Drivex

Design Report

1. Problem definition

1.1. Problem scope

The high volume of fuel-consuming cars in the cities has been increasing over the years, resulting in several negative effects both for society and the environment. Firstly, it is bringing pollution levels up to historical maximums and contributing to global warming through the greenhouse emissions of CO2. Moreover, the constantly congested traffic and lack of parking spots cause a good amount of people to move around in public transportation, while cars stay parked from Monday to Friday, not producing any usability. Furthermore, it is hard for a big part of the youth demographic to afford a car, and even if they can, they are not getting exposed enough to the real alternative of electric cars. There is a need to connect people looking for an easy and comfortable way of moving around the city with those who wish to obtain profitability out of their electric cars, while promoting the use of this type of vehicles for a healthier environment.

1.2. Technical review

DRIVEX presents an interactive online service with the ultimate goal to help improve the situations previously mentioned. During the last years, platforms such as *Lyft, Emov, Uber* or *Cabify* have experienced an astonishing growth thanks to the development of mobile applications that make car transportation more accessible. For that reason, the DRIVEX app has been designed as an intuitive digital environment, connected to the GPS location services and synchronized with real time traffic-monitoring. Anybody who wishes to utilize the service must create an account where they facilitate a phone number and upload their driver's (and, in case they want to set their car up for rentals, also their vehicle's) credentials. The app integrates several main and secondary functions explained ahead (design description), including the connectivity to a DRIVEX device that allows cars to be accessed through the app thanks to IoT technologies (internet of things).

1.3. Design requirements

In terms of the application, it must be completely accessible and functional with mobile data, and it must be placed in the App Store and Play Store with a size of less than 100 MB, including cache data. It must also ask the user for access to the location data for a complete experience. The servers must be daily checked and maintained by the IT cloud and cybersecurity teams to avoid crashes. The device must be ordered to an electronic IoT supplier under the following design conditions: attachable to the car's dashboard, 0.8 Kg, connectable to the dashboard's electronic system as a power font, tactile, 2.56 GB of

HDD. It must also come with an adaptable cable so that it can be fed by all electric cars and an installation guide must be developed and included for each model.

2. Design description

2.1. Overview

The main function revolves around the interaction between car owners and users through the app: in one hand, car owners can acquire a DRIVEX device (which can be ordered in the app's purchase section) and connect it to the car security and GPS location systems, making it recognizable by the system and accessible for other users. In the other hand, users can search cars available near them, consult the estimated cost of a trip depending on the route and destination and easily book a car of their preference. They may allow the app to use their credit card information so that the fee can be automatically charged once the trip is over. The connection between the app and the DRIVEX device, powered by IoT, will unlock the car door and automotive system of the car for the user who has booked it.

2.2. Detailed description

The app front-end, developed in JavaScript and PHP, presents a main interface with a map including the live location of the available cars, which is communicated by the DRIVEX device through IoT. Cars are identified with an encrypted ID so that they can be placed in the right database according to their status. The interface also allows the user to display the main features of the vehicle when clicking on it, such as model, mileage, area restriction or client reviews. When the servers detect the user has taken a car for a ride, the app will display the possibility to write a review. The DRIVEX device holds the function to store crucial legal information about the vehicle and its owner in its HDD, which can only be changed by the owner with their username and password.

Numerous subfunctions of the app allow both owners and users to explore more advanced possibilities. Using the 'route restriction' function, owners may restrict the area in which their cars can be driven (which is always shown on screen in the DRIVEX device for the driver) and get a warning notification in case the vehicle exceed these limits. They can request to have their car back at a certain location and time, as long as nobody is driving it. In this case, the system classifies the car ID number into a new database of unavailable items, hiding it for external users. Users who wish to make money by moving the car back to the indicated location can do so by registering as a facilitator. The servers process whether the user accessing the car is a particular or a facilitator to know if the fee should be charged or paid.

2.3. Use

The app must be downloaded from the App Store and every user must create an account where they facilitate their full name, contact information, payment information and driver's license and insurance. The types of profiles to choose from are: particular, facilitator and owner. In order to become an owner, a DRIVEX device must be ordered through the app, an address must be facilitated and crucial information about the vehicle must be uploaded (model, age, mileage, ITV card and insurance). The owner must follow the instructions on the installation guide to connect the device to the car dashboard for the vehicle to be detected by the system.

Legal conditions and terms of use must be highly considered. Bookings expire if the user who booked the vehicle does not get in it in a maximum of 30 minutes. The system will only allow users to access the car when located less than 10 meters away from it. If the user has an accident that results on damage of a car which does not have an insurance, then both driver and owner respond. Owners must keep their vehicle charged: users may help out by parking in public points where electric cars can be charged but they are never required. If the car is found out to be running out of charge by the DRIVEX device then it will be automatically removed from the system. Users will be charged over the estimated fee if they deviate from the calculated route or drive the car outside the restricted area (in this last case, their accounts will get suspended). If the DRIVEX device is harmed, it will indicate the user to park the car safely and send an alert to the owner. If the driver does not follow the instructions then the car could stop on its own.

Car documentation and insurance must stay inside the vehicle at all times it is available in the system. The owner must indicate their location to the driver in case they are asked for credentials. If the owner does not or the papers are either not found or found to be expired, the car will be banned from the system and the owner will hold responsibility. Same terms are applied to drivers and their documentation. If they are legally required to leave the car, the authorities will take care of it and the owner will be notified by the system and compensated by the user who carried the infraction.

3. Evaluation

After a series of tests conducted on an app beta prototype some changes have been made.

3.1. Overview

A beta of the app was built by the software engineers in order to conduct a simulation, using computers instead of cars as the items connected to some pre-ordered DRIVEX devices and, therefore, detected by the system. The battery life of the computers was found to be reduced up to a 60% due to the amount of functions that they had to carry out in order to keep feeding the device with data. More battery life means more distance that can be driven by an electric car, so the supplier was contacted and asked to include a built-in GPS function in the devices.

3.2. Description

Five main functions were tested for the app: the live synchronization with live-traffic systems for the main interface, the proper storage of the information introduced by each user in the database, the denial from the device to access a computer when located farther than 10 meters away, the automatic fade-out of computers running out of charge from the system and the ability of the filters to detect any false documentation. Once all of these were checked, the same procedure was conducted with 10 real cars and extended to all the specific functions.

3.3. Testing resources

Running servers, finished versions of the devices, GPS functionality and smartphones with internet access were necessary in order to conduct the procedures and get the product ready for launching

4. Conclusion

The device fulfills its goals, the app is functional and their connectivity is efficient. During tests they proved to stay updated, process data properly and execute the different features as they should. Electric cars can now be accessible to anyone registered and produce profitability for the owners, so DRIVEX solves the problem.

5. Bibliography

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