Computer Science & Computer Engineering

Capstone II - Team 01 - Spring 2022
Vehicle to Grid – Energy Buy Back

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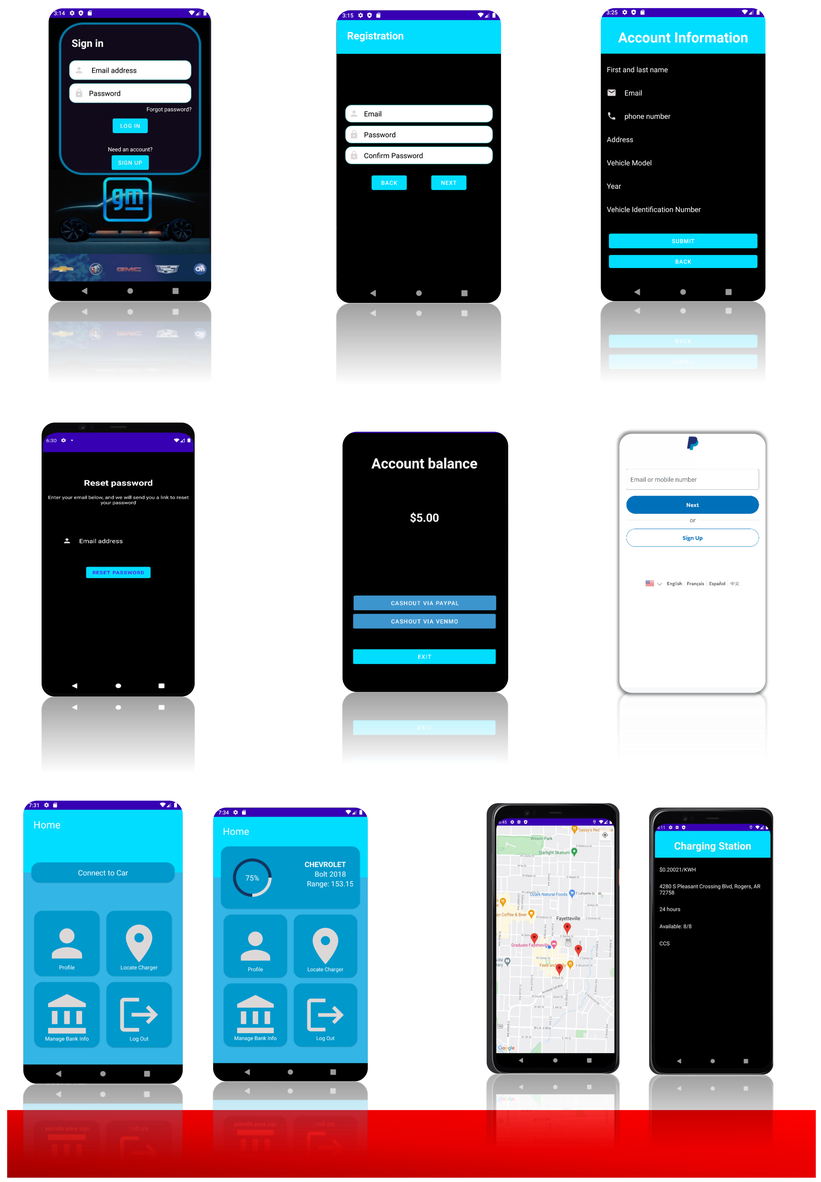
Introduction:

In the past several years, electric vehicles (EVs) have become increasingly prevalent. Additionally, infrastructures to support these vehicles, such as chargers are common in public places. Despite this, there is a lack of technology available to leverage the energy stores of these vehicles. EVs could serve as an additional power source during times of increased energy demand.
Events such as natural disasters can lead to power outages for several reasons, such as damage to infrastructure or increased energy demand. In such cases, EVs can act as batteries by providing unused, stored energy back to the grid. This would allow regions in the grid with increased energy demand to stabilize.
The objective of this project is to create a mobile application that enables EV owners/users to sell back energy to energy providers. Furthermore, the application would allow EV owners/users to identify areas of need and opportunities for selling back energy at different price points and facilitate some of the driver/car experience.

Design:

The app allows the user to:
- Set up an account.
- Manage account information.
- Track vehicle charge level.
- Locate charging stations.
- Identify grid areas of need.
- Link third-party payment accounts.

Technologies:
- **Android studio:** to create the application.
- **Google MAP API:** to get the charging stations locations.
- **PayPal API:** to allow user cash outs.
- **SmartCar API:** to retrieve a user's car information.
- **Firebase:** to save the user and car data, manage authentication, host functions.
- **Google cloud platform:** to host the application.
- **GitHub:** for source code control.
- **VS Code:** as an IDE.



Architecture:

Google Firebase is used to handle the app backend services. The platform's Authentication service was used for user authentication. As a result, user information was stored using the Realtime Database service. Functions were created and hosted through Firebase that allows the application to communicate with the SmartCar API.

The app was created through Android Studio, so it runs on Android devices. Several activities (screens) compose the app.

Results:

The app supports basic account functionality, such as account creation and editing account information. In addition, a user can connect to a vehicle and retrieve its charge level using the SmartCar API. This allows users to connect to vehicles across a variety of manufacturers. The app also allows users to locate charging stations and access relevant details.

Challenges:

Information regarding sell-back rates and energy needs is limited. As a result, it was difficult to implement functionality for locating need areas and displaying sell-back prices using real-world data. These features were implemented using mocked data.

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