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Development of android based mobile application for Fleet management

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Abstract *- Mobile applications are software applications that are designed to run on smart phones, tablets, and other mobile electronic devices. In this generation of rapid technological advances, these applications have become one of the predominant tools we use daily both in our personal as well as professional lives. These software applications play key roles in facilitating many choices that are important in our today's society in business, communication, entertainment, education, medical, finance, travel, social, transportation and utilities.*

Significant usage of smart mobile applications can be potentially very beneficial, particularly in automobile travel mode to reduce travel time, cost, and vehicle emissions. In the end this would make travel safer and living environments greener and healthier. This paper presents architecture and implementation method carried in Development of android based mobile application specifically for Fleet management. The Application helps in tracking and monitoring the fleet using Integrated Development Environment (android studio), Hardware (includes GPS location tracker, vehicle status monitoring and GSM module) and server. Which helps in an interactive, fast and easy-to-use way to enable tracking, automation and real-time fleet management.

Keywords *– Hardware (GPS Tracking, vehicle status monitoring, GSM module), webserver, Android studio and Android applications.*

I. INTRODUCTION

Transportation concerns the movement of products from a source such as a plant, factory, or workshop to a destination such as a warehouse, customer, or retail store. Transportation may take place by air, water, rail, road, pipeline, or cable routes, using planes, boats, trains, trucks, and telecommunications equipment as the means of transportation. The goal for any Fleet owner is to minimize transportation costs while also meeting demand for products. Transportation costs generally depend upon the distance between the source and the destination, the means of transportation chosen, and the size and quantity of the product to be shipped. In many cases, there are several sources and many destinations for the same product, which adds a significant level of complexity to the problem of minimizing transportation costs. In this generation of rapid technological advances, the software applications have become one of the predominant tools we use daily both in our personal as well as professional lives. Transportation and logistics industry has become potential market for adopting robust custom mobile solutions. From start to end point of delivery, customers are quick to integrate technology for tracking their shipments.

The main reason behind the fierce demand in transportation and logistics mobile app development is the ability to offer real-time information of goods, employee productivity, vehicle status and more during transportation. The transport companies should get equipped with unique industry-specific custom features, logistics mobile apps can improve the supply chain management and process efficiency. The interrelationship of these decisions means that successful fleet management (including planning and scheduling) can help fleet owners to save on transportation costs [1].

With regard to all points mentioned above, the simple knowledge of developing android application which helps in

1. Real time GPS vehicle tracking: As fleet management is concerned; GPS tracking allows fleet owners and fleet managers to get quick information about vehicles on a map or in the form of reports. **2. Asset tracking**: Apart from vehicles, your fleet might be made of mobile devices such as trailers that need to be located easily, this is possible thanks to our battery-powered asset trackers. By using GPS technology, you can get location data of your mobile assets as well as generate useful reports that tell you the complete story of your fleet. **3. Driver Behavior**, driving style is an aspect you need to monitor as part of risk assessment and in an attempt to cut costs and emissions within your fleet. Our software allows fleet managers to get alerts and reports on dangerous driving events (speeding, harsh braking and rapid acceleration) as well as on idling**. 4.Fleet maintenance** is just another of the endless responsibilities of fleet managers, if you act promoting prevention instead of precautions you will notice benefits in your costs and in the lifecycle of vehicles (and you will ultimately boost fleet safety). The Application Perform helps you setting up a comprehensive maintenance schedule with the help of alerts and reminders.

To summarize, it is evident that digital solutions have swept deeply through transportation and logistics industry. Having a mobile app is an interactive, fast and easy-to-use way to enable tracking, automation and real-time management of logistics processes such as dispatch, inventory management, record storage, inspections and more.

The paper is organized as explained further. Section II provides a detailed literature survey on tracking in metro trains, trucks and buses transportation using GPS from Android phones, On board units and older hardware approaches. Section III goes on to give a brief description of the proposed architecture. Section IV presents an android based implementation of the proposed architecture. Section V and VI arises at the conclusion and the future scope of this architecture.

II. LITERATURE SURVEY

A number of studies in the past decade have collected evidence about the organizational impacts of apps. Fleet-management information systems, In-Vehicle Data Recorders evaluation (IVDR'S) first appeared in the trucking industry in the early 1980s, but were limited to routing and tracking. The role of information systems in monitoring and transporting people and goods increased during the 1990s and IVDRs began to collect more detailed data, providing essential tracking capabilities to fleet organizations. Reporting and analysis capabilities, however, were periodic and not in real time. The fleet-management industry is engaged in studying driver behavior for several reasons: reducing insurance costs, monitoring vehicles, optimizing fuel consumption, and identifying idle vehicles. Although effective and efficient fleet management is essential for gaining organizational competitive advantage, the literature about the impact of apps on fleet management is sparse, probably because organizations are reluctant to share data. IVDRs aim at encouraging drivers to avoid undesirable incidents. While these studies provide evidence that IVDRs improve driver performance, they shed no light on the impact of new technologies, in particular mobile apps, on driver behavior [1].

An application by the name MTC Bus Metro Suburban train [2] allows the public to track the buses in Chennai. The app enables public to update the location of the metro train in a click. The app will take the information from the passenger travelling in the metro by retrieving it through the GPS of the user's phone and update it as the current location of the metro. The other passengers can check the location updated by those who are travelling in the metro using the app. The real time tracking of metro is not possible in this application. If there is no updating made, it is not possible to know the location of the metro train. In the year 2008, Metropolitan Transport Corporation (MTC) had planned to implement vehicle tracking system by fitting On-Board Units (OBU) into the buses but due to financial crunch the idea is yet stagnant.

Automated Fare Collection (AFC) System also known as the Transit Smart Card System provides us an edge over the manual fare collection system by lowering labour costs and also increasing the efficiency of manual fare collection process. The desire to extract more information than just a simple deduction of fare from transit smart cards has led to the research efforts in extracting other relevant information such as points of origin where a passenger would board a bus and have the data recorded as the passenger's smart card is scanned. To achieve this, a Markov chain-based Bayesian decision tree algorithm has been developed in this study, wherein the algorithm is verified with the use of public transportation vehicles that are equipped with GPS tracking and data loggers. Conclusively, it is stated that data collected to represent points of origin when a passenger's transit smart card is scanned, is crucial to the process of transit system planning [3].

The Development of smartphone technology modernized communications [4]. It has paved the way to SMS, text messaging, call, video chat, and apps that allow people to instantly communicate to everyone across the globe. Given the fact that most people nowadays use Smart Phones and that they are available at a reasonable price, makes this approach viable. In this literature the methodology is based on Android OS utilizing the inbuilt GPS to track the location of the fleet continuously and push it to a server on a frequent basis. But this system has certain drawbacks which is explained in the next session.

The next section is devoted to the Architecture of development of android based mobile app for fleet management which address this gap in the literature.

III. PROPOSED ARCHITECTURE

Android OS is considered as one of the most battery consuming operating systems. In the android operating system, there are plenty of process running in the background which results in the quick draining of the battery. It is hard to stop these applications as the majority of them are system applications. This is another drawback of android OS. As android phones are portable and wireless which has major drawback because it basically tracks the phone not the fleet. So, the phone can be outside the truck or far away from the truck, which tends to give incorrect impression for the fleet owner or user. Moreover, flexibility of such approaches is also less along with the complexity involved in the bundling together of the various components into a single Operating system framework.

Keeping in mind all these issues, we propose a simple Hardware (GPS tracking and vehicle monitoring device) and IOT based approach which can provide dynamic Fleet tracking information to the fleet owner as well as the clients in an efficient manner. We propose an architecture which is basically divided into three parts. The hardware module which consists of an internet and gsm equipped on the fleet, basically used to track the position of the trucks using the inbuilt GPS. The collected location information is then sent to a server using 3G network of the hardware device. The backend consists of a server module which receives continuous data from the hardware device. The received data is used to extract meaningful information which is then

used to service various queries. The client module consists of an Android application as well as a SMS based system which can be used by fleet owner and manager to track the location of the fleets in real-time as well as vehicle monitoring/status such as Driver behavior (on over-speeding and harsh braking alerts and notification, speed of the vehicle, total trip distance, ignition ON/OFF or idling status

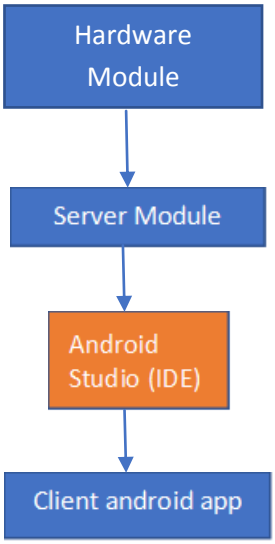

Fig 1. Architecture of proposed system

IV. IMPLEMENTATION

We have used Android Studio version 3.1.0 tested on an Android Phone supporting minimum API 28 (Oreo). By targeting API 15 and above ensures that the application will run on approximately 90.45% of the devices that are active on the Google Play Store. We have also used Linode as the Web Server.

1. *Hardware Module*

Hardware-based approaches have been proposed to solve the problem of bus tracking and scheduling. Most of the approaches use the same basic architecture: Micro controller, GPS module, GPRS/GSM Modem. All these are bundled together to form a Hardware which is fitted onto the fleet. The GPS collects location data which is sent to the micro controller which in turn sends it to the GPRS/GSM Modem, transmitting data through wireless cellular network to the back-end server. The back-end server is responsible for processing all the incoming data and extracting meaningful information from it like dynamic route tracking. Although improvements to GSM such as the next generation systems have been rolled out to cater for faster data centric traffic, backward compatibility to GSM is still maintained. Due to its wide availability, it is chosen as the medium for transfer of location information. The simple and inexpensive Short Message Service (SMS) allows users to send up to 140 characters and is more than sufficient for sending the location information.

Fig.2 WeTrack2 (ET200) hardware device

Hardware named WeTrack2 (ET200) as shown in Figure 2, is designed to meet the needs of various peripherals. Its wide voltage range ensures its stable operation in e-bike, motorcycles, cars and trucks. Small but compact, its highly reliable electric circuit and internal battery design functions not only basic tracking but SOS call, remote-cut off fuel, geo-fence, overspeed alert, historical data upload and more. It owns highly sensitive GPS chipset with built-in antenna, these outstanding features help it become the cutting-edge real-time GPS tracking device and make it timely report the status of your vehicle. It provides short start-up time and fast signal acquisition [5].

2. *Server Module*

The Web Server (Linode) module forms the core of this proposed system. It serves as the back-end tool. The server contains all the information about the fleet tracking and monitoring. The server also processes permission from a fleet owner to access the application. The server maintains a database of information pertaining to fleet tracking, current location, current speed, status of the vehicle (ignition on/off or idle) and geofencing. The server database can be organized in many ways, to reduce memory requirement, improve access speed, or reduce the number of queries.

The Hardware installed on the fleet sends information to the server in JSON encoded format which is stored in the tables created on the server using MYSQL. As soon as the information reaches the server a PHP script is invoked which is responsible for updating the information [6].

3. *Client Module*

Once the application is started for the first time, a splash screen pops up for 3 seconds and then directly take you to the Login activity asking you to provide username and password to keep app secure as shown in the figure 3. This is the one-time activity for the duration of entire application. After login activity is successful then the fleet owner will able track the vehicle and its status as shown in the figure 4.

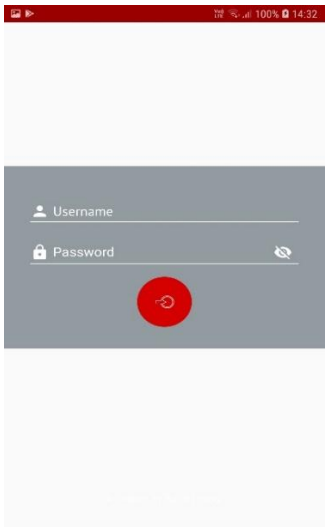

Fig. 3. Android activity asking Login information

This activity is the main activity which is divided in to fragments. In the tracking fragment we will able to track all the vehicles in real time on maps. The red color on the vehicle provides the owner that the vehicle status is IGNITION OFF similarly yellow shows as vehicle is IDLE and Green shows vehicle is MOVING. We can also convert the maps into traffic mode, satellite mode and hybrid mode as per the user convenience. In second fragment we can access the detailed history of each vehicle. Example: Fleet owner can know by which route did each vehicle travelled yesterday and total number of trips (source to destination and visa-versa) done each vehicle in a month. In the Third fragment the user has the option to logout, view profile, edit profile and refresh settings etc. Fourth fragment provides to the notification and alerts on driver behavior (harsh braking, over-speeding, stops), geofencing and on arriving the destination.

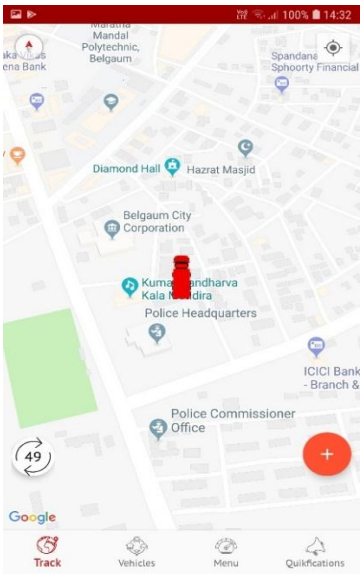

Fig. 4. Activity showing real time tracking of the system

Third Activity gives you the information about vehicle status i.e. The vehicle number, The current Speed of the of the vehicle if its MOVING, The total trip distance of the vehicle.

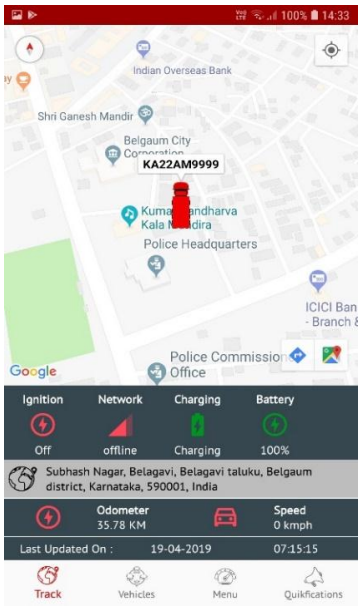

Fig .5. Activity in the Bottom sheet showing the current status of vehicle.

It also provides the information about the status of the hardware device like its Charging status, Battery status, Internet 4G network status as shown in figure 5[7].

V. CONCLUSION

Using mobile application as a means of service management, transport companies can not only achieve substantial gains but also sophisticate their processes around much ease and convenience. With real-time tracking features of mobile apps, fleet owners are enabled to track their vehicles so accurately and monitoring the vehicles is simplified by allowing sever to notify updated information in the application.

It not only helps receive the real-time data of vehicle, but it also keeps manpower properly organized. The insight generated in mobile apps eventually empower field employees in transport companies to make quick, flawless judgment calls at the time of adversities and can avoid possible delays.

Now, it is evident that digital solutions have swept deeply through transportation and logistics industry. Having a mobile app is an interactive, fast and easy-to-use way to enable tracking, automation and real-time management of logistics processes such as dispatch, inventory management, record storage, inspections and more.

VI. FUTURE SCOPE

The advancement in hardware (GPS, GSM and internet) technologies is unlimited and their useful implementation could lead to major breakthrough in the field of IOT. In future, we can have rich dashboard activity with dynamic features that ultimately automate existing processes, digital reports and order delivery confirmation and task scheduling, etc. Thus, paperless automation saves time and ensures that all the information and updates are securely managed in a centralized system of app and shared with a closed loop. thereby reducing the commotion and making it a good experience for the fleet owner. But since there are some shortcomings in these methods, it can be considered as a future scope which needs to be targeted by improved methodologies.

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