

EVTHON: PLATFORM FOR ELECTRIC VEHICLE OWNERS

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Abstract— Electric vehicles (EVs) originally appeared in the mid-19th century, when electricity was one of the favoured means for motor vehicle propulsion, providing a degree of comfort and ease of operation that gasoline cars could not match. In this work, we create a virtual community for electric vehicle users to assist them cope with range anxiety. The initial step was to organize the data on charging station locations for vehicle routing. The information was acquired from a variety of sources. Google Maps SDK was used to route the travel through the recharge stations. ANDROID was used to create the entire platform.

Keywords—EV(Electric Vehicle), ICE(Internal Combustion Engine), EVRP(EV Routing Problem), NoSQL, JSON, API, Android (key words)

I. INTRODUCTION

For many years, the automotive industry has been undergoing significant economic and environmental changes. This has led to the gradual electrification of automobiles, which allows for lesser harmful emissions on the one hand and cost savings on the other due to rising fuel prices [1]. Electric automobiles, which were first introduced more than a century ago, are gaining popularity for many of the same reasons they were when they were first introduced. Electric vehicles entered a type of technological abyss during the next 30 years or more, with little progress. Demand for alternative fuel vehicles was limited by cheap, plentiful gasoline and ongoing improvements in the internal combustion engine. [2] Due to advancements in battery technology and a desire to reduce greenhouse gas emissions and improve urban air quality, an electric vehicle manufacturing renaissance bloomed in 2008 [3]. Charging an electric automobile is possible at a number of charging stations, which can be found in both private and public spaces. In India, a unique mix of factors that favour a sustainable transportation paradigm have created an opportunity for EV adoption over ICE vehicles to accelerate [4].

A long origin destination (OD) journey frequently demands many recharges for an electric vehicle (EV) navigation framework, which distinguishes it from conventional vehicles. Because of its high charging efficiency, rapid transient reaction, and short charging time, fast charging is an appropriate charging solution for multiple charging. Fast charging of EVs during peak hours, on the other hand, may overload the distribution grid [5]. This paper serves the purpose of presenting an android based platform

for EVs to help the users to overcome the most basic problem, i.e., Range Anxiety.

II. RELATED WORK

Some research has been done on electric vehicle navigation. Sachenbacher et al. (2011), for example, investigated an energy-optimal routing issue that took into account recuperation, battery limitations, and other factors. Artmeier et al. looked at the same issue (2010). EV routing is formulated as a restricted shortest path problem with hard and soft constraints by both of them. They concentrate on travelling over short distances with only one charge and treat EVs as traditional vehicles with capacity limitations and recovery [5]. So far, research in this sector has focused on passenger car applications. The lack of interoperability of different charger plugs is still an unsolved problem in the charging process [6]. When compared to diesel truck VRP, it has been observed that EVRP has equivalent travel time and distance, but an EV's extended en-route re-charging time amounts to a considerable increase in labour required. Though the idea of green routing appeals to EV because it is a zero-emission car. Finally, the proximity of charging stations to customer locations has a significant impact on routing tactics [7]. The main goal of this paper is to first make available all of the data sets of local and major charging stations across India, and then to assist users in routing to the nearest charging stations within a radius of their current position. Also, to obtain feedback on the stations by establishing an existing community of EV owners in India.

III. DATASET

The project's key effort in moving forward was gathering data from numerous sources and manually organizing the disparate data. The information was acquired from a diverse source, including plugin India, Hyundai Tata Mg, and community data, which was carefully aggregated and converted into a useful format. These data were then stored in Firebase (Realtime Database), which is a cloud-hosted database.

IV. INCORPORATED TECHNOLOGY

A. FIREBASE

Data is synced in real time across all clients and is available even if your app is turned off. The Firebase Realtime Database is a database that is hosted in the cloud.

Data is saved in JSON format and synchronized in real time with all connected clients. All of your clients share a single Realtime Database instance and are automatically updated with the most recent information when you use our iOS, Android, and JavaScript SDKs to create cross-platform apps. Data is stored locally, and real-time events continue to trigger even when the user is offline, providing a responsive experience. Only operations that can be completed fast are allowed in the Realtime Database API. [8] The proposed application uses Firebase for storing and manipulating data of the various local charging stations.

B. GOOGLE MAPS API

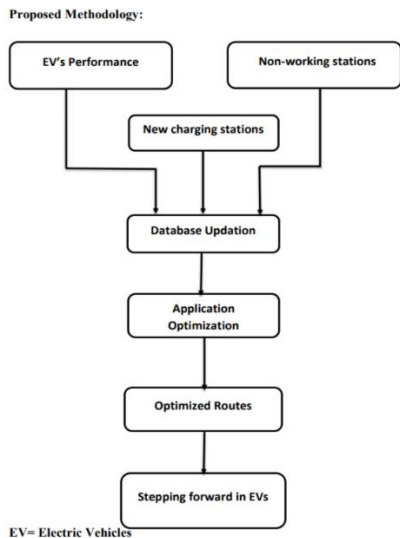
You can use the Maps SDK for Android to add maps to your app that are based on Google Maps data. Access to Google Maps servers, data download, map display, and response to map motions are all handled automatically by the API. You can also utilize API calls to customize a basic map by adding markers, polygons, and overlays, as well as changing the user's view of a specific map area. These objects give users more information about map places and allow them to interact with the map. [9]

C. ANDROID

Android Studio is the official Integrated Development Environment (IDE) for Android application development. In addition to IntelliJ's sophisticated code editor and developer tools, Android Studio provides additional capabilities to help you build Android apps faster. [10] With the growing availability of online geographic data, mobile navigation is becoming increasingly popular [11]. The platform presented in this article uses ANDROID's characteristics to build an underserved community of electric vehicle owners and make EVs a mainstream mode of transportation in India.

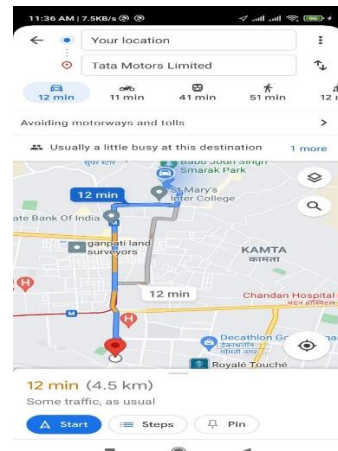
V. PROPOSED WORK

The proposed android platform for electric vehicle owners will feature the modules described below, which are briefly outlined to help the EV community flourish.



A. NAVIGATE MODULE:

The Navigate part is the application's core component, and it will be in charge of guiding the EV from a chosen source to a chosen destination, enrouting in the most efficient manner possible and so reducing range anxiety.



src/debug/res/values/google_maps_api.xml

```

<resources>
  <string name="google_maps_key"
    templateMergeStrategy="preserve"
    translatable="false">AIzaSyAUGjXx0l_UW8NUWfbn
    KCEq_bvLibnht1Q</string>
</resources>
  
```

B. LOCATE MODULE

The Locate option of the application's menu will be selectively used for locating/finding new charging station within a desired range of the user's EV's capacity. The below screenshot shows the nearest charging station within the user's current location.



C. HELP MODULE

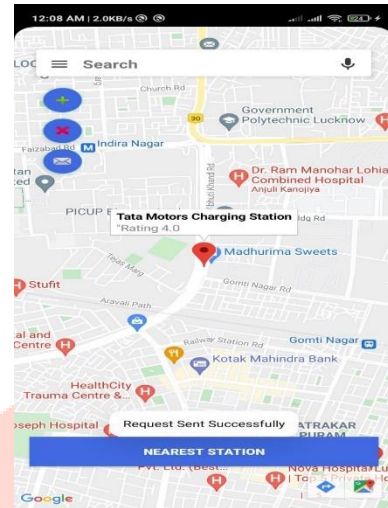
The Help option will give the user to “get help” in case of any emergencies, be it with charging or with almost any kind of emergencies.

src/main/java/com/example/mylocation/JavaMailAPI.java

```
package com.example.mylocation;
import android.os.AsyncTask;
import java.util.Properties;
import javax.mail.Message;
import javax.mail.MessagingException;
import javax.mail.PasswordAuthentication;
import javax.mail.Session;
import javax.mail.Transport;
import javax.mail.internet.InternetAddress;
import javax.mail.internet.MimeMessage;
public class JavaMailAPI extends AsyncTask<Void, Void, Void> {
    private final String email;
    private final String subject;
    private final String message;
    public JavaMailAPI(String email, String subject, String message) {
        this.email = email;
        this.subject = subject;
        this.message = message;
    }
    @Override
    protected Void doInBackground(Void... voids) {
        Properties properties = new Properties();
        properties.put("mail.smtp.host", "smtp.gmail.com");
        properties.put("mail.smtp.starttls.enable", "true");
        properties.put("mail.smtp.socketFactory.port", "465");
        properties.put("mail.smtp.socketFactory.class",
"javax.net.ssl.SSLSocketFactory");
        properties.put("mail.smtp.auth", "true");
        properties.put("mail.smtp.port", "587");
        Session session=Session.getDefaultInstance(properties,
new javax.mail.Authenticator() {
            protected PasswordAuthentication
getPasswordAuthentication() {
                return new PasswordAuthentication(Utils.EMAIL,
Utils.PASSWORD);
            }
        });
        MimeMessage mimeMessage = new
MimeMessage(session);
        try {
            mimeMessage.setFrom(new
InternetAddress(Utils.EMAIL));
            mimeMessage.addRecipients(Message.RecipientType.
TO, String.valueOf(new InternetAddress(email)));
            mimeMessage.setSubject(subject);
            mimeMessage.setText(message);
            Transport.send(mimeMessage);
        } catch (MessagingException e) {
            e.printStackTrace();
        }
        return null;
    }
}
```

D. ADD NEW STATION

The main menu's New Station option allows the user to add any new charging station to the routing function. The user can add any new charging station using the New Station option.



src/main/java/com/example/mylocation/MapsActivity.java

```
FloatingActionButton add =
findViewById(R.id.addStation);
add.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View v) {
        Toast.makeText(MapsActivity.this, "Creating
Request for new station", Toast.LENGTH_LONG).show();
        JavaMailAPI javaMailAPI = new JavaMailAPI(
            "evthon.connect@gmail.com",
            "User Station Suggestion",
            latLng.toString() + "user request for new
station location");
        StrictMode.ThreadPolicy policy = new
StrictMode.ThreadPolicy.Builder().permitAll().build();
        StrictMode.setThreadPolicy(policy);
        javaMailAPI.doInBackground();
        Toast.makeText(MapsActivity.this, "Request Sent
Successfully", Toast.LENGTH_LONG).show();
    }
})
```


E. REPORT FAULTY STATIONS.

The Report option of the menu will provide the facility to report any faulty/non-working stations into the navigation system and thereby preventing useless navigation routes.



src/main/java/com/example/mylocation/MapsActivity.java

```

FloatingActionButton rep =
findViewById(R.id.reportStation);
rep.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View v) {
        Toast.makeText(MapsActivity.this, "Creating
Report", Toast.LENGTH_LONG).show();
        JavaMailAPI javaMailAPI = new JavaMailAPI(
            "evthon.connect@gmail.com",
            "User Report Station",
            nearestL.toString() + "user report charging
station fault");
        StrictMode.ThreadPolicy policy = new
StrictMode.ThreadPolicy.Builder().permitAll().build();
        StrictMode.setThreadPolicy(policy);
        javaMailAPI.doInBackground();
        Toast.makeText(MapsActivity.this, "Report Sent
Successfully", Toast.LENGTH_LONG).show();
    }
});

FloatingActionButton con =
findViewById(R.id.contactUS);
con.setOnClickListener(new View.OnClickListener()
{
    @Override
    public void onClick(View v) {
        startActivity(new
Intent(Intent.ACTION_SENDTO,
Uri.parse("mailto:evthon.connect@gmail.com")));
    }
});
}

```

CONCLUSION

The adoption of EVTHON will help promote electric vehicles as a mainstream mode of transportation, supporting in the transition to a more environmentally friendly development, according to this study. The community would undoubtedly flourish by assisting one another, paving the way for a new era of transportation. There has never been a better moment to switch to driving an EV, with exciting new technologies presently being researched that promise to reduce charging times to minutes, considerably increase range, and improve safety and automation features. As a result of the effective use of the navigation platform, a new network of charging stations will emerge. The network might expand massively, obviating the need for non-renewable resources entirely. This application raises public awareness about the significance of adopting electric vehicles in some form.

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