|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Team member** | **As a….** | **I want to be able to…** | **So that…** | **Actions** |
| Goutham | User of the App | Optimise the path along with certain filters that help promote personalisation. | Users can select additional personalisation like Charger type, Preferred charge speed, Cost, Amenities nearby, etc. | * Update/Develop EV Charging Station Locations * Use open street map data for amenities nearby. * Add datasets related to different charger types. * Develop Algorithm to determine path * Implement the algorithm in Python * Try to incorporate traffic data using his google maps API to plan route considering traffic as well. |
| Goutham | User of the App | See the possible availability of EV charging stations. | I can plan the route that has EV stations available at the time of travel. | * Gather historical data on EV station usage * Perform time series analysis and use Machine learning algorithms to predict the availability. * Use this for optimal route planning if possible. |
| Goutham | Company | See the demand for EV stations in a particular area | We can invest/setup a charging station in the particular area. | * Gather historical data of EV stations. * See trends in areas where new stations have been setup. * Use ML algorithms to predict new locations, considering the previous trends, usage, charge types, etc. |
| Goutham | EVAT Team | Store data in a database | We can maintain all the datasets in a single Relational database management system.  Also, record user search history. | * Setup a RDBMS. * Add all datasets using appropriate foreign keys to connect them. * Develop algorithms to store search history for further analysis. |

### Detailed Methodology

#### 1. Optimize the Path with Personal Filters

**Objective**: Enhance user experience by allowing personalized path optimization based on user preferences such as charger type, preferred charge speed, cost, and nearby amenities.

**Introduction**: Optimizing travel routes for EV users is crucial for enhancing their experience and ensuring efficient use of charging infrastructure. By allowing users to personalize their routes based on specific preferences like charger type, charge speed, cost, and nearby amenities, we can provide a tailored and convenient journey. Integrating real-time traffic data ensures that the routes are not only personalized but also dynamically adjusted to minimize travel time.

**Actions**:

1. **Update/Develop EV Charging Station Locations**:
   * Collect and maintain a comprehensive dataset of EV charging stations, including details such as location, charger type, charge speed, and cost.
   * Data Sources: Open Charge Map, PlugShare, and Google Places API.
2. **Use OpenStreetMap Data for Amenities Nearby**:
   * Integrate data from OpenStreetMap to provide information about nearby amenities such as restrooms, restaurants, and shopping centres.
   * This data helps users select routes with preferred amenities.
3. **Add Datasets Related to Different Charger Types**:
   * Gather detailed information on various types of EV chargers (e.g., Level 1, Level 2, DC Fast Chargers) and their distribution across locations.
   * Ensure the dataset includes specifics about charge speed and cost.
4. **Develop Algorithm to Determine the Optimal Path**:
   * Create an algorithm that factors in user preferences and constraints to optimize the travel route.
   * The algorithm should balance factors like shortest distance, availability of preferred charger types, cost efficiency, and proximity to desired amenities.
5. **Implement the Algorithm in Python**:
   * Develop the optimization algorithm using Python.
   * Libraries such as NetworkX for graph-based routing and Pandas for data manipulation will be useful.
6. **Incorporate Traffic Data Using Google Maps API**:
   * Integrate real-time traffic data to dynamically adjust routes for optimal travel time and efficiency.
   * Utilize Google Maps Traffic API for real-time traffic updates.

#### 2. Predict Availability of EV Charging Stations

**Objective**: Enable users to see the potential availability of EV charging stations at the time of travel, allowing for better planning and reduced wait times.

**Introduction**: One of the significant challenges for EV users is finding available charging stations during their travel. Predicting the availability of charging stations using historical data and machine learning algorithms can greatly enhance user experience by reducing uncertainty and wait times. By incorporating these predictions into route planning, users can be guided to available stations, ensuring a smooth and efficient journey.

**Actions**:

1. **Gather Historical Data on EV Station Usage**:
   * Collect extensive historical data on the usage patterns of EV charging stations.
   * Data Sources: Open Charge Map, PlugShare, and various utility companies.
2. **Perform Time Series Analysis and Use Machine Learning Algorithms**:
   * Analyse historical usage data to identify patterns and trends.
   * Develop machine learning models (e.g., time series forecasting models) to predict the availability of charging stations at different times.
3. **Use Predictions for Optimal Route Planning**:
   * Integrate the availability predictions into the route optimization algorithm.
   * Ensure the model updates dynamically based on real-time data to provide accurate predictions and route adjustments.

#### 3. See Demand for EV Stations in a Particular Area

**Objective**: Provide insights into the demand for EV stations in specific areas to guide strategic investment and setup of new charging stations.

**Introduction**: Understanding and predicting the demand for EV charging stations is essential for strategic investment and optimal placement of new stations. By analysing historical usage data and identifying trends, companies can make informed decisions about where to set up new charging stations. Machine learning algorithms can further enhance this process by predicting high-demand areas, ensuring that new stations are placed where they are needed most.

**Actions**:

1. **Gather Historical Data on EV Station Usage**:
   * Collect historical data on EV charging station usage and new station setups.
   * Data Sources: Open Charge Map, PlugShare, utility companies, and government reports.
2. **Analyse Trends in Areas with New Stations**:
   * Perform trend analysis to identify usage patterns in areas where new stations have been set up.
   * Use statistical tools to understand how demand evolves over time in these areas.
3. **Use Machine Learning Algorithms to Predict New Locations**:
   * Develop machine learning models to predict optimal locations for new charging stations.
   * The models should consider historical trends, current usage patterns, population density, traffic flow, and types of chargers.

#### 4. Store Data in a Relational Database

**Objective**: Centralize all datasets in a single relational database management system (RDBMS) to ensure data integrity and facilitate easy access. Additionally, record user search history for further analysis.

**Introduction**: A centralized relational database management system (RDBMS) is crucial for maintaining data integrity and providing easy access to datasets. By storing all relevant data, including user search history, in a single RDBMS, we can ensure efficient data management and facilitate in-depth analysis. This approach supports the development of new features and enhancements based on user behavior and preferences.

**Actions**:

1. **Set Up a RDBMS**:
   * Choose a suitable relational database system like MySQL, PostgreSQL, or SQLite.
   * Design the database schema with tables for users, EV stations, search history, and other relevant data.
2. **Add All Datasets Using Appropriate Foreign Keys**:
   * Import datasets into the RDBMS and establish relationships between tables using foreign keys.
   * Ensure that the schema supports efficient queries and data integrity.
3. **Develop Algorithms to Store Search History for Further Analysis**:
   * Create algorithms to log and store user search history.
   * Analyse search history data to gain insights into user behaviour and preferences, which can inform future feature development.

<https://www.nature.com/articles/s41598-024-56507-2>

<https://datasetsearch.research.google.com/search?ref=TDJjdk1URjJaRE15ZW5GNWJBPT0sTDJjdk1URnFjelU1Y3pGeWNRPT0sTDJjdk1URjJaRzFtWkY4eE5RPT0%3D&query=ev%20charging%20stations%20usage&docid=L2cvMTFuOHlkc2YzcA%3D%3D>

<https://datasetsearch.research.google.com/search?src=0&query=ev%20charging%20stations%20usage%20australia&docid=L2cvMTFuZzByenJ4Zw%3D%3D>

<https://espace.library.uq.edu.au/data/UQ_9c4d6d2/UQ9c4d6d2_OA.pdf?Expires=1722171604&Key-Pair-Id=APKAJKNBJ4MJBJNC6NLQ&Signature=Bsjx3Yg4CGd3jP3-yRBtbjGRX64qUOnU2tXn6PtSxrdwcKpnlPE-X0Val~50XDKaQ0x2uU~FS5EuDWacwNJlWw75gjVG9sdzixu5Bk1aSAYFVrMr-BwgKM~KiFX4MLrlOdqCx3rqivgZcWw3UnOs-fPEdI2De8zFwMnfT3R1k4uOUhnNWmKkhYNj-sHsoGQZ8drsggtlp8Yq1H-dv7i0Jw4BOoqLEftL6dMatF91ZLazzdpT34eRKLXOaFhLUI3xqSzZ7HzDhdXSshcMenW1G1rInr~63cPgUBF9DhJFbo9nN6I6rqkpirk0m-~D7KzALOWImNwP5ohmNXa~kCfdkg__>

<https://www.udemy.com/course/learn-how-to-extract-web-data-with-python-and-beautiful-soup/?utm_source=adwords&utm_medium=udemyads&utm_campaign=Search_DSA_Alpha_Prof_la.EN_cc.AU&campaigntype=Search&portfolio=Australia&language=EN&product=Course&test=&audience=DSA&topic=Data_Science&priority=Alpha&utm_content=deal4584&utm_term=_._ag_164459486561_._ad_696231493105_._kw__._de_c_._dm__._pl__._ti_dsa-1677974310676_._li_9071446_._pd__._&matchtype=&gad_source=1&gclid=CjwKCAjwnei0BhB-EiwAA2xuBpBtceEvgsbw4XuzxLWe7p6JPT7Ldm_drxegbCdHC4dEXnG9EKpveBoCdXQQAvD_BwE&couponCode=2021PM20>

<https://www.datacamp.com/promo/learn-data-and-ai-skills-july-24?period=yearly-per-month&utm_campaign=july_2024&utm_medium=pop-up&utm_source=campus>