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Recent Trends in Aviation Management and Safety

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Abstract:

The management and safety regulations are of paramount importance in todays aviation, from all the stake holders point of view. The Ethiopian Airlines Boing 737 Max collapsed and crashed immediately after takeoff from Addis Ababa for Nairobi. It was second 737 Max tragedy in six months after a Lion Airplane in Indonesia in October 2019, resulting in death of 190 people, operating the same plane. After this incident, Boeing faced a Huge Loss in its shares, bringing them down to 35%, whereas Airbus had a 65%. Share of single-aisle. Hence, Airbus takes a lead in deliveries and Ranking top amongst all-other vehicles. The two biggest Airplane manufacturers in the world are Airbus and Boeing hence entering into a fierce rivalry. Boeing was behind far more wide body flights 103,244 Flightsin comparison with 6, 45,220 with Airbus aircrafts.

Regulations and Safety things Boeing can do are noted as follows:

As Boeing has had a lot of experience dealing with crisis situation over past several years and needs to focus on Safety and other issues too, and regain its customer service and trust by keeping in point the following points:

1. High damage tolerance.
2 Active controls
3. High Stiffness (since airline structures are sized for stability)
4. Low-cost raw materials fabrication methods with proper aircraft design and aerodynamics and low density.
5. Modularity

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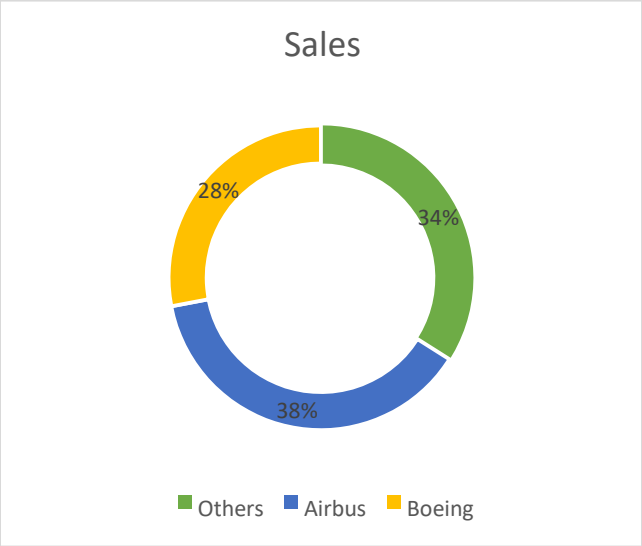
6. Resistance to Lightning strike.
7. Resolve the faults in Airframe, reportedly affecting parts made from Carbon fiber composites as well as titanium.
8. Airplane makes worry more about how quickly they can. Ramp up production at both their factories and their supplies.



Therefore, MAX's return service in most countries made 2021 a year of "stabilizing", which will involve further. Recovery in 2022. Hence, Boeing stock Shares mild increase and can reach a good milestone by some following points.

1) Safer landing, fewer costly excursion's: →Reduces chances of costly runway excursions of other runway related issues.

2) Cost saving and operational savings: Inaccurate payload and performance decrement on decision.

3) Better passenger experience and avoid cash: Passengers make sure that all the decisions are factual and knowledge based Safety of the Customer is most important. Boeing Should record proper care and safety.

4) Upgrade with emergency sensors in case of unusual flight conditions: Such sensors only work in emergency Situations and Others

International regulators and airlines around the world have worked together to allow the aircraft to return to work safely. This required software function only

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works in rare aircraft conditions and now relies on two sensors, operates only once and never exceeds the pilot's control over the aircraft.

Safety, Security management in Aviation Services:-

Airport security and co-workers ensure airport security, flight, and passenger safety. Airport management and flight safety, using the following steps:
Flight attendants and airports are trained in safety and security issues, as well as problem-solving procedures. Emergency airports have passenger evacuation procedures and airport campus is monitored by Closed Circuit TV camera systems. A dedicated team of trained security officers are safely deployed at the airport. Security guards take the help of sniffing dogs for any unwanted object is lying near or in the airport premises.

Recently, the airports are facilitated with:-
1. Transition of Airport Ownership
Airports view a change in ownership and management scenario from a public-private partnership, to contracted operators on behalf of the boss, and resulting to full-fledged private airports. This creates chances for greater investment in airport progress and allows providers to catch the market with conventional and new products.

2. Airport Cities (Aerotropolis)
Airports are changing into a public place where passengers can meet, relax, and enjoy a wide range of aviation facilities. Providers who build relationships with service providers or those who have diverted to the aviation industry are able to show new facilities that can merge with other sectors and provide more seamless, beneficial and connected services.

3. Services based on Locations
Marketing based on specific targets, which includes store site information and airport discounts, as well as new shopping models such as online platforms and delivery of products locally, will result in revenue for airline flights at airports. Non-Service Providers have given passenger and flow tracking systems and integrated personalized applications that use Bluetooth and WiFi that identify customer location with respect to the store and give data.

4. Consolidation
Due to the expansion of the airport and the even increasing competition among suppliers, they are trying to consolidate their position in the industry by pressing

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their products in current markets in order to get greater market share. In this, Providers build by venturing into new market regions and making and branding new products in current regions.

5. Security based on Digital Technology

Modern technology has been applied to promote new concepts such as "walking or safety" to deduce passenger waiting time, while biometrics can be used to digitalize the processes to verify and reduce staff. Security has quickly become the mandatory at airports. Providers are moving quickly to install IT services and solutions. Providers are pressing hard on advance security suits.

6. Self Operation

The emergence of passenger performance will result in passengers availing all services from entry to boarding flights on their own. This will help to increase resources, reduce operating costs, and improve non-aviation revenue. The providers have developed new high-quality products that allow such services including self-help platforms and e-boarding.

7. Digital Transformation

The level of digital deployment at airports is growing rapidly and supports trends such as increased automation and passenger-oriented services. This will lead to a connected airport where the control center is visible at all functions and can better monitor and manage performance compared to performance indicators, ways to provide seamless connectivity over the entire airport.

Conclusion:

Many advanced measures are taken by Aviation giants Boeing and Airbus for management and safety of aviation and world is there to follow them. However, with digitalization's and non-human interference will pave way to more advanced and modern ways to bring and impose measures. Safety and management will go on improving in future.

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Analysis of Autodesk and BIM Software towards Architectural Practice

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***Abstract*— Architectural practice started off from hand drawings of basic plans, sections, elevations and working drawings. The architect's ideas were expressed through sketches which are also an important part of learning in the architecture school. Although hand drawing and sketching are the basic training and skill improvement of students, while entering towards architectural practice, modeling and rendering Softwares are the need of the hour. As the technologyemerges, need of time saving and accuracy is the most importantfactor in designing parametric buildings. This research study aims to highlight the importance of Autodesk and Building Information Modeling Softwares in Architectural Practice. These Softwares are commonly used by engineers and designersin automobiles, gaming, mechanical and electrical designing, etc. and the study is limited to Architectural use. The method adopted is literature analysis, popularity in architectural firms and findings with comparative study of the Softwares such as AutoCAD, 3DsMAX, Autodesk Revit Architecture, Sketch up, ArchiCAD, Lumion, Rhinoceros and many more modeling and rendering Softwares. The analysis shows uses, benefits, limitations and differences between them for use and tries to set out their suitability related to factors such as, building typology, requirements, quality and cost.**

Keywords*— *architecture, interface, modeling, software

Introduction

The strongest mode of communication between architects and construction work is clear and accurate drawings. Visualizing a mass object before it comes into existence becomes possible with clear drawings and views.Architectural Models would express three dimensional buildings to the clients and stakeholders. As changes happenin design, it became time consuming and difficult to remake the whole model. Today, we find many software that providethree dimensional views of the building which saves a lot of time, shows realistic and timeline views with easy changes than the conventional model making. Although it has saved time, there are many software available to use. The cost of software license and features vary from version and type of software. The gap of this research is that how would you choose a suitable software for your firm which will give maximum benefit. The answer to this question lies only when we understand how many software are available, what is the cost of license, how suitable it is, what PC configuration is required and many more parameters will be discussed in this paper. The aim of this paper is to analyze architectural software and its use in Architectural firms. The paper gives an idea of what is the present scenario of use of software to create drawings, views and renders.

Aim: To study the existing architectural software & analyzes its parameters its.

Objectives:

- Literature Study of research articles
- Comparative Analysis of existing softwares used in architecture
- Questionnaire survey in various architectural firms

Research gap: what factors affects the choice of a software in a firm? How has software helped the architectural work? What issued are faced by architectural users?

I. Methodology

The methodology adopted in this research paper is literature review, product review from official websites, questionnaire survey of sample size 30 from architectural firms about the use of software. Google forms were circulated in architects who work in the architectural firms. Responses received give adequate information about type of projects, softwares used in 2D &3D drawings, benefits & drawbacks. This paper analyzes the features, cost, user interface, suitability & other necessary parameters derived from official websites, expert talks & author's observation. The questionnaire survey helps in understanding real time preferences of users. Literature study sets a background to this research & supports author's statement.

II. Types of Architectural Software Available:

A. AutoCAD

AutoCAD (Computer-Aided drawing) is the simplest and commonly used software in engineering and architecture work. [1] It has simple tools for 2D geometry and 3D models, it used UCS – Universal Co-ordinate System. The drafting layout consists of x and y axis. Versions are released every

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year with new and advanced features. It can be used in any measurement thus dimensions and Annotation is easier. Basic 2D drawings are done in AutoCAD. It is the first software that became popular after hand drafting. Due to AutoCAD, errors in drawings become less, more accurate drawings are produced, any drawing can be plotted in various scales, line weights and colors can be provided to different layers, 3D objects can be created easily. [4] A startup Architectural firm must at least have AutoCAD to work. The cost of AutoCAD subscription in recent date and version 2022 is approximately 15000 rupees monthly, 1 lakh rupees annually and 3 lakh rupees every 3 years. For a regular working firm, annually or every 3 year subscription is economical. However the cost of software are so high that small firms cannot afford to invest. Economical options are also available sometimes but AutoCAD is been taught in academics and coaching and that makes it popular. The Indian Institute of Architects have launched an optional CAD software. [7]

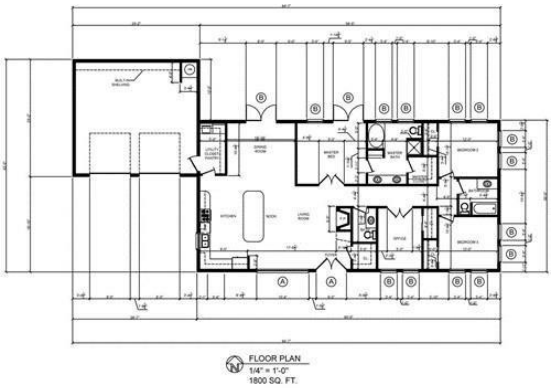

Fig. 1. Example of AutoCAD 2D plan

B. Sketchup

Sketchup by Trimble is a basic CAD software for 3D modelling that can import AutoCAD drawing [5] and generate 3D elements. Sketchup cannot be used to draw 2D plans, it provides all features of 3D and editing. However it has few 2D tools i.e. line, rectangle, arc, free line. Few 2D tools are given to draft the model at x, y and z axis. These are the reference lines while creating a model, if the axis is set n y axis, the 2D tool will create the shape on y axis. Annotation is not suitable in this software. Other advanced feature are, views, styles, adding materials and textures to elements, animation, lighting section, elevation, walkthrough, rendering and sunlight/shadows. However Sketchup alone does not give realistic renders. To create realistic renders, Vray Plugin for Sketchup is required based on compatible version. We can use it for rendering. The subscription price of latest professional version to date is around 23000 rupees per year (299 dollars) and studio version can go up to 53000 yearly. Sketchup provides wide range of plugins for additional features and faster work.

Fig. 2. Example of a Sketchup Model and Sketchup + Vray Render

C. Revit Architecture

Autodesk Revit Architecture is a software specially designed for architects or building work. It belongs to the BIM (Building Information Modelling) Family. [4] Revit comes in various engineering fields such as MEP, Electrical, etc. It is a well-developed interface that provides faster work than Sketchup. It reduces more than 75% time as compared to Sketchup. BIM is a process of creating 2D sketch and converting it into a 3D model without additional work. The process of BIM is plan, design, build, and operate. [2]

Fig. 3. Concept of BIM process

Revit helps designers to visualize in plan, elevation, section and 3D at the same time. Revit has tools such as wall, windows, doors, roof, ceiling, column, stair, etc. The elements of a building are the tools of the Revit software, thus while creating a wall, its elevation, plan, section and 3d view can be seen at the same time. This helps designers to understand what actually the element looks like, and this reduces mistakes in the structure. Such structural mistakes which are set by default in Revit cannot be rectified by CAD softwares. Revit and Sketchup are different systems and have different sets of tools. Revit is aimed at more complex projects of whole infrastructures. Revit offers realistic rendering at some extent, but not the best quality. It requires additional rendering plugin or Lumion rendering to create more realistic and high quality renders. [6] Revit can import CAD and Sketchup files. Its suitability is for structural engineering, fabrication, parametric architecture, MEP engineering, annotation, global parameters and large scale projects with complex site. Annual subscription costs around 1.5lakh and 4.50 lakh for 3 years.

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Fig. 4. Example of a Revit Model

D. Vray – Plugins

Vray is developed by Chaos group, a powerful 3rd party graphics plugin which is not and independent software but is installed within existing software. Vray renders a scene which can be adjusted accordingly, if we want another perspective, the model should be rotated and again renderingprocess needs to be done. Rendering process time depends onthe graphic card in a PC and the PC configuration. Vray plugins are available for Sketchup, Revit and 3DsMax, Rhinoceros, Maya, Blender, etc. It is also widely used in animation, visualization, product design film and video gameproduction etc. Graphics software are becoming popular in architectural firms as the demand of 3D views are high. Interior designers also require graphics software to show thetextures, colors, patterns, lights and shadows as much possible to look real. This ensures the client of what is beingdesigned and changes can be done easily. The chances of getting hired for large projects is more when showing graphical presentations.

Fig. 5. Example of a Vray render – Day and Night Scene

E. Lumion

Lumion is a 3D rendering software to add finishing to a model. It makes the design complete and visualizes in all perspectives, climate conditions and time. Real life experiences are possible with this software. It is similar to Vray but it is an independent software which imports models and renders in 360 degrees. However vray and rendering in Revit or 3DsMax are scene rendering in which at a time you can render one view. The PC configuration and graphic card required for this software is high. Minimum 2GB graphic card is required. This makes the investment in PC veryexpensive. It is compatible with other architectural softwaresand links the changes done in model to file. Night lighting, phase animation, real skies, atmospheric rain and snow in themodel, water effect, glass effects, details of nature, model can be placed in real site photograph, and many more features are given in this software.

Fig. 6. Example of a Lumion render – Day and Night Scene

F. 3DsMax

3DsMax is highly popular and professional 3D graphics software for 3D animation, models, games, and images, Autodesk 3ds Max is used by television commercial studios, video game developers, architectural visualization studios, as well as for movie effects and pre-visualization. It is a professional CAD software that is more advanced, it can draft like AutoCAD or directly import, it can create 3d models, and also complex objects, as well as it has good rendering quality than Revit. Thus it almost has all in one software, and thus most suitable for interior designers. The reason for this is that interior designers cannot always import furniture objects but they have customized designed, these designs can be modelled in 3DsMax with ease and the interior lighting is more advanced in this software.

Fig. 7. Example of 3DsMax Interior Render

G. Rhinoceros- grasshopper

Rhinoceros is a commercial 3D computer graphics and computer-aided design (CAD) application software that was developed by Robert McNeel & Associates. It is used to create unusual geometry that any software may not develop easily. These softwares are used for parametric design, 3D printing, rapid prototyping, mathematical representation of forms and curves, etc. Other than architecture, it is also used

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in product design, jewellery design, and watercraft, automotive and industrial. It also provides rendering with modelling. This software requires programming thus it might be difficult for architects to learn, but also it requires software engineer to operate and guide. This type of software is not very popular in small scale firms, in India. It has one-time payment subscription

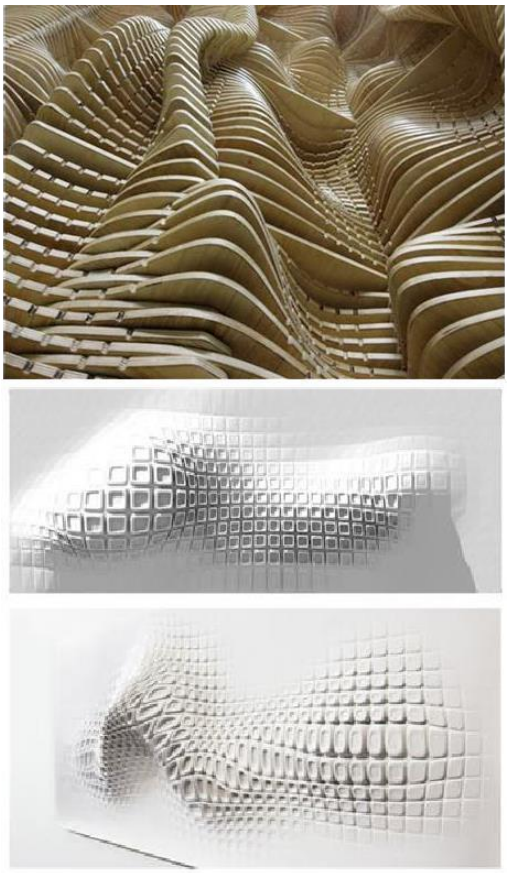

Fig. 8. Example of Rhino parametric Architecture Forms

All of the above softwares have student or educator's versions, educational licenses, studio and professional versions according to the use. The versions are updated every year or regular intervals. PC configuration of each software differs, thus consideration is required.

H. Survey Analysis

Our literature study towards each software is not enough to explain how to consider purchasing or using a particular software. Only the users know what difficulties are faced. Every architectural firm has varying number of employees, PCs, nature and type of projects done. The questions arises that how can we determine the suitability. Thus a survey questionnaire was regulated in Architectural firms to know the type of projects done and accordingly which softwares are used. The benefits and difficulties faced by Architects were also surveyed. Targeting 30 responses, we received 31 responses overall.

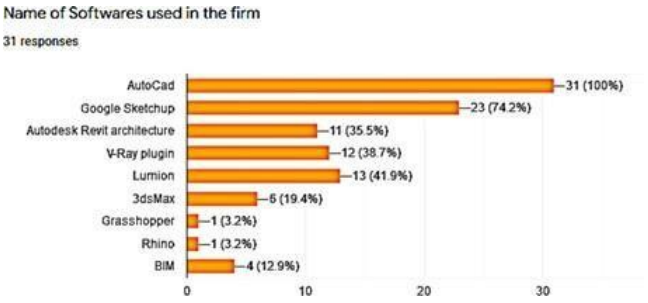

Fig. 9. Responses Chart- Name of Software used.

The figure above shows that all of the firms use AutoCAD as their basic drafting software. Following to that Sketchup is widely used as it is economical and suitable for residential and some commercial projects. As the project types vary such as industrial or outsourcing firms, the type of software referred is Revit and 3dsmax. The least used software is grasshopper and rhino. Lumion is very popular as it provides high quality renders. Rendered views are nowadays a requirement for clients before investing so much money in construction of the building. Other than these, the firms have mentioned softwares such as Photoshop, Coral Draw, Truview, ArchiCAD, Enscape, Google Earth, 3D Home, Vectorworks and Dynamo. Out of all Photoshop is most common as highest 16% responses mentioned it.

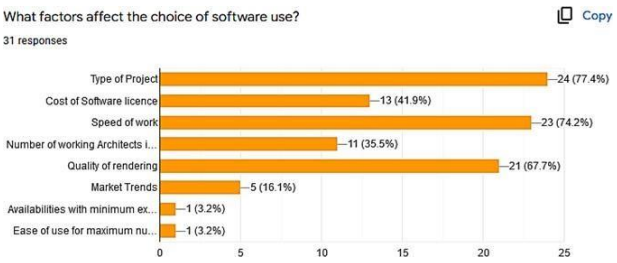

Fig. 10. Responses Chart- Factors Affecting Choice of Software.

Architects strongly believe that the type of project affects the use of software in a firm. The speed of work is also a factor that affects choice of software. Around 74.2% agree that the speed of work is important in a particular software. As we can see in the chart above, 67.7% agree that rendering quality is a requirement and choice of software depends on it. The least concerns are market trends, availabilities and expenses, number of architects working in a firm. But the amount is considerable while planning for choice.

TABLE I. ANALYSIS OF SOFTWARE AND SURVEY RESPONSES

Software	Type of Projects in Firm	Cost	2D Drawings	3D Drawings	Rendering quality	Suitability
AutoCAD	All types	high	✓	✓	NA	✓
Sketchup	Conservation Residential, Commercial, Urban design,	low	NA	✓	low	✓

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Software	Type of Projects in Firm	Cost	2D Drawings	3D Drawings	Rendering quality	Suitability
	Conservation, Transport					
Revit	Commercial, Transport	high			moderate	2D, 3D & rendering
3Ds max	Residential, commercial	high			better	interiors
Lumion	Residential, commercial, landscape,	high	NA		High	rendering
Vray	Redidentail, commercial, industrial, urban design, conservation.	medium	NA		high	rendering
Rhino	commercial	moderate			medium	parametric

The above table of analysis shows the type of projects and suitable softwares for particular project. The ability of every software is different in terms of use, cost, speed of work and rendering quality. Architects have recommended the best softwares are AutoCAD [5] and Revit. [6] However there are some points which were asked such as benefits and drawbacks while using particular software.

The benefits gained by practicing Architects are:

- Easy to use
- Easy imagination, ideas easily conveyed
- Fast work, easy and fast revisions can be obtained
- Saved time
- Learned Coordination with different agencies involved in construction (Structure, MEP), more understanding of design through 3D model
- Fast and easy to understand finished work produced
- Client gets a clear idea about proposed design.
- Repetitive or revised drawing is prepared very fast
- Easy to make various options using base file with min time
- Drawing file size is less.
- Helps in visualization, easy to explain
- Optimum use of resources
- Various options can be designed and presented to the client in less amount of time. Easier for the client to visualize the design through realistic 3D views.
- Layers benefit to create plantations at different levels in plans and sections
- 2D drafting is easy in AutoCAD
- 3DsMax has better render quality than other
- Fast work and good presentation

The drawbacks faced by Architects are:

- Time consuming for creating first draft
- In Revit ,Small changes takes lot of time than AutoCAD
- Lack of knowledge among the full team in BIM working, lack of IT infrastructure to support BIM softwares
- Software versions
- Revit takes time while rendering
- Issues are faced when we switch between softwares as the interface changes
- License version of AutoCAD subscription is not economical. It is very costly. Small scale firms cannot afford it.
- PC are not compatible to latest versions thus hangs a lot.
- Revit and Lumion- Takes time to open the file as the file size are too heavy.
- It is a challenge to remember the Commands
- Creating Landscape details on steep contour site is difficult in Sketchup
- Revit has poor quality rendering despite being so expensive, we need additional software like vray
- At the concept level stage software's are not free flowing for any creative design ideas it restricts the mind. Concept development cannot be done on any software, easier with hand drawings.
- Representation of plants in Sketchup is generic
- Lack of complete knowledge about the software.
- While drafting in AutoCAD and making its 3D in Sketchup, it is very difficult to make frequent changes

CONCLUSION

This research study is important to have a clear understanding about software use in architectural practice. Various factors need to be considered while using a software. The literature study reveals the basic information and understanding of each software. Questionnaire survey helped us understand real time problems faced by Architects. The view of Architects explain that Type of project, Speed of Work and quality of rendering are the main aspects to be considered while choice. AutoCAD and Revit are considerably good softwares as per responses. Though other parameters such as cost of subscription, PC configuration, knowledge and presentation are a challenge to face.

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Development and Calibration of Low Cost Corrosion Monitoring Equipment (Dr. CORe)

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Abstract: With the passage of time, structures deteriorate exponentially causing a potential life vulnerability on residential as well as infrastructure projects. This gives rise to proper maintenance requirement and need of developing Structural Health Monitoring (SHM) techniques. The SHM is a vast topic and involves various methods and equipment which can be costly. One of the parts of SHM is monitoring Corrosion which forms the base of reinforcement failure. The paper combines a few literatures done on SHM along with developing a Corrosion Monitoring Equipment which can produce approx. electrical corrosion potential of uncoated reinforcing steel in field and laboratory concrete. The equipment works on the principle of Half Cell Potentiometer and has been calibrated successfully conforming to ASTM C876. The cost of equipment was reduced by 98.6% when compared to a state of the art equipment available in market. The name Dr.CORe stands for Doctor for Corroded Reinforcement.

Keywords: Structural Health Monitoring, Corrosion, Reinforcement, Half Cell Potentiometer, Steel, NDT.

1. Introduction

Corrosion is an inevitable phenomenon that engineers have to consider right from conceptualization, designing, to maintenance stage of a project. A premature failure of structure may well be linked with the failure of rebar which is due to plenty of reasons, but the prominent one is the corrosion of rebar which leads to durability and serviceability decrement. This effect of corrosion cannot be neglected as it accumulates to failure of entire element, or in some cases, entire structure. Corrosion of rebar cannot be tracked right from the first day as it is an activity which is initiated inside the structure. By the time, it is visually recognized with cracks, expect a major damage commenced. Therefore, considerable attention is required on the maintenance of structures. Over the recent decade, corrosion testing has been deeply researched the methods to predict corrosion have been developed. The use of the principleof Half-cell Potentiometer is to measure the probability of corrosion. The use of this method and the interpretation of its results are described in ASTM C876 [1]. Corrosion sensors have also been developed to detect corrosion of stainless steel [2]. The internal corrosion also effects the durability of concrete studied by [3].

Since 1978 Half Cell Potential mapping is in vogue for detecting corroding areas on concrete structures. The Half Cell Potential Testing method is recommended for determining the likelihood of reinforcement corrosion, which is then used to determine how long reinforced concrete will last. The reinforcement check for corrosion can be done with various methods. Non-destructive technique such as half-cell potential measurement (HCP) is a well-known technique for investigation of corrosion in steel. The use of potential mapping on reinforced concrete structures makes it easy to understand the probability of corrosion potential inside a specimen. This potential mapping phenomenon is a data representation of half-cell potential measurements and this map depends on the corrosion severity. It can be represented in either a colour plot by assigning the entire specimen area with colour depending on corrosion values specified in [1] or by creating a contour map of corrosion values which will help insimple and easy depiction of probable corrosion value [4].

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2. Methodology and Materials

Corrosion of steel can be assessed by HCP measurement by an electrochemical process as per ASTM C876. Here, the electrical potential is measured with reference to a standard portable electrode in presence of a contact solution. The half-cell is made by a Copper/ Copper Sulphate or Silver/ Silver Chloride cell but other combinations are also used. In this arrangement, the concrete starts acting as an electrolyte and the potential difference value obtained is related with the risk of corrosion of reinforcement at the test location. The electrode consists of a tube, rigid in nature and made up of a dielectric material. It is non-reactive to the solution present inside it and has a porous plastic or a wooden plug which has capillary action enabled. A copper rod is also present which is immersed in thesolution of $CuSO_4$. The reference electrode is connected to the positive end of the high impedance voltmeter and the steel reinforcement to the negative. The Fe^{++} ions are dissolved and electrons are setfree at the anode. They form OH^- at the cathode end where they drifted the steel. This results in a potential difference which is measurable with half-cell method.

The reliability of half-cell potential measurement as an indication of corrosion potential has evolved by the good results during the bridge deck corrosion surveys. An indication of the relative probability of corrosion activity was empirically obtained through measurements during the 1970s [5].

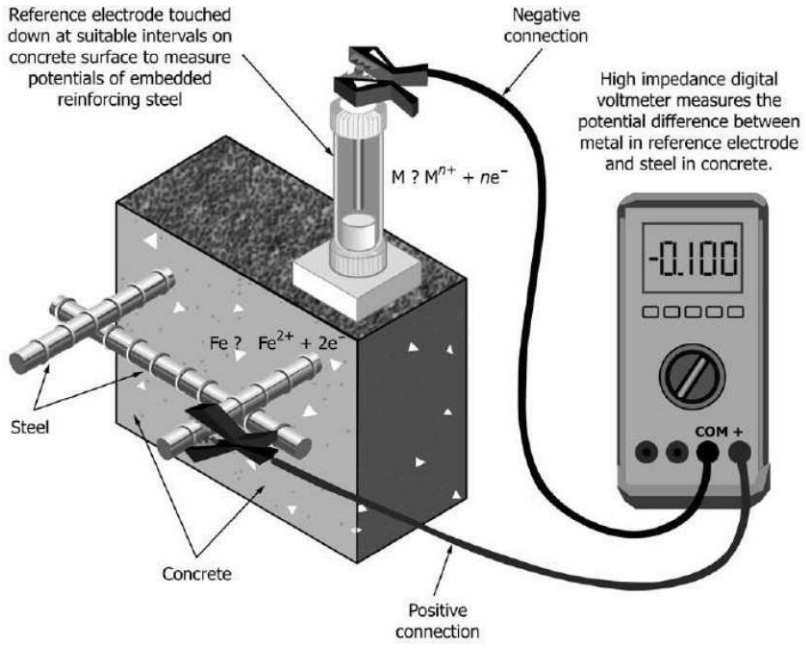

Figure 1: Reference Electrode Circuitry [1]

2.1. Materials

There are various corrosion measuring devices available in market but we decided to assemble it part by part in order to reduce cost. Following are the assembling parts used to develop this device.

- Reference Electrode – CuSo4

The electrode used for assembling the Half Cell Potentiometer device in taken with reference of CuSo4. For this equipment we used a locally available Reference electrode with a conical tip. It is to be filled with Copper Sulphate crystal and water till the top of electrode. Shown below is the image of reference electrode of FONTANA brand [Figure 2].

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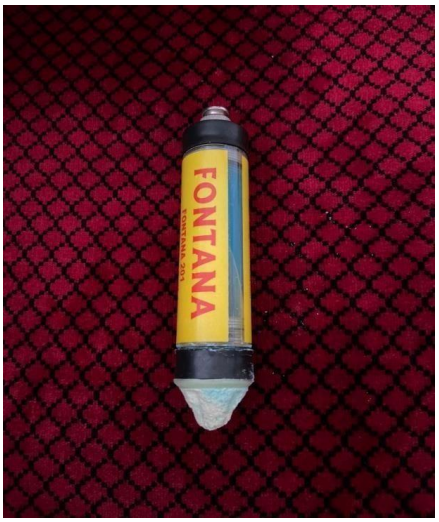

Figure 2: $CuSO_4$ Reference Electrode

Figure 3: Digital Multi-meter

- Digital Multi-meter

The voltmeter used was a digital multi-meter having DC voltage reading [Figure 3].

- Wetting Agent

The wetting agent can be of any type. For this study, we took a laundry use wetting agent. As per ASTM, the wetting agent needs to be a diluted solution of 95mL of wetting agent with 5 gallon i.e. (19L) of potable water [Figure 4].

Figure 4: Wetting Agent

Figure 5: Connecting Wires

- Connecting wires

The connecting wires include wires to be connected to the electrode and the reinforcing bar and also the extension wire in case the length of specimen is too large. Along with these, a couple of crocodile clips are also needed to connect to the electrode and reinforcing bar firmly [Figure 5].

Apart from the above mentioned, a sponge and $CuSO_4$ solution is also required. The sponge is kept at tip of electrode while the solution is filled in electrode during operation.

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2.2. Procedure of working of instrument

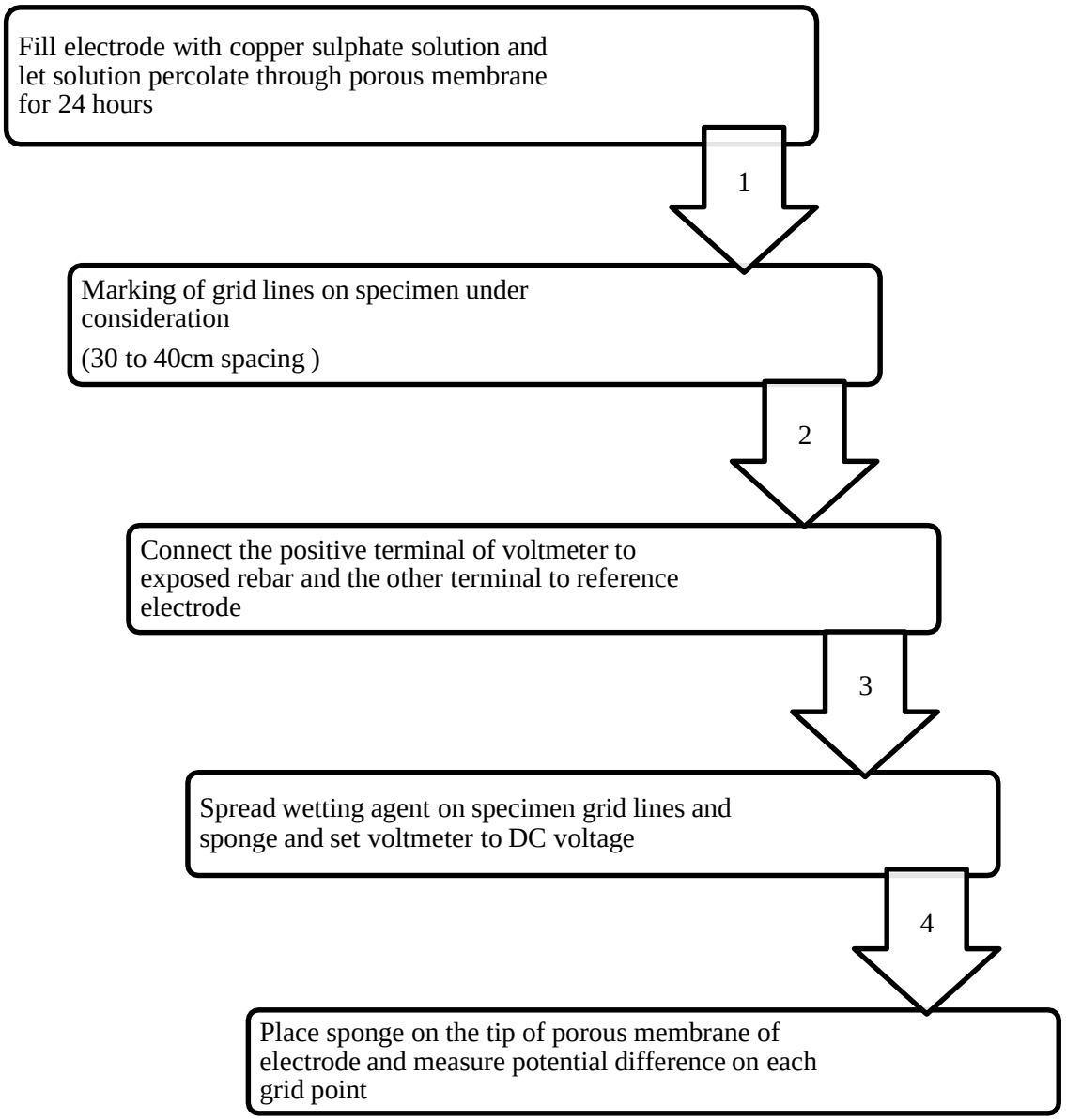

Figure 6: Flow chart of step wise procedure of testing

2.3. Calibration of the device

The assembled device can be used for determining the probability of corrosion on a RCC Structure only after it is calibrated and tested whether it is in accordance with the ASTM C876 standard values. For this purpose, a slab specimen is casted containing different types of corroded rebars. These vary from highly corroded rebar to sunlight rusted rebar to new rebar.

By doing so, we can check the potential difference for differently corroded bars and hence compare the values with the standard range of potential difference values specified in Annexure of ASTM C876 [Table 1].

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The calibration was done by initially preparing a mould for slab specimen and placing reinforcement bars with different levels of corrosion. This will help in calibrating the device, whether the corroded rebars potential value matches with ASTM [Table 1] or not, to conclude the authenticity of working of the equipment.

Details of rebar are as follows –

A	First from left	New Rebar
B	Second	Rebar kept on site unexposed to sunlight
C	Third	Rebar kept on site, exposed to sunlight, not rusted
D	Fourth	Rebar kept on site, exposed to sunlight, medium rusted
E	Fifth	Rebar kept on site, exposed to sunlight, highly rusted
F	Sixth	Rebar with light corrosion
G	Seventh	Rebar with high corrosion

Figure 7: Mould Preparation

Figure 8: Laying of different types of rebar

It was followed by concreting of mould and finishing the top surface evenly.

Figure 9: Concreting of the mould

Figure 10: Finished surface of specimen

Breaking of a portion of specimen to expose the rebars. This will help in connecting one end of the clamp to the rebar firmly. The values for each rebar are measured by connecting clamp to its respectively

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exposed rebar portion. This way, the values for potential difference of corroded rebar and new rebar are found.

Figure 11: Specimen broken from side to exposed rebars

Figure 12: Measurement of values

Table 1. Range of Potential Diff. values to determine probability of corrosion as per ASTM C876 [1]

Potential Difference (V)	Corrosion Rate (%)
> -0.20	<10
-0.20 to -0.35	Uncertain
<-0.35	>90

3. Results and Discussion

The results obtained from the calibration data in Volts is as follows –

Table 2. Values of Potential obtained for different rebar from specimen built to calibrate device

Point of Contact on Specimen						
A	**B**	**C**	**D**	**E**	**F**	**G**
-0.210	-0.385	-0.199	-0.155	-0.480	-0.359	-0.410
-0.250	-0.388	-0.215	-0.147	-0.450	-0.400	-0.379
-0.220	-0.369	-0.217	-0.167	-0.428	0.360	-0.390
-0.240	-0.366	-0.205	-0.169	-0.443	-0.345	-0.400

Table 3. Range Table from ASTM C876 with Code

Potential Difference (V)	Corrosion Rate (%)	Code
> -0.20	<10	
-0.20 to -0.35	Uncertain	
<-0.35	>90	

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Table 4. Result values from testing with Code

Point of Contact on Specimen						
A	**B**	**C**	**D**	**E**	**F**	**G**
-0.210	-0.285	-0.199	-0.155	-0.480	-0.359	-0.410
-0.250	-0.288	-0.215	-0.147	-0.450	-0.400	-0.379
-0.220	-0.269	-0.217	-0.167	-0.428	0.360	-0.390
-0.240	-0.266	-0.205	-0.169	-0.443	-0.345	-0.400

The above reading obtained show that Bar D is totally free of corrosion, whereas bar A, B and C are uncertain, whether there is corrosion occurring or not. The Bars E, F and G are having a 90% chance of being corroded which can be regarded as true due to the very physical appearance of bar.

3.1. Equipment costing

The cost of equipment part by part is given below –

- Fontana Reference Electrode - ₹1,770
- Digital Multi-Meter and Wires - ₹1,500
- Wetting Agent - ₹120
- Sponge - ₹50

The total cost of developing the equipment was under ₹3,500/-

3.2. Comparison with other devices available in market

On the other hand, price for a new equipment for different brands are mentioned below

- James Half-Cell Potentiometer Instrument - ₹250,000
- Giatech Half-Cell Potentiometer Instrument - ₹200,000
- Avantech Half-Cell Potentiometer Instrument - ₹35,000

3.3. Conclusions

The paper described the concept of Half-cell potentiometer and development of a corrosion monitoring device based on same principle. The device was assembled part by part and costed relatively cheap when compared with a market equipment. The instrument did lack the result in the form of potential map but the same can be drawn manually which definitely is not a big task. Based on the work carried out above we can conclude that

- The assembled device was calibrated and successfully tested to match with the ASTM C876 range of values.
- The device is therefore ready to use for detecting corrosion potential values.
- With the help of this instrument, the corrosion probability inside concrete can be successfully measured and hence, the maintenance work can be done accordingly.
- The repair cost estimation can be fairly estimated by the use of this device.
- The cost of equipment can be drastically reduced if assembled properly. Compared to a top model device available in market, the price is reduced by 98.6%
- The device has been submitted in the college model laboratory for use.

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"A Study of Winning Marketing Strategies Post Pandemic with reference to Out of Home (OOH) Media." : A literature Review

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Abstract:

Marketing is not just related to sales but it is a strategy which tries to modify and improve their performances in times of crisis. The economic world today in Covid 19 is not just affected by financial crisis, but also affected in terms of sales, market share and profitability. During such period of time marketing managers are striving hard to play a pivotal role in the post –pandemic era since it would be a different world were the outdoor advertising especially Out of Home (OOH) Media will lay emphasis on placing trust and reliability on connecting with people when they are on move. The purpose of this paper is to examine how Out of Home (OOH) Media will adopt winning marketing strategies in the new normal in post pandemic a winning strategy which will boost human care, sustainability of environment and really win the modern age.

Keywords: Marketing strategies, Post pandemic, Out of Home (OOH) Media.

Introduction:

Marketing strategy is a tool and technique which is used by the organization to have long term impact and approach in a business to achieve a sustainable growth and advantage with relation to customers' needs and wants. Strategic planning involves an analysis and evaluation of how one can cover up cost and meets companies profitability. To target all the factors with effect to the companies goals and objectives marketing uses the elements of 7Ps amongst its as promotional strategy plays a vital role in reaching targeted customers.

In the changing business scenario new winning market strategies along with outdoor advertising has become a need of the day. The role of Out of Home (OOH) Media is playing empathetic role in advertising especially when people are on move with media components like digital billboards, hoardings, canopies, and lollypops etc. which have started providing viewership measurements to the industry users and advertising agencies to gauge their profitability. Though now the world is under crisis and movers are less still there is a way to look at new normal again

Objectives of Study:

1. To study marketing strategies of post pandemic
2. To define and learn effects of Out of home (OOH) Media

RESEARCH METHODOLOGY:

It is a descriptive study in which secondary data is collected from various forms like journals, magazines, blogs, references which helped to understand the concept of marketing strategies

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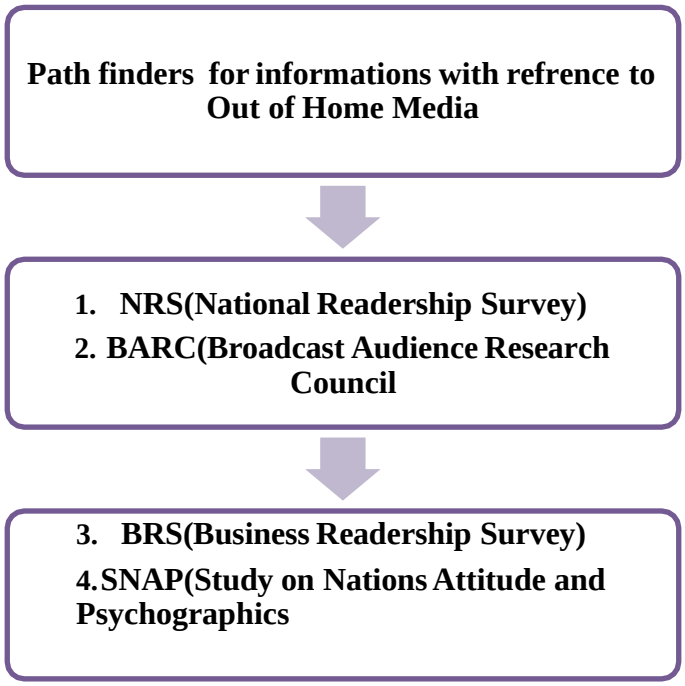
used for winning in post pandemic situations with reference of Out of home(OOH) Media advertising. The researcher conducted review of literature to identify the factors impacting mind of consumers while on go through new tools and techniques applied in new normal again.

Definition:

"Out of Home media encompasses a broad and diverse array of communication platforms that can reach consumers at almost any point in their daily lives. It is the oldest form of branded communication that humans have, and has stood the test of time with the ever-changing media landscapes because of the simple truth, that it continues to be effective at reaching an audience".

Similarly, Out of Home (OOH) definition is identified by various agencies or universities based on their implications and applied characteristics these are summarized in the following



REVIEW OF LITERATURE:

1. (How OOH media advertising might play out Post-Pandemic May 22.2020 Hub Spot Co-Founder, Dharmesh Shah,) The research study reveals that after the possibility scene faced after Covid 19 in post –pandemic stages the world would see an age of "revenge shopping " similarly compared to other countries which have experienced after lockdown and restrictions were normalized. The new strategies will move towards adopting new traffic zone patterns. The community who have shifted would return back in original areas and geographical places.OOH Media will have to mark up new campaigns and research how strategies been developed shall cope up in changing mindset

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2. (E.consultancy blog, effective-ooh-advertising- Nikki Gilliland 20.10.2020) The research study reveals in UK in late summer (Acc.to new Covid rules) company Skoda felt a need to launch a digital out of home media (DOOH) campaign for promoting its SUVs. The campaign was run by clear channel which was touch less the consumers could interact with the screen display by gesturing hands on it, they could discover vehicles and have the privilege of test drive too. Digital communication screens could not only attract the commuters but will be enhancing safety measures too.

3. (Ibboline.comTug.12.2.2021blog.Marketing agency.London) the research study reveals once the pandemic would come under normal picture people would be moving off the street which will be usually observed in the coming times. The OOH Media will be applying strategies of digital campaigns to retarget commuters who are exposed to these outdoor advertising. The post pandemic will also help the OOH media to display on psychology and behavior of consumers. More displays will be seen on roadside billboards rather than on pipes since public would demandtransits in cars than travel through any public transport. Out of Home (OOH) will need to chalk out the task by emphasizing on new spirit and winning reinforce.
4. (Adgully Bureau@adgully 5.5.2020 Dr.K.Rajeshwari) The research findings reveals OOH Media will move towards innovation strategy for its work in fiction advertisements in post pandemic since health companies will take up decision for messaging and revealing safety on billboards for family health care products. It would be combination ofcostumers mind and sense in belongings. OOH Media is quite flexible in advertisements taking the scenario into consideration .Taking other countries in the world after post pandemic scenes. There will be winning strategies coming up with new hope when publicwould move in around since outdoor advertisements senses people perception and emotional being personally. The industry will be adopting different combination method in retaining new practices.

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5.(exchange4media.com23.3.2021staff updated) The study finds The Noida Metro Rail Corporation (NMRC) has invited tenders for OOH Media advertisers granting license, spaces, and rights at movable transit across metros. As per choice, design upload and activate their creativity to attract the passerby. This would help the OOH Media put impact in the minds of goers post pandemic.

6.(Increasing Importance of Out of Home Advertising Post-COVID-19: The New Normal by April Koh May 12, 2020) The research study reveals Post pandemic with new winning strategies will find way out to shine up the business in the appearance of OOH Media advertising as community will recognize the importance of being out of home. The OOH Media will activate and relate to online digital campaign and commitment to movers. The media shall show cast positive and comfortable thoughts maintaining sensitivity of people during the later stages

Research Findings:

The information and the findings which the researcher collected have given a brief understanding of the importance of winning new marketing strategies in post pandemic situations with Out of Home (OOH) Media modes. Business is totally depended upon customers it would be unimaginable without them it is only the relationships of all marketing mix which usually provides a blend in strategies adopted in market. Marketing managers usually track out new findings and ways to reach the public along with media. The post pandemic will totally move into new positive new normal again.

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CONCLUSIONS:

Review of past literature on winning new marketing strategies in post pandemic with reference to Out of Home (OOH) Media Advertising has helped me in the generation of idea &knowledge of how new strategies are adopted by the firms to adjust according to the changing scenario. There are many information and studies available on post pandemic strategies has brought in new sights and hope. The opinions shared by the experts, comments, helped to understand the gaps and design in research methodology for the study. There are various modes to identify the factors which might influence the consumers buying decisions on there move. The researcher has studied various parameters which would be considered to regain the confidence of consumers in post pandemic situations. The researcher also analyzed the reasons behind foresee industries gearing up with fresh or minimal advertising plans and OOH will play an even bigger role in reaching their audiences.

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Analysis & Structural Optimization of Bumper as Shock Absorber in Frontal collision of cars

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***Abstract*—The occupant's safety from a direct impact during a frontal collision is become very important aspect in today's fast-moving world. Also, the passenger compartment and the structure of a vehicle should be such that in crash scenario their shape shouldn't change drastically so that passenger can face minimum of the damage. Number of ideas, Research & development is going on to improve safety & material selection are now more popular, standards are set to avoid different crash scenario.**

In many vehicles crash scenario most of the time we have observed that frontal collision of the cars. In that case if speed of the both vehicle is greater than 60 kmph then eitherwe hear news of death of driver or heavily injury of the same person, so to minimise these scenarios it is very important that we should focus on Design & Development of Bumper who absorbs maximum of frontal impact so that driver should face minimum of injury as possible. Although that we are concentrating on it, but additionally have to be mindful of the consumption of fuel, which poses a significant challenge that must be taken into account. Taking into account these limits allows for the adoption of an element that is both thinner and more durable than steel, specifically aluminium or a composite material. If this material were used, it would contribute to a reduction in fuel efficiency while maintaining the security ofthe passengers in the car and causing less harm to the vehicle overall.

In this research we will study the design of Bumper as a shock/energy absorbing structure and its behaviour while frontal impact (Using FEA). The injuries sustained by the occupant are predicted from previous researcher's data. Occupant injuries like chest and head injuries are studied & ways to avoid chances of different injuries.

Keywords—Collision, Direct Impact, Material, Efficiency, Shock Absorbing.

I. INTRODUCTION

To sustain impact loading the development of automotive structures in varied crash situations like frontal angular, perpendicular and side collisions is necessity of the current time. Some of other non-crash functional requirements like vibration, long lasting characteristics and fatigue life are also one of the prominent portions of vehicle design. But in today's world as there is growing focus on safety it is need of the hour that vehicles must be well tested and more & more focus would be on crash scenario that means vehicle-to-vehicle 30º oblique offset impact test as per National Highway Traffic Safety Administration (NHTSA).

The Throughout the span of the past few years, there has been a meteoric rise in the overall level of protection offered by today's automobiles in the event of a collision. A car that was thought to be the safest when it was first introduced ten years ago is no longer believed to be safe. . If the requirements are never altered, there are also certain benefits to improve the level of security. Even though they were rated safe and received high ratings, certain vehicles were still engaged in tragic accidents. It is very evident that current safety standards need to be revised if the percentage of people killed in automobile accidents continues to declinedown. [1].

II. NHTSA ANALYSIS OVER CRASH

According to the NHTSA study it has been observed that Rollover is one of largely occurred crash scenario in vehicle crash. Also, in the study Sport Utility Vehicles (SUV) with rollover accidents made death to the people in one out of every four people in crashes. Nearly 25% of new automobiles sold in the USA are SUVs.

In the year 2002, over 10,000 people's death occurred due to rollover crash, while in 1998 crash involvement of rollovers is about 10,280. This is characteristically qualified to a high CG (centre of gravity) comparative to vehicle's wheelbase. In number of scenarios, it has been seen that rollover is very critical incident which is also having complex fatality rate compared to other crash. There are almost 1.1 crores passenger Sedans, pickup and van crashes in the year of 2002 and out of those only 3% are having a rollover. Still, rollovers are accounted approximately 33% of the all deaths of peoples in vehicle crash [2].

The persistence of the report is to explore an efficacy of the front metallic bumper in frontal collision and to improve the structural design of the Bumper so that it should minimize people's injury which are inside vehicle.

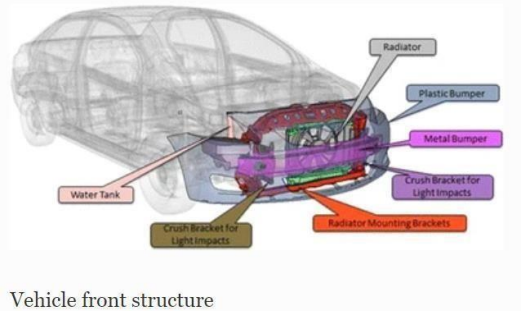

Fig. 1. Front support structure & Bumper mounting of a typical Sedan

In Fig. 1 shows relative positioning of the metallic as well as plastic bumper which is surrounded by the peripheral parts in a typical sedan car. As I explained that there are two bumpers Plastic and Metallic bumper. Plastic bumper is placed at exterior side of the vehicle whose

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function is to act as casing for metallic bumper as well as not to show inside components, also who faces maximum of contact with the surrounding, whereas Metallic bumper which is mounted inside of the car whose primary function is to absorb maximum of frontal impact in the crash scenario and to protect from severity of the injuries to the humans as well as damage to the components [3].

III. CRASHWORTHINESS

A. *Definition*

In simple terms Crashworthiness is refers to capability of the vehicle to absorb maximum of the impact energy in the crash scenario and to prevent occupants from any type of injury. So, the design of the vehicle should be such that even if at higher speed of the vehicle its occupants should not experience a net deceleration. For simplicity the Crashworthiness is categorizing into 3 basic domains, 1st one engineering material and its design, 2nd is combustion or fire, and 3rd would be biomechanics.

In Crashworthiness we can include accessories like airbags, seat belts. Sometimes zone or areas like crumple zones and protection from side impact, padding.

The calculate crashworthiness of any material it should be expressed in terms of its energy absorption, and formula for this is Es= F/D, in which D is denoted by the Density of that composite material and F is envaulted from crush stress.

For passenger's protection during the crash impact the structure should be based on its overall strength as well as its stiffness so that it should be far from being optimal [2].

B. *Composite Materials for Crashworthiness*

In this competitive automotive world, all customers are demanding for higher fuel efficiency and emission from the vehicle should be as low as possible. As the days passes, we can observe that day the price of the crude oils and the demand for fuels is increasing rapidly and eventually, the emission that are by products of chemicals as well as from the vehicle exhaust which are getting to pollutes the environment and leads to increase in the global warming effects biomechanics.

One of the main advantages of composite as a material is that it has capability to absorb maximum of energy to obtain unique combination of reduction in structural weight as well as enhanced passenger's safety as a result. With the help of composite materials, we can reduce the weight of structure thus it helps to bringing the down use of the fuel so likewise we can achieve its optimum quantity. Composite materials are such engineered materials that they are designed and developed mainly to provide pointedly greater specific stiffness along with specific strength (which can get it by stiffness/density of material).

Composite materials have very great potential for its tailored designs so as advantage of it is it can have wider variety of matrices as well as fibres. Also, there are various performs, and they have few laminates architecture i.e., fibre orientation and stacking sequence of single laminate.

Composite If we study the cost required to conduct the test on crash-worthy structure then we can have higher development program cost and the reason for the same is that FEA Analysis for simulating which requires more costing [4].

IV. CRASH STATISTICS SURVEY

In resent day, the number of accidents is happening in every single minute in the world and which are included with very hazardous consequences. If we analysed in many of the reports that the side-Impact crash is 2nd most happening crash after frontal-impact. In Fig. 1.2 we can observed comparison between different crash and its count/frequency.As per that study frontal impact is greater than the of side impact. If we compared the criticality of the occupant'sinjuries in the side-impact crash is very greater than that of frontal crash. Also, we can get the data for other crashes as well like rollover and rear side impact.

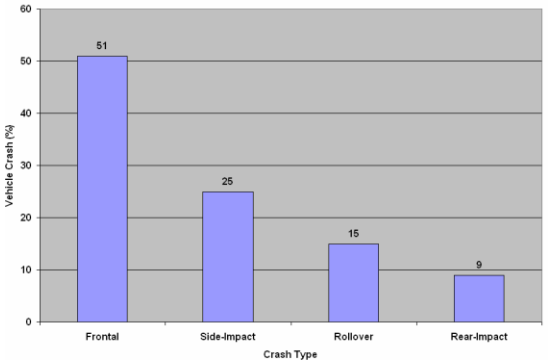

Fig. 2. Crash type Vs Vehicle Crash

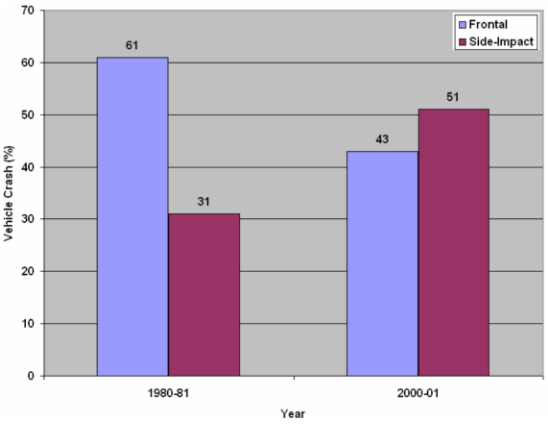

Fig. 3. Comparison of frontal and side impact crash

C. R. Sonawane & A. L. Shelar studied the current advanced world requires greater safety to the passengers with minimum fuel efficiency and cost. In the current automobile have one disadvantage that they have short front crumple zone to absorb frontal impact. So, the safety of the vehicle as well as of the passengers is certainly depending upon the design of the Bumper. Since the Bumper is the strongest structure which absorbs maximum of the frontal impact force

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in the crash scenario. As a result of the closeness of the passenger's head and neck to the crumpled bumper, the latter poses a significant threat to the individual's health in the event that the bumper sustains any damage as a result of the crash. The bumper is the component of the vehicle's crush zone that has the most responsibility because the vast majority of fatal accidents are caused by frontal and rollovercollisions.

The blind spots which are developed due to obstacle between occupants' eye and vehicle parts on side during motion, it is more than 70% of accidents occurred due to that fault on road. It has been observed that most of the times driver do one common mistake is that while changing lane on road and it leads to greater exposure to the blind spot andthis is the main reason for causing the accidents. As per the results for Russia in 2017 it has been confirmed that lots of accidents are happened only due to the driver's fault [5].

In this paper researchers observed that frontal bumper structure is made up by combination of 3 different material which are named Aluminium, GMT Thermoplastic and HSS Sheet Mould Compound. On these three materials FEA studies is carried out to get the data of Stress distribution, Impact force, Deflection, Total deformation of the component. As per the results it is observed that HSS Sheet Moulding Compound bumper structure would minimize the its deflection, stress applied on it as well as the impact force. Also, it will increase Elastic strain energy. For Glass Mat Thermoplastic it is observed that it has very excellent impact behaviour when it is compared with the steel & aluminium.

In the study conducted by Charis Phan and Yong Seok, the A-pillar cross-sectional shape of the Volvo XC60 was utilised as a benchmark to evaluate a potential upgrade for the 2015 Toyota Camry. This evaluation was done in relationto the previous paragraph. Steel (HSS) with yield strengths ranging from 210 to 550 MPa and tensile strengths ranging from 270 to 700 MPa is the material that is generally utilised for the construction of modern bumper beam structures. The use of advanced high strength steel (AHSS), which also includes ultra-high strength steel (UHSS) with a yield strength that is greater than or equal to 550 MPa and a tensile strength that is greater than or equal to 700 MPa, has become commonplace in many modern models of automobiles. [6].

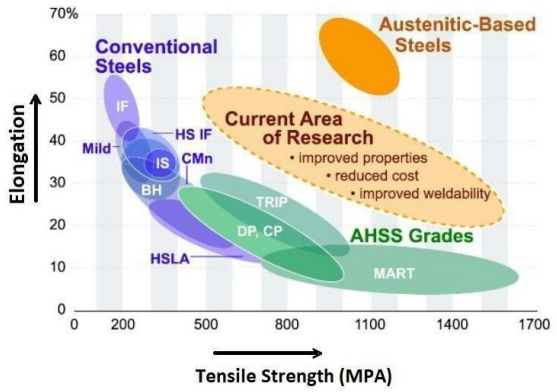

Fig. 4. Advanced HSS Elongation vs Total Tensile Strength of Materials

For traditional materials, the increase in strength may leads towards decrease in ductility or reverse of the same can happen. Although, newly evolved materials such as TRIP provides a combined advantage of high strength as well as ductility which we can observed in Fig. 4.

By the use of LS DYNA software, it is shown that the results are improved when GMT is used as a material in the design of commercial bumper beam in impact test. This test is conducted as per ECE United National Agreement. In the design there are three main constituents namely shape, material and study of impact. The results of the study are compared with steel and aluminium. It has been observed that in terms of impact behaviour when we use GMT as material in design of beam structure then the impact resistance is improved.

In this study the BEM sub-model is used for frontal bumper fascia. This process is further resulted into the more accurate one as well as improved the optimization of the sampling data. The objective is to conduct slow speed impact test and the test is carried out with IIHS standards and guidelines in the three different locations of vehicles, which are at Central, Right-hand (RH) and Left-hand (LH) corner [7].

- Insurance Institute for Highway Safety Test Protocol:

IIHS is nothing but one of the top educational independent organizations as well as scientific study conducting industry which is established to reduce deaths, injuries and damage to the property in the crash of vehicle. In this low impact test series frontal and rear both are studied in that addition two localised impact test also carried out. In this test the results show how various components will helps to absorb energy during impact. Following Fig. 5 shown how the Frontal and Corner impact test is going to be conducted.

Fig. 5. Snaps during frontal and corner impact test

Guideline per IIHS for the configuration is shown below:
Configuration For Full Frontal Test,

(a) Barrier Height (from ground) :- 457 mm
(b) Vehicle speed :- 10 km/h

Configuration For Front Corner Test,

(a) Barrier Height (from ground) :- 406 mm

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(b) Vehicle speed :- 5 km/h
(c) Overlap location :- 15 % to the width of the vehicle at frontal axle. (except accessories of vehicles)

Model Information :

To conduct this test the model is generated with the baseline of Toyota Yaris 2010. These models are developed for research purpose only and it is documented over this paper study. In the following figure the solid modelling has been generated as well as to conduct finite element analysis study meshing view is also shown. As per snaps we can observed that there are total 771 number of parts or components in the model, they are having 9,98,218 number of nodes with 9,74,383 hybrid elements.

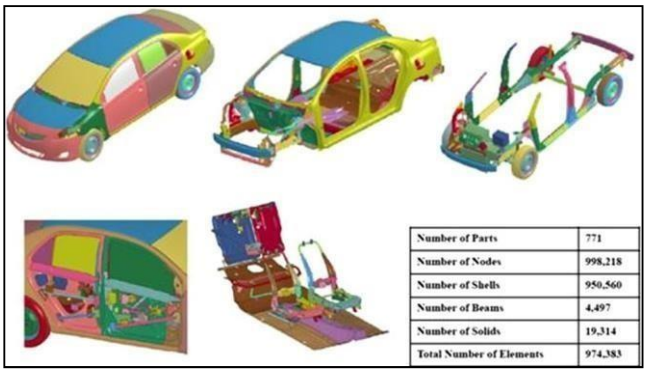

Fig. 6. Generated 3D Solid model information

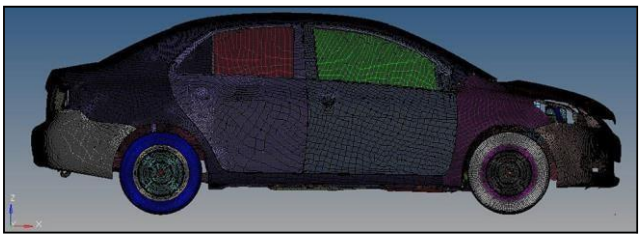

Fig. 7. Meshing of Generated 3D Solid model

In the following Table I is shown with detailed information of the meshing model, elements used and the utilized connections for analysis of FE model. As prominence is put down to analysis of the slow speed impact to the bumper with Mat24 (as a material) and the characteristics of the material is shown in the Table II.

While generating 3D CAD of metal bumper the meshing is made fine whenever possible to get more accurate results. In the previous researcher's data, the list of parts, it's materials, properties, testing details, etc. can be found.

TABLE I. DETAILS OF FE MODEL GENERATED FOR MESHING

Mesh element summery	Connections used
Number of parts: 771 Number of nodes: 998,218 Number of shells: 950,560 Number of beams: 4497 Number of solids: 19,314 Total number of elements: 974,383 Weight, kg: 1078 (actual vehicle)	Beam connections: 4324 Nodal rigid body: 423 Extra nodes set: 16 Joints: 14 Rigid bodies: 2 Spot weld: 2862

TABLE II. MATERIAL PROPERTIES OF METAL BUMPER

Material	Mat24
Density, kg/m^3	7890
Youngs Modulus (E), GPA	200
Poissons ratio	0.3
Yield Strength, GPA	800

In full overlap impact test, speed of the vehicle is maintained at 10 km/h. The mounting position of the crash barrier is placed such that front extreme end area of (bottom edge) the barrier at 457 mm from ground.

Fig. 8, 9 shows condition taken while doing test on front overlap impact test FE (finite element) modelling and their boundary condition. During an impact the centreline of the vehicle and barrier is aligned in straight manner. The impact of the vehicle on the barrier is takes place at 10 km/h as mentioned earlier and the analysis is done on it when vehicle comes to the rest.

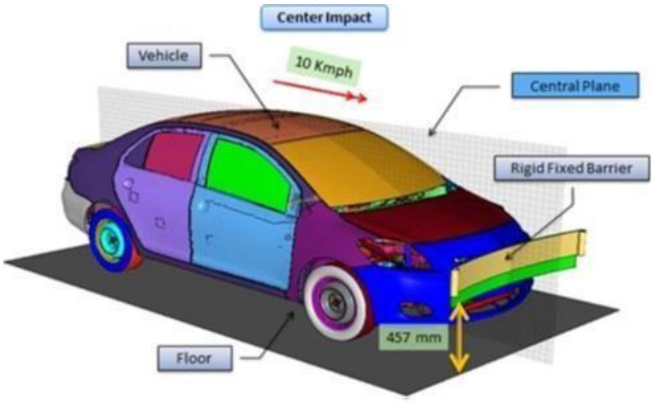

Fig. 8. FE model in Frontal full overlap impact test

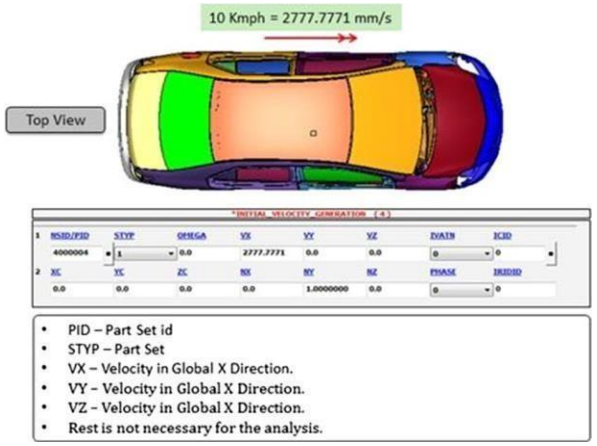

Fig. 9. Boundary conditions setup during frontal overlap impact test

When the frontal overlap impact test is conducted in the results it is came out that the metallic bumper is not having enough strength in the protection of the radiator and all its nearby parts. We can observe in Fig. 9 the simulation instances that has been captured during overlap impact test. Also, the damage happened to the radiator can also been seen.

In the following Fig. 10 the baseline geometry of the metallic bumper is shown as well as plastic strain's contour

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plot are shown. The highest value for plastic strain during immediate buckle (at t = 0.15 s) is observed which is 0.2284.

To get optimization in the results and more protections to the interior parts of the vehicle it is needed that the some of the Iterations, that is by doing modification in the geometry, material, thickness, etc.

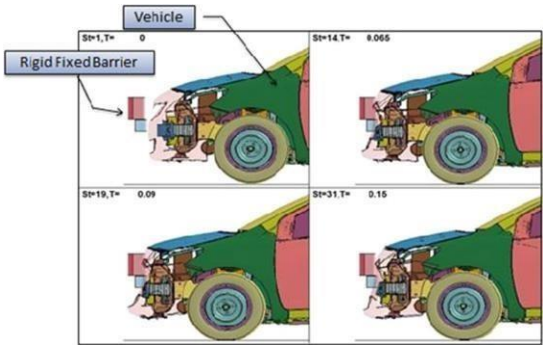

Fig. 10. Frontal overlap impact test Analysis instance

In Table III and IV will give us comparative study of all the Iterations for the energy absorption done by metallic bumper while both impact test. From that table it is also confirms that there is significant growth in the stiffness of the bumper whenever we modify it. This development is in terms of the increase in thickness of material and upgradation in bumper profile.

TABLE III. FULL FRONTAL OVERLAP IMPACT TEST RESULTS

Iteration	*Design changes*	Energy absorbed *by metal bumper, J*	Energy absorbed *by LH bracket, J*	Energy absorbed *by RH bracket, J*
Baseline	Thickness 1.5 mm	2857.5	90.64	94.756
Iteration 1	Geometry extended in corners	2830.4	90.7	92.693
Iteration 2	Thickness change (1.5–2 mm)	3453.8	76.09	67.63
Iteration 3	Shape changes (double C profile)	3597	85.4	89.68
Iteration 4	Thickness change (1.5–2.5 mm)	3735.4	98.14	95.7

TABLE IV. SIDE IMPACT TEST RESULTS

Iteration	*Design changes*	Energy absorbed *by metal bumper, J*	Energy absorbed *by LH bracket, J*	Energy absorbed *by RH bracket, J*
Baseline	Thickness 1.5 mm	1.54	0.17	0.87
Iteration 1	Geometry extended in corners	116.46	0.37	2.43
Iteration 2	Thickness change (1.5–2 mm)	184.81	0.51	2.61
Iteration 3	Shape changes (double C profile)	182.98	0.48	2.98
Iteration 4	Thickness change (1.5–2.5 mm)	186.69	0.45	3.08

This upgradation will impact the results to fewer deflection in the bumper beam which relates bumper would have greater impact to deflection to absorb more impact energy.

This change will result in lesser deflection of the bumper metallic beam which relates to the bumper would have better impact to deflection to absorb more impact energy.

In Fig. 11 we can get graphical representation of energy absorption for all iterations for comparative analysis.

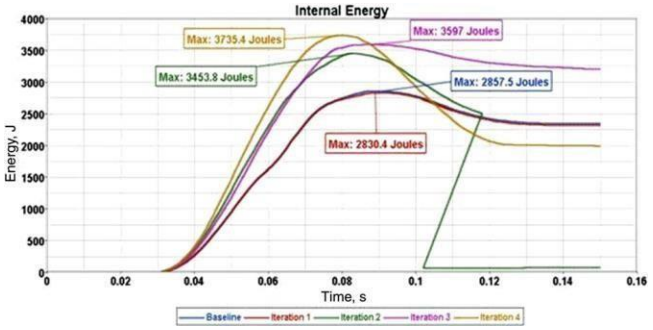

Fig. 11. Energy absorption at frontal full overlap test for different iterations

V. CONCLUSION

During study of above topic, we understood that composites can be used as an alternative in design of Bumper beam and hence it helps in the reduction of risk of injury to the passenger. Bumper which is made of composite was being tested on diverse fields to find out characteristics like highest energy absorption, toughness as well as thickness.

Use of GFRP as will gives better specific energy absorption and more importantly reductions in the load ratio. To use PET foam filled tubes gives advantage in the production cost because of the material price is lower than GFRP in the market. Use of the CFRP is having better corrosion resistance as well as it has excellent lower thermalconductivity. But it has only disadvantage over the higher costing.

After all the above studies I wish to conclude this topic by following statements,

1) We should use of combination CFRP and GFRP as a material in the bumper beam profile so that we can achieve optimum strength and cost for design.
2) To develop profile of the metallic front bumper in Double C shaped which gives higher impact energy absorption capacity.
3) Optimum materical thickness for optimum stiffness.
4) Use of sensors and alert system so that driver will notified before crash scenario.

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Design and Fabrication of Dual Axis Solar Tracking System For Performance Enhancement

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Abstract— The upward trend in energy demand across globe, renewable energy sources have emerged as one of the most viable options. The increasing pollution of the environment as well as the rising costs of fossil fuels have brought a significant amount of attention to renewable energy sources. Solar power is a significant contributor to the overall supply of renewable energy. Because of the ever-increasing need for solar power in a variety of contexts, including but not limited to the generation of electricity, the provision of heating, the illumination of public spaces, solar charging stations, and use in industry, etc. Therefore, solar energy is the best and most efficient option for a variety of uses. According to studies and data, the efficiency of solar panels is approximately 16% to 18%. As a result, research and development are currently being conducted to enhance of solar panel performance by increasing gross power it produces. The present work is focussed to implement dual-axis solar tracker arrangement to improve the overall efficiency of system. The fabrication of entire set up along with experimental work and testing has been conducted at MIT ADT University. The work on the project primarily centered on the design of the hardware, the manufactured part, and the assembly. The comparative study for single and dual axis solar tracker reveals superior performance of dual axis solar tracker arrangement. As a result of the testing that was carried out, we have come to this conclusion. This method produces a broad field of view while also reducing the amount of error effectiveness.

Keywords—*Real time clock, Arduino, stepper Motor, DC Motor.*

I. INTRODUCTION

The various thermal power stations in India consumed approximately 470 million tonnes of coal in 2017, which resulted in a significant amount of pollution. The solar tracking system plays a significant part, as its primary function is to collect highest of energy possible from the sun. In those days, the method for generating electricity was not nearly as efficient as it is today. This is due to the fact that there are many different kinds of power generation systems available today of various other non-renewable and renewable energy source power generation methods. A novel approach to the integration of solar detection sensors into photovoltaic dual- axis sun tracker systems is presented here. The prototype hasbeen constructed and put through its paces, which has resultedin a broad field of solar [1]. The structure of system is that ofa PILOT-PANEL, with every panel having a light to frequency converter (LTF) installed in it. The output frequency of LTF is proportional to irradiation, which also means that it is proportional to the power. This is an advantage of the LTF.

The PILOT will proceed to follow the rising sun constantly. A microcontroller is responsible for reading the frequencies of both LTFs and comparing them whenever the PILOT is moved to another location. If the disparity is smaller compared to the offsets, the Panels will remain in its present location while the PILOT will continue to follow its course. [2]. Using the dual-axis solar monitor, that is capable of rotating in both the horizontal and altitude directions, the goal of this study will be to mimic and then build the algorithm for control that will prove to be the most appropriate and effective. The simulation provides tracker with various angles needed to position the solar panel together with path of sun's rays in such a way that its surface receives maximum possible solar irradiation [3].

This system has been shown highly effective and advantageous over single-axis and fixed arrangements [4], even though the decision to make use of trackers is primarily determined by the physical characteristics of the land. In general, however, this is the case. The idea that was ultimately chosen was developed and improved in order to improve performance of solar panel. This has been accomplished by angling the panel in such a way that it was always perpendicular to the solar radiation.

As we fabricated the entire system and after placing the solar panel, we take readings in a day from 8 am to 6 pm by comparing with single axis solar panel. According to readings taken the efficiency is calculated and the dual axis solar tracking system is more efficient .

A. Arrangement of Base for Dual Axis solar Tracker .

- Specifications:-
- Solar Panel (Havells 100 W Polycrystalline Panel)
- MS Rectangular Coil Tube 3x1 inch(For Frame).
- MS Square Plate - 300mm x 300mm x 5mm.

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- Two MS Square Plates - 200mm x 200mm x 4mm.
- Square Pipe - 100mm x 100mm x 3mm
- 4 Nut Bolts - 12mm
- Ball Bearings

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- Arrangement of Spur gear for smooth rotation :-

As the solar panel is placed on frame and below the frame, we had made one arrangement of spur gear for smooth rotation of solar panel in north – south direction and due to the arrangement of spur gear the load acting or weight acting will manage by gears and it reduced the speed of rotation.

B. Governing Equation for the Analysis :-

The mechanical arrangement to follow the sun, it first needs to know where the sun is located. During the daytime, there are two different ways to track the sun. There is also a passive mode, which contrasts with the active mode. Linearity is the foundation of the passive mode's system. It is entirely dependent on the output of the sensors. This sensor determines where the sun is in relation to the atmosphere and then transmits that information to the controlling device. The disadvantage of using a tracking system based on linearity is that it is susceptible to being affected both physically and environmentally. The amount of solar radiation and the angle of solar incidence will shift throughout the year due to variations in climate. When the altitude and azimuth angle of the concentrators are in sun position, they are able to yield the highest amount of solar energy possible.The tracking device is essential in order to correctlyposition the concentrator in relation to the sun. Calculating the angles of azimuth and altitude is essentialif one is to make use of the solar radiation that is available.

The angle at which the sun is positioned is depicted in Figure 1.

δ	Declination angle
Ψ	Azimuth angle
α	Altitude angle
φ	Zenith angle
P	Ground Plane
H	Horizontal Line

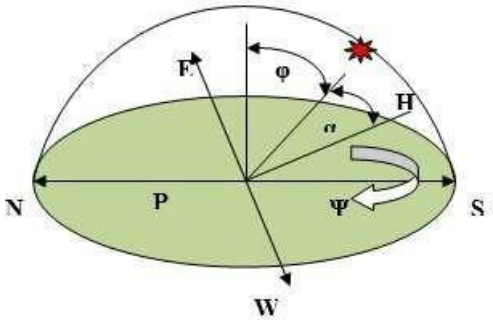

Figure 1 Direction of sun.

The angle known as the declination is shown by the symbol. Despite this, the axis of rotation of the earth is tilted at a 23.5-degree angle, and the range of the declination angle is

$$-23.5^{o} \leq \delta \leq +23.5^{o}$$

$$23.45\sin[360/365\ d\ 24^{0} \quad (1)$$

where ‘d’ is the day of the year. The following Eq. (2) provides the azimuth calculation,

$$\cos(\Psi) = (\sin(\square) + \sin(L) - \sin(\square) / (\cos(\square)\cos(L)) \quad (2)$$

where ’L’ is the latitude. The vertical angle ‘α’ is denoted as altitude angle.
The altitude angle is calculated by:

$$\sin(\square)\ [\cos(L)\cos(\square)\cos(H)][\sin(L)*\sin(D)] \quad (3)$$

where 'H' denotes inclination of the hourly. As determined by the next equations (4) and (5), the solar altitude in the northern region and the southern hemisphere, respectively.

$$\square = 900 - (-\square) \quad (4)$$

$$\square = 900 + (-\square) \quad (5)$$

The solar hour angle will increase by 15 degrees for each hour that passes. At twelve o'clock, the hour angle will be equal to zero degrees. The formula that is listed below can be used to determine it.

$$\cos(Hs) = -\tan(L)*\tan(\square) \quad (6)$$

The sun rise angle (Hs) ranges from -180 degrees to 0 degrees, and the sun set angle (Hs ranges from 0 degrees to 180 degrees).The angle formed by the sun and the line that extends vertically from the ground plane to the zenith is known as the solar zenith angle. Equations (7) and (8), which can be found below, can be used to determine the zenith angle at the summer and winter solstices, respectively.

$$\square = L - 23.5 \quad (7)$$

$$\square = L + 23.5 \quad (8)$$

The equation that describes the position of the sun indicates that the tracker system is capable of following the sun. The location of sun can be entered into the microcontroller so that it will move in the same direction as that of sun. The linearity system will not have any influence on the tracking system in any way.

C. Description and Apparatus :-

- Arduino UNO controller
- ATMEGA328P-PU is an 8-bit Microcontroller
- RISC Architecture
- Operating Voltage :- 1.8 to 5.5V
- Input Voltage:-7 to 12V
- Digital I/O pins:- 14
- Flash Memory:- 32k bytes.
- SRAM:- 2KB
- EEPROM:- 1KB
- Clock Speed:- 16MHz

- Motor 1

Type= DC Planetary Geared Motor
Torque = 40 KG CM
RPM = 10 Shaft Diameter:- 10 mm
Weight = 400 g
Supplier- HITECH ELECTRONICS

- Motor 2: -

Type = Stepper Motor
Torque=30.61 KG CM
Shaft Diameter = 6.35mm
Step angle :- 1.8 degree

- Driver Module

Type :- TB6600 Stepper Motor driver controller

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Input current :- 0 -5 A
Micro step :- 1, 2/A, 2/B, 4, 8, 16, 32.
Power :- 160W
Temperature :- 10 - 45 Degre

- Solar Panel

Rated power (Pmax) Wp = 100 W
Max power voltage (Vmp),V = 19.12 V
Max power current (Imp),A = 5.23 A
Open circuit voltage (Voc), V = 22.68 V
Short circuit current (Isc), A = 5.60 A
Module efficiency (%) = 14.90 %
Number of cells = 4 * 9
Module dimensions (mm) = 1005 * 668
Module thickness (mm) = 35
Approximate weight (kg) = 9.7
Ambient temperature °C = -40 to +85
Hail impact velocity, m/sec = 23
Frame = Silver Anodized Aluminum Alloy
Solar Module Price = Rs.5376/-

- RTC (Real Time Clock)

Type :- DS1302
With Battery

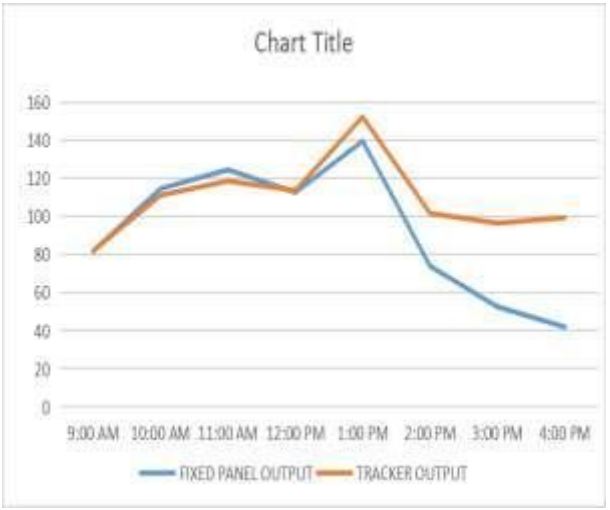
D. Result and Discussion

- Comparison between Existing and Proposed system

The comparison of solar panels to dual axis solar trackers from eight in the early hours till six in the late afternoon, it is observed that dual axis solar trackers are significantly effective over one-axis solar tracking devices. This conclusion is based on reading comparisons. The solar panel moves in the direction of RTC t and encounters a range of light intensities as it traverses the horizontal and vertical planes at varied angles and for varying amounts of time. This movement takes place as the panel moves in the direction of RTC t. The results of the important comparison that was carried out are presented in table no. 1 down here.

Figure 2:- Testing done in Morning

Figure 3 :- Testing Done at 4 pm evening



The x-axis of the graph that is being shown represents time, and the y-axis represents power in watts. The blue line represents a solar panel with a single axis, and the red line represents a solar tracker with two axes. When we look at the graph, we can see that the performance of the red line starts to shift slightly in the afternoon, and then a more significant shift takes place around noon. Therefore, the power output is maximized by using a solar panel with dual axes. In light of what has been discussed thus far, it should come as nosurprise that the Dual-axis Solar Tracker Systems come out on top in terms of both cost and benefits when pitted against the Fixed Solar System. Controlling stepper motors is just one of the many applications that can be made better with the assistance of an Arduino microcontroller. There are many others. For instance, the amount of time it takes for the position of a stepper motor to change in a step-by-step manner.

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- INITIALLY THE COMPARISON IS MADE BETWEEN STATIC AND SINGLE AXIS SETUP

The solar tracking system can generate mobile solar electricity anywhere in the world due to its mobility, efficiency, and ease of use. It's versatile.

TIME	FIXED MODULE			DUAL-AXIS SOLAR TRACKER			Power
	VOLTAGE (V)	CURRENT (I)	POWER (WATT)	VOLTAGE (V)	CURRENT (I)	POWER (WATT)	% Change
9 AM	21	3.90	81.9	21	3.90	81.9	0
10 AM	22.7	5.05	100.16	21.8	5.10	111.18	+0.11
11 AM	22.4	5.56	86.88	22.6	5.25	118.65	+0.35
12 PM	22.1	5.1	112.71	22.6	5.03	113.678	+0.85
1 PM	24.5	5.7	139.65	23.8	6.4	152.32	+8.3
2 PM	22.4	3.1	73.92	22.6	4.5	101.7	+37.58
3 PM	21.9	2.40	52.56	22.6	4.27	96.502	+83.6
4 PM	21.5	1.95	41.92	21.7	4.58	99.386	+137

E Overall system :

Figure 4 : - System

We use RTCs that track the sun at a rate of one degree every five minutes, and from eight in the morning until six in the evening, after which the RTCs stop functioning. Consequently, dual-axis solar tracking is more effective than fixed solar tracking.

CONCLUSION: -

Dual-axis solar trackers create more electricity than fixed-mount systems. This power-generating prototype is scalable.

The dual-axis solar tracking device will boost energy efficiency by tracking the sun's daily and seasonal movements. Efficiency gains will reduce solar panel size and electricity generation costs while maintaining output. An RTC-based dual-axis automatic sun tracking system will be designed, implemented, and tested in this project. The novel system was compared to a fixed solar tracking system. This RTC-based dual-axis solar tracking device produces more solar thermal output than a stationary solar concentrator. The real-time clock-based solar tracking system provides 75% better thermal gain than a fixed solar tracking system. system

G. Acknowledgement

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Auto Cleaning Centrifuge System

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Abstract

Every day is a rise in factories and industries producing automobiles, metals like steel, iron, etc. All such industries are in constant requirement of oil for lubrication or other purposes. But during such process, the oil gets unprocessed making it difficult to use repeatedly. Among the available systems, the Centrifugal Filtration system was chosen to meet the expectations. Due to the automation in the proposed system the accuracy of the system is bound to increase as well as decreasing the manual work. In the current era of automation, it is expected that systems work for large amount of time, so it being an automated system, the sludge will be disposed at regular intervals thus increasing its operating time during the iterations, this disposal of sludge is carried out bysystem's Improved Scraping Mechanism.

Keywords— Centrifuge, Automation, Filtration, Scraping Mechanism, Oil Sludge

I. INTRODUCTION

Centrifuges are used in industry for a number of purposes including the separation of materials based on density. This separation normally entails removing insoluble particles from supernatant liquids, but it can also entail extracting dissolved compounds from one immiscible liquid into another of a different density and centrifugally separating the combined liquids. The liquids are blended, the solute is transferred, and the immiscible phases are separated successively in the same machine at high speed. Centrifuges are commonly employed in numerous manufacturing industries to separate solids from liquids by using centrifugal acceleration of particles directed outward from the rotation axis. This force causes the particles to travel to the centrifuge's perimeter, where they are confined or contained by the rotating body's wall. Alternatively, a density difference between two immiscible liquids can be used to speed up liquid separation (for example, fat separation in dairies for cream or butter production) [1-2].

There are various types of centrifuges available today some of them are mentioned as follows:

Decanter centrifuge: - The primary use of decanter centrifuges is to continuously separate enormous volumes of particulates from liquids. They're also utilized in industry to clean and dry different substances like polystyrene beads, clarify liquids, and concentrate solids.

Disc stack centrifuge: - A centrifugal separator known as a disc stack centrifuge is a type of centrifugal separator. In the bowl of a centrifugal separator, a set of conical plates (disc stack) is inserted. More settling space is introduced with the addition of the 'disc stack.' Thus, increased surface area accelerates the separation process.

Solid bowl centrifuge: - The spinning assembly of a solid bowl centrifuge (SBC) consists of a horizontal centrifuge rotor with a scroll conveyor inside it. The assembly spins at a rapid rate around its own axis, providing a strong centrifugal force that allows solids to separate from liquid.

Tubular centrifuge: **-** Tubular centrifuges are made out of a bowl, a slow acceleration motor, and a starting. The bowl revolves at 15000 rpm, producing a centrifugal force 16000 times that of gravity. The liquid combination to be separated enters the Centrifuge's nozzle, which is located at the bottom of the base [3].

The rising industrial usage of centrifuges has resulted in a variety of customized centrifuges built and modified to specific needs during the last 10-15 years. Sedimentation centrifuges and filter centrifuges are the two types of centrifuges available. Solids are delivered to the revolving machine bowl's perimeter wall and gathered against this surface in sedimentation centrifuges; liquid is separated from the solids by the tight packing of the individual particles. Solids are brought to the surface of a filter element and trapped on this filter, while liquid drains through the particles and escapes through the filter surface in filter centrifuges. The G-force generated due to the rotational motion acts differently on the pumped liquid and the suspended solids inside it because of the density difference. Hence, the solids get concentrated on the centrifuge inner walls of the pot while clean liquid flows out [4].

II. RESEARCH GAP AND EXISTING TECHNIQUES

There is less research done in this field of centrifuge for testing. The manual method is used for cleaning the sludge

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from the centrifuge in some of the industries, it also requires a lot of time and human labor, Hence the productivity becomes low and the cost increases.

Therefore, the Automated centrifuge comes in picture, auto cleaning centrifuge system using the scraping mechanism with the help of the actuator and the pneumatic cylinder is easier to integrate, time saving, economical, and does not need human labor.[5-7]

III. PROPOSED SYSTEM

Figure 1: - 3D model of Auto cleaning centrifuge system

Proposed automated system for cleaning centrifuge consists of the upper plate, housing, centrifugal pot, shaft, scraper, actuator, pneumatic cylinder and coupling done inside the pot.

The linear actuator is a device that travels in a linear motion between two places. Mechanical, electro-mechanical, direct electric (linear motors), hydraulic, and pneumatic linear actuators are among the various technologies.

Scraper - It entails the use of a sharp instrument that is mostly employed in the cleaning procedure. The scraper, which is generally a tool with a pointed side, is scraped on the wall to be cleaned in this method. The scraper in the gadget will assist in cleaning the inside walls of the pot, resulting in sludge scraping.[8]

IV. COMPONENTS AND WORKING OF THE SYSTEM

1. Actuator:

An actuator is a component of machine which is responsible for moving or controlling a mechanism or system.
It is a device that uses a form of power to convert control signal into mechanical motion.
An actuator requires a control signal and a source of energy.
In this device, the use of actuator is to drive the arm to which the scraping mechanism is attached.
The actuator used in this device is a Linear Actuator.

Linear actuator are the ones that converts rotational motion into linear motion. The movement of the actuator can be powered by the use of Hydraulics or Pneumatics.

Figure 2: -Linear actuator [10]

The specifications of the actuator used is as follows:
Table 1: -

Actuator Type	**Linear Actuator**
Voltage	24 V DC
Valve Motion	Linear Motion Valve
Stroke Length	100mm
Rated Load	500 N
Speed at rated load	20mm/sec

2. Scraper:

It involves a sharp tool which is mainly used in cleaning process. In this, the scraper which is usually a tool with a pointed side is being scraped on the wall which is to be cleaned. In the device, the scraper will help in cleaning the inner walls of the pot which will result in scraping of sludge. The scrapping tool is attached to an arm. The arm is driven by an actuator which will bring the arm down when maximum sludge level is reached. In the previous solutions, the removal/falling of the sludge was fully/partially dependent on gravitational force. But using the scraping mechanism is an advantage for easy removal of the sludge.

3. Pneumatic Cylinder:

Pneumatics can be described as a technology of pressurized air using piped or compressed air to transmit force and energy. The role of the pneumatic cylinder is to open the corkwhich is at the lower end of the pot. Using the pneumatic cylinder, the cork or lower plate will be opened for the sludgeto pass out. The pneumatic cylinder is mounted on the lower plate from down side. The mountings will be done by front flange mounting method.

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Figure 3: - Pneumatic cylinder [9]

Specifications: -
Temperature: - 60 degree C
Stroke length – 250 mm

4. Coupling:

A coupling is a mechanical element/part that connects two shafts together to transmit power from the drive side to the driven side. The need of coupling in the device is to rotate the pot with the help of the motor which is mounted on the upper end. The coupling used in the device is a standard sized flange coupling with Internal Diameter of 30mm. The coupling attached will be bolted by using M10 type of bolts.[9]

Figure 4: - Coupling

5. Housing:

It is the outer body on which the whole device is mounted. There are provisions made for the inlet and outlet as well as shaft and actuator. It acts as a cover for the device as well as for maintaining the stability during the rotation of pot. The material used for housing will be a 3mm Mild Steel plate. The purpose of selecting Mild Steel is because of its properties. It has low self-weight and high strength to weight ratio. It has high ductility and durability. Also, it is a low cost, moldable and easy to transport material. This solution is final solution and may be considered for manufacturing.[10]

Figure 5: - Housing and coupling done inside the centrifugal pot

Working: In this solution, scraping mechanism is included for easy removal of sludge. In this solution, when the maximum level of sludge is reached, the oil flow from inlet will be ceased temporarily. Then the actuator will move down the arm to which the scraper is attached. The pot will be allowed to rotate at a certain RPM. This will ensure that all the sludge stuck on the inner walls of the pot is removed properly. Simultaneously, the lower cork will open with the help of pneumatic cylinder. As the lower end is opened, the sludge will fall with the help of gravitational force. As the sludge is excreted completely, the lower cork will again close the opening of the pot and the filtration process will be continued again.

Figure 6: - Design of the centrifuge

In this solution, only the pot will be in rotation motion. All the remaining parts will be stable. The rotating motion of the pot will be achieved by a shaft attached to the inner walls of the pot. Thus, with all these steps being processed, the required output may be achieved.

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Figure 7: - Inlet of oil and actuator

V. CONCLUSION

The working of the system is mainly based on the automated cleaning centrifuge system were the system decreases manual work and human labor thus increasing productivity and operating time by the improved scrapping mechanism and pneumatic discharge system.

VI. Acknowledgement

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Software Simulation of ANPR System using MATLAB

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Abstract—This paper highlights the importance and enhancement in the technology of the Automatic number plate recognition system (ANPR) system and its future applications for universities, large apartments, andhighly restricted areas. The ANPR system uses the concept of image filtering and character recognition technology to extract the characters from vehicle's number plate and correlate them with the pre-occupied database. This system will work as an access grant system when the vehicle's number plate matches with the pre-occupied database of the system, and then access will be granted. Otherwise, the access will be denied and the system will send an alert message to the security guard or the concerned admin via E-mail or SMS. A low-cost model of this system can be very well applied to apartments and societies where the problem of vehicle security in the parking lot, maintaining the record of residents' vehicles, and keeping a watch on suspicious intruders in societies can be solved.

Keywords—*ANPR, Image recognition system, MATLAB, Number Plate recognition*

I. INTRODUCTION

In the early 90s, the Automatic number plate recognition system (ANPR) was used as an integral part of the field of security and law enforcement in the UK. In the early 90s, this technology only used primary cameras to capture the image of suspected vehicle number plates for carrying out a clear investigation. However, the development in this technology increased when the primary cameras were replaced by the digital cameras having a higher range and wide-angle [1]. A synergy of data science and machine learning algorithms can be used to enhance the ANPR system to function in the real world. As the population increased over the period of time in India and abroad, this technology has become the need of an hour to manage traffic and also for the security and law enforcement. In essence, it consists of a powerful digital camera having a wide range that has the ability to capture images of the vehicle number plate in real-time [2]. When the image of the vehicle's number plate is captured, the system will segregate characters in the number plate by using a character recognition algorithm [3], when the characters inthe number plate will be checked with a pre-occupied large database with correlation [4]. OCR, i.e., Optical Character Recognition, plays a crucial role in this type of system [5]. MATLAB has commands integrated with it which help in Image Processing [6]. If the number plate is matched with the Pre-occupied database, access is granted. Otherwise, it's denied [7]. The increasing number of accidents day by day makes it important for ANPR systems (photo and video) to be used widely [8]. The amount of light present in the environment where is ANPR system is present needs to be monitored so as to get a better image for recognition [9]. As RGB images have a lot of data captured in them, it is important to convert them into grayscale for faster recognition [10].

Till now, we can see that the output for the Automatic Number Plate Recognition System is saved in a text file or directly in the command window of MATLAB. Here in this paper, we have showcased the system to be able to send an SMS or an E-mail to the user. This research paper focuses on the importance of using ANPR technology for universities and larger apartments or residential areas where security and maintaining records of every vehicle manually is a tedious task, especially in a country like India. This simulation is developed in MATLAB software which is easy to use and has good compatibility with cameras. Ease of use

II. METHODOLOGY

A. Image Acquisition

The first step in the process is to acquire the image. In the suggested method, we will take an input image from the user to aid the recognition process of the number plate, as shown in Fig. 1.

Fig. 1. Image Acquired from Input

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B. Pre-Processing Of Number Plate

The acquired input images are in the RGB format. For faster processing speed, they need to undergo a conversion from RGB to Greyscale. The RGB image is hence converted into greyscale using the **rgb2gray() function.**

The RGB colour group consists of three primary colours, that is Red, Green and Blue. Greyscale, on the other hand, is composed of two main colours that are black and white. Therefore, this aids in quicker processing. This can be seen in Fig. 2.

Fig. 2. RGB to B/W converted Image

Identifying the size of the plate is the first step in the process of recognising a vehicle number plate. Since number plates often have a rectangular shape, it is important to recognise the edges of the plate. The mathematical morphology method is utilised to find the region, and the Sobel operator is used to get the threshold value that finds the regions that stand out due to their strong edges and large edge variance.

The image forms a binary gradient mask as a result of which distinct, sharp contrast lines are discernible. The target image's outline is not easily distinguished by these lines. There are still a lot of gaps and noise around the lines that surround the item in the gradient mask as compared to the original Image.

If the Sobel image is improved with linear structuring components, this linear gap is eliminated. Matrix representations of the structuring components are used to measure the form of a picture. Matrix representations are a characteristic of specific structures and characteristics. Other image processing processes are performed using this. The vertical structuring element is used first to improve the binary gradient mask, and then the horizontal structuring element.

The MATLAB toolbox provides a pre-defined function **imfill()** which fills any overlooked holes in the binarized image. The enhanced gradient mask distinguishes the outline of the cell quite appropriately but does leave unwanted holes (impurities) inside the boundary. The image is scanned for any impurities, and if found, they are filled in accordance with the pixels in the background.

C. Image Filtration

The target is successfully found, but it is the target with some extra characters that has been found. Any entities in connection to the image border must be removed. This is how the actual region of the plate is detected.

D. Character Segmentation

Segmentation is a crucial process in the NPR process, as subsequent processes rely on it. If this stage fails, a character may not be recognized properly that is, the character may be divided into two or even merged to form a single character. To avoid this, we use the bounding box technique. The bounding box is used to measure the properties of the target region. Once a bounding box is created for each and every character in the image of the number plate, it becomes a separate entity for recognition of the number plate as shown in Fig. 3.

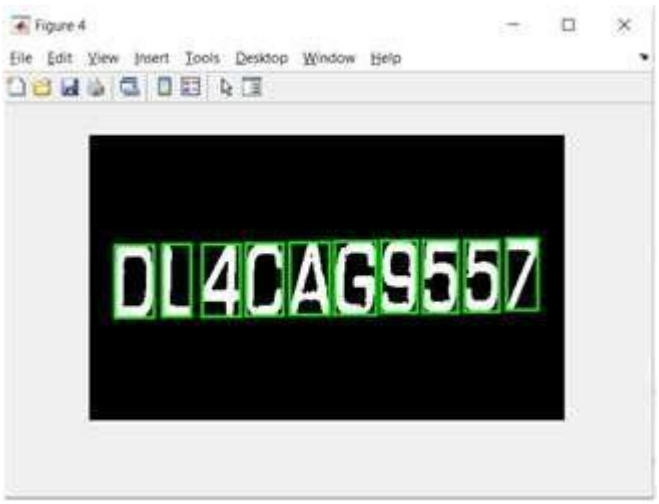

Fig. 3. Bounding Box Implementation

E. Character Recognition Using Template

The process of converting text images into characters uses character recognition. Now, utilising template matching arrays, the number plate identification process compares each character to the entire alphanumeric database. The template picture moves to every available point on the biggersource image throughout the matching process, and as a result, a numerical index is computed to show how well the template matches the image in that position. Pixel by pixel, the matching procedure takes place. Fig. 4 displays the image templates.

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Fig. 4. Template used for Template Matching

F. MATLAB Results

The ultimate outcome of ANPR system is shown in Fig. 5 and Fig. 6 below:

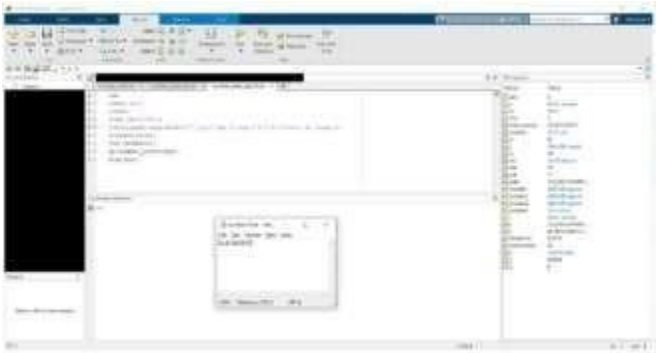

Fig. 5. Resultant Image

Fig. 6. Image of E-mail

The system thus successfully recognizes the all the characters from the Input image by neglecting the surrounding environment. The system can segment each and every character individually for recognition. It displays the number plate of the desired vehicle and also sends a mail to the registered mail id that is present in the program so that it cannot be changed by the user.

III. CONCLUSION

In this paper, automatic vehicle identification and reporting system from vehicle license plates are presented. The system uses numerous image processing and character recognizing techniques for analyzing number plates. That is implemented using the MATLAB platform and gives results after processing images. The image processing uses the tools and commands provided in MATLAB software. Thisprogram developed in MATLAB first extracts the number plate from the image provided and then recognizes the character using MATLAB commands and it's saved in the array, which forms the output of the program, which can be sent to the user via text file or E-mail or SMS.

The real-world performances are to be tested, as of now, only virtual simulations have been performed, but the results are great. The integration with e-mail gives our system the ability to instantly notify the security team about unknown vehicles entering an area.

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ONLINE MARKET SYSTEM BASED ON BIDDING MECHANISM USING AN AI AUCTIONEER

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ABSTRACT

The digital market systems have brought a revolution in the ways of buying and selling of goods. All the existing market system either sell new products or reselling markets use the static (discounted) pricing systems. This paper presents the development anddesign of a secure and efficient marketplace / market system using the core concepts of bidding so that an effective platform for buyers and sellers to bid and exchange goods can be developed. Overall, online market systems will revolutionize the way businesses operate and provide customers with greater convenience, access, and transparency in the purchasing process.

KEYWORDS

Market System , Bidding Mechanism , AI auctioneer ,Analysis , Recommendation

1. INTRODUCTION

The use of bidding systems can improve the whole digital market systems for reselling and make it easierfor users at both the ends [1-7]. This paper aims to provide a comprehensive solution to the challenges faced by the sellers and buyers in digital market systems through the creation of digital market system based on a bidding system. This paper proposes to create a website which will enable seamless experience of buying and selling.

1.1 This website in future will offer an **AI auctioneer** which will be used to auction luxurious items and items which need quick attention

1.2 **How an AI auctioneer works** – It enables the auction process on it's own which mean it will be able to conduct auctions , start it , stop it , declare the winner all at the run time.

1.3 The website's continuous updating database will help making a user friendly and user required recommendation system using ML methods.

2.LITERATURE SURVEY

In year 2021, Secure and Efficient Online Market System Based on a Bidding System.[11] paper was published by A. Gupta and S. Verma, mentioning the key feature of this project as this project has a User- friendly UI, it has an ability to automate the bidding process, it also provides features such as real time-alert and it also contains a bidding history on this online platform. In this project, PHP, MySQL, HTML, and CSS these components are used to develop and execute the project. As a result, the system can handle an increasing number of user and transactions without compromising it's performance, security, and reliability. A scalable system is designed to accommodate growth by adding resources such as servers, databases, and network bandwidth as needed. Thesystem should also be able to distribute its workload efficiently across these resources to avoid overloading any particular component. Additionally, the system should be designed with some security measures to protect against potential threats and ensure data confidentiality. In conclusion, a scalable system can maintain its performance and stability even if the user and transaction volume increases. A major limitation of the following project was that it was falling short of data for its further implementation.

The paper "Design and implementation of an Online Auction System" is published in year 2018 by M.F.Alhamid, M.Z.Alshamrani, and A.Alghamdi. In this

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system they defined many key features. As a project is able to perform a module auction listing, it has an ability to show real-time alerts, and can able to automate the bidding process and the most important facility which is required in today's market is a secure , fast payment options which has been included in this particular project .As a development tool of project PHP, HTML, CSS, and JavaScript are used. the system underwent testing to evaluate its performance and functionality the results showed that it met the expected standards of reliability and efficiency. This means that the system is able to function effectively and consistently without experiencing errors, breakdowns, or other issues that could compromise its performance. The system is also able to accomplish its intended tasks in a timely and efficient manner, with minimal delays or wastage of resources.

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This outcome is a positive indication that the system can be system was not built to handle multiple users or transactions, deployed and used with confidence, knowing that it will and it could only be used by the specific pair of users for which perform as expected. and the main issue is the system was it was designed.
designed to work with only one specific pair of users and
did not have any payment gatteway integrated. This
means that the

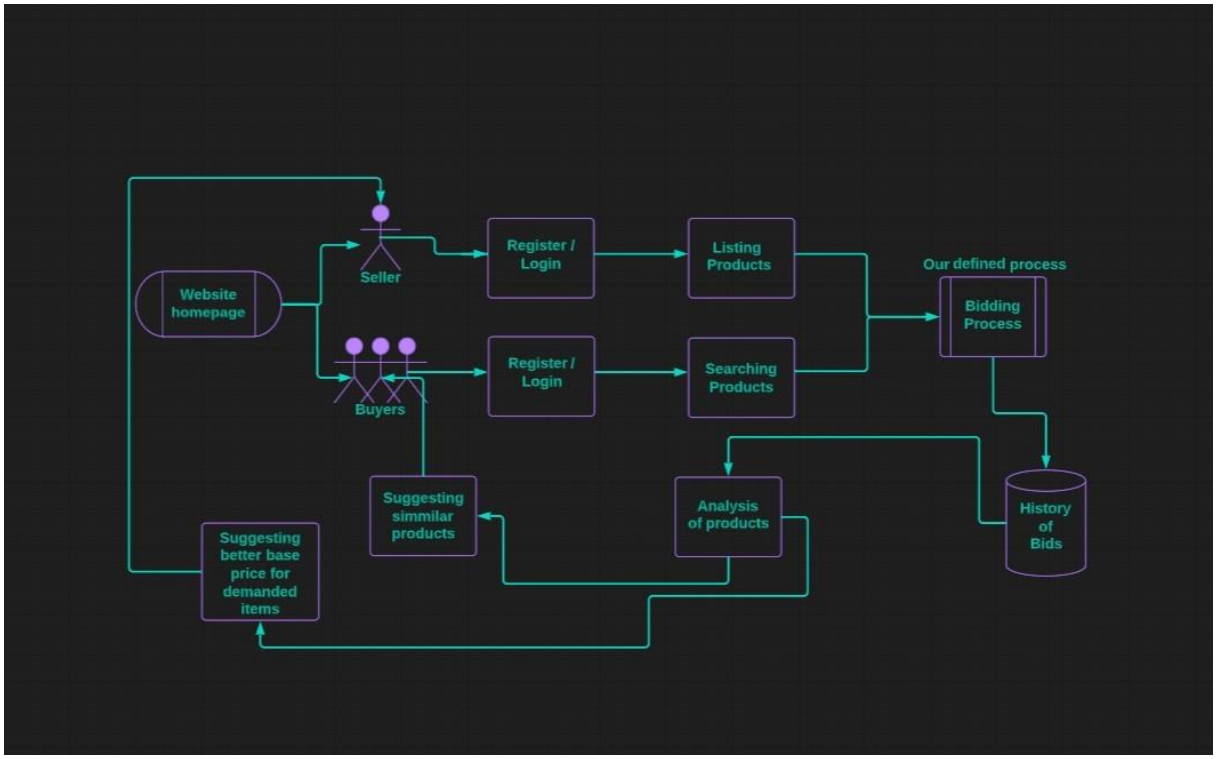

Figure 1. System Architecture of Online Market System

3. SYSTEM ARCHITECTURE

Figure 1 is the proposed system diagram – It's functional parts would be Figure 4 – Website homepage from there the customers can create their id and then select whether they need to continue as a customer or buyer as shown inFigure 3. Below is the description of both the scenarios:

3.1 **If the user continues as seller** – If that user isalready logged in he/she can continue directly otherwise needs to log in then the seller can go on with listing their product they want to sell for that some required fields need to be filled such as adding picture of the products from all the sides, adding a proper description of the product , the base price seller wants to start the bid, starting time of the bidding , expected time to stop bidding , is the ending time fixed or it can change for an higher bid and finally their UPI details for payments and then a seller can list their product , after that our defined auction system which we're going to make using java will come to play and the bidding process for that product will start which will be added dynamically with all the other products available for bidding at that time.

3.2 **At the buyers POV** if the buyer is already registered he/she can explore the market place search for items also if he's been our user from a duration of time he'll be getting suggestions, the buyer can place bids on any product he's interested to buy the if he wins that auctionthe product will be delivered to him after the payment isdone.

3.3 Also the database will be constantly updating on the basis of inputs received from the bidding process, this data will be used for analysis of products via **ML techniques** and multiple provisions can be provided to the users such as recommending correct base price of a product[13-14] , suggesting the max bid of a product, recommending products relevant to users and suggesting them to stop if they're overbidding all these analysis and their outcomes will used to create a better and seamless experience for both sellers and buyers.

4.DISCUSSION

This market system provides visible advantages when compared to the traditional players of reselling goods. It's handy behaviour makes it easy for the users to participate in auctions from anywhere with an internet connection[15]. This market place also provides a secure and efficient platform for reselling goods. Also, the recommendation system creates a very secured environment for selling and buying of goods.

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5.MODULE DIAGRAM

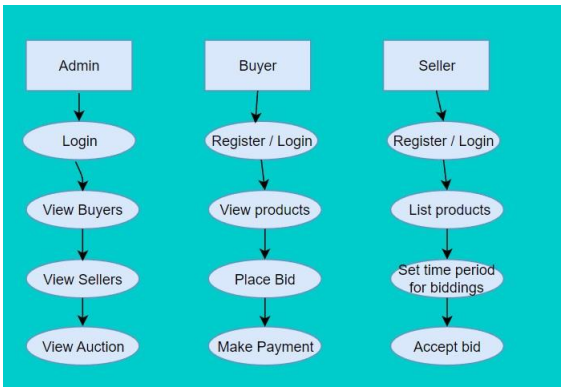

Figure 2. Module Diagram

Figure 2, represents the module diagram which includes three modules – Admin, Buyer , Seller. Admin module will be only accessible to the developers it will have the login for validations, then view buyers which will be useful for the study of the active buyers and help in the analysis purpose too. The next functionality will be view sellers which will provide the same mentioned details but for sellers , and the last will be the view auction by whichbidding process will be controlled. The second module / interface is the buyer module it contains functionality such as view products, place bid and make payments all these are informed above in the system architecture part. The final module is the sellers module which have functionality such as list products, set time period and accept bid and then accept payment all these modules arealso dynamic will be getting updates every now and then to make the system more reliable and effective. Figure 3 shows the landing page for the website that incorporates two options Buyer and Seller. Figure 4 shows the login page with proper validation controls on the passwordfield to ensure security.

6.CONCLUSION

This market system provides an accurate and perfect platform for reselling of goods, which is efficient, reliable and easy to use [8-11]. It offers a visible betterment over the existing players and their methods, which makes this market system more easy to use and easily reachable. This market system can be the bestpossible and achievable approach in the field of reselling and buying.

Figure 3. Landing Page

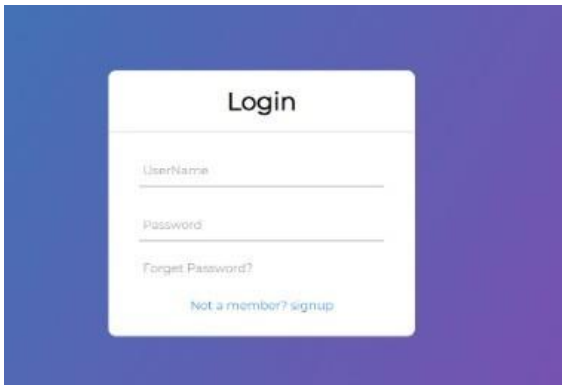

Figure 4. Login Page

7. FUTURE SCOPE

In near future our vision with this project is very bright and big we aim to add a AI auctioneer which will be useful for conducting live auctions and also it will be a great way to create an audience pull for the website. As technology continues to advance and more people gain access to the internet, online market systems are expected to become even more prevalent andsophisticated. Some potential areas of growth and development for online market systems in the futureinclude:

Enhanced personalization: Online market systems are likely to become more tailored to individual customers' preferences and needs, offering personalized product recommendations, pricing, and promotions based on their browsing and purchasing history.

Integration of emerging technologies: Emerging technologies such as virtual reality, augmented reality, and artificial intelligence are likely to be integrated into online market systems, providing customers with more immersive and interactive shopping experiences.

Expansion into new markets: Online market systems have already disrupted traditional retail markets, but they are expected to expand into new areas such ashealthcare, education, and government services.

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"Recent Technological Advancements in Asteroid Mining:

Expanding new frontiers of space."

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Abstract **This research paper explores recent technological advancements in asteroid mining. It discusses improvements in asteroid prospecting through advanced remote sensing technologies and the integration of artificial intelligence. It also examines cutting-edge extraction techniques, including robotic mining and in-situ resource utilization (ISRU) methods. The paper explores refining processes such as electrostatic beneficiation and chemical processes for extracting valuable resources. Transportation advancements, including ion propulsion and asteroid redirect missions, are also analyzed. The study concludes by emphasizing the potential economic, scientific, and environmental benefits of asteroid mining and the need for international collaboration and ethical considerations in this emerging field.**

Keywords: ***Asteroid mining, Asteroid prospecting, Extraction techniques, Remote sensing, Robotic mining, Technological advancements.***

I. INTRODUCTION

Asteroid mining, an evolving field with immense potential, has witnessed significant technological advancements in recent years. These breakthroughs have propelled the industry forward, enabling us to tap into the vast reservoirs of minerals and rare elements found within space. With Earth's resources depleting and the demand for essential materials rising, asteroid mining offers a promising solution for securing a sustainable future.

Asteroids, remnants from the early stages of the solar system, hold valuable metals, minerals, and resources. Technological progress has made asteroid mining increasingly feasible and economically viable.

Advances in spacecraft and robotic systems have played a pivotal role in asteroid mining. Innovative designs equipped with advanced propulsion systems, autonomous navigation, and precise landing capabilities enable us to reach asteroids with unprecedented accuracy and assess their mineral content.

Mining techniques tailored for the space environment have also seen significant development. From traditional excavation methods to novel approaches utilizing melting, vaporization, and chemical reactions, these techniques extract valuable elements from asteroid regolith. Advanced robotics and artificial intelligence ensure precise and efficient execution of mining operations.

Furthermore, in-situ resource utilization (ISRU) has revolutionized asteroid mining by enabling self-sustaining operations. ISRU utilizes on-site resources to generate propellants, life support systems, and construction materials, reducing dependence on Earth for supplies.

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Current missions for asteroid mining consider spacecraft prospection as a first step before the extraction process.

Prospection itself usually falls into three different phases: discovery, remote characterization, local characterization. These last two characterization phases are endeavours are endeavours currently pursued by asteroid mining companies using small spacecraft. However, recent advances in the miniaturization of spacecraft components and mining equipment may allow for a more cost effective and reliable approach to mine NEAs overall.

II.REMOTE SENSING

Remote sensing assumes a pivotal role by offering invaluable insights into the composition, structure, and resource prospects of asteroids positioned millions of kilometers away from Earth.

By harnessing remote sensing techniques, essential data regarding mineral composition, surface characteristics, and potential resources can be obtained, facilitating informed decision-making and resource evaluation.

Various remote sensing techniques, including spectroscopy, thermal imaging, and radar mapping, empower scientists and engineers to collect critical data for evaluating the mineral composition, surface properties, and internal structures of asteroids. This wealth of information enables informed decision-making and resource assessment, thus paving the path towards a sustainable and efficient approach to asteroid mining.

A. Spectrophotometry

Spectrophotometry helps determine the mineral content, elemental composition, and physical properties of asteroids. By studying the unique spectral signatures displayed by different materials, scientists can identify the presence of valuable resources such as metals, minerals, and rare elements.

If the light reflected from an asteroid is measured at many wavelengths and subsequently compared with the colour of sunlight, this can grant valuable information on what material the surface of the asteroid is composed of, which in turn is a strong indication of what the asteroid is generally composed of. The result is compared with reflectance from known types of rocks and minerals. These are the basic principles of spectrophotometry.

The most recent technology is called Charge-Coupled Devices - more known as CCD cameras. These work through simultaneous comparison of the object of interest and several neighbouring field stars as reference in a two-dimensional image. Various filters can be applied for analyzing different spectra of interest.

B. Radiometry

Radiometry helps in determining the temperature, thermal inertia, and surface properties of asteroids. By measuring the radiation emitted by asteroids at different wavelengths, scientists can calculate their thermal characteristics, which provide insights into their internal structure and composition.

If the incident sunlight is known, comparing the emitted IR radiation with amount of sunlight reflected from the surface can give an estimation of the asteroid's albedo. When having determined the brightness, distance and albedo, and estimating the temperature distribution, the size of the asteroid might be computed.

When the Earth is struck by solar radiation, some is reflected and a larger portion is absorbed. The absorbed energy is emitted as long wave radiation which can be measured in the IR spectrum (see fig).

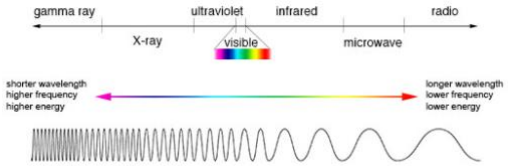

Fig: An image showing the different wavelengths of the electromagnetic spectrum. Radiometry is often measured in the infrared part of the spectrum. Credit: www.cyberphysics.co.uk

In order for this technique to be effective, it is necessary to make certain assumptions about the material composition of the asteroid beforehand. This is because the distribution of heat varies among different types of asteroids. For example, metals conduct heat more efficiently and experience a more uniform increase in temperature.

Hihara et al. (2015) suggest that by utilizing a combination of a thermal-IR imager and a near-IR spectrometer, it becomes feasible to observe and assess the geological characteristics and thermo-physical properties of an asteroid. Furthermore, this approach enables the detection of organic and hydrated materials present on the asteroid.

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C. Thermal dynamics modelling

Thorough analysis of the heat signature emitted by an NEAs in space can provide valuable insights. By employing thermal imaging and measuring specific parameters, it becomes possible to extract significant information from the analysis process.

C.1. Spectral analysis: Thermal models can be developed based on the unique spectral signatures of different minerals. By comparing the thermal emission spectra obtained from thermal imaging with known mineral spectra, the presence of specific metals and minerals can be inferred.

C.2 Thermophysical modelling: Thermophysical models involve studying the thermal behaviour of materials based on their physical properties. By analyzing the heat distribution and thermal conductivity of different materials, it is possible to identify certain metals and minerals based on their distinct thermal characteristics.

C.3. Multi-sensor data fusion: This approach combines thermal data with other sensor data, such as spectroscopic or radar data, to improve the accuracy of mineral identification. By integrating multiple data sources, a more comprehensive and reliable assessment of the composition of asteroid materials can be achieved.

The most significant method for thermal analysing is NEATM. This NEA Thermal Model (NEATM) is based on spherical geometry and can produce the diameter and albedo of practically any atmosphere-less body from thermal-IR data [1]. In this model, a fitting parameter is utilized to consider thermal inertia, spin vector, and surface roughness simultaneously.

In the case of an asteroid with a rough surface, the subsolar temperature exceeds the expected temperature for a smooth surface. This phenomenon is attributed to the "beaming" effect, which involves the intensified re-emission of light from surface elements directly exposed to the Sun.

The utilization of alternative heat sources, such as electromagnetic induction and collisions, has been considered adequate primarily for basic feasibility calculations. Additionally, if a Near-Earth Asteroid (NEA) exhibits indications of heterogeneity, a combination of spectral reflectance data and the Near-Earth Asteroid Thermal Model (NEATM) can be employed to reasonably estimate whether the asteroid's resource richness is limited to its surface or extends to its core.

D. Spectropolarimetry

By definition Spectropolarimetry is a technique used to measure the polarization properties of light at different wavelengths. It involves analyzing the changes in the polarization state of light as it interacts with matter.

It is the most common method for probing objects that exist without atmosphere of their own. In this technique, a polarizing material is employed, which rotates in front of a photometer to measure the amount and direction of polarization. These measurements are influenced by both the mineralogy and texture of the asteroid's surface. For example, metallic surfaces tend to exhibit lower polarization levels.

polarization is measured at different phase angles, which are the angles between Earth, asteroid and Sun. At zero-degree angle, the asteroid is directly opposite the Sun from Earth.

To meet the angle requirement, it becomes essential to conduct observations over an extended period of weeks or months in order to gather sufficient data. By doing so, it becomes possible to create a polarization curve by plotting the amount of polarization against the phase angle. For example, observe fig 2

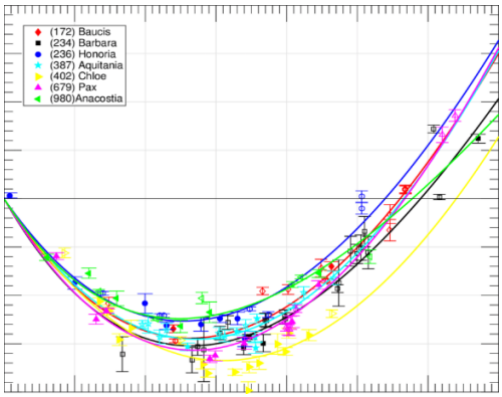

Figure 2: Phase-polarization curves derived for Barbarian asteroids using new polarimetric data presented in this work. The parameters of interest in this curve are: depth of the negative portion, the slope of the positive branch and the phase angle where it changes from positive to negative. These variables correlate strongly with albedos and can be compared to lab measurements to estimate the observed material.

Spectropolarimetry expands upon polarimetry by considering multiple bands of wavelength, allowing for the observation of wavelength-dependent linear polarization in scattered light. The practicality of spectropolarimetric observations is currently under

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evaluation to determine whether its additional information can reveal distinct characteristics that may go unnoticed by other methods.

E. Hyperspectral imaging

The main limitation of multi-spectral sensor systems, as highlighted by Chauhan et al. (2015), is the sampling of a limited spectral range using only a few broad channels. This limitation significantly hampers the accurate identification of mineral species and the quantitative assessment of mineralogical composition.

Hyperspectral imaging is akin to other electromagnetic observations, but it sets itself apart by employing a large number of finely spaced spectral bands. Typically, hundreds of narrow and contiguous spectral bands are utilized, resulting in highly detailed spectral reflectance data across the UV- NIR region.

Therefore, employing hyperspectral imaging enables the extraction of highly accurate information regarding the texture and composition of objects, surpassing the capabilities of the multispectral technique. This method allows for comprehensive analysis and precise characterization of fine details.

For example, here's a Comparison of reflectance spectra between two of the S/A/R/V asteroids.

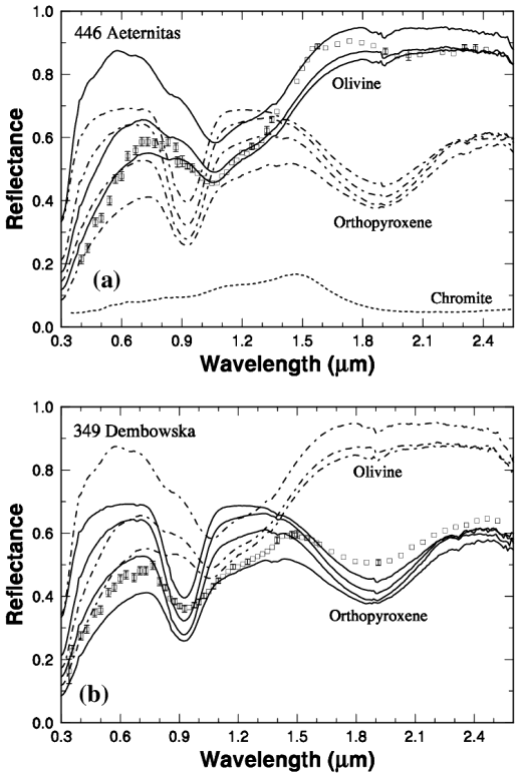

Figure 3: (a)446 Aeternitas, untreated and laserirradiated olivine and orthopyroxene samples (Yamada et al., 1998), and chromite powder (RELAB Database), (b) 349 Dembowska and untreated and laser-irradiated olivine and orthopyroxene samples (Yamada et al., 1998).

If plotted against wavelength, the reflectance values show a spectral reflectance curve. In the figure above we can see certain transition metal ions are displayed as transitions in the NIR region, whereas silicates are displayed in the mid- and thermal-infrared regions of the electromagnetic spectrum.

Conclusively, Hyperspectral imaging acquires data in numerous narrow and closely spaced spectral bands. This results in a highly detailed spectral signature for each pixel in the image, enabling the identification and analysis of specific materials and their properties based on their unique spectral characteristics.

F. LIDAR (Light detection and ranging)

Lidar systems employ high-energy laser beams, typically in the form of short pulses, which are emitted towards the asteroid. The laser pulses interact with the surface, and the reflected light is detected by a sensitive receiver. The precise timing of the emitted and received laser pulses allows for accurate calculation of the distance between the sensor and the asteroid surface.

By scanning the laser pulses over the surface in a controlled manner, Lidar systems generate a point cloud of distance measurements. These

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measurements are then processed to create highly detailed 3D maps of the asteroid's topography and surface features.

Lidar provides several advantages for asteroid mining. Firstly, it offers high-resolution data, allowing for precise mapping and modeling of the asteroid surface. This information is vital for mission planning, landing site selection, and understanding the geological characteristics of the asteroid.

III. METHODOLOGY & APPROACH

Given that the primary objective of asteroid mining is to extract resources, it is crucial to have a well-defined strategy for prospecting, gathering, processing, and delivering commodities. The effectiveness and success of the entire operation hinge on establishing a robust and functional plan for these essential stages.
We propose a possible mission architecture which will be
The mission architecture presented herein seeks to maximize resource extraction while considering the challenges and opportunities presented by asteroid mining.

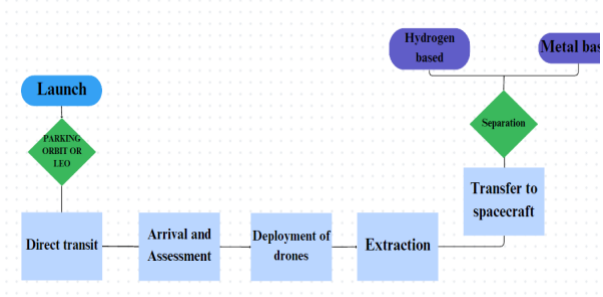

Figure 4: A flowchart illustrating the primary elements and processes involved in a hypothetical asteroid harvesting mission, starting from Earth and concluding with the return journey, while omitting minor steps and specific details.

T1 Launch and Transit Phase:

The spacecraft carrying mining equipment, drones, and processing facilities is launched from Earth.

The spacecraft undergoes a transit phase to reach the target asteroid's orbit.

T2 Arrival and Assessment Phase:

Upon arrival at the asteroid's orbit, the spacecraft enters a stable position relative to the asteroid.

Initial assessments are conducted to gather information about the asteroid's composition, surface features, and potential resource-rich regions.

Remote sensing techniques, such as spectroscopy and imaging, are employed to characterize the asteroid's mineral composition and identify valuable resources.

T3 Deployment of Drones:

Multiple drones equipped with sampling and mining capabilities are deployed from the spacecraft.

These drones autonomously navigate the asteroid's surface, collecting samples and performing mineralogical analysis.

Advanced imaging and spectroscopic sensors on the drones aid in identifying regions with higher concentrations of valuable resources.

T4 Resource Extraction and Collection:

The drones employ various mining techniques, such as drilling, excavation, or blasting, to extract resources from the identified areas. Extracted materials, including ores, regolith, or water ice, are collected and stored within containers carried by the drones.

T5 Transfer to Spacecraft:

Once the drones have collected a sufficient amount of resources, they return to the spacecraft.

The collected load from each drone is transferred and securely stored within designated compartments on the spacecraft.

T6 Separation of Extracted Materials:

Once the drones have collected the resources from the asteroid's surface, a crucial step in the mission architecture involves the separation of the extracted materials. This process focuses on dividing the resources into two primary categories: hydrogen-based materials and metal-based materials.

T6.1 Hydrogen-based materials:

The collected resources that contain hydrogen, such as water ice or hydrated minerals, are targeted for extraction of hydrogen as a fuel source.

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Specialized processing techniques, such as electrolysis, may be employed to separate hydrogen from other compounds and capture it for fuel generation purposes.

The extracted hydrogen is stored and utilized for various applications, including rocket propellant, energy generation through fuel cells, or as a component in in-space manufacturing processes

T6.2 Metal-Based Materials:

The remaining collected resources, which predominantly consist of metal-rich ores or regolith, undergo a separate processing path for metal extraction and refinement.

Techniques such as smelting or chemical processes are employed to extract valuable metals from the ore or regolith.

These extracted metals can be utilized for various purposes, including construction of space structures, manufacturing of components, or trade and commercial use.

T7 Processing and Refining:

The spacecraft houses onboard processing facilities that refine and process the collected resources.

Various techniques, such as smelting, electrolysis, or chemical processes, are employed to extract and purify valuable elements or compounds.

T8 Storage and Payload Preparation:

Processed resources are carefully stored within the spacecraft, ready for future utilization or potential transport back to Earth or other destinations.

The spacecraft is designed to handle and accommodate different types of resources efficiently.

T9 Return or Utilization:

Depending on the mission objectives, the spacecraft may return to Earth with the extracted resources for further analysis or commercial use.

Alternatively, the resources may be utilized in space for in-situ manufacturing, refueling, or supporting future space missions.

T10 Mission Conclusion and Analysis:

Once the extraction and processing operations are completed, a comprehensive analysis of the mission's success, resource yield, and lessons learned is conducted.

The findings help in refining future asteroid mining missions and improving techniques for resource extraction and utilization.

IV. ECONOMIC FEASIBLITY

The economic viability of planetary mining is a complex and evolving issue that involves a variety of factors and perspectives. While the idea of extracting valuable material from giant planets has great potential, several key factors need to be examined to determine its economic feasibility.

Resource Value and Demand: The economic feasibility of asteroid mining heavily relies on the value and demand for the extracted resources. Valuable resources such as rare metals, precious metals, and water (in the form of hydrogen and oxygen) can have substantial market value and drive the profitability of mining operations. The assessment of market demand, price stability, and potential customers for these resources is crucial in determining the economic prospects of asteroid mining.

Extraction Costs: The cost of extracting resources from asteroids is a major factor in assessing economic feasibility. It involves various expenses, including mission planning, spacecraft development and launch, robotic mining operations, processing facilities, and return transportation of extracted resources. These costs encompass a range of technical, logistical, and operational challenges that must be carefully evaluated to ensure that the extraction costs can be justified by the potential revenue generated from the resources.

Technological Advancements: The economic feasibility of asteroid mining is influenced by advancements in mining technologies and techniques. The development of efficient and cost-effective mining systems, robotic automation, resource extraction methods, and in-space processing capabilities can significantly impact the overall economics of the project. Technological innovations and improvements can lead to reduced extraction costs, increased resource recovery rates, and enhanced operational efficiency, making asteroid mining more economically viable.

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In April 24, 2012, the Keck Institute for Space Studies (KISS) conducted a feasibility study on an asteroid capture-and-return mission, as documented by David in their publication. The study primarily emphasized the technological aspects and logistical considerations involved in moving a Near-Earth Asteroid (NEA) weighing approximately 500 tons and measuring 7 meters in diameter. The objective was to place the NEA into lunar orbit by the year 2025. By positioning the asteroid in lunar orbit, it would serve as a strategic location for conducting further analysis, experiments, and research. This endeavour aimed to enhance our understanding and knowledge of asteroid-related matters, contributing to advancements in the field.

Some of the most accessible asteroids for exploitation and their properties are presented in a tabular form below:

Asteroid	Type	Value	Est. profit	dv (km/s)	Resources
Ryugu	Cg	86.4 Billion	30.08 billion	4.663	nickel,iron,cobalt,hydrogen,nitro
1989 ML	X	13.94 billion	4.38 billion	4.889	nickel,iron,cobalt
Nereus	Xe	4.71 billion	1.39 billion	4.987	nickel,iron,cobalt
Bennu	B	669.6 million	185 million	5.097	iron,hydrogen,ammonia,nitrogen
Didymos	Xk	62.5 billion	16.4 billion	5.162	nickel,iron,cobalt
2011 UW158	Xc	6.69 billion	1.74 billion	5.189	platinum, nickel ,iron, cobalt
Anteros	L	5.57 trillion	1.25 trillion	5.44	magnesium, aluminum, iron

Table: This brief table explores the estimated profit associated with these accessible asteroids, considering the rich abundance of resources they contain and the growing demand for such materials in various industries.

V. RESULTS:

Efficient Resource Prospecting:

The deployment of multiple drones in the mission architecture enables efficient resource prospecting on the asteroid's surface. These drones autonomously navigate and collect samples from identified regions of interest, maximizing the chances of extracting valuable resources while minimizing resource wastage.

Targeted Resource Extraction:

By focusing on specific areas of interest, the mission architecture ensures a targeted approach to resource extraction. The deployed drones gather samples from the identified regions, increasing the likelihood of acquiring valuable resources and optimizing the overall extraction process.

Versatile Resource Utilization:

One of the key advantages of the mission architecture is its ability to separate the extracted materials into hydrogen-based and metal-based categories. This separation enables the efficient utilization of resources for different purposes. The hydrogen-based materials are processed to extract hydrogen, which can be used as a fuel source for various applications. The metal-based materials undergo refining processes to extract valuable metals for construction, manufacturing, or trade purposes.

In-Space Processing and Refining:

The spacecraft in the architecture is equipped with onboard processing and refining facilities. This capability allows for the in-space processing of the collected resources, eliminating the need to transport raw materials back to Earth for processing. In-space processing reduces costs, conserves resources, and enhances the overall efficiency of the mission.

Fuel Generation:

The extraction of hydrogen from the hydrogen-based materials offers significant advantages in terms of fuel generation. The extracted hydrogen can be utilized as a clean and efficient fuel source for rocket propulsion, energy generation in fuel cells, and supporting in-space operations. This fuel generation capability enhances the mission's sustainability and self-sufficiency.

Metal Extraction and Use: The mission plan focuses on extracting and exploiting precious metals from the collection. Metallurgical materials treated by a finishing process eliminate the desired metallurgy. This metal can be used for construction, building materials, or even traded for valuables. The infrastructure emphasizes the importance of metal extraction to support aerospace infrastructure development and employment opportunities.

Sustainability and independence: Mission construction that leverages in-house resources encourages sustainable development and reduces reliance on limited Earth resources for future space exploration and colonization The ability to extract material from asteroids in and out contribute to the long-term sustainability of space missions and enhance the chances of establishing sustainable space colonies.

VI. DISCUSSION

Mission feasibility and operational efficiency: The above-mentioned mission plan demonstrates a viable and well-organized approach to mining asteroids. By employing less manned aircraft once the spacecraft has reached planetary orbit, the mission improves efficiency and enhances extractable material Extractive collection at systematically and inserted into the spacecraft

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ensures a systematic and coordinated recovery operation.

Separation and Treatment: The step-in mission planning involving the separation of separated materials, especially for hydrogen-based and metal-based materials, is an integral part of the mining process. The hydrogen extracted from the asteroid can be used as a fuel, while the metal is useful in a variety of industrial applications. Proper separation and subsequent handling of these materials is essential to maximize economic returns.

Technological Advances and Challenges: The dialogue recognizes the importance of advanced technologies in planetary mining. Successful execution of the mission program depends on state-of-the-art unmanned aerial vehicles capable of efficiently transferring cargo from the surface of the planet to the spacecraft and using No. Meeting challenges Continued research and innovation in these areas is critical to increase the efficiency and effectiveness of planetary mining.

Economic Feasibility and Resource Capacity: The mission architecture holds significant economic potential for targeting asteroids rich in valuable resources. Using remote sensing techniques such as spectropolarimetry and hyperspectral imaging, the mission aims to identify asteroids with high mineral and metal content, maximizing the potential for profitable resource extraction Successful execution of the mission has the potential to provide substantial economic returns through recovery and utilization of these valuable resources.

Environmental Considerations: The discussion emphasizes the importance of environmental considerations in asteroid mining. While mission architecture focuses on efficient resource disposal, it is equally important to minimize potential environmental impacts. Efforts to ensure sustainable mining practices, including space waste reduction and pollution prevention, are essential to terrestrial planetary mining efforts have achieved long-term operation and sustainability to strike a balance between extraction and environmental protection.

VII.CONCLUSION

In conclusion, the field of planetary mining holds great promise for the exploration and exploitation of space resources. The mission plan presented in this paper provides a comprehensive and efficient framework for extracting valuable resources from asteroids. Utilizing advanced technologies such as remote sensing, spectropolarimetry, hyperspectral imaging, and drones, the architecture increases the potential for accurate results while solving key challenges in the field the

The findings of this study illustrate the economic benefits of planetary mining, with hypothesized benefits from the identification and evaluation of accessible planets These celestial bodies contain precious metals, earth elements of their own making and, abundant storage of water, and other valuables resources. The findings of this study illustrate the economic benefits of planetary mining, with projected benefits from the discovery and measurement of accessible planets These celestial bodies contain precious metals, rare earth elements and other valuable resources that are in high demand across various industries. The anticipated profitability of extracting and utilizing these resources underscores the significant economic opportunities that asteroid mining offers

Moreover, the mission architecture underscores the importance of technological advancements and innovation. Continuous research and development efforts are essential for overcoming the unique challenges associated with mining in space, including asteroid characterization, robotic extraction, and in-space processing. Collaborative endeavours among space agencies, private companies, and research institutions are instrumental in driving the progress of technologies that will enable efficient and sustainable asteroid mining operations.

Environmental considerations play a crucial role in shaping the future of asteroid mining. Embracing sustainable practices, responsible resource utilization, and effective mitigation of potential environmental impacts are paramount. Striking a balance between resource extraction and the preservation of celestial bodies and space ecosystems is vital to ensure the long-term viability and ethical conduct of asteroid mining endeavours.

Additionally, the successful implementation of the presented mission architecture hinges on the establishment of a supportive legal and regulatory framework. International collaboration and coordination are imperative for defining clear property rights, mining rights, and resource ownership guidelines. Such frameworks will provide stability, foster investment, and facilitate international cooperation in the exploration and exploitation of space resources.

In summary, the mission architecture outlined in this paper offers a comprehensive and practical roadmap for asteroid mining. It highlights the economic potential, technological advancements, and environmental considerations associated with this

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emerging field. By venturing into asteroid mining, humanity can unlock new frontiers of resource availability, drive technological innovation, and shape the future of space exploration and utilization. Collaboration, research, and responsible practices will be paramount as we embark on this exciting journey, tapping into the vast resources hidden within our celestial neighbours and paving the way for a prosperous and sustainable future in space.

However, numerous unresolved challenges remain in the field of asteroid mining. One such challenge pertains to the absence of standardized and universally accepted space laws. Varying national approaches towards space travel and commercialization create potential discrepancies and may give rise to future conflicts in outer space, which could have significant implications for Earth and its nations.

Additionally, while financial feasibility reports indicate the profitability of asteroid mining, some uncertainties persist. Much of the available information is speculative, and unknown variables could introduce critical errors into mining operations. Therefore, careful consideration and further research are necessary to mitigate risks and address the unknown factors associated with asteroid mining.

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Study of LoRaWAN for EV Standardization Techniques in India

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Abstract— **As vehicles are evolving from basic transport medium to luxurious way of roaming and making life effortless, there is a need for standardization. This should not only include constructional and power consumption standards as already defined but also functional standards. LoRaWAN can be powerful IoT amongst all to be transceiver of huge information. Which can be used for EV standardization and hence for development. In this paper study of Standardization and techniques to improve them is the aim and standardization aspects are focused on. While compared with Wifi, BT, and the fastest LTE, LoRaWAN has some unique pros to perform a vital role in the process such as 80% more working range, power requirement, and hence cost-effectiveness. In this paper, the objective is to put up the study of the LoRaWAN technique to use for the standardization of EVs in India and how it can also be improvised with the use of LoRaWAN. Also, the model study and test cases are proposed. For the model actual CV car data and EV, model data is used from project work including CAN, LIN, and IoT data transfer medium. Communication between vehicle to grid, Vehicle to the user, and Vehicle to charging station are strained.**

Keywords— ***LoRa, LoRaWAN, LTE, Cloud, IoT, transceiver***

I. INTRODUCTION

The adoption of advanced electronics in automobiles prompts safety factors for electric as well as combustion vehicles. These electronics and intelligent systems can improve not only vehicle safety but the overall safety of transport systems on road. Now Electric vehicles are going popular because of enhancing efficiency, comfort functions, reduction in direct carbon emissions. Electric Vehicles come with variants having wired or wireless charging, supercapacitor, flywheel, hybrid energy container, front /rear driver assist, and cross-traffic alert combinations. Though Combustion vehicles in India have several regulations for design, manufacturing, and functionalities, Electric Vehicles still need to have a set of regulations adding to existing ones to improve safety parameters, improve linear manufacturing, and availability to the base user of basic troubleshooting which is the first question comes to end-user. It is also affected by varying driving styles and the charging habits of users. So to implement such functions and systems with the versatility of giving grid management, standardization model, and troubleshooting, a combination of electronics with high communication capability. This system should have communication management between Vehicle to Vehicle, Vehicle to Grid, Vehicle to User, or Vehicle to various devices, for that, we use the term V2X. To achieve this there is a need for a controlling server that will be monitoring data transfer and what type of data should transfer to which platform. This server ultimately develops the EV web platform. The data sets on this will be helpful to develop features. Energy handling will be smooth because of Vehicle grid communication for exchanging data on energy requirements and the nearest available source. This will assure driver or user comfort driving without worrying about power availability as this system also will provide information about the status of the vehicle if it is safe and ready to drive or not. However, it will toss the capability to support multiple automobile services further.

The potential of this LoRaWAN service can be described in multiple areas such as; the management of the shot he rests path among needy vehicles and charging stations, optimizing those stations to serve high quality services. It can help to find geographic points with real-time time information on availability. Considering business services, pricing information statistics could help to understand usual peak crowd hours and customers can get benefits of visiting nonpeak timings. Above all the concept of data for standardization may have to face data privacy issues till it is developed into a data sorting system that takes care of data security. As every bit of data cannot be shared with all the devices in communication and sources may object to the sharing of data; it is a must to sort and make flannel groups on gateways.

II. LITURATURE REVIEW

The Indian Government, India has the ministry of Surface Transport (MOST)and it brought up Automotive Industry Standards Committee which is responsible for standards prepared for Electric vehicles that are further approved by ARAI. This standard includes requirements of Electric Vehicles' functional safety, powertrain construction, Electrical energy consumption measurement in Wh/Km for various categories, method to measure working ranges, motor speed function and power at full load, maximum 30 min electric drive power and rules for CMV (Central Motor Vehicles Rules). For this work by MOST, assistance has been taken by UNECE (United Nations Economic Commission for Europe). Most of the regulations and standardizations are based on European standards in India. In this paper, functional safety is focused on, and AIS 038 is referred to. In AIS 38, tests for protection against electric shocks, protection against direct contact, service disconnect, markings to identify and follow precautions while working, protection against indirect contact, and protection against excessive current, gas accumulation, washing, and flood conditions. The idea for the research is with all these regulations studies of cloud data to improve safety requirements of vehicles based on actual incidents and reasons behind it. In 2018 and around Car sale become high and vision of front electric

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plants will be covered by 85% industries and market till 2030 as by 2020 overall growth rate increased rate of 28.12% [1]. Electric Vehicles Market and development scenario in India : First electric vehicle Reva Mahindra launched in 2001 with basic features had a sale of minimal sales unit introduced, then the Toyota hybrid was launched in 2010, and in 2013 it was the Camry Hybrid. [2].

TABLE I. AIS STANDARDS AND SIGNIFICANCE

Standards	Sub-System/Function
AIS-038 (Rev-1) 2015	Electric Power Train Vehicles-Construction and Functional Safety Requirements
AIS-039 (Rec-1) 2015	Electric Power Train Vehicles–Measurement of Electrical Energy Consumption
AIS-040 (Rev-1) 2015	Electric Power Train Vehicles - Method of Measuring the Range
AIS-041 (Rev-1) 2015	Electric Power Train Vehicles Measurement of Net Power and The Maximum 30 Minute Power
AIS-049 (Rev-1) 2016; Ref: IS 11852	Electric Power Train Vehicles - CMVR Type Approval for Electric Power Train Vehicles (Revision 1)
AIS-102 (Part 1) 2009: Amendment No.216 May 2014	CMVR Type Approval for Hybrid Electric Vehicles
AIS-102 (Part 2)	CMVR Type Approval for Hybrid Electric Vehicles of M and N category with GVW>3500 Kg
AIS 123	CMVR Type approval of Electric Propulsion Kit Intended for Conversion of vehicles for pure Electric Operation
AIS-137 (Part5)	Test Method, Testing Equipment, and related. Procedures for Electric Drive Trains intended for the Propulsion of Motor Vehicles of Categories L, M, and N with regards to the Measurement of Net Power of Electric Drive Trains
AIS-138 (Part 1)	Electric Vehicle Conductive AC Charging System
AIS -138 (Part 2)	Electric Vehicle Conductive DC Charging System

Electric transport was newly implemented by the Bangalore Municipal Transport Corporation in a heavily trafficked city sector. A poll was carried out in the town of Ludhiana, and the results showed that 36 percent of people who now possess cars or two-wheel drives are considering making the transition to electric vehicles [4]. The government of the Telangana District is also working to encourage the usage of electric vehicles (EVs), and it recently made the announcement that owners of EVs will not be required to pay any road fees. In 2018, the Telangana State Electricity Regulatory Commission (TSERC) decided to implement a levy of INR 6 on the charging of electric vehicles. In addition, TSERC decreased the price of the entire regional service down to INR 6.04 per kWh [2]. A partnership agreement has been reached between the Hyderabad municipal railway line and Power Grid Corporation of India Ltd. in order to install electric vehicle charging stations at municipal stations. The Hyderabad railway line will be the first railway line in the country to have electric vehicle charging stations that will be controlled and operated by an electric grid. Additionally, the government of Hyderabad is considering switching to diesel-powered automobiles instead of electric cars. The government of New Delhi successfully applied for and was granted permission in 2021 to install 131 public charging stations throughout the city [7]. The government of Delhi released a policy framework in November 2018 with the intention of converting twenty-five percent of their automobiles into electric vehicles by offering a variety of payments and establishing a tolling infrastructure for both residential and non-residential buildings. This programme aims to strengthen the 3-kilometer charging station by offering a 100% subsidy (up to INR 30,000), tax rebates, parking cost reimbursements, and EV bEVs2023 registration price discounts [10]. In addition, a private business known as Magenta Power is aiming to establish electric vehicle charging infrastructure along the Mumbai-Pune route [6]. The most important difficulty that needs to be overcome right now is catching up with all of the regulations and the environment in India in order to not only satisfy the demand of the existing standards but also produce better and safer electric vehicles that are suitable for use in Indian settings. In order to even attempt it, there are a few obstacles that Electric Vehicles in India need to concentrate on in order to think about successfully running on the market. Those barriers are:

- After market servicing; when the vehicle gets an into a technical problem
- Higher capital costs due to expensive system and spares
- Despite the growing range in the market for cars with a wide range of electric vehicles, the choice to buy an electric car is limited. Surveys are showing that less awareness of information related to Government schemes provision, and monitory advantages are affecting on direct sale and market of Electric Vehicle adoption on home level.
- The materials used for EVs batteries include lithium, nickel, phosphate and manganese, graphite, and cobalt, which are rare earthy materials. Lithium-ion batteries alone consume 5 million tons / year of nickel, which could lead to 10-20 times more use of lithium and cobalt in the future. [9].
- Battery life, as EVs batteries designed for long life, wear out over time. Currently, most manufacturers offer an eight-year / 100,000-mile warranty for their batteries. [9].
- Driving ranges with full capacity
- Charging time and knowledge of source availability
- Environmental impact and Safety requirements
- Government policies and infrastructural requirements

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- All the above-studied barriers for Electric Vehicles in India can be partially solved by a system of communication between vehicles to various devices and coordination for power source, safety, and services availability knowledge. The vehicle to Grid concept is already in discussion and supported by many industries and government bodies but not for standardization. For a vehicle to multiple device system, higher speed of vehicles, the density of vehicles on road, infrastructural development play an important role. Data transfer and receive have those parameters effect. Real-time data handover and sorting speed should be higher than the vehicle level. So that, when the ammo is sorted according to incidents observed. For that incidents background like the time, geographical place, environmental conditions, in an infrastructural situation will bunt of data stored, considered and a solution in form of the standard can be developed.

III. RESEARCH ANALYSIS

For establishing a system of Vehicle to Grid, Vehicle to User, Vehicle to the Main server through Cloud, a communication model is developed on an experiment base within a 30Km area range. This work is done using Motec hardware and software due to the high capability of data logging and analysis. C185 with T2 function, GSM modem for RS232 communication to PC used as hardware with basic sensors setup including Current, Voltage, Battery, Steering angle, wheel speed, GPS, temperature, diagnostics error, CAN errors, G-forces.

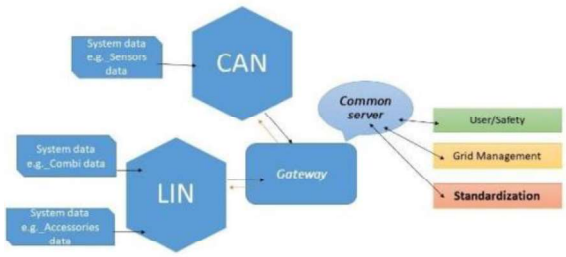

Fig 1. *System overlook*

Channels added are assigned according to the filter over signals from sensors connected to the system. CAN have voltage, temperature, GPS data, wheel speed data transfer assignment, and LIN has steering angle, current, and G-forces on it. It can be selected according to data priority. CAN has 1Mbps capability while LIN has 19200 Bps speed capability. Though LoRaWAN is flexible to increase and decrease data speed as per frequency and environment, it is focused to collect data and observe it from the perspective of real-time transport study in standardization improvement.

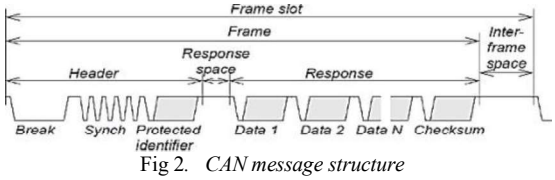

Fig 2. *CAN message structure*

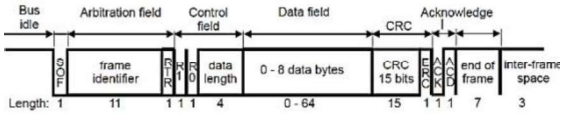

Fig 3. *LIN message structure*

In LIN data multicast transmission. transmitted data frames simultaneously received by an arbitrary number of nodes which has defined IDs. This structure has network commands for sleep mode (ID = 0x3C, length 8), active mode (ID = 0x3C, length 8), and wake up pulse (log.0 pulse of 250 µs - 5 ms (detected from 150 µs)). In CAN IDE bit is dominant in a standard frame, contains bus idle, SOF (Start of Frame), arbitration field (with RTR), data field, control field, CRC, acknowledge and end of the frame. A standard frame with the same first 11 bits of identifier has higher priority.

In V2X with LoRaWAN, real-time data is shared through different levels of data transmission such as Sensors to Gateway through CAN and LIN. From Gateway to the server, and then the server to interface devices, that the user, to grid management, to service centres. There is a challenge to be tackled to control parameters to be shared with these points because of possible data privacy concerns by the manufacturing brand. Also, it comes with time latency, data security, and criticality of data concerns which are possible to solve by sorting data channels according to need and application. OBU-on board unit in V2X with LoRaWAN can provide a reliable architecture of communication to address those obstacles. Board-carrying vehicles collect the required data through the integrated vehicle sensors and transfer the data to the OBU processing unit. Refined also makes the data packets more accurate. Vehicle infrastructure receives this predefined data from the communication system. Further Receiver takes triggers and warns, and suggests driver or user act on that. Moving on the road and sending the data is challenging due to the necessity of a high-speed network affecting a density of vehicles and data monitoring system capability. Constantly data monitoring system will sort accident incidents and background environments to provide solutions to accident avoidance.

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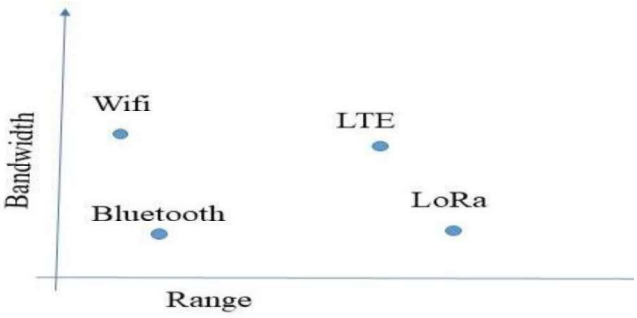

Fig 4. comparison of communication mediums

The establishment of V2X requires the prioritization of reliable architecture with minimum filters to sensor values. In this study, we calibrated sensors to standard vehicle ranges.

And start log trigger is KL15. In this particular test, false value is generated in system which further acted to the get vehicle into safe mode. But beyond that, this data set is logged into the server on real-time base. with heavy rain conditions with 50% visibility. The steering wheel showed up with a false value which is 3276 deg. Which acted upon a vehicle with instant speed reduction and current supply. The main idea is, functional tests are done in every manufacturing plant also tests with error reproduction are done in development stages. Existing standards are followed such as functional and safety standards, most of the time when it does not comply either terminology changed or the way of representation changed. It takes to underestimate the standards, which are referred from European standards, let us consider the below situation, Weather has 25^0 Celsius where actual road conditions are unmatched. This study

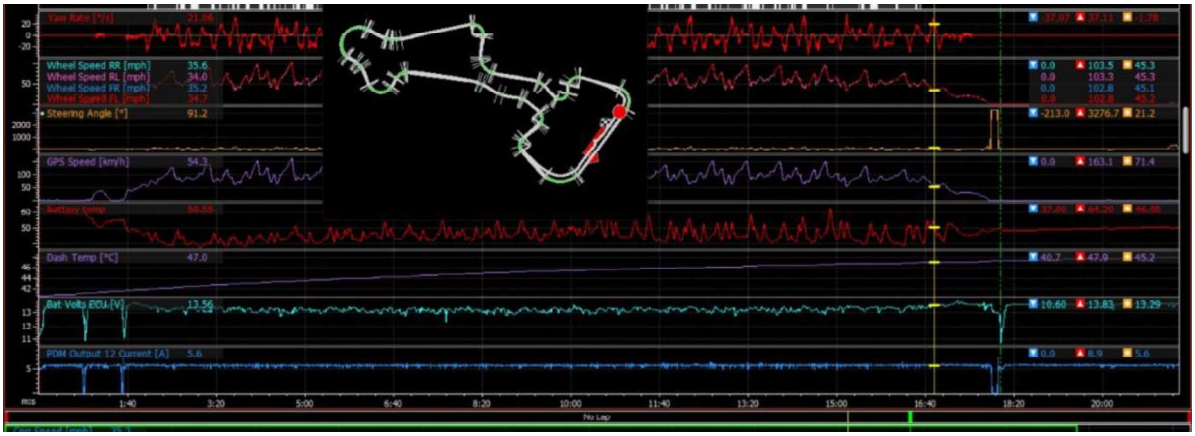

Fig 5. *Incident of steering failure (A)*

It monitors data sets, and the data studied which is logged and transferred to the server. Case study: Input parameters for the system are sensor data including all-wheel speeds, dash temperature, battery temperature, steering angle, LV battery

attempts to put the idea of using data from actual EVs on road to implement restrictions on design and functional parameters which compromise over safety. voltage, Power distribution, GPS speed, yaw rate. We can code the autosave function every x seconds. Our study is 120 sec time duration.

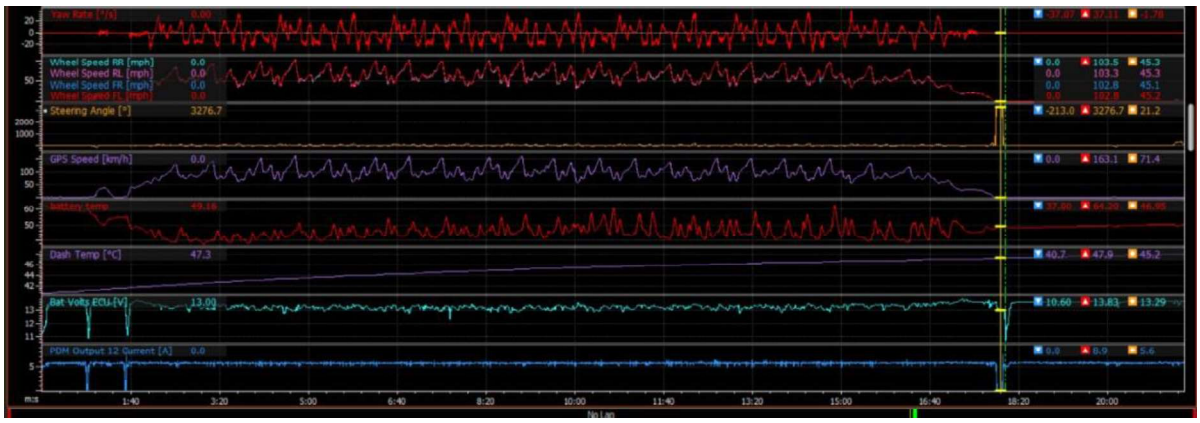

Fig 6. *Incident of steering failure (B)*

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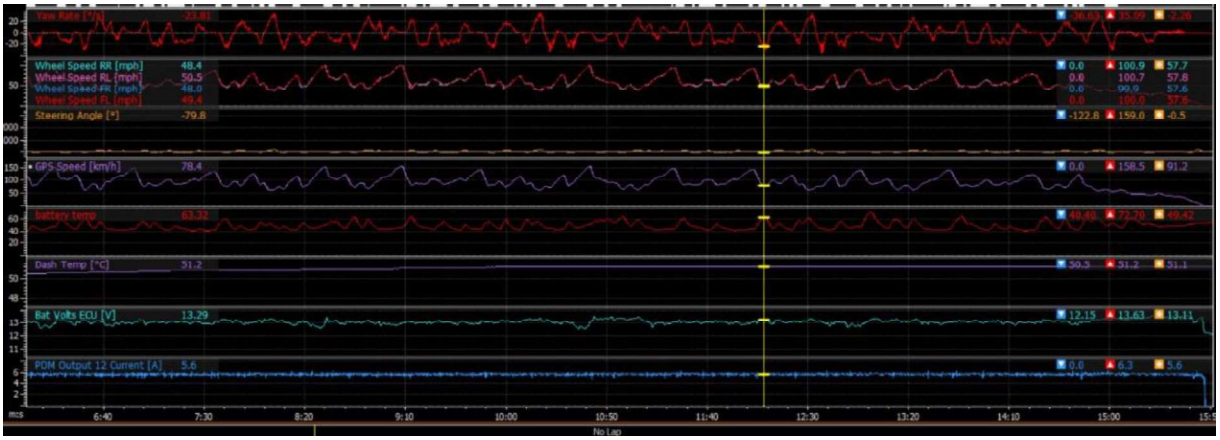

Fig 7. *Incident of High temperature*

And start log trigger is KL15. In this particular test, false value is generated in system which further acted to the get vehicle into safe mode. But beyond that, this data set is logged into the server on real-time base. Let us consider the below situation, Weather has 25^0 Celsius with heavy rain conditions with 50% visibility. The steering wheel showed up with a false value which is 3276 deg. Which acted upon a vehicle with instant speed reduction and current supply. The main idea is, functional tests are done in every manufacturing plant also tests with error reproduction are done in development stages. Existing standards are followed such as functional and safety standards, most of the time when it does not complies either terminology changed or the way of representation changed. It takes to underestimate the standards, which are referred from European standards, where actual road conditions are unmatched. This study attempts to put the idea of using data from actual EVs on road to implement restrictions on design and functional parameters which compromise over safety.

TABLE II. AVAILABLE DATA TRANSMISSION SYSTEM COMPARISON

Parameters	Wi-Fi	LR-PAN	Bluetooth	Lora
Frequency Band	5-60GHz	868/915MHz,2.4GHz	2.4GHz	868/900MHz
Data rate	1-6.75Gb/s	40-250Kb/s	1-24Mb/s	0.3-50Kb/s
Transmission range	20-100m	10-20m	8-10m	Less than 30Km
Energy Consumption	High	Low	Medium	Very Low

In Case two is observed increase in I battery temperature is higher by a system which is logged after giving this information by the sensor. So further it will be stored with other parameters such as usual outside temperature, GPS coordinates for location, timing of the incidents, and how many cars has this issue with the same standard configuration. When it is happening with multiple cases cooling standards need to be improved. In both cases, it seems very normal for the single vehicle but when collective data will be studied a group of information pallets will be generated by the system and very effective outcomes are expected.

IV. CONCLUSION

TABLE III. SYSTEMS COMBINED TO ACHIEVE LORAWAN

Parameters	Lora	LTE
Modulation	CSS(Chirp Spread Spectrum)	FDMA(Frequency Division Multiple Access)
Data Rate	50 Kbps	10Mbps
Link Budget	154Dbm	130Dbm
Power required	very low	moderate
Advantages	Long-range	long Range
Disadvantage	data limit depends on brand specs	data limit depends on brand specs

To achieve an effective V2X system for various purposes such as Grid management, Improvise standardization in the initial stages of EVs in India, troubleshooting, user management, Vehicle architecture should have embedded circuitry in Body Electronics and Smart user interface. This is possible to incorporate LoRa and LTE together to increase the range of data transceiving. It is found that multiple issues can be detected in the early stage of damage if there is data available. This data can be sorted and limited to respective requirements like grid management, Improvisation of standards implemented in India but tested for European markets, Troubleshooting purposes, and user interface. For example, it will be very convenient for users to have information about that steering have a fault , or the nearest battery charging source, its availability, and how much time it will take to reach there. Data security and copyright protection is the main challenge to implement this concept in Indian markets. As there are numerous startups and well-known brands are putting their knowledge and efforts to occupy the market with their development; parallel many

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incidents are happening with EVs in India concern to safety. Extensive research has been done on the suitability of various wireless technology for mid-range and long-distance wireless long-distance networks such as long-distance communication (LoRa), ZigBee, BLE, and WIFI [7] On the other hand, researchers have embraced it. wireless technology such as Third Generation Partnership Project (3GPP) LTE and new 5G radio.This study tried to understand and develop a lab car communication system for data transceiving and understand standards from a safety perspective and India oriented.

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A REVIEW PAPER ON THE USE OF ARTIFICIAL INTELLIGENT TOOLS IN THE PREDICTION OF STRUCTURAL RESPONSE

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Abstract: Artificial intelligence is a machine/software intelligence as opposed to intelligence shown by animals. AI when used makes a wide term, of which Artificial Neural Network is a sub-part. ANN even though not a new concept but its popularity in the structural engineering field is quite new. Its application in predicting the seismic response of masonry-infilled RCC frames, predicting the structural response of multi-storied reinforced concrete buildings for ground acceleration, predicting the shear strength of Fibre Reinforced Mortar strengthened masonry are recent examples of it. The aim and scope of this project is to identify the use of ANN in predicting structural behaviour. If ANN is better understood, it can be more efficiently used in the construction field. This study is carried out based on a literature review. The objective of this study is to aid in minimizing or probably avoiding prolonged laboratory or field tests to determine design parameters.

1. Introduction

Artificial intelligence (AI) is a branch of computer science related to developing software/machines which are efficient in carrying out tasks that often require human intelligence. AI is popularising as an efficient alternative approach to traditional techniques. Parting to traditional methods, AI offers a more efficient way to deal with issues associated with unpredictability and is an effective help to solve such complex problems.

AI-based answers are proving a better alternative to knowing engineering design parameters when testing is not possible, thus ensuing in significant savings of efforts and testing time spent in experiments. AI also has the potential of reducing error rates, decision-making faster, and increase computational efficiency.

Civil engineering is filled with problems that derive solutions through traditional computational techniques. However, these problems can usually be solved by an expert having the right training. Artificial intelligence (AI) has targeted this kind of difficulty by capturing the essence of human cognition at the highest level. To solve engineering problems that derivesolutions using conventional methods, AI (a computational method) is an attempt to replicate human cognition capabilities through symbol manipulation and symbolically structured knowledge bases.

In the field related to structural engineering, numerous problems are influenced by

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uncertainties, e.g., those related to construction management, condition monitoring, design, analysis decision making, etc. Such problems need mathematics, physics, and mechanics calculations to be solved, and their solution to an extent depends on the practitioner's experience. It can further be said that computers are still to be fully utilized for many tasks. This is due to the need for problems that tend to be unique, logical reasoning, feasibility constraints, and the need to use prior experiences in the analysis and design process.

However, AI techniques can be efficiently used to better these efforts and can also be considered to validate laboratory or field test results.

2. Literature Review

Title - Prediction of the Seismic Response of Multi-Storey Multi-Bay Masonry Infilled Frames Using Artificial Neural Networks and a Bilinear Approximation

Author - Tanja Kalman Sipos and Kristina Strukar

Developed a neural networking process tool for predicting the seismic response of masonry-infilled RCC frames so that they can check the reliability of neural networks. The database of experimental tests conducted on one-story one-bay masonry infilled RCC frames were collected, and from that database neural networks were designed. From the obtained results it was found that these networks were acceptable for predicting inter-story drift ratios and base shear. The obtained result for one-story one-bay masonry infilled RCC frames was then extended to multi-bay infilled frames by evaluating the applicability of the expression to multi-bay frames of different and same lengths. For the multi-bay frame, it was concluded that the proposed equation showed sufficient acceptability with only 4.5% means relative error.

Title - Prediction of structural response based on ground acceleration usingartificial neural network

Author - Reni Suryanita, Harnedi Maizir, Hendra Jingga

Used Artificial Neural Network (ANN) to predict the structural response of multi-storied reinforced concrete buildings when facing ground acceleration. Modal response spectrum analysis was performed to simulate ground acceleration so as to produce structural response data for further use in ANN.6345 data sets were used to train the ANN. The trained ANN was found to be capable of predicting structural responses based on ground acceleration at a (96%) rate of prediction and the calculated Mean-Squared Errors (MSE) were as low as 1.2×10^{-4}.

Title - An Artificial Neural Networks model for the prediction of the compressive strength of FRP-confined concrete circular columns

Author - Alessio Cascardi, Francesco Micelli, Maria Antonietta Aiello

Presented an ANN analytical model to predict the strength of FRP confined concrete. The proposed model was for circular columns for which an extensive experimental database was used to propose the variables of the proposed equations. A parametric analysis was performed in order to verify if the mathematical formula is coherent with the FRP-confined concrete compressive behaviour described in experimental tests, the proposed model did show to be consistent with the mechanical trends that were observed in the laboratory tests. And the proposed model shows satisfying statistical evidence of the predictive performance.

Title - Analytical model based on artificial neural network for masonry shear walls strengthened with FRM systems

Author - A. Cascardi, F. Micelli, and M. A. Aiello

Proposed an analytical model based on ANN to predict the shear strength of Fibre Reinforced Mortar strengthened masonry. Using an input database of laboratory results for masonry, ANN

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was developed. The developed database and the subsequent analysis provided an effective model for predicting the in-plane shear strength of masonry panels strengthened by FRM systems. Despite the great diversity of input parameters, the proposed model was found to present good precision and accuracy; the robustness and sensitivity of the model were also evaluated through an extensive parametric study.

Title - Response Prediction of Structural System Subject to Earthquake Motions using Artificial Neural Network

Author - S. Chakraverty, T. Marwala, Pallavi Gupta, and Thando Tettey

Developed Artificial Neural Network (ANN) models to compute the structural response of a single degree of freedom system subjected to Indian earthquakes at Chamoli and Uttarkashi ground motion data. Initially, the system was trained for a single real earthquake data. For simulating earthquakes, the trained ANN architecture was then used with various intensities and it was found that the predicted responses given by the ANN model were accurate for practical purposes.

Title - Emerging artificial intelligence methods in structural engineering

Author - Hadi Salehi, Rigoberto Burgueno

Presented the significance of emerging AI methods for structural engineering applications during the last decade. The importance of AI in structural engineering along with the application of Machine Learning (ML), Pattern Recognition (PR), and Deep Learning (DL) was discussed.

3. Scope, Methodology and Purpose

3.1 Scope

- The use of steel sheds is very prevalent for the construction industry, accordingly, the steel shed behaviour, in general, is known. The use of neural networks in the civil engineering field is already certain however the application of neural networks for the prediction of steel shed behaviour is rare. There are only a few studies that have explored this topic so this research area needs to be further investigated.
- The extensive knowledge and experimental data of steel shed can be used to train ANNs and a strong network can be built.

3.2 Methodology

- Selecting a structure to study response.
- Collecting experimental data based on response of structure.
- Creating neural network for predicting response of similar structure.
- Feeding collected experimental data in neural network for structural prediction.
- Verifying results.

3.3 Purpose

The proposed work will help to predict behaviour of steel shed while resisting wind force. Suggestion and recommendation made through this project will also be useful for the industry people, as precise behaviour of structure will be known ultimately reducing cost on laboratory work.

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