

Electric Vehicle Charging Station Finding App

Sumit S. Muddalkar¹, Nishant S. Chaturkar², Khushal D. Ingole³,

Shreyash B. Wadaskar⁵, Rahul B. Lanjewar⁵

Project Guide, Department of Information Technology¹

Project Group Leader, Department of Information Technology²

Project Group Member, Department of Information Technology^{3,4,5}

Shri Sant Gajanan Maharaj College of Engineering, Shegaon, Maharashtra, India

Abstract: We are living in 21st century where all the work is done using technology and has become an integrated part of life. In this article we proposed the design and implementation of an electric vehicle (EV) charging station finder application developed in android studio using Java and Kotlin language. Due to the limitation of electrical power distribution network, Electric Vehicles charging stations are limited and to find them is hard for new EV owner. In order to provide information to users about the charging stations and to help user to navigate, it was also created a mobile application to help the EV owners on these processes. This Proposed EV finder Application helps EV owners to locate a charging station near them and to plan a journey and with many features.

Keywords: Android Application Development, Kotlin, Java, In-Built Map, Navigation

I. INTRODUCTION

New industries are emerging, like Electric Vehicles (EV). As in India Electric vehicles Sales are increasing. As mentioned in a below chart.

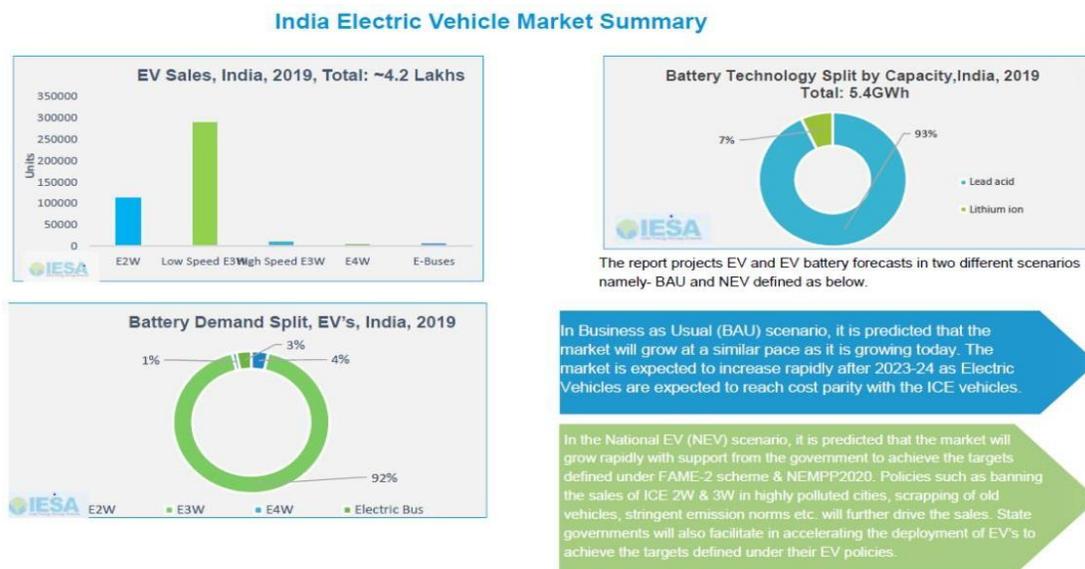


Figure 1.1: Indian Electric Vehicle Market Summary

As of now electric charging stations are limited in India due to which people can't find the right charging station which will save their time and money. EV charging stations requires space like parks, malls, societies. For private and semi-public charging stations, this space is available in the parking areas of the societies, apartment buildings, or of commercial or public or institutional areas. Due to this there is more difficulty for EV owners to find charging stations nearby them.

The problem is not only to find the charging station but also to charge it quickly because of the time required to charge the EV's. This leads to inconvenience of EV users as requires a lot of time so need of slot booking is require in the charging of EV's. As electrical vehicle industry is growing in India and less charging stations are available India and also new

registrations of charging station is growing so there is no availability of these growing charging station on virtual Maps. This leads to inconvenience of user for finding charging station virtually.

When a customer buys an electric car, the maintenance of these cars is not like the ordinary cars. One have to seek some help such as an Electric vehicle charging station finder app to find charging stations. An electric vehicle charging station finder app can save our time to find these charging station rather than search independently. One cannot find charging stations like the petrol or diesel or CNG station which are available everywhere. Due to this problem we have to plan the refuelling (charging) of these cars, but with the help of our apps which directly navigate us to nearby EV charging stations. In this article, we will be going through every aspect of an Electric vehicle charging station finder app.

An Electric Vehicle Charging Station Finder App will show the nearby location of charging across stations across our locality as well as nearby your destination. We will get various information about the stations such as how many ports are available and how variety of chargers available at that station. The app provides, real-time availability of the stations, photos of the stations, and cost of the charging of car at the station. The users can contribute to app also by adding a new electric vehicle charging station as they discover.

In this article we will primarily focus on the basic idea of our project which we are going to develop. To give you our project's basic idea we have organized this paper in chapters; second chapter is literature survey which includes several documents, manuals, analysis papers which are associated with our plan of the project, third chapter focus on the method which we will going to follow during implementation of our project, and fourth chapter is technology stack, which focus on technologies we will be using during our project, fifth chapter is discussion, in which we will discussing in what manner we will be working on this project. Finally last we have focus on the future work and conclude the statement how we are going to make this project ready for public usage

In this project we will design and develop an app which will find nearby charging stations of users locality. The app will show all nearby electric vehicle charging stations. The user can directly navigate to this charging stations. This app will provide a facility of booking slots for charging the Electric vehicle of the users based on the type and charging port of their vehicle in their convenient time slots. This app will save a lot of time of Electric vehicle owners.

In this project we will develop an app which will be helpful for Electric charging station owners (Vendors) also. This app will give all booking of users for charging their vehicle at the vendor station. This app will provide comfortable and easy to use interface for user as well as for vendor.

II. LITERATURE SURVEY

1. Design and Implementation an Online Location Based Services Using Google Maps for Android Mobile By Dr. Omar A. Ibrahim, Khalid J. Mohsen.

This paper introduces an application for android mobile, which is implemented to provide the android mobile user to add, remove and review specific locations on the online map. The proposed applications also presents the basics navigation operations like showing directions with the optimal path between source and destination and calculating the distance and expected driving time.

Google Maps APIs, Google Direction APIs, PHP, JSON and MySQL have been integrated and used in this application to obtain solutions. [7]

2. The Study and Implementation of Mobile GPS Navigation System Based On Google Maps By H. Li, L. Zhijian

Google Maps API provides a number of utilities for adding individual content to the google maps. Google Maps API is a set of application programming interfaces that lets us talk to its services. It will allow us to build simple apps to very sophisticated location-based apps for Web, iOS, and Android. [2]

3. GPS-Based Mobile Cross Platform Cargo Tracking System with Web-Based Application By A M Qadir , P.Cooper

Working of Web based application by using Global Positioning System (GPS). GPS is a system of 30+ navigation satellites circling Earth. We know where they are because they constantly send out signals. A GPS receiver in your phone listens for these signals. Once the receiver calculates its distance from four or more GPS satellites, it can figure out where you are. [3]

4. API Recommendation System for Software Development By F.Thung

APIs simplify how developers integrate new application components into an existing architecture, they help business and IT teams collaborate. Business needs often change quickly in response to ever shifting digital markets, where new competitors can change a whole industry with a new app. [4]

5. Smart Electric Vehicle Charging System João C. Ferreira, Vitor Monteiro, João L. Afonso, Alberto Silva Member, IEEE

In this work is proposed the design of a system to create and handle Electric Vehicles (EV) charging procedures, based on intelligent process. Due to the electrical power distribution network limitation and absence of smart meter devices, Electric Vehicles charging should be performed in a balanced way, taking into account past experience, weather information based on data mining, and simulation approaches. [8]

III. METHODOLOGY

We come up with the idea to design an Electric vehicle charging station finding app which facilitate a pleasing experience to the user with its unique features. In this section we discuss the method selected to complete our project. Our team searched for a variety of references related and have some linked with the app then sorted out the references that are together to pick references that are related and by the purpose of this paper. The search method is carried out by referring related keywords and sorting methods is completed by studying the discussion topics from each reference and choosing which may be used for the process. After filtration, we have started to create ideas and designs for developing this app. Our team has started developing app by combing ideas from selected references and applying them in order as per the need of our project.

Our planned EV finder app contains firebase email authentication, navigation system, slot booking and deletion system, profile management user as well as vendor, online payment system, real time availability of electric vehicle charging stations, addition of new stations and booking maintenance. Below are the basic function a user and vendor can do.

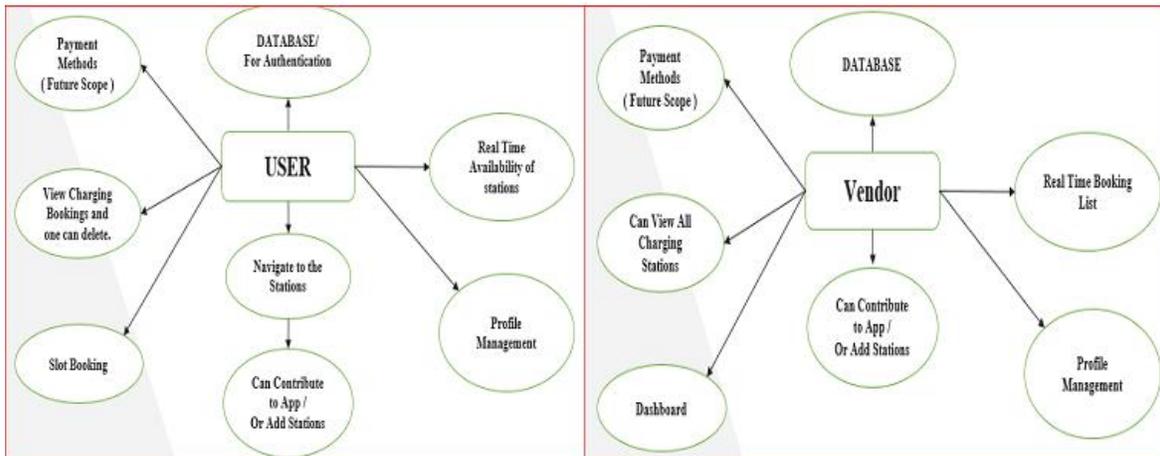


Figure 2.1: Use and Vendor Feature Chart

User can interact with:

- Map and navigate also
- Can Book Slot
- Can Delete slots
- Can add Stations.

Vendor can interact with:

- Booking List
- Can Delete Bookings
- Can Add Stations

3.1 Profile Selection: User or Vendor

On opening of app firstly we have to choose the user (Electric vehicle owner) or vendor (Electric vehicle charging station owner) and have to login if already register or sign up if not. At the backend firebase email authentication process is going on so that a valid register user is logged in.



3.2 User

A. Map Activity

On selecting user and logged in into the app the first activity is map activity .This page have the Full in built Map and have markers of all available stations on map and a separate list of them also. The user can select their nearby station.

1. Station

On clicking the nearby station this activity opens. This activity has the all information of station such as image of station, location of station, Distance of station from users live location, Number of ports available at this station, Cost of charging the EV per hour, booking the slot feature.

2. Slot Booking

On clicking the book slot this activity opens. This activity has booking details to be filled to book slot for charging such as Car company ,car model , type of charger used to charge car , time of slot for charging.

3. Navigation Feature

This feature is to navigate the user directly to the station from user's current location. This open the google maps and directly starts the turn by turn maps activity of google maps.

B. Booking List Activity

This is the activity which has data of all users booking details at the charging stations and from here user can also delete booking at the specific stations.

C. Profile Activity

1. Contribute Feature

This feature allows the user to add the new stations to the map and to the database of the app. This feature helps to add new stations as EV industry is growing in India and new stations are opening in India.

2. Profile

This has all information of user such as name, live user location and you can edit it also.

3.3 Vendor

A. Dashboard Activity

It has the total charging income of vendor from the bookings. It also has the number of available ports at the charging station.

B. Station Activity

It has all the stations list of particular vendor. A vendor can add as many station as he want with the valid sources. For adding a new station vendor requires GST number of station, station image, station location, name of station and charging cost of it per hour. Each station has all booking list of that selected station. A vendor can also delete the booking of user if necessary. Vendor also has the Profile Activity same as the user such as Profile having name and location of the vendor and vendor can also edit its profile details.

C. Profile

Both the user and vendor has the same information about the app in the about us section in the Profile Activities of them which will give the basic information of the app to the user and the vendor.

IV. TECHNOLOGY STACK

In this section we will study about various software parts that were used while designing this application

Android Studio: Android Studio is an IDE which provide environment, where we can build apps for android phones, tablets, android OS, android TV's. The android studio interface is easy to understand and as well as efficient to use. The well-structured code modules of the android studio allow you to divide your project into well-structured format that we can independently build our project, test and debug it also.

- **Kotlin:** Kotlin is used to build the native android apps. Kotlin is used for many different kind of application developments like on server-side, android application, on client-side web. With the kotlin one can work in native and can support for other platforms such as systems which are embedded, Mac-OS.
- **Java:** Java is the widely used programming language. Java is used for a wide range of platforms to build the applications. Servers, mobile phones, desktops, tablets all uses java and developers can develop java-based applications for any of these platforms. Java can also be used for Blu-ray players, televisions, and web browsers.
- **Firebase:** Google Firebase is a software which is used for the application development of the iOS, android and web apps. It is a google-backed application development software. Firebase provides services tools and support for real time tracking systems, fixing of the app crashes, product experiment, reporting of the app crashes.
- **Firebase Authentication:** Firebase Authentication provides backend services for the authentication of users of the app. It provides service of authentication in different format such as passwords authentication, phone numbers authentication using OTP, organizations identity providers like Facebook, Twitter and Google and more. It provides easy SDKs to use and already ui libraries also.
- **Firebase Real-Time Database:** Firebase Real-time Database is a cloud database that provides services for iOS, android, C++, unity, web platform. Real-time means if you change anything in data then it will be reflected immediately across all the platforms and devices within milliseconds.
- **Google Play Services:** Google Play services provides a large set of SDKs on android to help us to build our app, to increase privacy and security, engagement of the users, and grow your apps. These SDKs are unique. These libraries require a thin client library to be included in our app. At runtime, the client library communicates with the packages of the SDK's implementation and footprint in Google Play services.
- **Google Maps API:** It is a set of API (application programming interfaces) that provide the communication bridge to the google various services. It will help us to build simple android, iOS apps to very complex apps which are based on real time location for android, web and iOS.
- **Google Place API:** The Places API (application programming interfaces) is a service which provides information about places using HTTP requests. Prominent points of interest like establishments or geographic locations are referred as places in these API's.
- **Google Direction API:** It is a set of API (application programming interfaces) that provide the communication bridge to the google various services. It provides to navigate to the destination from the source. It will help us to build simple android, iOS apps to very complex apps which are based on real time location for android, web and iOS.
- **Framework - MVVM:** It is a Model-View-View-Model (MVVM) a design pattern at the client-side. It provides guidance to build the structure and design of our code to achieve "Separation of Concerns". The implementing of MVVM requires a different way of thinking about the functionality and structure of our application.

V. DISCUSSION

The concepts and methodologies that we will implement in the way, so we will have the interaction with the app directly and it will be very interactive, reliable and easy to use by the users as well as by the vendor of electric charging station. The architecture will be adopted to develop and deploy many services like real-time location finder, Google map, Navigation, slot booking and management and profile management.

With all of these services app will be more interactive and will be more efficient as we get more data on the electric vehicle charging stations. The user will have easiness to these station to book and to navigate directly to these stations. This will increase the business of the vendor also.

These project has a great future scope as Electrical vehicle Industry is growing in India and will have more opportunities. In future scope we can also add subscription models to these app as more user join it. We can provide passes and scratch cards to user to spend time at cafes, theatres, malls to spend their time until their vehicle is charge.

VI. CONCLUSION

The main purpose of the project is to develop a useful product for the EV users which will be very convenient for them. This app will not only provide service to the user, but it will also be used by the vendor (Electric station owners) as an interactive system. It can also generate more data of user which owns the electric vehicles and also the vendors which have charging station.

By using this one can used to find as well as to navigate to stations. This app will also be expanded in the future as a commercial product with more features that will also use subscription packs and as well as features like charge and chill which will generate more revenue.

REFERENCES

- [1]. Location Tracking Using Google Geolocation API Monika Sharma, Sudha Morwal.
- [2]. The Study and Implementation of Mobile GPS Navigation System Based On Google Maps H. Li L.Zhijian.
- [3]. GPS-Based Mobile Cross Platform Cargo Tracking System with Web-Based Application. A M Qadir, P.Cooper.
- [4]. API Recommendation System for Software Development F.Thung.
- [5]. Trip Planning Route Optimization with Operating Hour and Duration of Stay Constraints Wai Chong Chia*, Lee Seng Yeong, Fennie Jia Xian Lee, Sue Inn Ch'ng.
- [6]. Traffic and Mobility Data Collection for RealTime Application J. Lopes, J. Bento E. Huang, C. Antoniou, M. Ben-Akiva.
- [7]. Design and Implementation an Online Location Based Services Using Google Maps for Android Mobile Dr. Omar A. Ibrahim1, Khalid J. Mohsen2.
- [8]. Smart Electric Vehicle Charging System João C. Ferreira, Vítor Monteiro, João L. Afonso, Alberto Silva Member, IEEE