International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Design and Development of Technode E-Hub in Urban Square In 2050

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Abstract:
In the year 2050, people will use more technological gadgets than they do now, and supercomputers will be many times quicker than they are now, and all electronic devices will be wirelessly charged. Petrol as a fuel will be phased out in the future. Hydrogen will be utilized as a fuel instead. Aside from that, many chemical components will be used as fuel, and research is being conducted on wind and solar energy as a never-ending fuel source. Such a technology will be available in 2050, eliminating the need for fuel to traverse thousands of km. At that point, all vehicles will be powered by electric and magnetic waves.
To create a hub that serves as a charging station for various types of electronic devices, from earbuds to cars. This hub will house all of the sources from which energy may be recycled. To modify automobile charging ports such that they may be utilized for several purposes. To create a leisure environment with futuristic chairs and lighting. To cover the entire area with a green belt, with a slab given at regular intervals that transforms mechanical energy to electrical energy when some circulation occurs.

Index Terms– Electric vehicle, Charging station, Wireless charging, Pavegen, Parametric design, solar panels, sustainability, energy conversion

I. Introduction

Charging stations have become increasingly popular as more people switch to electric vehicles. These stations provide a convenient and efficient way for drivers to recharge their cars while on the go.This presentation, will explore the benefits of charging stations, the different types available, and how they work. As the number of electric vehicles on the road continues to increase, so does the need for charging stations. One of the biggest concerns for those who wish to install a charging station is determining how much space is needed. The area required for a charging station depends on several factors, including the type of charger, the number of chargers, and the location of the station. Charging station layout is a crucial aspect of electric vehicle (EV) infrastructure design. It determines the number and placement of charging units, their accessibility, and overall user experience. The ideal charging station layout should prioritize safety, convenience, and ease of use for EV drivers while also maximizing the utilization of available space Electric vehicles (EVs) are becoming increasingly popular as people seek more sustainable and environmentally friendly transportation options. However, the issue of charging these vehicles is still a major concern for many drivers. This is where EV charging devices come in. An EV charging device is a piece of equipment that allows you to charge your electric vehicle at home, work, or on the go. These devices come in a range of sizes and charging speeds, making it easy to find one that suits your needs. Depending on the region and requirements, electric vehicles (EV) can be charged in a variety of methods. As a result, EV charging infrastructure is essential. There are several sorts and designs for various uses. Specifications and requirements for EV chargers, also known as electric vehicle supply equipment (EVSE), differ from nation to country, depending on market EV models and power grid features. This chapter introduces the basic ideas of electric vehicle charging infrastructure and emphasises the necessity for a contextual approach to local EV charging network development and deployment. A novel straightforward analysis and design of a freestanding charging station driven by solar energy is presented in this study. New closed-form equations are created for design purposes based on the assumptions. The analytical concept and assumptions are novel. To justify the analysis and design method, modelling, simulation, and experimental verification are performed. Electric vehicles (EVs) are gradually replacing traditional internal combustion engine (ICE) cars. Indeed, ICEs have several shortcomings that can be alleviated by EVs. EVs emit less pollutants, have greater energy efficiency, produce less noise, and require less maintenance than ICEs. However, several challenges remain in the EV battery charging process, such as charging time, charging station infrastructure, and the impact of these stations on the current electrical power supply. Using quick charging techniques, charging time may be decreased to minutes.

II. Benefits of charging station

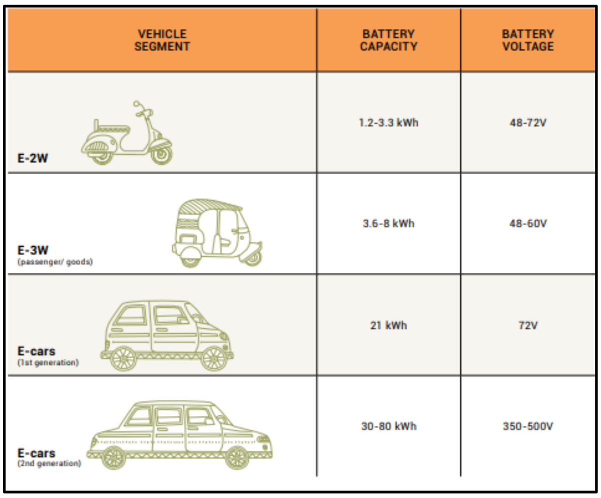
One of the biggest benefits of charging stations is that they are environmentally friendly. By using electricity instead of gasoline, electric vehicles produce zero emissions and help reduce air pollution. Additionally, charging stations can save drivers money in the long run. While electric vehicles may have a higher upfront cost, they are often cheaper to maintain and operate than traditional gas-pored cars. By placing EV charging stations in areas where vehicles prefer to park, EV owners may charge their vehicles while they are parked, saving time and removing the need to travel a long distance to access public charging. The requirement for high power and ultra-high power charging points, which are more expensive and can be harmful to the health of EV batteries if overused, is reduced by a dense network of normal-power EV charging stations. An evaluation of EV charging demand can inform several elements of charging infrastructure development. It may be utilized as input data to define goals for the system. in this chapter, there are a growing number of public EV chargers. It may also be used to design the location of public charging infrastructure and to assess grid capacity and the need for upgrades. EV charging demand at the urban or regional level is determined by per capita car ownership rates, EV penetration levels, and vehicle utilization patterns. Because it is commonly utilized in public planning procedures, such an evaluation should be done or commissioned by government planning bodies in charge of charging infrastructure..

III. Data collection

The world's largest electric car fast-charging station intends to make EV charging a pleasurable and productive experience, rather than merely wasted time. The design conjures the feeling of being in a park, with green areas and walking trails, as well as green roofs shading the chargers, all of which can serve to offer passive cooling for charging vehicles, people, and the surrounding environment. The station will also have reservable conference rooms, office spaces, restaurants, and shops.

IV. Literature study

Electric mobility is a viable worldwide solution for decarbonizing the transportation sector. India is one of a few nations that have signed on to the worldwide EV30@30 initiative, which aims to have at least 30% of new vehicle sales be electric by 2030. A reliable and accessible network of electric vehicle (EV) charging infrastructure is a must for completing this ambitious shift. The Indian government has implemented a number of enabling laws to encourage the construction of a charging infrastructure network. However, given the original qualities of this new infrastructure type, it is necessary to tailor it to the unique Indian transportation ecosystem and establish capacity among stakeholders to enable its on-the-ground deployment. A contextual strategy is required to enable timely and efficient deployment



VEHICLE SEGMENT	BATTERY CAPACITY	BATTERY VOLTAGE
E-2W	1.2-3.3 kWh	48-72V
E-3W (passenger/ goods)	3.6-8 kWh	48-60V
E-cars (1st generation)	21 kWh	72V
E-cars (2nd generation)	30-80 kWh	350-500V

Fig no 01 Battery specification of different EV segments

4.1 Types of Battery swapping

Manual: The battery changing station is a stand-alone apparatus in which batteries are manually added and withdrawn from individual slots, typically by hand. Manual changing stations are modular and take up very little space. Because the battery pack sizes are lower and the weight can be handled by one or two people, these are employed for 2W and 3W battery applications.

Autonomous: A robotic arm is employed in these sorts of switching stations, with the battery swapping procedure being automated. Automation can be semi-automated or fully automated. Robotic switching is employed in 4W and e-bus systems since battery packs are bigger and heavier and require mechanical help. These exchanging stations are likewise costlier and need more land. EV charging entails supplying direct current (DC) to the battery pack. Because electrical distribution networks deliver alternating current (AC) power, a converter is necessary to give direct current (DC) power to the battery.

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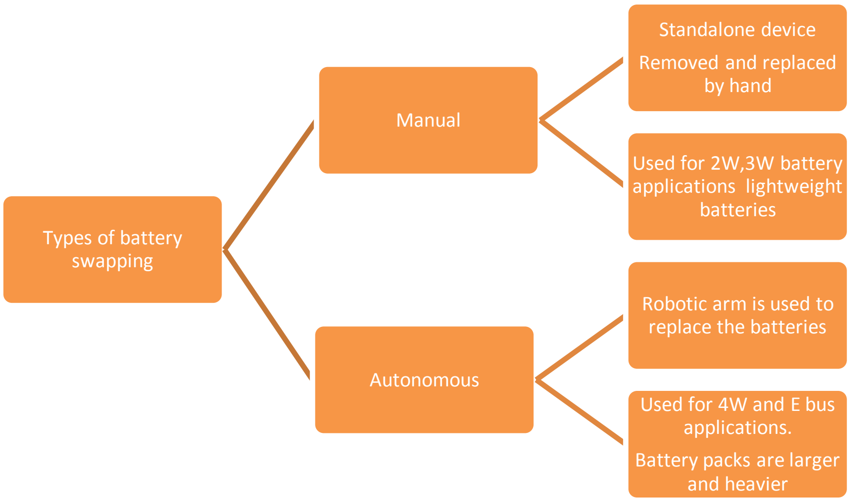


Fig no 02 Types of Battery swapping

Conductive charging can be either AC or DC. In the case of an AC EVSE, the AC power is given to the EV's onboard charger, which converts it to DC. A DC EVSE transforms power outside and sends DC power straight to the battery, bypassing the onboard charger. AC and DC charging are further subdivided into four charging modes, with Modes 1-3 related to AC charging and Mode 4 pertaining to DC charging. Modes 1 and 2 can be used to connect an EV to a conventional socket outlet through a cable and plug. Mode 1, often known as dumb charging, allows no communication between the EV and the EVSE and is not advised. The portable cable used in Mode 2 includes built-in protection and control and is commonly used for home charging. Modes 3 and 4, which employ a separate charger device to give power to the EV, offer enhanced control systems and are used for commercial or public charging

4.2 Ola Charging Station

The mission of Ola is to create a sustainable future for the globe. To make that a reality, ola isconstructing a large two-wheeler charging network. The Ola Hypercharge Network is what ola named it, but you might call it a tremendous leap forward in green transportation. Time to charge and range are affected by scooter temperature, ambient temperature, scooter age, and other factors.

Specification	Unit	OLA S1	OLA S1 Pro
Top Speed	km/h	90	115
Range	km	121	181
Drive Modes		Normal & Sports	Normal, Sports & Hyper
Motor Type		Mid Drive IPM	Mid Drive IPM
Acceleration (0-40 km/h)	sec	3.6	3
Acceleration (0-60 km/h)	sec	7	5
Peak Motor Power	kW	8.5	8.5
Rated Motor Power	kW	5.5	5.5
Torque at Motor Shaft	Nm	58	58
Gradeability Claim	Deg	12	12
Battery Capacity	kWh	2.98	3.97
Battery Type		Fixed	Fixed
Charger Type and Capacity		Portable / 750W	Portable / 750W
Home Charging Time (100%)	hr : mm	4 hr 48 min	6 hr 30 min
Fast Charging Time	min	75 km in 18 min	75 km in 18 min

Fig no 03 Ola charging specification

4.3 Ather Charging Station

For all of your everyday commutes, Ather Grid charging spots are conveniently located around the city. It charges your Ather scooter at 1.5 km/h until it's 80% full. Your scooter will be ready to go by the time you stop for coffee or shopping.

Fig no 04 Ather charging device

4.4 Tata Charging Station

For your fleet, Tata provide smart, safe, and creative charging options. Complete End-to-End Services, from Captive Charger Installations to Maintenance, EV CMS Software, Car and Bus Solutions, and Attractive Offers at Tata Power Public Charging Stations

Fig no 05 Tata charging device

4.5 Comparitive Analysis

SPECIFICATION	OLA	ATHER	TATA
Charging time @ home	0 - 100 % in 6 hr 30 min	0-100 % in 5 hr 15 min	0-100 % in 8 hrs 30 min
Type of Charging	AC and DC	DC	AC
Output Voltage	120 V	60 V	60 V
Output Current	12 Ampere	12 Ampere	6.5 Ampere
Efficiency	181 km/ charge	165 km/charge	312 km/ charge
Kerb Weight	121 - 125 kg	111.6kg	125 kg
Cable Length input	3 m	1.2 m	1.2 m
Cable length output	2.5 m	2 m	2 m
Mounting	wall mounted	Bolt mounted	wall mounted

Fig no 06 Comparitive analysis

As per the analysis, OLA S1 pro is better in all aspects. It has both type of charging and is also wall mounted.

V. Primary Research

This station is located in yeshwanthpur in bengaluru,the total area is 60sq.m in total.near Vaishnavi sapphire mall. This charging station is handled by government.

Fig no07Yeshwanthpur Charging Station

In Yeshwanthpur station, there are only 3 charging points in which one is used for cyle, another one is used for 2 wheelers and the third one is udes for car. The space is very compact where one car, one bike,one cycle can be accommodated.

VI .Need for study

In India, coal is used to generate the majority of our power. All of these fossil fuels will be depleted in the future, and there may be a power outage. All electronic devices are now updated. Electric transportation will be implemented. As a result, discovering the alternatives to power.An EV charging network with numerous low-power charging stations is preferable than one with few high-power charging stations. For EVs, any parking spot where the car is stationary and has access to an EV charging station may be used to replenish the vehicle battery.This is also known as destination charging, as opposed to "on-the-go charging," which occurs when cars rapidly charge their batteries in order to continue driving to their destinations.As a result, rather than carving out new areas for EV charging stations, EV charging infrastructure should be supplied in locations where vehicles are often parked.This charging infrastructure implementation strategy encourages a dispersed network of EV charging points for consumers to plug into at different locations, including houses, apartment complexes, workplace campuses, retail malls, metro and railway stations, bus depots and so on. Users and operators benefit from a dispersed network architecture in a variety of ways, ranging from ease of access to financial feasibility.

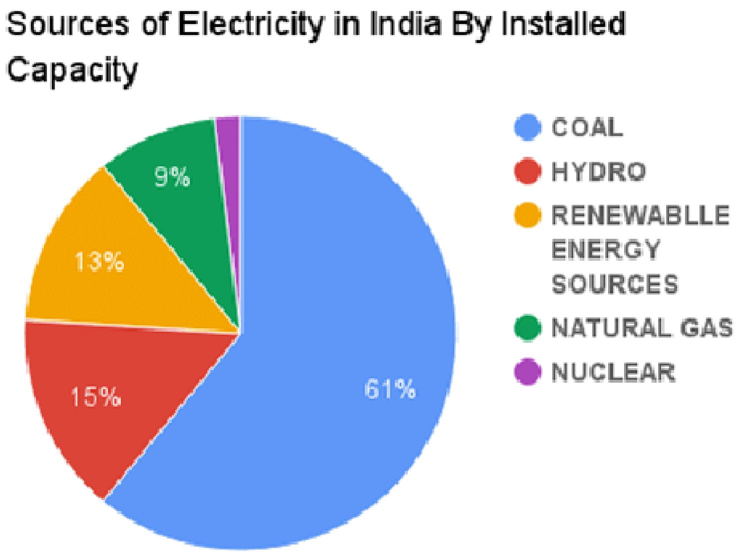


Fig no 08 Capacity of Energy Used

VII .Problem statement and design development

With the EV revolution well started, electric vehicle charging networks must keep up with demand from auto manufacturers introducing new models. They must also keep up with the fast-paced technology and charging architecture featured in current Electric Vehicles. However, the efficiency of electric vehicles is always being checked. With so many businesses competing for their version of a quick or home charger, each one confronts network issues. Sometimes the charging point makers are not to blame. The key hurdles are the high cost of installation, communication between grid and charge station businesses, and charger compatibility.Researcher went through all of these and other concerns in full here to give you a feel of what manufacturers confront while installing.

The largest electric vehicle fast-charging station in the world aims to make EV charging a pleasant and productive experience – not just lost time spent waiting.The design evokes the experience of being in a park, with green spaces and walking paths, as well as green roofs shading the chargers, all of which can help to provide passive cooling for charging vehicles, people, and the surrounding environment. The station will also feature reservable meeting rooms, office spaces, restaurants, and shopping.

7.1Conceptual ideas

7.1.1 Abstract concept

An abstract concept, this concept is an idea where people can understand that has no physical form. The ability to identify, understand and communicate abstract concepts is a foundational element of human intelligence. a concept such as "probability of precipitation" may be calculated from millions of data observations from weather stations and satellites.

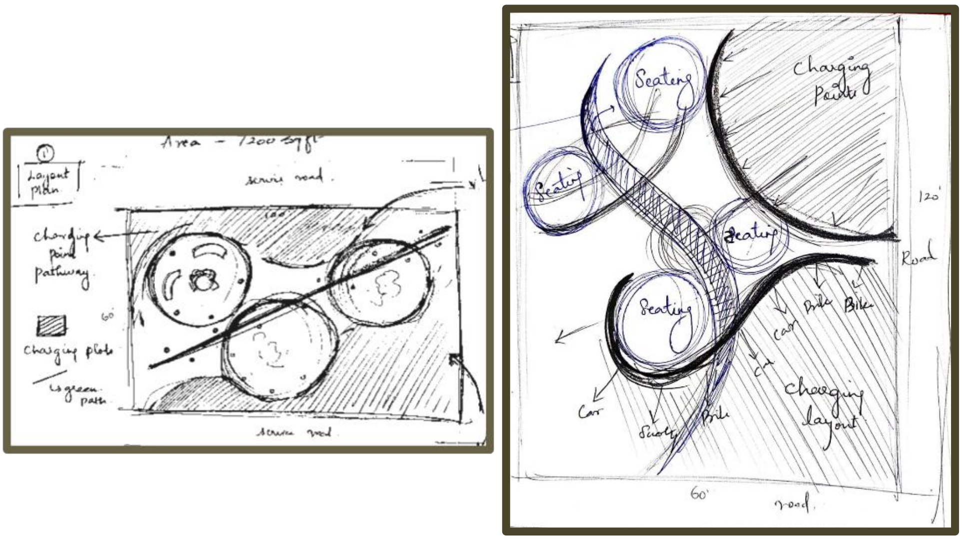


Fig no 09 Concept 01

7.1.2 Freeze the moment

Freezing the moment is a concept which is related to the photography, capturing the moment. Here the zoning is interlinked with the journey and the movement through the site and structure, this concept enables one to freely explore the realm of creativity.

1. Poor charging infrastructure
2. Station performance and downtime
3. Power issues while charging
4. Vehicle grid interoperability
5. Ease of use while charging
6. Charging station to network
7. Finding balance between rapid and on street units.

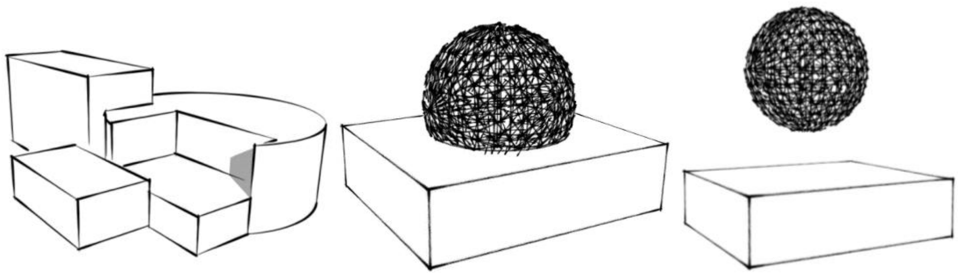


Fig no 10 Concept 02

7.1.3 The column pavilion

Columns isa fundamental architectural element that defines the solids and voids in the space, is by nature a theatrical spatial artifact. Sound created by the reverberation of the columns is an interactive, emotive and performative medium of space.

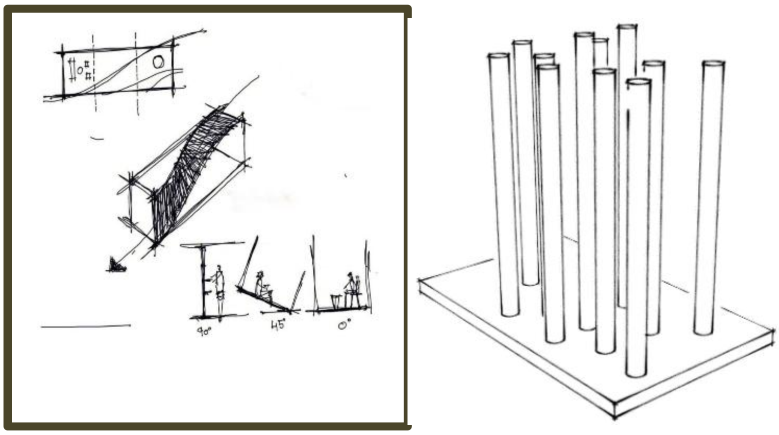


Fig no 11 Concept 03

7.1.4 Clover column

The thin structure of the columns blurs boundaries and create a sense of disorientation in a similar way to the overlapping of many sounds in space. The column pavilion is a dynamic pause in the urban dissonance emphasizes the relationship between sound, space and body, engaging the public in a playful kinetic spatial design while offering an immersive ‘silence’. It genuinely invites the visitor for interaction, for a play, while creating a rich visual and sonic atmosphere.

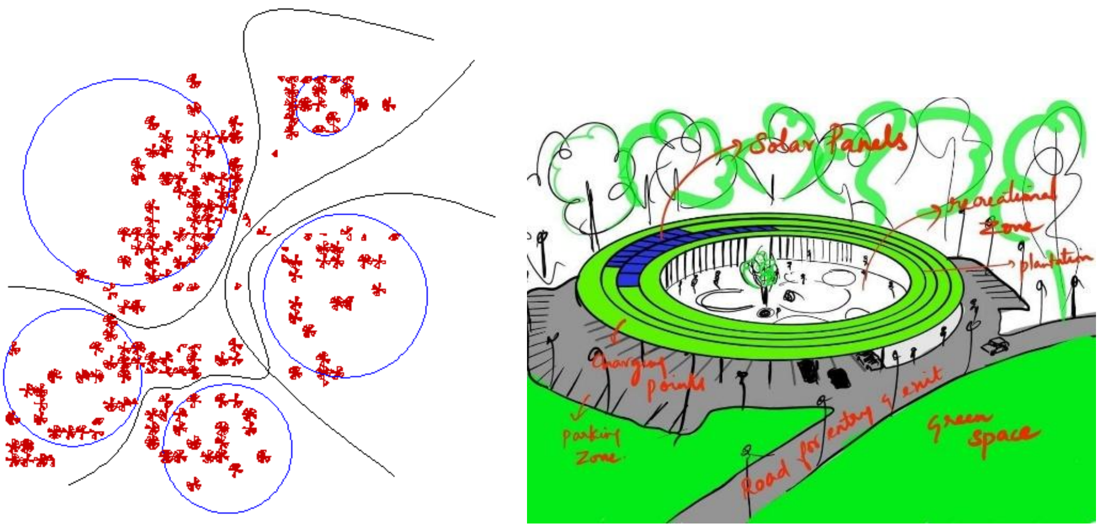
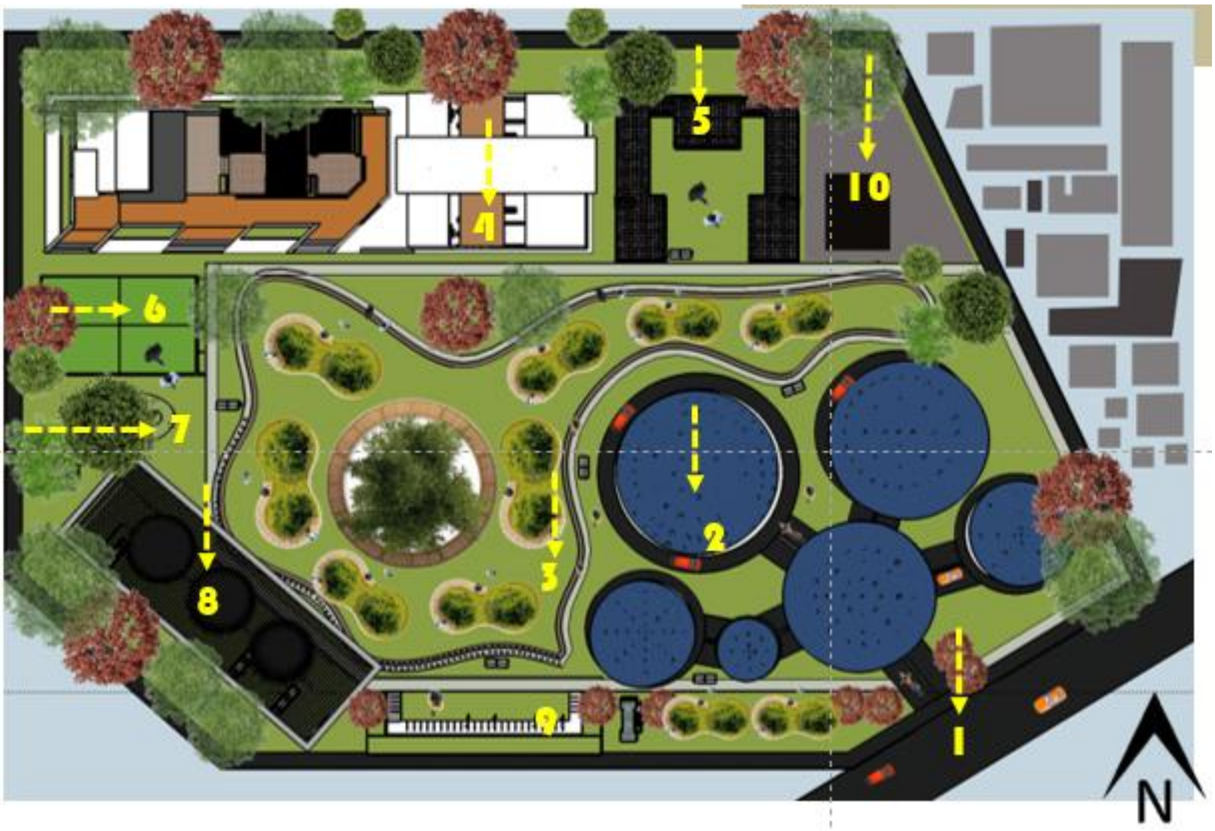


Fig no 12 Concept 04

7.2 Master Plan

This site area is around 12 acres. Here the hub consists of charging station, green belt which converts mechanical energy into electrical energy.



1. Entrance
2. Charging station
3. Green belt
4. cafe/restaurant
5. Restroom
6. Fitness gym
7. Farmers market
8. Car parking/ art gallery
9. Cycle parking
10. Electric unit

7.3 Design and Development of Charging Device and Station

The total length of the steel rod is around 38’. One clover column is of 20’ tall. The rods will be immersed in l shape under the ground. The roof will have a L shaped connecting from the rod like a tree form. Each twist's upper surface becomes a circulation ramp that effortlessly transitions between the staggered gallery plateaus. The charging stations are organised around a central triangular atrium that rises as an open core through the building. This magnificent void surrounds the building's inner workings and provides different views of the interior as visitors make their way through the charging station. The charging spaces alternate between open and enclosed and are linked by intersecting, helical paths. When descending into the gallery spaces, this route allows visitors to see the exhibitions from close and far, as well as from above. In the event of a fire, smoke is evacuated from the structure using a revolutionary 'tornado' smoke removal system designed specifically for the museum. Smoke is drawn into the vacuum from the open gallery spaces and then discharged through 144 air nozzles at the top of the atrium.

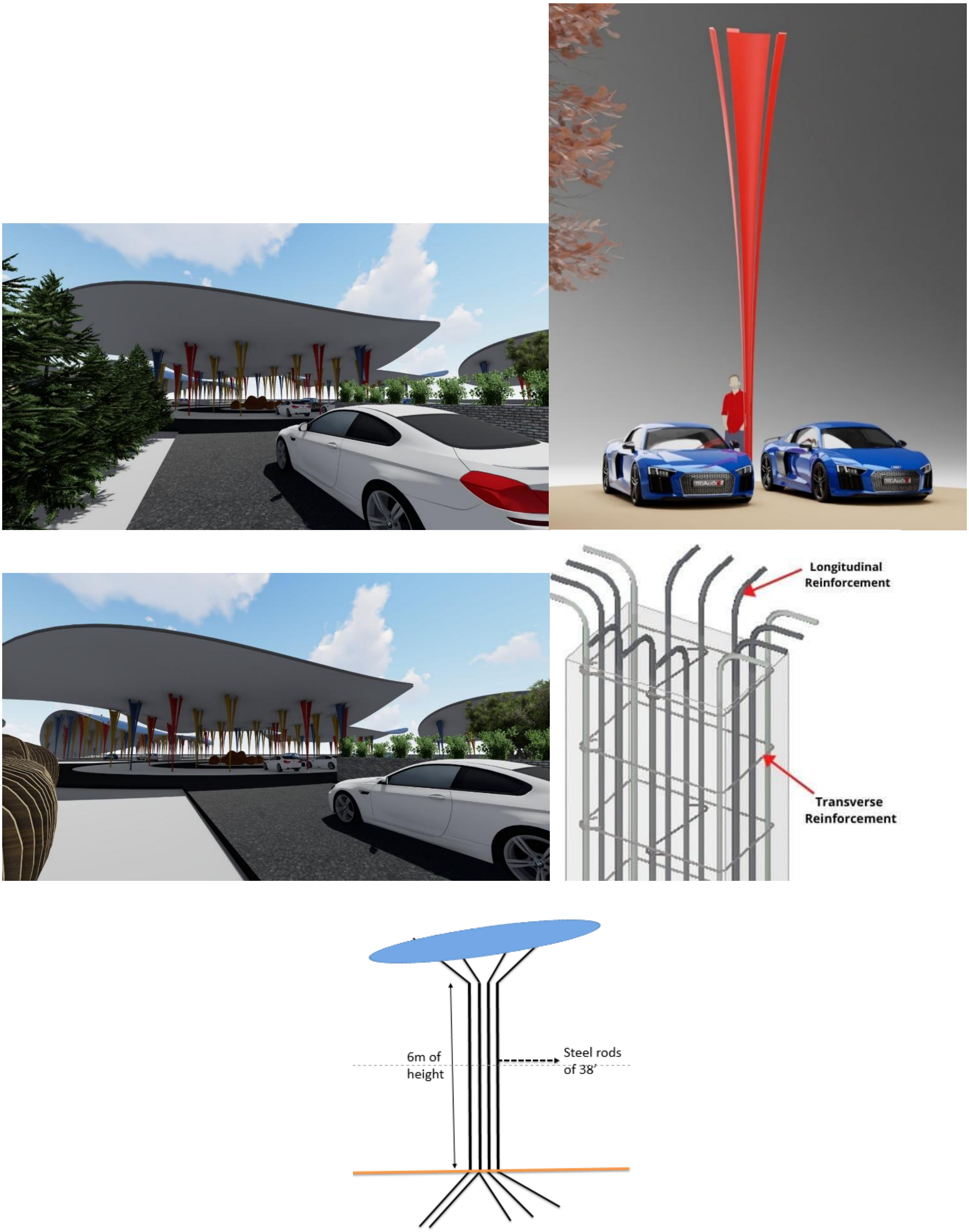
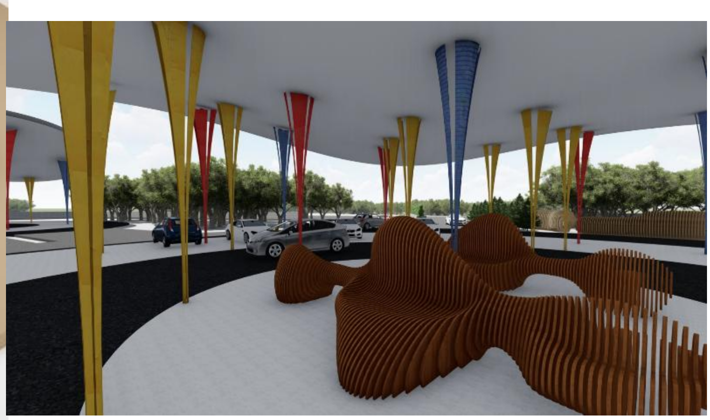


Fig no 13 The Structure

This clove changes its color accordingly, once the car comes and is parked, the person will get a notification and once they approve, charging starts immediately. Some claim a four-leaf clover is difficult to locate, while others believe it brings good luck. Check out what the Atomic Leprechauns are cooking up and make your own decision! Mix and combine with other Super Lever forms, but make no mistake: this isn't your kid's Lucky Charms box; this is real Clover showmanship with incredible negative space. A quatrefoil is a decorative element composed of a symmetrical shape that produces the general contour of four slightly overlapping circles of the same diameter. It can be found in art, architecture, heraldry, and traditional Christian iconography. The phrase 'quatrefoil' means "four leaves," and comes from the Latin quitter, "four," plus folium, "leaf." It refers especially to a four-leafed clover, but it also refers to four-lobed forms in general. In recent years, some luxury businesses have sought to illegally assert intellectual rights to the sign, which naturally predates any of those firms' creative creation. A trefoil is a similar form that has three rings.



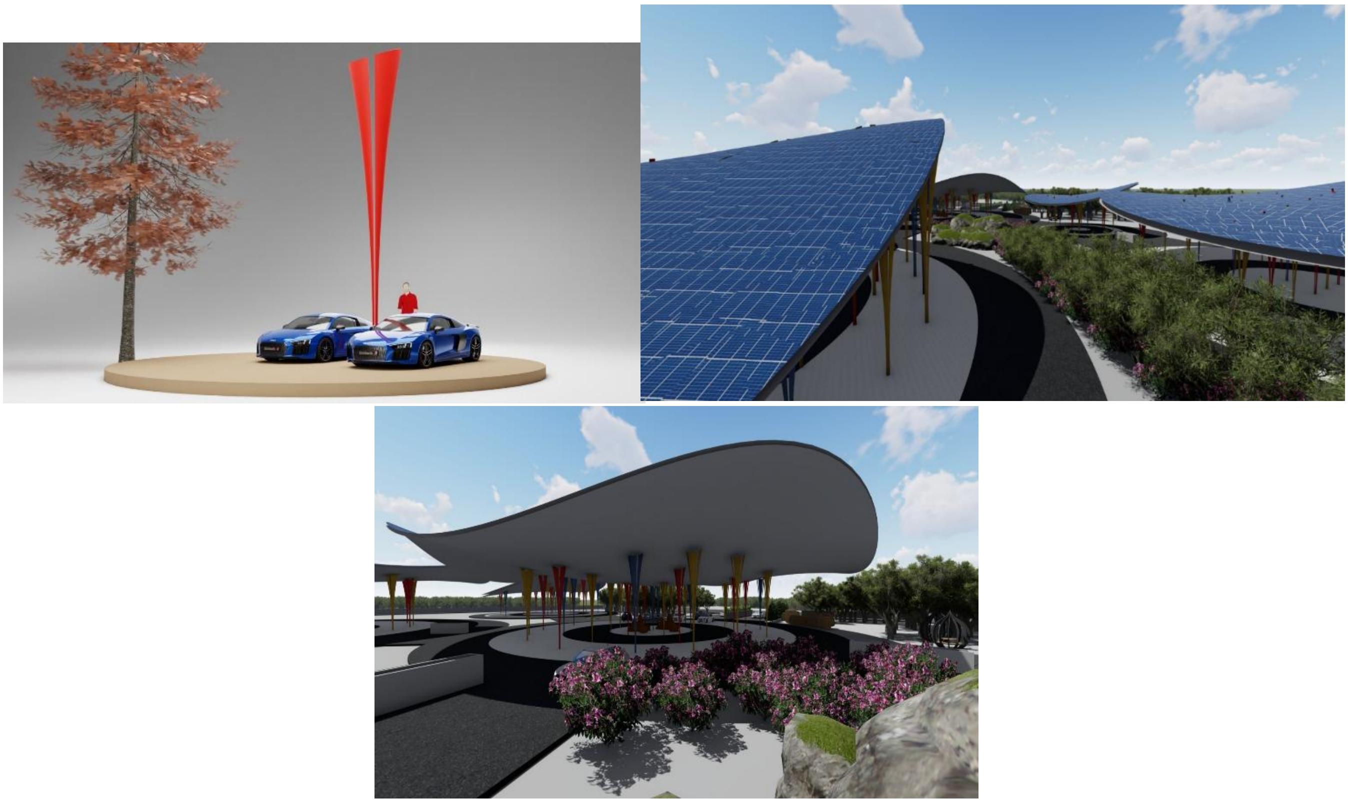


Fig no 14 Rendered design of the site with charging device

This patch acts as a convertor of mechanical energy into electrical energy. There are two different lanes for walking and cycling. The lane is of 5' width. Simply stepping upon a Pavegen tile generates 3-5 joules of electric charge, which is enough to power a light bulb for a few seconds. These tiles employ electromagnetic induction, which occurs when certain materials are crushed and release an electric charge. Copper coils and magnets then assist in the generation of a charge via induction.It is one example of how kinetic energy may be used to generate clean power in addition to other renewable sources such as hydro, wind, solar, and nuclear. The electrical energy produced is then stored in batteries and used in appliances like as lights. The triangle tile has three generators placed into each of its corners, making it nearly difficult to step on a tile without activating at least one of themThis would aid cities' efforts to transform into smart cities and minimise pollution. At the moment, metropolitan regions are responsible for 70% of global greenhouse gas emissions. Future flooring: presenting a high-tech paving tile that generates power and data with each step.Pavegen has created 129 prototypes for smart, electricity-generating flooring since 2009. The Pavegen tiles work on a pretty basic principle: when a tile is trodden on, the weight causes a rotating induction generator under the surface to move.

Fig no 15 The green belt for walking and cycling

7.4 Design and Development of Seating

Combining complexity and variation, and so rejecting uniform utilitarianism. Priorities shared in urbanization, interior design, an architectural marvel, and even fashion. The notion that all design aspects are interconnected and changeable. This form of seating is for group of people sitting together to have a chit chat. People who loves treescan also have a rest here. Materials used are recycled plastic with stone texture. As people will love to sitin stone benches in future. Here the materials used are plastic which can be recycled into any texturerequired.

Fig no 16 Rendered images of seating provided

7.5 Final Representation

The materials used are acrylic sheets of different colours which are cut into small pieces which acts as the charging device and the columns called clover columns. The sheets are cut in the laser machine by providing the 2D drawing and is cut accordingly. The materials for making the prototype are a 1200mm x1200mm MDF board is taken. On that the cad drawing of the charging station is printed on the MDF by laser cutting machine

Fig no 17 Final prototype

This is the output after the laser cutting in MDF. The details in the board are the 6 circles of the charging station and the connected roads, the entry to the site and seating will also be added. The main highlight of the design The Green Belt is also given in this board. A part of green belt is also added. The slots for parkingis also given. The boxes are the parking slots of the charging station for 2 wheelers, 3 wheelers and 4 wheelers. The roofs are cut in sunboard with proper scaled dimensions and is made into the particular parametric structure using the blower which gives heat and the shapcan be changed accordingly.

Figno 18 Final prototype with roof

7.6 ProductValidiation

Reviewer 01 (Architect)

In the master plan, the spirit of collaboration and community engagement is well planned. The design process met the highest standards of quality and feasibility.

Reviewer 02 (Architectural Professor)

As per the reviewer, the site plan is not just a collection of buildings and infrastructure. It is a symbol of progress, growth and the possibilities that lie ahead, have carefully considered every aspect of the site plan from its functionality and aesthetics to its environmental impact and sustainability.

Reviewer 03(Architect)

This particular reviewer have looked into aspects such as from the placement of building to the integration of green spaces which showcased a thoughtful and strategic approach to urban development.

VIII .Conclusion and Future Work

EV charging devices are an essential component of the electric vehicle ecosystem, providing a convenient and reliable way to charge your electric vehicle at home, work, or on the go. With a range of options available, it is easy to find a charging device that meets your needs and fits your lifestyle. By using an EV charging device, you can enjoy the many benefits of electric vehicle ownership, while also contributing to a more sustainable and eco-friendly future. Whether you are a current electric vehicle owner or considering making the switch, investing in an EV charging device is a smart and practical choice that will pay off in the long run. So why wait, Start exploring your options today and join the growing community of electric vehicle enthusiasts who are driving towards a cleaner, greener future. Determining the area needed for a charging station requires careful consideration of several factors, including the type of charger, the number of chargers, and the location of the station. By taking these factors into account, it is possible to install a charging station that meets the needs of electric vehicle owners while minimizing the impact on the surrounding environment. As electric vehicles become more popular, the need for charging stations will continue to grow. By understanding the space requirements for these stations,researcher can ensure that they are installed in a way that is both practical and sustainable.

Finally, a good charging station layout should allow for future expansion as demand for EVs and charging infrastructure grows. This may involve reserving space for additional charging units or planning for the installation of higher-capacity charging equipment as technology advances. The layout should be flexible enough to accommodate these changes without disrupting the existing infrastructure. As electric vehicles become more popular and widespread, the demand for EV charging devices is expected to grow exponentially. This means that researcher can expect to see more advanced and innovative charging technologies in the future, including faster charging speeds, longer battery life, and more convenient and accessible charging locations. One exciting development in the world of EV charging devices is the integration of smart technology. Smart charging devices use advanced algorithms and data analytics to optimize charging times and reduce energy consumption, making them even more efficient and eco-friendly. Researcher can also expect to see more wireless and portable charging options, as well as increased use of renewable energy sources like solar power.

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