Culture Society' (Government Registered Scientific Research organization) are organizing - 'International Scientific Research Conference' during 28 - 29 November, 2022.

The aim of the conference is to provide an interaction stage to researchers, practitioners from academia and industries. The main objective is to promote scientific and educational activities towards the advancement of common citizen's life by improving the theory and practice of various disciplines of science and engineering. Provide the delegates to share their new research ideas and the application experiences face to face.

I believe, this International Conference will help in redefining the strong connection between students and academicians from different institutions. An additional goal of this international conference is to combine interests and scientific research related to General Science, Physical Science, Applied Sciences, Agriculture, Engineering and Technology Development to interact with members within and outside their own disciplines and to bring people closer for the benefit of the scientific community worldwide.

My best wishes to the committee members, speakers and participants of this scientific conference ISRC-2022.

Dr.C. M. Patel

Director, Research Culture Society.

Dr.Jessica C.

Founder President, Scientific Research Association.

Email : scientificresearchassociation@gmail.com

Message

Dear Colleagues !

I am grateful to co-organizing institutions, all the speakers, committee members and presenters of 'International Scientific Research Conference' (ISRC-2022). The overwhelming response to the contributors was acknowledged in a very positive manner and it shows that the new age is very much eager to work with technical literature. The rising researcher and scholar from various institutions and in-house participants motivate us to improve ourselves.

We are currently in the era of science and engineering revolution, spearheaded by recent developments in engineering, technology and sciences, providing sustainable solutions to various issues.

Here I am delighted that the series of conferences has successfully completed its first fold, it's all due to the valuable efforts of faculty members of the computer science and engineering department.

I extend my best wishes to the editorial team of the special issue, at last I hope this technological literature interaction will be a source of inspiration to upcoming educationists, technocrats and stakeholders.

Jessica

ISRC - 2022 Conference Chair

Founder, Scientific Research Association

Prof. Maria Eropenko
Head, Institute of Science and Technology
EURASIAN UNIVERSITY
Email : ist@eurasianuniversity.uk

MESSAGE

Dear Colleagues!!!

I am proud to be the part of Organizational Committee of "International Scientific Research Conference - 2022", jointly organized by 'Apex University, Jaipur, India; 'Scientific Research Association'; & Institute of Science and Technology Eurasian University (EU) in collaboration with 'Research Culture Society' (28 - 29 November, 2022).

We have an exciting program at this conference that will allow participants to reflect upon and celebrate their accomplishments, renew friendships and extend networks, and jointly explore current and future research directions. I hope that all participants will have a productive and fun-filled time at this online conference.

I sincerely hope that this conference will deliberate and discuss all the different facets of this exciting topic and come up with recommendations that will lead to a better world.

I wish the conference great success.

Prof.Maria Eropenko
Head, Institute of Science and Technology,
Eurasian University

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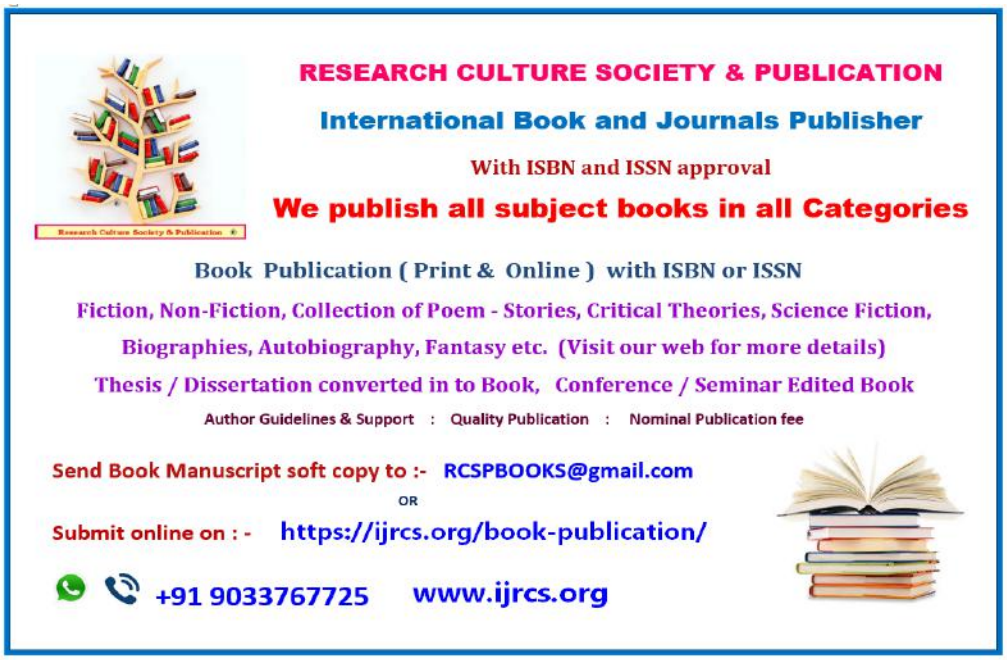

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DOIs:10.2015/IJIRMF/ISRC2022/01 --:-- Research Paper

METAL SCHIFF BASE COMPLEXES OF DAPSONE AND FURAN-2-CARBOXALDEHYDE, THEIR SYNTHESIS, CHARACTERIZATION AND BIOLOGICAL STUDY

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Abstract: *In the present paper we synthesize Schiff base of Dapsone and Furan-2-carboxaldehyde. Schiff base was formed by condensing dapsone with Furan-2-carboxaldehyde. Schiff base was complexed with metal ions and metal Schiff base complexes were formed. Then their structures were confirmed by IR, U.V, elemental analysis and m.p. After that their antibacterial and anti-fungal activities were evaluated. It was found that antimicrobial activities of metal complexes were found more than Dapsone and Schiff base of Dapsone.*

Key Words: *Schiff base, Dapsone, Furan-2-carboxaldehyde, antimicrobial activities.*

INTRODUCTION:

H. Schiff in 1864 reported the first study on the Schiff base formed by condensation of primary amines with carbonyl compounds [1-3]. Schiff bases exhibit a variety of biological actions, including antibacterial, antifungal, and antitubercular effects [4–8]. It has been established that dapsone (4,4-diaminodiphenylsulphon) is a potent antibacterial substance [9].Schiff bases are widely used in the food, analytical, agrochemical, catalytic, dye, fungicidal, and biological industries [10]. With the prevalence of deep mycosis rising, there is a greater focus on the screening of new, more potent antimicrobial medicines with low toxicity [11]. The most often prescribed medication for treating leprosy is dapsone, which prevents M. leprae from producing foliates [12].

EXPERIMENTAL: All Analytical grade chemicals were used. All chemicals were purchased from Merck. IR spectra were captured using a Perkin Elmer IR RXI spectrometer. The Elico melting point apparatus was used to calculate the melting points of complexes. The elemental analysis was recorded using an elemental analyzer.

Synthesis of Schiff base ligand: To 0.01 mol of Dapsone 100 ml of ethanol was added. To 0.02 mol of Thiophene-2-carboxaldehyde 5 ml of ethanol was added. Now mix both the solutions. Now pour the solution into round bottom flask. Then the solution was heated on a hot plate for four to five hours. The solution separates into precipitates as it cools. It was filtered, cleaned, and dried. This is the location of our Schiff base. Its melting point was discovered to be 140^0C, and its yield was 75%.

Schiff base metal complex synthesis: To 0.002 mol of Schiff base ligand was dissolved to 25 ml ethanol. 0.001 mole of metal salt was added in 25 ml of ethanol. Mix the two solutions together. Reflux the solution for 1h. Cool the solution and collect the solid complex. Filter it, wash it and dried it thoroughly.

Biological activity: The complex synthesized were screened against bacteria S. aureus, B. pumilus, E. Aerogenes, K. oxytoa, C. butyrium, E. coli, and fungi A. niger, Candida albicans. The data obtained was compared.

RESULTS:

Analytic data: The analytical data is in accordance with molecular formulae of complexes. The metal and ligand are in 1:2 (M:L) ratio [M=Ni^{2+}, Cu^{2+}, Co^{2+}, Zn^{2+}, $Mn^{2}]^{+}$ having formula $[M(HNSP)_2Cl_2]$ (Table-1).

IR Spectra: IR spectra was taken in the range of 400-4000cm^{-1}. It confirms the bonding and structure of complexes. The main stretching modes were shown for υ(M-O), υ(C=N), υ(M-N) and υ(M-Cl). IR spectral data of Schiff base of Dapsone and furan-2-carbox aldehyde and their metal complexes are shown in table [2]. Here a band at 1602 cm^{-1} confirms the presence of (-CH=N-) entity. When azomethine nitrogen coordinates to metal ion this frequency is decreased by 25-35 cm^{-1}. The position of IR peaks changes on chelation. For aromatic furan ring oxygen stretching the band appears between 1100 and 1238 cm^{-1}. New bands appears at 535-585 cm^{-1} and 350-445 cm^{-1} which confirms the metal-oxygen and metal-nitrogen bonds on complex formation. Schiff base spectra does not have these two band. Coordination through furan ring oxygen confirmed by the frequency shift of these complexes by 10-30 cm^{-1}. The frequency for the Schiff base because of $\nu_{as}(SO_2)$ and $\nu_s(SO_2)$ were obtained at 1126 cm^{-1} and 1290 cm^{-1}, respectively.

Data for Schiff base ligand: On condensation of Dapsone and furan-2-carbox aldehyde, Schiff base was formed. It has yellowish brown colour. It has melting point 165^{0}C and yield 80%. IR spectra for (-NH) shows peak at 3310 cm^{-1} which disappears on Schiff base formation, for (O=S=O) at 1126 cm^{-1} and 1290 cm^{-1}. Element analysis shows C-65.28%, H-3.96%, N-6.92%, O-15.83% and S-7.91%. It has molecular formula $C_{22}H_{16}N_2SO_4$ and molecular weight 404.44 g. It has molar conductivity 2.5 $ohm^{-1}cm^2\ mol^{-1}$.

Metal complexes:

Co2+ complex: It has light pink colour and yield 65%. It has melting point 135^{0}C. Its IR spectra showed peaks at 1568 cm^{-1} for (-CH=N-), at 1125, 1292 cm^{-1} for (O=S=O), at 445 cm^{-1} for (M-N), at 572 cm^{-1} for (M-O), at 1082 cm^{-1}, 1215 cm^{-1} for furan ring oxygen stretching vibration. Elemental analysis showed that it contains C- 48.28%, H-3.23%, N-5.04%, S-5.91% and Co^{2+}-10.04 %. It has molecular weight 463.37 g and molecular formula $C_{22}H_{16}N_2SO_4Co$. It has molar conductivity 4.6 $ohm^{-1}cm^2\ mol^{-1}$.

Cu2+ complex: It has greenish blue colour and yield 70%. It has melting point 135^{0}C. Its shows IR peaks at 1580 cm^{-1} for (-HC=N-), peaks at 1125 cm^{-1} and 1287cm^{-1} for (O=S=O), at 352 cm^{-1} for (M-N), at 562 cm^{-1} for (M-O). Elemental analysis showed that it has C-47.79%, H-3.20%, N-5.61%, S-5.21% and Cu-12.71%. This complex has molecular formula $C_{22}H_{16}N_2SO_4Cu$ and molecular weight 467.98 g. It has molar conductivity 5.4 $ohm^{-1}cm^2\ mol^{-1}$.

Ni2+ complex: This complex has light green colour and yield 70%. It has melting point 125^{o}C. Its IR spectrum shows peaks at 1568 cm^{-1} for (HC=N), at 1127 and 1290 cm^{-1} for (O=S=O), at 427cm^{-1} for (M-N), at 537 cm^{-1} for (M-N). This complex has molecular weight 463.13 g and molecular formula $C_{22}H_{16}N_2SO_4Ni$. Elemental analysis shows that it has C- 48.30%, H- 3.24%, N-5.65%, S-5.42 and Ni-11.86%. It has molar conductivity 5.9 $ohm^{-1}cm^2\ mol^{-1}$.

Zn2+ complex: It has white colour and yield 75%. It has melting point 130^{0}C. Its IR spectra shows peaks at 1568 cm^{-1} for (HC=N), at 1290 and 1128 cm^{-1} for (O=S=O), at 367 cm^{-1} for (M-N), at 582 cm^{-1} for (M-O). Its elemental analysis shows that it has C- 47.19%, H-3.19%, N-5.58%, S-6.12% and Zn-11.95%. Its has molecular weight 469.85 g and molecular formula $C_{22}H_{16}N_2SO_4Zn$. It has molar conductivity 7.3 $ohm^{-1}cm^2\ mol^{-1}$.

Mn2+ complex: It has white pink color and yield 75%. It has melting point 120^{0}C. Its IR spectra 1572 cm^{-1} for (HC=N), at 1125 and 1290 cm^{-1} for (O=S=O), at 382 cm^{-1} for (M-N), at 565 cm^{-1} for (M-O). It has molecular formula $C_{22}H_{16}N_2SO_4Mn$ and molecular weight 459.38 g. Elemental analysis shows it has C- 48.22%, H-2.26%, N-5.65 %, S-5.38 % and Mn-10.18 %. It has molar conductivity 5.6 $ohm^{-1}cm^2\ mol^{-1}$.

Table-1: (PHYSICAL DATA OF COMPLEXES)

Schiff base and complexes	Colour	C(%)	H(%)	S(%)	O%	N(%)	Metal	Halogen	M.P. (^{0}C)	YIELD(%)
HNSP	yellowish brown	65.28	3.96	7.91	15.83	6.92	-	-	165	80
[Zn(HNSP)Cl_2]	white	47.19	3.19	6.12	11.37	5.58	11.95	10.55	130	75
[Cu(HNSP)Cl_2]	greenish blue	47.79	3.20	5.21	10.41	5.61	12.71	10.35	135	70
[Mn(HNSP)Cl_2]	white pink	48.22	2.26	5.38	10.46	5.65	10.18	10.98	120	75
[Ni(HNSP)Cl_2]	light Green	48.30	3.24	5.42	11.46	5.65	11.86	10.98	125	70
[Co(HNSP)Cl_2]	light pink	48.28	3.23	5.91	13.81	5.04	10.04	11.12	135	65

TABLE-2: IR data of complexes

Ligand and complexes (cm^{-1})	ν(-CH=N-) Azomethine	ν(M-N)	$\nu_s(SO_2)$, $\nu_{as}(SO_2)$	ν(M-O)	Furan ring O vibration	ν(M-Cl)
HNSP	1602	-	1290,1126	-	1100,1238	-
[Zn$(HNSP)_2Cl_2$]	1578	367	1290,1128	582	1078,1210	272
[Cu$(HNSP)_2Cl_2$]	1580	352	1287,1125	562	1068,1225	307
[Mn$(HNSP)_2Cl_2$]	1572	382	1290,1125	565	1078,1225	287
[Ni$(HNSP)_2Cl_2$]	1568	427	1290,1127	537	1072,1218	332
[Co$(HNSP)_2$ Cl_2]	1568	445	1292,1125	572	1082,1215	297

TABLE 3: (Antimicrobial activity of complexes)

Inhibition effects of complexes	E.coli (mm)	E.aerogenes (mm)	C.butyrium (mm)	B.pumilus (mm)	S.aureus (mm)	K.oxytoa (mm)	A.niger (mm)	Mucor (mm)
Ligand	14	8	12	11	10	9	-	-
[Zn$(L)_2$ $(H_2O)_2$]	20	18	22	15	25	20	15	19
[Co$(L)_2$ $(H_2O)_2$]	19	18	20	17	20	15	11	15
[Ni$(L)_2$ $(H_2O)_2$]	24	17	25	22	26	25	17	14
[Cu$(L)_2$ $(H_2O)_2$]	28	16	25	19	29	18	15	19
[Mn$(L)_2$ $(H_2O)_2$]	18	15	22	15	18	15	12	12

CONCLUSION:

Biological activity Antimicrobial activity: Disc diffusion method is used to screen the antimicrobial activities of complexes against bacteria and fungi. Against bacteria and fungi, the complex of Cu(II), Mn(II), Zn(II), Co(II), and Ni(II) exhibits substantial antibacterial activity. Antimicrobial activity were

screened against Staphyloccus aureus, Klebsiella oxytoa, Enterobacter aerogenes, Bacillus pumilus, Clostridium butyrium. Enchanced inhibitory activity for bacteria was shown by metal complex as compared to Schiff base ligand. Mucor and Aspergillus niger fungi were used to screen the antifungal activity of complexes. Data recorded shows that the metal complexes has more significant antimicrobial property than ligand (Table-3). The study revealed that no antifungal activity shown by Schiff base ligand whereas metal complexes show significant antifungal activity for these two fungi. Biological activity of the complexes follows the order- Cu(II), Ni(II), Zn(II), Co(II) = Mn(II) complexes.

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Seasonal Variations of Physico-chemical Characteristics and Diversity of Macrophytes in two lakes of Holalkere Taluk, Chitradurga, India

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Abstract*: A crisis with safe drinking water is forcing the many Government authorities to put forth strict regulations for the discharge of water to aquatic bodies. The quality of small pockets of water is important for domestic and agricultural usage and hence, the work reports the analysis of various physical and chemical parameters for the water in the author's surrounding environment. Two sites, Gangasamudra lake (Site 1) and Gowdihalli lake (Site 2) are the study areas, located in Chitradurga (D), Karnataka (S), India. The analysis was carried out for two years from 2019 to 2021 for all three seasons. In addition, the wide variety of macrophytes present in study areas was also identified.*

Key Words: *Physico-chemical parameters; seasonal variations; aquatic macrophytes; Gangasamudra lake; Gowdihalli lake.*

INTRODUCTION:

The water quality of the lakes and other sources of water is a subject of natural degradation and the eutrophication process. Some of the chemical components in the surface water are important for the micro as well as macro-organisms (Varjo et al. 2003). Nevertheless, beyond the threshold limits, visible effects of eutrophication could be seen and it includes the accelerated growth of biomass, plankton scum and algae. Such macrophytes tend to absorb the nutrient ions and accumulate the same in their tissues (Mahujchariyawong and Ikeda 2001). These would also act as metal nutrient traps and support metal retention which slows down the water current and favours sedimentation (Kadlec 2000). They are also known to decrease the resuspension process of sediments by providing wind protection (Brix 1997).

Though the negative impacts of macrophytes on aquatic quality are provided by many researchers, there exist some contradictory conclusions as well. For instance, Ozimek et al., (Ozimek et al. 1990) and Reddy and De Busk (Reddy and De Busk 1985), respectively stated that macrophytes condense biomass of phytoplankton and nutrient concentrations. There are also reports on improvisation of water transparency due to the macrophytes (Jeppesen et al. 2014), (van Donk and van de Bund 2002). However, the relation between macrophytes and water quality is unclear, the climate change and the ecological act leading to the restoration of lakes are interdependent. The major reasons for the same are 1) the growth of different macrophytes has a different mechanism and hence varied nutrient removal (Dhote and Dixit 2009), and 2) the efficiency and method of allelopathy diverge among the forms (Gross 2003), (Gross et al. 2007). Nonetheless, the assessment of the relation depends on study protocols and each protocol suffers varied limitations attributing to scale and tenacity of unexpected inference. Inclusively, the concentration of chlorophyll α of phytoplankton, total nitrogen, phosphorous and many other nutrients and even contaminants play a key role in the growth of macrophytes in a study water source for a particular geographical area and the season. Once, the significance of forms of macrophytes and the nutrients are figured out, the process has increased the curiosity and motivated the authors to study the disparity in the nutrients and water quality of surrounding lakes concerning season and two successive years. The present study aims to analyse the variation in several parameters such as air and water temperature, total dissolved solids (TDS), pH, turbidity, conductivity, concentrations of calcium, potassium, magnesium, free ammonia, sulphate, sodium, phosphate and nitrite, total alkalinity, hardness, chemical oxygen demand (COD), biological oxygen demand (BOD), dissolved oxygen (DO), free carbon dioxide and suspended solids in addition to macrophytes in two nearby locations:

Gangasamudra lake and Gowdihalli lake. The parameters are analysed for all the three seasons, rainy, winter and summer for two years June 2019 to May 2020 and June 2020 to May 2021.

MATERIALS AND METHODS:

Study Area:

Two study areas included in this research are classified as site 1 and 2, which is named Gangasamudra lake and Gowdihalli lake, respectively. Both the lakes is located at Holalkere taluk, Chitradurga District, Karnataka state, India. Site 1 lies between the latitude 13°9'19"N -76°14'6" E at a mean altitude of 727 mts. Site 2 lies between the latitude 13°9'27"N -76°16'7"E at a mean altitude of 714 mts. The satellite views of both Site 1 and 2 are provided in figure 1.

Figure 1: Satellite view of Site 1 (Gangasamudra Lake) and Site 2 (Gowdihalli Lake)

Sample collection: The water samples from Site 1 and 2 were collected in all the three seasons (rainy, winter and summer) for two successive years, June 2019 to May 2020 and June 2020 to May 2021. The surface water of both the sites was collected in polyethene bottles according to the previously mentioned times and labelled from numbers 1 to 6 for convenience. The collected water samples including macrophytes were stored in dark conditions at a lower temperature until use, to avoid the obstacles caused by contamination and interference of light and temperature.

Limnological studies: Some of the physicochemical parameters such as air and water temperature, pH and conductivity were measured soon after the samples collection with an aid of a thermometer and digital pH and conductivity meters. Whereas all other parameters such as TDS, turbidity, conductivity, concentrations of calcium, potassium, magnesium, free ammonia, sulphate, sodium, phosphate and nitrite, total alkalinity, hardness, COD, BOD, DO, free carbon dioxide and suspended solids were estimated in the laboratory using suitable standard measuring protocols of American Public Health Association (APHA 2012), and the details are provided in Table 1. Standard herbarium techniques were adopted for the collection and preservation of macrophytes. Identification of macrophytes was through an extensive literature survey and the identification was confirmed via herbarium of Botanical Survey of India, and Flora of Madras Presidency.

RESULTS AND DISCUSSION:

Physicochemical parameters of collected samples:

The physical-chemical parameters for Site 1 for the years June 2019 – May 2020 and June 2020 – May 2021 are summarized in Figures 2 and 3, respectively. The physico chemical parameters for Site 2 for the years June 2019 – May 2020 and June 2020 – May 2021 are summarized in Figures 4 and 5, respectively. The biogeochemical activities of the aquatic environs depend on the temperature of the

surrounding air and water. As the average temperature in Holalkere (T) in summer is ~35 ºC, the same near the lakes is found to be greater (varied from 32 to 32.5 ºC) in both the sites for both the years. However, on winter and rainy days, the temperature was less and was about 28 to 29 ºC. All the limonological parameters are provided in Table 1 and 2. The temperature of the water is graphed, wherein, the trend of temperature variance for water and air remained the same indicating their direct relevance. The maximum water temperature was high in summer attributed to intense solar radiations, reduced water level, clear atmospheric conditions and even the greater atmospheric temperature. During the winter and rainy seasons, the recorded temperature was lower due to the cold and ambient conditions with squatter photo-session (Niedrist et al. 2018).The components such as clay, organic matter, some microscopic organisms, slit and phytoplankton's are the key responsible factors for the turbidity of water (Schwartz and Levin 1999). Turbidity is termed as the expression of the optical property of the water as it affects the light scattering property. Like temperature factors, the turbidity was also high in summer and recorded to be 9 NTU for the year 2019-2020 and it further increased for the sites for the following year. Increased turbidity is due to the addition of sewage waste or increased aquatic vegetation growth or lowered water levels. The turbidity was minimum in the rainy season, which is due to increased water levels.

The chemical parameters of water are comprised of pH, total alkalinity, suspended solids, TDS, conductance, total hardness, free CO_2, BOD, COD, dissolved oxygen and many other ions. pH, total alkalinity, suspended solids, TDS and conductivity values were minimum in the rainy season and increased in winter and maximum in summer. No significant pH changes were seen between Site 1 and Site 2 for both years. pH was maximum in summer, varied from 7.12 to 9.15 and minimum in the rainy season, which was about 7. Generally, in India, the small pockets of water are usually alkaline (Gangwar et al. 2012). The alkalinity is attributed to solutes showing buffering action, that maintain a compensation between H^+ and OH^- ions (Pan et al. 2011). The greater pH might be because of greater decomposition activities resulting in salts or ions of bicarbonates and carbonates (Rommozzi et al. 2020). The lower value of pH is owed to accumulated organic matters and vegetation decomposition resulting in the CO_2 release upon biological oxidation. Obtained results are following the literature (Kaushik et al. 2007), (Solanki and Karlikar 2012). The salts of bicarbonates and weak acids are said to be the total alkalinity of the given water sample. The total alkalinity is maximum in rainy and especially in Site 2. The minimum recorded total alkalinity was 143 NTU, for the first year, rainy season of Site 1 and the maximum is 211 NTU, which is for the first year, rainy season of Site 2. The decreased water level in summer leads to the death and decay of aquatic organisms and plants. These will release CO_2 upon oxidation (decomposition) and increases the alkalinity and the results are well consistent with the lakes of Dharwad (D), Karnataka (S), India (Hegde 1985). The increase in suspended solids in the summer season again is the reason for greater turbidity.

TDS signifies the presence of several minerals in the water. Site 1, the summer season sample showed a high TDS value of 706 mg/l. The values were less for Site 2 (446 and 463 mg/L). In the rainy season, the number of water increases and hence TDS value decreases. Certainly, greater TDS concentrations augment the nutrient status of the water sources and lead to aquatic ecosystem eutrophication. Conductivity is another parameter to assess the purity of water and is attributed to ions concentrations in water. The previously discussed parameters are maximum in summers which in turn increases the conductivity. The water dilution in the rainy season decreases conductivity. Total hardness is not the measure of a specific constituent, besides, a mixture of several ions. Calcium and magnesium ions are the major contributors. The maximum total hardness was for Site 2 (218 mg/L) in the summer and the minimum was for Site 1 (138 mg/L) in the rainy season. The results obtained concerning all other parameters such as free CO_2, dissolved oxygen, COD and BOD are well substantiated by each other. All the parameters show the dynamism of aquatic life happening due to the accumulation, oxidation, and decomposition of organic as well as biological matters in water.

Furthermore, some of the ions and inorganics like sodium, potassium, magnesium, phosphate, sulphate, calcium, nitrite and chloride were estimated in all the samples. The concentrations of all the ions were maximum in summer and no significant variations were observed among different sites or different years. Sodium, magnesium, calcium and potassium are some of the natural components of raw water. Nonetheless, their concentration increases due to the pollution caused by soap and detergent

solutions, rock salt and precipitation runoffs. Each ion owes a major benefit at their threshold limits for the aquatic world but is harmful beyond that limit. Calcium ions are plentiful in water and helpful for the construction of shells, building bones and even plant precipitation of lime (Preedy 2016). Magnesium is usually accompanied by calcium ions but is less abundant compared to calcium ions. The presence of magnesium is vital for chlorophyll growth and also an inhibiting parameter for phytoplankton growth (Chouhan et al. 2009). Sodium and potassium are together efforts in maintaining the normal osmotic pressure in the cells.

Table 1: Seasonal variations of physicochemical parameters of site 1 (2019-2021)

Sl no.	Parameters	June 2019 to May 2020			June 2020 to May 2021		
		Rainy	Winter	Summer	Rainy	Winter	Summer
1	Air Temperature	28.5	28	28.5	28	28.5	32
2	Water Temperature	27.2	26.7	27.2	26.7	27.2	30.5
3	TDS	392	389	418	389	418	706
4	pH	7.12	7.18	7.69	7.18	7.69	8.65
5	Turbidity	3	3	6	3	6	11
6	Conductivity	529	518	590	518	590	772
7	Calcium	38.5	38.5	47.5	38.5	47.5	68.5
8	Chloride	72.0	68.0	81.5	68.0	81.5	106.5
9	Potassium	8.32	8.26	9.37	8.26	9.37	12.9
10	Magnesium	11.5	10.5	13.1	10.5	13.1	18.6
11	Free Ammonia	0.027	0.029	0.043	0.029	0.043	0.14
12	Sulphate	57.5	57.0	66.5	57.0	66.5	94.5
13	Total Alkalinity	173	149	143	211	173	149
14	Total Hardness	138	138	161	138	161	201
15	COD	63	67	75	67	75	99
16	BOD	4.8	5.1	5.9	5.1	5.9	8.9
17	Free Carbon Dioxide	14.7	15.1	16.8	15.1	16.8	19.5
18	Suspended Solids	6	6	9	6	9	14
19	Sodium	45	78	57	49	86	62
20	Phosphate	0.020	0.023	0.029	0.023	0.029	0.12
21	Nitrite	2.88	0.52	0.47	2.73	0.78	0.52
22	Dissolved Oxygen	16.5	13.5	11.5	16.0	12.5	10.5

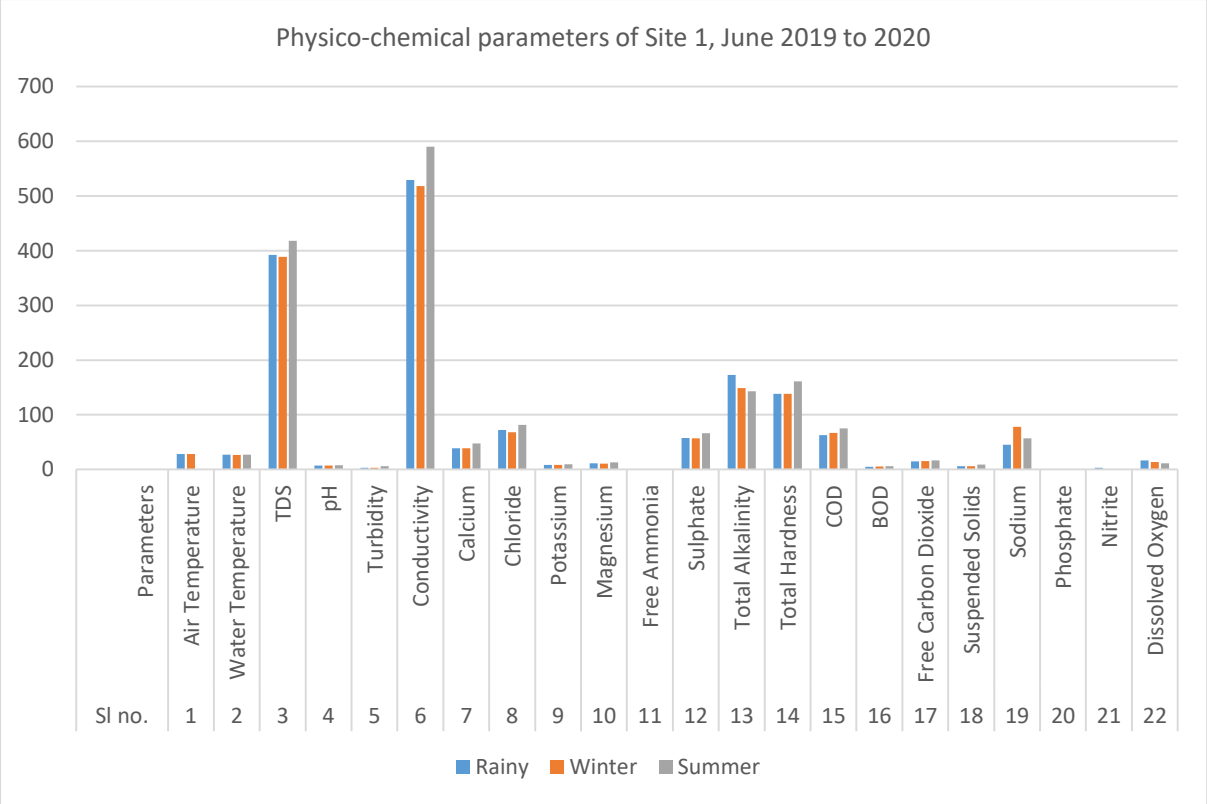

Figure 2: Physico-chemical parameters of Site 1, year 1

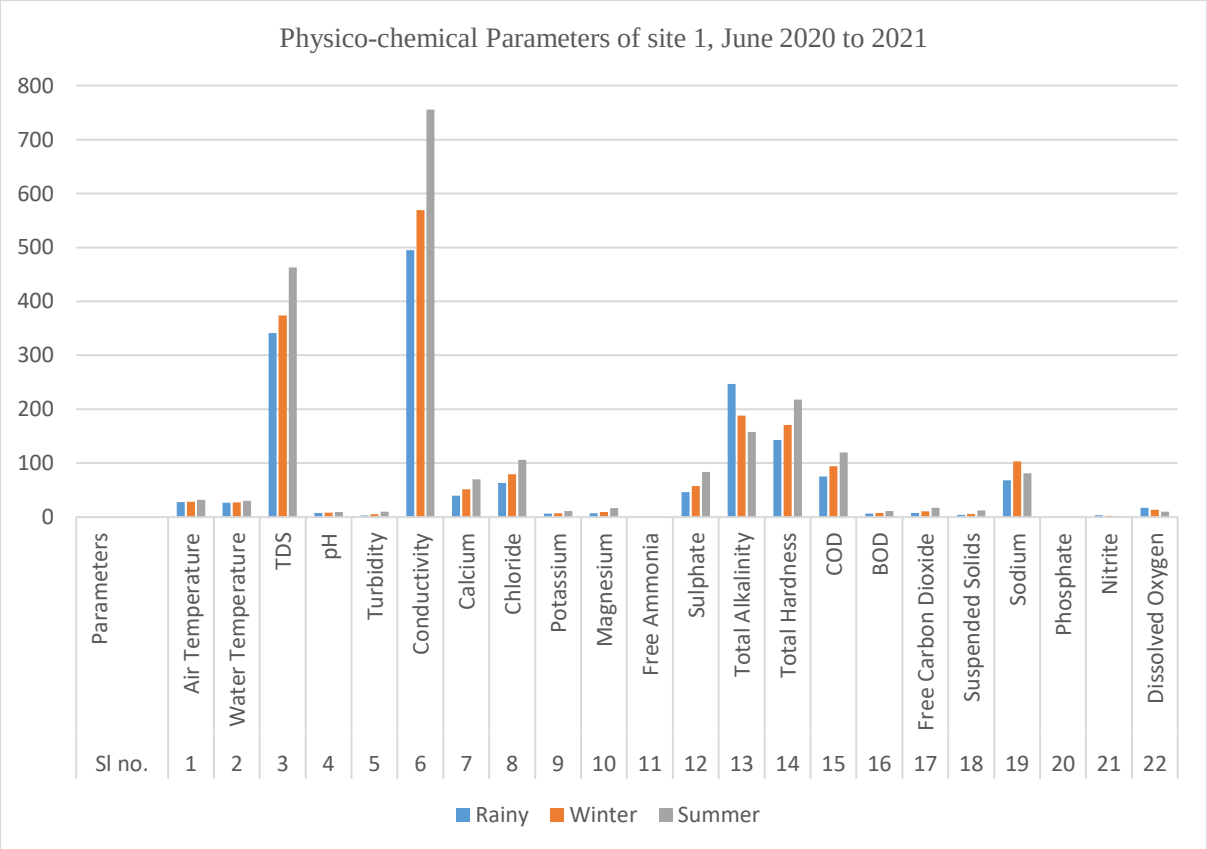

Figure 3: Physico-chemical parameters of Site 1, year 2

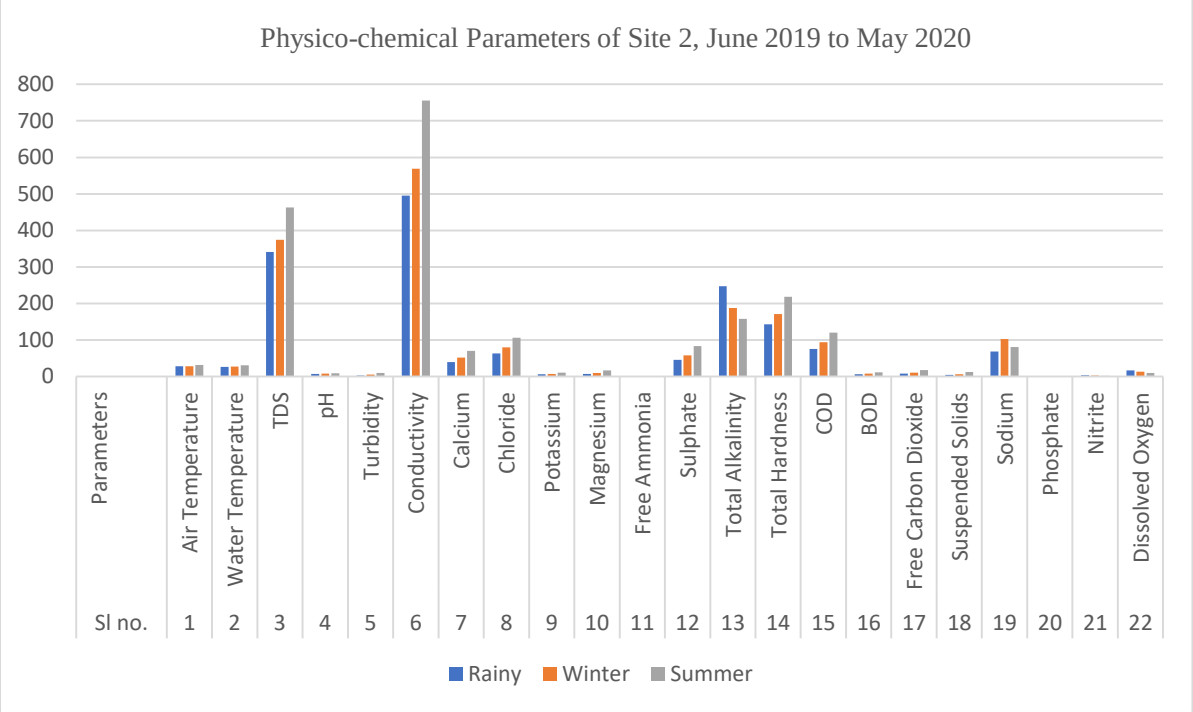

Figure 4: Physico-chemical parameters of Site 2, year 1

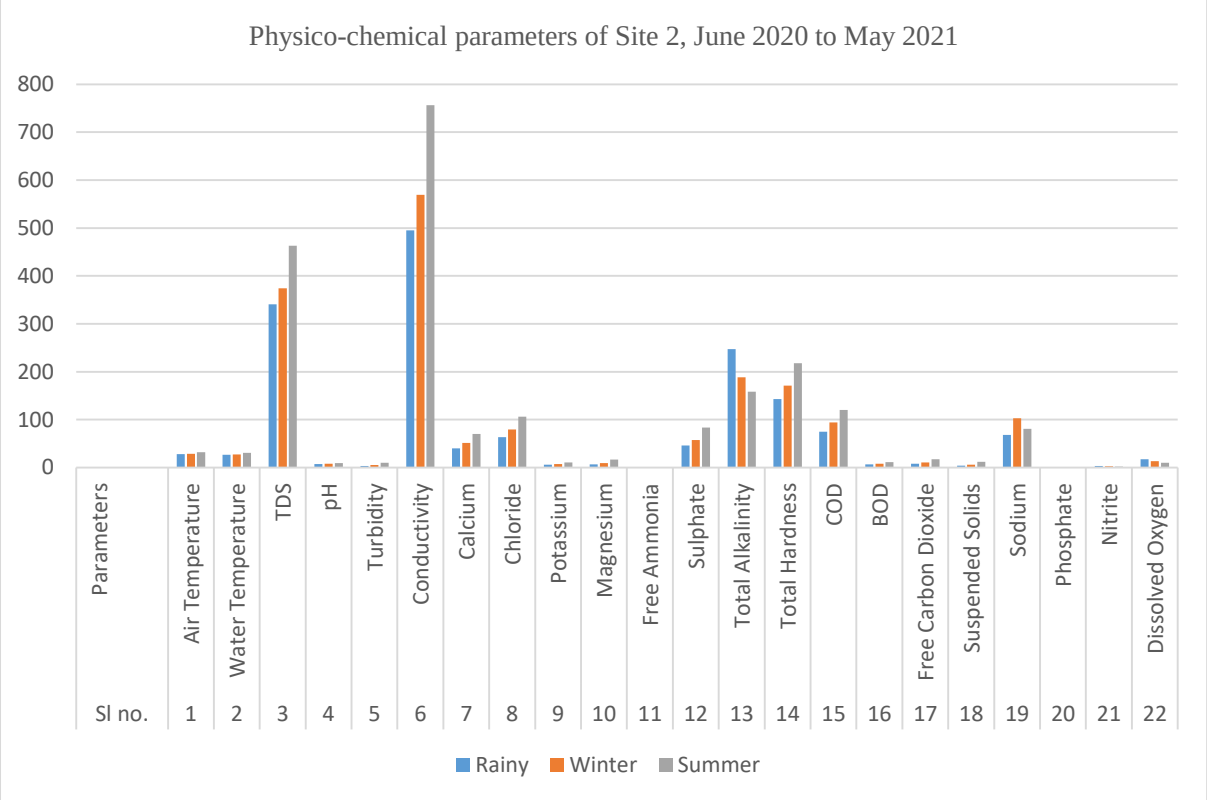

Figure 5: Physico-chemical parameters of Site 2, year 2.

The phosphates geochemical shortage is the limiting factor for the productivity of phytoplankton in the drainage basin. With the plankton multiplication, the phosphate concentration will

also decrease (Moss and Balls 1989). The concentration of phosphates varies with the discharge of phosphorous-containing fertilizers. Increased phosphates result in eutrophication in the lakes, reducing the dissolved oxygen levels and hence affecting the aquatic life. The total hardness of water is reliant on the sulphates and chlorides of calcium and magnesium ions in water. The variation in nitrate and phosphate concentration among the target sites is significant. In summer it is almost double the concentration of the same on rainy days. The sources of these ions are the sewage water and the pollution caused by domestic purposes. The greater concentrations of all these ions in summer are due to greater evaporation of water or due to decay of organic matters.

Identification of macrophytes in the collected samples:

The role of macrophytes is one of the major considerations for the quality and ecosystem of aquatic life. Fifteen macrophytes belonging to twelve families were tried to identify in the collected samples. The results are tabulated in Table 2. All fifteen macrophytes were present in Site 1 and Site 2, Identified macrophytes were confirmed from literature and herbarium of the Botanical Survey of India. Site 1 was rich with macrophytes compared to Site 2.

Table 2: List of identified macrophytes in the target study areas of Site 1and 2.

Sl no.	Name of a Species	Family	Site 1	Site 2
1	*Nitella Species*	Characeae	+	+
2	*Cyperus Longus*	Cyperaceae	+	+
3	*Stuckenia Pectinata*	Potamogetonaceae	+	-
4	*Callitriche Palustris*	Plantaginaceae	+	+
5	*Potomogeton Species*	Potamogetonaceae	+	-
6	*Azolla Pinnata*	Salvinaceae	+	+
7	*Najas Marina*	Hydrocharitaceae	+	-
8	*Alternanthera Sessilis*	Amaranthaceae	+	+
9	*Ipomoea Fistulosa*	Convolvulaceae	+	+
10	*Polygonum Glabrum*	Polygonaceae	+	+
11	*Utricularia Minor*	Lentibulariaceae	+	-
12	*Cyperus Aggregatus*	Cyperaceae	+	-
13	*Portulaca Oleracea*	Portulacaceae	+	-
14	*Hydrilla Verticellata*	Hydrocharitaceae	+	+
15	*Ottelia Alismoides*	Hydrocharitaceae	+	+

CONCLUSIONS:

A seasonal versatility of the several physicochemical parameters of water from two study sites, Gangasamudra lake and Gowdihalli lake were explored along with the macrophytes. Air temperature and water temperature remained greater in summer for both the years in both the sites. Site 1 showed a greater TDS value of about 706 mg/L in summer for the first year and the least value was observed for Site 2, during the rainy season and the first year. Most of the parameters were greater in summer and lower in rainy, which is attributed to decreased levels of water in summer. As a whole, the water quality in both the sites remained almost the same and not many variations were observed in comparing the two successive years.

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Declarations

Ethics approval Not applicable.
Consent to participate Not applicable.
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The ramification of xenobiotics on soil health and its phytoremediation: A brief review

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Abstract*: The lithosphere is a significant component of the biosphere of our planet that maintains life by interacting with the hydrosphere and atmosphere. However, in recent years industrialization and modern agricultural practices have change the land use and led to the addition of various xenobiotics in soil, hence causing soil contamination. Xenobiotics are substances which are foreign to the metabolic pathway of living organisms and may cause severe damage to the living organisms whether flora or fauna. Xenobiotics include chemical fertilizers, pesticides, heavy metals, etc. Industrialization and urbanization has accelerated the addition of xenobiotics in the soil, which has negative impact on soil health by causing the soil flora and fauna to decline by the addition of toxins or the altering their habitat by changing the soil quality. This has also caused damage to other physical, chemical and biological characteristics of the soil such as the addition of heavy metals, change in pH, etc. According to research, soil organic carbon is negatively affected by the degradation of the environment through unsustainable human activities. This adverse impact of xenobiotics can be reversed by phytoremediation to tackle unsustainable activity in the soil biota by using plants like Helianthus annuus, Lolium perenne. Phytoremediation is an eco-friendly approach for xenobiotic elimination and it comprises various approaches like phytovolatilization, phytoaccumulation, phytostabilization, phytoextraction, rhizofiltration and phytostimulation or rhizostimulation.*

Key Words: *Phytoremediation, heavy metals, unsustainable activities, sustainable agriculture, xenobiotics.*

INTRODUCTION:

Anthropogenic actions including industrialization, modern agriculture practices and increasing human population has adversely affected the soil fertility which in turn damages the soil biota due to continuous use of chemical pesticides, insecticides, fertilizers, polycyclic aromatic hydrocarbons and other heavy metals etc. and ultimately results in the overall decline in productivity of fertile land. Chemicals produced by industries like printing, chemical and other manufacturing industries are the major sources of xenobiotics which are damaging the soil biota (fig. 1).

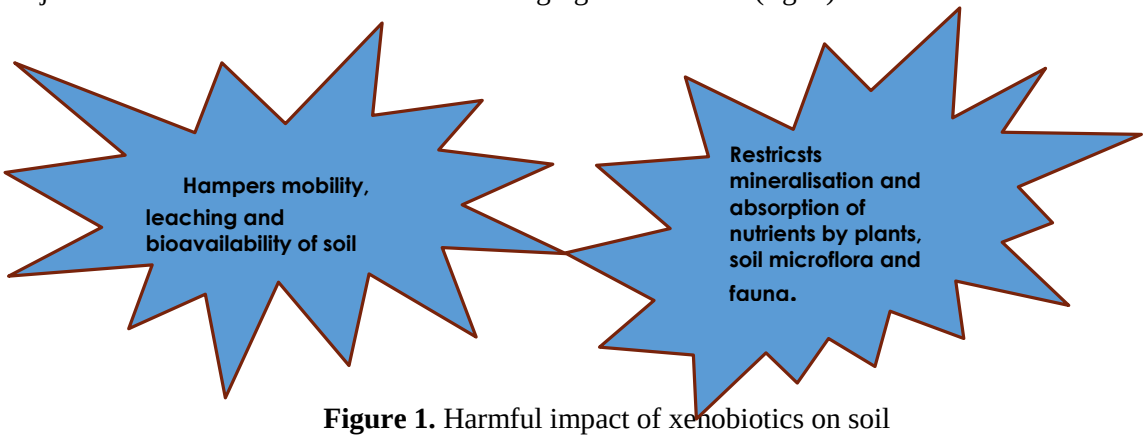

Figure 1. Harmful impact of xenobiotics on soil

Its addition in turn alters the mobility, leaching and bioavailability of soil nutrients due to the attachment of xenobiotic chemicals. Along with it, mineralisation and absorption of nutrients by plants, soil microflora and fauna. These pollutants may enter into the food chains of animals and other Microbes by getting mixed in the soil and finally becoming a part of their metabolic process which in turn will adversely affect them. Bioaccumulation of these xenobiotics in humans may lead to various diseases like cancer, heart attack, headache, nausea, asthma, Alzheimer's etc. The methods through which removal of these xenobiotics can be done are electrodialysis, ion exchange, membrane separation, chemical precipitation, electrochemical treatments, reverse osmosis, advanced oxidation process in exchange absorption and flocculation by using Nano composite materials and electrochemical treatments (1). But these conventional methods are generally complex and expensive, they require a large number of energy consumption devices which in turn lead to the generation of huge quantities of toxic intermediates and hence generate secondary pollutants and certain times some of the methods fail to eliminate high concentration of pollutants. To solve this issue there is the method of phytoremediation which is cost effective as well as environment friendly. In phytoremediation we use organisms like bacteria, fungi and plants to immobilize and remove the toxic Xenobiotics present in soil and thus, detoxify it. Phytoremediation is also known as green remediation and agro-remediation (2). Chaney firstly investigated this method of phytoremediation (3). Soil biota, fertility and biological activities of the plant don't get affected during the process of phytoremediation. In this process pollutants are removed by phytovolatilization, phytoaccumulation, phytostabilization, phytoextraction, rhizofiltration and phytostimulation or rhizostimulation (4) (Fig. 2, Table 1).

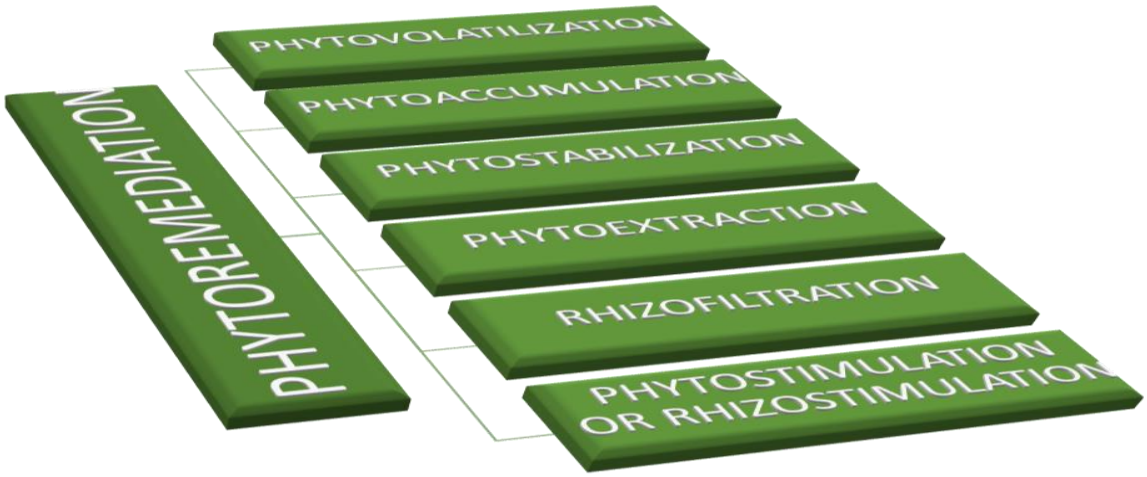

Figure 2: Various methods for phytoremediation

Rhizostimulation by using rhizospheric microbes can also be used to reverse the damaging impact of xenobiotics (5, 6). Rhizospheric bacteria enhance plant growth through multiple processes including biological nitrogen fixation, generation of plant growth regulators, , mineral and nutrients translocation. There is no direct involvement of plants in phytoremediation, rather it is directly carried out by endophytic and rhizospheric microorganisms. It can be considered as symbiotic association between plants and the microorganisms in which nutrients are provided to microorganisms by plants while microorganisms transform xenobiotic pollutants into non toxic one in order to make it's healthy alternative available to plants and soil biosphere by natural recoupment and recovery of contaminated sites. This rhizostimulation by rhizospheric bacteria (it's consortium is more effective than single strain) completely eliminates xenobiotic pollutants by transforming them into non toxic form (7). This paper deals with the various approaches which can be used to transform toxic Xenobiotics in their non toxic form in order to maintain soil health.

Xenobiotics:

Soil pollution is majorly caused due to the presence of xenobiotic (human-made) / recalcitrant chemicals or other alteration in the natural soil environment. These xenobiotics are human made chemicals released by various means, namely- (1). Industrial activities for eg. fly ash (combustion of

pulverized coal) is produced by thermal power plants, it contains acidic, toxic, and radioactive matter. This ash can contain lead, arsenic, mercury, cadmium, and uranium. (2).Chemical fertilizers like Ammonium nitrate, Ammonium sulphate, Nitrogen, Potassium and Phosphorus. These chemical fertilizers affect microorganisms living in the soil. The acidity of chemical fertilizers also adversely affects the soil pH and makes it acidic. (3).Urban, commercial and domestic waste for eg. Polythene, Nano pollutants from daily use products, glass. (4).Commercial waste / E- waste released from electronic items like AC, tv, mobile, etc. (5).Biomedical wastes which comprises organic material, chemicals, metals, plastic, soil born pathogens etc. (6).Harmful Pesticides such as DDT (fig. 3)

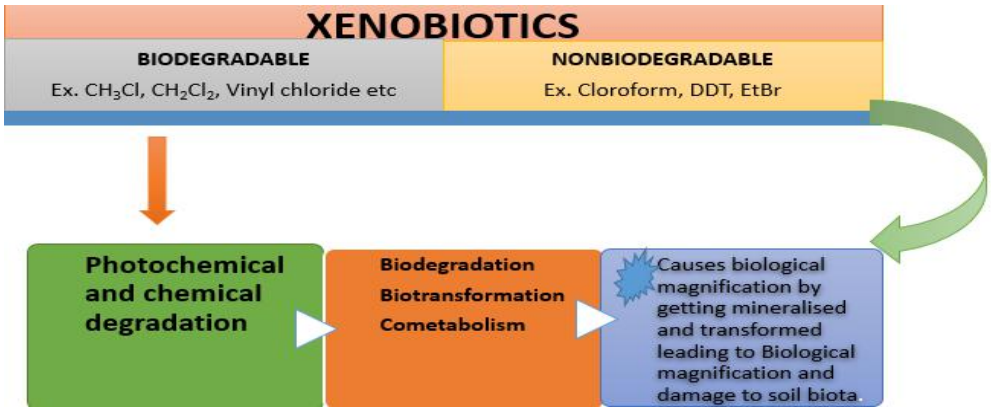

Figure 3: Effect of Xenobiotics (7).

Xenobiotics like heavy metals hampers mobility, leaching and bioavailability of soil nutrients which in turn restricts mineralisation and absorption of nutrients by plants, soil microflora and fauna. Heavy metals are the group of those metals and metalloids which generally have high density and have toxic impacts on living organisms. It's release in the environment has been accelerated due to nthropogenic actions (fig. 4). Certain heavy metal like Cu, Zn, Mn, Fe, Ni and Co are major micronutrient required for the metabolism of plant but if these are present in excess amount along with the other non-essential metals like Cd, Hg, Ag and Pb then they become toxic and cause soil pollution (8).

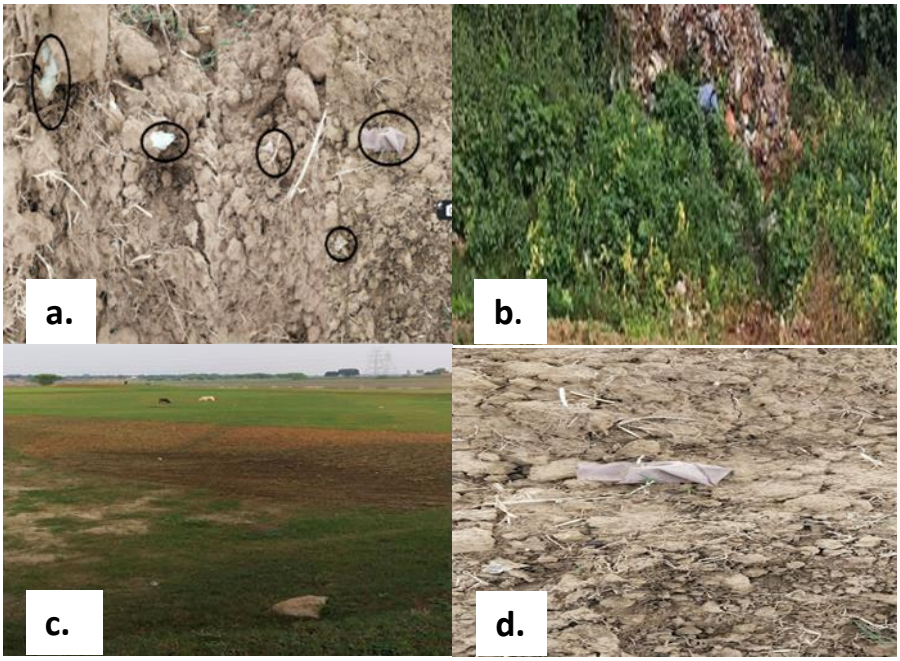

Figure 4: Unsustainable activities- a. Xenobiotics b. Domestic waste c. Soil erosion d. Flood in ecotone region due to encroachment.

It has been found that Cd toxicity deteriorates the soil microflora by altering the physiology of soil which in turn reduces the overall productivity of fertile land, Pb toxicity alters soil pH and nutrient assimilation which in turn hinders the foliage growth by reducing chlorophyll and protein content, Cu salts damage soil microflora and fauna by reducing oxidation potential and Zn restricts enzymatic activity, alters bicarbonate, organic content and soil pH which ultimately leads to the chlorosis, etc. (9)(Table 1).

Table 1. Toxic effect of certain heavy metals.

Heavy Metals	**Toxicity Form**	**Toxic Effects**	
		Soil	Plant
Cd	Cd^{+2}	Kills soil microbes and alters the physiochemical characteristics of soil.	Decline in biomass and root length, reduced shoot conductivity and inhibition of seed germination.
Pb	Pb^{+2}	Reduction in soil fertility, change in soil pH and assimilation of nutrients in soil.	Reduction in protein and chlorophyll content leading to hindrance in foliage growth.
Cu	Cu salts	Reduced oxidation potential and damage to soil microbes.	Abnormality in root growth, reduction in lipid, polypeptide quantity and shoot growth.
Zn	Zn^{+2}	Restricts enzymatic activity, alters bicarbonate, organic content and soil pH	Interveinal chlorosis, alternation in enzymatic activity and restriction in transmission of elements

PHYTOREMEDIATION:

In Latin language *phyto* stands for 'plant' and *remedium* stands for 'to restore the proper balance of the environment' by eliminating toxic substances present in it. There are a large number of plant species which can be used for the purpose of phytoremediation. These include hyperaccumulator plants like *Astragalus racemosus*, *Viola calaminaria*, *Brassica juncea* etc (10). A wide range of hyperaccumulator plants use various modes of phytoremediation to eliminate xenobiotics from soil and maintain its health (Fig. 5).

Phytoremediation may involve (Table 1) - (1) Rhizoremediation (2) Phytodegradation/Phytotransformation -After being absorbed from the soil, xenobiotics are degraded and turned into minerals by plants by metabolism. (3) Phytovolatilization- It involves absorption of xenobiotics from the soil by plants that are later discharged in the atmosphere in volatile form. (4) Phytostabilization- In this approach xenobiotics get neutralized by their assimilation and precipitation by plants. (5) Phytostimulation / Rhizodegradation - It is the biodegradation of xenobiotics by rhizospheric microbes. (6) Phytoextraction- Translocation of xenobiotics occurs via root from soil to the various parts of the plant. Once the concentration of xenobiotics in these hyperaccumulators surpasses its saturation point then the plant is cut down and properly disposed of (11).

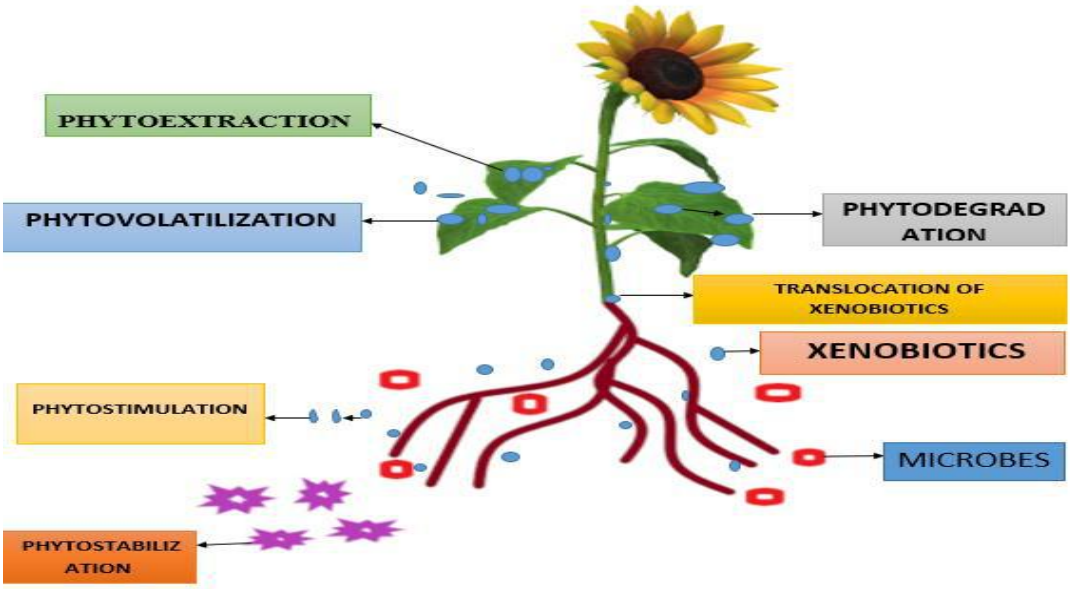

Figure 5. Phytoremediation of xenobiotics by plants

Table 2. Phytoremediation of Xenobiotic pollutants by various plants

S. No.	Name of Process	Xenobiotics	Phytoremediation by
1.	Rhizoremediation	Petroleum hydrocarbons (PHCs) Lindane Chromium (Cr)	*Helianthus annuus* (12) *Withania somnifera*(13) *Lolium perenne*(14)
2.	Phytodegradation or Phytotransformation	TPH (Total Petroleum Carbon)	*Scirpus grossus*(15)
3.	Phytovolatilization	Mercury (Hg)	*Chara canescens* & *Arabidopsis thaliana* (16)
4.	Phytostabilization	Arsenic (As)	*Piricum sativum* (17)
5.	Phytostimulation / rhizodegradation	Biodiesel Pyrene & Phenanthrene	*Pisum sativum* (18) *Kandelia candel* (19)
6.	Phytoextraction	Lead (Pb) Arsenic (As)	*Glycine max* L. (20) *Pteris vittata* (21)

Characteristic of an ideal plant which can be used for phytoremediation - (i) Rapidly growing, (ii) Flourish rapidly, (iii) High tolerance for xenobiotics, (iv) presence of highly effective xenobiotic degrading metabolic pathways, (V) Extremely efficient rhizospheric activities like translocation of xenobiotics, phytostimulation by rhizospheric microbes etc (22, 23, 24), (vi) Ability to overcome allelopathic impact of other plant species. (vii) Proper translocation of xenobiotics from root to various parts of the plant. (viii) Hyperaccumulator (25, 26, 27). The plants used for phytoremediation are neither used as fodder or as food for human population hence their chances of biological magnification are rare. Generally accumulation of xenobiotics in the edible portion of the plants are negligible (28).

CONCLUSION:

Phytoremediation promotes sustainable agriculture practices. Despite all these, there are certain hindrances which we have to overcome in order to achieve our target of restoring soil health by complete transformation or elimination of xenobiotics from soil. These short hindrances are- (i) It is a very time taking process. (ii) It might get failed in the absence of proper translocation which will in turn hamper the process of phytoextraction. (iii) It may adversely affect the biological process of the plant used for the purpose of phytoremediation of xenobiotics. (iv) Accumulation of these xenobiotics should occur with tremendous speed to avoid long time duration for the removal of xenobiotics from soil.

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WizAgro – The Smart Agriculture Using Internet of Things and Cloud Computing

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Abstract*: The application of Internet of Things (IoT) technology is employed in the process of "smart agriculture" to improve both the quality and yield of agricultural goods. Utilizing this technology will result in far less human work being done in farms. In present work, IoT system is designed that offers collection, storage and processing of data from the field to take appropriate action in response in addition to inputs from the farmer. The cost effective "WizAgro" smart gadget, which is an innovative method of monitoring the atmospheric conditions (temperature, humidity, soil moisture, and water level) around a field, is presented in this study. The system is an Internet of Things stick that uses an Arduino Mega microcontroller and few sensors linked to it to monitor the atmospheric conditions. These atmospheric conditions are displayed on Liquid-Crystal Display (LCD) display and water motor is controlled through SMS using GSM module. Five plants were selected in this study over the span of 3 weeks. The information gathered on Cloud is further useful for weather forecasting, quality control, and optimum future planning.*

Key Words: *IoT, Arduino Mega, Smart Agriculture, Sensors, DHT11, Precision Agriculture.*

INTRODUCTION:

Agribusiness is the primary occupation in India and is the backbone of Indian financial framework. It provides employment openings to country individuals on an expansive scale and creating nations in expansion to providing nourishment. It is the method of creating nourishment, grains and many other craved items by the development and rising of domestic animals. Agribusiness is the essential source of livelihood for approximately more than 58% of India's population. Climate changes will have noteworthy effect on agriculture due to expanding water requirement and restricting crop productivity in ranges where water system is most needed. A system is designed for efficient and optimum utilization of water a smart system that is designed in present work. With the designed system farmer require not to make the Irrigation into farm lands manually, but the frame work automatically does that proficiently.

Figure 1: Smart Farms

The conventional strategies practiced by farmers typically result in huge wastage of water mainly due to over irrigation and irrigation when it is not actually essential. Consequently, the concept of automated farming with blend of IoT has been created [1]. The technological headways started to extend the efficiency over decades remarkably hence, making it a dependable system. The information of properties of soil decides the water supply to be driven in a systematic way. The practice of agriculture in a keen way makes a difference to obtain information of soil and surrounding environment conditions. Creating the intense agriculture practices using IoT based framework not as it were increments the production but too avoid wastage of water [2]. The soil moisture sensor, humidity and temperature sensor ceaselessly screens the soil and natural conditions, sends the live information to smartphone through cloud service. This information is further utilized to control the irrigation system in farm lands. The system includes water level sensor which determines the level of the water in the field. When the indicator shows zero then a notification will be sent to the farmer in the form of Short Message Service (SMS) on their mobile phone. User can be able to turn ON and OFF the motor as per the field's requirements. In this way farmer can manually turn ON and OFF the motor to irrigate the field. In this work, the framework includes few sensors which gives the estimate of moisture within the soil, the humidity and temperature of the region and a water level sensor which can be used in determining the water level in the field. All these sensors along with Arduino Mega microcontroller are connected to the smartphone and with the internet access provided through 800L modem number.

Table 1: *Growth of IoT*

Year	Number of connected devices
1990	0.3 million
1999	90.0 million
2010	9 billion
2025	1 trillion

As we can see from table 1 which is showing the growth of IoT all over our lives through smart connected devices. The growth of IoT in agriculture is helping farm management to combat the climate change and other factors too which is shown in table 2 in the form of IoT devices integrated in smart farming shipped all over the world.

Table 2: *Growth of IoT in Agriculture*

Year	IoT devices in agriculture (in million)
2018	52
2019	62
2020	75
2021	87
2022	99

IMPLEMENTATION OF SMART FARMING SYSTEM:

The system uses microcontroller (Arduino Mega 2560) which has an internet Subscriber Identity Module (SIM) module over it, soil moisture sensor, humidity sensor (DHT11), temperature sensor (LM35) as well as water level sensor along with DC motor. This DC motor operates a water pump which pumps water to the crops when the DC motor is ON. The hardware integration setup of the WizAgro is as shown in the Fig. 2. The soil moisture sensor senses the moisture in the soil [3]. Depending on the level of dampness, microcontroller chooses whether to water the crop or not [4]. By utilizing suitable capacities and conditional explanations within the code composed for the Arduino functioning, the watering of the trim begins by microcontroller making DC engine ON when the water level is underneath threshold esteem and is made OFF when there's enough water level within the field. The humidity and temperature sensor gives the humidity and temperature values of the atmosphere which decide whether the crop is reasonable for growth [5].

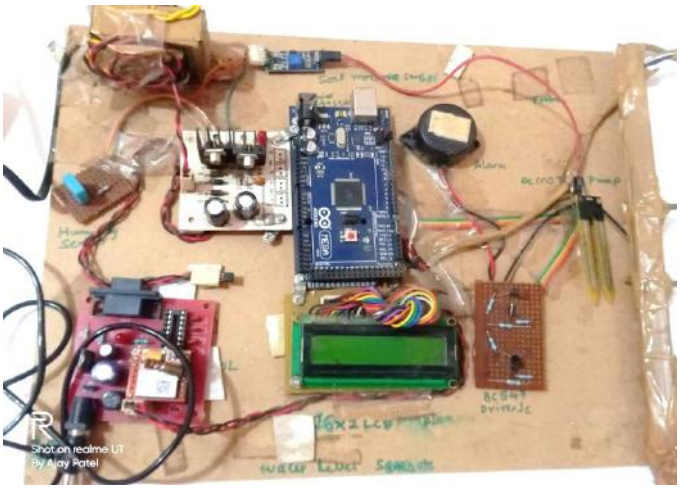

Figure 2: System- Design Implementation

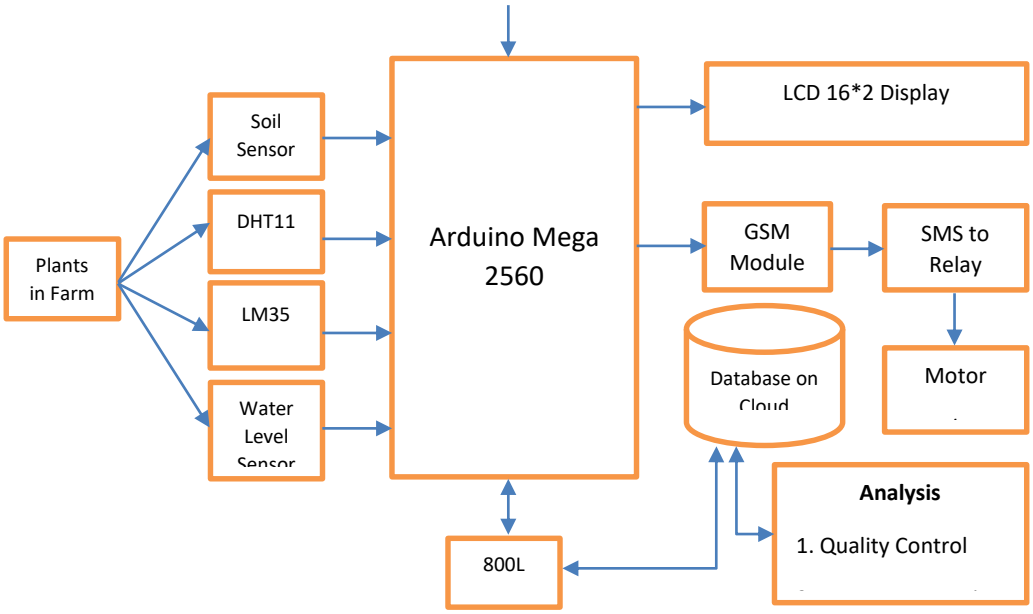

Figure 3: Block Diagram of WizAgro

A few crops develop as it were in specific weather conditions and a few grant way better yields as it were for a particular temperature range. The water level sensor measures the level of the water in the field. When water level reaches underneath the threshold value then a notification will be sent to the user in the form of SMS via 800L sim module which has internet connectivity into it. User can also go through the WizAgro mobile app which is developed to look into the environment of the field. The Figure 3 describes the important blocks and work flow of the designed system. From this app, the farmer can control the DC engine through various buttons and switches. When the microcontroller gets the command from the app at that point the suitable examination is done and the DC engine is controlled. The information once more travels through Wi-Fi again within the same way. The cost involved in this project is as per below:

- Installation Cost- Considering hardware installation like Arduino Mega microcontroller, soil moisture sensor, water level sensor, humidity sensor, temperature sensor and other hardware parts the cost comes to approximately ₹. 5000 (~ $62).

- Operational Cost- Considering monthly internet connectivity the cost comes to approximately ₹. 200/month (~ $2.5 a month).

RESULTS AND ANALYSIS:

The result can be distinctly showcased into multiple parts. The soil humidity detector is calibrated and running. Result calibrated and showcased on 16 * 2 LCD display. One of the most important aspects about this design is the auto irrigation installation. With regard to the requirements, which are being throughout the country and also the extreme rainfall conditions, this installation can play a veritably important part.

TEMP	HUMIDITY	MOISTURE	WATER LEVEL	Date
				
29	014	001	WL1	2022-10-12 10:02:00
29	024	001	WL0	2022-10-12 10:00:20
29	024	001	WL0	2022-10-12 09:59:51
29	002	011	WL0	2022-07-07 16:13:42
29	005	010	WL0	2022-07-07 14:46:35
29	004	010	WL0	2022-07-07 12:05:23
29	008	009	WL0	2022-07-07 11:15:35
28	007	009	WL0	2022-07-07 10:16:15
28	017	004	WL0	2022-07-07 09:05:27
28	017	004	WL0	2022-07-07 09:04:57
29	003	072	WL0	2022-07-06 21:10:40
29	003	072	WL0	2022-07-06 21:10:07
29	005	073	WL0	2022-07-06 20:03:04
29	006	073	WL0	2022-07-06 20:02:30
29	004	071	WL0	2022-07-06 19:07:15
29	004	071	WL0	2022-07-06 19:06:42
29	005	075	WL0	2022-07-06 18:52:00

Figure 4: Web Page designed for WizAgro

The data has been recorded for 21 days for all the five plants. Each plant's data is recorded for 2 hours in a day. The data obtained by the sensors would be collected in an application named Arduino IDE. The major collecting would be done here. Along with that, the output values will be suitably shown on the LCD panel. We can see all the updated values on the web in the form of webpage that displays readings of sensors as shown in figure 4. In the present work, following five different plants were considered for experiment

- Castor Plant
- Brinjal Plant
- Dragon Fruit Plant
- Ivy Gourd Plant
- Finger Millet Plant

The experimental setup designed and implanted for these plants is as shown in figure 5.

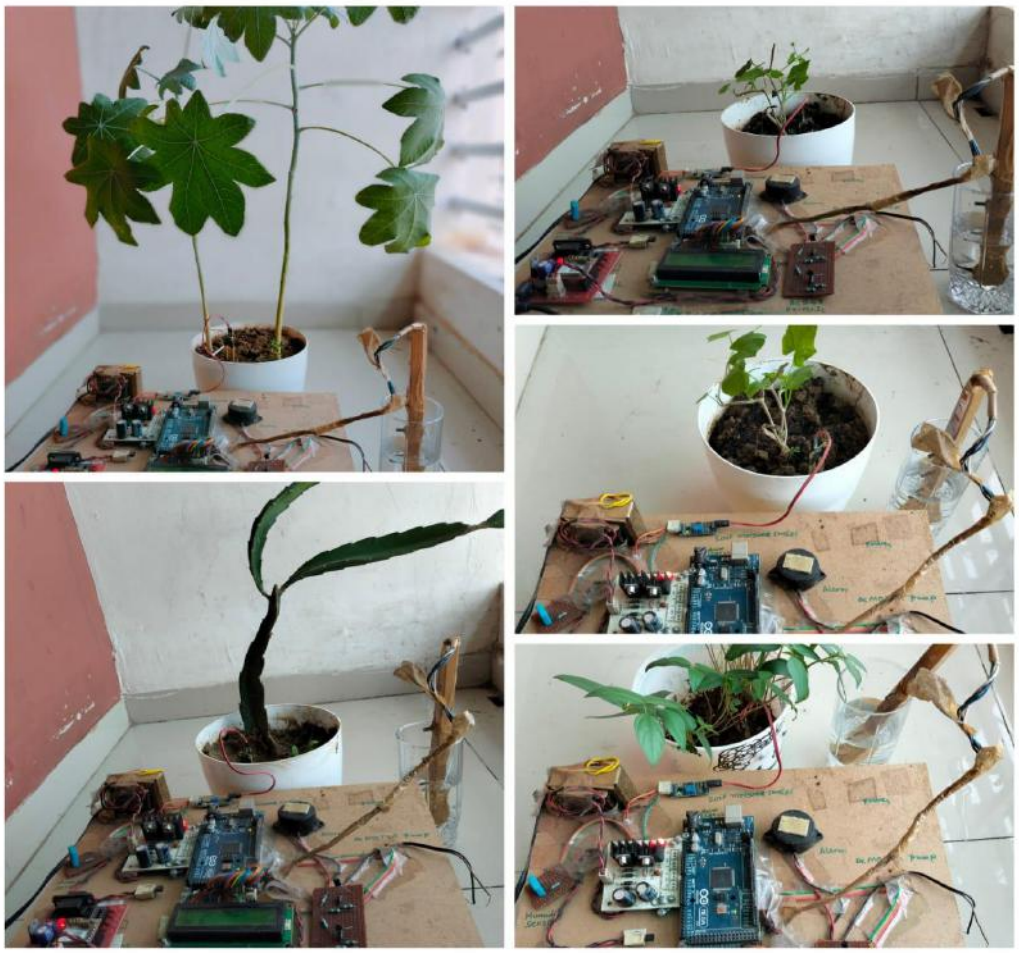

Figure 5: Experimental Setup of all five plants

The recordings were monitored and recorded over the span of 21 days at the interval of 2 seconds. These readings are further averaged over the day period and are plotted as a line graphs as shown in figure 6 to figure 10 for the relative humidity, temperature and moisture of each plant by date.

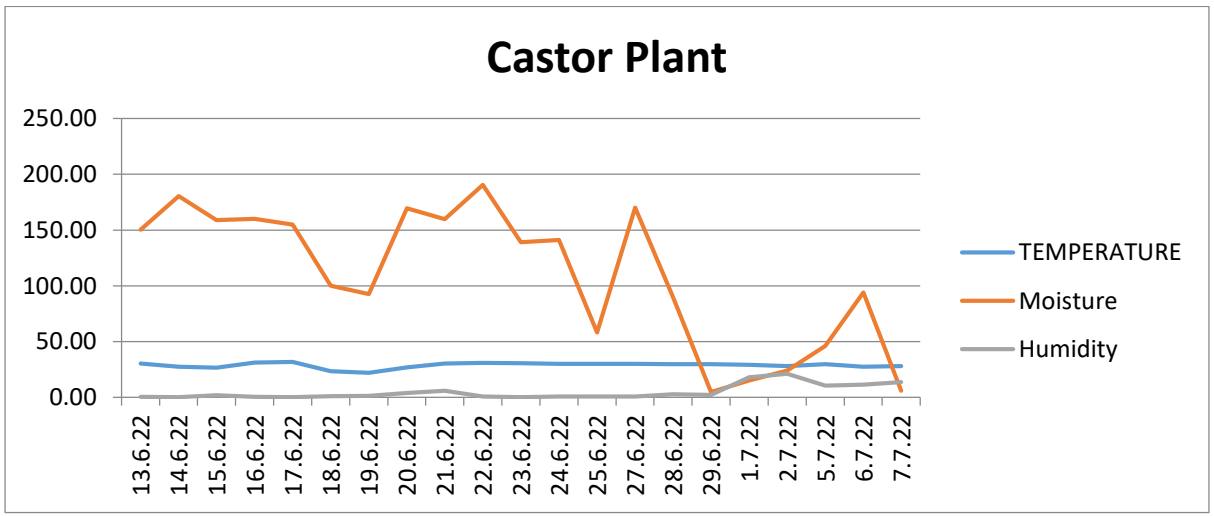

Figure 6: Averaged graph of Castor Plant

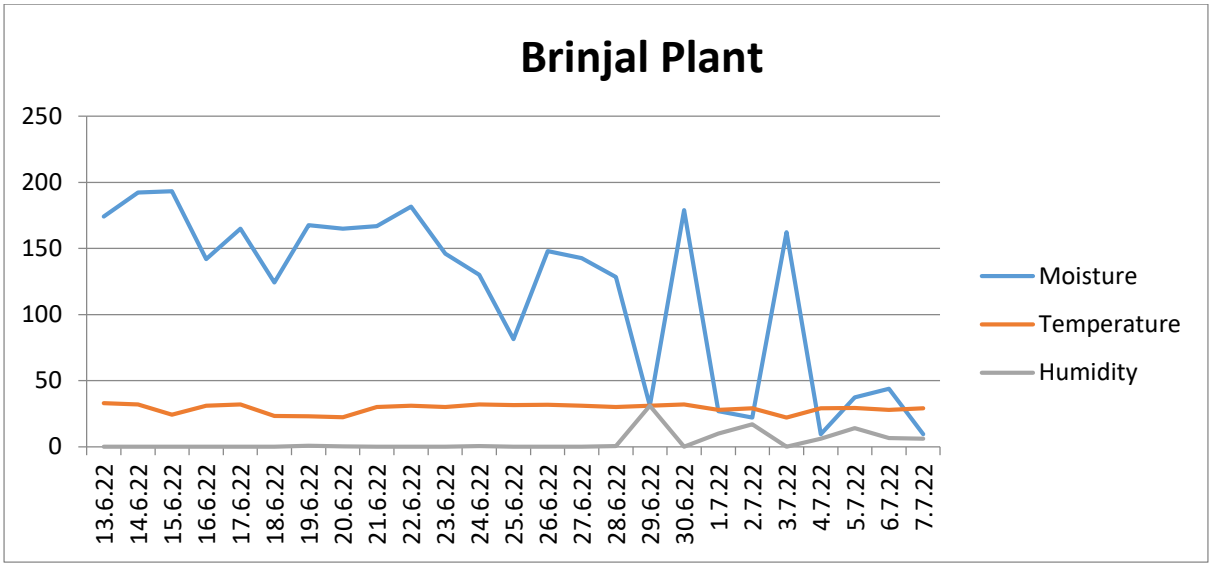

Figure 7: Averaged graph of Brinjal Plant

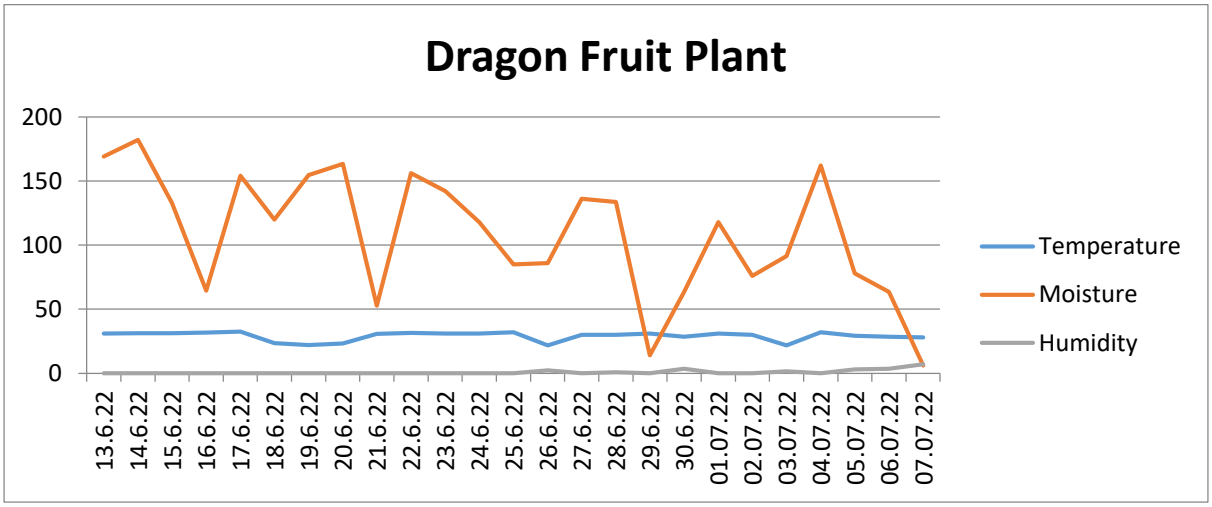

Figure 8: Averaged graph of Dragon Fruit Plant

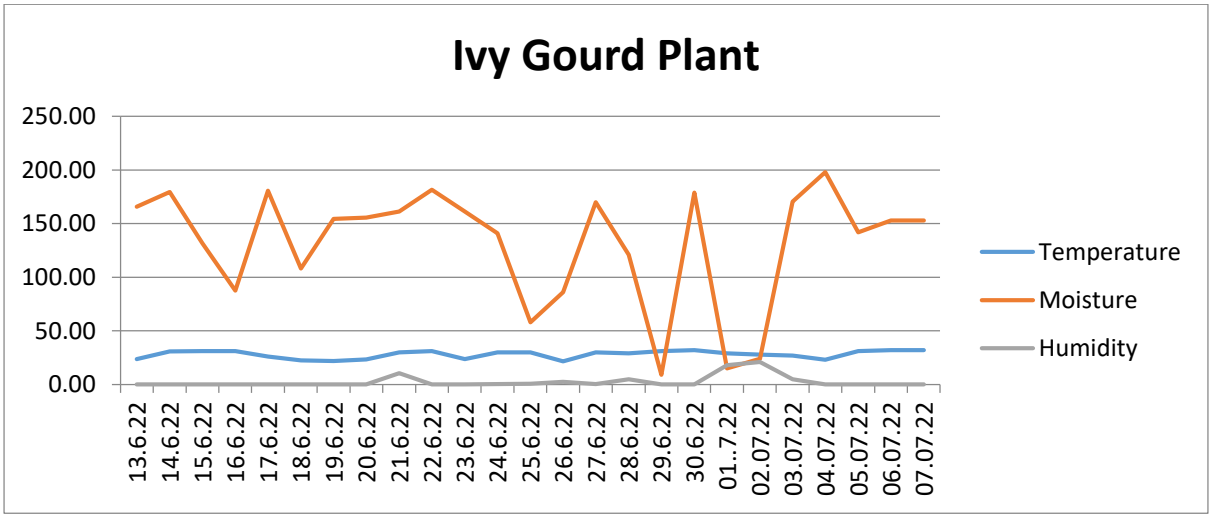

Figure 9: Averaged graph of Ivy Gourd Plant

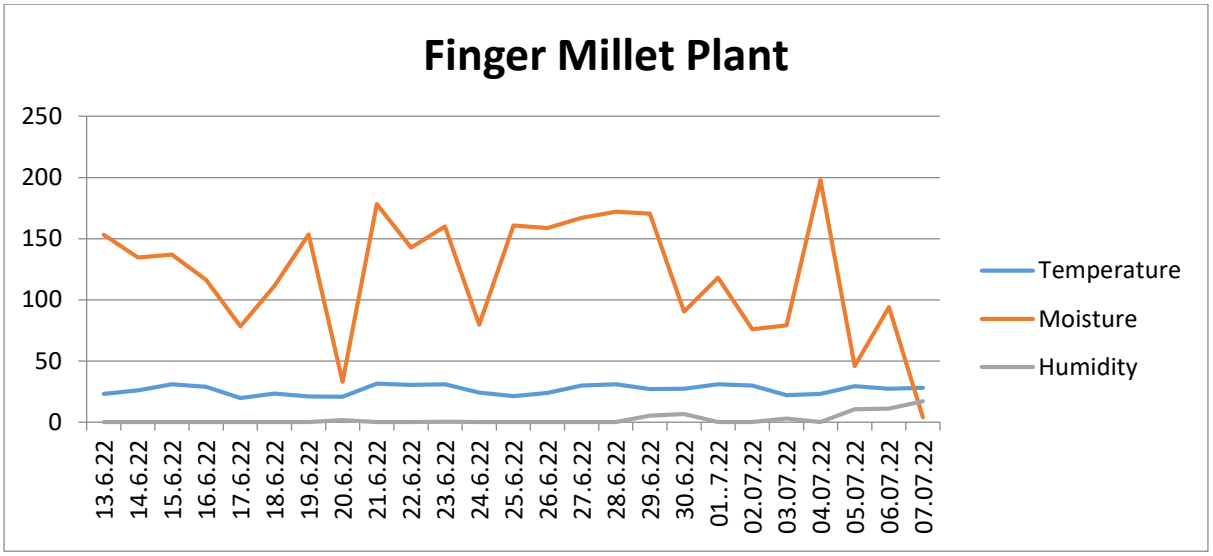

Figure 10: Averaged graph of Finger Millet Plant

The measured over the span of 3 weeks are further averaged for each plant. These values are as shown in the table 3.

Table 3: Relative Average Values of All Five Plants

Plant	Moisture	Temperature	Humidity
Castor	109.72	28.63	4.56
Brinjal	118.83	29.03	3.69
Dragon	108.89	28.72	0.86
Ivy Gourd	131.5	28.03	2.54
Finger Millet	120.487	26.49	2.23

The system and the Arduino Mega are both linked to the same network, and the importation of sensor information will be accomplished wirelessly via the use of the 800L protocol. The sensor readings are extracted in real time and saved in a database, which is called real-time extraction. This database is constructed in Microsoft SQL and has variable names that correspond to the variables in the database. The next step is to create a graph for further analysis. The Figure 10 depicts the average readings of all the attributes of all five plants.

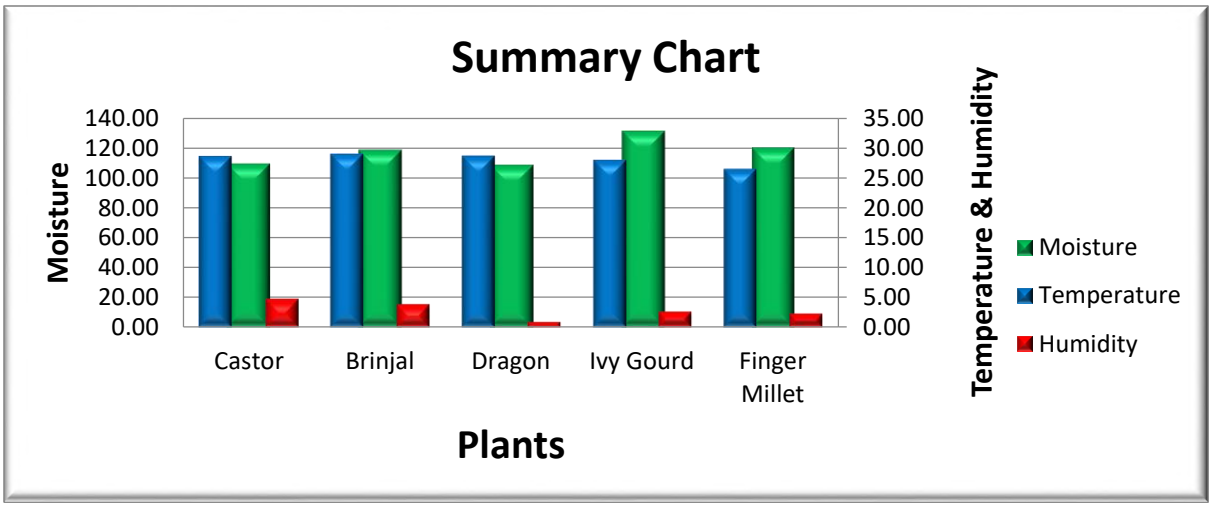

Figure 11: Combined Graph of all 5 plants

IoT also helps reduce pitfalls for growers. By tracking rainfall conditions, for illustration, growers can make better opinions about when to plant and gather their crops. This helps reduce the threat of losing a crop to droughts. With IoT, numerous agrarian tasks can be automated. This saves the planter time and plutocrat. For illustration, automatic irrigation systems can accumulate water inflow rates grounded on soil humidity situations. This makes sure that crops get the right quantum of water without over or under soddening them.

CONCLUSION:

The temperature, humidity, soil moisture, and water level are all sensed and analysed in the present study using IoT innovation. The Arduino microcontroller is used to operate a DC motor through SMS sent by SIM. Through the use of a GSM module with internet access, all of these values are transmitted over cloud and displayed on a smart phone. The use of this architecture allows for the efficient pumping of enough water for irrigation. The adoption of this framework has the advantages of requiring less human effort, saving users a lot of time, and improving data collecting while increasing efficiency and food security. In light of the fact that farmers must often pump water and assess the condition of each crop, this framework is highly accommodating to them. Agriculturists may use the SMS feature on their cellphones to check the humidity, temperature, soil moisture, and whether or not the DC motor is ON remotely. The proposed system needs General Packet Radio Service (GPRS) connectivity for its functioning. The land areas where GPRS system is weak or not available at all can be a great challenge. Due to farmers' need for reliable access to agricultural data at all times and from any location, the cost of installing and maintenance of IoT devices across the field is crucial factor in utilization of proposed system. With larger acceptance and mass production the lower cost and compact modules can be produced. In present work, the security aspects of recorded data are not considered. The readings of sensors recorded over sufficiently longer period of time on a Cloud will further useful through data analysis for weather forecasting, planning of crop patterns, quality control, and optimum future planning.

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A STUDY ON THE EXTENT OF SATISFACTION WITH REGARDS TO SELECTED INTERIOR ASPECTS AMONGST SMALL SPACE DWELLERS

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Abstract: *Small space living can prove to be a challenging endeavor; however, for some, it is a perfect fit and a viable housing solution. Also right now, small spaces and the industry behind them are still in their infancy, but businesses and infrastructure are growing fast, which might mean living small will be a big thing in the future. Increased knowledge regarding tiny homes and their impact could help overcome some of the challenges faced by the tiny house community such as lack of awareness, legality concerns, and financing opportunities. At present, people's values and lifestyle have changed dramatically, so they are no longer satisfied with the simple survival environment, but the quality of life and they pay more attention to the comfort of housing. The present study aims to analyze the extent of satisfaction with regards to selected interior aspects amongst small space dwellers. The research design for the present investigation was descriptive. To collect the statistics of small space dwellers, Google form has been used as a tool for gathering data. The sample technique used for present study was purposive sampling and the sample size selected was 160. It incorporated the details of small space dwellers, details of their space & details about how they feel about their space. The findings of the study presented that most of the graduate young age respondents live in space range 500-1000 who own or rent the space. A number of respondents were not satisfied with the space they live in as the space lacked privacy decoration, storage space even though the space had adequate natural light, outdoor space. There was a need of awareness about smart products as respondents showed willingness to invest in it. Most of the respondents needed smart makeover for their space while living in the comfort of the same space whereas some of them wanted to move to a larger housing structure. This study explored key factors driving the movement and how one's satisfaction of his or her small space is associated with overall satisfaction.*

Keywords- *Dweller, Interior, Natural light, Small space and Satisfaction etc.*

1. INTRODUCTION:

Small apartments are a result of the on-going growing population and the urban housing development. As the populations in big cities increase and more people choose to live alone, a new trend of living in very small spaces has emerged. From trendy micro-apartments to tiny homes to no-nonsense shipping container homes to sustainable cabin homes -more and more people are gladly moving into smaller dwellings and saying no to all that unnecessary, wasteful extra space. The present study covers some aspects such as main problem about space, awareness about multifunctional furniture and willingness to pay for multifunctional furniture.

The small space crowd is apparently a happy crowd. Certainly, there's still something to be said for minimalist living, especially in an age where everyone else values luxury and excesses. Today's designs are all about maximizing the minimal. Minimal and modern designs are the way to go, but that doesn't mean people are left with dull designs. When people live in a small space trying to fit everything and making it look cute is an even bigger challenge, but that's what makes small space design so fun.

While many people think that living in a small house or apartment is a disadvantage, there are many benefits to small space living that people in larger dwellings miss out on. While a big advantage is money-saving, small space living also lends itself to a number of decorating tricks and imaginative solutions that can turn even the tiniest of spaces into a stylish and practical abode. Today interior and fittings that can respond to a unique function and are changing into multi-functional elements which makes small spaces feel so much larger while maintaining style.

It's important to keep in mind that the goal of small space design isn't necessarily to cram in as much as can fit, but rather to make the smartest design decisions possible. This study explores the extent of satisfaction with regards to selected interior aspects amongst small space dwellers.

2. Literature Review:

Wang S. (2013) conducted a study on "An Analysis of Transformable Space Saving Furniture" with objective Innovation designs, the hard wares, the application and future development, cost and price, and the important markets of transformable space saving furniture. They reviewed that, people tend to move to metropolises for their greater employment opportunities and this trend towards urbanization causes cities to have relatively less available free space. This provides a good opportunity for the development of transformable space saving furniture. Transformable space saving furniture provides small properties with greater space and multiple functions. Such furniture can be made more effective and efficient if designers cooperate with architects and engineers in its manufacture.

Richmond S. (2012) conducted a study on "MICRO-LIVING: learning to live large in small spaces". This design research paper aims to produce an alternate design method that can be applied to apartment living to produce positive, affordable apartment designs. They accomplished that, high-density living has always been proclaimed as a way of the future, but the future is now here and we are plagued by inadequate, uninviting city-living environments. A large proportion of smaller, more affordable apartments have been identified to be poorly designed, producing low quality spaces and unsatisfactory living environments. Moreover, the public perception of these 'shoebox' apartments is highly negative. Ultimately, this thesis tests the applicability of planning and spatial design strategies, adapted from micro-architecture, to a context in the development of small, high quality urban apartments.

Lin M. (2010) administered a study on "The Design of a Storage Product to Help People Live Happier and more Comfortably in Small Spaces based on Design Research and Environmental Psychology" with objective to find a way to optimizing small spaces and create a friendlier atmosphere for the occupants. It identified these design principles that are lighting, privacy, and storage for improving small-space living. For small-space residents, first, adding better lighting can effectively improve their living spaces. In addition, A living space with various level of privacy can better satisfy residents' multiple needs in their daily lives. The last but not the least, storage space are the most important feature for increasing a living quality. The use of vertical space for storage is encouraged.

Schneider T. and Till J. (2005) issued that a research "The opportunities of flexible housing", and addresses today's need for buildings that can adapt to change over time. Flexible housing can be defined as housing that is designed for choice at the design stage, both in terms of social use and construction, or designed for change over its lifetime. This paper argues that flexibility is an important consideration in the design of housing if it is to be socially, economically and environmentally viable. This ability is of particular importance for the social housing sector, where the opportunity to change the use or configuration provides a level of choice, for both tenants and their public sector landlords, which is otherwise nonexistent in this sector.

3. Research Objectives / Aims:

To study the extent of satisfaction with regards to selected interior aspects amongst small space dwellers.

4. Research Method:

1. **Research design:** Research design is an arrangement of condition and analysis of data. Consists of specific methods for inquiring the information needed. The research design for this study was descriptive in nature, which helped in knowing the opinions.

2. **Operational Definitions:** The terms used in present study were operationally defined as follow:
   Small space: Small space is operationally defined as kind of area that is available for a particular activity or for putting a particular kind of thing.
   Dweller: Dweller operationally defined as a person or family that lives in residential space.
   Satisfaction: Satisfaction operationally defined as pleasant feeling that get by using multifunctional furniture.
3. **Locale of the Project**: The introduced study was conducted in Vadodara city of Gujarat, India.
4. **Sampling Technique**: The sample technique used for present study was snow ball technique.
5. **Selection, Description and Development of Tool:-** To collect the statistics of small space dwellers, google form has been used as a tool for gathering data. It incorporated the details of small space dwellers, details of their space & details about how they feel about their space. The sample technique used for present study was snow ball technique and the sample size selected was 160.
6. **Establishment Of Content Validity:-** The google form regarding satisfaction level of small space dwellers was prepared and given to ten judges from field of interior designing and teaching staff from Department of Family and Community Resource Management, in Faculty of Family and community sciences. Those items were selected which had 80% agreement among judges.
7. **Data Collection**: The google form was built to analysis the satisfaction level of small space dwellers and it was sent to 160 respondents with such small spaces by email and WhatsApp link. The goal of research was explained so as to get the true responses. The data was gathered by the researcher in April 2022.
8. **Data Analysis**: The data was analyzed using descriptive statistics like frequency and percentage .

5. Results / Findings:

The possibility of a "mobile way of life" is certainly an attractive feature of a modern welfare society.

Findings and discussion related to background characteristics of the respondents

Section I: PERSONAL INFORMATION

1.1. Age group

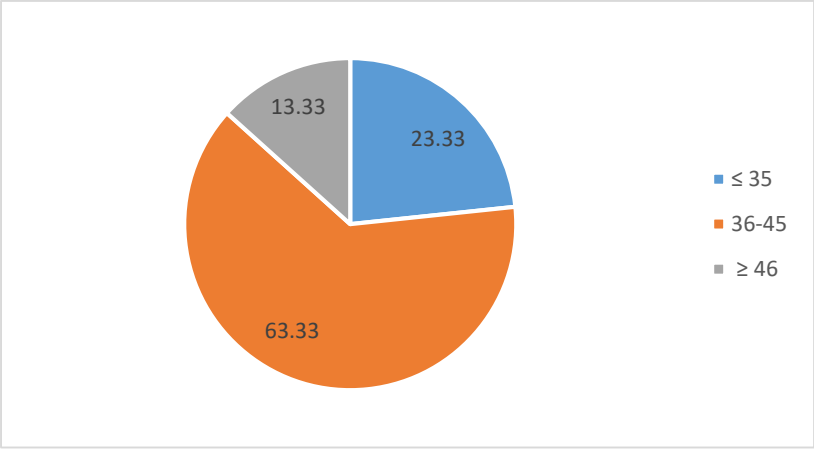

FIGURE 1.1 Frequency and percentage distribution of Respondents according to different age group

From the data, 23 per cent were in the age group of less than and equal to 35 years while in 36-45 years age group it was 64 per cent, and the rest i.e. more than 46 years of age it was 13 per cent. The analysis indicates in Fig. 1, that a majority of the dwellers belonged to the middle age group i.e. between 36-45years.

1.2. Educational Qualification

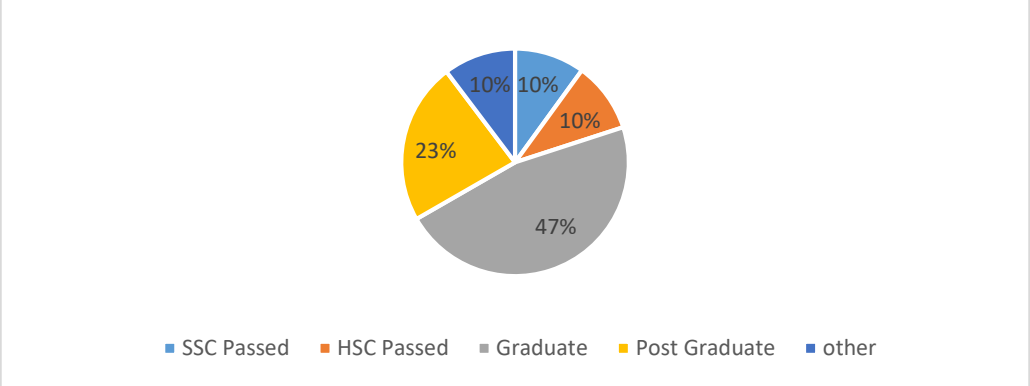

FIGURE 1.2. Frequency and percentage distribution of Educational Qualification

In the given analysis fig. 1.2 represent that, 47% respondents were graduate, 23 % were post-graduate & 10% were HSC passed, SSC passed and in the category of others.

1.3. Work status

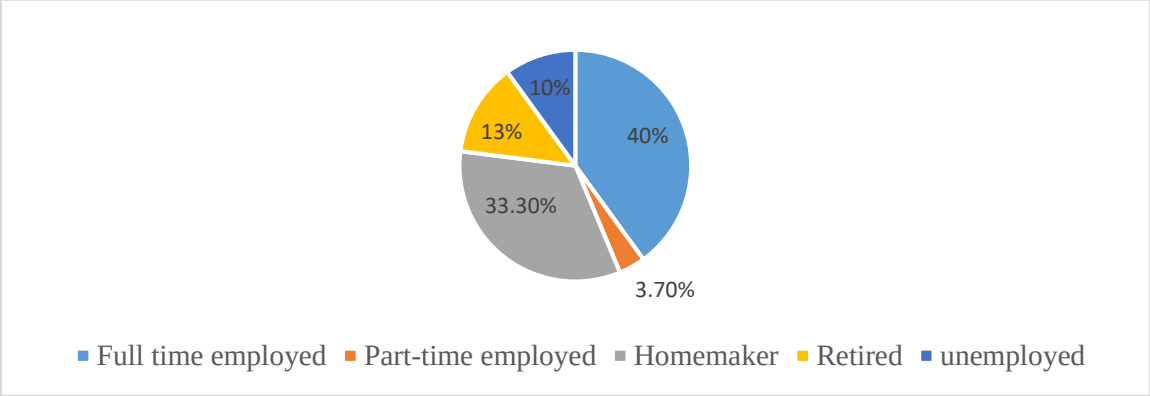

FIGURE 1.3. Frequency and percentage distribution of work status

From the data, 40% respondents were full time employed, 33.3% respondents were homemaker & the rest of the 26.7% respondents fell in the category of retired, unemployed and part-time employed.

Section II: Extent of Satisfaction with regards to selected Interior aspects amongst Small Space Dwellers

2.1 Space in interiors

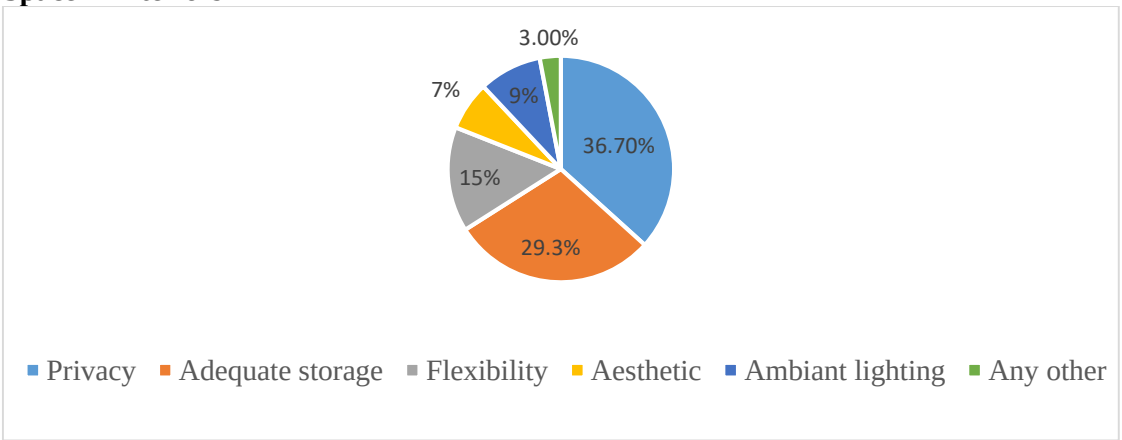

FIGURE 2.1. Frequency and percentage distribution of respondents extent of satisfaction with regards to space in interiors

In the mentioned research above graph shows that, maximum respondents faced low privacy and flexibility issue followed by less storage and others issues in their space.

2.2. Awareness about multifunctional furniture

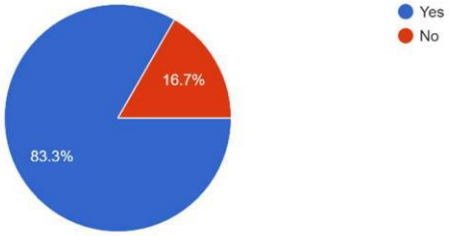

FIGURE 2.2 Frequency and percentage distribution of awareness about multifunctional furniture

In the analysis data shows that, 83.3% respondents were aware about multifunctional furniture.

2.3. Satisfaction with the existing Furniture

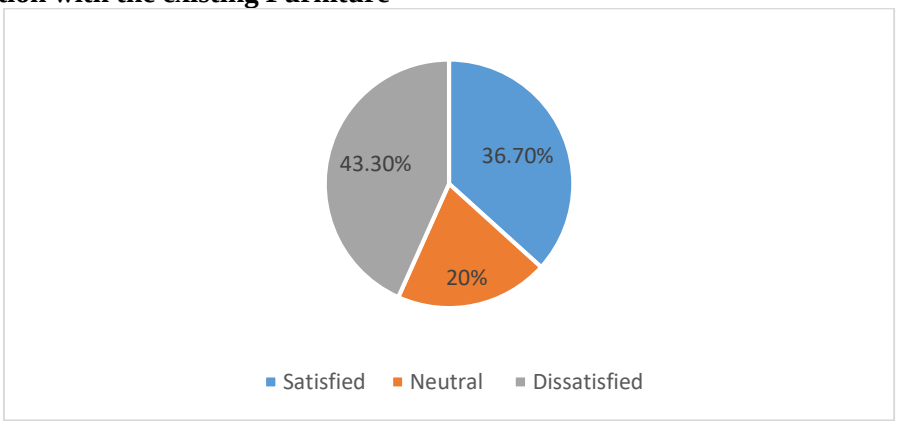

FIGURE 2.3. Frequency and percentage distribution of satisfaction with the existing Furniture

Above Fig. shows that, 43.3% respondents were not satisfied with the existing furniture at their space, whereas 36 per cent of them were satisfied .

2.4. Willingness to pay for multifunctional furniture

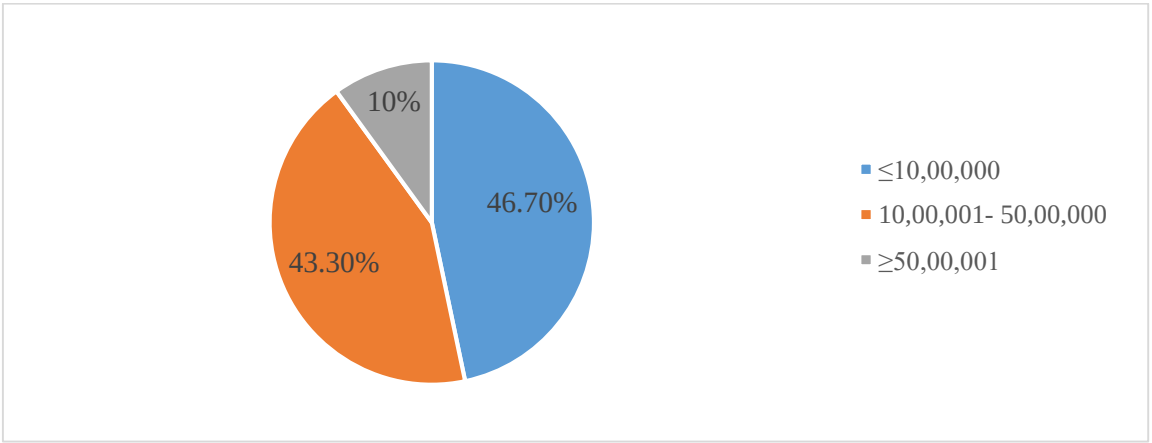

FIGURE 2.4. Frequency and percentage distribution of willingness to pay for multifunctional furniture

Above data represent that,almost an equal distribution of the respondents were willing to pay between less than equal to Rs.10,00,000 and Rs. 10,00,001- 50,00,000 for multifunctional furniture

6. CONCLUSION:

The findings of the study presented that a number of respondents were not satisfied with the space they live in as the space lacked privacy decoration, storage space even though the space had adequate natural light, outdoor space. There was a need of awareness about multifunctional furniture as respondents showed willingness to invest in it. This study explored key factors driving the movement and how one's satisfaction of his or her small space is associated with overall satisfaction.

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An Analysis of green AI with major beneficiary improvement over Red AI and implementation of the environmental footprint to increase Green AI

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Abstract: *In this paper, we can analyze Green AI, which refers to green artificial intelligence used for a sustainable environment. Green AI models with lower computational costs and fewer carbon emissions. The emission of energy by any software can be calculated with the help of two ways first calculate the energy the hardware consumes and second total energy consumed by manufacturing the hardware which is used by running particular software. Green software carbon intensity is a methodology for calculating carbon emissions by any software system. This paper analyzes some strategies for reducing energy consumption, carbon intensity, and energy-efficient code for programmer-making software. The main vision of green AI is to reduce computational expenses and improve performance in resource management with an advanced renewable concept.*

Key Words: *Green AI; Artificial Intelligence; Decoupling Carbon Footprint; Energy Efficient System; Computational Operations; Neural Network; Large Energy Generation; Material Development Energy; Sustainable Development.*

INTRODUCTION:

"Green AI" effort that focuses on the energy efficient system of decoupling carbon footprint in the environment. The main vision of green AI is to reduce computational expenses and improve performance in resource management with the advanced renewable concept. Green software is software have minimum greenhouse gas emissions with renewable energy with low energy consumption and less use of hardware. This software can be run on a personal computer, private data centers, or a cloud base architecture. When we design, develop and deliver software applications, we should follow some strategy for reducing carbon intensity and energy in a software program. To understand all the concepts of the green word we need to focus on all aspects related with reduce energy consumption and using renewable energy for a sustainable development environment. Power BI to gain access to a collection of data models that enhance our data preparation efforts. Power BI with AI analysis can improve social, economic, and environmental aspects with less atmospheric harm. Because sustainability needs law operational cost, reduction of waste, and develop energy-efficient systems.

LITERATURE REVIEW:

Vinuesaet al.(2020) The emergence of artificial intelligence (AI) and its progressively wider impact on many sectors requires an assessment of its effect on the achievement of sustainable development Goals. The fast development of AI needs to be supported by the necessary regulatory insight and oversight for AI-based technologies to enable sustainable development. Failure to do so could result in gaps in transparency, safety, and ethical standards.

Oke (2020) Research on artificial intelligence in the last two decades has greatly improved the performance of both manufacturing and service systems. This paper reports the state-of-the-art on artificial intelligence in an integrated, concise, and elegantly distilled manner to Show the experiences in the field. In particular, this paper provides a broad review of recent developments within the field of artificial intelligence (AI) and its applications. The work is targeted at new entrants to the artificial intelligence field. It also reminds the experienced researchers about some of the issue they have known.

Lee (2019) Emerging technologies such as artificial intelligence help operations management achieve sustainability. However, in sustainable operations management studies, scholars pay less attention to product design, which can be highly affected by artificial intelligence. In addition, sustainability is perceived as maintaining economic development while limiting environmental harm caused by human activity. Therefore, social sustainability is treated as peripheral compared to economic and environmental sustainability.

Liang tan (2018) Green Internet of things (GIoT) generally refers to a new generation of Internet of things design concept. It can save energy and reduce emissions, reduce environmental pollution, waste of resources, and harm to human body and environment, in which green Smart device (GSD) is a basic unit of GIoT for saving energy. With the access of a large number of heterogeneous bottom-layer GSDs in GIoT, user access and control of GSDs have become more and more complicated. Since there is no unified GSD management system, users need to operate different GIoT applications and access different GIoT cloud platforms when accessing and controlling these heterogeneous GSDs.

RoySchwartz et al. (2017) The field of artificial intelligence (AI) has reported remarkable progress on a broad range of capabilities including object recognition, game playing, speech recognition, and machine translation. Much of this progress has been achieved by increasingly large and computationally intensive deep learning model plots training cost increase over time for state-of-the-art deep learning models starting with AlexNet in 2012 to AlphaZero in 2017.

Kusters et al. (2016) The use of artificial intelligence (AI) in a variety of research fields is speeding up multiple digital revolutions, from shifting paradigms in healthcare, public services and education offered to the masses around the world, to future cities made optimally efficient by autonomous driving.

Amann J, et al. (2025) Explain ability is one of the most heavily debated topics when it comes to the application of artificial intelligence (AI) in healthcare. Explainability is not a purely technological issue; instead, it invokes a host of medical, legal, ethical, and societal questions that require thorough exploration. This paper provides a comprehensive assessment of the role of explain ability in medical AI and makes an ethical evaluation of what explainability means for the adoption of AI-driven tools into clinical practice.

MATERIALS:

Green IT:

Green IT aims to minimize the negative impact of IT operations in an environmentally friendly manner. Growth of data, data transfer, data plan, utilization of cloud service, and data management with no negative effects on our ecology. Green IT provides intermediate actions to adopt renewable energy methods. Energy hunger companies and various digital structures are ever going demands of energy. Green IT help out the use of renewable energy like the amount of water energy for cooling their data center, low energy consumption software, use-on-demand energy aware management, cloud services etc. This type of example helps us to apply the concept of green IT in our environment.The sustainability of digital infrastructure we need wide spread adoption on basics of technical, social, and environment. The use of green energy source like (solar form), high scale hardware management, deployment of domain specific hardware, tight collaboration between hardware and software to develop integrated infrastructure. Basically, we can say in broad sense of green IT means lower energy consumption in data center cloud services, data plan and management also. Green IT technology can landscape for energy efficient digital structure. First, we need to conduct interview and discussion with stakeholder and ask what they can do for such kind of change we require? The stakeholders were indicating and define the solution on different-different aspects.In short term solution it includes mainly to the cloud like (reallocation data, computation and software capabilities are based on cloud), serverless applications, maximum resource utilization. As energy can save use-on-demand, communication rises awareness of all such methods are short-term based. Second, the solution for the future flexible distributes networks work, de-aggregated data management can possible vast number of competition's task. The appearance of the distributed energy landscape, dynamics software services, hardware resource, allocation, and strategic position of digital infrastructure with high band width with low energy consumption. Energy awareness software can consolidate software energy virtualization of hardware components and energy-driven workload, skill training required for new professionals. The

average life cycle of digital infrastructure like hardware component growing trend of design, and reuse e is best practice for that.

Green Software:

Green in software engineering aim to include green constitution in a part of software engineering. Green software is design and coded to require less power and less hardware to perform tasks. Sustainability is a most important aspect of our life. Software sustainability can be major by the software system, soft products, web applications, data center to reducing its power consumption by various software. The software can be made by various resources like human, economics and energy. These are helpful for making green software life cycle. Human sustainability means software that can be provided better social and psychological impact in our society, social equality, support and future aspects also. Economic sustainability protects stakeholders' investment, ensure profits, reduce risk and future assets. Environmental sustainability means the development of software, uses in each and every area, energy consumption and utilization of maximum resources. Green software development strategy can possible with short and long-term methods based on green it. Low carbon sources like awareness in wind, solar, geothermal or nuclear fundamental concepts of sustainable computing. We need to determine the key aspect of green and sustainable software area is quantitative point. In short term aspect developed use domain specific hardware like AI accelerators. These artificial intelligence accelerators chips improve power performance year by year. Strategy for awareness creations for data centers operators to configure management setting for 10 to 13% energy saving. 84% percent of energy reduction by data centers of energy aware software and shifting down idle servers. Heuristics for hyperscale hardware management can use liquid-based cooling methods for 40-45% reduction of IT energy footprint. Cloud sustainability means 100% consume energy product by renewable energy resource there are called green energy resources. Cloud service have more efficiency in scalability, decrease energy consumption and less overheads. For that we need to re-engineering and re-architecting application for cloud software techniques to manage by energy for data storage, computing resources to process data and the network resource to transfer data between cloud, edge and customer side. Energy efficient data management is data flow optimization, data duplication, smart data comparison based on frequency of use serverless computing and function-as-a-service scalability of resource consumption

METHOD:

Emission of energy by any software can be calculate with the help of two ways first calculate the energy in hardware consume and second totally energy consume by manufacturing the hardware which used for running particular software. SCI software carbon intensity is a methodology for calculating carbon emission by any software system. This software can be distributed cloud system and desktop application, client-server system or server less software. An SCI (Software Carbon Intensity) score is a rate of carbon emission, not a total. The equation is simple and elegant solution to the extremely complex problem behind it.

SCI=((E*I)+M) /R

E= Energy Consumed by software in kwh.
I=Carbon Emitted per kwh of energy.
M=Carbon emitted through the hardware that the software is running on.
R=Functional Unit this is how software scale. Per/user and per/device
Per R = Secret source to the SCI

Example: Energy Consumption by Laptop

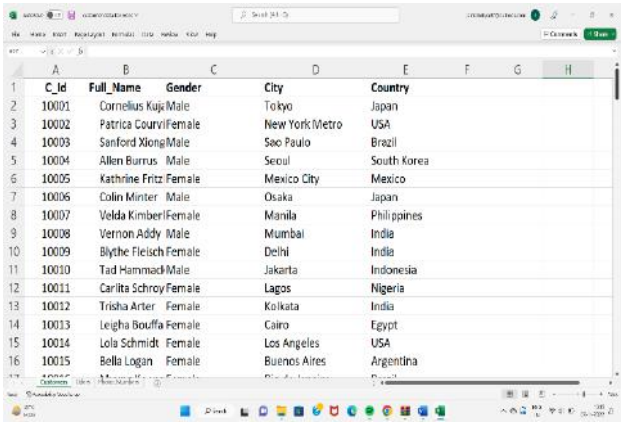
Table 1: Energy Consumption by Laptop

1 Kilowatt	**1000 Watt**
Daily Operational Hours	**1 Hour**
Daily Units Consumed By The Appliance (kWh)	**3 Hours**
Electricity Tariff (Any currency)	**12 Rupees**
Units Consumed By The Appliance (kWh)	**12*3=36**

TOTAL CO2 EMISSION

Customer Table:

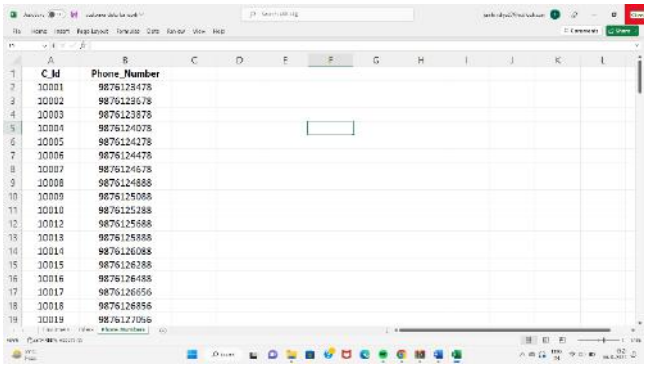
Table 2: Customer Table



C_Id	Full_Name	Gender	City	Country
10001	Cornelius Kuji	Male	Tokyo	Japan
10002	Patrica Courvi	Female	New York Metro	USA
10003	Sanford Xiong	Male	Sao Paulo	Brazil
10004	Allen Burrus	Male	Seoul	South Korea
10005	Kathrine Fritz	Female	Mexico City	Mexico
10006	Colin Minter	Male	Osaka	Japan
10007	Velda Kimberl	Female	Manila	Philippines
10008	Vernon Addy	Male	Mumbai	India
10009	Blythe Fleisch	Female	Delhi	India
10010	Tad Hammadi	Male	Jakarta	Indonesia
10011	Carlita Schroy	Female	Lagos	Nigeria
10012	Trisha Arter	Female	Kolkata	India
10013	Leigha Bouffa	Female	Cairo	Egypt
10014	Lola Schmidt	Female	Los Angeles	USA
10015	Bella Logan	Female	Buenos Aires	Argentina

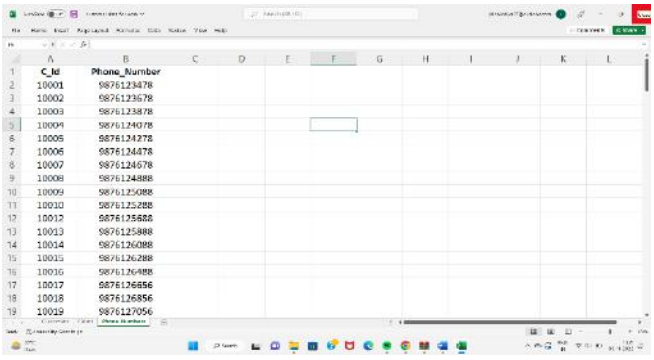
Order Table

Table 3: Order Table



C_Id	Phone_Number
10001	9876123478
10002	9876123678
10003	9876123878
10004	9876124078
10005	9876124278
10006	9876124478
10007	9876124678
10008	9876124888
10009	9876125088
10010	9876125288
10012	9876125688
10013	9876125888
10014	9876126088
10015	9876126288
10016	9876126488
10017	9876126656
10018	9876126856
10019	9876127056

Phone Table Table 4: Phone Table



C_Id	Phone_Number
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10002	9876123678
10003	9876123878
10004	9876124078
10005	9876124278
10006	9876124478
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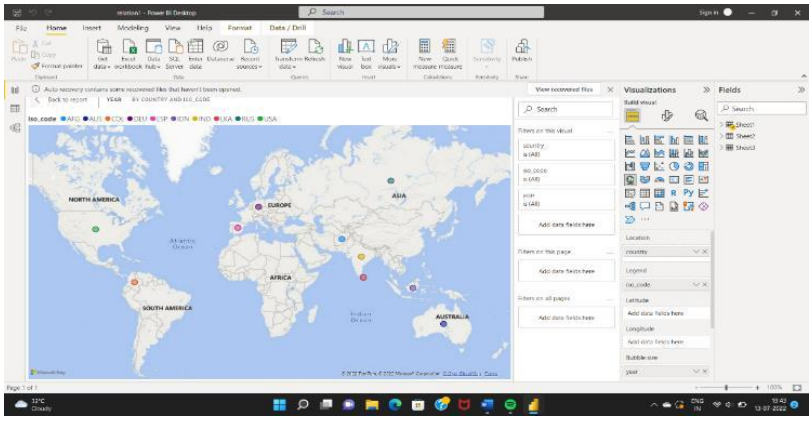
10008	9876124888
10009	9876125088
10010	9876125288
10012	9876125688
10013	9876125888
10014	9876126088
10015	9876126288
10016	9876126488
10017	9876126656
10018	9876126856
10019	9876127056

- The data for this analysis has been taken from the freely available data repository on git-hub: https://github.com/owid/co2-data
- Create a excel file and extract require data which is used to calculate total emission of CO2 in 12 different countries and 2013 to 2022 years.
- Using with power BI tool we display data in form of charts and graph and analysis that how much co2 emission in particular country.
- We use power query editor for writing a query, after execute a query, data visualizer Data display in charts and graph.
- = Table.TransformColumnTypes(#"Promoted Headers",{{"iso_year", type text}, {"co2", type number}, {"trade_co2", type number}, {"cement_co2", type number}, {"coal_co2", type

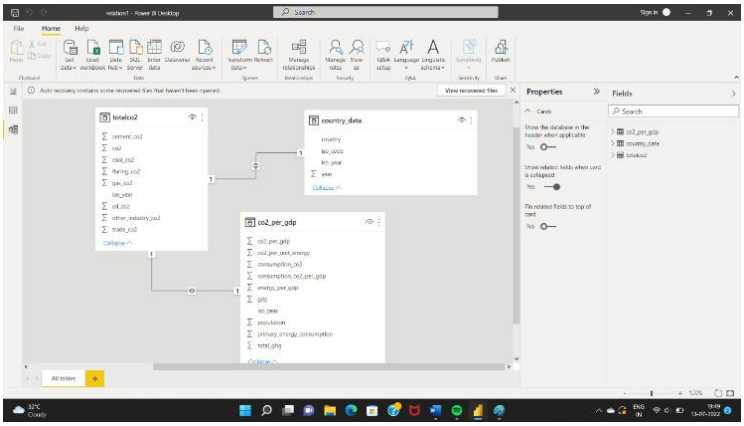
number}, {"flaring_co2", type number}, {"gas_co2", type number}, {"oil_co2", type number}, {"other_industry_co2", type number}})



Map 1: CO2 Emission in Particular Country

RELATIONSHIP BETWEEN TABLES:

Table 5: RELATIONSHIP BETWEEN TABLES



Group by Clause

=Table.Group(#"Changed Type", {"iso_code"}, {{"total_consumption", each List.Sum([consumption_co2]), type nullable number}})

Table 6 : Group by Clause

iso_code	total_consumption
AFG	Null
AUS	2712.625
COL	704.115
DEU	6120.111
IND	15083.469
IDN	4082.405
RUS	9953.302
ESP	1969.218
LKA	213.52
USA	39800.35

Map 2: Visual Display of DAX Query

DAX Query:

These DAX query can help us to retrieve our data and make comparison between various factor. According above DAX query and relationship show that where the maximum emission of CO2 (2012 to 2022). Using Power BI visual effect can analysis the text data very easily and effectively. AI builder can make more visible and understandable tables and forms. Using natural language processing it is a way to get an answer in our own words. Power BI allows us to do exactly advanced analytics AI capabilities. Analyzing non-numerical data can be difficult, but with the AI capabilities of Power BI, I can analyze text data very easily and quickly. I get more constructive and meaningful results, which will help me ultimately show total co2 emission in environment. These types of tools will develop the concept of green AI. Each and every industry regard for digital advancement in this technology kept capable of contribution data provided information every business need. To meet social investment supply analysis push event and regular development so green AI use advance technology like related with new business need and to meet social inventory and regulatory requirements the way of sustainable development. We need to use machine learning and deep learning to talk the power of green AI to make better data driven model using current and future trends ecosystem being and pollution protected system. A key role to environmental enhancing decision and policy making Green AI and algorithm approach is useful for renewable energy. All area's like manufacturing, healthcare, finance, banking, agriculture, E- Commerce, and human resource. Green AI can help reduce conjunction and improve the capability voice recognition application, digital assistant platform in market that interact with people, automated machine provides information constant as per their need on anything search Siri, Alexa, Amazon and Google messenger etc. These all are best example reduce more energy consumption. Green AI model with Power BI, two services text and image analytics and Azure ML model. These both tools are available, as a pair of new AI visualizations, analyses etc. Environment improvement and save energy concept makes a good pressure on businesses to respond to the threat of global warming is growing. Consumers, regulators, and investors are increasingly followed and do their best to customizing the climate impact of companies in every industry to the need to reduce their greenhouse gas (GHG) emissions. Green artificial intelligence (AI) can have an ability to deliver deep insights into multiple aspects of a company's carbon footprint and quick cost-cutting methods to accelerating sustainable transformation and reducing expenses in a time of need. The Carbon Disclosure Project currently calculate total emission 53 gigatons of carbon dioxide equivalent (CO2e) in Global GHG emissions. The great strength of Green AI lies in its ability to reduce collecting massive amounts of data from its environment. Companies looking to reduce their carbon footprint should turn the green AI powered data engineering methods for automatically track emissions throughout their carbon footprint. These best practices help to overcome this problem and we can save our environment.

DISCUSSION:

GREEN AI WITH CONTROL STRATEGY OF CARBON EMISSION:

Green AI is making a new area of life we all talking about carbon footprints and these carbon footprints are harmful for us. A carbon footprint is the total greenhouse gas emission by each and every individual events and organization the global average annual carbon footprint per person was about 5-ton CO2e in calculate year 2014. All human activities events and organizations come out the direct cause of co2 emissions will increase the earth temperature and are emitted from fossil fuels used in electricity manufacturing products etc. An individual and organization may monitor GHG admission generated from the cloud tracking with tools for the decarburization standards. The great strength of

AI lies in its ability to learn by experience, collecting massive amounts of data from its environment, intuiting connections that humans fail to notice, and recommending appropriate actions on the basis of its conclusions. Reduce emission were possible an organization makes a sustainable strategy for less emission of GHG gas. Science base target initiated used 80% available electricity transport like electric vehicle etc. Example of carbon offsetting are: -

- Forestry
- Agriculture: Use maximum resources reduce waste when growing crops
- Renewable Energy
- Waste management
- Water Management
- Energy efficient system

All such kind of methods can help to reduce GHG admission in our environment.

CONCLUSION:

Green AI aims to encourage a reduction in the force computational cost important evaluation. Matrix research along with accuracy green AI promotes an approach that has favorable performance and efficient trade-off. The Green AI with a sustainable approach refers to novel results while taking into account the computational cost, encouraging a reduction in resources, etc. Whereas Red AI has resulted in rapidly escalating computational costs, Green AI promotes approaches that have favorable performance and efficiency trade-offs. If measures of efficiency are widely accepted as important evaluation metrics for research alongside accuracy, then researchers will have the option of focusing on the efficiency of their models with a positive impact on both inclusiveness and the environment. The term Green AI refers to AI research that yields novel results while taking into account the computational cost, encouraging a reduction in resources spent. Whereas Red AI has resulted in rapidly escalating computational (and thus carbon) costs, Green AI promotes approaches that have favorable performance/efficiency trade-offs. If measures of efficiency are widely accepted as important evaluation metrics for research alongside accuracy, then researchers will have the option of focusing on the efficiency of their models with a positive impact on both inclusiveness and the environment. Reaching an energy transformation carbon footprint will be socially not accepted in the coming year 2025. The public attention on needful tasks to be taken to deal with threats in our daily life, health, and future. Different government policies are behavioral changes that are subject to the current world. We create sustainable, net-zero elimination of carbon footprint for reaching transformation with industrial and digital revolution innovation carbon reducing or remove world.

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A Systematic Literature review of Software Testing Methods

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Abstract: *The complexity of today's software applications, along with the pressure of growing competition, has increased the level of quality control for newly generated software. Testing is a work that is carried out to evaluate the program's quality and, at the same time, it increases software performance. Software testing is simply evaluating software to see if it behaves appropriately and meets user expectations, or if it doesn't. In software development lifecycle software testing is an essential phase and should be handled with improved and effective approaches and techniques because of its significance in the post as well as pre-development phases. So that we can assure and the uplift quality of software. In this paper both recent and novel testing approaches are addressed.*

Key Words: *Automation Testing, Software Testing Life Cycle, Re-engineering, Testing Methodologies, Test optimization, Quality Metrics, Level of Testing, Testing Frameworks*

INTRODUCTION:

Testing is defined as a cycle of assessment that determines whether or not the framework satisfies its initially identified requirements. It is mostly a cycle that includes an approval and check step to see if the produced framework satisfies the client's requirements. As a result, this activity establishes a divide between actual and anticipated outcomes. Programming Testing remarks to identifying flaws, mistakes, or absent components in the established code as well as in framework. As a result, this investigation gives the associates detailed information about nature of the item. Programming additionally, testing might be perceived as a risk based action. Crucial aspect of the testing process is for the product analysts to be able to reduce a huge quantity of tests into a practicable set of tests and style wise choices approximately which risk warrant testing and which do not [1]. The link between testing expenses and errors are depicted in Figure 1. Figure 1 clearly demonstrates that testing the two types, such as utilitarian and non-functional, is much more expensive. The dynamic of what to test and how many tests to run can lead to many issues being missed. The testing goal that was achieved.

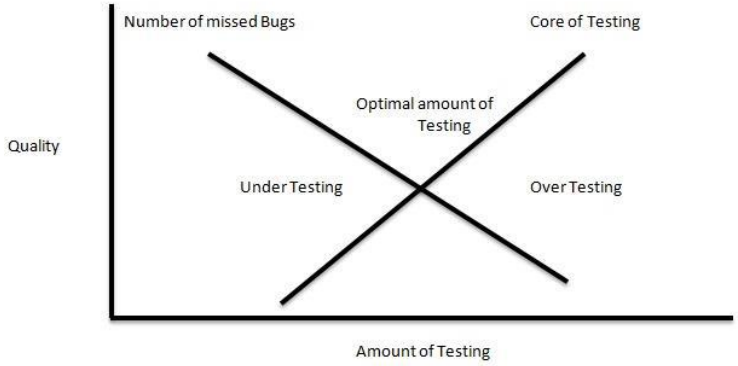

Figure 1: Software testing in terms of Quality

Every software project has an ideal amount of testing to be done in order to keep the amount of subsequent testing to a minimum [1]. Software testing is a procedure of relating a system's functionality to actual user expectations in order to figure out gaps, faults or anything else that is

missing [1]. Testing is used to determine whether the conditions that are now in place and those that are necessary differ. The primary goal of the testing process is to find flaws or bugs in any software and to work to fix them in order to raise the product's overall quality. Software testing will be done in parallel during the product development life cycle (SDLC) in order to improve the software's quality [2], [3]. Software testing is a crucial part of confirming the quality of programming, as shown in Figure 1. The need of testing may be seen in life-basic programming (such as flight control) testing, which can be extremely expensive due to the possibility of plan delays, cost invasions, or outright scratch-offs [2][3][4]. Testing has a set of levels and phases, as shown by the way the test taker changes from level to level. , Integration testing, Unit testing, and User Acceptance Testing these are the three crucial product testing steps. Test planning to the analysis of Test Results, the testing cycle consists mostly of a few stages. The first step of testing involves planning all of the test exercises that will be conducted throughout the testing process. The experiments that will be applied in the testing cycle are established during phase second of the testing life cycle, which is called test development. The next stage of the testing life cycle, known as test implementation, involves running the test cases. The applicable bugs are then taken into account in the stage after that, known as test reporting. The designer completes the deformity analysis during the testing cycle's last phase, which is called test outcome analysis. Test Result analysis is the final phase of the testing cycle, where the designer who created the framework or the product completes the deformity examination. This progression is handled in conjunction with customer as it will support in a better acceptance of what to overlook and what precisely to fix, upgrade, or merely change [7].

EXISTING TESTING METHODS:

The first step in starting the testing cycle is to design experiments. For successful and accurate testing, many testing methodologies are used to design the studies. Black box testing, White box testing and Gray box testing are the three important testing techniques [8]. White Box testing is quite operative since it examines both the internal organization of the application and the usefulness of the product. Programming skills are crucial when organizing the experiments that will drive white box testing. Clear box and glass box testing are other names for white box testing. All testing layers, including unit, coordination, and framework testing, can use this type of testing. The testing type is also referred as safety testing since it satisfies the want to regulate whether the data frameworks maintain information security and function as planned. This type of testing method uses the product's internal coherent process of action; therefore it is suitable for evaluating all of a module's autonomous ways. All intelligent decisions are made, all circles are verified at every boundary level, and inner information structures are also developed. However, because programming skills are included in the testing cycle, white box testing fits demand for being a confusing method of testing [9][10].

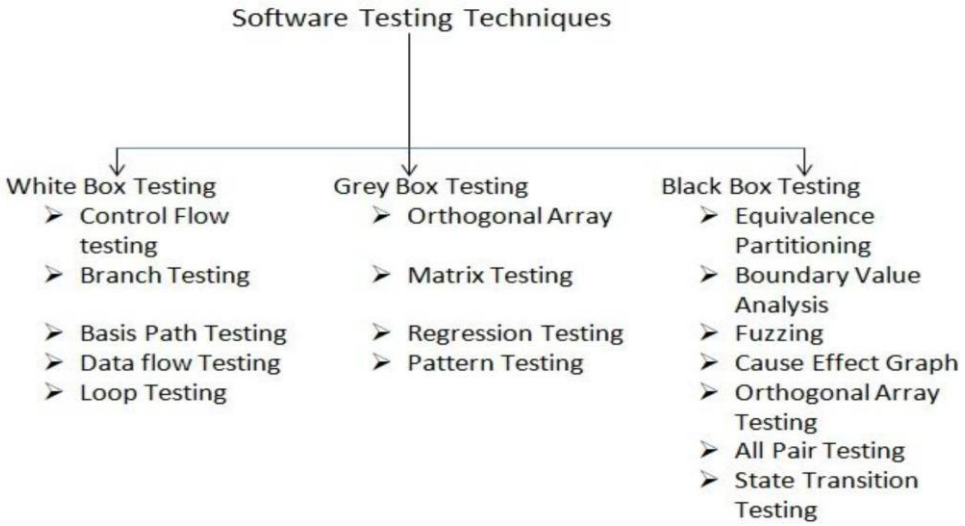

Figure2: Ways of software Testing [8]

A new technique called "discovery testing" simply evaluates an application's usefulness without becoming too specific about how it will be used. Each level of testing inside the SDLC can be

done using this technique. In order to assess whether or not the programmer satisfies the client's initial requirements, it primarily runs the testing to ensure that it covers every single usefulness of the application. It is suitable for identifying false functionality by evaluating their utility in all base, greatest, and base cases. It is by far the most widely used and straightforward testing method overall [9] [10]. Grey box testing combines benefits of both White Box as well as Black Box Testing Techniques. This form of testing is necessary because the concerned who is performing testing is conscious of the inner organization of designer, which allows for better functionality testing by taking the internal organization of the application into account. Author J. Irena is cited for creating Figure 2, which is expanded upon in this study.

STLC phases, stages, and steps that a piece of software goes through while being tested are covered in Figure 3.Although there isn't a universal standard for software applications experiencing STLC, it differs from country to country around globe [11].

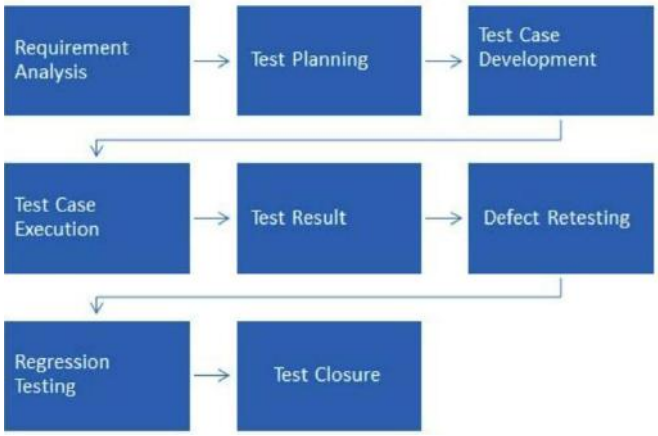

Figure 3: Software Testing Life Cycle (STLC)

The Quality Assurance team conducts a survey of the product requirements during the STLC's primary phase, during which they understand the fundamental requirements that will determine the direction of the test. If a disagreement arises as a result, the group must coordinate with the advancement group in order to more effectively understand and settle the disagreement. Subsequent and supreme crucial stage of the STLC is test planning since it is at this phase that every testing system is characterized. The test strategy is organized during this stage, which will result in a clear deliverable. Without a test plan, the testing cycle would not be required to be impartial towards the application's utilitarian testing. Without a test plan, it is impossible to imagine how the testing cycle could proceed impartially toward the utilitarian testing of the application [11]. The experiment is generated during the test planning step, which also marks the end of the test arranging process. Suitable The QA team physically constructs test cases, or occasionally, mechanical trials are developed. A number of test information sources, execution conditions, and expected results are indicated by an experiment. The preset set of test data should be selected so that it yields the desired results as well as purposefully false values that will result in fault during testing. This is typically prepared to determine under what circumstances the software application increases working [11]. The test execution stage entails carrying out the experiment in accordance with the test plan that was provided prior to the execution stage. The test is expected to be cleared or completed if the usefulness makes it through the execution stage without any bug reports, and each experiment that fails will be linked to the bug or error that was found. After experiments are completed, the results are revealed in test reports, which also include a bug report that is delivered to development team so they can fix those [11]. The SRLC is followed by STLC and includes more testing operations, including Alpha and Beta testing. Both the white box and the grey box techniques can be used for alpha testing, which the initial application testing is done by the developer. A black box technique, often known as an alpha release, could be used to test the integration or system level. A feature freeze marks the conclusion of alpha testing and often signifies that no addition of new features to both for enhancing product functioning or for any other reason [13][14].

Beta testing, which follows after Alpha testing and is done by the user following the Alpha release, can be regarded as a recognized reception testing. For testing purposes, the software or application is made available to a specific target audience of consumers. Before being formally released, beta versions of programmers are typically made accessible to the intended audience for input. The programmer might be considered an exec platform of the software intended primarily to demonstrate reasons, and targeted audience is frequently referred to as Beta Testers. As a result, the beta testing is followed by the release of the software's final version [15] [16].

ENHANCEMENTIN TESTING PROCESSES:

A Re-Engineering of Software Re-Engineering of software is the assessment and amendment of a program to rebuild it in a brand new method. It influences definitely at software program Excellence, price, customer service and delivery speed. In software Re-engineering, we're enhancing the software program to make it more competent and real. Requirement of software program Re-engineering: Software re-engineering is a cost-effective manner for software program development and acceptable improvement of product. This procedure permits us to categorize unusable consumption of deployed resources and restrictions that are limiting expansion procedure so that development process could be made informal and cost-effective (period, economic, straight benefit, optimize the code, unintended benefits, etc.) and sustainable. The software reengineering is necessary for having-

- Increase productivity: Software reengineering rise efficiency by optimizing coding as well as information and process gets quicker.
- Procedures in stability: Practicality of previous version of software package may be still used for testing or development of software.
- Improved prospect: Meanwhile procedure of software program re-engineering, now no longer simplest software program qualities, functions and capability however additionally your abilities are refined, new thoughts hit to your thoughts. This makes the builders thoughts aware of shooting new possibilities in order that increasingly new functions may be advanced.
- Decrease in risks: Instead of growing the software program product from scrape or from the start degree right here builders expand the product from its present degree to beautify a few unique functions which might be delivered in difficulty via way of means of sponsors or its workers. Such form of exercise diminishes the possibilities of error unreliability.
- Less time: The product is advanced from prevailing degree other than of the start degree so the time consumes in software engineering is lesser.
- Optimization: The procedure enhances machine functions and decreases the complexity of the product via way of means of constant optimization as most as possible.

Software Re-Engineering Events:

- Inventory Analysis: All software program corporation need to have stock of all of the applications.Inventory may be not anything greater than a spreadsheet version containing data that gives in depth explanation of each lively application. By sorting this data consistent with commercial enterprise criticality, longevity, and contemporary maintainability & different nearby essential criteria, applicants for re-engineering appear. Useful source can then be allotted to a contender utility for re-engineering.
- Reconstructing Document: Documentation of software clarifies both the way of functions and a way to use it. Documentation need to be efficient.
  It won't be significant to absolutely record an application. The software is business-vital and need to be absolutely re-documented.
- Reverse Engineering: It’s a procedure of layout retrieval. Reverse engineering gear extract records, procedural and architectural layout statistics from present program.
- Data Restructuring: Data restructuring starts with an opposite engineering activity.Present records structure is dissected, and the important records fashions are defined. Data items and attributes are identified, and present records shape is reviewed for quality.

- Forward Engineering: It is additionally known as maintenance, recovery, even not simplest for Improves layout statistics from current software. The use of this statistics regulates or reconstitutes the prevailing software that allows you to enhance its normal quality.

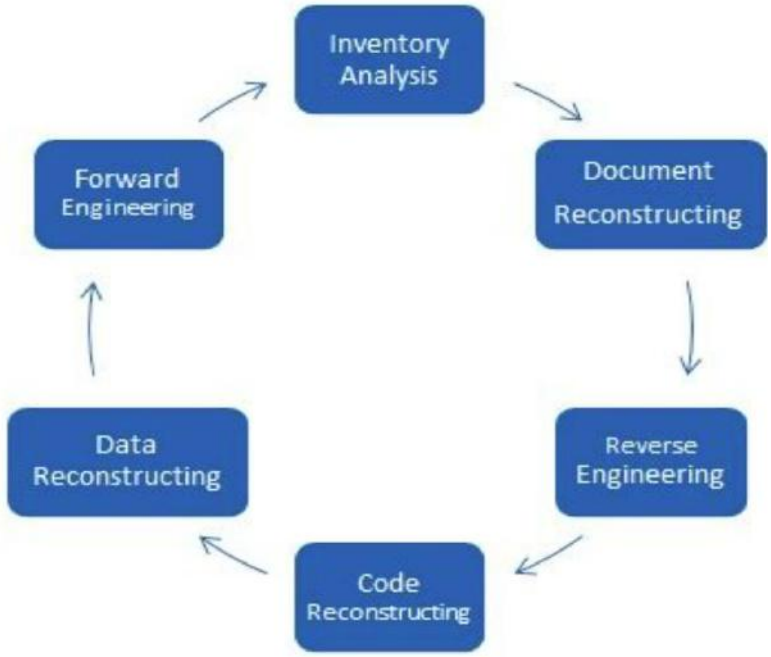

Figure 4: Software Re-Engineering Activities

Test Automation:

The testing cycle has seen a considerable improvement, which pushes it in the direction of test automation the use of specialized programming to carry on with testing cycle to compare actual results to anticipated results. The test automation saves time since it eliminates an hour of time for deadly labor-intensive testing. In the SDLC, test automation occurs at the same time as testing. Test automation is being implemented instead of manual testing all over the world because it saves a ton of time and accomplishes the testing measures in a shorter amount of time. Test robotization has taken control of the manual testing method by reducing its necessity as well as by exposing the level of errors and deficiencies that cannot be detected manually. Physically performing relapse testing, one of the important testing methods takes a lot of time. After any flaws or errors have been fixed, the product or application is often tested to see if it functions properly. Since the percentage of errors or bugs in the code or programmer sometimes increases after the error obsessive. Therefore, many robotized test suites are created to frame a relapse test suite in order to avoid the time required for relapse testing. Additionally, test automation aids in identifying problems at an earlier stage, saving a great deal of money and effort at a later stage [21].

Testing Framework is which in turn accomplishes the mechanization testing execution. The testing structure is basically responsible for carrying out the tests, as well as for defining the format for expressing desires and for describing the results. Testing Framework's application independence is a key feature, which makes it broadly applicable in a variety of contexts [21]. We have diverse types of testing frameworks, such as data-driven modular, keyword-driven, and hybrid. The Modular Testing Framework is based on the rule of consideration, which entails creating diverse contents for various product or application modules that will be tested, extracting every element from a higher level. The modular split encourages adaptation and makes it easier to handle automated test suites. Similar to how it becomes easy and quick to create different driver contents for various types of tests when the usefulness is readily available in the library. The main drawback of this type of system is that information is implanted within it, thus when a change or upgrade to the test information is required, the entire test content's code needs to be altered. It served as the primary justification for the development of the Data Driven Testing Framework. In this sort of framework, data for test and required results are distinctly stored in distinct records, assisting in the implementation of only driver

content with the capability of carrying out all the experiments with diverse informational arrangements. This type of Framework lowers the amount of code required for the age of trials, reduces the amount of test content, and provides better versatility.

TESTING METRICS:

Prioritization Metrics:

Practice of this test metrics is highly noteworthy because it can significantly increase how effective the testing cycle is. They serve as a valuable indicator of the competence, accuracy, and research of characterized measures. Additionally, they can assist in identifying the areas that need improvement and the succeeding step which needs to be made to remove it. Test Metrics are a solitary advancement in STLC and act as a capstone for continuous improvement of testing measure as a whole [23] [24]. Software testing metrics are divided into two categories: Process Quality Metrics and Product Quality Metrics. Both of these initiatives objectives are to improve testing by focusing on quality characteristics relevant to the cycle and item. In any event, the coordination of the testing strategy with the developing application is a fundamental problem addressed by the current testing measure. Each application that is being generated can only use one of every odd testing strategy. This illustrates the importance of humans' interaction within testing cycle and just not a simple dependence on current test cases. For instance, testing an organization convention programming as compared to testing a specific web-based business application will be very extraordinary with totally unique experiments unpredictability. Prioritization Metrics comprise of length of experiment built on a few HTTP requirements. [25] [26].

Cycle Quality Metrics:

Most important component is a cycle since it is designed to produce a high-quality outcome quickly and effectively. This is a conclusive justification for why organizations throughout the world have focused on enhancing the efficiency of their cycles. It was precisely at this point that the demand for measurements arose because it was necessary to check the cycle effectively using various measurements. The primary indicator of cycle quality is cycle efficiency, which contains various evaluations of components such the test progress curve, which shows how the testing phase is organized to proceed by test plan [27][28]. The testing cost is the next important development of metric, both in terms of phase insight and section savvy. Its main objective is to make it easier to identify the components that need more thorough testing and the associated costs. Another statistic that illustrates typical confirmation period by testing team for the examination of flaws is usual defect turnaround time. Measurement that indicates the operational competence is the normal defect response time. It is the percentage of typical time used by the group to address errors. Measures for Process Effectiveness provide assurance that the developed application or products will produce a high output. Requirement Volatility Index, Test Inclusion, Defect Removal Efficiency, and Executed Experiments.A better testing process can also result from using the RTM (Requirement Traceability Matrix), which links each experiment to an indication of a requirement and increases testing precision [23] [24].

LEVELS OF TESTING:

Testing levels are broadly classified as

- Unit Testing
- Integration Testing
- System Testing
- Acceptance Testing.

Figure 5: Testing levels in Software

Unit Testing:

Different parts of a system's distinct components are subjected to unit testing. Additionally, this is utilized to verify whether each component is operating in accordance with user needs or not. Three methods are used to carry out this test:

- The Black Box testing,
- The White box testing,
- The Unit testing

Integration testing:

In this testing test will be conducted among the components as well as interfaces. Moreover it will examine how different system components interact with one another. The developer also conducts this test. Three strategies will be used in this as well:

- Top-down approach
- Bottom-up strategy
- Integration testing

System Testing:

The tester is the one who will check the entire piece of software. Functional and Non-Functional Testing are two types of testing that are part of system testing. The system's usability and external interfaces are also tested, along with the system's performance and security.
Acceptance Testing: After system testing and before delivering the system to users, acceptance testing, which is the final stage of software testing is conducted.

CONCLUSION AND FUTURE WORK:

The software development lifecycle's testing phase is its most fundamental component because it is the point after which the item's final delivery is required. It is a tiresome and serious cycle, thus it is crucial to use innovative methods and enhanced processes. This enables the implementation of automatic testing and numerous test metrics both beforehand and throughout testing cycle. Which enhances the present testing methodologies in terms of period efficiency as well as effective and reliable final products that satisfy the established requirements and provide the highest possible operational productivity?

The stage that product testing and enhancement take place over is always evolving and is still quite well-known. However, something as important and fundamental as testing typically occurs somewhat late in the procedure of software development. For better comprehension and early analysis, there should be the utmost cooperation between decision journalists and Testers. This will help to resolve ambiguity issues and prevent the need for costly product repairs in the future.

Engineers should receive a specific lightweight test model from analysts when they are informed on the decisions and requirements so they can mark certainty key requirements are satisfied formerly management project for legitimate testing. The practice of renovation in terms of tools can greatly aid analysts in creating a comparable condition to which the object is bound. It is best to choose specific special case testing and handling techniques for the exemption. By introducing the reproduction into the testing cycle, it is possible to test the item in the comparative testing environment for which it is intended. As a result, future work on the testing cycle will place a lot more emphasis on innovation while using reenactment and computerized testing model-based methodologies to speed up the testing life cycle and provide effective bug counteraction and quality assurance. Basically, testing identifies the flaws, problems, and errors in a system or piece of generated software. An essential component of software quality control is software testing (SQC). These tests could be acceptance tests, system tests, integration tests, or unit tests. There is no evidence to support the claim that the system is flawless following the testing process. The various teams have been given varied duties. For instance: Similar to how interface testing is done to identify errors in the interfaces of complicated systems, system testing is performed by a different team, and component developers are in charge of component testing.

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Cost Estimation of Different Materials used in Designing the Traditional Rajasthani Style Haveli of Udaipur City.

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Abstract : *Market Survey of the materials was conducted for the designing of Traditional Rajasthani Haveli. The Design project was adopted for the present study. The designing of the Traditional Rajasthani Haveli was entirely on the basis of needs and preferences of the client and the suggestions given by the client were also incorporated in the designs. Different software like AutoCAD software version 2017, AutoCAD 3ds Max and Vray 2018 were used for designing the Traditional Rajasthani Haveli. Based on the needs and preferences of the client, each room's furniture layout, flooring layout, electrical layout and sectional elevations were proposed for the designing of the Haveli. The 3D views of selected rooms of the ground floor and first floor were also developed. Cost estimation of the Traditional Rajasthani Haveli was estimated ₹66, 60,525/-. The survey will be helpful to the students of Interior Designing, Architects and Interior Designers to undertake residential and commercial projects featuring Traditional Rajasthani Style.*

Keywords: *Traditional Rajasthani Haveli, Market Survey and Cost Estimation etc.*

INTRODUCTION :

A home is a personal space and excellent residential interior design personalizes the designs of homes. Residential interior design refers to the designing of people's homes as opposed to commercial property. It also covers all elements of a house, from the floor to the ceiling [(1)].

Residential interior space designing is a creative art which can transform an ordinary house into a very happy lively home. The purpose of interior designing is to make the home liveable according to the needs and requirements of the family and the space characteristics. The interior designer should be able to satisfy the functionalism, expressiveness and beauty. It is not just decorating the house; but it is the total designing of the house. The design should be such that it should be able to express the personality, aesthetic taste of the family, through proper designing of the space, proper selection of furniture pieces, accessories and furnishing e.g. light, colour texture, furniture etc. (Calkins, 1988).

India is diverse in terms of culture, religion, and climate. Architectural differences in these places were very significant in the past. Rajasthan, the royal state of India, a place of royal monuments, fine arts and rich legacy never fails to impress its visitors. The state is also known for the Rajput miniature paintings, temple architecture, and monumental sculptures. They have created a much spectacular building where they used to stay popularly known as "Havelis", which helped as a resident for the royal family [(2)].

A Haveli is a traditional townhouse, mansion, manor house, palace or fort in the Indian subcontinents, usually one with historical and architectural significance [(3)]. The havelis served as status symbols for the Marwaris as well as homes for their extended families, providing security and comfort in seclusion

from the outside world. It uses vibrant colours as part of its interior design scheme with dashes of it in almost every tiny element [(1)].

While designing the Traditional Rajasthani Haveli the researcher wanted to reconnect to the cultural roots, tradition, heritage and materials that were used before in Rajasthan.

The present study was focused on the market survey and different materials used in designing the Traditional Rajasthani Style Havelis at Udaipur city with cost estimation.

Residential space designing is one of the courses as a part of curriculum of FCRM department. The findings would add a new element to the study for the subject and at the same time it would also enrich the data based on the related researches.

In India, Interior designers had concentrated on designing of commercial building and residences, but little concentration was given on style-based designing. So, there was a need for conducting a market survey on traditional style of Rajasthan. The study was useful for the client as the study explored the different materials for the designing based on traditional style and it had given better interior space according to their needs and preferences.

The study will be very useful for the interior designer students and as well as to the FCRM Department. It will contribute to the field of FCRM and other Educational Institution in strengthening their knowledge, curriculum and in its application to the practical field.

Objectives of the study:

1. To conduct a market survey and to explore the different materials for designingTraditional Rajasthani Style of Haveli at Udaipur with the cost estimation.

METHODOLOGY :

The present study aims to do the market survey of the different materials available in the market to design a Residential Haveli of Udaipur city Contemplating the Traditional Rajasthani style. It was fulfilled by a systematic approach of organizing design ideas, materials and drafting 2-D designs. The design will be implemented after the construction of Residential Haveli based on the architectural drawing.

In the successful implementation of any design project, finance plays a vital role. The cost estimation was prepared by calculating the cost of each work based on the market survey as per the proposed design along with the labour cost and material used.

FINDINGS AND DISCUSSION :

Market Survey for Proposed design of the Traditional Rajasthani Haveli

It was essential to know the availability of the Rajasthani interior materials in the market of Udaipur, Rajasthan. The market survey was conducted in the month of November, 2021, for the Interior materials such as wall paints, plywood, veneer, laminate, Italian marble, Kota stone, stone finish, plaster of Paris, gypsum, wooden, ply ceiling, wallpapers and accessories were as follows:

Table 1: Market survey of Hinges available in local market of Udaipur

Sr. No.	Name of the Hinges	Cost (in ₹)	Usage
1	Full overlay	₹80/piece	Kitchen cabinetry
2	Half overlay	₹90/piece	Kitchen cabinetry
3	Butt Joint	₹20/piece	Door hinges
4	Insert	₹110/piece	Kitchen cabinetry

Table 2: Market survey of wall paints available in local market of Udaipur

Sr. No.	Name of the Paints	Cost (in ₹)	Usage
1	Acrylic Distemper	₹1100 / 20kg	Wall paints

2	Synthetic Distemper	₹1100 / 20kg	Wall paints
3	Synthetic Distemper	₹790 for a bag of 40kg	Wall paints
4	Tractor emulsion and apcolite	Tractor emulsion ₹140/lt. and apcolite: ₹260 /lt.	Wall paints
5	Royale matt	₹475/lt.	Wall paints
6	Oil based paints	₹ 300-600 /lt.	Wall paints
7	Asian paints apex ultima	₹80 /kg	Wall paints
8	Texture paints	₹40-220/Sq. ft	Wall paints
9	Varnishes	₹300 / lt.	Wall paints

Table 3: Market survey of MDF, Plywood, Laminates and Veneer available in local market of Udaipur

Sr. No.	Name of the MDF	Cost (in ₹)	Usage
1	**MDF**		
2	Medium Density Board	4mm- ₹800, 6mm- ₹2500, 8mm- ₹3400, 18mm- ₹7000, 25mm- ₹9000	Furniture
3	High Density Board	4mm- ₹900, 6mm- ₹3000, 8mm- ₹3500, 18mm- ₹8000, 25mm- ₹1000	Furniture
	PLYWOOD		
4	Plywood	₹60 Sq. ft.	Furniture
	LAMINATE		
5	SF-2409 Laminate	₹30 -500/ Sq. ft.	Furniture
6	SF-2403 Laminate	₹30 -500/ Sq. ft.	Furniture
7	SF-2449 Laminate	₹30 -500/ Sq. ft.	Furniture
8	CS-2359 Laminate	₹30 -500/ Sq. ft.	Furniture
9	SA-2267 Laminate	₹30 -500/ Sq. ft.	Furniture
10	SA-2268 Laminate	₹30 -500/ Sq. ft.	Furniture
11	RT-2443 Laminate	₹30 -500/ Sq. ft.	Furniture
12	WW-2412 Laminate	₹30 -500/ Sq. ft.	Furniture
13	WW-2427 Laminate	₹30 -500/ Sq. ft.	Furniture
14	RW-2403 Laminate	₹30 -500/ Sq. ft.	Furniture
15	HG-2360 Laminate	₹30 -500/ Sq. ft.	Furniture
16	HG-2462 Laminate	₹30 -500/ Sq. ft.	Furniture
17	HG-2442 Laminate	₹30 -500/ Sq. ft.	Furniture
18	HG-2478 Laminate	₹30 -500/ Sq. ft.	Furniture
19	SF-2475 Laminate	₹30 -500/ Sq. ft.	Furniture
20	SF-2482 Laminate	₹30 -500/ Sq. ft.	Furniture
	VENEER		
21	Malaysian rain wood Hz	₹60 -700/ Sq. ft.	Furniture
22	Dark Bean	₹60 -700/ Sq. ft.	Furniture
23	Satinox	₹60 -700/ Sq. ft.	Furniture
24	Oak Granito	₹60 -700/ Sq. ft.	Furniture
25	Molten Chocolate	₹60 -700/ Sq. ft.	Furniture
26	Hazelwood	₹60 -700/ Sq. ft.	Furniture
27	Tropical Stalion	₹60 -700/ Sq. ft.	Furniture
28	Rivera Wood	₹60 -700/ Sq. ft.	Furniture

29	LouroPreto	₹60 -700/ Sq. ft.	Furniture
30	Ipe	₹60 -700/ Sq. ft.	Furniture
31	Wenge Crown	₹60 -700/ Sq. ft.	Furniture
32	Ovangkol	₹60 -700/ Sq. ft.	Furniture
33	Figured Eucalyptus	₹60 -700/ Sq. ft.	Furniture
34	Gabon Wood Horizontal	₹60 -700/ Sq. ft.	Furniture
35	Brazilian Santos Horizontal	₹60 -700/ Sq. ft.	Furniture
36	Roasted Almond	₹60 -700/ Sq. ft.	Furniture
37	Hatched Flakes	₹60 -700/ Sq. ft.	Furniture
38	Spiced Ginger	₹60 -700/ Sq. ft.	Furniture
39	La Paz Metallic Wood	₹60 -700/ Sq. ft.	Furniture
40	Dark Cinnamon	₹60 -700/ Sq. ft.	Furniture
41	Vintage canvas	₹60 -700/ Sq. ft.	Furniture
42	Borneo Rain Wood	₹60 -700/ Sq. ft.	Furniture
43	Silver Shimmer	₹60 -700/ Sq. ft.	Furniture
44	Gold shimmer	₹60 -700/ Sq. ft.	Furniture
45	Ivory Shimmer	₹60 -700/ Sq. ft.	Furniture
46	Oak Granito Glow	₹60 -700/ Sq. ft.	Furniture
47	Castanea Rays Glow	₹60 -700/ Sq. ft.	Furniture
48	American Walnut Glow	₹60 -700/ Sq. ft.	Furniture
49	American Walnut Diagonal Line	₹60 -700/ Sq. ft.	Furniture
50	Barkburn Diagonal line	₹60 -700/ Sq. ft.	Furniture
51	Wegen	₹60 -700/ Sq. ft.	Furniture
52	Pie	₹60 -700/ Sq. ft.	Furniture
53	Capyulates	₹60 -700/ Sq. ft.	Furniture
54	American Walnut butt cut	₹60 -700/ Sq. ft.	Furniture
55	Fan Chocolure	₹60 -700/ Sq. ft.	Furniture
56	Cross Wood	₹60 -700/ Sq. ft.	Furniture
57	Choco Umbrella	₹60 -700/ Sq. ft.	Furniture
58	Arizona Coffee	₹60 -700/ Sq. ft.	Furniture
59	Arizona Coco	₹60 -700/ Sq. ft.	Furniture
60	Gabon Wood Crotch	₹60 -700/ Sq. ft.	Furniture

Table 4: Market survey of ceiling materials available in local market of Udaipur

Sr. No.	Name of the Ceiling Materials	Cost (in ₹)	Usage
1	Pop Ceiling	₹70 - ₹78 / Sq. ft.	False ceiling and wall treatment
2	Plywood False Ceiling	₹450/ Sq. ft.	False ceiling
3	PVC False Ceiling	Coated-₹45/Sq.ft. onwards Colour-coated-₹38/Sq.ft. onwards Film-coated-₹32/Sq.ft. onwards Galvanised-₹60/Sq.ft. onwards	False ceiling
4	Wooden False Ceiling	₹200/ Sq. ft.	False ceiling
5	Gypsum	₹240/ Sq. ft.	False ceiling

Table 5: Market survey of Granite, Marble, Kota stone, Stone Finishes available in local market of Udaipur

Sr. No.	Name of the Flooring Materials	Cost (in ₹)	Usage
	GRANITE		
1	Premium Z-Black.	₹400/Sq. ft.	Flooring
2	Lakha red Umra, Zalore	₹200/Sq.ft.	Flooring

3	Safari Brown	₹130/Sq.ft	Flooring
4	Lata pink, Suma pink	₹120/Sq.ft.	Flooring
5	Sorento blue	₹120/Sq.ft.	Flooring
6	R-Black	₹175/Sq.ft.	Flooring
7	Cat -eye	₹210/Sq.ft.	Flooring
8	Black pearl	₹130/Sq.ft	Flooring
9	Galaxy	₹200/Sq.ft	Flooring
10	Commercial Green	₹120/Sq.ft	Flooring
11	Steel grey	₹300/Sq.ft	Flooring
12	K-Black	₹175/Sq.ft	Flooring
13	Jade brown	₹120/Sq.ft	Flooring
14	D-White Jirawala Sadardi	₹120/Sq.ft	Flooring
	MARBLE		
15	Katni marble	₹150/Sq.ft	Flooring
16	White Marble	₹500/Sq.ft	Flooring
17	Green Marble	₹40-50/Sq.ft	Flooring
18	Chocolate marble	₹250/Sq.ft	Flooring
19	Onyx marble	₹550/Sq.ft	Flooring
20	Italian Marble	₹200/Sq.ft	Flooring
21	Australian White	₹500/Sq.ft	Flooring
22	Ita gold	₹325/Sq.ft	Flooring
23	Brown Dungri	₹75/Sq.ft	Flooring
24	Black Marble	₹175/Sq.ft	Flooring
25	Bidasar Marble	₹150/Sq.ft	Flooring
26	Bidasar Green Marble	₹150/Sq.ft	Flooring
27	Bidasar Brown Marble	₹150/Sq.ft	Flooring
28	Katni Purple	₹100/Sq.ft	Flooring
29	Pink wonder Marble	₹200/Sq.ft	Flooring
30	Wonder marble	₹125/Sq.ft	Flooring
31	Italian wood	₹225/Sq.ft	Flooring
32	Italian Chocolate laventro	₹240/Sq.ft	Flooring
33	Chocolate Laventro	₹250/Sq.ft	Flooring
34	Italian bolevo	₹125/Sq.ft	Flooring
35	Pebbles Black Italian	₹300/Sq.ft	Flooring
36	Red kotdalapatro	₹150/Sq.ft	Flooring
37	Italian Black lapatro	₹175/Sq.ft	Flooring
38	Alaska White Italian	₹150/Sq.ft	Flooring
	KOTA STONE		
39	Multi-kota Stone	₹45/Sq.ft	Flooring
40	Green kota stone	₹18/Sq.ft	Flooring
41	Chocolate Kota stone	₹40/Sq.ft	Flooring
42	Kadappa	₹32/Sq.ft	Flooring
	STONE FINISHES		
43	Natural Cleft	₹30/Sq.ft	Flooring
44	River polish	₹30-40/Sq.ft	Flooring
45	Mirror Polish	₹40/Sq.ft	Flooring
46	Rough	₹16-20/Sq.ft	Flooring
47	Flamed	₹50/Sq.ft	Flooring
48	Splits face	₹40/Sq.ft	Flooring
49	Leather Finish	₹30/Sq.ft	Flooring
50	Sand Blasting	₹40/Sq.ft	Flooring

Table 6: Total cost estimation of all the interior components of the Traditional Rajasthani Haveli

Total cost estimation of all the interior components of the Traditional Rajasthani Haveli		
Sr. No.	**Interior design components**	**Total cost in ₹**
1	Floor, wall and ceiling of Ground Floor	₹22,38,356/-
2	Floor, wall and ceiling of First Floor	₹13,25,342/-
3	Furniture items	₹30,96,827/-
	TOTAL	**₹66,60,525/-**

CONCLUSION :

The researcher wanted to reconnect to the cultural roots, tradition, heritage and materials that were used before in Rajasthan as per the client's needs and preferences. Cost estimation was prepared considering the actual price and labour cost of Interior materials such as wall paints, plywood, veneer, laminate, Italian marble, Kota stone, stone finish, plaster of Paris, gypsum, wooden, ply ceiling, wallpapers and accessories. It was essential to know the availability and price prevailing rates of the Rajasthani interior materials in the market of Udaipur, Rajasthan. The market survey was conducted in the month of November, 2021, for selected interior components and the total cost of design project was **₹66, 60,525/-** .

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The Power of Visual Communication in Digital Marketing

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Abstract: *A picture is worth a thousand words, and in the world of digital marketing, a visual can be worth even more. The power of visual communication is undeniable, and yet many companies are still lagging behind when it comes to using visuals in their marketing campaigns. Why is visual communication so important? Well, for one thing, it is proven to be more effective than text alone. People are more likely to remember an image than a block of text, and visuals can also help to understand a product or service in a better manner. Visual communication is one of the most important elements in digital marketing. It is essential for businesses to use visuals in their marketing campaigns in order to stand out from the competition and connect with their target audience. There are many benefits to using visuals in marketing, including that they can help to communicate your message more effectively, capture attention, build trust, and increase engagement Additionally, using visuals can also help you to boost your SEO efforts and drive traffic to your website. When it comes to creating visuals for your marketing campaigns, there are a few things you should keep in mind, make sure that your visuals are relevant to your brand and target audience. Also, consider using both images and videos in your content strategy as this will give you the best chance of reaching your goals.Finally, keep in mind that different types of visuals work better for different objectives. For example, animated GIFs are great for capturing attention on social media while infographics are perfect for driving traffic from search engines experimenting with different types of visuals to see what works best for your business goals.*

Key Words: *Visual, Digital, Marketing, Business, Technology, Communication, SEO, Content.*

INTRODUCTION:

The marketing industry is one that is constantly moving forward and evolving into new things. The function of marketing in and of itself has undergone a profound transformation as a result of a variety of crises, including shortages of raw materials and energy, inflation, economic recessions, high unemployment, declining industries and companies, terrorism and war, and the effects of rapid technological change in some industries. These kinds of shifts, which include the advent of the internet, have compelled marketing executives of today to become more market driven in their strategic decision making. As a result, they require a formalised method for acquiring accurate and up-to-date information regarding customers, products, the marketplace, and the environment as a whole. The promotion and sale of products or services through the use of the internet is referred to as "Internet marketing." Internet marketing is a method of selling and marketing products by leveraging the capabilities of electronic commerce. Any kind of business conducted over the internet is referred to as "electronic commerce." Internet-based selling, purchasing, and exchanging of goods and services are all made possible through the use of electronic commerce. Electronic commerce can be broken down into subcategories, one of which is internet marketing. Because of the explosive growth of the internet, internet marketing has been gaining a lot of attention recently. According to some accounts, the earliest examples of internet marketing appeared at the start of the year 1990 on text-based websites that provided information about various products. Because of the proliferation of the internet, it is no longer sufficient to merely sell things; rather, the internet is now used for providing information regarding products, as well as advertising space, software programmes, public auctions, stock trading, and matching. A select group of businesses, including Google.com, Yahoo.com, Amazon.com, Alibaba.com, and Youtube.com, have fundamentally altered the manner in which marketing can be conducted over the internet. In this article,

we share some perspectives on certain current trends in online marketing as well as potential future trends.

Figure 1: The-importance-of-visual-communication-in-your-marketing-strategy

LITERATURE REVIEW:

A "Review of the Literature" (or simply "Review") is an attempt to read all of the available research articles in order to gain an understanding of how various scholars have investigated various topics and features of digital marketing. According to Kaini (1998), the introduction of innovative new technologies, such as the internet, assists in opening the door for marketers and enables them to engage in online marketing in order to realise their professional objectives.

Song (2001) clients now have access to a wider variety of options. Therefore, developing a positive public perception of a business can be challenging. Advertising on the internet is a highly effective marketing technique that can be utilised to create a brand image and assists businesses in increasing their sales to a significant degree. Mort, et al (2002) The expansion of the digital market is being driven by developments in related technology as well as the dynamics of the industry. Teo(2005) The outcomes of the survey, which was carried out by companies based in Singapore, showed that digital marketing is an effective marketing technique for achieving desired objectives.

Researchers Jarvinen, Tollinen, Karjaluoto, and Jayawardhena (2012) investigated how widely social media tools are used as a component of the digital marketing mix in the B2B industry, the significant objectives that are aimed at, and the primary roadblocks to the utilisation of digital marketing in B2B businesses. Kwak, Lee, Park, and Moon (2014) provide the findings of an empirical study that investigates Twitter and how information moves around the platform. The writers conducted research on 106 million tweets and studied 41.7 million people, 1.47 billion social relations, 4,262 popular themes, and more. During the course of the study, the authors were aware of a pattern on Twitter: communication between persons who share commonalities occurs at a higher frequency than it does among those who have significant differences. According to Roberts and Micken (2015), the world's economy has undergone a transformation in recent years as a direct result of the proliferation of digital technology. Roberts and Micken (2015) referenced Dean et al. (2012) discoveries that a 4.7% contribution to gross domestic product had been made to the economy of the United States (U.S.) in 2010.

Afrina Yasmin, Sadia Tasneem, and Kaniz Fatema (2015) have not only studied the comparative comparison of traditional marketing and digital marketing, but they have also discussed the many components of digital marketing. (Zimmer, 2017) One of the most effective marketing tools

today is social media marketing. Users are able to communicate with one another when using social networking sites that are part of online communities. The social networking platform makes it possible for individuals or organisations to facilitate marketing transactions with one another through the posting of information online and the exchange of messages (Zimmer, 2017).

RESEARCH OBJECTIVES:

The objective of this paper is as follows:-

- To study the concepts & various aspects of digital marketing
- To study the importance of visual communication in marketing
- To identify the advantages of digital marketing

RESEARCH METHOD:

The major focus of this research is on the previous academic work that has been done on the subject of the influence that social media has had in the field of marketing. As a consequence of this, additional research that investigated how the influence of social media extends to other domains, such as education, society, politics, and management, have been discontinued. In addition, the scope of this investigation was restricted to articles written in English and published in journals that had a quantifiable impact factor. In other words, the papers that are selected for this study should have been previously published in a reputable journal that possesses both an adequate index and a platform that is well regarded. This is done to guarantee that the journal under consideration is a peer-reviewed journal, which means that the papers in the journal are written by professionals in the field and are vetted by a number of other professionals in the field before being published. In the current review, a technique known as concept-driven systematic review was utilised. This approach was introduced by Webster and Watson (2002). This method analyses the literature from the perspective of the concepts supplied by all writers, as opposed to utilising an author-driven strategy that looks at how particular authors have analysed multiple themes in various publications (Webster and Watson, 2002). In light of the fact that marketing through social media looks to be an area that is still in the process of evolving, this approach was thus decided to be acceptable after going through the present review. In addition to this, the use of this method makes it a great deal less difficult to compile all of the essential research.

In point of fact, our research has already begun looking at primary database research engines (such as Science direct, Emerald insight, EBSCO, and Google scholar) in order to compile a list of linked articles covering the period of time from September 2015 to January 2016. This time span is being considered. These articles were selected with great consideration through a process of selection due to the fact that they investigate identical marketing challenges on various social media platforms. Researchers have utilised a range of words, such as marketing and social media, marketing and Web 0.2, consumers and social media, social media marketing, and social media and branding, in order to discover the relevant papers. In addition to searching for the articles they needed by using the specific names of the most prominent social media sites, such as Facebook, Twitter, YouTube, and Google+, the researchers looked for the articles they needed by utilising marketing, consumer, and brand terms. This approach was utilised by Zeng and Gerritsen (2014), Filo et al. (2015), and Dwivedi et al. (2015) in the course of their research evaluation to identify the publications that were the most pertinent. After this, each of the articles was given a thorough analysis and review by the writers, who made it their mission to determine whether or not the primary objective of each study was germane to the primary objective of the current inquiry. The papers were whittled down using a number of criteria, the most important of which was that the primary topic of the paper be related to marketing, as was stated earlier; that the paper be published in a journal with a significant impact; that the paper be written in English; and that the paper use a methodology that is both understandable and scientific. This procedure resulted in the production of 144 articles, and it is these 144 articles that are being investigated in the present study. The study of subjects connected to social media is quite common in academic institutions and professional settings (Gironda and Korgaonkar, 2014). In point of fact, a number of research have been conducted to investigate the significant problems regarding social media in relation to consumer behaviour (Bianchi and Andrews, 2015; Gironda and Korgaonkar, 2014). However, as Bianchi and Andrews (2015) and Leeflang et al. also point out, there has been less of an effort made to explore the significance of social media from the perspective of marketing management (2014).

DISCUSSION AND ANALYSIS:

The Power of Visual Communication in Digital Marketing

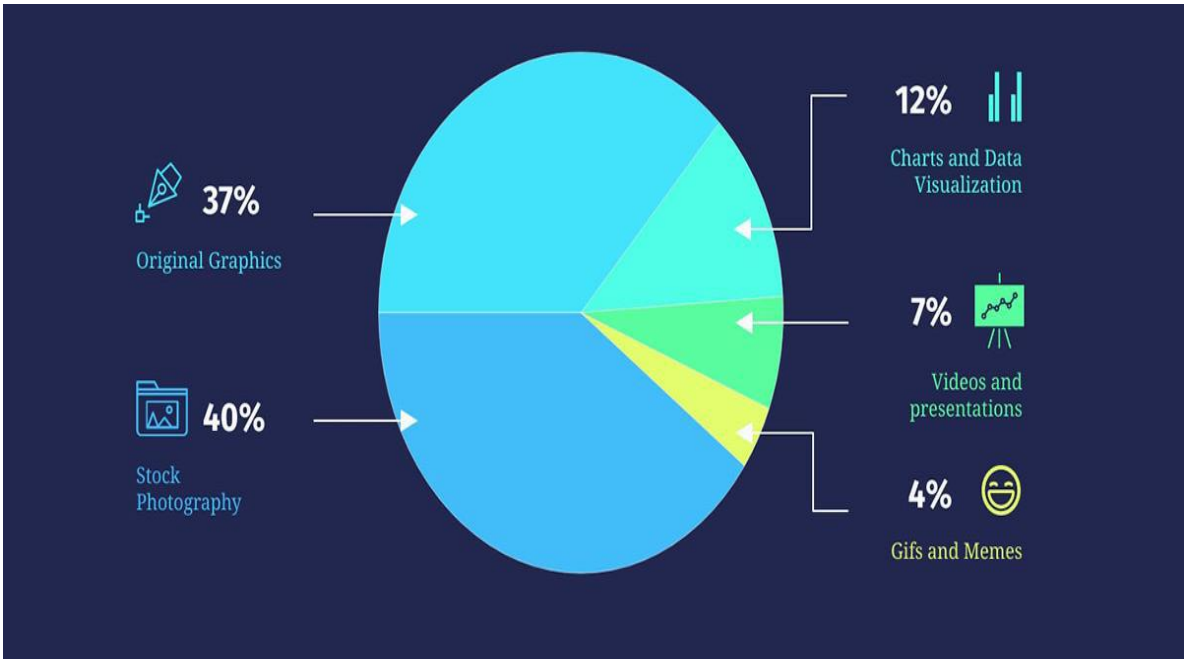


Figure 2: Visual-communication

A picture is worth a thousand words, and in the world of digital marketing, a visual can be worth even more. The power of visual communication is undeniable, and yet many companies are still lagging behind when it comes to using visuals in their marketing campaigns.Why is visual communication so important? Well, for one thing, it is proven to be more effective than text alone. People are more likely to remember an image than a block of text, and visuals can also help to understand a concept in an easy way. Visual communication is one of the most important elements in digital marketing. It is essential for businesses to use visuals in their marketing campaigns in order to stand out from the competition and connect with their target audience. There are many benefits to using visuals in marketing, including that they can help to communicate your message more effectively, capture attention, build trust, and increase engagement Additionally, using visuals can also help you to boost your SEO efforts and drive traffic to your website. When it comes to creating visuals for your marketing campaigns, there are a few things you should keep in mind. Make sure that your visuals are relevant to your brand and target audience Also, consider using both images and videos in your content strategy as this will give you the best chance of reaching your goals. Finally, keep in mind that different types of visuals work better for different objectives. For example, animated GIFs are great for capturing attention on social media while infographics are perfect for driving traffic from search engines. Experiment with different types of visuals to see what works best for your business goals.

The Importance of Visual Communication in Marketing:

The power of visual communication in marketing cannot be understated The importance of visuals in marketing is clear when you consider the benefits of using visuals in marketing Visuals can help you to quickly and easily communicate your message, engage your audience, and increase conversions In this article, we will explore the importance of visual communication in marketing and provide some tips on how to use visuals effectively in your marketing strategy We will also share some examples of effective ways to use visuals in marketing

The Benefits of Visual Communication in Marketing

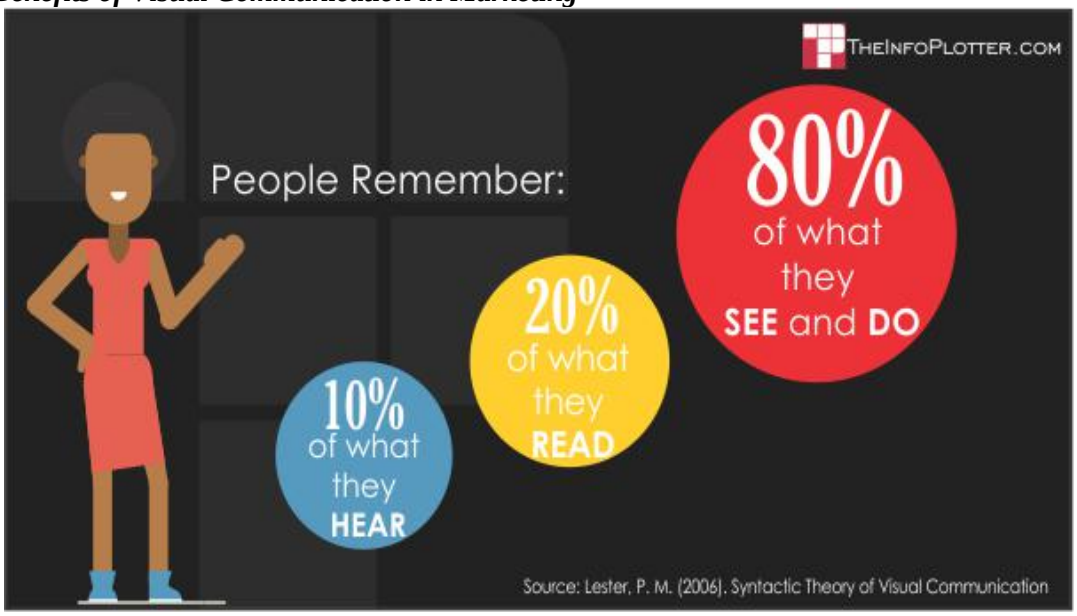
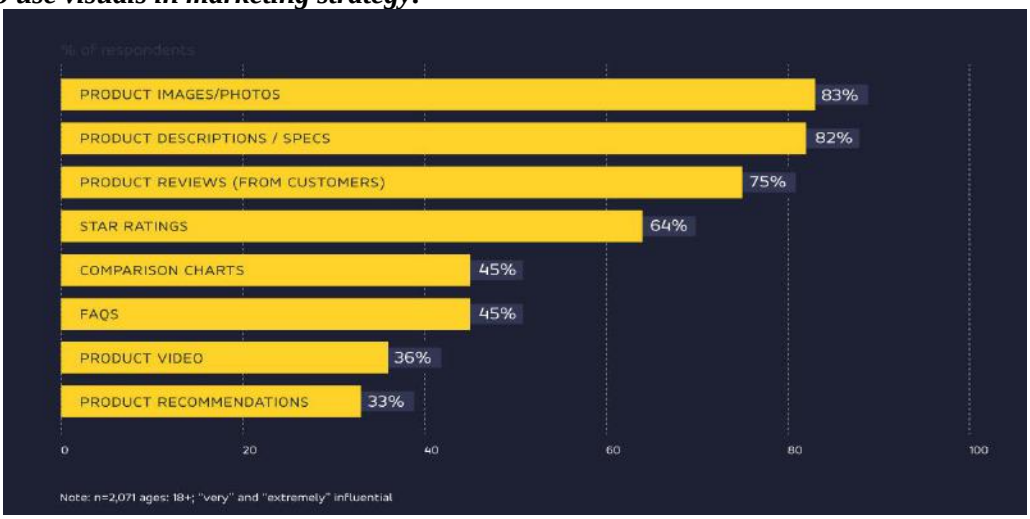


Figure 3: Importance of visual communications in Marketing

Visual communication is a powerful marketing tool that can help businesses to connect with their target audiences more effectively By using visuals such as images, videos and infographics, businesses can communicate complex messages in a way that is easy for consumers to understand. Visual communication plays an important role in marketing because it can help businesses to stand out from the competition, engage with consumers and deliver key messages more effectively. In today's digital world, there is an increasing demand for visually-led content and businesses need to adapt their strategies to meet this demand. There are many benefits associated with using visual communication in marketing, including the ability to capture attention, convey complex messages and create an emotional connection with consumers. When used effectively, visuals can be a highly effective way to improve brand awareness and drive sales. There are various ways that businesses can use visuals in their marketing campaigns, depending on their objectives and target audience Some common examples include using images and videos on social media, creating infographics or using visual content on company websites or blog posts Ultimately, it's important to experiment with different tactics and find what works best for your business Below are some tips on how you can use visuals effectively in your marketing.

Ways to use visuals in marketing strategy:



Use images and videos social media platforms such as Facebook, Twitter and Instagram are highly visual channels that provide businesses with an opportunity to share engaging content with their target audiences Images and videos tend to perform well on social media and they are a great way to grab attention, build interest and generate excitement about your products or services, Create Infographics Infographics are a popular type of visual content that combines text and graphics to communicate information in an easy-to-understand format, Use Visual Content On Your Website Or Blog Adding visual content to your website or blog is a great way to make your site more engaging for customers. The power of visual communication is undeniable. In our fast-paced, constantly bombarded world, we are quickly losing the ability to process large amounts of text. However, visuals have the ability to communicate messages quickly and effectively.

Creating Visuals for Marketing:

The power of visual communication has been proven time and again Whether it's a simple infographic or a more complex marketing campaign, visuals can be incredibly effective in getting your message across. In this post, we'll take a look at the importance of visual communication and how you can use visuals to boost your marketing efforts. Visuals are important in marketing because they can help capture attention, convey information more effectively, and increase engagement When used correctly, visuals can be a powerful tool in your marketing arsenal.Use images to capture attention People are more likely to pay attention to an image than text alone When crafting your message, consider using images that will grab attention and make people want to learn more about what you have to say. Use infographics to convey information Infographics are a great way to take complex topics and explain them in an easy-to-understand format. If you have data or concepts that you need to communicate clearly, consider using an infographic instead of (or in addition to traditional text-based methods. Increased engagement with video Video is one of the most engaging types of content out there. If you want people to really pay attention to what you have to say, try using video as part of your strategy. From product demonstrations to customer testimonials, there are many ways that video can be used effectively in marketing campaigns. Use animation for fun and interactive content. Animation is a great way to add some personality and interactivity. To Your website or social media posts with minimal effort required on the part of the viewer if you want people to stop scrolling and actually spend time with your content, adding some animated elements could be just what you need.

Why Visuals are Important in Marketing:

The power of visual communication should not be underestimated – it is a key part in marketing campaigns and can help to increase engagement, conversions and ROI. Good visuals are important in marketing as they can help to capture attention, communicate messages effectively and create an emotional connection with the audience. There are many benefits to using visuals in marketing, including the ability to tell a story, evoke emotions, highlight important information and add interest. When used correctly, visuals can be a powerful tool in any marketing campaign – here are some tips on how to use them effectively. There are many different types of visuals that can be used in marketing, from photos and videos to infographics and illustrations – each has its own strengths that can be leveraged for maximum impact.

How to Use Visuals in Marketing :

The power of visual communication is undeniable. The way we take in information is constantly evolving, and visuals are now more important than ever before. In a world where we are bombarded with messages and images, it is essential that your marketing strategy includes some form of visual communication. There are many benefits to using visuals in marketing, including the ability to grab attention, convey complex ideas quickly, and create an emotional connection with your audience. But how do you know which visuals to use, and what type of visual strategy will work best for your business?

Effective Ways to Use Visuals in Marketing:

Visuals are a powerful tool that can help you communicate your message more effectively Here are some tips on how to use visuals in marketing. Use visuals to tell a story Humans are visual creatures and we respond well to stories that are told through images When you use visuals in marketing, you can create a more compelling and persuasive story that will resonate with your audience. Use visuals to

highlight important points sometimes, all it takes is one strong image to make a point stick in someone's mind. When you're trying to communicate an important message, using visuals can help ensure that your audience remembers the most important points. Use visuals to make complex ideas easier to understand. Some concepts can be difficult to explain with words alone. However, by incorporating visuals into your explanation, you can make complex ideas much easier for your audience to understand. This is especially useful when explaining new or innovative products or services. Use visuals to create an emotional connection. We tend to connect with images and videos on an emotional level much more easily than we do with text alone. So if you want your audience to really connect with your message, using visuals is a great way to do it.

What Type of Visuals Work Best in Marketing :

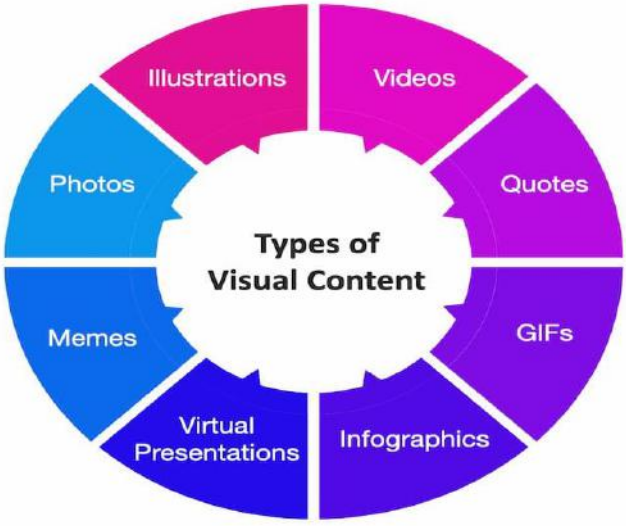


Figure 4: Types of Visual Contents.

The power of visual communication cannot be understated—it is one of the most important aspects of marketing. Visuals can convey messages more effectively than written or spoken word, and they can help to engage audiences and communicate complex ideas. There are many different types of visuals that can be used in marketing, and the best approach will vary depending on the goals and target audience However, some effective ways to use visuals in marketing include using infographics to simplify complex information, using charts and graphs to show data trends, and using images and videos to capture attention. When creating visuals for marketing purposes, it is important to keep in mind the needs of the target audience. The visuals should be easy to understand and should support the overall message of the campaign Additionally, they should be visually appealing in order to capture attention and encourage engagement.

RESULTS:

Overall, visuals are a powerful communication tool that can help you market your business effectively. When used correctly, visuals can help you grab attention, convey information quickly and clearly, and even build trust and credibility.

CONCLUSION:

Digital media is very helpful in promoting many kinds of enterprises, whether it be through the use of classic artwork and paintings or brand-new market trends. Customers benefit from having the opportunity to engage various hobbies while working or at home. Digital marketing is without a doubt an effective technique to advertise your company online, but you must keep in mind that you can't do it all by yourself because many other people must be involved before you can make a sale. In general, I'd like to say that digital media is incredibly advantageous for both big brands and small enterprises, which ultimately aids in the expansion of their respective firms. Social networking sites, SEO strategies, and shared links should all be considered if you wish to advertise your goods online. It's possible to use art

to make wise business judgments. For instance, if a person or business has a website that receives little traffic, they could wish to employ an artist to produce artwork for the site that will increase traffic. Customers could be inspired and persuaded to visit a website by an artist's drawings or paintings. Customers may use this to make online purchases of goods or even merely to sign up for free information about the company's services. Businesses are able to grow through art employing digital media in this way without losing money, which is advantageous for all stakeholders. This demonstrates how, despite their ignorance, artists frequently make a substantial contribution to businesses. Additionally, it shows how commercial exploitation of digital media is possible.

Due to its ability to customise websites, art has always played a significant influence in how distinctive they appear from other online spaces. These days, artists are also involved in online design, which makes websites more appealing, interactive, and educational. A company's website and an artist's website both depend on traffic to draw visitors. Both of these sorts of websites need to stand out from competing websites in terms of appearance. An artist can produce paintings or images utilising digital media that will increase online activity and attention for their clients' initiatives. This paper clearly expresses our viewpoint, which benefits the reader. The provided example clearly illustrates the point being made and enables readers to comprehend how art may truly support business growth through digital media without costing them money. To remain relevant in the cutthroat commercial environment of today, firms must constantly adapt to visual technology. You'll be able to increase user engagement by adding more variety to your visual communication. Your audience's attention will be largely drawn by your visual appeal. Your company can reach entirely new heights if you integrate strong graphic material into your marketing approach. When it comes to the brand marketing ecosystem, selecting the appropriate visual communication formats requires a thorough understanding of the marketing funnel. The graphics won't speak to your customer's awareness, deliberation, and decision-making journey until then. Understanding how to employ and integrate visual forms with SEO, PR, campaign strategies, and social media is essential for success.

RECOMMENDATION:

According to this study, it can also be stated that a significant element in ensuring the effectiveness of online marketing is understanding which social media platforms a company's target market uses. It is possible to analyse the success of Internet marketing in relation to various businesses. The study can be expanded to examine internet marketing strategies that are unique to different types of firms.

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DOIs:10.2015/IJIRMF/ISRC2022/10 --:-- Research Paper

AN AUTHENTICATION PROTOCOL AND KERBEROS

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Abstract: *In this paper, a single-sign-on authentication protocol has been proposed. The protocol is a derivative of the Kerberos protocol that uses one server for authentication purposes, except that it is simpler in its implementation. The encryption schemes are all based on symmetric key cryptography. The protocol also is not susceptible to reply attacks. A single user may have multiple accounts that are protected by passwords. Research shows that users keep the same or similar passwords for different accounts with little difference. Once a single password becomes known, a number of accounts can be compromised. The paper discusses the working of the protocol and analyses its strengths and weaknesses of the same. Kerberos is an authentication protocol developed by the Massachusetts Institute of Technology (MIT). The Kerberos protocol provides a sign-in facility for the clients and is composed of Ticket generation and Ticket grating services for authentication over the network. Kerberos protocol is widely accepted by many organizations and its latest versions are Version 4 and Version 5. This paper will help us get an overview of the basic working of the Kerberos protocol with its strength and limitation.*

Key Words: *Kerberos protocol; Ticket granting server; Service Ticket; Symmetric Key cryptography.*

INTRODUCTION:

Security in today's world is a major concern. As networks grow, they provide more and more services. Providing these services to the user in a secure way is an issue. Attackers can easily gain information during its transmission across the network and then gain unauthorized access to the servers, to whom they are not able to access. For example, in a distributed environment, nodes or computers are distributed across the network. users want to access services that are stored on servers and servers are distributed. So, in this scenario, servers should be able to authenticate all requests for services. Authentication is a way of ensuring that no one can access the system without providing the way that he has access rights. Kerberos provides a central server that does the task of authentication. If an authorized user gains access to the resources, he may either gain access to secret information or may damage resources such as Information stored in the database. Therefore, security is needed at all places in today's world from protecting computer resources to the protection of a nation. But security involves the implementation of measures to protect against attacks. But it does not meanthat an attack will never occur. For example, preventing outside attacks doesn't mean that you are secure, attacks may occur from inside an organization. Researchers have proved that many attacks occur from inside the organization. Therefore, it is necessary to provide security insidean organization. An authentication protocol is one of the most classical single sign-on protocols. A single sign-on system means that a user can access all services from the application servers after only sign on one time in multiple application systems. Kerberos V5 is being used at present but there are lots of replay and password attack problems in it. Kerberos V5 was designed to overcome some of the deficiencies of Kerberos V4, but it can't guarantee to avoid replay and password attacks. This paper provides an extended version of Kerberos, which modifies the basic protocol to allow public-key authentication. Although Kerberos has proven its strengths so far, it also has a number of limitations and some flaws. This paper presents the analysis of PKINIT and mainly focus on a number of vulnerability and flaws at the layer of security.

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OVERVIEW OF KERBEROS PROTOCOL:

Kerberos Basic Networked computer systems provide a great number of shared resources at a user's fingertips; without leaving one's desk, remote hosts, file servers, printers, and many other networked services are readily at hand. Authentication and other security mechanisms are needed so that this convenience is not abused, especially where one's personal computer or organization network is at risk of dangerous backdoors when connected to the Internet. A simple solution to this problem, requiring users to authenticate to each service they use (for example using a password) is not only inconvenient but also insecure in practice as people are poor at dealing with a large number of different passwords. The Kerberos protocol was designed to provide transparent access to all the networked resources. Each time the user needs to retrieve a file from a remote server, the required authentication will be handled by Kerberos securely behind the scene, with no user intervention needed. This section will review how the latest version of this protocol, Kerberos 5, achieves secure authentication based on a single login, and for the time being in situations where all the authentications take place within the same administrative domain (or realm) without PKINIT. Principals, The informal example above has described three principals, which form a typical Kerberos exchange: the human user at his/her terminal, the client process that recognizes the user's password and transparently handles the authentication of each request on the user's behalf, and the requested services, or servers in Kerberos terminology. Kerberos relies on two additional administrative principals together, namely the KDC: the Kerberos Authentication Server (KAS) which authenticates the user and provides the corresponding client with credentials to use the network for a typical day, and the Ticket Granting Server (TGS) which authenticates the client to each requested server based on those credentials. Kerberos relies on two additional administrative principals together, namely the KDC: the Kerberos Authentication Server (KAS) which authenticates the user and provides the corresponding client with credentials to use the network for a typical day, and the Ticket Granting Server which authenticates the client to each requested server based on those credentials. The high-level picture is given below:

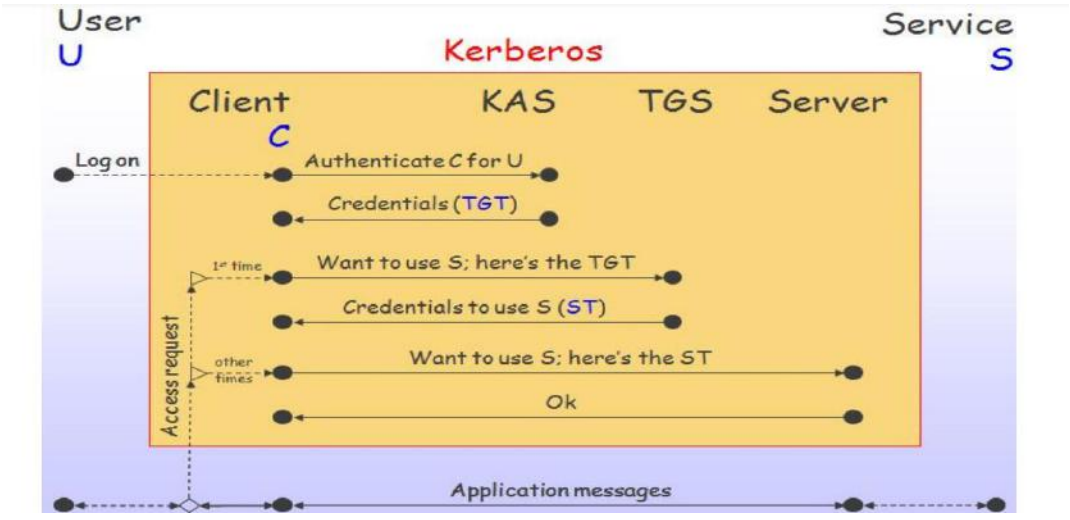

Figure 1: Authentication of Kerberos

The top of the figure represents the daily authentication process to Kerberos: as the user (U) logs on, the KAS authenticates the client process representing the user and provides credentials to use the system for that day. These credentials from the KAS are called the Ticket Granting Ticket (TGT). Whenever the user wants to use a networked service, the client on his/her behalf will seek authentication to the process S managing this service. This is done in two steps: the first time U attempts to access S, C presents the TGT from the KAS to the ticket-granting server (TGS) which will in turn provide credentials for S. These credentials are called the Service Ticket (ST). Every subsequent time U wants to access this particular service, C forwards ST to S, without involving the TGS. The line at the bottom of the figure represents the actual use of the desired service: this is all the user sees as the client process

handles the authentication overhead. The above mode of interaction represents a typical single organization or realm in Kerberos terminology. Each realm is regulated by a single KDC, although there may be synchronized replicas for performance and fault tolerance reasons. Within a realm, there will be generally multiple clients and multiple servers. Intra-realm authentication, as this modality is known, is widely deployed and has been extensively studied. Kerberos also supports cross-realm authentication, a scheme by which a client in a realm R1 can access a service in a different realm Rn. The rest of this paper will explore how Kerberos achieves cross-realm authentication. Firstly, let's recall how the basic intra-realm protocol works.

Message Exchange within the same administrative realm:

This section focuses on the messages exchanged during a typical intra-realm authentication session between A Survey of Kerberos V and Public-Key Kerberos Security. client C and server S, as shown in the box of Figure 1. The simplified version of the Kerberos 5 exchanges is given in Figure 2: the top part relies on the traditional "Alice-and-Bob" notation, with the standard name [Figure 2] for each message given on the left. the three roundtrips between a client (C) and the KAS (K), the TGS (T), and a server (S), respectively represented in figure 2.

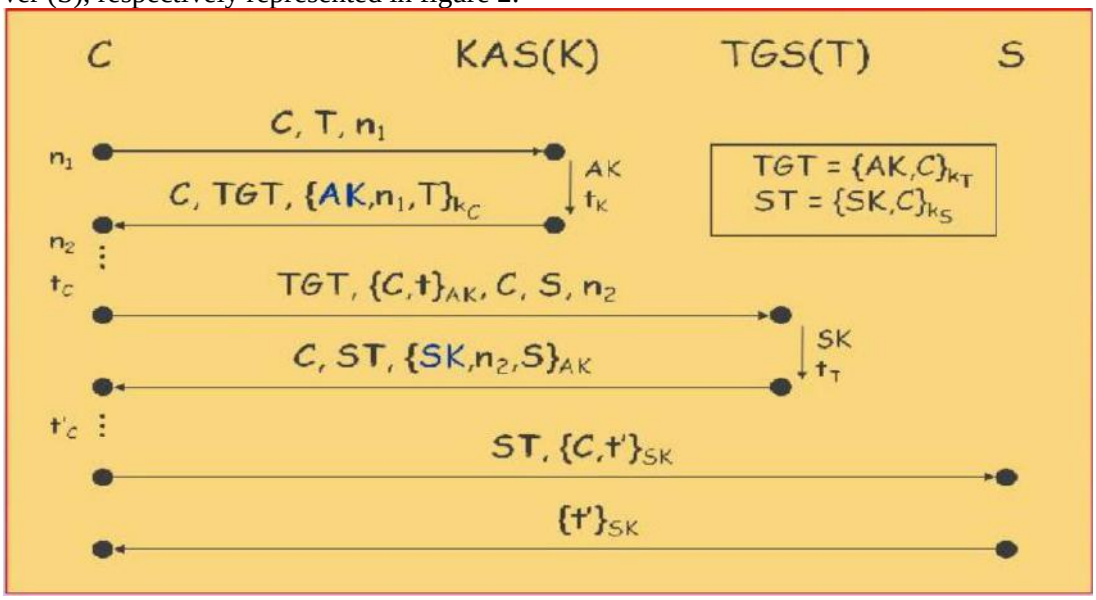

Figure 2: Message Exchange within the same administrative realm.

Security Consideration:

One weakness of the standard Kerberos protocol lies in that the key kC used to encrypt the client's credentials is derived from a password, and passwords are undoubtedly vulnerable to dictionary attacks. In addition, since the initial request is completely plaintext, an active attacker can repeatedly make requests for an honest client's credentials and accrue a large number of plaintext-cipher text pairs, the latter component is encrypted with the client's long-term key kC (which is derived from a password). While the attacker is unable to use these credentials to authenticate to the system, he is given the considerable opportunity to perform an active dictionary attack against the key. Kerberos can optionally use pre-authentication, a feature designed to prevent an attacker from actively requesting and obtaining credentials for an honest user. Pre-authentication functions by requiring the client to include a timestamp encrypted with his/her long-term key in the initial request. The authentication server will only return credentials if the decrypted timestamp is recent enough. This method successfully prevents an attacker from actively obtaining cipher text encrypted with the long-term key; however, it does not prevent passive dictionary attacks, i.e., a passive attacker could eavesdrop on network communications, record credentials as the honest client requests them, and attempt off-line dictionary decryption. Hence, pre-authentication makes it slower for an attacker to perform cryptanalysis against the user's long-term key, but it does not prevent the attack. PKINIT, along with a number of other methods, aims at eliminating this dictionary attack vulnerability.

PUBLIC-KEY KERBEROS: PKINIT:

PKINIT is known as an extension to Kerberos 5, which uses public key cryptography to avoid shared secrets between a client and KAS. It modifies the AS exchange. However, other parts of the basic Kerberos 5 protocol are the same. The long-term shared key (kC) in the traditional AS exchange is typically derived from a password, which limits the strength of the authentication to the user's ability to design and memorize good passwords; PKINIT does not use kC and thus solves this issue. Also, PKINIT allows network administrators to use an existing public key infrastructure (PKI) rather than expend additional effort on managing users' long-term keys needed for traditional Kerberos. This protocol extension adds complexity to Kerberos as it retains symmetric encryption in the later rounds but relies on asymmetric encryption, digital signatures, and corresponding certificates in the first round. In PKINIT, clients C and KAS have independent public/secret key pairs. Certificate sets CertC CertK issued by a PKI independent from Kerberos are used to testify the binding between each principal and its purported public key. This simplifies administration as authentication decisions can now be reached based on the trust the KDC holds in just a few known certification authorities within the A Survey of Kerberos V and Public-Key Kerberos Security PKI, rather than keys individually shared with each client. Dictionary attacks are defeated as user-chosen passwords are replaced with automatically generated asymmetric keys. The login process changes as very few users would be able to remember a random public/secret key pair. In Microsoft Windows, keys and certificate chains are stored in a smartcard that the user swipes in a reader at login time. There are two operation modes in PKINIT. First, in public-key encryption mode, the key pairs,e.g.,(pkC, skC) and (pkK, skK), are used for both signature and encryption. The latter is designed to protect the confidentiality of AK, while the former ensures its integrity. A variant of this mode allows the reuse of previously generated shared secrets.

Public-key encryption mode In PKINIT the AS exchange is illustrated in Figure 2. In discussing this and other descriptions of the protocol, (PKINIT realizes digital signatures by concatenating the message and a keyed hash for it, occasionally with other data in between).

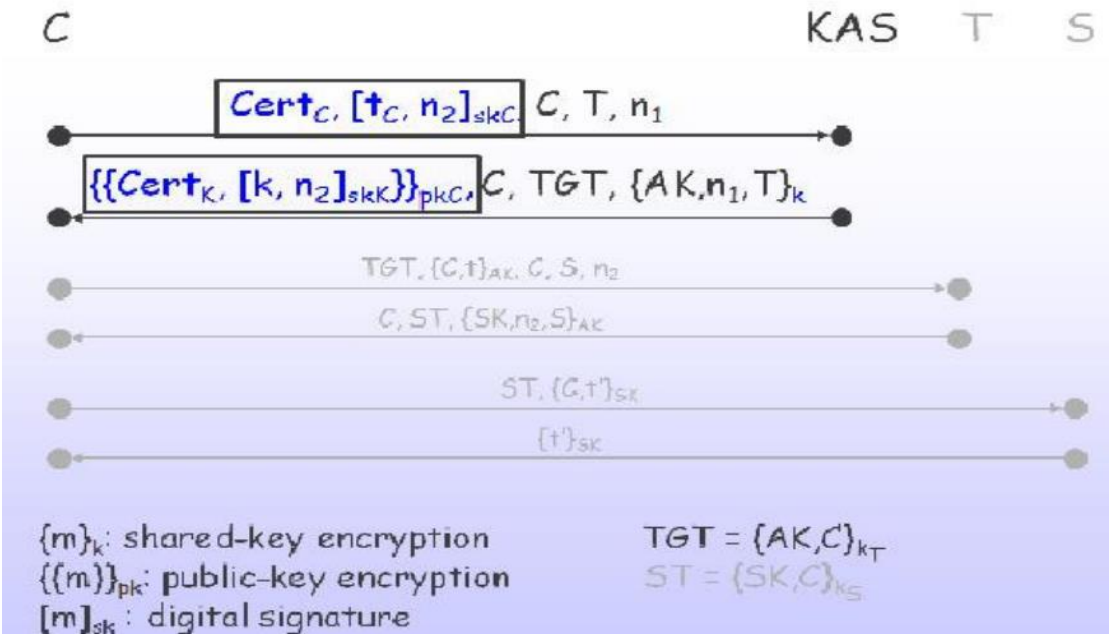

Figure 3: Public-key encryption mode

Figure 3: Public-key encryption mode First line in Public-key Encryption mode: This shows the relevant parts of the request that a client C sends to a KAS K using PKINIT. The last part of the message "C, T, n1" is exactly the same as in basic Kerberos 5, containing the client's name, the name of the TGS for which he/she wants a TGT, and a nonce. The "boxed" parts are added by PKINIT and contain the client's certificates CertC and his/her signature (with the secret key skC) over a timestamp tC and another nonce n2. The nonces and timestamp to the left of this line indicate that these are generated by C particularly

for this request, with the box indicating data not included in the abstract formalization of basic Kerberos 5 . This effectively implements a form of pre-authentication. Second line in Public-key Encryption mode: This shows the formalization of K's response, which is more complex than that of basic Kerberos. The last part of the message "C, TGT,{AK, n1, tK, T}k"is very similar to K's reply in basic Kerberos; the difference boxed is that the symmetric key k protecting AK is now freshly generated by K and not a long-term shared key. The TGT and the message encrypted under k are as in traditional Kerberos. Because k is freshly generated for the reply, it must be informed to C before C can learn AK. PKINIT does this by adding the boxed message {{CertK, [k, n2]skK}}pkC. This contains K's certificates and its signature, using its secret key skK, over k and the nonce n2 from C's request; all of this is encrypted under C's public key pkC.

ATTACKS ON KERBEROS V:

Kerberos V implicitly relies on the servers being secure and the software being non malicious. However, the most interesting assumptions are the ones about password guessing and replay attacks. Both attacks are non-trivial but could be carried out over the local network. Password guessing attacks can be based on any text encrypted with the key derived from the victim's password, and will result in the exposure of the plaintext password. Replay attacks will usually result in the attacker assuming the victim's identity without actually recovering the password. Now we can see how an attacker might hijack a network connection allowing active monitoring and modification of the victim's network traffic.

Analysis of this Attack:

We can conclude from the results of research that replay attacks against Kerberos 5 on a Windows domain are feasible. An attacker will be able to use the victim's credentials to access file shares. Research shows that the Windows Server SP3 does actually cache used authenticators. The attempt to replay used authenticators failed because the server refused to accept them. This indicates that an attacker must use an active man-in-the-middle attack to listen to the SMB session setup and prevent the server from seeing the credentials the victim sends. As such, when the attacker replays the security blob, and the server has not seen the authenticator, the attack succeeds. The research shows that the Windows Server SP3 acting as a file server either does not verify the address field or the Windows KDC does not include it in the tickets it issues. This means that an attacker, once he has captured the victim's security blob, may reuse it from his own network address. This makes replay attacks easier. A tool to perform such an attack, is a proxy that listens to connections on the attacker's machine, forwards session negotiations between the real server and the victim and captures the security.

Protecting environment against this attack:

When an attack is underway, the victim will see an error message stating that the service is not available. This is because the attacker will stop proxy traffic to the server after capturing the security blob. However, this is not an efficient solution, since such errors are also possible in normal circumstances. Also, counting on users in such problems is probably not the best choice. The detection of this attack is very difficult. More effort should be made on preventing it from happening. This is possible in a number of ways, among which, the most efficient is to use some form of encryption on the IP layer. The use of IPSEC would be a sufficient protective action. However, using it to encrypt all client-to-server traffic is very difficult. SMB signing, which is available on some implementations, can be used to prevent replay attacks. In brief, when signing is enabled, packets will include a cryptographic MD5 checksum created with a session key to ensure their integrity. There is a significant pitfall. Servers usually support SMB signing, but do not require that clients always use it. If the victim is using SMB signing, the connection can still be attacked. The security blob is easily extracted since no encryption is used. If the attacker is then allowed to connect to the server with the stolen credentials without signing, the attack will succeed. The server must require SMB signing for all connections for the attack to fail. In this case, the attacker will not know the key to create the checksums, and therefore cannot create a connection.

CONCLUSION:

An extended version of Kerberos, PKINIT, modifies the basic protocol to allow public-key authentication. Even though Kerberos has proven its strengths so far, we could spot several security

weaknesses in Kerberos V. This paper provides an extended version of Kerberos, which modifies the basic protocol to allow public-key authentication. Although Kerberos has proven its strengths so far, it also has a number of limitations and some flaws. This paper presents the analysis of PKINIT and mainly focused on a number of vulnerability and flaws at the layer of security. It provides reliable communication over the distributed environment by identifying the client's identities in the same domain. It is an authentication protocol that authenticates its client with the help of the Ticket system. It is an authentication protocol that authenticates its client with the help of the Ticket system.

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DOIs:10.2015/IJIRMF/ISRC2022/11 --:-- Research Paper

TRANSFORMATION OF HEALTHCARE MONITORING DURING COVID CRISIS IN INDIA USING IOT

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Abstract: *Internet of Things (IoT) in medical services is the key component in providing patients with better clinical settings and interacting with clinics and specialists as well. The framework that is being suggested now consists of several checkup strategies, such as sensors and electronic or mobile applications that convey information-related tools and techniques for keeping track of and collecting healthcare data and patient wellness information. This paper's recommended arrangement is to foster a framework to convey the most important clinical consideration. Helping patients, even in the most remote areas with almost no crisis centers in their areas, is possible by communicating over the Internet and obtaining information on their health status through the wearable devices provided in the unit using a raspberry pi microcontroller that would have the option to record the patients' heartbeat and pulse.*

Keywords: *IoT, Healthcare, Framework, Internet, Raspberry Pi, Microcontroller.*

1. INTRODUCTION :

The Internet of Things is an interconnected network of procedure, software, sensors, and organizations that improves the capacity of various components to gather and switch data. The unique feature of IoT in the medical services framework is the continuous observation of a patient via closely examining many boundaries and moreover expecting a good outcome from the historical background of such secure observation. There are many such devices with clinical sensors nearby in ICUs today. Even with 24 hours of checking, there may be times when a problem cannot be detected in time to alert the professional. Additionally, there can be obstacles to communicating facts and data with knowledgeable experts and worried families moreover, family relatives. [1] The IoT gives a creative innovation to boost health administrations to a higher level. [2] In order to enable consistent systems administration between patients, clinical devices, and doctors, it ensures that reasonable, inexpensive, dependable, and convenient devices are carried by or inserted with the patients. [3] This is possible because of the development of the IoT. For instance, several illnesses, such as heart failure and stroke, might develop suddenly and without warning. Quick treatment would be expected to save a person's life if they were to suddenly suffer the negative effects of a cardiac attack or a brain. It will be possible to follow various major physical processes as the (IoT) concept develops; in this case, the ECG (Electrocardiogram). The obtained ECG can then be gradually and inexpensively transmitted to specialists in distant locations. The doctor(s) or expert(s) can then add input by suggesting a crucial measure that could save your life. [4]

2. INTERNET OF THINGS IN HEALTHCARE :

Through IoT, specialists may support clients online. The distance between the patient and the expert can be greatly reduced by small health monitoring devices. IoT gives you the freedom to examine each patient without limitations, evaluate their health, and choose the best course of action. The health of patients can be remotely monitored and continuously responded to by specialists using a variety of

sensors. In any case, uninterrupted Web connections are necessary for ongoing measurements. Although IoT in healthcare is expanding quickly, just a few clinical projects have fully accepted it. There are several challenges in creating good Internet apps for conventional treatments. IoT is likely to lead to an immediate increase in the number of clinical examinations. [5]

Figure 1: IoT Based Healthcare System [6]

A huge quantity of data must currently be gathered, examined, and understood by clinical specialists for them to make informed decisions that are unique to each patient. All of that demands an investment. This contact can be enhanced and supported by new IoT developments. To the widespread dissemination of electronic health records, a growing amount of processed clinical data is visible. This data must be fully examined and analyzed, which will cost money. Additionally, it is necessary to inform the clinical staff about new technologies in light of artificial intelligence, which is closely related to the Internet of Things. [7] Through planned exercises of diminishing advancements like the IoT and artificial intelligence, doctors are required to adjust medications to patients' needs. With these improvements, it is now possible to handle a much larger volume of data to keep and evaluate it to closely monitor the progression of a particular illness or collaboration. Positive modifications in healthcare administration will result from knowledge fully integrating common sense person participation in the potential outcomes of new ways of finding, selection, and examination [8].

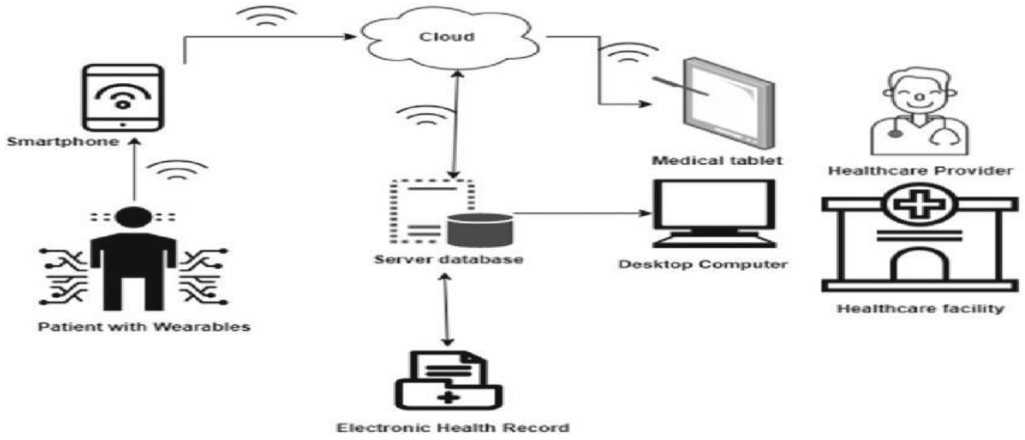

Figure 2: Concept of IoT In Healthcare [9]

3. POTENTIAL IoT BASED SOLUTIONS IN HEALTH CRISES :

The creation of several industries- and user-specific IoT applications is made easier by the IoT While tools and networks offer a physical Through connectivity and IoT applications, interactions between machines and people are made reliable and robust. IoT software on hardware It is necessary to confirm that data and communications have been received and appropriately handled on time. Applications for transportation and logistics, for instance, keep track of the condition of carried products like such as

fresh fruits, vegetables, meat, and dairy products. The preservation status during transit(such as temperature, humidity, and shock) are observed When the connection is unstable, suitable measures are performed automatically to prevent decomposition outside of reach. FedEx, for instance, uses Sense Mindful to monitor the weather. Customers can lock and unlock doors as well as regulate the lighting, atmosphere, and security system through the Control network. The IoT is also utilized to monitor and control various auto parts. The primary buyer incentives are drivers' satisfaction and unique experience. In 2014, Passage and Intel worked together to investigate fresh approaches to customizing the client experience with face recognition software and a portable application. In the collaborative research effort known as Portable Inside Imaging, reasonable processing technology is used to improve security measures, identify various drivers, and subsequently change features by customer preferences [10].

4. CHALLENGES OF IOT BASED SOLUTIONS :

IoT has been used for a variety of functions and offers distinct assistance for the medical care framework, such as patient monitoring and a clever home system for diabetes patients. The following are serious incidents that occur within the context of medical care.

- IoT enables high adaptability, allowing for routine patient observation to take place from home rather than in a clinic even if the patient still has to receive appropriate care. Some wearable technology, such as sensors, cause pain in the patient's body.
- The majority of the existing methods for ECG observation involve carefully examining the sign. This increases the cost and could result in a mistake being made. AI may be used to examine the sign, which helps with cost reduction and skill development.

- As there are more sensors and devices, processing them requires more energy, which increases power leakage and energy consumption. To reduce energy usage, a calculation for improvement might be used.

- On the IoT, monitoring large numbers of clients requires a more powerful, centralized computer, which can become overloaded by storing the data in the Cloud. However, the complexity increases when the IoT is combined with the cloud [11].

5. FUTURE OF IoT BASED SMART HEALTHCARE SYSTEM :

Future research in this area has a great deal of potential. This exam should stress information collection (via sensor organizations and IoTs), identifying designs, exercising good judgment, and carrying them out using controllers and reaction capabilities. Future research will also need to focus on areas of strength for working with residents of facilities like smart homes to provide routine services like clinical attention and, in an ideal world, provide information sources that can be used to change behavior to benefit smart home residents and the general populace. Some of the challenges faced by the industry in the wide use of IoTs for medical services include the following [12] [13]:

- Publicizing, looking, and disclosure norms, as well as protection and trust.
- Protection of IoT devices and data transmission.
- Basic web administrations are currently the most widely adopted online technology. Remotely identifiable medical care systems that are inserted outside of the organization should be connected to and use web services.
- Corresponding functionalities and this will turn out to be a web is about to face a threat. These large numbers of components create research, consume, and process info on certain medical issues, for instance, emergency rooms, households, and nursing homes, in addition to the daily lives and occupations of humans.
- The IoT will alter the people at large and bring about consistency "whenever personalized medical services and monitoring wherever swift, reliable, and safe organizations

6. CONCLUSION :

Scientists from all around the world have started to design numerous mechanical arrangements that will progress medical treatment and enhance current administrations by combining the IoT's capabilities. The many components of the IoT medical care structure are examined in this section, along with various organizational structures for the delivery of medical services that facilitate access to the IoT system and the collection and transfer of clinical data. The section also mentions studies that have thought about how the IoT can benefit older and pediatric considerations, private safety, executive wellness, and care of the chronic infection. This section frames a discussion of safety and security concerns relating to IoT medical care. multiple security requirements, problems, and various exploration concerns. In addition, IoT and eHealth guidelines and methods for collaborating with various partners who are crucial to the evolution of IoT-based medical services—are presented. To conclude, it is expected that the findings of this section will be helpful for health professionals, specialists, architects, and decision-makers working in the field of medical services innovations and the IoT.

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ROLE AND ACCOUNTABILITY OF CLOUD COMPUTING IN BIG DATA

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Abstract: *Cloud computing and Big Data are the hottest topic in current vogue. Currently, all the peoples are using social sites and related apps they are required to save a lot of data with their security. We are proposing to explore the role of cloud computing being store big data. Cloud Computing play an important role in Scalable database management systems (SDBMS). being support systems for deep analytics and ensuring secure and smooth transition.*

Key Words: *Cloud Computing, Big Data, SaaS, PaaS.*

INTRODUCTION:

The huge volume of data is called big data. Infect, big data is also a data with great size. Big data has a lot of complexity to store it in the field of Information Technology. At that time, we are required the technology named Cloud Computing. The cloud computing emerge integrators and aggregators. Cloud Computing assures to cut capital and operational costs of strategic projects which deals with huge size of data [1]. The name cloud was probably inspired by Information Technology reference books. The cloud images in order to complexity that lies behind them.[2]

OBJECTIVES: The main objective of this research is to tackle huge amount of data and recognize latest opportunity for helps for different organization. There a lot of organizations or e-commerce sites are leads to happier customers with more effective operations with increasing quality and reducing cost moves as smarter business.

REVIEW LITERATURE: There are some relativity between big data and cloud computing described or reviewed as follows:

APPROACH OF BIG DATA:

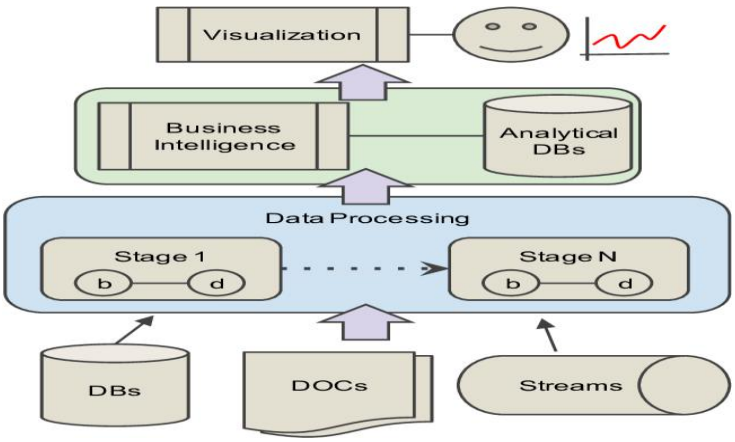

Figure 1: Typical Big Data Approach[5]

It is always required for scaling to manage and support big data. We may start by make motivate the discussion of cloud data management because technique of cloud computing is successful and associated. we are going to elaborate the main enabling peculiarity that widespread success and popularity. [3].

Large Multitenant Databases:

The multi tenancy is mainly considered SaaS with a small data footprint. It is suppose to require large number of applications [4]. The features of cloud in open source RDBMSs and the cost associated with solutions to make RDBMSs less attractive for the deployment of large scale applications in the cloud[5]

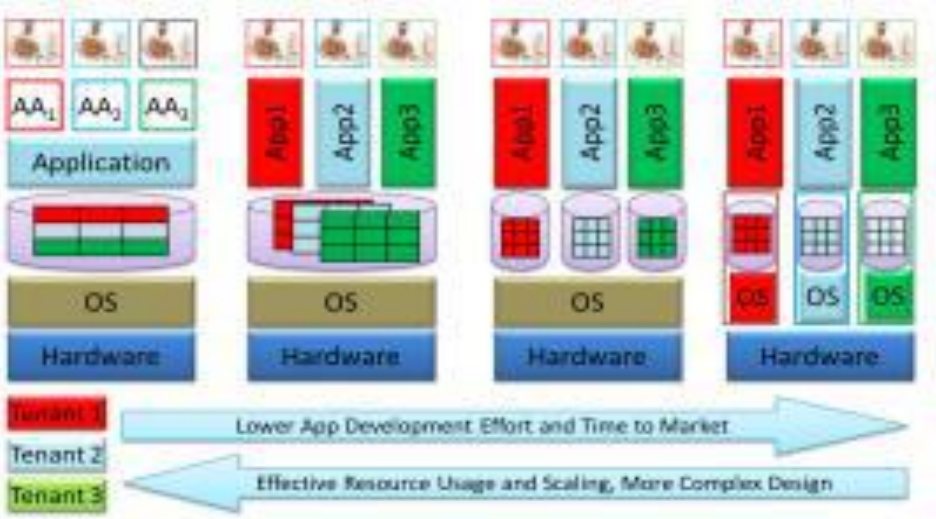

Figure 2: Different models of multi tenancy. From left to right, they correspond to shared table, shared database, shared OS, and shared hardware[6]

Security of Internet Browser:

The cloud is accessed from remote servers by the internet browser that is used only for input/output and also for authorization and authentication of commands to the cloud. It is observed that it has been categorized under different names such as SaaS, Web 2.0 and Web Application for last year's [7].

Data Binding and Integrity Issues of Cloud:

Data integrity and security means that the data can be modified or accessed by authorized user to do so. According to Balachandra Reddy Kandukuri, Ramakrishna Paturi V, Dr.AtanuRakshit it is process of verifying data. The guarantee of unmodified, correct, high quality data given by data integrity [8].

Signature of Extensible Markup Language:

S. Subashini and V. Kavitha have described in their research article titled "A survey on security issues in service delivery models of cloud computing" in figure 3. In this figure they said that the different deployment models of cloud namely hybrid, public, private and community cloud are deployment models. There are different delivery models described above deployment layer. there are Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).All these models exhibit certain characteristics such as rapid elasticity, ubiquitous network, multi tenancy and on demand self service which are shown in the top layer. There are a lot of security required by cloud which varies and depends with respect to the deployment model being used. In this research paper it has also been described that Software as a Service model is used for deployment of software that is provided the licenses to customers for use as service on as per requirement. The Salesforce.com CRM application is the example of Software as a Service. Infrastructure as a Service is the delivery of infrastructure of computer as a service rather than purchasing network equipment, or data center space, software and server. The client do outsourced services instead of buy [9].

METHODOLOGY:

As far as the research methodology is concern, we adopted the methodology named observation the facts of requirement of storage, security, reliability and scalability of huge amount of data being used by different organization and mobile user in current vogue due to facilitating social media and other resources.

ANALYSIS AND DISCUSSION:

It may be obtained reliable services being the use of multiple sites which is suitable for business continuity [10].Services of cloud computing suffers many times at that time the respondent hardly able to do something[11]. The software implementation is required a virtual machine that is able to run related system software. Different software can be concurrently executed by more then one VMs on distinguish system software environments being independent single physical machine. This is process to reduce cost of hardware and requirements of space. Separate VMs is able to hosted different clients being a shred tenancy of cloud computing environment on a independent physical machine. It facilitates a lot of flexibility that does not influence software running or such impact as required[12].As far as cloud computing environments for data of mobile, the service provider of mobile cloud requires efficient techniques to satisfy for the same. The user of mobile require to avail benefits as increases storage, scalability and battery life. So it is required to addresses due to dynamic and distribute connection for energy sufficiency [13].

RESULT/FINDING:

We found that the cloud technology plays big role to help analysis of big data. It is required to reduce the cost for the same. There are two major issues for all concern as protection and security.

RECOMMENDATIONS:

Firsty, we recommend prioritizing data integeration and holistically governance of data and secondly we would like to recommend maintaining data consistency for all VMs of operating system for big data.

CONCLUSION:

As far as the review of the relativity between big data and cloud computing is suppose to optimize the data storage with considering scalability, security and flexibility for huge amount of data on mobile and different VMs of system software. As far as the future work of cloud computing with respect of big data it is supposed to belong infinity.

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DOIs:10.2015/IJIRMF/ISRC2022/13 --:-- Research Review Paper

A REVIEW OF WIRELESS TECHNOLOGY AND APPLICATIONS IN AGRICULTURE: CONTEXT WITH RAJASTHAN E-VILLAGE

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Abstract: *The paper provides an overview on the role of wireless technology in Agricultural Information Systems and Services to be implemented in Rajasthan. It consists of a range of implementation of adhoc wireless networks in Rajasthan villages. It uses modules consists of use of various wireless technique for Agricultural Research in Rajasthan. Modern farming practices and inclusive technologies have been implemented in many parts of rural Rajasthan villages to enhance the rural growth. Wireless communication network and Global Information System based agro-software technology are reaching to every part of rural Rajasthan Villages giving them access to essential and updated information about weather, farming technologies, fertilizers, commodity prizes etc. Restricted access to digital technologies, high cost of access, insufficient content in correct language, lack of equipments, lack of power are some of the barrier to implement e-agriculture in Rajasthan Villages. This paper discuss the fundamental application of Wireless Technology and their application in agriculture and its different models related to agriculture developed so far such as Kisan Call Center, Gyandoot Project, Bhoomi Project, Village knowledge Centers etc.*

Key Words: *Wireless, GIS, adhoc, e-village.*

INTRODUCTION:

E-Agriculture is an emerging field focusing on the enhancement of agricultural and rural development through improved information and communication processes. More specifically, e-Agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (ICT) in the rural domain, with a primary focus on agriculture. E-Agriculture is a relatively new term and we fully expect its scope to change and evolve as our understanding of the area grows. E-Agriculture is one of the action lines identified in the declaration and plan of action of the World Summit on the Information Society (WSIS) [1]. The "Tunis Agenda for the Information Society," published on 18 November 2005, emphasizes the leading facilitating roles that UN agencies need to play in the implementation of the Geneva Plan of Action. The Food and Agriculture Organization of the United Nations FAO has been assigned the responsibility of organizing activities related to the action line under C.7 ICT Applications on E-Agriculture. The main phases of the agriculture industry are: Crop cultivation, Water management, Fertilizer Application, Fertigation, Pest management, Harvesting, Post harvest handling, Transporting of food/food products, Packaging, Food preservation, Food processing/value addition, Food quality management, Food safety, Food storage, Food marketing. Information and Communication Technology (ICT) can play a significant role in maintaining the above mentioned properties of information as it consists of three main technologies. They are: Computer Technology, Communication Technology and Information Management Technology. These technologies are applied for processing, exchanging and managing data, information and knowledge. The tools provided by ICT are having ability to:

- Record text, drawings, photographs, audio, video, process descriptions, and other information in digital formats,
- Produce exact duplicates of such information at significantly lower cost,

- Transfer information and knowledge rapidly over large distances through communications networks.
- Develop standardized algorithms to large quantities of information relatively rapidly.
- Achieve greater interactivity in communicating, evaluating, producing and sharing useful information and knowledge.

INDIA'S AGRICULTURE TODAY:

Facts and Figures:

Since the early 1970s India has achieved food self-sufficiency. As reflected by the growing per capita income (USD 450, with purchasing power parity - ppp - USD 2'150), the rural poverty itself is decreasing: today, it reaches 33%, down from 56% in 1973-1974. Even if the agriculture part of GDP is relatively small at around 24%, its share of employment is about 67%. This agriculture remains largely rain-fed (60%). Nevertheless, the irrigation part is growing, as it is needed to sustain the general trend of a shift to a market economy. Although India is using only about 57 percent of its total water resource potential at present, the country is already using about 66 percent of its irrigation potential [2]. Being a vast and monsoon-dependent country, India displays a wide variation across time and space for water resources availability. However, an average can be drawn for the effective water resource potential: 1'122 bn m3 per year. The projections for water requirements are sharply increasing. From 644 bn m3 per year today, likely forecasts assess 784-850 bn m3 in 2025 [3]. As a consequence, one witnesses an increasing supply-demand gap and a continuous decline in per capita water availability (in 1955: 5'277 m3, today: 1970 m3 [2]). The canal irrigation sector is developed and managed by public agencies. Its importance for distributing water and recharging wells must not be underestimated. However, the inadequacy of the water institutions' projects and policies, and inequality of water distribution has led to a flourishing of private initiatives, which are mostly centered on exploitation of groundwater. Groundwater irrigation is developed and managed by independent farmers, often illegally. It is estimated that 9.8 million electric and 4.4 diesel pump-sets are scattered across the country, as well as about 10 million dug-wells [3].

WIRELESS SENSOR NETWORKS:

A wireless sensor is a self-powered computing unit usually containing a processing unit, a transceiver and both analog and digital interfaces, to which a variety of sensing units – typically sampling physical data, such as temperature, humidity etc. – can be adapted (see Figure 1 as an example). These sensors automatically organize themselves into an ad-hoc network, which means they do not need any preexisting infrastructure, as do cellular networks such as GSM.

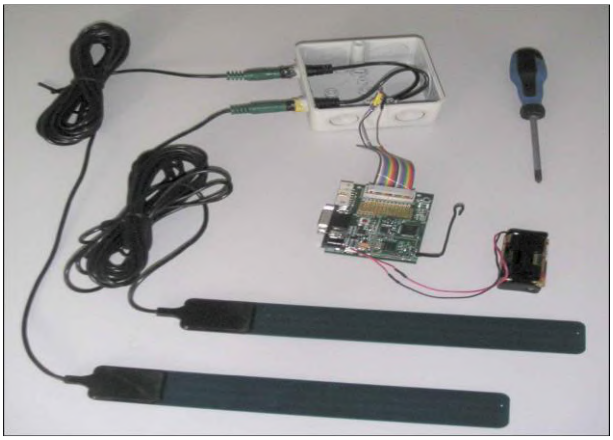

Figure 1: Wireless sensor with 2 alkaline batteries, a connector to 2 soil moisture Probes and its weatherproof casing

For this reason, we refer to such a network as an ad-hoc Wireless Sensor Network, which we denote as WSN throughout this paper. The sensor nodes communicate with each other in order to exchange and process the information collected by their sensing units. In some cases, nodes can use other wireless sensors as relays, in which case the network is said to be multi-hop. If nodes communicate

only directly with each other or with a base station, the network is single-hop. In a data-collection model, sensors communicate with one or several base stations connected to a database and an application server that stores the data and performs extra data-processing. The result is available typically via a web-based interface 2.2. Recently, WSNs have raised considerable interest in the computing and communication systems research community. They have decisive advantages, compared with the technologies previously used to monitor environments via the collection of physical data. Whenever physical conditions change rapidly over space and time, WSNs allow for real-time processing at a minimal cost. Their capacity to organize spontaneously in a network makes them easy to deploy, expand and maintain, as well as resilient to the failure of individual measurement points. Wireless sensors are order of magnitudes cheaper than traditional weather stations connected to cellular networks. Although they remain expensive at the moment because they have yet to evolve from laboratory prototypes to off-the-shelf products, most analysts rely on Moore's Law to predict a price per unit within 5 to 10 years for light-weight applications using cheap off-the-shelf sensors, such as temperature monitoring in buildings.

Design Dimensions in Environmental Monitoring:

In any environmental monitoring application, many design dimensions need to be taken into account before choosing the appropriate technology to deploy. Based on the requirements of typical applications and our own experience, we propose the following dimensions to be the building blocks of any multicriteria decision for a system designer. Spatial scale: What is the size of the area to be instrumented? This can vary from single point if the phenomenon is to be observed at a single location, to local if the area spans a few hectares or square kilometers, to regional if an entire city or district must be instrumented, and even to global for larger areas (provinces, countries etc.).

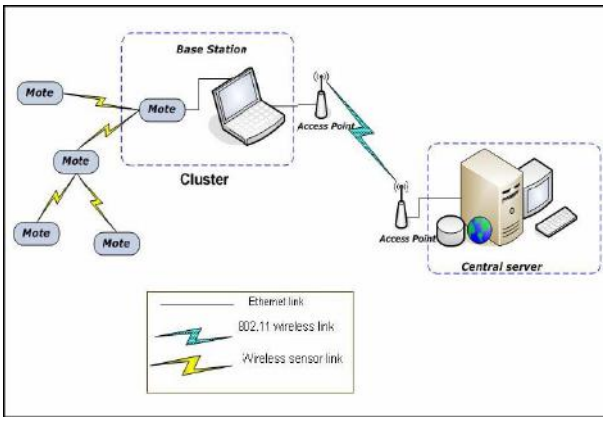

Figure 2 Typical (Hybrid) Wireless Sensor Network Architecture.

Time scale: How long must the phenomenon is observed? We can distinguish one-time phenomena, where a single measure is sufficient, short-term phenomena, lasting a few days or weeks, seasonal phenomena, lasting several months, and permanent phenomena, supposed to last an indefinite time.

Spatial variability: How many measurement points are necessary to model a given phenomenon over the monitored area? We can distinguish dense phenomena and sparse phenomena.

Time variability: How fast does the phenomenon evolve over time? We can distinguish fast varying phenomena, which vary at a time scale in the order of the second or the minute, and slow varying phenomena, which remain constant several days, weeks or more.

Responsiveness: What is the time period, within which the environmental information must be made available to the user? We can distinguish off-line systems, where data can be retrieved after an arbitrary long time and real-time systems, with stringent response-time requirements.
Non-accessibility: Is the area to monitor remote or difficult to access?
Non-Intrusiveness: Must the monitoring system be invisible and non-conflicting with any activity happening in the monitored area?

Deployment and Maintenance Costs What is the cost to deploy and maintain the system? This includes the hardware and software costs incurred by the system, and also the price of labor necessary to accomplish these tasks.

Sensors and Agriculture:

Sensors have been used in precision agriculture for years. They are used in convergence with other technologies like the Global Positioning System (GPS), Geographic Information Systems (GIS), miniaturized computer components, automatic control, remote sensing, mobile computing and advanced information processing and telecommunications. In the following per-parameter state-of-the-art review, we focus on sensors that work in an automated fashion, come at a reasonable price, and can be easily adapted to an existing system.

Soil Moisture: The soil moisture (or soil water) content is defined as the quantity of water contained in the soil. This quantity is calculated as a volumetric or gravimetric ratio between water and the soil. The most commonly used metric is water content per volume θ , which links water volume Vw to the total volume

Vt: $\theta = Vw/Vt$

There are several methods to assess this ratio. Direct Methods consist in weighing explicitly the water contained in a portion of soil, and in deriving the gravimetric or volumetric relative water content. Indirect methods consist in assessing this content by computing soil characteristics that change as a function of soil moisture.

WSNs IN AGRICULTURE:

Wireless sensor networks, a light-weight sensing and communication system necessitating little, if any, network configuration and maintenance, are entering their maturity phase. There are no examples of commercial applications to date. However, in recent years a number of investigations have been conducted by scientists in realistic agricultural settings.

Cattle Monitoring:

Work has been done to find the possibility of using WSNs to monitor cattle in a farm [4], [5]. Radenkovic and Wietrzyk [5] explore the potential of wireless sensor networks for nationwide cattle monitoring systems. Each wireless sensor acts as an extended RFID collar storing the identity and health status of the animal, which can be tracked at different locations, such as pasture or farm buildings. Each location is equipped with a base station opportunistically recording the information from the collars as the animals come into its range. Bishop-Hurley et al. [4], tested in-situ the responsiveness of cattle to electrical and audio stimuli designed to modify their behavior and prevent them from crossing a line in an experimental alley. Cattle were equipped with collars containing a GPS receiver for positioning and a wireless transceiver similar to a wireless sensor. The sensed data here is the positioning of the animal. Each collar communicated to a base station connected to a server responsible to analyze the received signals and to generate the appropriate cues. The goal was to design a virtual fencing application replacing expensive wired fences in extensive grazing systems.

Wireless Sensor Network for Water Quality Management:

In current scenario regarding Rajasthan our goal is to develop an infrastructure that will be used to measure water quality using Wireless Sensor Networks. The work focuses both on the design, implementation and deployment of an innovative wireless sensing application, and on the dissemination of results. The network is envisioned to be single-hop, with a periodic data collection paradigm. Samples are going to be collected once per day. Because the network is to be deployed in a remote region without easy access to technology and expertise, automated fault recovery is a major theme in the system design.

COMMON- Sense Net: a Decision-Support Tool for Agriculture:

Since 2001, drought has hit India repeatedly. A wave of farmer's suicides ensued, claiming probably tens of thousands of lives throughout the country, although official figures are lacking [6], [7]. What is certain, however, is that the principal cause of this outbreak is a vicious circle of borrowing

money to buy seeds, and getting into increasing debts because of crop failure [8]. Adverse climatic events can often be blamed, but farmers bear their part of responsibility, since they tend more and more to replace subsistence crops with cash crops, sometimes ill-adapted to the local conditions, often inefficiently grown due to lack of knowledge and experience. Farmers lack information and knowledge to face the new challenges raised by the shift of paradigm in their activity. Improved environment monitoring may be part of the answer. Although it cannot prevent drought or replace a political solution to the structural problems of Indian agriculture, environment monitoring can help to improve the lives of resource-poor farmers by mitigating the effects of extreme events, allowing the farmers to adapt their strategy to abnormal or changing climatic features when they occur. Information on the temporal and spatial variability of environmental parameters, their impact on soil, crop, pests, diseases and other components of farming, play a major role in formulating the farmer's strategy [9], [10], [11]. Today, large mechanized farms in developed countries take this factor into account and utilize the convergence of several technologies, including in-field sensors, geographic information system (GIS), remote sensing, crop simulation models, prediction of climate and advanced. Information processing and telecommunications. Similar techniques can be highly useful to farmers in the semi-arid regions of Rajasthan, provided they can be adapted to small land holdings and labor intensive, low productivity agriculture. However, traditional approaches are too expensive and do not scale down to the size of a marginal farmer's plot. Moreover, the implications of climatic variability are a largely unexplored area for agriculture research [12]. Designing and implementing a decision-support tool based on environmental information for Indian marginal farmers is an ideal occasion to investigate the use of wireless sensor networks in developing countries (see Fig. 3).

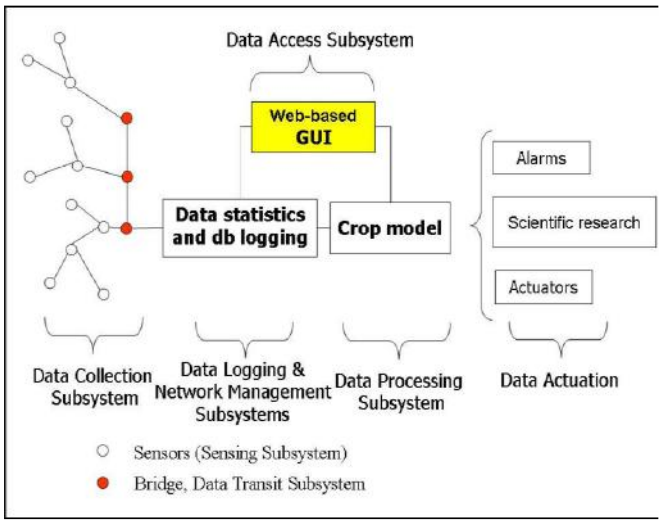

Figure 3: Technical components of a decision-support system for agriculture

CONCLUSION:

Thus we can promptly able to say that Wireless Sensor Networks are emerging as a fundamental block of the Internet of things that is likely to emerge in the years to come in highly. In this paper, we broadened the scope and sought to find relevant applications of this technology for issues specific to agriculture. We also highlighted the various issues in the context and showing the strengths of wireless sensor networks to tackle problems linked with the Millennium Goals.

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DOIs:10.2015/IJIRMF/ISRC2022/14 --:-- Research Paper

DELINEATION AND ENABLE TECHNOLOGIES OF INTERNET OF THINGS (IoT) TOWARDS SCIENTIFIC CENTERED APPLICATION RESEARCH

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Abstract: *Nowadays, Internet of Things (IoT) has become main innovation because of its extensive variety of conceivable application regions. The range of utilizations prompts a significant measure of client protection data dispersing, which is very dangerous for client security. The IoT is a sort of organization that interfaces everything with the Web in view of preset conventions using data-detecting hardware like sensors, actuators, and processors to accomplish savvy acknowledgments, area, following, checking, and organization. Eventually, it demonstrates that the articles speak with each other to do a huge undertaking. Client validation is significant in the IoT climate since it considers secure correspondence between the client and the gadget. The joining of confirmation-empowered advancements and IoT takes into consideration secure information recovery and access to the executives. Here, we will look at the present status of the IoT sense, highlights, key empowering innovations, and expected IoT extension.*

Key Words: *IoT (Internet of Things), Protocols, Sensors, Actuators, Processor, Technologies.*

INTRODUCTION:

The Internet of Things (IoT) thought was conceived by a person from the Radio Repeat ID (RFID) improvement neighborhood in 1999, and it has actually become more appropriate to the useful world for the most part because of the advancement of mobile phones, embedded and unavoidable correspondence, conveyed processing and data assessment [1]. IoT is an association of genuine things. The Internet isn't simply an associated with computers, but it has formed into an linked of devices of vehicles, PDAs, home machines, toys, cameras, clinical instruments and current systems, animals, people, structures, all related, all conveying and sharing information considering indicated shows to achieve savvy adjustments, arranging, following, safe and control and, surprisingly, confidential consistent electronic noticing, online update, process control and association [2] [3]. Regardless of what the correspondence channel, the maxim "IoT" suggests a greater idea of things, particularly typical ones, that may be examined, seen, found, and watched out for through an information distinguishing contraption, as well as worked over the Internet (whether through RFID, far off LAN, wide district associations, or various means). Close to the electronic devices we use reliably, normal articles furthermore integrate things we don't regularly see as electronic using any and all means, like food, clothing, seats, animals, trees, and water, as well as those that are the aftereffects of higher mechanical progress, like stuff and vehicles. The goal of the Trap of Things is to engage relationships among devices and any person or thing at whatever point, wherever, and ideally using some way, association, or organization.

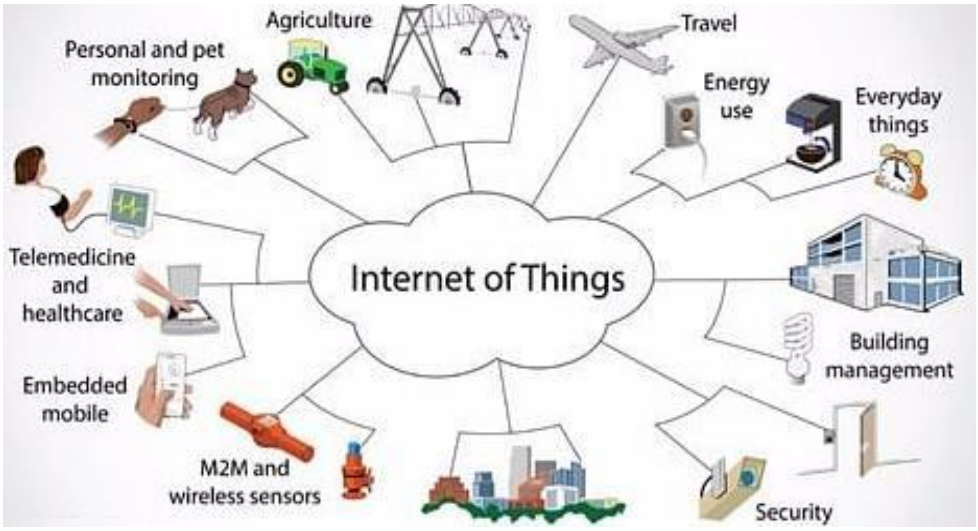

Figure 1: Internet of Things [4]

SIGNIFICANT CHARACTERISTICS:

Coming up next are the IoT's center ascribes coming up next are the IoT's center characteristics [3, 5]:

Interconnectivity: The Internet of Things (IoT) contemplates the interconnection of everything with the general beginning stage for data and correspondence.

Heterogeneity: IoT things can converse with different contraptions or association stages through various affiliations.

Things-related associations: Inside the imperatives of things, for example, security assurance and semantic sufficiency between certified things and their associated virtual things, the IoT is ready for giving things-related associations.

Resemblance in Association: Straightforwardness suggests joining a relationship, while comparability proposes the ability to share information creation and use.

Securing Endpoints: Affiliations and the information interfacing them all requires developing a security viewpoint that will scale the thriving of our own information and the flourishing of others' information.

EMPOWERING TECHNOLOGIES FOR IOT:

With the Catch of Things, the correspondence is relaxed through the Web to all that incorporate us. The IoT is essentially more than machine-to-machine correspondence, far-off sensor affiliations, sensor affiliations, RFID, WI-FI, GPS, 2G/3G/4G, GPRS, GSM, microcontroller, chip, and so on. These are seen as a lot of like the empowering movements that make "Internet of Things" applications conceivable. The Catch of Things is definitely not a solitary turn of events, but rather it is a blend of various stuff and programming improvement [2][3]. There is a heterogeneous blend of correspondence progressions, which should be changed as per address the essentials of IoT applications like energy suitability, speed, security, and resolute quality. Models unite wired and far-off progressions like WI-FI, Bluetooth, Ethernet, ZigBee, GPRS, and GSM. The fundamental drawing in improvements for IoT are [6][7]

Wireless Sensor Network (WSN):

A WSN contains orbited contraptions with sensors that are utilized to screen regular and conditions. A far off sensor network contains end focuses, switches, and facilitators. End focus focuses have several sensors related with them and the information is passed to a facilitator with the assistance of switches [8].The facilitator in addition goes most likely as the entrance that interfaces WSN to the web. Model - Barometrical circumstances checking structure, Indoor air quality seeing framework Soil dampness seeing construction, Perception design, and Flourishing checking system [9].

Cloud Computing:

It gives us the means to us to get to applications as online utilities. Cloud suggests a resource that is open in far-off regions. With conveyed figuring, clients can get to any resources from wherever, including databases, web servers, limits, any contraption, and anything over the web. Electronic stages are given by the coursed handling environment and are used for PC development. It shows a variety of figure thoughts [10]. Cloud propels into the new improvement when loomed over it. The dealing with resources is undeniably collected and administered properly using conveyed figuring [11]. The cloud can be a strong stage for taking care of and directing data from IoT contraptions. IoT coordination and conveyed enrolling through and through influence ordinary tasks.

Figure 2: Precision of Cloud Computing

Big Data Analytics:

It proposes a strategy for focusing in on enormous volumes of data or giant data. Mix of data whose volume, speed, or collection is fundamentally unreasonably goliath and unbelievable to store, control, cycle, and overview the data using standard illuminating records [14]. Neighbouring the associated devices, data come from many sources: section data, climate data, shrewd and clinical data, energy usage data, etc. This colossal number of data gives information about the area of clients of the devices, their development, their tendencies, their utilization affinities, their relaxing works out, and their endeavours, and so forth. In any case, extra information on how the establishment, stuff, and contraption are used. This is an emerging field, and as we try to sort out a satisfactory strategy for executing this new perspective and seat the value, the definition is changing [15] [16]. Enormous data is accumulated from various sources including social connection accounts, robotized pictures, sensors, and approach trade records. A few stages pulled in with checking enormous data out-

a) Data cleaning, b)Managing c) Processing d) Visualization.

Type of Enormous Data Evaluation:

- **Descriptive Analytics:** It consolidates watching out for the solicitation: What's going on? A lot of evident data is passed on during the major phase of data managing. Data coalition and model disclosure are kept up with by data mining procedures. Future probabilities, plans, and a perspective on potential outcomes are given by clear evaluation.
- **Prescriptive Analytics:**It contains tending to the requesting: what should be done? It is revolved around outline the magnificent move as started. Expressive assessment gives an apparent data, and sharp evaluation helps contemplate what could happen. Prescriptive examination uses these endpoints to find the best strategy.
- **Diagnostic Analytics**: It incorporates tending to the sales: why did it end up working? Brand name appraisal looks for the fundamental driver of an issue. It is used to close why something

happened. This type attempts to find and manage the purposes for events and ways of managing acting.

- **Predictive Analytics:**It consolidates tending to the requesting: What is no doubt going to happen? It integrates past data to contemplate what's to come. Everything really pivots picking. Sharp evaluation uses various techniques like data mining and man-made attention to destroy current data and make states of what could happen.

Communications Protocols:

They are the underpinning of IoT structures and enable affiliation transparency and speaking with applications. Correspondence shows grant devices to exchange data over the association. Different shows continually depict different pieces of a singular correspondence. To the degree that the distant IoT is the fundamental concern, different far off correspondence advances and shows can be used to convey the dazzling contraption like Web Show Development 6 (IPv6), over Low power Far away Individual Locale Affiliations (6LoWPAN), ZigBee, Bluetooth Low Energy (BLE), Z-Wave and Near Manage Correspondence (NFC). They are short appear at standard connection shows, while SigFox and Cell are Low Power Wide Locale Alliance (LPWAN).standard shows. A party of shows expected to collaborate is known as a show suite; when executed in programming they are a show stack. They are used in Data encoding and Addressing plans Different models used to take a gander at between the correspondence shows. Such standards coordinate association, topography, power, range, cryptography, spreading, balance type, synchronization with framework and power use. In Future work, this work will be loose to frame IoT applications and IoT security frameworks to really see the attacks in IoT, even new IoT attacks and raise a caution on the off chance that there ought to emerge an event of any anomaly[17][18].

Embedded Systems:

It is a mix of stuff and programming used to perform extraordinary tasks. It integrates microcontroller and chip memory, arranging units (Ethernet Wi-Fi connectors), input yield units (show verbalization, etc) and limit contraptions (streak memory) [19]. IpT deals with the improvement of sharp contraptions that makes number of task for the singular more clear. The fast contraptions are made using embedded structures. Embedded structures are the more unassuming than normal laptops that license the sensor devices to work in a strong manner to make an electronic system.It gathers the data and sends it to the internet.Embedded development can be consider as a downsized PC with committed works and used in the predictable environment. [20][21] The introduced system joins different parts, for instance:

- **Processor:** Processor is the major piece of any introduced system. It is all things considered called IC microcontroller. In the embedded structure IC is committed for playing out the entire task that ought to work by the plan.
- **Memory:** The memory part is likewise annexed with the embedded plans that can be used to store data and undertakings or set of headings that are to be executed to play out unambiguous task onto the submitted data thing. The memory an embedded development can have is Squash, ROM or Store memories and the size of memory changes starting with one structure then onto the accompanying. The memory in embedded structures goes from bytes to even MBs.
- **System Clock:** Structure clock is a multi vibrator system circuit that is obligated for playing out unambiguous endeavor onto the particular repeat. The circuit used for structure clock is 555 multi-vibrator IC.
- **Peripherals:** The introduced structure integrates different ports that can be used to take input from outside world or can be used to give result to the outcome world. By using these ports we can interface sensors and can send and get data to or from the sensors. Embedded structures used in Models - Electronic camera, blue shaft player, music player, Present day robots and Remote Switches, etc.

CONCLUSION:

IoT looks out for another Internet revolt. By breaking down the area of IoT data, geologies, essential arrangement, practices, degrees of progress, and applications, this study shuts the sketch and

expected increase of IoT-based structures toward the present new rising limits. It is a crushing assessment issue for experts in embedded, programming, and information improvement because of its gigantic number of heading districts and heterogeneous blend of many embedded and correspondences headways in its plan. Irrelevant cost laptops, cloud affiliations, gigantic data upgrades, evaluation, and versatile advances have all high level to where unimportant true contraptions related with a connection could assemble and share data without the requirement for human intercession. In this hyper connected universe, each center can record, notice, and change each arranged effort between related objects.

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EXEMPLIFICATION AND IMPLICATION OF INTERNET OF THINGS (IOT) AND HEALTHCARE SYSTEM

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Abstract: *The IoT (Internet of Things) is a collection of physical objects/things that are equipped with sensors, software, electronics, and network connection. This network enables such things to collect and share data. Through the use of existing network infrastructure, the IoT enables remote sensing and control of machines. The IoT is made possible by the most current developments in communication technology, smart devices, and Internet Protocols (IPs). In paper try to exemplification and describe the appropriate description of IoT and Healthcare via describing definitions, vital review literatures, architecture, role and benefits.*

Key Words: *IoT (Internet of Things), Sensors, Healthcare, IPs (Internet Protocols), M2M (Machine-to-Machine), Cloud Computing.*

INTRODUCTION:

The healthcare sector is in a terrible condition of distress. The global population is ageing, healthcare expenses are greater than ever, and chronic diseases are becoming more common. [1] We are rapidly moving toward a society in which the majority of people lack access to basic healthcare, a sizeable portion of the population ages and becomes unproductive, and people are increasingly prone to chronic diseases. Is the world really ending as we predicted? IoT app development might be useful in any situation. While technology cannot stop the ageing of the population or totally eradicate chronic illnesses, it may at least make healthcare more accessible to consumers by offering them reasonably priced medical services. Medical diagnostics account for a significant amount of hospital costs. Technology allows regular medical exams to be performed at the patient's home instead of at a hospital, which is more hospital-centric (home-centric). [2] Patients that obtain the right outcomes will have lower healthcare costs. A new paradigm known as the IoT is extensively used in many different sectors, such as healthcare.

By the year 2025, it is anticipated that all gadgets will be online, which would increase the total number of online devices. By 2030, the IoT will be connected to 500 billion things, according to Cisco. According to Telefonica, by 2030, everyone will possess an average of 15 connected gadgets and 90% of cars will be IoT-linked. However, a 2015 study predicted that by 2020, there would be over 250 million linked automobiles available worldwide—an increase of 67%. The IoT provides a variety of commercial prospects that let businesses develop original methods and models to put their ideas into practice. [3]

EXEMPLIFICATION OF IOT:

The phrase "Internet of Things" is a broad concept in which "things" such as everyday items, locations, and surroundings that may be linked to one another through the Internet are considered. The IoT refers to the interconnection and communication between physical devices that have electronics integrated into their design. IoT-based technology will provide more and more services in the next

years, dramatically altering people's routines. IoT has made significant progress in a number of industries, including healthcare, energy, agriculture, gene therapy, smart homes and cities.[1][7] A network of networked computer devices that are inserted into everyday objects and allow them to transmit and receive data is known as the IoT. The Internet of Things (IoT) is a network of everyday objects that communicate with one another using software, electronics, network connection, and sensors. This system provides a means for these items to communicate and exchange information with one another. People with embedded heart monitors, farm animals with biochip transponders, automobiles with built-in tyre pressure monitors, and so on are all instances of "things," which may be either natural or artificial and are able to be assigned an IP address and send data via a network [2][7].

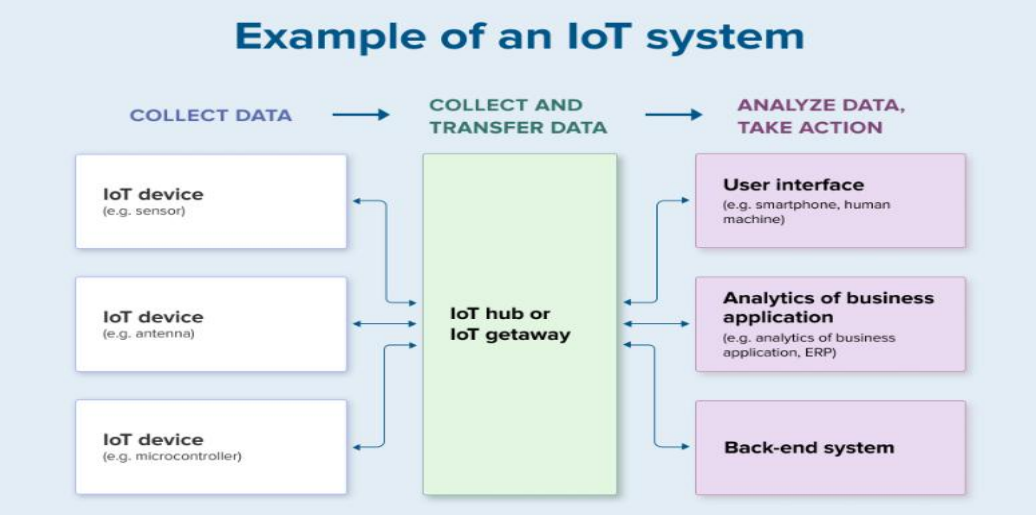

Figure 1: Illustration of An IoT System

As the world becomes more reliant on the internet, which allows for worldwide communication, some linked devices are required to meet requirement. Almost all industries are taking advantage of this IoT trendy technology in order to flourish because of it connects numerous devices, collects, and share data. It is increasingly being developed for a variety of applications [14][15].

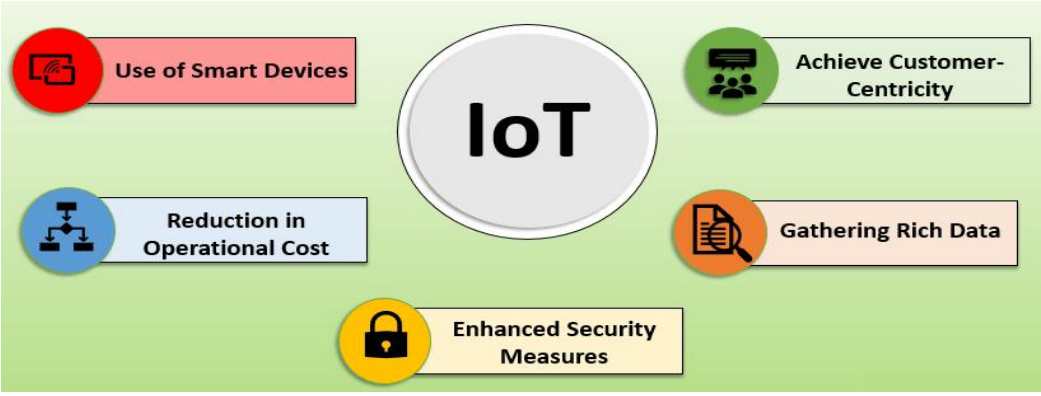

Figure 2: Benefits of IoT[16]

FOUR STEP STRUCTRUAL DESIGN OF IOT:

The IoT is more than simply regular consumer gadgets. ICT will ultimately demand you to construct an infrastructure to support it. Energy businesses are already using networked sensors to analyse turbine vibrations. [4] It send that data via a network to computing systems, which analyse it and estimate when equipment will fail and require maintenance. It utilise sensors to measure various factors in order to improve their productivity. It designed architecture provides operate sensors to continually measure the data and expedite delivery if storage or transit or display to monitor. IoT's four-

step structural design/architecture may be thought of as a series of steps (See Figure 3). The four processes are linked together so that data is acquired or processed at one level and is used in the ones that follow. Adding values to the process produces intuitions and presents attractive marketing options.[5][6]

Step 1: The initial phase is the deployment of connected devices, like actuators, video systems, sensors, detectors, monitors, etc. These gadgets gather the information.

Step 2: To be processed further, analogue data generally collected from sensors and other devices has to be integrated and converted to digital data.

Step 3: After being aggregated and digitized, the data is pre-processed, standardised, and moved to the data centre or Cloud.

Step 4: In step four, the final data is handled and appropriately analysed. Utilizing advanced analytics on this data yields practical business insights for wise decision-making.

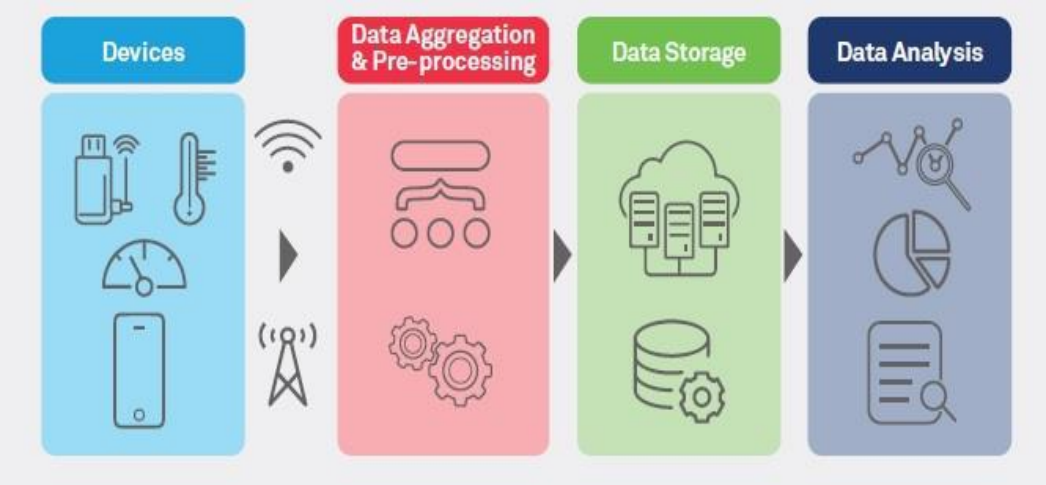

Figure 3: The Four Stages Solution/Structural Design of IoT

IMPLICATION BASED REVIEW LITERATURE:

During the preceding several decades, the average life expectancy of people living in industrialized countries has increased considerably, according to **Damian Dziak1 et al. (2017)** [8]. Those who are elderly and live alone may need help due to problems with their dementia symptoms, mobility, or other health issues. A self-driving system might be useful in these situations. Create an interior and outdoor information system with the help of the IoT. Methodology (DM) is offered that analyses the design aim from stakeholders, contracting authorities and future consumers based on a comparative investigation. DM is presented. There is an approach that includes PDR (pedestrian dead reckoning), holding, and the DT (decision tree) technique.

Nikunj, et al. (2018) [9] has represented, "Heart Attack Detection and Heart Rate Monitoring Using IOT". In this study, a heart attack may be identified using the measured heart rate from an IOT device. In this case, the author utilized an Arduino board, a Wi-Fi module, and a pulse sensor. Once the system is configured, the pulse sensor can start detecting heart rate data, and the patient's heart rate will be shown on the LCD screen. Wi-Fi module may be used to send data over the internet. Based on the heart rate shown on the LCD screen, it is possible to tell if a person is healthy or not by examining their heart rate. The system has been given limits; the patient's heart rate is tracked, and the system will quickly send an alert message if the heart rate falls or rises below a certain level. They have executed a programme that accurately tracks and monitors the patient's heart rate and sends alerts when a heart attack could be imminent.

Raghavendra K K et al. (2018) [10] has published an article "An IOT Based Smart Health care system using Raspberry Pi". A patient's health metrics are tracked using an exclusive sensor. Raspberry Pi platform is used for interaction with IoT. The Raspberry Pi is a device that provides a cost-effective, small platform for a Linux server. IoT and the Raspberry Pi together represent a brand-new technology

that is revolutionizing the healthcare industry. Raspberry Pi delivers a variety of sensor-derived data to databases. Several benefits exist for cloud computing, including flexibility, high automation, cheap cost, etc. Customers may create and deploy their apps on virtual servers due to the characteristics of the cloud. One of the advantages of cloud computing is that it makes it possible to store massive volumes of data on remote computers. This paper has focused on the concept of isolating cloud computing from wireless sensor networks. Sensors including blood pressure, ECG (AD8232), temperature (DS18B20), and heartbeat begin to receive data as soon as they are linked to the patient's body and transfer it to the database. The collection, storage, and distribution of patient data are handled through cloud-based services.

Tamilselvi, V., et al. (2020) [11] The author has presented the real time health monitoring of coma patients. This paper includes dedicated sensors like eye blink, SPO2 sensor. It also includes accelerometer sensor to track body movement. The purpose of this study is to continually monitor the oxygen saturation %, body movement, temperature, blood pressure, heart rate, and other parameters using the appropriate sensors. The gadget receives the recorded data, and if the value exceeds, an alarm message is delivered to the doctor using cloud server and GSM technology.

IOT IN HEALTHCARE SYSTEM:

IoT-enabled gadgets have made it feasible to remotely monitor patients in the healthcare sector, unlocking the potential to preserve patient safety and health and allowing clinicians to provide outstanding treatment. Patient satisfaction and participation have increased as doctor-patient interactions have become easier and more efficient. Keeping tabs on patients' health through remote monitoring also helps reduce hospitalization and prevent readmissions. IoT has a vital effect on minimizing healthcare costs and improving health results of patient [7][12]. IoT is undeniably shifting the healthcare sector by influencing the way in which gadgets and people collaborate to provide new types of medical care. Patients, caregivers, medical professionals, healthcare facilities, and payers all stand to benefit from the healthcare industry's increasing use of IoT applications. Smart healthcare is very important in healthcare applications because of the function it plays in monitoring and tracking patients' medicines through the use of sensors and actuators. The IoT is used in healthcare settings to monitor patients' vitals through the installation of sensors.

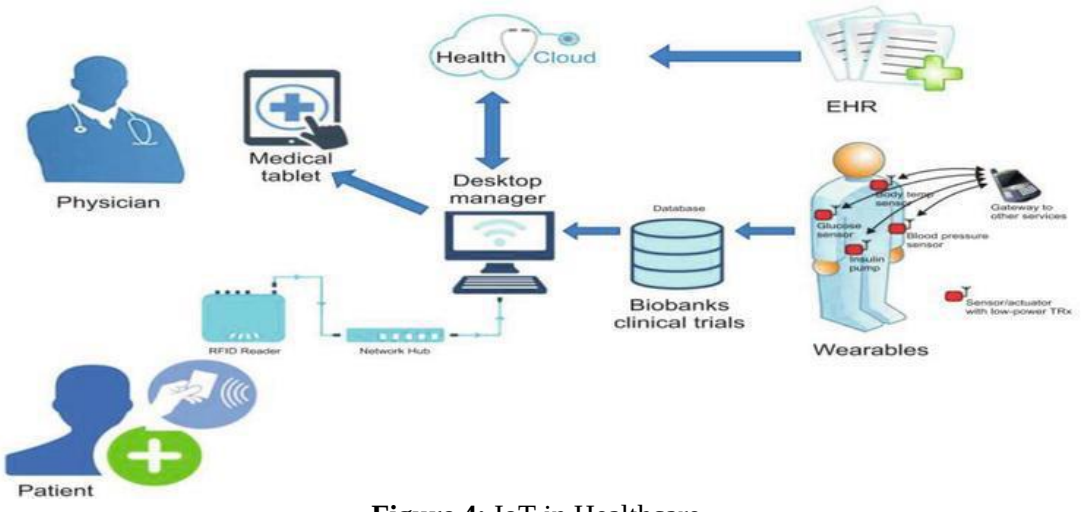

Figure 4: IoT in Healthcare

The patients' data is gathered, analysed, and sent wirelessly to central processing centres where the results are analysed and decisions made. For example, Masimo Radical-7 remotely monitors patients and provides their data to medical staff. With the advent of the IoT, wearable gadgets may automatically inform the nearest Wi-Fi network and hospitals to request an ambulance based on the person's health state, like her heartbeat, eliminating the need for a third party to notify the facility of an accident.[10][13] Due to the COVID-19 epidemic taking the global spotlight, the need of hygiene in healthcare has increased significantly. The Internet of Things provides the necessary infrastructure at

the appropriate time for contactless applications and remote connection, paving the way for cleaner healthcare administration.

IoT in healthcare offers a number of key benefits, including:

- **Cost-cutting:** With the help of IoT, patients may be monitored in real time, cutting down on unnecessary visits to the doctor, lengths of stay in the hospital, and readmissions.
- **Better Treatment:** It allows for total transparency and enables clinicians the freedom to make judgments using just the most up-to-date information. Prior Illness Continuous patient monitoring and real-time data might aid in early illness diagnosis based on symptoms. Using real-time data, doctors may be more preventative with their medical treatment.
- **Error reduction**: Information retrieved from IoT gadgets not only supports in wise decision, but also ensures faultless healthcare operations at reduced system costs.
- **Management of Medical Equipment and Medications**: One of the major issues in the healthcare industry is the organisation of pharmaceuticals and medical supplies. These can be monitored and used more efficiently and economically because to the prevalence of linked devices.

CONCLUSION:

The IoT (Internet of Things) Technology is through of vast possibilities by the furthermost contemporary expansions in Information and communication technology (ICT), The IoT is an assembly of physical objects/things that are well-appointed with sensors, program code, and connectivity. This connected network empowers such things to gather, accumulate; process and segment wise communicate to each other or display somewhere. As concluded IoT is the practice of obtainable set-up structure facilitate to remote recognizing, monitoring and regulator of devices. This paper described the applicable explanation of via defining IoT, self-motivated review literatures, four step solutions for communicational design, role and its benefits especially focused on significant contribution into healthcare system and monitoring the captured data.

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The influence of the intellectual thoughts of Spaniards about the freedom of the indigenous people of the Americas in XVI and XVII centuries

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Abstract: Freedom of the indigenous people of America was a result of not only different efforts taken up by people, but also of various happenings. Some reasons that resulted in the legislation of various Spanish and Portuguese Laws to assure freedom to the natives of America during XV and XVI centuries, were the ideas and the thoughts of the intellectuals from various Spanish universities, about the freedom of these people. We can remember that during the initial days of the Spanish colonization, with the famous sermons of Fr. António de Montesinos in Haiti in 1511, a question about the legitimacy of the catholic kings to rule over America and its indigenous population. In fact this question is a complex one. The humanists among religious leaders questioned the right of the catholic kings to undertake war against the indigenous people and subjugate them. The catholic Church of that time considered wars against the indigenous people as a pure spiritual mission, as it had received the approval of the Pope.

We get an explanation about the evangelization of the infidels in the words of Prof. Rakesh Bartabyal:

> "*Conversion as a mode of converting a world view has been broadened to include all efforts at assimilation, i.e., non-religious and religious [….] Fr. Vieira in Brazil, for instance thought of a Portuguese universal plan in which the native population could be incorporated*[1]".

For this purpose, apart from using force, the Jesuit priests also try to use other pacific methods to make the indigenous people accept the Catholic faith. This use of different methods of conversion present a philosophic question before us. The Europeans show discrimination in their treatment of the indigenous people as against whites. We can also see that this issue of discrimination does not appear only in theory but also remained in practice. It is also essential to consider the methods of administration in those newly occupied territories and their political organization.

Still we find some initiatives to protect the freedom of the indigenous people, by promulgating the following Laws in Spain: *Leyes de Burgos de 1512, Leyes Nuevas de 1542, Ordenanzas de 1573*.

There are a lot of literatures that are dedicated to these issues, particularly in the writings of Bartolomé de Las Casas, who was an untiring defender of the indigenous people and certainly one of the most radical authors about the issue of Spanish dominion over America. Bartolomé de Las Casas is not a lone warrior. Among the other authors, there are some Jesuits of the "second generation" of the *Escuela Española de La Paz*, whose doctrines have influenced Fr. Antonio Vieira and his writing about the freedom of the indigenous people.

It is essential to mention that the issue of slavery of the indigenous people come up in different terms for Spanish America and for the Portuguese occupied territories in Africa and Brazil in the 16th and 17th centuries. On reaching the American shores for the first time, Christopher Columbus wrongly thinks that he had reached India. The catholic kings not only believe the wrong report of Columbus in the first instance, but also continue believing it for many years. Due to this reason also, they would not

[1] Bartabyal, Rakesh. "Writing the History of Conversion and Inquisition in Expanding Colonial World" *Hispanic Horizon*, Univerdade Nehru, Nova Delí, 2000.

treat the indigenous people of America like the people of Africa. Columbus, thinking that he had reached the land of Great Khan, where "it is believed that they talk about Christ", Columbus would go on to consider immediately those indigenous people as free people. As a result, in 1500, an assembly of legal experts and theologians, called by the catholic kings, declare the Amerindians as free people having an equal standing with the citizens of Spain.

Starting from the Dominican priest Fr. António de Montesinos and during the XVI century, the Spanish religious authors write against the slavery of the indigenous people by force. They protest against slavery because of their belief that the indigenous people also follow the same GOD as the Europeans do. These authors do not talk about natural justice, nor do they talk about the principles of moral and of religion. We would be curious to note that they concede rights "positively", immediately recognizing the difference between the Amerindians and the heretics who are at war against the Christian world.

At the same time, some radical elements deny freedom to the indigenous people citing their nature. A humanist, Juan Ginés de Sepúlveda tries to show in his *Democrates secundum*, that the indigenous Americans have the nature of being a, "*natural slave*" referring to the policy of Aristótle about the indigenous people who are not Europeans. But this idea does not reveal the main currents of the thoughts of that time. In this case, we can look at the famous "*Controversia de Valladolid*[2]" (1550-51) between Juan Ginés de Sepúlveda and Las Casas, which ended in the prohibition of the book written by Sepúlveda, with the initiatives taken by the Universities of Alcalá & Salamanca.

The *Leyes Nuevas de 1542*, that simply and completely prohibit the slavery and subjugation of the indigenous people, including those who were caught in just wars, result in the colonizers being stranded without workers in their mines and plantations. During this time we see Sepúlveda taking an extreme stand in favor of the colonizers. In 1539, the great theologian Francisco de Vitória categorically explains about the indigenous people as:

> "*La esclavitud natural solo puede existir en los casos excepcionales, particularmente en los individuos privados de la razón. Pero, eso no es el caso de los indígenas americanos, que son seres razonables, que se puede observar de su organización social y su religión*[3]."

His disciple Domingo de Soto, spreads this idea later, almost among all the Spanish theologians and legal experts during the XVI & XVII centuries.

There is also another imperialist idea that is prevalent during that time in the universities of Iberian Peninsula: as per this idea the Pope assumes the authority over the infidels, and in virtue of that authority, he can grant rights to the Christian rulers over the infidels. In this debate within the Church, Francisco de Vitória takes a stand against the doctrine of Hostiensis[4] (Ou Ostiensis cujo nome próprio é Henricus de Segusio, cardinal de Ostie, o canonista mais famoso do século XIII). All people, being rational and logical, have the right to enjoy natural freedom, irrespective of their religion. As per Vitória this right to enjoy natural freedom must be respected by everyone, including the Pope, whose authority over the believers is only spiritual and that authority cannot be extended outside of the Church over non-believers. Due to this reason we can say that the Sovereign Pope does not actually possess any power to grant rights over the infidels, not over the territories in which they live.

Vitória denies the famous bulls of Pope Alexandro VI, through which rights were granted to the rulers of Spain to occupy the American territories and to wage war against the indigenous people who live there. Vitoria goes on to claim that the rulers of Spain can only have the right to carry out business dealings and to evangelize the indigenous people of America and not any right to wage war against them. We can say that Fr. Francisco de Vitória thought of evangelizing in a peaceful manner hoping that the indigenous people would accept that kind of evangelization without the use of any force, freely, without any fear. These ideas are not truly new ones, but their being put together shows a progress. From Spain, these ideas naturally pass to the other universities of the Península, where they would be taught by the famous theologians of that time, including, Martín de Ledesma, Domingo Bañez, Juan de la Peña, and Jurists like Diego de Covarrubias, Vasquez de Menchaca, Baltasar de Ayala. Finally, these ideas also manage to cross the atlantic to the first or the earliest universities of América. As we can see, in Spain there was always a voie to proclaim that the indigenous people have rights to

[2] Carro, Venancio. *La Teologia y los Teologos-juristas Españoles ante la Conquista de América*, Salamanca, 1951.
[3] Zavala, Silvio. *Los Esclavos Indios en Nueva España*, El Colégio Nacional, México, 1994, p.94
[4] Ou Ostiensis cujo nome próprio é Henricus de Segusio, cardinal de Ostie, o canonista mais famoso do século XIII.

enjoy freedom. These ideas emerged from the universities of the península and the legal professionals and the theologians who work as counsellors to the officers who exercise royal authority and power. It is evident that the concepts of the Spanish theologians are put together in the Bull "Sublimis Deus" in 1537, that condemns equating the infidels with the wild animals. In his book the historian Garcia Gallo writes:

> "*La bula considera a los que mantienen su argumento que los infieles deben ser sometidos para nuestro servicio como animales, que son inaptos para la fe católica, como los hombres que pueden hacer todo lo posible para satisfacer su avaricia*[5]".

Pope Paul III takes a stand against these concepts of using force to evangelize the infidels, and declares that:

> "*Los infieles deben ser tratados hacia la fe Cristiana por la predicación de la Palabra Divina y el ejemplo de la vida honesta*[6]".

In this way, we observe that there is a slow movement started by the religious leaders to free the indigenous people from slavery. But it is also pertinent to observe that the Crown has its own purpose of obtaining workers from among the indigenous people to develop the economy of their recently established colonies. They also do not bother about the method used for obtaining workers, whether it is by force or by any other means. We can also see that the catholic kings gradually accept the concepts of natural freedom of the indigenous people and begin to impede the attacked of colonizers against this "freedom of the indigenous people".

If we objectively study the process of development of the colonization in América and in África, we can find the fact that slavery is not considered as a practice against human rights during those days. In 1517, Fr. Bartolome de Las Casas himself recognizes the need to import black slaves to the Spanish American territories in order to strengthen the process of colonization started by the Spaniards.

As a result, the Spanish theologians and legal specialists who belonged to the "second generation of the Spanish seminary" do not form a clear and strong opinion againsr the slavery of the indigenous people. On the contrary, they accept this activity of enslaving as an unavoidable process of colonization. We also find another type of acceptance of slavery by heredity, which is about the father or the mother transmitting the slavery to their children. Some authors, to some extent, accept slavery by a contract – a point at which parents sell their children because they do not have the means to feed them. There is another problematic point of view as per which, the slaves can become object of transactions, because of not having legal right. The buyer acquires the slave as a merchandise, with all the legitimacy to possess "it". We can also cite the opinion of Silvio Zavala who wrote:

> "*El combate contra la esclavitud natural sin duda nos lleva a la esclavitud legal*[7]"

Gradually the Crown begins to consider the already converted indigenous people as citizens and protects them from the attacks of not yet converted indigenous people groups. At the same time allows force to mitigate rebellions of the indigenous people against their power and authority.

Under pressure from the religious peple and other defenders of the freedom of the indigenous people, the emperor Carlos V completely prohibited the slavery of the indigenous people, "*bajo ningún concepto*[8]", which is summed up in the *Leyes Nuevas de 1542* and in the *Ordenanzas de 1573* recognizing that the indigenous people can enjoy their political rights and their independence, "as per their natural right", till they on their own do not voluntarily submit themselves to the authority of the Spanish rulers. It is true that there is a clear difference between the decrees declared in Spain and their implementation in the colony. In fact the colonizers continued to capture Amerindians as slaves, especially in case of war. On the other hand, when the sugar-cane economy developed, the scarcity of the workers went from bad to worse and a solution to this problems was sought by introducing African slaves who came to the province in XVI century. They were mainly from Sudan, purchased by the Portuguese from the eastern coasts of África[9]. We can observe that this importing of slaves from África

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[5] Carro, Venancio. *La Teologia y los Teologos-juristas Españoles ante la Conquista de América*, Salamanca, 1951.
[6] Garcia Gallo, Alfonso. *Los Origenes Españoles de las instituciones Americanas, Estudios de Derecho Indiano*, Real Academia de Jurisprudencia y Legislación, Madrid, 1987.
[7] Zavala, Silvio. *La filosofia política en la Conquista de América*, Fondo de cultura económica, México, 1993.
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[9] Mauro, Frédéric. *Le Portugal, le Brésil et l'Atlangique au XVIIe siècle (1570-1670)*, Fund. Calouste Gulbenkian, Centro Cultural Português, Paris, 1983, pp. 171-177.

reduces the need to enslave the indigenous people in the Spanish occupied territories of América. The main reasons for importing of African slaves are the following:

- Indigenous people are incapable of carrying out hard tasks, like the strong Africans;
- Indigenous people could easily disappear into the interiors of the forests that are not accessible to the colonizers;
- African slaves are less capable of rebelling against the colonizers because they found themselves in a land that was completely unknown to them;
- Capturing the indigenous people also poses high risks, because their companions could attack the colonizers in retaliation, and at times with the help of other European enemies of the Iberians like the French and the Dutch;
- No strong voice of a religious leader to speak up against the slavery of Africans in América.

May be, all the religious leaders do not protest this import of slaves from Africa because they believe in the curse pronounced by Noah against his son (Ham as per older translations):

> "*Cursed be Canaan!*
> *The lowest of slaves*
> *Will he be to his brothers*[10]"

It is believed that Canaan son of Cam (or Ham) is the forefather of black Africans. In continuation to these verses, we can also observe in the same book of Genesis, how, Joseph, one of the children of Israel, was sold as a slave to the Egyptians in the following words:

> "*Meanwhile, the Midianites, sold Joseph in Egypt to Potiphar, one of Pharoah's officials, the captain of the guard*[11]."

In this manner, Joseph serves the egyptians, first as a slave of an official of pharaoh and later as a prisoner for almost 13 years. Joseph gains not only his freedom, but also receives command over the Egyptians conceded by the authority of Pharaoh himself[12], by managing to interpret the dreams of the king of Egypt. As per the writer of Gênesis, a few years after getting command over Egyptians, the same Joseph who was a slave previously manages to enslave his erstwhile masters, the Egyptians themselves[13], thus subverting the previously established order in Egypt. But, after a century passed by, the Egyptians once again enslaved the Hebrews, who were the descendants of Joseph and his brothers, the children of Israel[14]. Also the famous historian C.R. Boxer comments about the acceptance of slavery in his book "A Igreja e a Expansão Ibérica" in the following words:

> "*A Bíblia, e principalmente o Velho Testamento, servia de arsenal de textos de apoio não só acerca da validade da escravatura e do tráfico de escravos, como também dos preconceitos raciais contra os negros. Segundo opiniões diversas, era suposto serem descendentes de Caim, que fora amaldiçoado por Deus, ou de Ham, amaldiçoado por Noé, e estavam por isso condenados à servidão perpétua. É evidente que os defensores dos negros, como Sandoval, podiam também citar as Escrituras a seu favor, dando como exemplo a Rainha do Sabá e Gaspar, um dos três Reis Magos, mas estes argumentos não eram tão convincentes. Também o bom senso era ocasionalmente utilizado para combater os preconceitos raciais. « E pode haver » - perguntava retoricamente António Vieira no sermão da Epifania de 1662 – « maior inconsideração do entendimento, nem maior erro do juízo entre homens, que cuidar eu que he-de ser vosso senhor porque nasci mais longe do sol, e que vós haveis de ser meu escravo, porque nasceste mais perto? » E ainda: « Um etíope que se lava nas águas do Zaire fica limpo, mas não fica branco: porém na água de baptismo sim, uma coisa e outra. » Todavia, esta antecipação do poema protestante « Sou negro, mas oh, minha alma é branca », não impediu Vieira de defender até ao fim dos seus dias, como Las Casas o fizera durante quase toda a sua longa vida, que a melhor forma de assegurar a*

[10] Gênesis 9:25 de *Bíblia Sagrada*, Nova Versão Internacional, Editora Vida, São Paulo, 2001.
[11] Gênesis 37:36 de *Bíblia Sagrada*, Nova Versão Internacional, Editora Vida, São Paulo, 2001.
[12] Gênesis 41:44 de *Bíblia Sagrada*, Nova Versão Internacional, Editora Vida, São Paulo, 2001.
[13] Gênesis 47:22 de *Bíblia Sagrada*, Nova Versão Internacional, Editora Vida, São Paulo, 2001.
[14] Gênesis 47:22 de *Bíblia Sagrada*, Nova Versão Internacional, Editora Vida, São Paulo, 2001

liberdade dos Ameríndios era aumentar a importação de escravos negros da África Ocidental[15]".

Apart from this, we can see that there is no contradiction between the freedom of the Indians recognized in the natural human rights and their forced labor. As per the historian Garcia Gallo, the XVI century was very far from the French Revolution and the principle of equality before law[16]. In the beginning of colonization the indigenous people were declared equal to the workers from Spain, but we can find that this assimilation is very artificial. The fact that the Amerindians are incapable of working very hard as the European workers. In this context various measures of protection are taken, for the purpose of teaching the Amerindians about the principles of European civilization and religion. With the intent of teaching the Amerindians about European culture and catholic religion, the Spanish established institutions like the *encomienda*. These institutions gave rise to a number of abuses power by the colonizers and gave rise to controversies. This process of acculturation took the slavery of the indigenous people for granted, and accepted it. Particularly among the disciples of Francisco de Vitória, a concept of considering the indigenous people as "*children*" developed and particularly the religious leaders and in general the Spanish must assume the moral responsibility of protecting, educating and civilizing these "*children*". This responsibility of taking care of these "*children*" was handed over to the religious orders, first to the Franciscans and later to the Dominicans and lastly to the Jesuits. In return these authorities can make them work for a nominal salary. In this way the catholic king began to exercise an authority over the indigenous people and facilitate the process of conversion, ensuring that they received a human treatment and not an inhuman treatment as they received before. Thus, a harmonious solution was brought in between the colonizers and the religious leaders in the issue of the slavery of the indigenous people. In this condition, the catholic king also receives an authority over the indigenous people with the approval of the religious orders working in América.

The *Escuela Española de La Paz*, develops and disseminates the ideas about the freedom of the indigenous people, resulting in not only the issue of Bull *Sublimis Deus* of 1537, but also exercising influence over the Jesuits who received the opportunity to accompany the governor Tome de Sousa to Brazil during 1549. In fact, the first Portuguese Jesuits are the academicians from universities that have contact with the intellectual world. Their brothers in Brazil were obviously influenced by this intellectual world, which is seen in their voluminous correspondence of that time. These Portuguese thoughts were also influenced by the theological and legal controversies arising out of the *Escuela Española de La Paz*. We can find this in the voluminous correspondences exchanged by these brothers during that time.

From the year 1540, in the writings of the Portuguese we can see ideas that are close to the new concepts of Vitória developing, and we can find them especially in the anonymous "*Tratado sobre a guerra que será justa*[17]". Some famous Portuguese theologians, including Martin de Azpilcueta Navarro, Martin de Ledesma, Francisco Suarez, Luís de Molina, had received their religious training in the universities of Salamanca e Alcalá, where they participated in the debates about the issue of indigenous people, residing in the islands occupied by the Catholic Kings.

We can also see a suggestion made by the Jesuits to have the indigenous people as allies to be able to strengthen the process of colonization and avoid incursions by European rivals. Due to this reason the Jesuits also feel that their mission of evangelizing the indigenous people and gaining their friendship form an integral part of the new strategy of colonizing the province effectively. These thoughts and suggestions are strengthened by the support from the Crown that come in the form of "*sesmarias*" (1550) to get the revenue needed for evangelization[18]. This also results in the formation of a council in 1566 to take measures that reconfirm the protection of the Amerindians by the religious groups. These measures are the ones that were to inspire the first law about the freedom of the indigenous people of Brazil, adopted by the king Dom Sebastião in 1570, prohibiting the slavery of those Amerindians who were already converted. Only those native people who were captured in a just war waged by the king or by the governor general against those native people groups accused of plundering, murdering of the

[15] Boxer, C.R. *A Igreja e a expansão ibérica (1440-1770)*, Edições 70 Lda. Rio de Janeiro, 1978. p. 51

[16] Garcia Gallo, Alfonso. *Los Origenes Españoles de las Instituciones Americanas, Estudios de Derecho Indiano*, Real Academia de Jurisprudencia y Legislación, Madrid, 1987.

[17] Dias, J.S. da Silva. *Os Descobrimentos e a Problemática Cultural do Século XVI*, 3ª Edição, Ed. Presença, Lisboa, 1988, p. 182.

[18] Leite, Serafim. *História da Companhia de Jesus no Brasil*, Livraria Português, Lisboa, 1950.

Portuguese, or the other free Amerindians or other slaves for the purposes of cannibalism. Taking into consideration the work done by the Jesuits, the administration of the Amerindians was officially entrusted to the Society of Jesus in 1571. Those aspects of the Spanish laws, like *Leyes Nuevas de 1542 de la América española,* exercise their influence for the formulation of the Portuguese law of 1609 that prohibits the slavery of the indigenous people in an absolute manner. We can observe the following reasons due to which the Spanish laws influenced the promulgation of laws in Brazil:

- Jesuits did not oppose the working of those native people groups in those villages that they administered.
- They also passively accepted that the native people should serve the colonizers, if they stay under their power.
- The colonizers, on their part, suggested to the metropolitan authorities that they should introduce in Brazil an administrative regime like the Spanish encomienda.

This type of conflict between the religious leaders and colonizers only continued as a philosophical debate about the issue of "freedom" of the indigenous people. In the Portuguese Latin América, we can observe almost a conflict of two methods of colonization. The first method is by the religious leaders who commit their lives to assimilate the infidels in the European culture. The second is by the colonizers who subjugate the indigenous people and use them to strengthen the imperialist economy of Portugal. The patrons of both sides tried their level best to demonstrate that their system serves better the interests of the kingdom. The Jesuits, who work as missionaries in Brazil, influenced by the Spanish thoughts about freedom, never forgot to remind the crown that the indigenous people are very useful, especially when they fight alongside Portuguese troops in the warfront. Fr. António Vieira also observed that the process of colonization must be carried out with the alliance of the indigenous people because the colonizers are not sufficient in number to carry out this process. He wrote the following in his letter to the king, indicating this need for alliance with the indigenous people for an effective resistance against the rival European forces who invade the Brazilian territory during various occasions:

> "*E porque a dita empresa de nenhum modo se podia conseguir sem o socorro dos índios da terra, cujas aldeias estavam todas já obedientes aos Holandeses, o dito António Moniz falou secretamente ao principal Joacaba, Mitagaia, Henrique de Albuquerque e outros, que quisessem tomar as armas contra os Holandeses, e prometendo-lhes em prémio desta acção, se a conseguiam, que ele se obrigava a que Sua Majestade lhes mandasse tanto número de padres da Companhia, que pudessem residir pelas suas aldeias e ensinar seus filhos. O sucesso de tudo foi que os ditos índios, com esta promessa, e persuadidos igualmente dos padres, aceitaram a dita empresa, e foram a principal causa de os Holandeses serem lançados fora, como com efeito foram, não havendo em todo o Estado de Maranhão [...] que anteviu a felicidade de sucesso prometendo-o e assegurando-o, da parte do mesmo Deus, aos Portugueses e índios em muitas ocasiões em que estavam já desesperados dele e retirados da ilha do Maranhão para a terra firme*[19]."

These happenings of XVI & XVII centuries mentioned above, show us that the thoughts of the Spanish intellectuals left their influence over the different positions taken by the religious leaders, and also we can see their influence even on various laws promulgated and implemented in Spanish America and in Brazil. This clearly signifies that these colonizing countries have good knowledge of the inhuman conditions of the Amerindians who work as slaves in their colonies. However, they could not manage to take a radical stand to abolish slavery in toto immediately or even during the XVI century itself, due to the economic interest.

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GENETIC ANALYSIS OF WHOLESOME HETEROSIS AND IN VITRO ESTABLISHMENT OF MULTILOCULES IN SESAMUM INDICUM L.

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Abstract: *Sesamum indicum L*. commonly known as gingelly is one of the most ancient and important vegetable oil seed crop after groundnut and rape seed, in India. It is preferred over rest of the oil seeds for its rich oil and protein in the seeds with high demand not only in food industry but also in cosmetic, medicine and various industries, In view of its multifarious application heterosis in sesamum was assessed deploying the 5- parameter model (Hayman.1958) of generation mean analysis and scaling tests. Five *Sesamum indicum L*. lines viz Vinayak mutant, X-79-1, EC351887, EZ351881 and EC 359007 which were not studied yet were included in crossing programme to develop wholesome heterotic lines. Superiority of crosses were evaluated for heterosis, genetic gain and per se performance in seed yield and eight yield components, nutritional quality and resistance to three diseases-*Phyllody*, *Cercospora* and *powdery mildew*. Successful outcome of the present study is the development of two crosses Vm x EZ351881 and X-79-1 x EC 351887with wholesome heterosis in morphological parameters, High seed quality and almost immunity to three diseases. For establishing pure stock with six and ten locule pods, the genetic basis was followed and invitro techniques was resorted for 10 locule in the eight locule Vinayak mutant. Explants of hypocotyl and Cotyledon when supplemented with MS plus 5mg/l of BAP and 0.5mg/l of NAA was effective for regeneration and rooting. On the same medium when plantlets left undisturbed for two weeks showed invitro flowering and fruiting.

Key words*: Sesamum indicum L., Heterosis*, Multilocules, *Invitro* regeneration, Flowering and fruiting.

INTRODUCTION:

Among the five vegetable seeds, sesame ranking second after groundnut is preferred for its oil and protein in the seed. Though India ranks first in area under sesame cultivation in the world, the productivity is very poor (304kg/ha) due to lack of stable high quality seed with desirable attributes breeding programs in sesame therefore were concentrated mostly towards developing early maturing, high yielding, and high quality seed coupled with insect/pest/disease resistance.

Development of stable genetically superior lines involving the available germplasm necessitates the understanding of the genetic basis behind heterosis. Precise knowledge of the genetic components of heterosis enables not only to test the feasibility of releasing heterosis but also for its subsequent stabilization and commercial exploitation.

Direct reports of epistasis in sesamum are very limited. In order to estimate epistasis, the five *Sesamum indicum L. parents viz. Vinayaka (mutant),X-79-1,EZ351881,EZ351887 and EC 359007* were mated and the data relating to the mean values of the hybrids from F_1,F_2 and F_3 generations were availed for conducting generation mean analysis and scaling test; following the five parameter of of Hayman(1958).The amount of heterosis expected on basis of five genetic parameter **m^,d^,h^,i^, l^.** and seed yields and eight yield components viz days to maturity, Plant height , number of branches,(primary and secondary),no. of pods/plant ,pods size (length and width), no. of seeds /pod and 1000 seed weight was compared with the realized amount of heterosis (mid parent), Heterobeltiosis (Better parent) and standard heterosis (Standard parent,TC-25 National check).Wholesome heterosis for seed yield and eight yield components, together with percent proportion of heterosis in oil/protein/ fatty

acid profile and resistance response to three diseases : Cercospora leaf spot, Phyllody and powdery mildew.

Experiments on genetics of multilocules revealed them as unstable for which in vitro techniques were resorted for rapid stabilization and multiplication of ten locule type.

Materials and Methods:

The five *Sesamum indicum L.* lines viz. Vinayak mutant (m), X-79-1, EC351887, EC359007, EZ351881 were not studied yet were taken for crossing programme. The feasibility for exploiting heterosis in sesamum was assessed deploying the five-parameter model (Hayman,1958) of generation mean analysis and scaling test.

The five parents and ten crosses were raised up to three generations. The cultures of all the three generations were simultaneously organized in 35 X 3 RBD in Kharif (may to August) and data was recorded for seed yield and eight yield parameters like seed yield/plant(gm), days to maturity, plant height (cm), primary and secondary branches per plant, number of pods /plants, number of seeds /pods, size(cm), length and width,1000seed weight(gm) and seed yield/plant (gm). The evaluation ten plants/replicate for each treatment were considered.

Heterosis in F_1 over mid parent (MP), Better parent (BP) and Standard parent (SP) were calculated following Singh and Chaudhary (1979). Goodness of fit of the model applied was tested as per the joint scaling test of Cavalli (1952) using weighted least square method illustrated in Singh and Chaudhary (1979) and Mather and Jinks (1971).

Nutritional quality of seed was estimated. The oil estimation was conducted on pulsed NMR spectrometer and percent oil equivalent was recorded. Protein estimated by Kjel tec 1026 distilling unit and percentage protein in seed was determined in five parents and ten crosses. Fatty acid profile was analyzed by gas liquid chromatography (GLC Helvet Packard unit no.5850A.

Data relevant to the disease index was taken following 0-5 grade scale. Using the 0-5 grade scale, Percent disease intensity was calculated based on logarithmical table as in stastical methods by Snedecor and Cochran (1967). Screening for resistance to the three diseases was affected from standing crops in the field without applying any specific control measures as per the methods adopted for an ICAR research project.

For *In vitro* experiment V(m) was taken which was developed in our research laboratory. The V(m) has eight locule capsules; with enhancement in seed yield, oil and oil quality upto 8-13 times over its four locule control. The 8L V(m) also had plants With 10L.pods in whorl setup. Attempts to stabilize the 10L line in field culture was not successful. seeds collected from strictly self-pollinated flowers of these 10L plants were therefore used for multiplication through *In vitro* experiments.

Results and Discussions:

Conventional ANOVA test was carried out for the five parents and ten crossed. F values from ANOVA revealed highly significant difference for the 35treatments (5 parents ,10 crosses and 3 generation). Data relating to *per se performance* for five parents and the ten crosses in F_1, F_2 and F_3 in respect of the nine characters considered were collected for not less than 10plants per replicate. Almost all the 15 treatments showed highly significant mean values for the three generations. (Tables-1,2).

TABLE-1 ANOVA for nine characters of 35 treatments (5 parents +10 crosses) each of F_1, F_2, F_3 GENERATIONS in *Sesamum indicum L.*

ANOVA	Plant Height			Primary branches			Secondary branches			seeds/pod		
	ss	df	F	ss	df	F	ss	df	F	ss	df	F
Treatments	43114.7	34	16.30286**	188.2117	34	7.84228**	289.3427	34	6.1537**	39881.9	34	10.116**
Replications	1637.31	2	10.48**	0.2001	2	2.411		2	0.893	635.01	2	2.74
Error	5311.99	68		47.999	68		56.0862	68		7885.176	68	
ANOVA	pod length			pod width			100seed weight			seed yield/plant		
	ss	df	F	ss	df	F	ss	df	F	ss	df	F

Treatments	12.036	34	7.054574**	5.2859	34	12.478**	39.469	34	11.214**	1209.846	34	139.94**
Replications	0.005	2	0.049933	0.041	2	1.637	0.348	2	1.6768	0.3159	2	0.621
Error	3.4123	68		0.85	68		7.041585	68		17.2917	68	

TABLE-2 Mean values with standard errors for nine characters of 4 parents and two crosses in F_1, F_2 and F_3 generations *Sesamum indicum L.*

Name of The Treatment	Plant height(cm)	no. of primary branches	no. of secondary branches	no. of pods/plant	no. of seeds/pod	pod length(cm)	1000seedweight (gms)	Seed yield/plant (gms)
Vm	138.5±3.65	3.9±0.65	0±0.00	128.5±18.38	121.80±5.80	1.98±0.02	2.4±0.23	5.10±0.1
X-79-1	95.2±3.73	4.0±0.21	3.9±0.75	128.6±14.10	67.6±1.92	2.51±0.06	2.1±0.12	6.25±0.16
EZ351881	133.7±5.32	3.7±0.7	4.9C±1.45	193.1±26.09	81.6±2.80	2.8±0.07	2.3±0.08	8.2±0.13
EC351887	1121.3±4.27	2.0±0.29	0.7±00	114.2±4.64	144.8±7.58	2.95±0.09	1.70±0.58	8.11±0.13
VmXEZ351881								
F1	85.4±2.79	3±0.14	0.9±0.27	106.1±5.07	69.6±0.88	2.67±0.09	2.2±0.11	13.54±0.02
F2	138.0±2.85	3±0.61	0.0±0	120±4.71	97.2±9.83	3.09±0.01	2.0±0.05	14.05±0.05
F3	100.2±3.65	3.3±0.42	0.3±0.21	106.4±5.96	97.2±7.31	2.75±0.08	2.2±0.08	13.6±0.09
X-79-1xEC351887								
F1	99.3±1.89	4.1±0.03	0±0	115.3±3.78	87.21±0.44	3.0±0.02	3.2±0.17	8.09±0.21
F2	95.7±2.74	3.2±0.32	2.3±0.61	113.2±3.83	73.6±0.88	3.36±0.05	3.03±0.12	8.34±0.21
F3	118.5±3.57	3.6±0.54	1.5±0.52	103.6±5.47	73.2±2.15	2.62±0.06	3.4±0.11	9.15±0.11

The amount of heterosis realized was calculated for eight characters as the percent proportion of enhancement of the F_1 over the mid parent (MP),better parent (BP), and the national check TC-25 as the standard parent (SP) .Excellence of any cross combination in F1 if in follows in F3 indicates the real improvement in stock .Data relating to the crosses showing positive and negative heterosis (MP) , heterobeltiosis(BP),standard heterosis (SP) for eight characters are presented in table-3. The amount of heterosis realized over MP, BP, SP has been compared with the heterosis expected from five significant parameters **m^,d^,h^,i^, l**^.Significant heterosis was expressed for all the said characters through generation mean. Table -4.

Table -3 Percent proportion of heterosis for seed yield and seven yield components in two crosses of Sesamum indicum L.

crosses	Days to maturity			Plant height			Primary branches			Secondary branches		
	MP	BP	SP	MP	BP	SP	MP	BP	SP	MP	BP	SP
Vm X EZ351881	-14.04**	-7.54*	37.97**	-33.06**	-34.22**	18.92*	-30.43	-58.97**	-27.27	-55.1	-77.55**	-70.27

X-79-1 X EC351887	0.77	27.45**	-17.72	26.28**	12.7**	78.46**	133.33**	75**	218.2**	320.51**	100.25**	121.62**
****Cd at .01**	8.28	8.81	8.09	12.25	11.96	23.82	42.44	47.64	64.12	96.29	34.45	39.02
***Cd at .05**	5.76	6.12	5.62	8.52	8.31	16.56	29.51	33.13	44.58	66.92	23.95	27.14
crosses	**Pods/plant**			**1000seed weight**			**seed yield/plant**			**Seeds/pod**		
	MP	**BP**	**SP**	**MP**	**BP**	**SP**	**MP**	**BP**	**SP**	MP	BP	SP
Vm X EZ351881	-39.61*	-49.71**	49.38**	29.41*	-8.33	-22.37**	103.6**	65.12**	55.63**	-35.29**	-45.97**	-
X-79-1 X EC351887	48.76**	40.44**	117.84**	84.21	66.66	22.37**	97.91**	75.21**	63.33**	-25.43**	-45.30**	-
****Cd at .01**	42.7	21.67	42.9	37.01	29.96	16.73	46.5	37.31	23.62	9.88	18.82	-
***Cd at .05**	31.01	15.07	29.83	25.74	20.83	11.63	33.77	25.94	16.43	6.87	13.08	-

Table-4 Estimates of scale tests, Joint Scale Test, Gene effects and heterosis for seed yield and eight yield component in two crosses of *Sesamum indicum L.*

	Plant height										
cross	**Estimates of joint scale test**					**χ2**	**Scale test**		**Heterosis**	**Gene effect**	
	m	**d**	**h**	**i**	**l**		**C**	**D**		**h/d**	**types of epistasis**
V_m X EZ351881	138**	2.4	69.53**	114.56	-326.66**	122.45**	-97.6**	-147.8**	144.98	28.97	Duplicate
X-79-1x EC351887	133.8**	-13.05**	74.86**	28.09	-139.73**	8.60**	-45.3	-58.3**	23.73	-5.73	Duplicate
	primary branches										
cross	**Estimates of joint scale test**					**χ2**	**Scale test**		**Heterosis**	**Gene effect**	
	m	**d**	**h**	**i**	**l**		**C**	**D**		**h/d**	**types of epistasis**
V_m X EZ351881	3.0**	0.10	-1.73	-4.72	18.66**	4.51	-1.2	-0.4	12.11	-17.13	Duplicate
X-79-1x EC351887	3.7**	1.0**	2.73**	1.06	-1.6	10.82**	502**	0.6	1.07	2.73	Duplicate
	secondary branches										
cross	**Estimates of joint scale test**					**χ2**		**Scale test**	**Heterosis**	**Gene effect**	
	m	**d**	**H**	**i**	**l**		**C**	**D**		**h/d**	**types of epistasis**
Vm X EZ351881	0	-2.45**	-0.06	1.29*	4.53	0	7.1**	-3.7*	0.85	0.02	Duplicate
X-79-1x EC351887	2.4**	1.95**	4.93	-1.32**	13.33	32.02**	10.7**	-0.7	14.99**	2.52	Complementary

	pods/plant										
cross	Estimates of joint scale test					χ2		Scale test	Heterosis	Gene effect	
	m	d	h	i	l		C	D		h/d	types of epistasis
V_m X EZ351881	120**	-32.3	21.0	84.70	-133.6**	641.65**	35.8	-136**	44**	-0.65	Duplicate
X-79-1x EC351887	117**	7.2	64.53**	-94.67**	125.33	19337.79**	136**	-42	102.39	8.96	complementary
	seeds/pod										
cross	Estimates of joint scale test					χ2	Scale test		Heterosis	Gene effect	
	m	d	h	i	l		C	D		h/d	types of epistasis
V_m X EZ351881	97.2**	20.1**	-20.93	-5.97	83.73	1.49	-53.8	-9	36.73	-1.04	Duplicate
X-79-1x EC351887	82.4**	-38.61**	12.8	39.81**	-38.4	37.21**	41.21*	-17.01**	-52.80	-0.33	Duplicate
	Pod length										
cross	Estimates of joint scale test					χ2	Scale test		Heterosis	Gene effect	
	m	d	h	i	l		C	D		h/d	types of epistasis
V_m X EZ351881	3.09**	-0.49**	0.6	0.89**	-3.23*	13.01**	-2.44**	-0.16	-1.25	-1.22	Duplicate
X-79-1x EC351887	2.75**	-0.22	0.83**	0.27	-0.24	23.62**	0.7	-0.84	0.58	-3.77	Duplicate

Pod width											
cross	Estimates of joint scale test					χ2	Scale test		Heterosis	Gene effect	
	m	d	h	i	l		C	D		h/d	types of epistasis
V_m X EZ351881	0.73**	-0.07**	0.42*	-0.43	0.88	4.53	0.3	0.36	-0.94	-6	complementary
X-79-1x EC351887	0.93**	-0.11	0.74**	0.85**	-1.65**	34.18**	-0.53	-0.72**	6.72	-6.72	Duplicate
	1000 seed weight										
cross	Estimates of joint scale test					χ2	Scale test		Heterosis	Gene effect	
	m	d	h	i	l		C	D		h/d	types of epistasis
V_m X EZ351881	2.0**	0.05	-0.04	-0.25**	1.6*	9.09*	1*	0.1	0.9	-8	Duplicate
X-79-1x EC351887	3.00**	0.20	-0.2	-1.8	2.4	41.91**	-1.2	3*	1.4	-1	Duplicate

	seed yield /plant										
cross	**Estimates of joint scale test**					**χ2**	**Scale test**		**Heterosis**	**Gene effect**	
	m	**d**	**h**	**i**	**l**		**C**	**D**		**h/d**	**types of epistasis**
V_m X EZ351881	14.05**	-1.55**	0.86	-6.03**	-3.76**	42262.28**	-9.49**	14.17**	-1.58	-0.55	Duplicate
X-79-1x EC351887	12.41**	-0.93**	-4.58	-11.61	16.37	4634.8**	-7.09	19.19**	-1.11	4.92	Duplicate
***, **	Significant at .05 and 01										

Results of generation mean analysis and joint scale tests in present study showed the epistatic gene action for heterosis in addition additive component in all crosses (Singh and Chaudhary; 1979). The five parameters **m^,d^,h^,i^, l^**, along with the scaling test C and D estimated and the adequacy of the additive x additive and dominance x dominance model was tested applying χ^2 as per join scaling test of Cavalli(1952).The highly significant values of the scale tests C and D indicated the operation of epistasis in the ten crosses ,on seed yield and selected yield components viz days to maturity , plant height, number of branches (primary and secondary),number of pods per plant , pod size (length and breadth),number of seeds per pod ,1000 seed weight and seed yield per plant.

Both additive and non-additive genetic effects in the form of epistasis mostly of duplicate and to some extent complementary was also detected operative on the above nine characters in the ten crosses, predicting significant heterosis. The theoretical expected heterosis thus estimated was compared with the amount of heterosis actually realized in the ten crosses for the nine selected characters. Heterosis over mid parent (MP), over better parent-heterobeltiosis (BP) and at least by 50%even over the standard parent (SP, TC-25 National check-25) serves as an index of the real superiority of any crop line for direct release. The relative potential of the ten crosses was therefore assessed through wholesome evaluation of heterosis realized over MP, BP and SP, together with the range per se performance and genetic gain in the nine morphological traits in F2and F3, Heterosis in nutritional quality (oil/protein and fatty acid profile) and resistance to three diseases Cercospora leaf spot, Powdery mildew and Phyllody, for the improvement in quality in these crosses. (Table-3,4,5,6,7).

Breese and Mather (1960) postulated the nature of genetic variation in a population for a quantitative character will depend upon the type of selection which had operated on the population in the past. Stabilizing selection will be expected to maintain genetic variation of a largely additive nature, while strong directional selection reduces the total genetic variation which will tend to become composed of non-allelic interactions and unidirectional dominance effects. These expressions are again subjected to be complicated by the nature of breeding system and the size of the population.

Results of the present study regarding the operation of both additive and non-additive genetic factors in seed yield and yield components in Sesamum are corroborating with the earlier reports from diallele and generation mean analysis experiments. (Chavan et. Al. 1981,1982; Dharma lingam and Ramnatham,1996; Chakraborti and Basu,1998; Kamala,1999; Senthil kumar and Ganeshan (2004); Torpore ,2008; Padma sundari et.al.,2012; Kanak Saxsena and Rajani bisen(2018).

Wholesome improvement brought about through hybridization in terms of improvement in productivity potential accompanied by improvement in the seed and oil quality and resistance to pest and diseases makes any breeding project meaningful. The very interesting outcome of the present study is the development of two crosses V_m X EZ351881 and X-79-1 X EC351887 with significant excellence over MP,BP and over SP TC-25 in respect to seed yield and all eight yield components, seed quality in terms of simultaneous improvement in oil and protein together wit significant immunity to three diseases phyllody , powdery mildew and Cercospora leaf spot in the former and only to two disease in the later cross.(Table-3,4,5,6,7).

Table 5- Percent content of oil and protein in the seed of parents and their F_1s in *Sesamum indicum L*

Treatment	**%oil**	**%protein**
Vm	49.6	21.65
X-79-1	43.6	23.3

EZ351881	44.8	25.23
EC351887	42.5	30.63
Vm x EZ351881	56.24	29.08
x-79-1 x EC351887	60.21	28.57

Table 6- Heterosis (%) over Mid parent (MP), Better parent (BP) and Standard parent (SP) in Oil and Protein in 2 crosses of *Sesamum indicum L.*

Treatments	**Oil (%)**			**Protein (%)**	
	MP	**BP**	**SP**	**MP**	**BP**
Vm x EZ351881	24.56**	23.6**	8.15**	19.19**	15.25**
X-79-1 X EC351887	36.84**	32.32**	15.78**	6.21*	-6.72*
****CD at0.01%**	12.38	11.77	5.6	8.12	7.95
***CD at0.05%**	8.61	8.18	3.88	5.62	5.51

Table 7- Transformed percentages of resistance for the three diseases Powdery mildew (PM), Phyllody (PH) and Cercospora leaf spot (CLS) in parents an in the two progenies of *Sesamum indicum L.*

		Powdery Mildew (PM)						**Cercospora leaf spot (CLS)**						**Phyllody (PH)**					
Treatments		**IM**	**VR**	**MR**	**MS**	**S**	**HS**	**IM**	**VR**	**MR**	**MS**	**S**	**HS**	**IM**	**VR**	**MR**	**MS**	**S**	**HS**
		Sc-0	**Sc-1**	**Sc-2**	**Sc-3**	**Sc-4**	**Sc-5**	**Sc-0**	**Sc-1**	**Sc-2**	**Sc-3**	**Sc-4**	**Sc-5**	**Sc-0**	**Sc-1**	**Sc-2**	**Sc-3**	**Sc-4**	**Sc-5**
VM		-	-	-	16.74	42.60	35.24	-	-	-20.7	49.78	32.71	-	-	-	-	-	35.24	-
X-79-1		-	-	60.67	26.56	11.54	-	-	-	-	48.45	41.55	-	90	-	-	-	-	-
EZ35 1881		-	-	-	64.75	28.45	38.35	90	-	-	-	-	-	-	-	17.56	-	-	-
EC35 1887		-	-	-	-	51.56	51.56	38.35	90	-	-	-	-	-	-	16.43	-	-	-
Vm x EZ351881	F1	-	-	-	-	64.08	14.28	90	-	-	-	-	-	-	-	-	22.79	-	-
	F2	-	-	-	40.92	12.66	43.62	-	-	-	39.23	50.77	-	90	-	-	-	-	-
	F3	75.14	12.66	21.15	21.15	-	1.95	72.54	-	12.66	29.2	54.7	-	88	-	12.44	-	-	-
X-79-1 X Ec351887	F1	90	-	-	-	-	-	-	-	-	46.26	43.74	-	90	-	-	-	-	-
	F2	90	-	-	-	-	-	-	-	-	48.73	41.21	-	-	-	17.16	-	-	-
	F3	90	-	-	-	-	-	-	-	33.46	17.16	51.24	-	-	-	12.11	-	-	-

Disease Intensity: IM- Immune VR-Very resistant MR-Moderately resistant MS-Moderately Susceptible S-Susceptible

Disease Index/scale: 0 1 2 3 4

The multilocules condition is indeed of high economic advantage to Sesamum in view of the associated proportionate enhancement in productivity potential realized. Establishment of pure lines for multilocules through conventional breeding technique followed by constant selection of the required type is a question of time, effort and facilities and is also found unsuccessful. To achieve this goal *In vitro culture* has been recognized as successful adjunct to conventional breeding. The multilocules V_m with 6L,8L and 10L(Fig-3) have been selected for establishment of the pure stocks through *in vitro* culture. Explants of Hypocotyl with cotyledons of 10 L V_m proved combatively more responsive for better regeneration when MS medium supplemented 5mg/l of BAP found more effective for regeneration of shoots in high frequency. These shoots when sub cultured on ½ strength MS Media with 0.5mg/l of NAA showed rooting and surprisingly flowering and pod formation when left undisturbed on the same medium for over two weeks (Fig-1,2).

Fig1 multiple shoots from coteledonary explants

Fig2 Invitro flowering and fruiting

George et. al. (1989) reported multiple shoots but only after treatment of seeds with hormones like BAP. Batrice et. al. (2006) reported multiple shoots with modified MS with N6 macronutrients with TDZ and IAA. Seo et.al. (2007) produce high frequency plant regeneration from deembryonated cotyledon explant of *Sesamum* after preculturing on6-9% sucrose for two weeks. Michael et.al. (2020) also reported invitro shoot regeneration from cotyledon explant.

The auxin NAA present in the medium might have induced flowering also in addition to rooting as has been observed by Sarmah and Sarla(1997) in oil seed crop Brassica. The prolonged exposure of the medium with NAA without disturbance might have satisfied the time requirement for activation of the flowering hormones in these shoots as happens in natural field conditions.

The present *in vitro* experiment in Sesamum is optimistic for establishment of multiloculed types especially for the 10L stock of V_m.

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