CHARGEMATE: ELECTRIC VEHICAL BOOKING

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ABSTRACT: The project's goal is to reserve charging slots online for charging stations. The Charging EV Anyone with an internet connection can access Reservation System, an Internet-based program, from anywhere in the world. This application is going to hold the places to charge. This technique for booking online charging spots offers an Android application for the purpose of reserving charging slots on an Android user-accessible charging station. To book the reservation, the user must log in to the system and provide either a credit card or a debit card places to charge. By reserving the charging spaces, one can charge at the charging station other than standing in line amid a busy schedule. The most notable advantage is that this tactic enables allows the simultaneous charging of all electric vehicles, especially when there is insufficient electricity for charging. This Android app offers comprehensive information about the next charging station along the route, including reservation timings and available places. The owner or driver can reserve the charging stations by selecting the periods that work best for them when traveling and making the reservation. For individuals who lack the time to come in lengthy lines or come in to charge their EV, one of the best options is to use our online

charging reservation system. We also offer the ability to cancel previously made reservations for EV charging through our reservation system.

Keywords:

Smart transportation, electric vehicle telematics, charging schedule, reservation service, acceptance ratio.

1.Introduction:

The public is beginning to accept electric cars (EVs) more and more these days because to advancements in battery technology. It is problematic, though, since an increasing number of EVs will result in a significant demand for charging and would undoubtedly worsen the grid load during peak hours. In order to supply the additional electric power, more power plants will therefore need to be constructed, which will be expensive and problematic for the environment. Concurrently, there has been significant advancement in the utilization of sustainable energy sources in recent times. Therefore, in the near future, charging stations that are integrated with renewable energy sources will be crucial to the widespread usage of EVs, even for car to grid applications. Furthermore, a great deal of study has been done thus far on the management of electric car charging.

The public is beginning to accept electric cars (EVs) more and more these days because to advancements in battery technology. The growing number of EVs does, however, present a challenge because it will undoubtedly increase the grid load during peak hours and create a massive demand for charging. Then, in order to supply the additional electric power, more power plants must be constructed, which is expensive and causes environmental issues. In the meantime, there has been significant

advancement in the use of renewable energy sources in recent years. Therefore, in the near future, charging stations that are integrated with renewable energy sources will be crucial to the widespread usage of EVs, even for car to grid applications. Furthermore, a great deal of study has been done thus far on the management of electric car charging.

Challenges:
1.Limited Charging Station Availability:

Problem: It may be difficult for EV users to locate a charging station in some areas due to a lack of charging stations.

Solution: Increase the number of charging stations installed by working with local businesses, governments, and utility companies to expand the infrastructure for charging. Prioritize station placement by using data analytics to identify high-EV usage areas.

2.Range Anxiety:

Problem: EV owners may worry that their batteries will run out of power before they get to their destination.

Solution: Incorporate cutting-edge navigation and route planning tools into the booking app to recommend the best places to stop for charging along the way. Continually update the availability of charging stations and their estimated charging times.

3.Charging Station Compatibility:

Problem: It can be difficult to accommodate all users when different EV models call for different kinds of charging connectors.

Solution: Provide universal charging stations that accommodate various connector types, and make sure that details regarding each charging station's compatibility with different connector types are provided by the booking system.

4.Peak-Time Congestion:

Problem: There may be a backlog at charging stations during busy times, which could result in lengthy waits.

Use dynamic pricing models as a solution to incentivize users to charge during off-peak hours. Manage station traffic, recommend other nearby stations, and provide estimated wait times with booking system data.

Key Components of the System:

Booking Engine:

Reservation management allows users to make reservations choosing dates, time of pick up and drop off of a car at a certain place. Real-time availability to avoid overbooking, monitors and keeps vehicle availability data current on a real-time basis.

User Authentication and Authorization:

User accounts managing user information such as secure login and registration to authenticate customers and manage account details. Authorization levels the different user roles, like customers, administrators, and fleet managers, having their own level of access and permissions.

Payment Gateway:

Secure transactions secure payment link that allows users to pay their reservations through an integrated payment gateway. Payment history tracking and tracking of user payment histories.

Vehicle Management System:

Fleet monitoring the whole fleet of all electric vehicles in real time. Maintenance Schedule carrying out monitoring and scheduling of preventive service to keep the cars well maintained.

Notification System:

Booking confirmation user's automated confirmation notifications and subsequent information. Reminders Alerts concerning forward reservation recalls, and deadline returns.

GPS and Navigation Integration:

Location services interfacing with GPS for real-time mapping of the vehicle and directing users on where to find picking up and dropping points.

Key Features and Benefits:

Key Features:

User-Friendly Interface:

They focus on the simplicity of usability through an easily registerable interface as well as a convenient method of choosing a car rental. The design has an intuitive design that is easy to use since it is highly user-friendly and provides good screen aesthetic.

Real-Time Availability:

Such up-to-date information helps user to select an electric vehicle at the same time when he/she needs it. The booking system

enables one to plan for their trip, make better choices, as well as enhancing user satisfaction by simplifying the booking process.

Secure Payment Integration:

Also, it utilizes strong security for easy and safe deals. It is important on this context because users' confidence depends entirely on a transaction being flexible and trustworthy. This may include use of credit card or even a digital wallet that supports varied payment options.

Charging Station Assistance:

The platform provides a complete information on nearby charging points for use in electric vehicle use. This would provide users with information about charging times, station location, and availability therefore making travel easy for them.

Notification System:

The notification system based on communication allows timeliness communication. It sends messages to users for confirmation of reservations, the status of charge, as well as future bookings. This increases their active involvement in user's community.

Fleet Management Tools:

The powerful admin dashboard provides administrators an in-depth view of the entire electric fleet. On this note, it integrates various functionalities, including maintenance tracking and analytics. This allows for informed decision making aimed at improving uptime and enhancing reliability.

Benefits:

Optimized Charging Efficiency:

This improves efficiency by enabling individuals to book for charging sessions hence minimizes the waiting period while maximizing utilization of charging infrastructure. This increases utilization by both users and charging station operators thus reducing their periods of downtime.

User Convenience and Planning: This allows users to book charging sessions well in advance, therefore, making it more convenient to them. Electric car owners can easily schedule charging in their time and this feature make process of recharging the car more reliable and comfortable for people who use cars.~.8

Reduced Energy Grid Strain:

Staggered and planned charging of the system contributes in grid management as it reduces the peak demand for electricity during certain parts of the day. It also helps in off-peak charging, which reduces strain on the energy grids and supports the integration of renewable energies as well.

Environmental Impact:

Indirectly, this system helps promote a sustainable environment by encouraging an efficient use of charging infrastructure. Optimized scheduling will help reduce energy consumption as well as the impact on the environment since electric vehicles consume electricity.

Enhanced Fleet Management:

The charging booking system acts as a single means of monitoring and managing electric vehicle fleets for businesses. This

involves carrying out normal maintenance, planning for optimal recharging schedules as well as guaranteeing a reliable and efficient fleet.

Data-Driven Insights:

It provides useful information on the ways in which people charge vehicles at stations as well as station usage for instance. With this information it is possible to develop efficient infrastructure planning and growthdecisions, targeted at meeting everchanging user expectations of mobile chargers.

2.Literature Survey:

[1] D. Gong, M. Tang, B.Buchmeister and H. Zhang. Solving location problem for electric vehicle charging stations a sharing charging model.This study reports a new emobility platform to construct effective usage of charging points by electric vehicle users to eliminate long charge durations. It's platform includes such subsystems as smartphones, databases, and IoT.

[2] Dost, P.Spichartz, P.and Sourkounis, C. (2015). Charging behaviour of users utilising battery electric vehicles and extended range electric vehicles within the scope of a field test. The number of electric vehicles (EVs) on the road is increasing, charging stations is becoming increasingly crucial. An increased number of Electric Vehicles (EVs) on the roads. Charging infrastructure is gaining an ever-more key role in addressing the needs of both the local distribution grid and EV consumers at the same time.

 [3] Yongmin Zhang, Lin Cai. Dynamic Charging Scheduling for EV Parking Lots With Photovoltaic Power System. The

spread of these vehicles is still low due to the lack of charging stations as well as their high prices. This paper reviews important research about charging stations with IoT and the charging type used in these stations. Saves the time spent by the user looking for the stations, knowing the location of charging stations by using a mobile application.

[4] S. Akshya, Anjali Ravindran, A. Sakthi Srinidhi, Subham Panda, Anu G. Kumar. Grid Integration for Electric Vehicle and Photovoltaic Panel for a Smart Home. The growing number of electric vehicles on the roads makes it increasingly necessary tohave a public charging infrastructure. On the other hand, the limited range of their batteries and charging times. At the goal of optimizing trip time, drivers need to automate their travel plans based on a smart charging solution, which will require the development of new Vehicle-to-Grid applications that will allow at the charging stations to dynamically interact with the vehicles.

[5] Florea, B.C. and Taralunga, D.D. (2020). Blockchain IoT for Smart Electric Vehicles Battery Management. Electric Vehicles (EVs) have generated a lot of interest in recent years, due to the advances in battery life and low pollution. Similarly, the expansion of the Internet of Things (IoT) allowed more and more devices to be interconnected. One major problem EVs face today is the limited range of the battery and the limited number of charging or battery swapping stations.

[6] Subudhi, P.S. and Krithiga, S. (2020). Wireless Power Transfer Topologies used for Static and Dynamic Charging of EV Battery. Electric vehicles (EV) are found to

be a good alternative for the conventional internal combustion (IC) engine vehicles in transportation sector due to its various advantages. Now-a-days, wireless charging of EV battery is preferred among the various methods used for charging EV battery. Static wireless EV battery charging technique adopts inductive and capacitive method for transferring power whereas, dynamic wireless EV battery charging technique adopts only inductive method for transferring power.

3.Existing System:

Zipcar:

Zipcar is a well-known car-sharing organization which gives customers a hassle and cost-free way of using a vehicle, without any ownership commitments. Individuals are required to join Zipcar so that they can be able to book different kinds of cars such as the sedans and hybrids on hire either per hour or per day. The system is also compatible with different mobile apps making it easy for one to look for, book, and unlock the cars. Zipcar's keyless entry streamlines the rental procedure by permitting users to get into a vehicle using their membership card or cell phone. Usually, fuel costs are added to rental fees while liability insurance cover is offered as an extra. Zipcar is a model of fuel-efficient and hybrid cars as opposed to being popular in urban areas that may be impractical for owning cars. My latest news indicated that Budget, a leading multinational car rental service bought Zipcar.

Car2Go:

Car2Go is an innovative mobility option that is adaptable to the needs of modern life in cities. A mobile application would enable users to look and book a car through their phones to pick within minutes for shorter travels. Generally, Car2Go would offer a car park that comprised small-sized cars, and users were free to start and stop the use of the cars in specific urban locations without needing to visit conventional stations. Service was charged at per minute basis with the incorporation of fuel cost and coverage for the insurance. Car2Go offered an ideal solution for improving the mobility in congested cities and addressing the existing challenge of urban traffic.

However, it is vital to state that there could be some changes in the way Car2go provides its services since I made my previous update, thus verifying the most updated information from official sources is advisable.

Blue SG:

This is a review of blue SG, an electric car sharing service in Singapore. The idea behind the establishment of Blue SG was to come up with a green transport strategy for use in towns as a measure towards achieving sustainability outcomes. This featured a fleet of electric cars whose rental was available for short periods of time through a membership card and a specialized app. Blue SG ensured that its stations were conveniently placed all over the city such that users had no troubles picking or dropping off their cars. The technologically fitted electric vehicles enabled rental monitoring and management via an easy-to-use application. The goal of blue SG was to come up with a way that would make it possible for individuals to use transport conveniently and conveniently so as to promote the provision of clean and green transport in cities. However, it is important to ensure you get

updated information directly from Blue SG or official sources as they might be different from what was available earlier.

Blink charging:

These charging stations can accommodate both level 2 AC charging and DC fast charging and are usually installed in public places, commercial areas, or neighbourhood settings. Additionally, users can use the Blink mobile app to access Blink's charging network and get directions for station, payment processes. Blink's dedication to sustainability is demonstrated through the expansion and improvement of the EV charging infrastructure for mass adoption of electric vehicles. Moreover, Blink Charging through association and alliance has also looked to extend beyond.

Turo:

Turo is an online car sharing network for private cars which allows owners to rent them out to other people. Until my recent knowledge update (January 2022), I am aware that Turo presents itself as an easily flexible alternative to ordinary car rental companies. A variety of automobiles from ordinary cars to high-end and unique ones are made available for users' search through the website or its app offered by private car owners. That's why in this case this platform provides an opportunity to rent a vehicle in a more individual manner giving options which would be not offered by other traditional cars rentals services. Turo ensures security through insurance cover and 24/7 customer care that make people trust one another including car owners and renters.
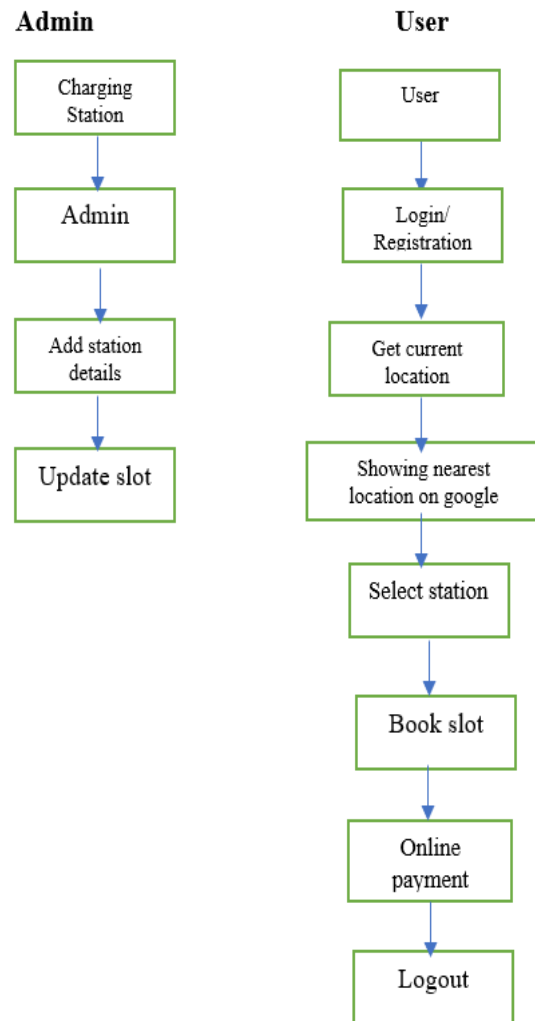
4. Proposed System

Electric Vehicle Advanced Booking System is a modern system created for optimizing and improving the process of using an electric charge. This system presents an intelligent reservation and booking platform in line with the growing electricity dependence on electric cars. EV users can find time to schedule and reserve charges on a user-friendly application through their mobile phones or via the website beforehand in order to make them available as soon as possible when required.

Admin module:

It is worth noting that one of the critical actors in the charged electric vehicle system is the administrator who is responsible for ensuring its proper management. Administrators employ different functions in the system in a way that ensures the maximum effectiveness of charging stations. They can revise details of stations, add new stations and provide updated information on existing ones. The same system enables administrator to dynamically maintain availability state for every slot in every station, giving users accurate data in real time. Administrators are able to generate detailed reports regarding station utilization and performance that can be leveraged in informed decision-making. One important feature relates to user account management where administrators can manage and maintain user profiles either for additions or withdrawal of accounts. More so, they can monitor specifics like all charging stations for comprehensive comprehension of the charging grid. These robust set of function enables managers effectively manage whole functionality of electric vehicle charger management system.

User module:

The system in question will involve a crucial element of a user participating in different features that would lead him/her effortlessly through the process of electric charging. The engagement between users starts when they log into their credentials and get an individual encounter. Such a system gives allows users to easily find the nearby charging stations using actual time of place data. Users will then have an option of picking a good charging spot for booking. Booking requires the user to select a particular date and time; however, the payments are made via the in-built online payment system. After a successful payment, users receive a booking confirmation, making it easy to make electric vehicle charging reservations. This is done In an all-round manner to provide convenience for the users from the point of making search to paying through the process.

Block Diagram:

Admin

Charging Station → Admin → Add station details → Update slot

User

User → Login/ Registration → Get current location → Showing nearest location on google → Select station → Book slot → Online payment → Logout

5. System Design

SYSTEM ARCHITECTURE

A strong platform called the Charging Station Management System was created to make managing electric vehicle (EV) charging stations easier. It is made up of a number of parts and features that make managing and operating charging stations easier. This one-page summary highlights the system's importance in the expanding electric vehicle ecosystem by outlining its parts, features, and process. The architecture of the Charging Station Management System gives administrators the ability to easily manage charging

stations and slots. By making it simple for EV users to find open spots, our approach encourages the use and accessibility of electric vehicles and helps to ensure a sustainable future.

Functionality of Admin:

Admin Login: Admin logs in the system with their account details to gain access to the admin interface.

View Existing Stations: An admin may view all available charges in the system. One's list commonly entails information like Station ID, position, frequency, charging slots.

Add Station Details: Further, the admin can be able to include other new locations for stationing of the charging stations within the system. It includes giving details of the sites address, number of wagons handled there and any special instructions features.

Update Slot Availability: Updating of the availability status of charging slots by admin.

each station. This is crucial considering it shows which slots are in use and which slots are available for booking.

Manage Station Information: Admin can modify and update the stations information like the street address physical address, telephone numbers, and opening hours for the station.

Remove Stations: The admin may likewise disable charging stations from the system if that is required such as when a station is closed down or relocated.

Reporting and Analytics: This includes creating reports and analysis around station uses, slot occupancy, and revenue. These reports provide insights into the activities of the users and are accessible by the admin performance of the charging stations.

Functionality of User:

User Login: To provide safe access to the system, users log in with their login credentials.

Get Current position: Using GPS or user input, the system determines the user's current position.

Show Nearest Station: The system looks up the closest charging stations in the charging station database based on the user's location.

When the user selects a station, a list of adjacent charging stations is displayed, together with information about each one's location, available slots, and cost. The user decides whatever charging station they like best.

Book Slot: If there are several charging slots available at the station, the user selects one after choosing a station. The user makes a reservation for a time slot on a particular day.

Online Payment: The system enables credit card processing, mobile payment, or other online payment methods to be used during the designated charging slot. A booking and payment confirmation is sent to the user.

Logout: After concluding the interaction, the user logs off the system.
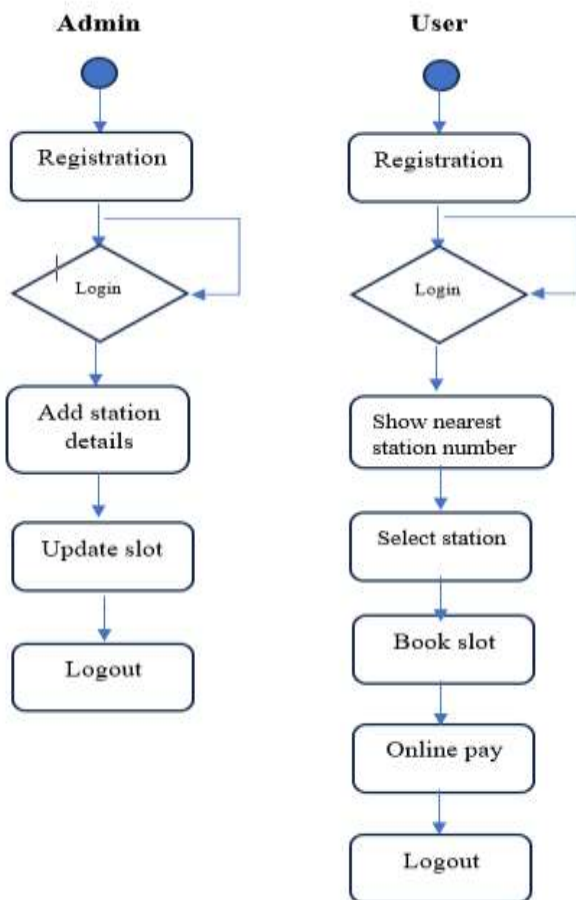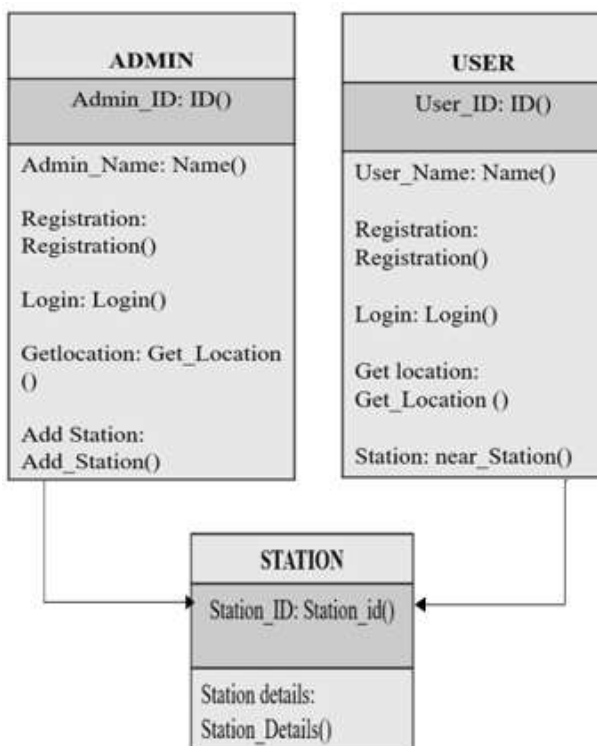
Fig:5.1 System architecture

Fig:5.2 Class Diagram

6. Mathematical Model:

Admin Side Algorithm:

1. Registration:

   StoreAdminDetails(adminDetails

2. Login:

   if (Verify Login Credentials(admin Credentials) = = false)
   return to Registration
   else
   Proceed to Add Station Details.

3. AddStationDetails:

   AddStation(stationInfo).

4. UpdateSlot:
   UpdateSlotInfo(slotDetails)

5. Logout: TerminateSession()

User Side Algorithm:

1.Registration:

StoreUserDetails(userDetails)

2.Login:

if (Verify Login Credentials(user Credentials) == false)

return to Registration

else

Proceed to ShowNearestStation

3.ShowNearestStation:

NearestStations =

FindNearestStations(userLocation)

DisplayNearestStations(NearestStations)

4. SelectStation:

SelectedStation=

UserSelectsStation(stationChoice)

5. BookSlot:

SlotReservation

ReserveSlot(SelectedStation)

6.OnlinePayment:

MakePayment(SlotReservation)

7. Logout:

TerminateSession()

7. Conclusion:

Our solution is a fresh take on the EV charging reservation function. In order to reduce the overall travel time, including waiting time, we have developed a smartphone application to address the issue of electric vehicle charging wait periods at public charging stations. To fulfil the EV driver's request for recharging, we suggest developing a communication system based on the idea of the MVC design pattern. The drivers can check the times that the charging stations are open, select the hours that work best for them, and make a reservation. By lessening the fear of range it promotes the usage of electric vehicles and lessens greenhouse gas emissions, both of which are good for the environment. In addition, these technologies produce insightful data that opens up business prospects and helps the electric vehicle market expand. To guarantee that these systems succeed in transforming electric transportation, it is imperative to address issues like equitable access, charging infrastructure management, and seamless user experiences.

8. Future Scope:

1.Global Expansion: EV booking systems are expected to penetrate new markets, particularly in developing nations.

2.Integration with Smart Cities: These systems, which optimise transport and traffic, will be essential to smart city initiatives.

3.Multi-Modal Transportation: In addition to automobiles, users will be able to utilise public transportation, bikes, and electric scooters on one platform.

4.Advanced Charging: More stations and quicker charging technology will lessen range anxiety.

5.Subscription Models: It's possible that monthly payments for limitless EV access will become the norm.

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