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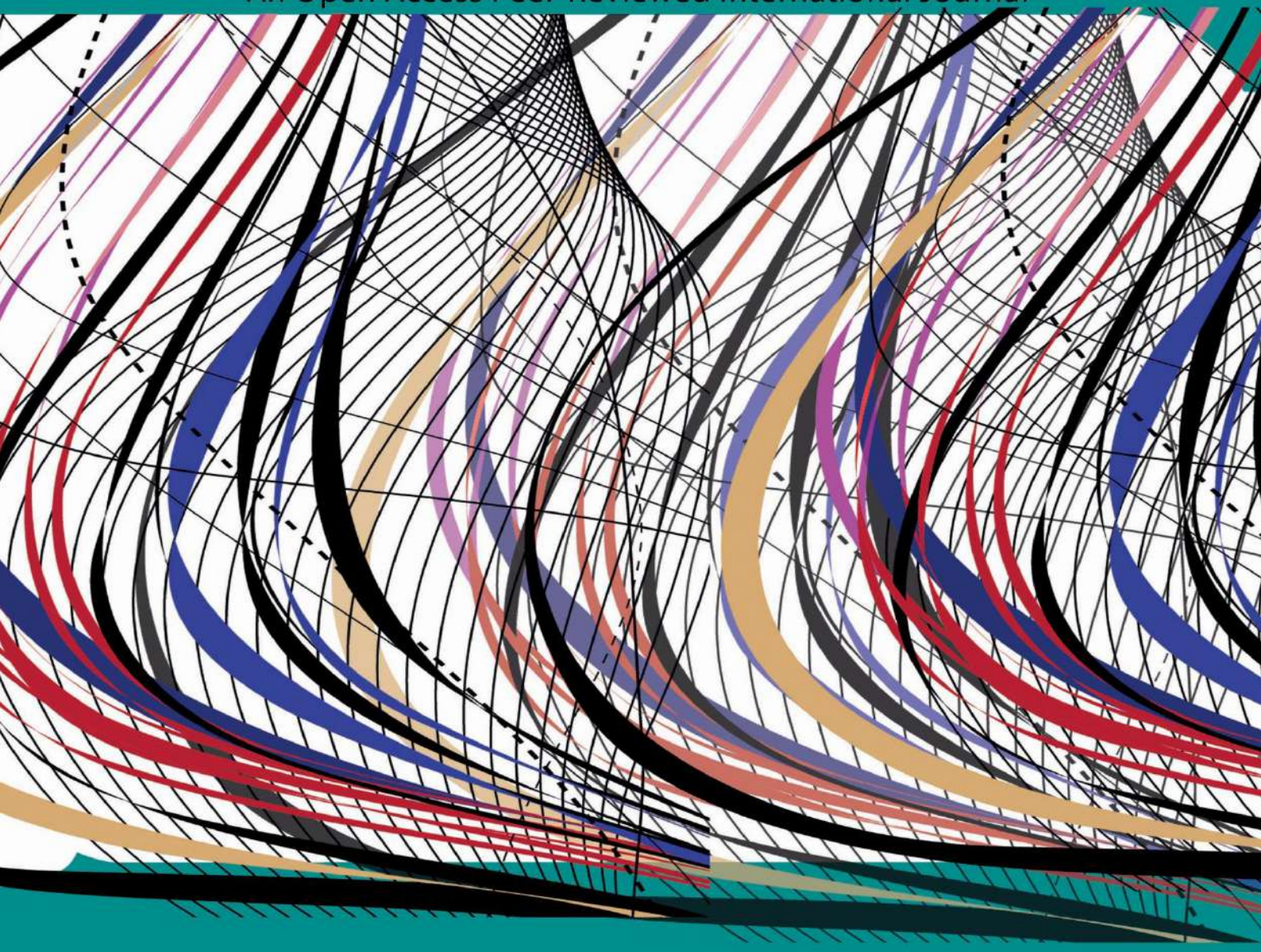

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Development of A Solar-Powered Slider-Crank Mechanism for Hand Pump in Rural Areas

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Abstract— *The demand for alternative water pumping mechamism needed to overcome the challenges facing people in the remote areas is on the increase. The conventional manually operated hand pump requires a large amount of energy before quality water can be pumped for domestic and irrigation purposes. This limits its usage by the average persons, the elderly and the disabled. This study presents the development of a solar-powered slider crank mechanism, a more energy friendly drive system. Slider crank mechanism with connecting rod 70 mm, radius of crank 14.8 mm and a frame with width, breadth and height of 70 mm, 70 mm, 134 mm, respectively was fabricated using mild steel. Solar panel, charge controller, battery and low speed motor were used to power the mechanism. The performance of the solar powered slider-crank aided system for pumping water was evaluated in terms of actual and theoretical discharge, as well as volumetric and pumps efficiencies with values of 0.01693 m^3/s, 0.01302 m^3/s, 76.905%, 73.26%, respectively. Conclusively, the solar powered slider-crank aided water pumping system is about 24% better in terms of performance compared to the conventional manually operated hand pump.*

Keywords— ***Hand pump, Rural areas, Slider-crank mechanism, Solar-powered, Water supply***

I. INTRODUCTION

One of the four interrelated basic needs with a significant effect on socioeconomic progress and the quality of life is access to adequate water [1]. Since it significantly affects both public health and living standards, water is essential to life. For basic human functions like nutrition, respiration, circulation, excretion, and reproduction, water is a crucial component. Scarcity of water on the other hand reduces biodiversity in both aquatic and terrestrial environments, jeopardising the human food supply [2]. Due to a lack of access to clean and safe water, people suffer from starvation, dehydration, and die from diseases that may be prevented in some regions of the world.

The demands for freshwater on a global scale has been rising significantly as economies and populations have expanded. The negative consequences of global population growth are putting growing pressure on our essential water resources is causing significant water stress in many countries.

Over the past century, great progress has been made in providing millions of communities and billions of people with access to clean drinking water. However, billions of people still lack access to drinkable water, primarily in developing nations and their rural areas.

The common technological method of getting water from its natural sources is by drilling of borehole connected to a pump (either centrifugal or submersible pump, or reciprocating pump). Due to a borehole water systems pump needing electricity to operate, mechanical hand pumps are adopted and are very predominant, most especially in rural areas. According to Ottoson [3], over 4 million hand pumps have been erected in Africa, India, and Asia over the last two decades, and at least 1 billion people rely on hand pumps to get their daily water needs met worldwide. The India Mark II hand pump, which may

be seen in Figure 1, is the mechanical hand pump system that is the most widely produced. It was created by UNICEF in 1978. Over 2.6 million India Mark hand pump systems are reportedly in operation in India [3]. The India Mark II hand pump (figure 1) is utilized all over the world.

The reciprocating pump is the most used among these hand-operated pumps [1]. In comparison to centrifugal pumps, reciprocating pumps are more expensive to install and maintain, making them obsolete for industrial applications. However, hand-operated pumps still find wide application [4]. The structure of the reciprocating systems has the crank-slider as the key component, and The design of reciprocating systems is based on a dynamic analysis of the crank mechanism. A mechanical device called a slider-crank mechanism can change straight-line motion into rotary motion, such in a reciprocating piston engine, or the other way around [5].

The common hand pump is mostly operated using a lever system operation. One of the main disadvantages of using lever-powered handpumps is the physical effort required for pumping the water. The human effort plays a major role in sucking the water from the depth (lower heads) to the higher heads. Due to the effort required, these pumps are not long-term usable for the normal person, aged and disabled people are unable to operate them, and an increase in fatigue is usually experienced. Additionally, because of its low capacity, the water demand is not satisfied, especially when demand is strong, which causes long lines to form at the pump location [1].

The quick return mechanism was found to be more effective and dependable in the study done by Wen-Hsiang and Chia-Heng [6], conserve energy, and enhance the capacity of the reciprocating pump by at least 42.7% to service a huge population in record time. Additionally, it will remove operator fatigue from pumping water, need simpler, more reliable maintenance, and reduce the energy (effort) needed to pump water by at least 19%.

In order to create water pumping capabilities that can be used in place of electrical pumps, water pumping mechanisms utilizing windmills have been devised [7, 8]. In most cases, the cost of installing a new windmill is comparable to that of a solar-powered system for pumps. However, these are typically more reliable and require less maintenance [9].

In the present study, a solar-powered quick return mechanism was developed to aid the pump in rural areas. This would in no small measure ease the stress of getting water and making it available. The following is the paper's outline: The first section covers the introduction; the second section discusses methods; and the third section discusses the outcomes. Conclusion and a suggestion are presented in the final part.

Fig.1: Image of an India Mark II hand pump [3]

II. METHODOLOGY

This section provides an in-depth explanation of how the system was developed interms of system design, materials selection, fabrication and assembling.

2.1 SystemDesign

System design involved the design of various components required, as well as modules that are connected to one another, interfaces and mathematical explanations. All of these elements are necessary for the system to meet the required goals of a functionaltechnology.

2.2.1 Software Design

Autodesk inventor CAD software was utilized to verify the relative functioning of the interconnections prior to the actual implementation of the system using hardware components.Figure 2(a) shows the hand pump design snippet fromAutodesk Inventor.The designed solar powered slider crank hand pump is also shown in figure 2 (b) while the exploded design of the solar-powered slider crank mechanism design pump is shown in Figure 2 (c):

Fig.2 (a): Hand Pump Design Snippet

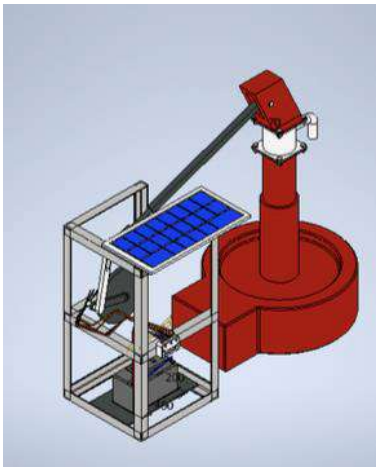

Fig.2 (b): Solar Powered Slider Crank Hand Pump Design

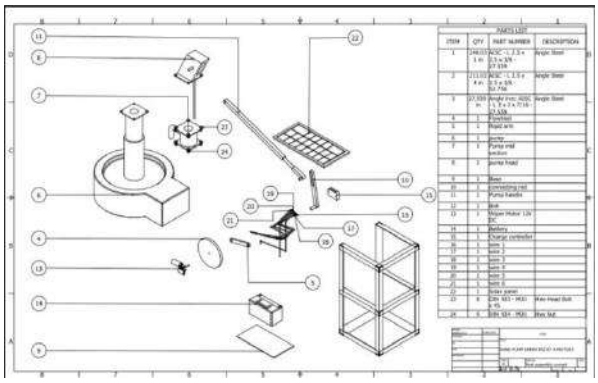

Fig.2 (c): Autodesk exploded design of the solar-powered slider crank mechanism design

2.2.2 Hardware System Design

Hardware design makes use of physical components that may be described by their form, size, and feel. The term "machinery" or "equipment" is often referred to as hardware of a system. Components of the system's hardware are selected with great care to ensure that they meet the requirements of the system's overall design and maximize its effectiveness. The selected components for Solar Powered Slider Crank Hand Pump include:

I. **Solar Panel:** A 26Volts (V) with a rated power of 85 Watts (W) solar panel shown in Plate 1 was acquired for the powering of the DC motor as well as charging of the battery. The array of the solar panel was utilized to harvest the sun energy required in powering the whole system setup after the energy conversion. The selected panels have higher resistant to wear and tear.Solar panels usually wear out slowly.

Plate 1: Solar Panel

II. **Steel Pipe:** A cylindrical hollow steel pipe of 28mm diameterand 150 mm length (Plate 2) was incorporated to firmly hold the lever of the hand pump during operation, through the holes drilled 50 mm from both ends on a centre lathe. The steel pipe utilized has high strength, good weldability and high resistance to cracking.

Plate 2: Steel Pipe

III. **Fasteners:** Bolts and nuts (Plate 3) were used to hold the connecting rod and rigid arm firmly, as well as connecting the crank on the motor to the rigid arm.

Plate 3: Bolt Nuts –Fasteners

IV. **Charge Controller:** A solar charge controller shown in Plate 4 controls the voltage and current on the solar panel to the battery. This keeps the battery from getting too charged. The solar panel was connected to the first 2 ports of the charger controller using a solar panel cable, the battery

was connected to the next 2ports while the motor was connected to the last 2 ports using normal cables. It was used to control the charging process by indicating whether the battery was fully charged, halfway charged, or discharged. It was also utilized for powering the DC motor.

Plate 4: Charge Controller

V. **Low-Speed Motor (Wiper Motor):** Synchronous low-speed motor (Plate 5) provides speed control that is very exact, spinning at low speeds, and rapid rotation in both directions.The motor operates a connection that oscillates the crank and rigid arm.

Plate 5: Wiper motor

VI. **12V Lithium Rechargeable Battery:** A solar battery (Plate 6) is an addition to solar power system that stores the extra electricity generated by your solar panels. When there is no solar energy harvesting, the power stored in the battery is utilized. The system is powered by stored energy.

Plate 6: Lithium Battery

2.3 Mode of Operation

The mode of operation is shown in figure 2. The solar panel absorbs solar energy and transmits it to the charge controller. The controller supplied the motor with the necessary power to start cranking the slider mechanism while simultaneously charging the battery. The mechanism needed to drive the handle of the water pump for water delivery then transformed the rotating motion of the crank into the reciprocating action of the connecting rod.

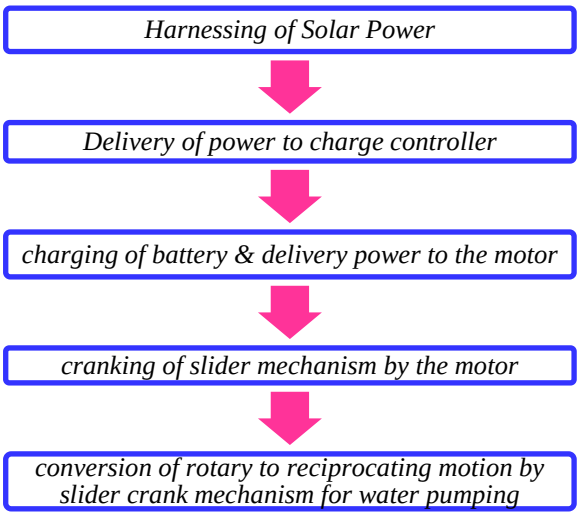

Fig.3: Mode of operation

2.4 Design and Fabrication Analysis

2.4.1 Slider CrankSystem Mechanism

It is essential that any slider crank mechanism have the correct design in order to produce the desired level of output force for the given level of input force. Figure 4 is the kinematic arrangement utilized in the present work. Calculating the stroke and length of the crank arm, as well as the connection between the two, is consequently necessary for many research works using a slider crank in order to satisfy a certain capacity. The following design calculations were considered:

A. Radius of crank: Calculating for radius of crank The diameter of the crank (Figure 4) is

$$D = mn/\pi \ (mm)$$

$$Crankradius, R = mn/2\pi \ (mm) \qquad (1)$$

Where, distance between TDC and BDC is mm

B. Velocity of the piston: Three **(**3) readings were taken to determine the mean velocity of the piston for an average person, and this was obtained using the relation:

$$v_{ave} = \sum_{n=1}^{n=3} \frac{n}{t} rev/sec \qquad (2)$$

Thus, in one minute,

$$v_{ave} = N = \left(\sum_{n=1}^{n=3} \frac{n}{t}\right) \times 60rpm$$

Thus, Average velocity of the crank disc, $\omega = \frac{2\pi N}{60} rad/sec$ (3)

Where N = No of revolutions per min.

C. Torque and input power: The Torque, T as well as the power,P required to drive the mechanism shown in figure5were obtained from;

Torque, $T = Fx$ (4)

Where, F = Effort needed to drive the mechanism.

x = length of the hand pump lever

Thus, the power required to drive the mechanism,

$P = T\omega$ (5)

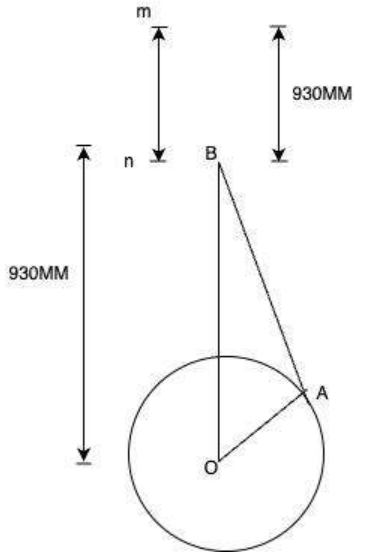

Fig.4: Kinematic Arrangement

Note: *OA is the Crank radius, AB is the connecting rod, m is the TDC, and n is the BDC*

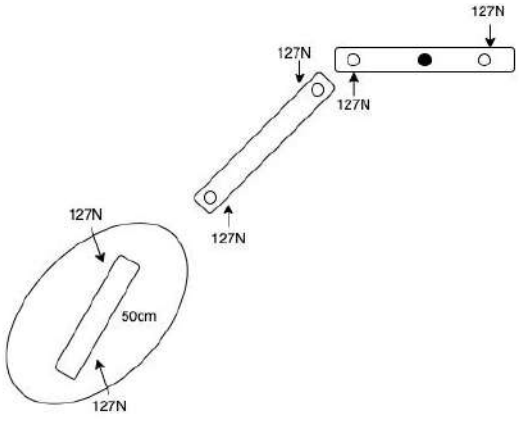

Figure 5: Driven mechanism

D. Length of the connection rod (C): The length of the connection rod, C was calculated (figure 6) as

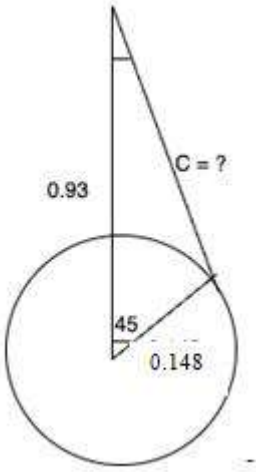

Fig.6: Determination of the length of connecting rod

$$C^2 = a^2 + b^2 - 2abcos\emptyset \quad (6)$$

Table 1: Parametric specifications

S/N	Parameters		Value	Unit
1	R	Crank radius	148	*Mm*
2	N	No. of revolutions per minute	113	*Rpm*
3	ω	Angular speed of the piston	11.83	$rad.s^{-1}$
4	F	Effort required	127	*N*
5	T	Torque	18.99	*N.m*
6	P	Input power	222.28	*W*
7	C	length of the connection rod	0.86	*m*
8	Θ	Crank angle	45	*Deg*

The parameters considered in the design as well as their values are as presented in Table 1.

2.4.2 Fabrication and installation of the solar power hand pump

Metal fabrication is the process of putting together, bending, and cutting metal to create structures. It is a process that adds value to raw materials by making machines, components, and buildings. Cutting, drilling, grinding, welding, and installation of the control system in a packing box are all fabrication procedures. The frame houses control system box and the electric motor. The frame also houses the complete linking mechanism.The

parts of the slider crank mechanism such as connecting rod, rigid arm and flywheel, were measured and cut. The slot for the hand pump was drilled towards the end of one side of the connecting rod using the specified specifications and holes were drilled at the centre of the flywheel at the edges of the flywheel radius and the other side of the connecting rod.The frame for the slider crank mechanism was built using angle iron. A motor was connected to the crank on the shorter side of the frame with bolts and nuts. The drilled hole on the connecting rod was placed on the other drilled hole on the rigid arm and then bolted with a washer in between (plate 7).The solar panel was then connected to the charge controller and from the charge controller to the battery and also the motor before integrated to the lever of the community hand pump. Figure 8 shows the solar powered slider crank mechanism assesmbly before it was taken to the field for testing. Figure 9 shows the integration of the solar powered slider crank mechanism into the community hand pump.

Plate 7: Different views of the fabricated solar-powered slider crank hand pump system

Plate 8: Solar-powered slider crank mechanism assembly before field test

Plate 9: Solar-powered slider crank mechanism assembly during field test

Table 2: Bill of Engineering Measurement and Evaluation (BEME) for the solar powered slider crank mechanism for hand pump

S/N	Part Name	Description	**Q**ty	**Amount** (₦)
1	Connecting Rod	Steel [Flat Bar]	2	4,000.00
2	Crank Disk	Steel plate	Off cut	5,000. .00
3	Angle Iron		1	5,000.00
4	Bolt and Nut		10pcs	10,000.00
5	Cutting Stone	Abrassive	1	1,500.00
6	Electrode		1	2,500.00
7	Motor	Wiper type	1	8,000.00
8	Paint	1 gallon	1	3,000.00
9	Solar Panel	85 W	1	70,000.00
10	Battery	12 V	1	70,000.00
1 1	Charge Controller		1	25,000.00
	TOTAL			**199,000.00**

2.4.4 Performance Evaluation Parameters

A. Theoretical discharge (Q) of the pump: This depends on the stroke (l_s), number of revolutions per minutes (N), diameter of the piston (Dp) and the volumetric efficiency, η_{vol} [1] and was computed using the continuity equation stated in

eqn. (7) $$Q_{th} = A_p \times v \quad (7)$$

Where, A_p is the piston area; $A_p = \frac{\pi}{4} D_p{}^2$ (m^2)

V is the crank speed of the mechanism (m/s); $v = 60Nl_s$

D is the diameter of the piston (m)

N is the crank speed in rpm

l_s is the length of stroke (m)

B. Volumetric efficiency(η_{vol}): This isthe percentage of actual to theoretical discharge [10]. This was computed using Eqn. (8).

$$\eta_{vol} = \frac{Q_{act}}{Q_{th}} \times 100\% \quad (8)$$

C. **Pump efficiency (η_{pump}):** This is the percentage of actual output volume to the actual input volume of the water. This was computed using Eqn. (9).

$$\eta_{pump} = \frac{O_{v,act}}{I_{v,act}} \times 100\% \quad (9)$$

Where, $I_{v,act}$ is the volume of water discharged per unit period of test; $I_{v,act} = \frac{\pi}{4} D^2(x_i - x_f)$ (10)

D = diameter of the well (m)

x_i= initial level of water in the well before pumping

x_2= final level of water in the well after pumping

$O_{v,act}$ is the volume of water collected per unit period of test; $O_{v,act} = \frac{\pi}{4} d^2 z$

z= depth of water in the collector (container) in meters

d= diameter of the collector (container) in meters

III. RESULTS AND DISCUSSION

3.1 Pump testing and evaluation procedure

The pump was initially tested manually and operated by an average sized operator at a certain suction head under normal conditions of operation.This was done to obtain the actual and theoretical discharge, volumetric and pump efficiencies. The manual testing was undertaken by eight (8) different operators by body weights.

3.1.1 Manual Pumping Result

Figure7shows that the actual discharge of the pump increase as the weight of operator increases when the hand pump was operated manually under several attempts, that is, without the integration of the developed solar slider-crank mechanism to the hand pump. Manual testing serves as the basis of comparison against the newly developed solar slider-crank mechanism.

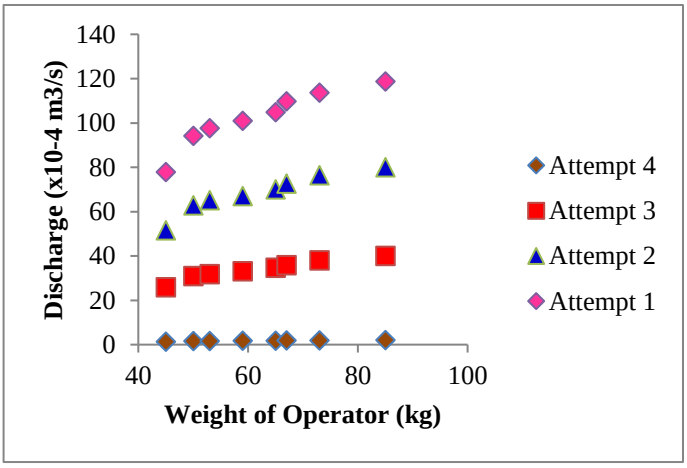

Fig.7: Discharge against weight of operator

3.1.2 Solar powered slider crank mechanism operated pump result

Figure 8 shows that the actual discharge of the pump increase as theinput power of the solar powered slider crank mechanism operated pump increases under several attempts. In addition, the actual flow rate decreases as the number of attempts increases which is an indication that the power require for operating the mechanism reduces after several attempts and thus affect the actual discharge of the pump.

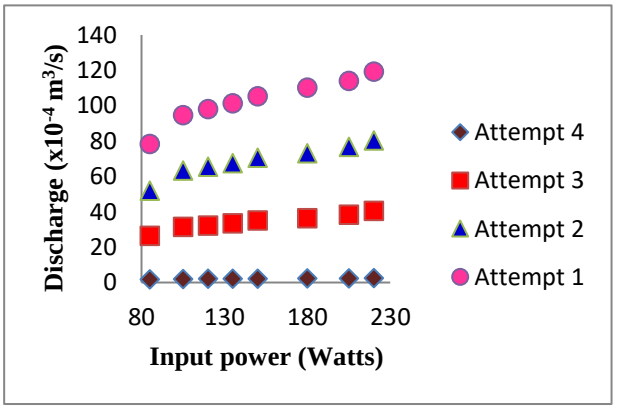

Fig.8: Discharge against input power of the solar powered slider crank mechanism operated pump

3.2 Comparison of Manual Pumping and Aided pumping (with the developed slider-crank mechanism)

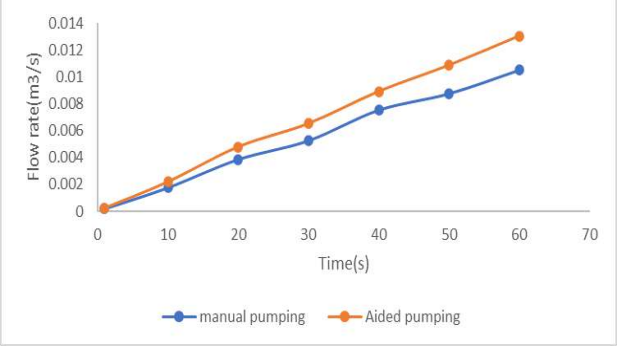

Fig.9: Comparison chart of Time against flow rate between manual and aided pumping

Figure 9 shows the comparison between manual pumping and slider-crank aided pumping. The results clearly show an increase in flow rate when the developed slider-crank mechanism was employed to aid the pumping of water. For instance, at 10 seconds, the average flow rate of manual pump was 0.00175 m^3/s while that of the aided pump was 0.00217 m^3/s. Also, at 60 seconds, average flow rate in manual pumping was 0.0105 m^3/s while 0.01302 m^3/s was obtained when the developed system was employed for the pumping of water.Generally, the developed solar-powered slider crank mechanism increased the flow rate as well as eliminated the stress of hand pumping.

Table 3 shows the performance evaluation results obtained when the slider-crank mechanism was incorporated into the pump.

Table 3: Parametric specifications

S/N	Parameters		Value	Unit
1	Q_{th}	Theoretical discharge	0.01693	m^3/s
2	Q_{act}	actual discharge	0.01302	m^3/s
3	η_{vol}	Volumetric efficiency	76.905	%
4	η_{pump}	Pump efficiency	73.26	%

IV. CONCLUSION

The creation of a slider-crank mechanism powered by solar energy for hand pumps in rural areas has been achieved successfully. The goal of the current design is to lower the amount of effort needed to pump water using conventional lever lift mechanisms to the absolute minimum. A meticulous design process was carried out to precisely determine the machine's dimensions and operational state. Finally, a prototype was created and tested on the field to confirm the pump's viability and accuracy. The experimental result with flow rate of 0.000217 m^3/s and 0.000175 m^3/s obtained when aided with solar powered mechanism and when operated manually, respectively demonstrates how the suggested mechanism can be used to enhance capacity, decrease input effort, and minimize electricity costs. The solar powered slider-crank aided water pumping system is about 24% better in terms of performance compared to the conventional manually operated hand pump.

However, the following recommendations were made from this research:

i. The system design can be improved on to make it suitable for several scenarios of usage.
ii. The prototype development can be improved and produced in a larger case to reduce unit production cost.

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Researcher Reliance on Digital Libraries: A Descriptive Analysis

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Abstract— *The digital library is an information technology that is structured as a digital knowledge resource, or can be alluded to a medium that stores information for a huge scope and is teamed up with the information the board gadget equipped for showing the information or information required by the client. Digital libraries can be extensively characterized as an information stockpiling and recovery frameworks that control digital information in the media (text, pictures, sound, static or dynamic) on the web. The main aim of this study is to study the awareness and using pattern of digital library by the researchers, to analyse the influence of digital library on researchers' efficiency, analyse the purpose of using Digital Library Consortium, decide the effect of problems and motivational components of the digital library on the users, evaluate the satisfaction level of users with coverage of journals and perspectives on training and awareness programs and propose the available resources for effective utilization of the Digital Library.*

Keywords— *digital libraries, efficiency, Technology and Engineering, academic, standard.*

I. INTRODUCTION

The open-source software program moves extra weightage in explosion of digital libraries universal. Standard consciousness readily available in a lone and an extra form was being explore documented potted as well as made reachable via network of digital documentation. The prearranged task of digital library under the Digital Library Initiative (DLI) was begin in 1994 as a combined effort of the National Science Foundation (NSF), Department of Defence Advanced Research Projects Agency (DARPA), as well as the National Aeronautics as well as Space Administration (NASA), in 1994. 6 universities had been providing the money for advance as well as sharp of underlying technology for digital libraries. The next stage of the project was initiate in February 1998. (Devika, 2003).

The landmark initiative which led the road in the direction of the Digital Library group are actually the CMU, MERCURY task; CORE task at Cornell University the TULIP task and ENVISION, Cornell Institute of digital compilation, Yale University Open Book Project, Networked Digital Library of Theses and Dissertation (NDLTD), National Science, Mathematics, Technology and Engineering (SMET) Education Digital Library (NSDL), National Policy,

Digital libraries are a momentous channel that guarantees that priceless in order is quickly easily reached and retrievable by possible distribution. All around planned digital libraries have steady advantages to readers as far as ease of use. Excellent digital libraries are accessible and information can be universally recovered.

The Digital Library System design allows specific organizations in order to incorporate the own content of theirs in the Digital Library System or even to make the most of network-based information as well as services provided by others. It provides information which could be internal to a certain business and that which crosses organizational boundaries. This particular document provides a scheme to create such a system on an experimental schedule with the cooperation of the research group. Lastly, it deals with the application of a Digital Library System to satisfy a multitude of user needs

The output profits from having access to a Digital Library System are very easily as huge as those produced from internal combustion engines as well as electric motors in the first part of this particular century. Just like an automobile on an interstate highway is immensely better than a single on a rutted dirt road, computer-based information "vehicles" could be done significantly better provided the appropriate

operating environment. Computer as well as communications technology makes it easy for old fashioned, gradual retrieval techniques to be replaced by practically instantaneous electric retrieval. Each and every user of this particular technology is able to foresee overwhelming potential advantage, but we lack the herbal infrastructure to allow for the capability on a prevalent schedule now. This particular absence of infrastructure represents both a chance as well as a barrier of remarkable proportions.

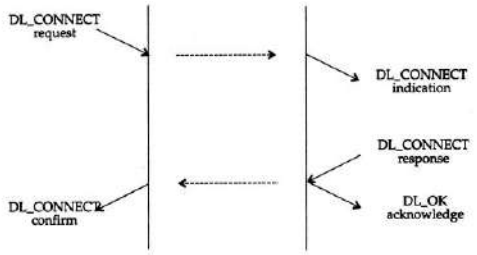

Fig.1.1: Service and End user of DLS

II. REVIEW OF LITERATURE

Moshood Alabi Alarape and Samuel NdifrekeEdet(2017) – An e library system is actually an amazingly essential piece of the web age libraries. A library without it might experience a great deal of issues, for instance, the nonattendance of sufficient appearance by the visitors. This particular paper gives an e library system which was made by using PHP programming language, CSS and HTML for MySQL and style as a backend vault advancement to deal with Apache v3.21 program labourer similarly as Mozilla Firefox web program. The structure grants blended media resources for be seen by the owners of the library notwithstanding was in the circumstance to discard the challenges of unavailability of library information, defenceless room, physical ricocheting and confined permission which portrayed the standard library system.

Laura Brewer (2017) - Having an objective of redesigning the headway similarly as movement of extraordinary online information instruction online resources, the target of this particular assessment was looking at how the situation and program level of the dispatch of a Literature Review library manual to the structure affected web business understudy obvious valuation of this source. An open of student associations understudies (Online MBA close by n=355) understudies (N=319) had been conveyed to a Literature Review library manual during explicit districts in the activities of theirs. Understudies had been facilitated to finish a web study which included seventeen shut completed things made to measure evident likeliness, satisfaction, and supportiveness to use the guide before long. The audit also joined 2 open completed issues mentioning that understudies go over those sections of the manual they discovered best and whether they required any extra features associated with the manual.

Vidya Bhaurao ThillarandShyamla Chandrakant Yadav (2016) -Information Communication Technology has transformed the face of library functionality. Electronic library is actually a set of diverse and large repositories of electronic information and digital items, which could be seen by a lot of geographically, distributed owners. This particular paper is focusing digital E library online resources, benefits, disadvantages as well as challenges.

Asad Khan (2016) examined the variables that impact the selection of Digital Library among research students. The discoveries uncovered that Interface qualities impact psychological reaction which anticipate student's aim of utilizing digital library. Though route, singular contrasts and framework attributes altogether influenced the convenience. Handiness is straightforwardly influenced by framework attributes and framework quality. At long last, it is discovered that convenience effect sly affect digital library use goal.

B. J. Bamgbade, et al (2015) - The paper surveys the pertinence of Information Communication Technology (ICT) as identified with different callings particularly, the Library callings. The significance, focal points and confinements of digital library over the traditional library were underscored. The similar examinations of the two sorts of libraries were likewise talked about. Governments in all levels of the Nation and Legislators were encouraged to make arrangements and administer charges individually that can propel the current situation with the National framework and enhance the Internet technology foundations which are main considerations that can drive digitization.

III. METHODOLOGY

Research is methodical in light of the fact that one needs to follow an unmistakable arrangement of systems and steps to get exact and exact outcomes. The research in the sociologies is worried about the people and the authoritative conduct is a significant piece of center and should be considered cautiously before reaching the determinations. Research is a sorted-out request structured and done to give information to take care of the issue.

The population have been separated into two gatherings/layers for example Research Scholars and PG students. Further the samples have been taken from each gathering on random basis. A sample of 200 (50 Research Scholars and 150 PG students) have been taken from every

University. In this way, an aggregate of 1800 questionnaires have been distributed among the Research Scholars and PG students of nine Universities, out of which 1587 questionnaires returned and just 1380 questionnaires discovered legitimate for the analysis.

Table 1.2: Sample Size

States	Sample taken
Haryana	599
Punjab	482
Himachal Pradesh	299
Total	1380

3.5 DATA COLLECTION

Data have been collected through the primary and secondary sources.

3.5.1 Primary source

In primary source the data have been collected through the observation, interview and questionnaire technique by distributing the questionnaire among the sample of the study.

3.5.2 Secondary source

In secondary source the data have been collected through the magazines, reports, annual reports, internet, websites etc.

3.8 DATA ANALYSIS

The examined data has been introduced in the even structure alongside charts any place required. In each table frequencies and level of reaction are given. The data is broke down and introduced by the four unique classifications, to be specific, State wise respondents, Status wise respondents, State wise Universities and University wise respondents.

3.9 STATISTICAL TOOLS USED FOR THE STUDY

The whole work depends on overview and examination of the data. Questionnaires got once again from the clients were fundamentally examined and assessed. The reactions of clients about mindfulness with various information assets, information recovery skills, information access and recovery aptitudes and capacity to utilize the recovered information of the faculty and students were gathered, arranged, codified in excel and recorded in SPSS package.

Frequency distribution with rate in cross tabulations have been created by utilizing the SPSS. For drawing derivations, chi-square ($\chi 2$) have been utilized. The aftereffects of the investigation introduced under two headings, the chi square ($\chi 2$) value and level of opportunity (df) which have been be introduced in the last two columns of the table. The level of the significance is with .05 degree of significance.

3.11 HYPOTHESIS OF THE STUDY

H1: There is a significant distinction in the research scholars and students' Awareness based on DL

H0: There is no significant difference in the awareness of Digital Library amongst the users of libraries.

H2: There is critical distinction in usage pattern of Digital Library amongst research scholars and students

H0: There is no critical distinction in usage pattern of Digital Library amongst research scholars and students

H3: There is a significant distinction among the research scholars and students based on Main reason for Using Digital Library- State wise.

IV. DATA ANALYSIS AND RESULT

DEMOGRAPHIC PROFILE OF THE RESPONDENTS

Table 1.3: Number of the universities taken from the states

Status	Number of the universities
Haryana	4
Punjab	3
Himachal Pradesh	2

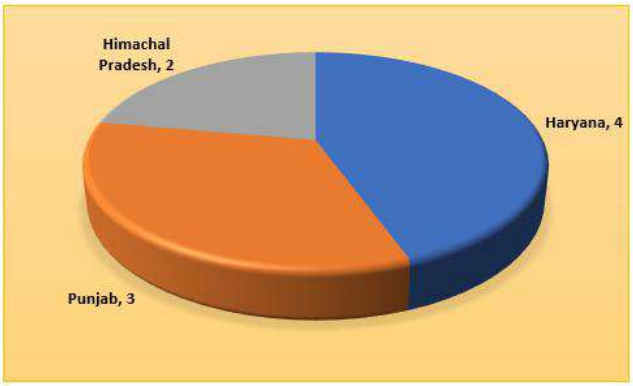

Fig.2.1: Number of the universities taken from the states

Figure 2.1 displays the state wise number of Universities. Generally, nine Universities were examined. four Universities were from Haryana, three from Punjab as well as two Universities were from Himachal Pradesh**.**

Status of the Respondents

Table 1.4: Status of the Respondents

Status	Frequency	%
PG Students	1043	76%
Research Scholars	337	24%
Total	1380	100%

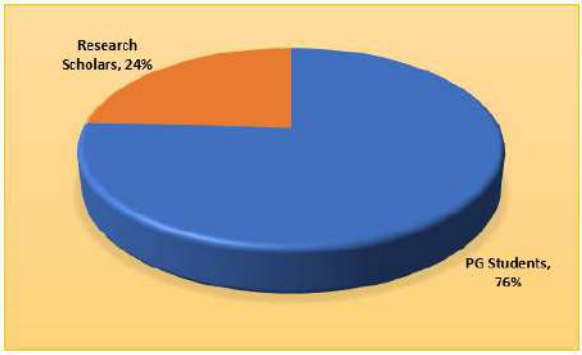

Fig.2.2: Status of the Respondents

Table as well as Figure spotlights the condition of the respondents. 1043 (seventy-six %) respondents were PG Students and 337 (twenty-four %) respondents were Research Scholars.

In the present chapter, interpretation as well as analysis of the entire result of the study have been talked about. The analysed information is provided in tabular type and in graphical type anywhere necessary. Percentages as well as frequencies of responses are provided in each table.

V. CONCLUSION

Even though a lot of users are aware regarding the Digital Library, however, they do not create the maximum use of the resources out there throughout it. The Digital Library has improved the academic excellence of the academic communities by offering them access to a big variety of the comprehensive and relevant information which subsequently allows the users to enhance the academic output of theirs. Through different studies it's been testified that university libraries in Haryana, Punjab as well as Himachal Pradesh use Digital Library at a reasonable level consequently the university authority ought to determine the optimum use of Digital Library for the gain of the users to be able to enhance the academic standard.

Vast majority of the users believe that the Digital Library is actually the easiest way to get information readily and with no a lot of expense. What's more, it will help them to preserve their cash as well as time. Vast majority of the respondents thus desire that the Digital Library must subscribe far more e resources besides the now available for the gain of the users.

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Enhancing Flexural Performance of GFRC Square Foundation Footings through Uniaxial Geogrid Reinforcement

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Abstract**—** *This study investigates how the flexural characteristics of square foundation footings, strengthened with glass fiber reinforced concrete (GFRC), are influenced by uniaxial geogrids. The research involves tests on five reinforced concrete square footings under square loading until failure. Variables include geogrid layer count and longitudinal reinforcement proportion. The analysis covers factors like different stage loads, deflection, energy absorption, ductility, and crack patterns. Results indicate that adding geogrid layers with GFRC significantly improves footing flexural performance and fracture mechanism. More geogrid layers lead to notable load increases at each stage. The data also reveals that geogrid reinforced GFRC footings surpass those reinforced with steel and standard concrete mixes in strength resistance. Moreover, a simplified empirical equation correlates footing moment directly to geogrid tensile strength, offering efficient predictive accuracy for their relationship. This research emphasizes uniaxial geogrids' benefits in reinforcing GFRC footings, enhancing flexural performance, and offering valuable insights for earth structure design and construction.*

Keywords**— Square foundations, Flexural behavior, Geogrid reinforcement, Geosynthetics, Concrete footings, Uniaxial geogrids, Glass fiber reinforced concrete (GFRC).**

I. INTRODUCTION

Due to its flexibility and versatility, reinforced concrete is used a lot in the construction industry. Still, steel reinforcements in concrete that corrosion can cause the structure to weaken and need expensive repairs [1][2]. Researchers are investigating into other materials, such as glass, jute, synthetic coconut fibers, rubber, plastics, sisal, and hemp, to improve the concrete tensile strength [3][4]. Plastics are getting more attention these days because of worries about the environment and the oceans. Even so, they are still used, along with other materials, as reinforcements in civil infrastructure [5][6].

Geogrid, a vital element in geotechnical engineering, plays a significant role in reinforcing and stabilizing civil and infrastructure projects. It can be used instead of or in addition to steel reinforcement, and it works well to reduce the damage caused by impacts [7][8]. Geogrid can be utilized in uniaxial or biaxial forms, depending on the specific application. Uniaxial geogrids are well-suited for slope separators and retaining walls, whereas biaxial geogrids excel in highway structures such as bridges, drainage systems, and pavements [9]. By enabling the construction of steep slopes or walls on weak terrain, geogrids expand the usable land area. Additionally, they reinforce pavements and provide stability to unconsolidated surfaces and asphalt layers [10][11][12].

The utilization of geosynthetic materials in the construction of reinforced concrete (RC) and pavement structures has witnessed a significant surge in recent

decades. Geogrids have become increasingly prevalent in the construction of RC and pavement structures [13]. According to Abdel-Hay (2019) [14], geogrids offer a viable alternative to conventional methods and effectively reinforce RC slabs. The incorporation of geogrids enhances flexural strength and reduces deflection at the failure load. Meski and Chehab [15], as well as Hadi et al. [5], have investigated the potential application of geogrids in reinforcing concrete beams. Their studies have demonstrated that geogrids can markedly improve the strength and flexural capacity of concrete beams. Additionally, experimental studies have demonstrated that the application of geogrids can improve the post-cracking performance, failure mode, strength, and longevity of reinforced structural elements [16][17].

In recent times, there has been an increasing focus on augmenting the strength of concrete by incorporating glass fiber reinforced concrete (GFRC) material [18]. GFRC is recognized for its exceptional durability within concrete and comprises a composite material with a matrix that exhibits an asymmetrical dispersion or arrangement of small fibers, whether they are of natural or synthetic origin [19]. The employment of discrete glass fibers has demonstrated the ability to enhance the shear-friction strength of concrete while serving as an effective shear reinforcement. Additionally, the application of glass fibers has been observed to efficiently mitigate crack propagation in beams and footings [20][21].

The main aim of this study is to examine the flexural properties of square concrete footings that have been strengthened with geogrid reinforcement and GFRC. In this study, four distinct variations of uniaxial geogrids, encompassing both rigid and flexible alternatives, are introduced into footings constructed with glass fiber reinforced concrete (GFRC). The specimens undergo square loading. The experimental results clearly demonstrate that the inclusion of geogrids in the concrete footings significantly enhances both strength and post-cracking ductility, especially when multiple layers of geogrids are used.

II. APPLICATION OF EXPERIMENTS

A- Experimental Design and Samples

In the experiment, five footings with different reinforcement configurations were tested. The footings were square in shape (30 cm x 30 cm x 9 cm) and subjected to specific loading conditions using a 7 cm x 7 cm square loading plate. The footings were divided into five categories to evaluate various reinforcement methods. The control specimen was reinforced with steel without any glass fiber bristles. The other specimens were reinforced with uniaxial geogrid and GFRC, with some having two layers and others having four layers of uniaxial geogrid. Table 1 provides a summary of these configurations.

Table 1: Summary of Experimental Test Conditions

Group Name	Code of Specimen	Reinforced Material	Number of Units	Arrangment of layers	Concrete Mixture
Control	C	Steel	4 @ 6 mm	2 bars on each direction	Reinforced concrete mixture (Without adding fiber bristles)
Geogrid reinforced.	S1	Re 520	4 layers	2 sheets on each direction	Glass fiber reinforced concrete (GFRC)
	S2	Re 570	2 layers	1 sheet on each direction	
	S3	Re 540	4 layers	2 sheets on each direction	
	S4	Re 580	2 layers	1 sheet on each direction	

B- Components of Reinforced Concrete

In our experimental specimens, we used ordinary Portland cement (OPC-42.5 grade), natural sand (fineness modulus of 2.6), and filter stones (maximum aggregate size of 9 mm). The concrete mix comprised carefully measured quantities of key components: 450 kg/m3 of cement, 680 kg/m3 of sand, 215 liters/m3 of water, and 970 kg/m3 of coarse aggregate. The GFRC mix have the same items in addition to 2.5 kg/m3 of 12-16 mm long glass fiber bristles with a diameter of 12 microns, supplied by the CMB Group company in Egypt. The normal reinforced concrete mix achieved a compressive strength of 28 MPa at 28 days, while the glass fiber reinforced concrete (GFRC) had a strength of 32.26 MPa.

C- Footings reinforcement

The experimental control specimen employed standard mild steel bars with a diameter of 6 mm and a grade of 36, possessing a yield stress of 36 Ksi, as the primary reinforcement in both longitudinal and transverse directions (as illustrated in Figure 1-a). Furthermore, uniaxial geosynthetic geogrids, supplied by Tensar International Corporation and imported by National

Geotechnical Company for GEOTECH, were extensively utilized in this research (as referenced in [22]). The mechanical properties of the uniaxial geogrids employed in this research were described in Table 2. Uniaxial Geogrids Re520, Re540, Re570, and Re580 were employed and are depicted in Figures 2-b to 2-e.

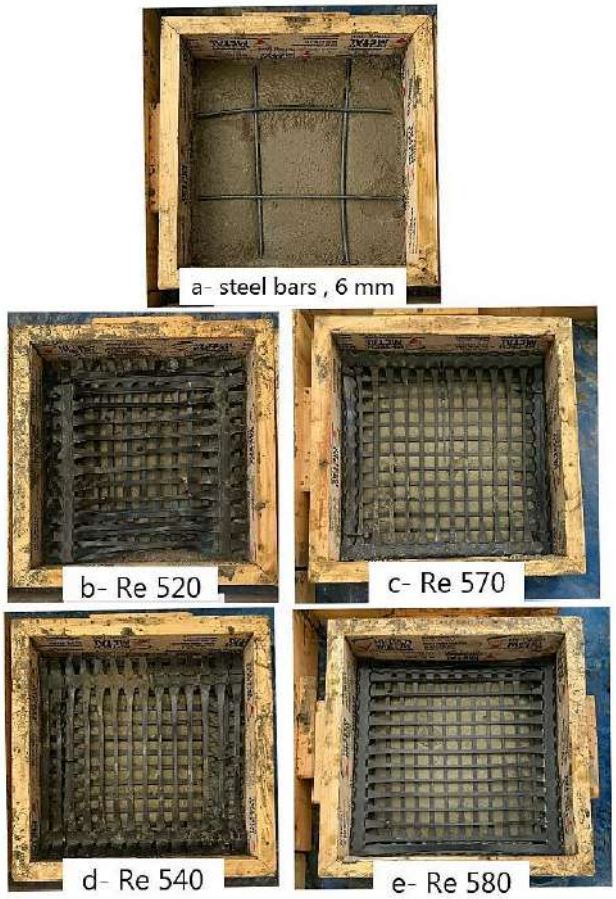


Fig.1: Specimen Reinforcement Layout

Table 2: Uniaxial Geogrid Mechanical Properties Consistent with Manufacturer's Specifications.

Component of Uniaxial geogrid					
Mechanical properties	Uniaxial Geogrid type				Unit
	Re 520	Re 540	Re 570	Re 580	
polymer	High density polyethylene				
Junction strength	95%				
Unit weight	0.36	0.45	0.87	0.98	Kg/m^2
Long term strength	25.10	30.66	56.28	65.27	Kn/m

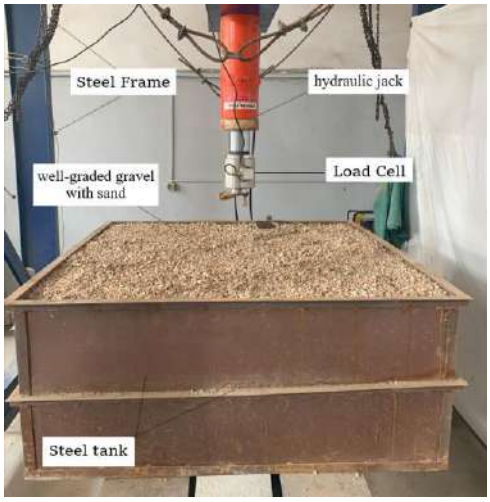
D- Analysis of Soil Specifications

The soil used in this study was classified as well-graded gravel with sand according to the unified soil classification system. Its grading was determined by the uniformity coefficient (22.50) and uniformity curvature (1.98). The soil's compaction characteristics were evaluated through the standard proctor test, revealing a maximum dry density of 2.078 t/m3 and an optimum moisture content of 6.88%. These test results provide valuable insights into the soil's suitability for the footings' application.

Experimental Setup and Instrumentation Configuration

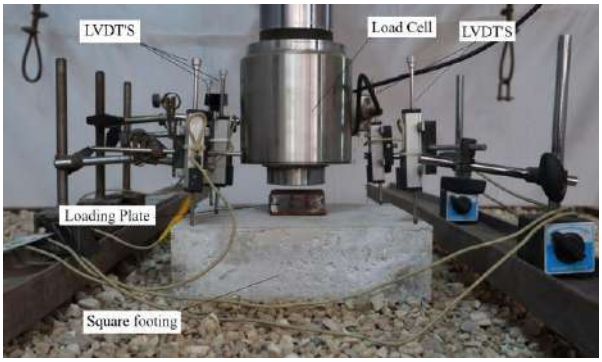
The laboratory-based study utilized a model setup comprising a sturdy test tank, a loading mechanism, a sensor-equipped plate, and a data collection system. The tank, constructed from rigid steel, had dimensions of 1.50 meters in length, 1.50 meters in width, and 0.70 meters in height, Figure 2-a. A motorized hydraulic jack applied a constant load to the footing, with the load measured using

a 1000 kN capacity load cell placed on top. Five LVDT transducers with a resolution of 0.04 mm were strategically positioned on the footing to capture any vertical displacement. The output voltage from each electrical measuring circuit was automatically recorded at one-minute intervals through a data logging system. Figure 2-b, provided a visual representation of the apparatus, illustrating its principal dimensions and layout, ensuring accurate data acquisition, and facilitating subsequent analysis.



(a) Soil setup inside the steel tank

(b)



(b) Footing setup for testing

Fig.2: Experimental Setup for footing specimen.

III. FINDINGS AND EVALUATION

Figures 3 depict the load-displacement response of square concrete footings that were enhanced with either two or four layers of uniaxial geogrids. The load-carrying capability (P) and vertical displacement (Δ) were calculated for all the examined footings during the initial crack, yield, and ultimate stages. Moreover, the ductility (μ) and energy absorption (En) properties of each footing were assessed. A comprehensive compilation of these parameters is presented in Table 3.

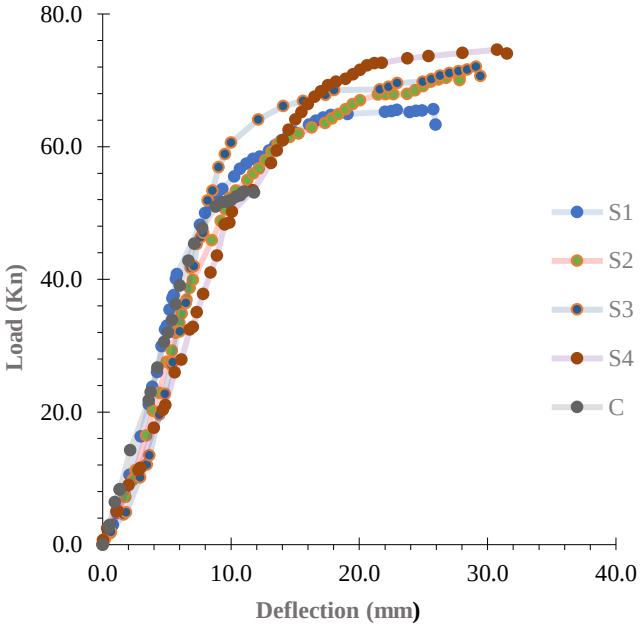


Fig.3. load-deflection relationship of square concrete footings that have been reinforced with both steel and Uniaxial geogrids.

A- Investigating the influence of glass fiber and geogrid on footing performance at various stages.

1- Load Capacity at Various stages

The results suggest that the inclusion of glass fiber bristles and geogrid reinforcement in footings effectively delays the onset of initial cracks, and the post-crack behavior of the reinforced footings exhibits significantly higher load-carrying capacities compared to the square footing (C), as illustrated in Figure 3. Furthermore, when compared to the control footing, the application of uniaxial geogrid reinforcement with GFRC leads to gradual improvements in the cracking load (Pfc), yield load (Py), and ultimate load (Pult).

Footings reinforced with four layers of uniaxial geogrid Re 520 show significant improvements in load capacity. The values of cracking load (P_{fc}), yield load (P_y), and ultimate load (P_{ult}) increase by approximately 21.90%, 19.23%, and 23.32%, respectively, compared to the concrete control footing (C).

Similarly, footings reinforced with two layers of uniaxial geogrid Re 570 exhibit enhanced load-carrying capacities. The values of P_{fc}, P_y, and P_{ult} increase by approximately 22.51%, 28.50%, and 32.45%, respectively, when compared to the concrete control footing (C).

Moreover, footings reinforced with four layers of uniaxial geogrid Re 540 demonstrate significant improvements in load capacity. The values of P_{fc}, P_y, and

P_{ult} increase by approximately 26.82%, 33.10%, and 35.35%, respectively, compared to the concrete control footing (C).

Lastly, footings reinforced with two layers of uniaxial geogrid Re 580 exhibit notable enhancements in load-carrying capacities. The values of P_{fc}, P_y, and P_{ult} increase by approximately 34.14%, 35.79%, and 40.18%, respectively, when compared to the concrete control footing (C).

These findings highlight the effectiveness of incorporating uniaxial geogrid reinforcement in improving the load capacity of footings and suggest that the number of layers and specific geogrid type play a significant role in enhancing the structural performance of the footings.

Table 3: The parameters and properties of square concrete footings that have been reinforced with both steel and Uniaxial geogrids.

	First crack stage		Yield stage		Ultimate load stage		Ductility factor	Energy absorption
	P_f (Kn)	Δ_f (mm)	P_y (Kn)	Δ_y (mm)	P_u (KN)	Δ_u (mm)	μ	En (kn/mm)
C	41.000	7.653	51.000	8.500	53.225	11.044	1.299	398.702
S1	50.000	8.310	60.810	14.400	65.642	25.785	1.791	1309.523
S2	50.230	9.312	65.536	15.530	70.500	27.824	1.792	1409.116
S3	52.000	9.384	67.881	16.110	72.043	29.087	1.806	1591.158
S4	55.000	12.312	69.253	16.900	74.615	30.738	1.819	1704.215

2- Vertical displacement Across Different stages

When compared to a control footing (C), the footings reinforced with uniaxial geogrid and glass fiber bristles demonstrate an increase in vertical displacement values at the cracking stage (Δ_{fc}), yield stage (Δ_y), and ultimate stage (Δ_{ult}), as observed in the load-deflection curves. The specific increases are outlined as follows:

For footings reinforced with four layers of uniaxial geogrid Re 520, the values of Δ_{fc}, Δ_y, and Δ_{ult} increase by approximately 8.58%, 69.41%, and 133.47%, respectively, compared to the concrete control footing (C). Similarly, footings reinforced with two layers of uniaxial geogrid Re 570 exhibit increases in Δ_{fc}, Δ_y, and Δ_{ult} values of about 21.67%, 82.70%, and 151.9%, respectively, in comparison to the concrete control footing (C).

Furthermore, footings reinforced with four layers of uniaxial geogrid Re 540 demonstrate increases in Δ_{fc}, Δ_y, and Δ_{ult} values of approximately 22.61%, 89.52%, and 163.36%, respectively, compared to the concrete control footing (C). Lastly, footings reinforced with two layers of uniaxial geogrid Re 580 exhibit significant increases in Δ_{fc}, Δ_y, and Δ_{ult} values, with approximately 60.87%, 98.82%, and 178.32% increases, respectively, in comparison to the concrete control footing (C).

B- Energy Absorption [En].

The ability to absorb high levels of energy is crucial, especially in scenarios such as major earthquakes, where effective dissipation of energy is required to mitigate significant dynamic responses and provide sufficient hysteretic damping in concrete structures. The energy dissipation capability of the footings under investigation was assessed by calculating the area enclosed by their load-deflection curves, as depicted in Figure 3. Furthermore, a comparative analysis of the footings was conducted based on their energy absorption capacity, revealing the following observations.

The energy absorption for S1 exhibited a substantial increase of approximately 228.44% compared to the concrete control footing (C). Similarly, the energy absorption for S2 demonstrated a significant increase of about 253.42% compared to the concrete control footing (C).

Furthermore, the energy absorption for S3 showed a remarkable increase of approximately 299.08% compared to the concrete control footing (C). Additionally, the energy absorption for S4 displayed a substantial increase of about 327.441% compared to the concrete control footing (C).

These findings highlight the significant improvements in energy absorption achieved by the respective configurations (S1, S2, S3, and S4) when compared to the concrete control footing.

C- Displacement Ductility Factor [μ]

In this study, we examined the influence of geogrid reinforcement on the displacement ductility characteristics of concrete footings. The displacement ductility index, which measures the ability of structural elements to

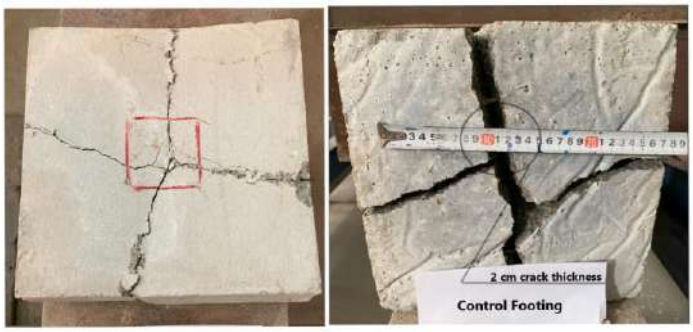
withstand considerable deflections without experiencing significant loss in strength prior to failure, was employed to assess the performance of the concrete footings. Maintaining the strength of concrete structures above the yield strength and allowing for permissible plastic deformation, as specified in the design guidelines [21], is essential to ensure their resilience during seismic events.

The Displacement Ductility factor for S1 demonstrated a substantial increase of approximately 37.81% compared to the concrete control footing (C). Similarly, the Displacement Ductility factor for S2 exhibited a notable increase of about 37.9% compared to the concrete control footing (C). Furthermore, the Displacement Ductility factor for S3 displayed a significant increase of approximately 39% compared to the concrete control footing (C). Additionally, the Displacement Ductility factor for S4 showcased a remarkable increase of about 40% compared to the concrete control footing (C).

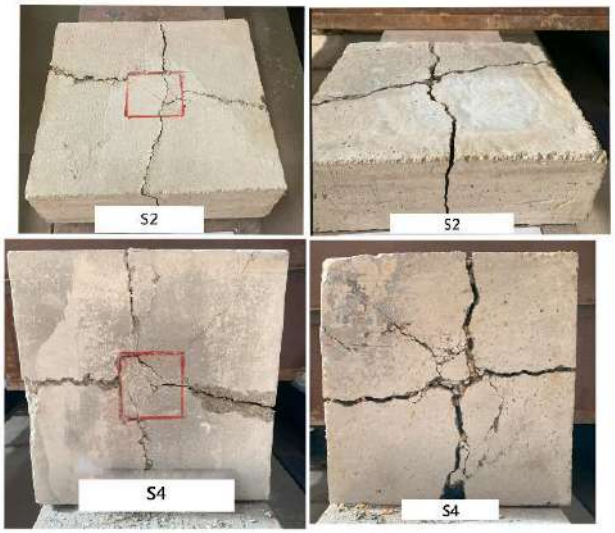
These findings highlight the substantial enhancements in Displacement Ductility achieved by the respective configurations (S1, S2, S3, and S4) when compared to the concrete control footing. Furthermore, our investigation unveiled a direct association between the augmentation in displacement ductility and the tensile strength of the utilized uniaxial geogrids. Additionally, the inclusion of multiple layers of uniaxial geogrid reinforcement did not detrimentally impact the response of the footings, as evidenced by the load-deflection curves. Consequently, the integration of multiple layers of uniaxial geogrid reinforcement presents a pragmatic and efficient approach to enhance the overall performance of reinforced concrete footings.

D. Failure Mechanism

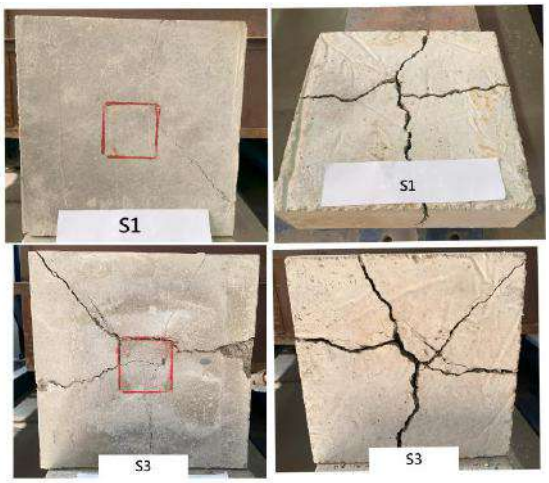
In the conducted tests on the concrete footings, crack development was observed to predominantly occur in a perpendicular direction to the load plate. Specifically, flexural cracks were observed, while shear cracks were absent. The failure pattern of the concrete footings was characterized by the widening of cracks, the appearance of additional cracks in certain footings, and the propagation of these cracks from the tension zone (located at the bottom surface of concrete) to the compression zone (located at the top surface of concrete), ultimately leading to failure.



a- Control footing



b- Footings with two uniaxial layers, S2 and S4



c- Footings with four uniaxial layers, S1 and S3

Fig.4: The observed crack patterns in the concrete footings.

Within the control concrete footing (C), four noticeable cracks emerged and progressively extended until reaching failure. These cracks exhibited notable width, signifying

significant impairment to the steel reinforcement bars upon reaching the load capacity that caused failure, Figure 4-a.

In contrast, the concrete footing reinforced with two layers of uniaxial geogrid exhibited the presence of multiple smaller cracks, which were observed to propagate in various directions (Figure 4-b). These cracks displayed narrower widths, and their density notably decreased in footings reinforced with four layers of geogrid compared to those reinforced with two layers (Figure 4-c). Importantly, no evidence of rib cutting was observed in the uniaxial geogrids. Overall, the damage observed in the samples reinforced with uniaxial geogrids was significantly milder in comparison to the damage observed in the control samples. Thus, a direct correlation can be observed between the quantity and width of flexural cracks, the tensile strength of geogrids, and the number of geogrid layers, as indicated by the findings of this research.

E. Correlation between Square Footing Moment and Geogrid Reinforcement

The study aims to explore the relationship between the applied moment on a square footing and the effectiveness of using uniaxial geogrids as reinforcement. By analyzing various factors such as load distribution and geogrid properties. The findings of this analysis will contribute to a better understanding of the interaction between footing moments and geogrid reinforcement, aiding in the development of more efficient and reliable geotechnical design practices.

The calculation of the ultimate moment (Mu) and the required area of geogrid (Ag) for all groups of square footings has yielded conclusive results, Fig. 5. In order to establish a correlation between the ultimate moment (Mu) and the required area of geogrid (Ag) for different square footings (S 1 to S 4), data-fit software was employed. This software allowed for the analysis of the relationship between M_u and A_g. Consequently, an empirical formula can be derived from these results as given in (Eq.1).

$$Ag = \delta * e^{\sigma * \frac{Mu}{d}} = N * L * \quad T_{ult} \qquad (1)$$

In the provided context, the variables in the equation have specific meanings. Here are their explanations:

- Ag: Total ultimate strength of the uniaxial geogrid on the square footing (Kn).
- Mu: Ultimate moment exerted on the footing (Kn.m).
- d: Depth of the square footing (m).
- δ: Value of 3 for reinforced concrete mixture and 2.1608 for glass fiber reinforced concrete mixture (Constant values).
- σ: Value of 0.106 for reinforced concrete mixture and 0.1204 for glass fiber reinforced concrete mixture (Constant values).
- N: Number of geogrid layers.
- L: Length of geogrid within the footing (m).
- T_{ult}: Tensile strength of the uniaxial geogrid used (Kn/m).

These points provide a concise overview of the variables and their respective meanings.

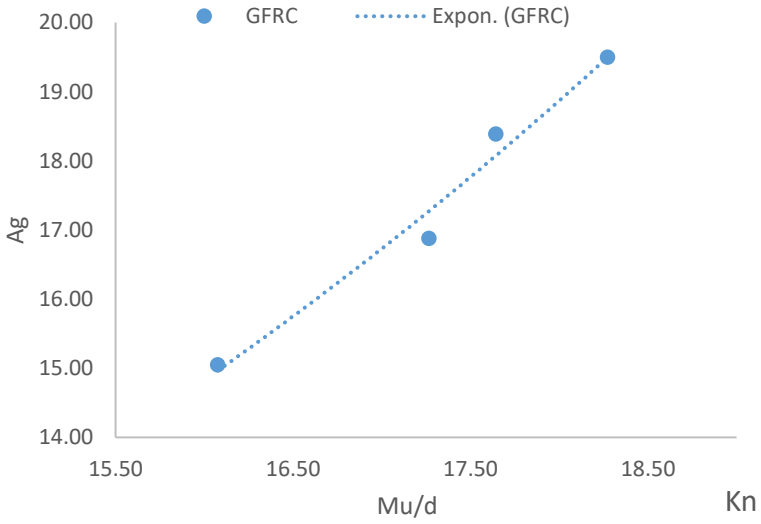


Fig. 5: Correlation between (Mu/d) and Required Area of uniaxial Geogrid (Ag) for Different footings.

IV. CONCLUSION

1- Uniaxial geogrid reinforcement with GFRC significantly enhances the load capacity of footings, with improvements in cracking load (P_{fc}), yield load (P_y), and ultimate load (P_{ult}) ranging from approximately 19.23% to 40.18% compared to the concrete control footing.

2- Geogrid reinforcement substantially improves the displacement ductility of footings, with notable increases in Δ_{fc}, Δ_y, and Δ_{ult} values ranging from approximately 8.58% to 178.32% compared to the concrete control footing.

3- Geogrid reinforcement leads to substantial improvements in energy absorption capacity, with increases ranging from approximately 228.44% to 327.441% compared to the concrete control footing.

4- Geogrid reinforcement positively impacts the Displacement Ductility factor, with increases ranging from approximately 37.81% to 40%, enhancing the structural element's capacity to endure significant deflections without strength reduction.

5- Geogrid reinforcement effectively mitigates crack development, reducing crack width and damage to steel bars, improving the overall structural integrity of the concrete footings.
6- An empirical formula was developed to establish a relationship between the ultimate moment (M_u) and the required area of geogrid (A_g) for square footings.

In summary, the study highlights the significant benefits of utilizing uniaxial geogrid reinforcement in enhancing the load capacity, displacement ductility, energy absorption, and crack mitigation in concrete footings. These findings contribute to the advancement of engineering practices and offer valuable insights for designing and constructing resilient structures in various applications.

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Quantitative Analysis on Financial Performance of Merger and Acquisition of Indian Companies

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Abstract— *In general, Mergers and Acquisitions (M&A) are becoming more common around the world as a way to strengthen companies by raising their profile, diversifying their portfolios to reduce business risks, expanding into new markets and topographies, and exploiting economies of scale, among other things The information analysis identified by all five financial metrics, such as ROI, will provide data about profitability, liquidity, leverage, and efficiency using all seventeen ratios. T-Test is a cumulative analysis that is typically examined in detail using factual research methods that are linked to all seventeen proportions. The general analysis of financial performance and the overall scientific theory of outcomes complete the final section. Since the analyst is unable to conduct the exam on a full scale, it was done on a miniature scale. The study community includes a wide range of organisations with a wide range of business operations and unusual business practises.*

Keywords— ***Financial, Performance, Merger, Acquisition and Indian Companies.***

I. INTRODUCTION

M&A (mergers and acquisitions) has become increasingly popular around the world as a way to improve a company's strength by rising the portfolio's importance, expanding the collection to reduce market risks, entering new business markets and geographies and leveraging economies of scale, and so on. In India, they now have a monthly event as well. Many people are interested in them, including business officials looking for potential fusion partners, risk financiers involved in fusions, lawyers who lead meetings, administrative experts concerned with the exchange of shares and the development of corporate segments in the economic field, and scientists who must understand.

Financial performance measurements provide a relative baseline for comparisons between a company and itself over time, or between a business and its industry competitors. Furthermore, money-related execution metrics have no global cutoff and are critical in assessing an organization's overall performance. Business language is sometimes said to include financial proclamations. This method is measured to assess qualifications and flaws in a company's performance using quantitative relationships.

The analysis of financial performance is often intended to incorporate considerations of the critical and economic changes of the organization over time. Financial directors and CEOs alike ask for appraisal criteria so that they can quickly evaluate the company's performance and chart a path forward. These metrics can be used to improve the company's tasks easily. The Management Board's excessive enthusiasm for assessing financial performance has increased significantly, as annual and long-term remuneration is increasingly dependent on the achievement of worthy performance, as measured by financial performance.

II. REVIEW OF LITERATURE

Gupta, Isha et.al. (2022). The purpose of this study is to explore the expansion of merger and acquisition (M&A) literature in the context of Indian studies and examine the impact of mergers and acquisitions on various financial performance parameters of India's Agri-Food companies. The period of study is from 2011 to 2019, and Wilcoxon Sign Rank methodology has been used. The study hypothesized that there is significant growth in Indian

literature of M&A and there is a significant difference in the operating performance, financial performance and shareholders' return of acquiring firms during the period of pre-M&A and post-M&A. The study findings state that the literature of M&A in India increases significantly, and the operating ratio, financial ratio, and shareholder return also exhibit a significant improvement whereas the expense ratio related to the operating ratio shows no improvement in performance. The study concludes that the India Agri-Food company's financial performance has improved overall for the acquiring firms during the post-M&A period.

Gupta, Isha et.al. (2022). This article aims to examine the impact of mergers and acquisitions (M&A) on the financial performance of the construction and real estate industry, using the broad spectrum of financial ratios. The period of study is from 2011 to 2020, and paired t-test methodology has been used. It is hypothesized that there is a significant difference in the pre-M&A period and post-M&A period. The study findings conclude that profitability ratio and liquidity ratio have improved significantly, whereas leverage ratio exhibits no change in performance. In the efficiency ratio, the fixed-assets turnover ratio substantially improves, but the total asset turnover ratio and current asset turnover ratio show a slight improvement. The study concludes that the Indian construction and real estate company's financial performance has improved overall for the acquiring firms during the post-M&A period. The study implies that the construction sector supports the synergy hypothesis, stating that M&A will improve synergy during the post-M&A period because of the consolidation of two firms' resources.

Sengar, Neeraj et.al. (2021). Merger and acquisition (M&A) activities increases revenue, enhances competitive advantage, and drives the organization to undergo strategic initiative such as management of products. This study is focused on the financial performance analysis after merger of two Indian banks. Quantitative research methodology particularly trend and hypothesis analysis of key financial indicators are implemented. For validation of hypothesis, t-test is performed. The trend analysis results show a consistent growth of all the key financial indicators post-merger. The hypothesis analysis shows increment and decrement of financial parameters for the acquirer and acquired. The findings of the study discuss the benefits gained by the acquirer and validate success of the merger.

Rani, Neelam et.al. (2016). Mergers and acquisitions (M&A) have long been used as a strategy for corporate growth and expansion. But, does the financial performance of the acquiring firm (in long term) really improve following mergers and acquisitions ? This chapter addresses the major questions related to the long-term performance of the acquiring firm.

Mehrotra, Arpita et.al. (2018). The Mergers and Acquisitions (M&A) wave was triggered post-liberalization in 1991. The liberalized policies included removal of industrial licensing as well as lifting of Monopolistic and Restrictive Trade Practice (MRTP) Act. The strategies embarked the advent of new emerging scenario where the combining businesses became a well-opted measure to fight the cut-throat competition through better governance in India. The purpose of this article is to review literature already published pertaining to post-merger financial performance of acquirers. The review revealed that the research is mostly focused on the deals which took place in developed nations where M&A came into vogue as early as late nineteenth century. Further, most of them were announcement-related. The review brought out the gap in research undertaken in emerging nations. This article attempts to help the researchers to the understanding of the issues in M&A and recommends avenues for future research.

III. RESEARCH METHODOLOGY

Until a few years ago, the news of the Indian entity having acquired US-European elements was very unusual. However, this situation has unexpectedly shifted. Updates on Indian firms outside organisations are now more popular than every other case round. When sourcing and buying the chosen organisational fields are only focussed on the company's secondary financial statements, the relative monetary results analysis. For this purpose, descriptive science architecture is suitable for ebb and flow research. The demographic of the review consists of several Indian institutions, but they work with Indian firms in all sorts of commercial transactions and they are completely unexpected. The test was carried out in a miniature shape, so that the scientist could not do it at a wide scale. The research group comprises a wide range of organisations with various corporate operations and somewhat unexpected market practises. Although the specialist will do the evaluation, all organisations cannot be selected. The examination in these lines was comfortable. As described below, researchers choose 10 organisations (these represented by 10 top 10 merger and takeovers in respect of opportunities between 2006 and 2011): The study universe considered for Indian Industries: This study is based on previous study that used data from financial reports from chosen organisations and the EMIS database.

IV. DATA ANALYSIS

Ratio analyses are one of the most important assets of the financial analysis. What are the most important financial accounting methods used to assess the financial situation and results of the company with ratios. An expert and expert understands more than he should have done the financial condition of the firm clearly by analysing and assessing various accounting aspects of his/her paper, and by reviewing his/her financial statements. It's been seen here below.

Return on Investment Ratios

The ROI is a crucial statistic for measuring the profitability of any financial capital, no matter where it came from. Return on the money invested as well as the capital employment in the industry, an indispensable indication of profitability. This calculates the power gain gained from the capital source. The "end-profit rate" results from an increase in the amount of quantitative variables that relate to various linked and contingent factors in the industry." The return on investing resources is completely eliminated by all the failure to ensure the profitability of the company when investments return, while the benefit profit advantage does not centre on the use of the money of the company. Therefore, ROI is a reference to the relationship between net benefit and business properties.

- Return on Net Capital Employed Ratio

The viability of net resources is a guide to business sustainability logic. It also shows that the net cash for making desirable gains has been appropriately utilised. The short-term binding capital used is the number of financial reserves compared to the current assets. Exclusion from total capital utilised by current obligations was the main measure of the gross capital used with the net capital used. Complete capital profit returns were handled by a net profit division until intrigue and net capital assessments were used. Cast-off net capital recurrence is dependent on the following formula;

The research was carried out 5 years before and 5 years after M&A.

The table below displays the yield on total resources utilized in units defined as fusions and transactions. The maximum prices for Tata Steel are reported by 43,88 percent, and the minimum return duration of 19,34 percent and 14 percent for Huchison Essar and Tata Teleservices, while others show conventional return on net capital utilised prior to fusions and acquisitions. Furthermore, after fusions and acquisitions, production improved by 25,86 per cent, by 1.45 percent, 11,90 per cent and by 2.17 per cent individually in Huchison "Essar, Ranbaxy Laboratories, Tata Tele and HDC bank " The majority of the six instances had a slowing growth rate on return on net investment. In this respect, the analyst believes that since fusion and acquisitions, the financial efficiency of the research units has not been changed.

Table 1 Return on Net Capital Employed Ratio

Sr. No	Name of the Companies	Before M & A (X)	After M & A (Y)	Diff (D = Y - X)	Diff Squared (D^2)
1	TATA STEEL	43.88	12.61	(31.27)	977.60
2	HUTCHISON ESSAR	-19.34	6.55	25.89	670.29
3	HINDALCO INDUSTRIES	15.53	9.25	(6.28)	39.40
4	RANBAXY LABORATORIES	12.42	13.87	1.45	2.11
5	ONGC	35.30	23.71	(11.59)	134.26
6	TATA TELESERVICES	-14.00	-2.09	11.90	141.66
7	HDFC BANK	8.82	10.98	2.17	4.70
8	TATA MOTORS	27.01	16.72	(10.29)	105.78
9	STERLITE INDUSTRIES	31.46	16.70	(14.76)	217.93
10	SUZLON ENERGY	28.59	6.98	(21.61)	466.99
				(54.38)	2956.68

Table 1 (a) "Analysis of T - Test Return on Net Capital Employed Ratio"

n	Mean (D)	S.D.(σ)	d.f.	Tc	Tt	Result
10	-5.44	5.23	n-1 10 -1 9	-1.04	2.262	H0

H0 = The score of net capital returns employed by selected units is not a vital differentiation in terms of fusion and acquisitions.

H1 = "There is enormous difference between the ROI ratio used in selected items when merger and acquisitions."

$$H0 = \mu1 = \mu2$$

$$H1 = \mu1 \neq \mu2$$

5% level of noteworthiness table worth Tt = 2.262

The estimate determined for T is - 1.04, while T is 2.262. Under that way,

$$Tc < Tt$$

The estimate of 't' is not precisely the estimate of t in the graph. It's recognised the zero hypothesis. The results depend on the wish.

- Return on Long Term Fund Ratio

This proportion connects the ultimate advantage to a considerable distance. The reserve funds drawn are valid for the absolute important company distance interest. The overall long-term finances dictate it by limiting profits before suspense and evaluation (EBIT). The benefit for large distances savings depends on the specification below,

$$\text{Return on long term fund ratio} = \frac{\textbf{operating profit (EBIT)}}{\textbf{long term fund}} \times \mathbf{100}$$

Table 2 Return on Long Term Fund Ratio

Sr. No	Name of the Companies	Before M & A (X)	After M & A (Y)	Diff (D = Y - X)	Diff Squared (D^2)
1	TATA STEEL	44.82	12.82	(32.00)	1023.94
2	HUTCHISON ESSAR	13.22	19.18	5.96	35.52
3	HINDALCO INDUSTRIES	16.60	11.23	(5.37)	28.80
4	RANBAXY LABORATORIES	14.82	20.43	5.62	31.53
5	ONGC	35.35	27.40	(7.96)	63.31
6	TATA TELESERVICES	-18.95	-5.70	13.25	175.67
7	HDFC BANK	67.24	76.37	9.13	83.32
8	TATA MOTORS	29.28	22.41	(6.87)	47.20
9	STERLITE INDUSTRIES	36.66	19.07	(17.59)	309.23
10	SUZLON ENERGY LTD	31.49	8.75	(22.74)	517.06
				(58.56)	3429.23

The above table indicates the return on long-term financing in 10 preferred units for merger and procurement. “HDFC Bank has a higher return on long-range capital of 67.24% and Tata Tele's administrations are the lowest of 18.95% until mergers and acquisitions. In addition, Tata Steel, Hutchison Essar, Hindalco, RanbaXy Laboratories, OPTA, Tata Motors, Sterlite Industry and Suzlon Oil report their normal 27% return on long-haul assets during pre-merging and procurement operations. In either case, after fusions and acquisitions, HDFC Bank shows 76,37% of its return on long-term capital. The results of fusions and consumers in the four units Hutchison Essar, Ranbaxy Labs, Tata Tele Services and HDFC Bank increased by 5.96% by 5.62%, by 13.25, by 13% and by 9.13% separately.' After mergers and acquisitions, the remaining 6 units display a decrease in growth rate following a 32 percent decline in steel from TATA. Thus, the expert would conclude that the practicality of four units has increased and 6 units have decreased since variations and acquisitions.

Table 2 (a) Analysis of T - Test Return on Long Term Fund Ratio

n	Mean (D)	S.D.(σ)	d.f.	Tc	Tt	Result
10	-5.86	4.68	n-1 10 - 1 9	-1.25	2.262	H0

H0 = “In the case of fusions and acquisitions, there will be no major contrast in implying the return on long-term funds ratio.""

H1 = “It is important to contrast that the long-term fund return ratio is measured in selected units when fusion and security occurs."

$$H0 = \mu1 = \mu2$$

$$H1 = \mu1 \neq \mu2$$

Hugeness table degree 5 percent Tt = 2.262

Tc is measured at -1.25 and the Table is estimated at 2.262. Thus, the

$$Tc < Tt$$

The value of the table is not necessarily specified. The null hypothesis is well established. The results are based on the requests.

Return on Assets Ratio

The connection between overall pay after cost and the complete capital is characterised in this proportion. The term "absolute capital" refers to the common speculation that resources are being poured into business. Tax Net Benefit (PAT) is computed with the overall cash. Based on the formula below, the total return is approximate

Table 3 Return on Assets Ratio

Sr. No	Name of the Companies	Before M & A (X)	After M & A (Y)	Diff (D = Y - X)	Diff Squared (D^2)
1	TATA STEEL	144.18	351.10	206.92	42816.16
2	HUTCHISON ESSAR	-16.82	4.67	21.49	461.82
3	HINDALCO INDUSTRIES	558.20	132.28	(425.92)	181409.55
4	RANBAXY LABORATORIES	86.27	94.91	8.65	74.74
5	ONGC	338.15	228.61	(109.54)	11999.89
6	TATA TELESERVICES	0.33	-4.83	(5.16)	26.58
7	HDFC BANK	186.36	330.03	143.68	20643.66
8	TATA MOTORS	145.82	157.54	11.72	137.39
9	STERLITE INDUSTRIES	335.40	265.56	(69.85)	4878.32
10	SUZLON ENERGY	112.72	43.04	(69.69)	4856.32
				(287.70)	267304.44

The above table displays the asset return in 10 units chosen as merger and acquisition occurs. Hindalco Industry reported the lowest income of Hutchison Essar until mergers and acquisitions at 558.20 percent (16.82 percent). Moreover, during pre-mergers and acquisitions, several divisions have a typic Asset Return. However, after mergers and acquisitions, Tata Tele Services shows the most incredible 351.10% of profit return. Following mergers and purchases, the output of 5 units Tata steel, 8,65% Hutchison Essar, HDFC Bank and Tata Motors was increased by 206,92%, 143,68% and 11,72%. In addition, after fusions and acquisitions the remaining 5 units saw a decrease of asset return growth rates with Hindalco Industries a significant decline by 425.92%. In these lines the specialist will establish that the production is increased by five units and five units decreased after mergers and acquisitions.

Table 3 (a) Analysis of T - Test Return on Assets Ratio

n	Mean (D)	S.D.(σ)	d.f.	Tc	Tt	Result
10	-28.77	53.65	n-1 10 - 1 9	-0.54	2.262	H0

H0 = There is no huge difference in the Return on Assets score in units chosen while fusions and acquisitions are taken.

H1 = The return on assets ratio in the chosen units is huge in separation as fusion and securing are achieved.

$$H0 = \mu1 = \mu2$$

$$H1 = \mu1 \neq \mu2$$

5% level of centrality table worth Tt = 2.262

The determined estimation of T is - 0.54 while tabl

$$Tc < Tt$$

The calculation of 't' isn't quite the calculation of t table. The null hypothesis is well established. The results are based on the requests.

- **Return on Shareholders' Fund Ratio**

"Return On Net Worth" is the term for the return of shareholders. The return on net value is shown in the success of the investor transactions. We recognise that an organisation is established to make a profit overall. Investment returns along these lines could at least be given.

The word net value or shareholder properties

- Money for equity shares
- Capital share preference
- Less amassed disasters inventory and surplus

The increase in salarieties, which potentially has room for business clashes and financial risk owners, needs to be quantified. It's valuable." This relationship therefore concerns anticipated owners with an outstanding zeal for existing and sometimes unparalleled management concerns."

A higher ratio shows greater profitability, better business opportunities and the appropriate usage of the owners' funds while or otherwise selling profits. The return on net worth of utilising imported capital can be improved by making it enthusiastically pay by international agents at a fixed rate which also reduces tax danger. Whenever the profits recognised from the use of earned reserves are higher, the expenditures by such investments and investment funds have consistently impacted revenues or firms, leading to an increased total return. The shareholder's return on reserve is calculated in the form below.

Table-4 Return on Shareholders' Fund Ratio

Sr. No	Name of the Companies	Before M & A (X)	After M & A (Y)	Diff (D = Y - X)	Diff Squared (D^2)
1	TATA STEEL	42.54	18.92	(23.61)	557.57
2	HUTCHISON ESSAR	0.00	0.00	0.00	0.00
3	HINDALCO INDUSTRIES	15.97	10.89	(5.08)	25.81
4	RANBAXY LABORATORIES	21.60	-15.49	(37.10)	1376.15
5	ONGC	25.71	18.13	(7.58)	57.41
6	TATA TELESERVICES	261.01	32.47	(228.54)	52232.36
7	HDFC BANK	17.16	16.18	(0.98)	0.96
8	TATA MOTORS	28.39	19.63	(8.76)	76.71
9	STERLITE INDUSTRIES	28.98	11.65	(17.33)	300.24
10	SUZLON ENERGY	37.58	-5.83	(43.42)	1885.04
				(372.39)	56512.26

The table gives information on the return of 10 units selected during mergers and procurements on the subsidy ratio of shareholders. Tata Tele Services displays the largest 261.01%, though Hindalco Business shows the smallest 15.97% until mergers and acquisitions. In addition, residual units produce 29 per cent typical return on shareholders' expenditure prior to mergers and acquisitions. Since then, Tata Chemical Ltd. has been merged and bought. Shows the highest return 19.62 percent. Following mergers and acquisitions, per 10 units was at a declining growth pace, which saw the Tata TeleServices decline significantly by 228.54%. The decay rate is seen in all 10 sample units in the shareholder support ratio. In this regard, researchers should infer that after mergers and acquisitions the financial contribution of the sample units has been lowered.

Table 4 (a) Analysis of T - Test Return on Shareholders' Fund Ratio

N	Mean (D)	S.D.(σ)	d.f.	Tc	Tt	Result
10	-37.24	21.77	n-1 10 - 1 9	-1.71	2.262	H0

H0 =There is no fundamental difference in the Return Shareholders' Fund score as fusions and acquisitions occur.

H1=The score of shareholder return is significantly different in units selected when fusing and getting.

$$H0 = \mu1 = \mu2$$

$$H1 = \mu1 \neq \mu2$$

5% level of significance table value Tt = 2.262

The calculated value of T is -1.71while table value of T is 2.262. Thus,

$$Tc < Tt$$

The 't' approximation is not the same measure of the t graph. The null hypothesis is well established. The results are based on the requests.

V. CONCLUSION

Fusion and purchases are a standard discussion at present. Companies favoured fusion and take-over to expand fast, to capture the company and reach new borders. The fusion and procurement rate was paved as the Indian government has since 1991 seen multiple monetary changes in its expansion, privatisation, and globalisation. Over the past decade, fusion and acquisition steadily increased the numbers of partnerships and partnerships in the Indian sector The analysis gives vendors, brokers and directors incentives to understand and monitor the reasons of M&A and M&A hours with their financial reports or mutual capital. The analysis provides incentives. This example also provides the scientist with the basis for potential research from top to bottom, and makes him know that M and A are multifaceted and work. Furthermore, this Summary Report is a Guideline for compilation or incorporation of all M&A participants and financial statements.

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Application and Methods of Deep Learning in IoT

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Abstract**—** *In this talk, we provide a comprehensive overview of how to use a subset of advanced AI techniques, most specifically Deep Learning (DL), to bolster analytics as well as learning in the IoT URL. First and foremost, we define a development environment that integrates big data designs with deep learning models to promote rapid experimentation. There are three main promises made in the proposal: To begin, it illustrates a big data engineering that facilitates big data assortment in the same way that businesses facilitate deep learning models. Then, the language for creating a data perspective is shown, one that transforms the many streams of large data into a format that can be used by an advanced learning system. Third, it demonstrates the success of the framework by applying the tool to a wide range of deep learning use cases. We provide a generalized basis for a variety of DL architectures using numerical examples. We also evaluate and summarize major published research projects that made use of DL in the IoT context. Wonderful Internet of Things gadgets that have integrated DL into their prior knowledge are often discussed.*

Keywords**— Deep Learning, IOT.**

I. INTRODUCTION

One definition of artificial intelligence (AI) is when computers can mimic human intelligence by doing activities normally done by humans with little to no human intervention. In the 1950s, experts in the field of programming design started to wonder whether they might teach computers to recognize, marking the beginning of the field of study today known as artificial intelligence. Initially, experts believed that AI could be programmed with great programs using a comprehensive strategy of clear set coding principles shown by human managers. This kind of artificial intelligence is mostly agent-based and was the dominant AI approach from the 1950s until the late 1980s. While this viewpoint is useful for solving problems that can be simply depicted, like playing chess, it is not equipped to solve problems that are more complex and require more nuanced analysis, such as those involving the representation of images, the localization of objects, the confirmation of verbal claims, or the clarification of linguistic concepts. Throughout the 1990s, ML emerged as a perfect technique that was quickly supplanting significant AI, and it has since become the most widely utilized, best field of AI.

Machine learning (ML) is a broad discipline, but deep learning (DL) is an area that has been growing in popularity over the last several years. DL combines frameworks for learning representations at several levels of detail (...) by creating fundamentally indirect modules that successively transform the representation at a given level into a representation at a more pressing, somewhat logically distinct level. DL's structure is fundamentally different from that of conventional ML systems, which gives it a great deal of adaptability. While just a handful of layers are actually in use, DL enables a computer to analyze raw data and quickly assess systems for depiction. DL does this via the use of artificial neural networks (ANN), with features like dynamic ability sorting and several caretaking layers that provide automated learning of constraint chains of relevance. Because DL estimates can swiftly complete tasks like resolving dependencies and recreating data from raw data (feature structuring), ML is inherently more efficient. As Google's AI defeated a human in the chaotic game Go, ANN received a few expressions of open enthusiasm. In order to filter through data and address comprehension, we apply a variety of enhancements at varying levels.

II. LITERATURE REVIEW

Zeng et al. (2017) have proposed a scalable big data integration architecture based on meta-synthesis for analyzing massive amounts of data. The foundation of the suggested framework is the notion of meta synthesis, which is based on the coordination of meta synthesis' structural style, intelligence, and comprehension. Data categorization, data creation, data finding, data attainment, and data inquiry have all been made possible via the employment of a variety of big data processing equipment and technologies, multi criteria decision making designs, and artificial smart procedures. Human factors in big data, big data preparation methods, cultural features of big data, big data components, big data executives, and data ambiguity are all areas where the suggested framework places special emphasis on finding solutions.

Oussous et al. (2018) spoke about how crucial data mining methods are in a few specific fields. Finding patterns and extracting value from massive datasets is a crucial use of data mining methods. Traditional data mining techniques, such as association mining, clustering, and classification, are incorrect and inefficient when applied to massive data. Such data is unfit for long-term storage and analysis due to its volume, velocity, and variability. In light of this, several data mining methods have included detection tactics that account for the data environment.

Haider and gandomi (2015) demonstrates that several meanings of big data are used in practice and research. Actually, these big data definitions vary depending on the understanding of the user, with some focusing on the characteristics of big data in terms of volume, assortment, and speed; others focusing on precisely what it accomplishes; and yet others categorizing it based on their business's requirements. Harris Interactive conducted an online survey of 154 C-suite corporate officials in April 2012 for the benefit of SAP, and Figure 7 displays the many interpretations of the term "big purchased."

Garca et al. (2016) highlights the rise of data pre handling inside distributed computing and how its use has altered the landscape of insight discovery from data. This is shown by looking at how data mining strategies and pre handling have evolved as a result of the widespread adoption of big data structures for storing, preparing, and analyzing data. The provided solution included a wide variety of data pre-handling strategy families, with considerations like optimal size support studied in terms of big data and data pre-preparing across the board of systems. Hadoop, Spark, and Flink, among other amazing large data systems, have also been discussed**.**

Pouyanfar et al., (2018) Artificial intelligence (AI) is rapidly approaching what many believe will be its moment of supremacy as deep adaptation gradually takes its place at the forefront of its field. Deep learning employs several levels of abstraction to have computational conversations with data reflections. Our view of data management has been revolutionized by a few key enabling agent deep learning calculations such generative adversarial networks, convolutional neural networks, and unit movements. By the way, there is a lack of knowledge about the history of this very active region since it has not been lately discussed from a broad perspective. These persuasive techniques as discovery tools are produced by a lack of central knowledge, which impedes fundamental progress. Additionally, deep learning has frequently been portrayed as a silver bullet to various obstacles in AI, which is far from the truth. This report begins with an extensive overview of the documented as well as the most recent best-in-class techniques in visual, sound, and content preparation, informal organization investigation, and common language handling, and then moves on to an in-depth analysis of the revolving as well as earth-shattering improvements in deep learning applications. It was also anticipated to deal with problems related to major learning, such as performance learning, disclosure structures, and online learning, and to discover how these problems may be transformed into fruitful future avenues for research.

III. METHODOLOGY

Proposed Approach

- Data Pre-Processor: It processes data in a variety of ways before it's used.
- Data Trainer: It's what you use to get your deep learning models trained.

Scope Of the Study

Many different areas of research and design make use of deep learning processes, such as speech recognition, image classification, and language processing. Traditional data preparation methods also have their limitations when it comes to dealing with massive amounts of data. Researchers have also recently combined a number of deep learning techniques with mixed learning in order to build very fast data-handling frameworks. The reliance of many of these approaches on vector space means they perform poorly outside of their intended context, which includes things like big data learning capabilities. Furthermore, one of the main causes of that dissatisfaction is the increased role that humans play in configuring new and better computations thanks to deep learning methods and machine learning.

IV. DATA ANALYSIS

Successful DL solutions have been shown with top-tier outcomes in a variety of settings, including banner planning, trademark language care, and image verification. The IoT industry is moving upwards. Models of brain systems vary greatly in terms of where they excel. In the realm of vision-related applications, convolutional networks tend to perform better overall, whereas AEs excel in irregularity disclosure, data denoising, and dimensional reduction for data depiction. Connecting the kind of neural framework model that works best across all of the different application domains is crucial.

In this section, we discuss the useful applications of DL in IoT environments. Our research has shown that many Internet of Things (IoT) applications rely on visual or image recognition for critical functions like validating traffic signs or maybe even diagnosing illnesses. Human stance differentiating evidence is only one example of an extra organization that may be put to use in both smart home applications and smart vehicle support. We consider many of these businesses to be foundational platforms upon which other Internet of Things (IoT) applications may be built. Rather than storing their data for future analyses, most businesses should focus on taking care of their regular operations as they arise. It's possible that there are other, less important groups present in each location. Organizational essentials and other IoT use cases are shown in Figure 1.

In the sections that follow, we'll first examine some of the most prominent IoT firms that rely on DL as their intelligence engine, before expanding our scope to include IoT applications as a whole.

Foundational Services

1) Image Recognition: The majority of IoT applications deal with scenarios where images or videos serve as the input data for DL. The widespread availability of high-quality cameras in smartphones has encouraged people all around the world to start shooting movies and taking images. Additionally, smart camcorders are employed in a wide variety of settings, including factories, sports stadiums, and savvy households. Among the most essential uses of such devices are picture confirmation/request and object ID.

When evaluating the overall success of IoT-related activities, it might be problematic to rely on just a small subset of available stock statistics. In order to train their models, several of these methods make use of publicly available normal image datasets like the MNIST collection of hand-written digits, the VGG face dataset, the CIFAR-100 and CIFAR-10 tiny pictures dataset, etc. Despite the fact that these statistics are great for general evaluation purposes near different processes, they do not reflect the unique qualities of IoT systems. Examples include situations when the data image is at night or maybe in a foggy or stormy environment state, and analysis for the system of vehicle acknowledgment in clever linked automobiles, which isn't often a prominent picture. Cases like this aren't controlled by the readily available datasets, hence the models suggested by those datasets don't cover all bases.

2) Speech/Voice Recognition: Minute chat confirmation is genuinely changing into a clearly dynamically typical and uncomplicated approach for people to assist out their contraptions, especially with the massive rise of wonderful mobile phones and wearables. In addition, the modest components of modern smartphones and wearables lessen the need for consoles and touch displays as a method of cooperative effort and dedication.

Several researchers have reported developing a low-force DL chip designed specifically for automated discourse recognition. The new, specialized chip uses just 0.2 to 10 milliwatts of power, which is far less than the power required to run a speech recognition program on a modern smartphone. DNNs for discourse recognition have been implemented in the spic and span chip. Three distinct neural networks, each with a different level of complexity, are used to create three distinct levels of vocal exercise recognition in service of energy conservation. Presumably Discourse movement may be distinguished from other types of motion by keeping an eye on the resistance presented by the natural world around it. If the system's administration determines that a voice has been detected, the chip will then execute an associated complexity sum acknowledgment structure, the operation of which is acoustic displaying to determine whether or not the voice seems to be discourse. If this system's output is more likely, the third network, which has the greatest practical use, is triggered to quickly decide on individual words.

3) Indoor Localization: Offering location-aware services like indoor navigation and store advertising is quickly becoming the norm in enclosed spaces. The Internet of Things (IoT) may find use for confined spaces in areas as diverse as smart homes, fairgrounds, and even buildings. Input data from these applications often comes from a variety of sources, including vision, obvious light correspondence (VLC), infrared, ultrasound, WiFi, RFID, ultra-huge band, and Bluetooth, to name a few. The vast majority of the writing in this review relied on mobile phones to acquire fingerprint-like markers broadcast by stationary transmitters (i.e., entry or maybe iBeacons) connected through Bluetooth or WiFi. Many projects have employed DL models to predict the area fingerprinted, and DL has also been put to use to locate interior conditions with

remarkable accuracy. DeepFi is a system that uses a DL technique beyond fingerprinting WiFi channel declaration data to detect client locations. This approach incorporates both online and offline phases of preparation. In reality, DL is misused in the off-line preparation step to prepare all of the loads using the previously spared channel pronouncing information fingerprints. There are a number of reports in the literature that use somewhat different DL models in relation to various learning procedures in order to extract capabilities for use as assessment positions. These studies demonstrate that the limiting precision of DL models is directly impacted by the number of hidden layers and devices included inside the models. A convolutional neural network (CNN) may be used for in-house confinement by combining visual and appealing detecting data. CNN has also been tasked with deciphering owners' interiors by analyzing images captured of their immediate environments.

4) Physiological as well as Psychological State Detection: The Internet of Things (IoT) in conjunction with DL techniques is also utilized to observe a variety of human physiological and mental states, including the present, the work at hand, and emotional state. Most Internet of Things applications (smart houses, smart cars, entertainment (e.g. XBox), guidance, recovery similarly to health aid, sports, and current gathering) integrate a module for human attitude estimate or maybe practice confirmation to pass on their firms. For instance, smart houses' organization of beneficial apps is informed by an analysis of residents' attitudes. The cameras feed the occupant's video feed into a DNN, which analyzes the data to determine the person's position and then executes the most appropriate action. Toshev describes a framework that makes use of a CNN model to do this. This kind of company may also be used in the classroom to gauge students' interest and in stores to simulate consumers' purchasing habits.

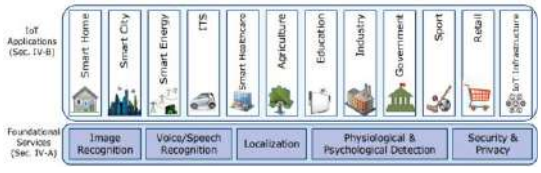

Fig. 1: IoT applications and the foundational services

V. APPLICATIONS

1) Smart Homes: With the help of the Internet of Things (IoT), smart houses may centralize a wide range of tasks that improve residents' convenience, income, and quality of life. Devices used inside the nuclear family may now link to the internet and provide additional intelligent services. Cortana DL is being used by Liebherr and Microsoft in a joint effort to analyze data collected from within the cooler. When combined with other external data, these analytics and hypotheses may be utilized to assess and predict general prosperity patterns in the home and to help the homeowner have a far better handle on the expenses and supplies of maintaining their household.

Using three DL models—LSTM, LSTM Sequence-to-Sequence (S2S), and CNN—Hyper conducted an evaluation study on weight comparing for domestic imperativeness usage. Their results show that LSTM S2S is superior to other methods for predicting best-in-class performance, with CNN coming in second and LSTM third. They also distinguished between the unknown dataset and a baseline ANN, and all of the most recently cited models ultimately prevailed over the ANN.

2) Smart City: Organizations in forward-thinking cities consider a wide range of Internet of Things (IoT) fields, including transportation, agriculture, urgency, etc. Also, from an AI standpoint, this region is becoming more and more satisfying, as the disparate datasets collected from numerous locations ultimately form a large dataset that, when evaluated with DL models, will inspire tremendous productivity gains. The progress made in one area helps the city of splendor as a whole in terms of its resourcefulness. Getting plans and analytics out of open transportation activities, for instance, is useful for local professionals since it helps the open transportation structure and provides new redesigned organizations.

Together with Dell Technologies, Toshiba has recently developed a DL testbed for use in analyzing the data collected by a community center in Kawasaki, Japan. The testbed's operation is meant to evaluate the ease of applying DL models in IoT natural frameworks and choose the most optimal approaches for business redesign, which incorporates expanding machine accessibility, enhancing monitoring receptors, and decreasing maintenance expenses. The massive data which maintains the demonstration site was compiled through official construction, air conditioning, and security measures.

Predicting the construction of new public buildings and the ways in which they will be used for public transit is a crucial problem for any genuinely magnificent city. To achieve this objective on a metropolitan scale, Song developed a method that relies on DNN models. Their strategy is based on a four-layer recurrent long short-term memory (LSTM) neural architecture to discover from GPS data on people and their various modes of transportation. Instead of working together to overcome these limitations, they split the mobility of the population and the transportation industry into separate sectors.

Table 1 Typical Iot-Based Services in Smart City

Service	Input data	DL model
Crowd density/ transportation prediction	GPS/ transition mode	LSTM
	Telecommunication data/CDR	RNN
Waste management	Garbage images	CNN
Parking lot management	Images of parking spaces	CNN

Liang proposed a method for measuring crowd density at transit hubs that makes use of information about mobile phone users' media transmissions -- also known as a "visitor detail record," or CDR. CDR data are genuinely obtained whenever a client makes a media transmission move on the telephone (i.e. a call, SMS, MMS, or Internet access), and they often include information on the customer's ID, geographic location, and time, in addition to their telecommunications activity. Similarly to how they found that logically precise wishes differed from nonlinear autoregressive neural system models, they constructed their system based on an RNN model for metro stations. Waste management and refuse collection are two sides of the same coin for thriving metropolitan areas. In the past, deep convolutional neural networks (CNNs) have been used for vision-based automation leadership. One more route for organized control is monitoring air quality and anticipating pollution. By using a stacked AE for single trademark extraction and a determined backslide model for the final gauges, Li was able to create a DL-based air quality want model.

Amato created a decentralized system that uses brilliant and deep CNN cameras to choose the empty and included spaces inside designated stopping areas. The experts provided a basic framework for a CNN using smart cameras and the Raspberry Pi 2 computer. In this way, the CNN may be performed on each camera unit, and images of express auto rest stops can be sorted into empty and occupied categories. The cameras would only relay the request's outcome to the rules server. Additionally, Valipour built a framework for detecting parking spaces using CNN and discovered that it produced notably better results compared to SVM baselines. Recent projects are included in Table III.

3) Energy: The two-way dialogue between vitality consumers and the smart system is a treasure trove of Internet of Things big data. Canny meters are the wave of data progress despite acquisition in this extraordinary situation, allowing for granular assessment of energy use. In order to succeed in the market, energy providers must master the next power use designs, foresee the needs, and make sound judgments based on real-time data. Mocanu have developed a kind of RBM to continually recognize and predict the buildings' energy potential. Changes in a family's power consumption that have a little effect on the travelers themselves constitute vitality flexibility. Adaptive power management is expected to be realized within the context of the aforementioned use, duration of use, and performance of selected home appliances.

On the bright side of things, calculating the potential of electrical power from renewable sources like the sun, the wind, and other forms of natural controllable force is an active area of study. The area is seeing a rise in the adoption of DL across a variety of use cases. Take a look at the overall performance of several DL models such as DBNs, AEs, LSTMs, and MLPs while trying to visualize the solar-powered importance of twenty-one different types of photovoltaic plants. An essential aspect of the analysis for sun-based imperativeness is a numerical motivating factor for atmosphere determining in a certain time horizon. Their research shows that when differentiating and comparing models, the combination of LSTMs and AEs (Auto LSTM) produces the best possible outcomes. Since Auto LSTM is able to infer attributes from noisy data, it may be used to validate a high desire score, which isn't the case with MLP. Additionally, ANN In, a web determining structure sensitive to LSTM, is offered to forecast the solar flare strength twenty-four hours in advance.

4) Intelligent Transportation Systems: The data collected by Intelligent Transportation Systems (The) is another example of the increasingly ubiquitous nature of big data. Mother proposed a strategy for assessing the feasibility of DL-based transportation options. For their models of a parallel figuring situation, they've relied on RNN and RBM architectures, with GPS data from intriguing explorations serving as a comparable commitment to the models. Preparing their method to anticipate traffic jam progress from more than an hour's worth of data took no more than six minutes, and it was accurate to within eighty percent. The evaluation of flashing traffic stream desire was also seen. In their study, they found that LSTM was the most effective learning model when compared to a number of other popular options, including as support vector machines, simple feed-ahead neural networks, and stacked AEs.

VI. DEEP LEARNING ON IOT DEVICES

Before the advent of the Internet of Things, the majority of DL studies focused on boosting its count and attempting to transmit practical models on cloud stages in case the problem became too large to handle the massive data. When the scale of the problems reduced to the level of resource-constrained devices, interest in continuous analytics grew in a way that was not possible before the development of IoT.

In some measure, light weight understanding is required to

ponder splendid things. Given DL's fruitful results in talk and video applications, which are among the most fundamental services and commonplace uses of IoT, adapting its procedures and models for arrangement on asset-restricted gadgets has been an exceptionally fundamental focus of research. To far, DL methods have been inapplicable in asset constrained gadgets and IoT for educational purposes due to the resource-intensive nature of DL models. There are situations when the readily available resources are inadequate to cope with a pre prepared DL computation for induction assignments. To our relief, it has recently been shown that many of the parameters often used in DNNs might really be detrimental. In certain cases, it may be unnecessary to use several obfuscated layers in pursuit of precision. As a result, these DNNs may become IoT-friendly by effectively removing these parameters and, moreover, layers, which will significantly reduce their sensitivity to noise without significantly reducing their output. The remainder of this section will focus on the techniques and tools that have been developed to achieve these ends, and will demonstrate how they have been put to use in a variety of contexts.

Methods and Technologies

DL models may include millions or even billions of parameters, necessitating fast computing and a large amount of storage space. In this section, we take a look at a variety of state-of-the-art methods for bringing DL models to IoT-enabled, low-resource gadgets.

1) Network Compression:

Using system pressure, in which a dense network is converted to a sparse one, is one approach of delivering DNNs to resource-constrained devices. When DNNs are used for various forms of distinction on IoT devices, this strategy may assist keep their storage and processing demands to a minimum. One major drawback of these methods is that they can't properly account for a large variety of networks. It's only relevant for sparsity-displaying system models.

The authors conducted tests of the approach on four vision-related models: LeNet5, LeNet-300-100, VGG-16, and Alex Net. Even if the models' precision had been nearly safeguarded, they had been compressed numerous times for AlexNet and many times for VGG 16. The approach is limited in that it can only be used to one specific kind of DNN model.

Table 2 DNN Sizes and Complexities In Different Applications

	Type of DNN	Depth	Layers Sizes	Training Time	Test Time
Transportation analysis	RNN+RBM	2	R(100)-RBM(150)	NA	354 (s), whole test set
Localization	RBM DBN	4 4	500-300-150-50 300-150-100-50	NA	NA
Localization	SdA DBN ML-ELM SDELM	4 3 5 5	26-200-200-71 26-300-71 26-300-300-1500-71 26-300-300-1500-71	451 (s) 110 (s) 14 (s) 24 (s)	NA
Localization	SdA	5	163-200-200-200-91	NA	0.25 (s)
Pose detection	CNN	12	C(55×55×96)-LRN-P- C(27×27×256)-LRN-P-C(13×13×384)-C(13×13×384)-C(13×13×256)-P-F(4096)-F(4096)-SM	NA	0.1 (s)
Human activity detection	CNN+LSTM	7	C(384)-C(20544)-C(20544)- C(20544)-L(942592)-L(33280)-SM	340 (min)	7 (s), whole test set
Human activity detection	LSTM	5	L(4)-FF(6)-L(10)-SG-SM	NA	2.7 (ms)
FDI detection	DBN	4	50-50-50-50	NA	1.01 (ms)
Malware detection	DBN	3	150-150-150	NA	NA
Parking space	CNN	8	C(64×11×11)-C(256×5×5)-C(256×3×3)-C(256×3×3)-C(256×3×3)-F(4096)-F(2)-SM	NA	0.22 (s)
Traffic sign detection	CNN	6	C(36×36×20)-P-C(14×14×50)-P-FC(250)-SM	NA	29.6 (ms) on GPU 4264 (ms) on CPU
food recognition	CNN	22	Used GoogLeNet	NA	50 (s)
Crop recognition	CNN	6	C(96×7×7)-P-C(96×4×4)-P-F(96)-F(96)	12 (h)	NA
Classroom Occupancy	CNN	5	C(6×28×28)-P-C(16×10×10)-P-F(120)	2.5 (h)	2 (s) (4 thread)
Fault diagnosis	AE	4	300-300-300-300	NA	91 (s)
Road damage detection	CNN	8	Used AlexNet [37]	NA	1.08 (s)
Classifying offensive plays	RNN	3	10-10-11	NA	10 (ms)

For use with dense network models, a guessing motor known as EIE was developed using a specialized piece of hardware design similar to SRAMs rather than DRAMs, and its efficacy was shown. This technology allows for the management of redid insufficient lattice vector duplication and industry sharing without compromising the system's

overall viability. The engine is made up of a flexible cluster of preparation segments (PEs), each of which does its comparing computations in its own SRAM. Since almost all of a neural network's available power is used up in the process of retrieving data from memory, this artificial speeding agent consumes far less energy than its benchmark system.

VII. CONCLUSION

When it comes to the automated extraction of obscure data portrayals (features) at deeper levels of reflection, Deep Learning computations are a very promising avenue of research. Such calculations provide a multi-tiered, dynamic structure of learning and addressing facts, in which higher-level (more potent) restrictions are genuinely seen in articulations of more base-level (less imaginary) traits. Artificial intelligence mimics the deep, layered learning technique of the rule sensorial territories of the neo cortex within the human character, which quickly concentrates thoughts similarly as limits from the concealed data, and this dynamic learning structure of Deep Learning counts. Learning from large amounts of isolated data is a strong suit for Deep Learning algorithms, which also tend to uncover data representations in an unendingly layer-wise fashion. Accumulating nonlinear part extractors (as in Deep Learning) has been shown to produce better AI results than other methods, including more recent portrayal illustrating, higher quality conveyed tests by generative probabilistic models, and the invariant property of data depictions.

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Data Mining Framework for Network Intrusion Detection using Efficient Techniques

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Abstract— *The implementation measures the classification accuracy on benchmark datasets after combining SIS and ANNs. In order to put a number on the gains made by using SIS as a strategic tool in data mining, extensive experiments and analyses are carried out. The predicted results of this investigation will have implications for both theoretical and applied settings. Predictive models in a wide variety of disciplines may benefit from the enhanced classification accuracy enabled by SIS inside ANNs. An invaluable resource for scholars and practitioners in the fields of AI and data mining, this study adds to the continuing conversation about how to maximize the efficacy of machine learning methods.*

Keywords— ***Data Mining, Techniques, SIS, ANNs***

I. INTRODUCTION

Data mining, which "mines" knowledge from data, has recently attracted attention from the information industry and society due to the availability of massive amounts of data and the need to turn it into meaningful information/knowledge. Market research, factory administration, basic research, and even customer retention might all benefit from this data. In order to glean even the most fundamental insights from massive datasets, data mining employs a set of fundamental algorithms. Statistics, machine learning, database systems, and pattern recognition are just few of the areas of study that are included within this multidisciplinary field. System security procedures must be built to prevent Organization access to resources/data, and because data mining enables data analysis applications, this is a need. Protecting applications and networks against intrusion in highly interconnected systems is the job of an intrusion detection system.

Password/biometric user authentication, avoiding programming errors like buffer overflow, and encrypting sensitive data on computers are all initial lines of defense. When systems get complex, intrusion prevention alone isn't enough to keep them safe. As the number of people with access to the internet grows, the number of cyber threats faced by businesses also grows.

II. LITERATURE REVIEW

Kumar et al. (2016) The neural network approach has also been shown for automatic tumor detection in liver CT scans. Because the input may include noise introduced during acquisition, the CT input image is first pre-processed using a Median Filter based on expert opinion. The next step involves using first-order statistics and the gray-level matrix to extract local and textural features. Pixels in the gathered data sets are used to determine whether they are associated with the liver or not using a neural network. Tumor boundary detection using an active contour model of the targeted region 32 is possible, and the study's findings are both effective and timely.

J. Peter Campbell (2020) To provide an introduction to contemporary techniques of machine learning, with a focus on selected machine-learning methodologies, best practice, and deep learning, and their application in medical research. The literature on artificial intelligence techniques in medicine, particularly ophthalmology, was searched extensively in PubMed.a summary of machine learning for those who aren't familiar with the ins and outs of programming. However, there are still several obstacles that must be overcome before AI may be widely used in the medical field. This review article aims to provide an accessible overview of current machine learning

applications in healthcare for readers who are not experts in the field. The goal is to help readers understand the potential and challenges of AI in healthcare.

Jonathan Schmidt (2019) There have been many fascinating new additions to the materials science toolset in recent years, but machine learning ranks among the highest. Previous research has shown that this statistical toolkit may significantly speed up both basic and applied research. Studies focusing on applying machine learning to solid-state electronics have recently proliferated. Here, we survey and evaluate the most recent studies addressing this topic. Here, we lay out the foundations of machine learning by introducing key concepts including algorithms, descriptors, and databases for the study of materials science. We proceed to detail further methods in which machine learning may be used to locate stable materials and predict their crystal structure. Here, we provide findings from studies investigating various strategies for using machine learning to supplant first principles in design, as well as quantitative relationships between structures and their attributes. Using examples from the fields of rational design and related applications, we investigate how active learning and surgical optimization may be used to improve the process. There are always major issues with the interpretability and physical understanding of machine learning models. For this reason, we discuss the different facets of interpretability and their importance in the study of materials. In conclusion, we provide solutions to a variety of computational materials science problems and suggest directions for further study.

Pita Jarupunphol (2022) In order to find the most reliable classification model for predicting dengue illness, this research investigates a wide variety of feature selection and classification combinations. Dengue fever prediction parameters based on association patterns were investigated. In order to get the most effective classification model, several feature selection procedures have been categorized and studied with the use of popular classifiers. Many models' measurements were compared graphically. The three-layer neural network model is the most effective. One hundred ReLu-enabled nodes make up each tier. Accuracy of 64.9%, F-measure of 71.8, accuracy of 65.7%, accuracy of 66.0%, and recall of 79.0% were achieved in the identification of five qualities. In addition to the Naive and information gain combination, the Naive and Relief neural network combination, and the Naive and FCBF combination are all competing machine learning approaches with fairly equivalent efficiency. However, if specific feature selection procedures are investigated, SVM is seen as the weaker model.

Saima Anwar Lashari (2018) In this research, we investigate how medical data is currently being categorized and where future prospects may lie by applying data mining techniques. It explains major modern approaches to classification that have been shown to significantly raise the bar for classification precision. Past research has provided literature on the subject of medical data classification through data mining techniques. Extensive research shows that data mining methods excel at the task of classification. This article evaluated and contrasted the current state of medical data classification. The study's findings suggested that the current system for classifying medical data had room for improvement. However, further research is needed to identify and eliminate the uncertainties associated with classification in order to increase precision.

III. DATA MINING ALGORITHM

Without a priori knowledge of the structure of the data points, clustering labels and distributes them to groups of similar objects. The instances of a cluster are unique, but its members are consistent. Organizationa's clustering techniques include the partition algorithm, the hierarchical algorithm, the grid algorithm, and the density algorithm.

Recursively separating cases, hierarchical methods produce clusters from the top down or the bottom up. The following may be further broken down into:

Clusters are initially items, according to agglomerative hierarchical clustering. Once a suitable cluster architecture has been reached, more clusters are fused.

Distinctive hierarchical clustering - Initially, all data points are assigned to a single cluster. After then, a cluster is divided into even smaller clusters. This process is repeated until the cluster is properly structured.

KDD99 DATASET

Third International Competition for Knowledge Discovery and Data Mining Tools produced the data mining technique known as the KDD99 data detection data set. A data set may be thought of as a collection of inferred characteristics of a network link. When it comes to intrusion detection datasets for data mining, the KDD99 IDS dataset has been widely used. Connection records for each link in the Annie George network are among the 42 primary features that make up the KDD99 dataset benchmark.

The KDD 99 is based on five million logs representing seven weeks of network activity, extracted from four gigabytes (GB) of compressed TCP binary dump data. Two million connection records were gathered from two weeks of test data. Using three servers housing computers belonging to the victims, the network mimicked a military

network, revealing several attacks and routine network activity.

There are a total of 65 features in the training and testing data sets, with 24 types of assaults used in training and 14 in testing. Here are a few examples of names for attributes:

- Duration: continuous,
- protocol_type: symbolic,
- Service: symbolic,
- Flag: symbolic,
- src_bytes: continuous,
- dst_bytes: continuous,
- Land: symbolic,
- wrong_fragment: continuous,
- Urgent: continuous,
- Hot: continuous,
- num_failed_logins:continuous,
- logged_in: symbolic,

I Bayes (Nb)

In the simplest type of Bayesian network, I Bayes (NB), all characteristics are treated as unrelated to the value of the class variable. Conditional autonomy describes this situation. In practice, conditional independence almost never holds. Adding the ability to represent attribute dependency is a simple method for expanding Bayes beyond its naive restrictions.

The class node in an Augmented I Bay expands the original I Bay by pointing out direct nodes with links between attribute nodes. I Bayes classification does this by assuming conditional independence to drastically reduce the number of modeling parameters.

$PX|Y$, from original to just 2n

$$PX|Y^{22nl}$$

In real-world settings, including as text categorization, medical diagnosis, and system performance monitoring, I Bayes has been shown to be useful. It works well when there are interdependencies between features because... The quality of the fit to a probability distribution (the suitability of the independence assumption) is unrelated to the optimality of a zero-one loss (classification error). Certain deterministic or low-entropy dependencies result in strong performance on I Bayes, as shown by the effect of distribution entropy on classification error. As entropy decreases toward zero, the I Bayes error disappears. NB is easy to understand and compute.

$$argmax\left(p(c_i)\prod_{j=1}^{n}p(a_j|c_i)\right)$$

NB classifies I by selecting

Random Tree

The decision-making bodies in the random decision tree classification are selected at random. When classifying a test instance, the posterior probability is calculated as the sum of the weighted probability outputs of the individual trees. Generating a random tree has less memory requirements and reduces training time. There are two primary settings to adjust in this ensemble method:

(i) height h of each random tree, and

(ii) number N of base classifiers.

Database analysis, computer science search methods, and even biological models (evolutionary family trees) all make use of random trees in some capacity. As the number of vertices increases indefinitely, the spectrable distributions of the neighboring matrices of the random trees converge on the line of deterministic probability measures, demonstrating a topology of weak convergence.

The average height and average diameter of a random tree is the subject of a large body of literature. The height/diameter enumeration dilemma holds true for both labelled and unlabeled trees, with the anticipated height of a randomly labelled rooted tree being 1 2n. There is a large but scattered body of work on exact/asymptotic results for various models, and many other random tree models have emerged to meet the needs of certain applications. Deep searching in a particular random treeline pattern is reflected here: the "uniform ordered trees" combinatorial model is the model CBP(n) with a shifted geometric (1/2) offspring distribution. When you build on n nodes, you get a random Tn tree. It is easy to calculate the center of the star graph t with vertex 1.

Neural Network

In mathematics and computers, an Artificial Neural Network (ANN), often known as a "Neural Network" (NN), is a model inspired by biological NNs. Information is processed utilizing a network of artificial neurons and a connectionist approach to computing. During the training phase, an ANN adapts its structure in response to information from the network and the outside world. A NN is a widely dispersed, massively parallel processor with easy access to stored accumulated wisdom. In two aspects, it resembles a brain:

1. One acquires information by way of a networked learning procedure.

2. Synaptic weight information is stored as intensities of connections between neurons.

An algorithm for learning describes the method used to carry out the learning process. Neuro-computers (NNs) are a kind of a distributed parallel processor also known as a neuro-network or a connection network.

Advantages:

- In contrast to linear programs, neural networks are able to.
- When an element of a NN fails, the network as a whole keeps running because to its parallel design.
- It is not necessary to retrain a neural network since it is self-learning.
- It's adaptable enough to use in any scenario.
- Its implementation poses no difficulties.

Disadvantages:

- NN needs training to operate.
- Since NN architecture varies from that of microprocessors, the latter needs to be modeled after the former.
- Significant time for processing is required for rganiz.

IV. INVESTIGATION OF FEATURE SELECTION TECHNIQUES FOR INTRUSION DETECTION SYSTEM

One common method for streamlining businesses is called Feature Selection (FS). It improves learning performance (higher classification accuracy), reduces computational costs, and enhances model interpretability by selecting a small subset of relevant features from the original, based on predefined relevance evaluation criteria. Based on whether or not a training set is labeled, FS algorithms are categorized as supervised, unattended, or semi-supervised. FS is a method for identifying, within a collection of data, the subset of features that is optimal for processing according to a certain set of criteria. The method through which an FS may to find a subset ${}^{A}opt^{a}1,opt^{a}2,opt^{\cdots,a}m,opt_{\text{of A,which guarantees}}$ accomplishment of a processing goal by reducing a defined FS criterion $JfeatureAfeature\_subset$. Optimal FS solutions are not need to be unique. The faster computation speed and more accurate predictions are made possible by using fewer characteristics in the learning process. Filters and wrappers are two types of FS procedures. First, there is agnostic classification, which does not include any specific methods of categorization. Instead, the wrappers evaluate the quality of a set of features and, from a statistical and computational standpoint, create an efficient filter based on the performance of a classifier type. The relevance of qualities is analyzed using filter techniques by looking just at the data's fundamental properties. The importance of each item is assigned a value, and those with low scores are omitted. Several FS methods are used in this data gathering process. accuracy values depend on the base rates of different classes, therefore in practice, the percentage of accuracy is not preferred for classification. The accuracy of a predictor may be evaluated by calculating its ROC or F-Measure value. Feature ratings evaluate the importance of an individual trait while disregarding the effects of other traits. The output functions of classifiers or statistical methods provide the basis for many ranking systems.

IDS has the potential to mitigate or prevent attacks in the event of updated signatures or improved attack recognition/response capabilities. Intruder detection systems are now distributed real-time component networks rather than batch-oriented monolithic systems. Monolithic IDS either combines all these features into a single system or splits them out into several procedures and applications.

Feature Selection Techniques For Ids

FS is an essential and popular tool for IDS data pre-processing. It has direct repercussions on IDS because of the decreased functionality and the elimination of irrelevant/redundant/noisy data. Many experts recommend using wrapper, filter, or hybrid methods for feature detection in feature selection. In order to evaluate the features' (or feature set's) quality, the wrapper method employs a learning algorithm. The Filter method relies on the central characteristics of the training data to evaluate the relevance of features and feature sets using objective metrics like distance, correlation, and consistency rather than any machine learning methodology.

Feature Selection Based On Correlation (Cfs)

CFS is an efficient FS method, and it selects, using gene expression data, a set of properties that are important to some class. It often reduces the dimensionality of data by over 60% without sacrificing precision.

On the other hand, CFS is able to establish a link between features and classes, as well as features. CFS is a correlation-based rapid filter used in continuous/discrete circumstances. The CFS algorithm ranks a collection of criteria based on their worth or quality. CFS takes use of the best search by using a correlation measure to evaluate a subset's quality, with each feature's predictive power and inter-feature correlation taken into account.

Analysis Of Independent Components (Ica)

Since many ICA features are predetermined at the primary data processing component analysis (PCA) stage, the ICA approaches do not provide such feature selection opportunities. The only feature selection technique used in

ICA face recognition literature to yet to account for this is the percentage of variance (PoV).

Since the original ICA facial recognition architecture provides local features, we've also been working to determine which of these traits are most useful for identifying specific people. In the ICA method, we know nothing about the mixing matrix or the distribution of sources beyond what is gleaned from the data.

Information Gain (Ig)

Word IG measures the data we learn about a category from the presence/absence of a certain word in a text.

Let me be the class number. The IG of a word t must be defined as

$$IG(t) = -\sum_{i=l}^{m} p(c_i)\, logP(c_i) + P(t)\sum_{i=l}^{m} p(c_i|t) logP(c_i|t) + P(\check{t})\sum_{i=l}^{m} p(c_i|t) logP(c_i|t)$$

The error rate for the test set is substantially higher (13.5 percent) than it is for the training set (for which the stated functions constitute an IG filter). This second discovery suggests that a redundancy reduction approach, such a Markov blanket filter, is necessary for feature selection beyond a simple "relevance check."

This section discussed the feature selection strategies that were put to use in this investigation.

V. CONCLUSION

This research takes a look at how normal/abnormal traffic is currently classified using data mining methods and makes recommendations for improvement. The KDD 99 dataset was mined for UDP data streams, and from there a multi-class dataset was created to emphasize the many threats inherent to UDP data streams. Naive Bayes Algorithm, Random Tree, and NN were all shown to be accurate in classifying the dataset's signatures. The random tree-based methods were 99.88% accurate in their classifications. In this study, we compare PCA to the Fisher Score for dimensionality reduction. PCA is a data-minimization technique for discovering and articulating patterns in order to highlight similarities and differences. Fisher Score is a model-based statistical method that may be used to make distinctions. It's a quick and easy approach to evaluate your ability to distinguish between label and trait.

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