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IDENTIFYING DRIVER BEHAVIOUR THROUGH OBD-II USING ANDROID APPLICATION

"Alert today – Alive tomorrow Safe Driving - Save Lives"

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Engr. Muhammad Kashif Shaikh, Prof. Dr. Sellappan Palaniappan, Engr. Fayyaz Ali, Engr. Dr. Muhammad Khurram, IDENTIFYING DRIVER BEHAVIOUR THROUGH OBD-II USING ANDROID APPLICATION
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Keywords - Driver, OBD-II, android, brake, Bluetooth, Tracking, accidents, Wi-Fi.

Abstract

Purpose: To develop an Android application which will track your driving behavior and alert you about any irregularity or anomaly in your driving attitude to help avoid any catastrophic disaster.
Design/methodology/approach: The Android app will connect through OBD-II device and will track your ride with the help of Bluetooth and Wi-Fi connection.
Findings: The Android app successfully records the key metrics of the driving behavior. This data is not only available to access in real-time but also after trip is complete to be accessed later at any stage.
Originality/value: To create awareness about the disadvantages and different losses which are and could be face by any citizen of Pakistan due to rough driving, over speeding and sudden lane changing.

1. INTRODUCTION

The amount of vehicles is increasing day by day with the advancement of technology. Similarly, the number of amateur andunskilled drivers also increase who have no sense about driving and they are the main cause for most of the accidents. Driving accessories is instant need to remind drivers to correct inappropriate behavior. So, in order to overcome this cause, we are developing an Android application using OBD-II which will help and keeps you updated about how you are driving such as where u made unexpected brake, where u drive good or bad, and where you made over speeding. This papertries to utilize the OBD-II data to examine the elements that influence the driver'sperformance including speed, brakes, sudden lane changes, and hope that the results can be helpful to improve individual's behavior.

Some of the main offerings of the study are: The main objective of this proposed system is to monitor driving, detect anomaly and if unusual event arises such as over speed, it will alert the driver. The system is able to detect safe and dangerous drivers. It is of great importance to participants like insurance corporations (Nirmali*et al.*, 2017). In this paper, the regression models are used to suggest that the women are better drivers than men. Low risk of accidents is seen in female drivers which means that female drivers are less risky compared to men. While the effects of accidents on both men and women had the same vehicles, the effects of the accidents were the same. Pay-as-you-drive (PAYD), or Usage based Life Insurance (UBI) are policies linked to the use of cars. Most insurance companies would not discriminate between females and males in terms of different rates of penalties for their insurance policies because of current laws. We also do not suggest that age is a risk factor of accidents but the driver behavior and driving risk is important in the risk of accidents whether driver could be male or female (Ayuso*et al.*, 2016).

The rest of the paper is structured as follows: Chapter 2 discusses some of the related work in the field. Chapter 3 details the methodology used to develop the Android app. Chapter 4 presents and discusses the results. Chapter 5 concludes the entire study.

2. RELATED WORK

Driving data analysis includes driver behavior, driving data collection, driving algorithms and driving applications that would be useful for identifying the behavior of driver through different sensors, cameras, and different algorithms such as decision trees, Support Vector Machine (SVM), and most importantly the OBD-II device. This paper proposes identifying driving behavior using ADABOOST Algorithm and data preprocessing module which is Machine Learning, a branch of Artificial Intelligence. The mainelement of ADABOOST method is to generate a strong classifier by combining a lot of weak classifiers.Input: Dataset to train, Output: Strong classifier. We are collecting the driving data for the training set and then tested using the ADABOOST algorithm (Chen*et al.*, 2015). This paper proposes the use of OBD-II data of a vehicle information to examine the aspects that affects the driver's performancelike speed, accuracy, driver expressions, etc.

Vehicle data provided by OBDII (On Board Diagnostic) provides a data base for analyzing user driving behavior, which records vehicle data and driver behavior data during driving. The data gathered by OBD-II focused on dangerous driving behavior of the driver. This helps as an emergency driving; it will be notified through smart phones (internet connection) that warns to avoid any accidents. We calculate the possibility of dangerous driving by more than one km/min, which canraise the danger of dangerous driving. Classification method is used to predict the OBD-II data that is regression analysis which is a faster method. The data obtained from OBD-II contains four variables which are mileage(km), number of emergency brakes, maximum speed(km/hour), and driving time(hours) (Pan*et al.*, 2017).

In this paper we are detecting driving irregularitiesusing a large amount of vehicle data such as big data. Internet of Vehicles (IOV) makes it possible to gather data from several vehicles through the use of sensors, cameras, etc. Here we propose Safe Drive that uses state graph (SG) as a behavioral model. Each segment of driving is then compared with SG as an anomaly. Safe drive then evaluates on a cloud based IOV platform where different registered vehicles are connected. Safe drive then identifies different driving anomalies which would be very helpful in correcting their driving behavior where required. The results will be based on their driving behavior. Safe drive evaluates anomaly for each drive (Zhang*et al.*, 2017). Driving while distracted is one of the biggest reason ofaccidents on the roads. Driving while usingmobile phones is also a big cause of injuries and deathson roads.

This paper proposes to detect drivers who use mobile phones during driving which commonly causes accidents using a convolutional neural network (CNN) to detect these types of drivers which are also dangerous for passengers. Detecting driver's distraction can reduce and promotes safe driving. In order to detect distracted drivers who uses mobile phones during driving we record a driver's video through GoPro camera where every second of the footage is divided into 24 images. A deep learning algorithm is then applied on these images in order to train a distracted or non-distracted driver (Celaya-Padilla*et al.*, 2019).

This paper proposes a mobile application for iOS which is used to monitor driver's performanceusing measurements of acceleration and providesa response to drivers for improvement if necessary. The uncertainty and other issuesrendermobile phones less consistentthan other sensors. Therefore, we evaluatevital driving data given by a mobile phonein comparison with the reference data of acceleration from anautomobile. The smartphone appgathers data from multiple sensors likegyroscope, accelerometer, and GPS sensors. The data collected is recorded which outputs via trip profiles. Drivers can view their driving and also receives the feedback of their driving. This iOS mobile application is used for detecting critical driving events and it also reduces device and data transfer costs (Paefgen*et al.*, 2012).

This paper proposes a cloud based mobile application connected with OBD-II and Bluetooth to obtain real time driver behavior. This study uses complex event processor (CEP) which is used to discover and alertabout dangerous events in real-time (Andrade *et al.*, 2019). This is used to provide real-time alerts to the automobile using a CEP engine applied on a smartphone application. The app extracts real time readings from the vehicle's sensors. We can also use past data for detecting driving irregularities and forecast sensor malfunctions. This system can gather, store, and examine the vehicle data for a long time. The smartphoneapplication gathers the data using an OBDII to Bluetooth interface. Then the gathered data is preprocessed at the smartphone to monitor the events. Thenthis data is transmitted to backend cloud servers using the internet connection of the smartphone.

One of the drawback of this system is that it relies completely on the internet connection of the mobile phone. If the driver stops data transfer through the phone, this system will not work(Amarasinghe*et al.*, 2015). The new age of the Internet of Things (IOT) is driving the vehicles into the Internet of Vehicles (IOV) (Chen*et al.*, 2019). It is great for acquiring real-time automobile data for security purposes and anomalies detection. This paper proposes a STM32-based data acquisition system(DAS), where the real-time data will transfer to Controller Area Network through the OBD-II device. Then, the vehicle data is transferred and examine according to the OBD-II protocol, and then the vehicle status in real-time will be displayed on LED. Getting Vehicle data can help for safe driving and improves the driving.

The proposed system is based on STM32(a microcontroller), LED display, OBD-II, CAN, etc. By implementing this system on a real automobile, it can collect the automobile data in real-time. In future, the obtained real-time automobile data will be transmitted to the cloud server (Xie*et al.*, 2017). Distracted drivers are the main cause for the road accidents (Huang *et al.*, 2020). This could be due to many of the reasons such as stress, drunkenness, distraction using the mobile phones, etc. This paper proposes a system where real-time data is collected from OBD-II(ELM327) device and Bluetooth through an Android application. Mobile app transfers the collected data to backend CEP (Complex Event Processor) where system checks the historical trips completed by the driver to examine the behavior of driver. The system uses K-Means clustering, Adaboost algorithm and Markov Model to monitor driver’s behavior.

In this paper, we have used the XGBOOST algorithm which is a decision-based algorithm used to predict, solve unstructured data and in neural networks. This paper proposes a Logistic Regression and XGBOOST algorithm for forecasting the presence of risk of accidents. We use a database of 2767 drivers under the age of 30 and their driving activity is recorded through the telematics program. The contained information from the insurance company about each driving. Logistic Regression uses a general linear method that incorporates coefficients. The XGBOOST algorithm can only detect the size of those particles if the primary reader allows it. XGBOOST and many other optimization algorithms are commonly used due to their preciseestimates. While logistic regression and XGBOOST strive to estimate the incidence of accident claims without modeling procedures, the predicted effects of the XGBOOST algorithm were significantly higher than the computational rate (Pesantez-Narvaez*et al.*, 2019).

3. METHODOLOGY

System Design

Identifying Driver behavior is a helpful app which will be very useful to monitor your driving where ELM327 device is connected to a mobile device and transfer all the data through Bluetooth which extracts the data like longitudes, latitudes, engine load. Speed, time and much more. This information is recorded into the databases according to each driver and car and then can be viewed in real-time or with respective to each individual.

Figure 1 presents an overview of the proposed system:

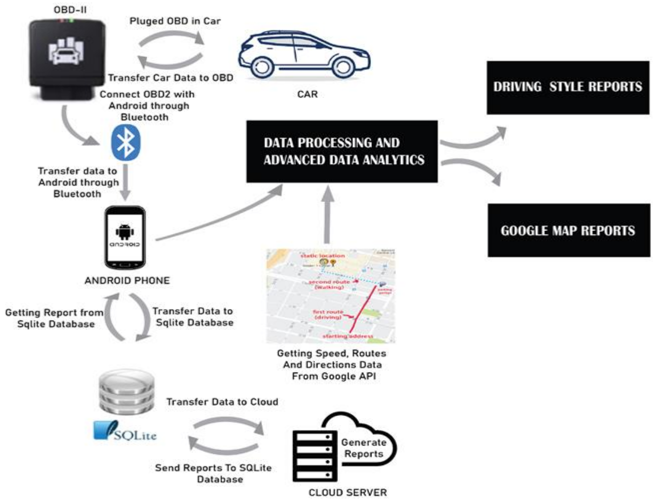

Figure 1: Overview of the proposed system

Software Architecture

The User will log into the system using a User Name and Password. The user then can choose Real time and offline mode. User can select according to their requirements. If user or driver selects Real time mode, then the device ELM327 is to be connected where data is transferred to mobile through Bluetooth and according to the trip driver behavior will identified and stored into the cloud for the generation of reports which can be also be viewed anytime.
In case, if user or driver selects offline mode he/she can only view and read reports.

Software Components Used

Java: Java is a class-based object-oriented programming language aimed at lettingsoftware designers to write once run everywhere (WORA) applications. Java is similar to C and C++ with fewer differences. Our application is being built through Java programming language.
SQLite: SQLite is a C-language library that implements SQL database engine. SQLite is the most used database engine in the world. SQLite reads and writes directly to normal disk files. SQLite comes with all smartphones and computers and is built innumerous other applications that are in use on a daily basis.
Android OS: Android is an open source operating system intended for mobile phones. It was developed using a customizedkernel of and other open source software, designed primarily for touchscreen devices such as smartphones and tablets. Our application is an Android app which can be run on android phones.
Windows OS: The development of this application we need Windows OS where we can develop our app and run on android phones.

4. Results

This section showcases the Android app in action. Figure 2 shows the screen that appears when you open the app for the first time. You first have to register yourself by giving the details asked in the figure 2.

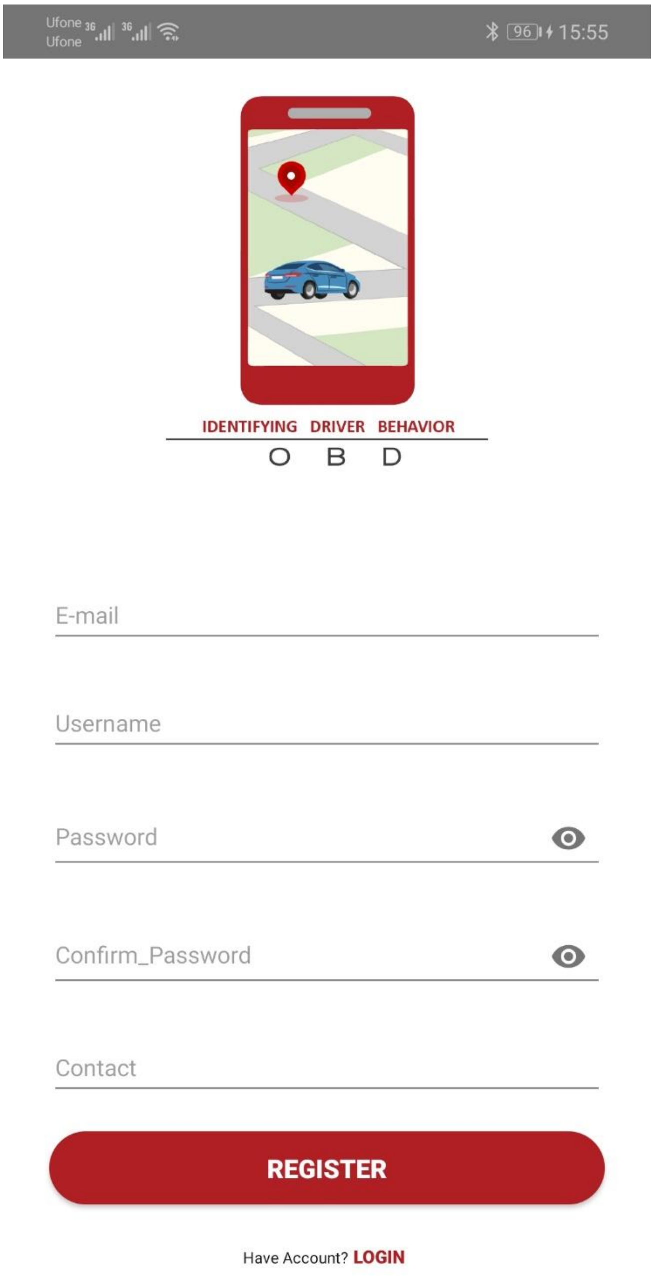

Figure 2: Signing in as a first-time user

After registering yourself, you start your trip and the app starts to record the key metrics associated with your driving. You can check these metrics in real-time by tapping the “about” button on your app. It opens up a page like shown in figure 3.

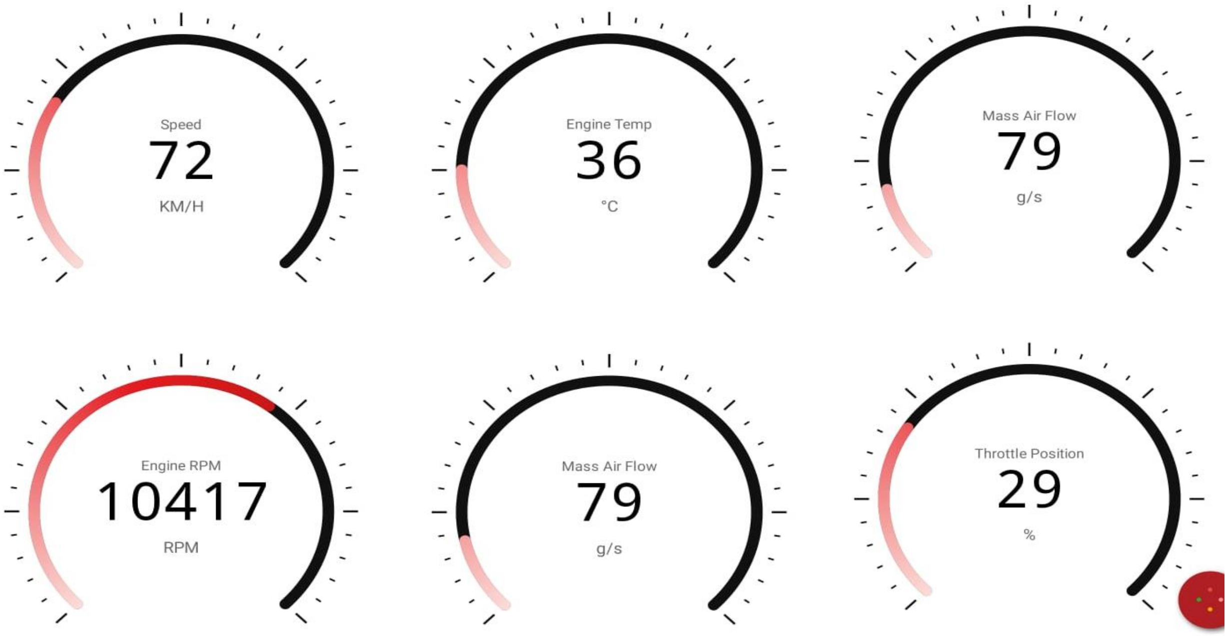

Figure 3: Key metrics related to your driving

As you can see in figure 3, the app shows you the speed, engine RPM, engine temperature, mass air flow, and throttle position of your vehicle in real-time. You can even check these statistics for any of your past trips by tapping the button "trips" and it will present you all the past trips. Select the one you want to see the details of, and it will show its statistics as seen in figure 4.

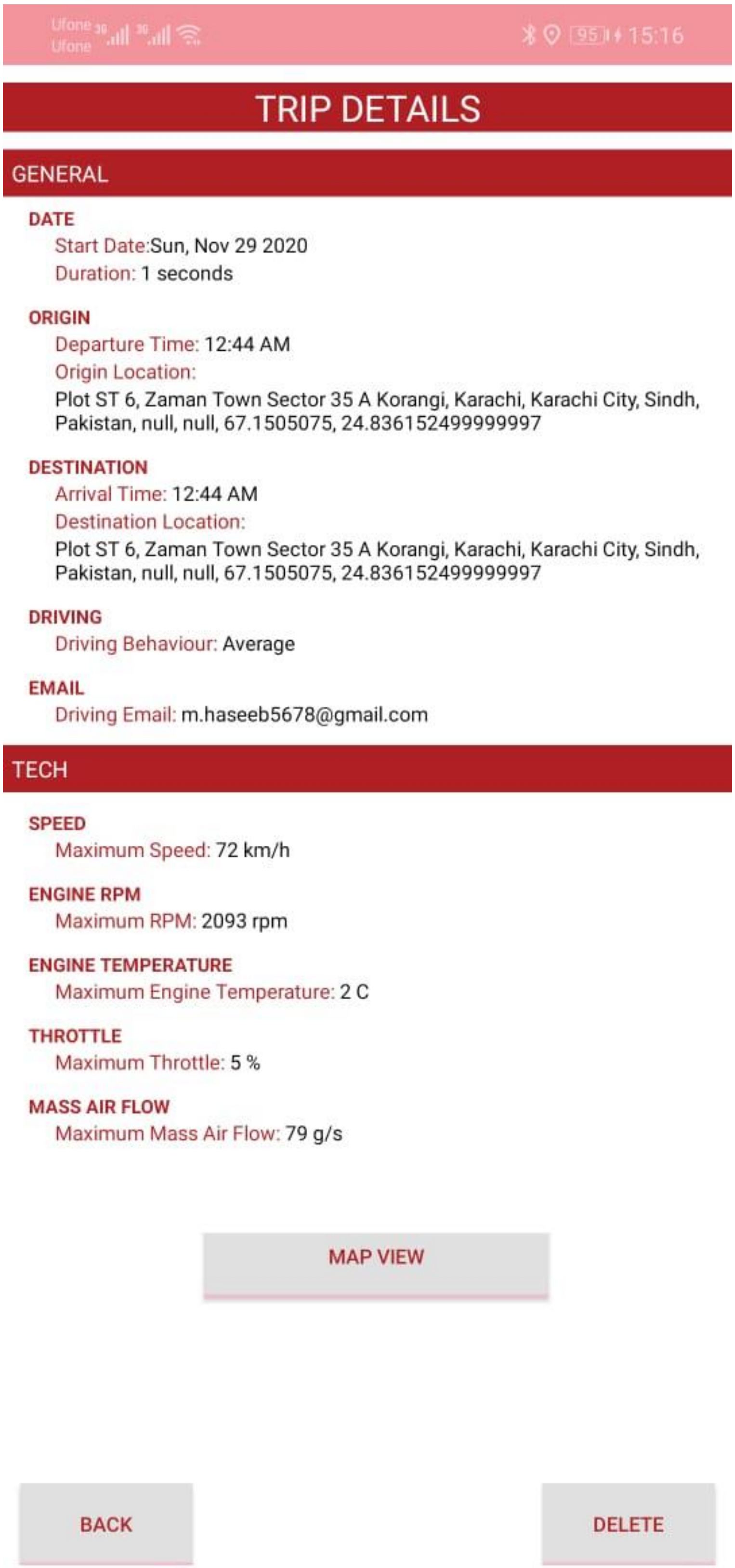

Figure 4: Details of past trips

As is apparent from figure 4, it not only shows the data about your driving but also other details like the date, origin, and destination of the past trip.

Finally, for first-time users, a useful help section is also added to demonstrate how to use the app. When you tap the “help” button on the app, a screen appears as shown in figure 5.

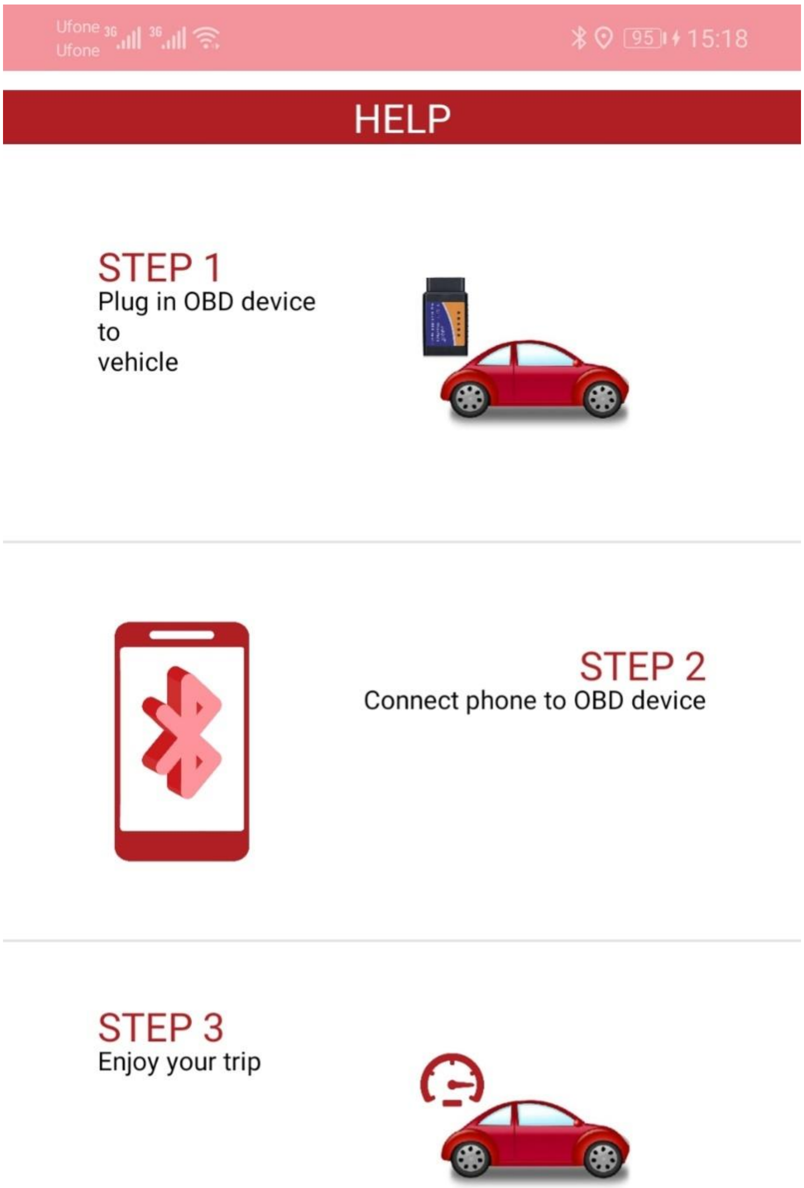

Figure 5: Help section

The app further explains the steps in detail. If you tap the step 1, you see the screen as shown in figure 6. As you can see, it explains how to connect the OBD device to you vehicle.

Figure 6: Step 1 explained

Similarly, figure 7 explains the step 2 with illustrations. As shown in the figure 7, it demonstrate how to connect your phone to the OBD device.

Figure 7: Step 2 explained

Finally, figure 8 explains the final step to start using your app. After connecting the OBD device to your vehicle and then the OBD device to your phone, you just have to press the "Start Trip" button and the app will start recording the key statistics of your driving.

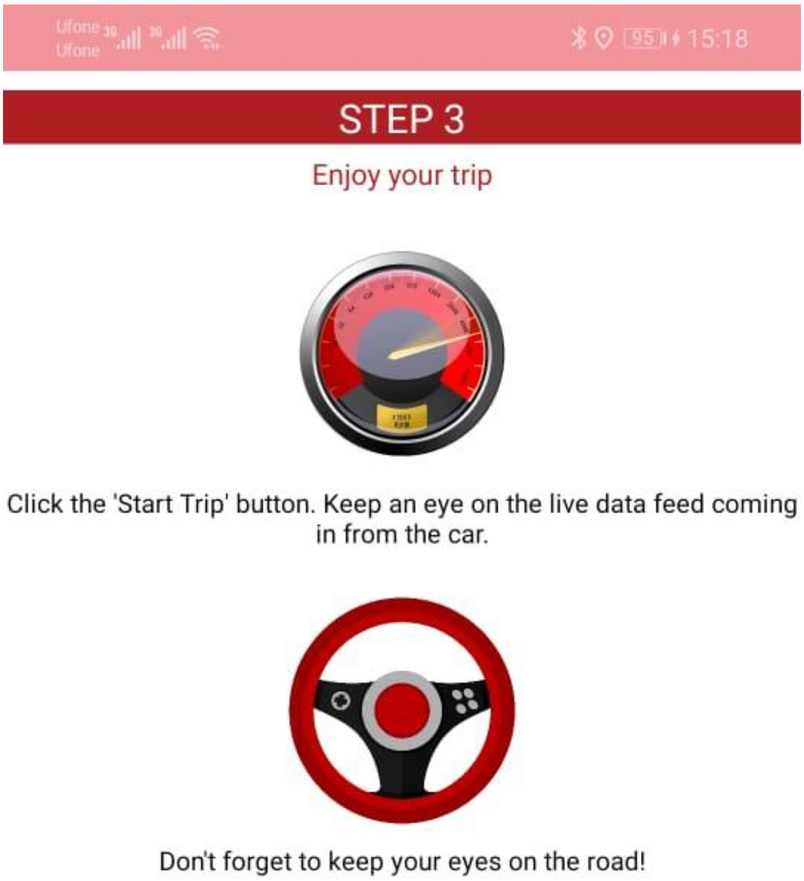

Figure 8: Step 3 explained

5. Conclusion & Future Scope

The purpose of this study was to develop an Android application which will track your driving behavior and alert you about any irregularity or anomaly in your driving attitude to help avoid any catastrophic disaster. The Android app connected through OBD-II device and tracked the driving behavior with the help of Bluetooth and Wi-Fi connection. The Android app successfully recorded the key metrics of the driving behavior. This data was not only available to access in real-time but also after trip is complete to be accessed later at any stage.

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