# Vehicle Tracking Based on GPS using Android

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***Abstract-Travel has always been a man's best pass time, a method to renew from the daily stress, a break from the monotonous life and to experience the thrill of adventure. Until the last decade, camera was a traveler's best friend but little did we know things are going to change a lot better. In today's era everyone is using mobile phones for communication. At the same time Mobile Providers are also providing the variety of services to users. In attempt to expand on this, we propose a GPS based vehicle tracking system for an organization to help to find addresses of their vehicles and locate their positions on mobile devices. The organizations are investing money in monitoring and tracking vehicles aiming at improving services and ensuring the safety in cargos transports. The proposed technology allows organizations to track real-time information about their organizational vehicle during travel. So it becomes a very important aspect to keep track of the vehicle, hence proposed work to locate and report the location of the vehicle.***

***The system contains android application installed android mobile that is available with the driver of the vehicle. During vehicle motion its location update can be continuously reported to Firebase (service provided by the Google for storing real time location values in the cloud) using GPRS service. The same location database is used to plot the location of the vehicle on the Google maps.***

***Keywords- Android, Mobile Application, GPS (Global Positioning System), Firebase, GSM (Global System for Mobile communication).***

## I. INTRODUCTION

India has progressed on enormous rate that many companies have establish themselves here. These companies have a huge work force. Arranging the transportation to such huge force is difficult task. This transportation is arranged through local transport vehicles on yearly basis. But this causes many mishaps like rape, burglary etc. Therefore, the proposed tracking system will help users in finding the location of vehicle through satellite communication.

GPS and GSM based vehicle location and tracking system will provide effective, real time vehicle location, mapping and reporting this information back to monitoring device and improving the level of service provided. A GPS based vehicle tracking system informs user about the present position of the vehicle. The system uses geographic position and time information from the Global Positioning Satellites. Currently, mostly the existent tracking systems use techniques of virtual fence known as Geofence which compares the entity position with a predetermined zone or a point of interest, checking if the entity is inside or outside an area. Those techniques do not allow full coverage of the course, making difficult to determine if a truck or another delivery vehicle is travelling in a planned path. Therefore, we need to use an alternative technique that allows continuous monitoring of travels, obtaining information of probable deviations or even emergency situations. This system consists of an android mobile which contains GSM and GPS modem along with the processor that is available with vehicle driver. This device is called as tracking device which is continuously accessing its current location and is sending updates to Firebase and the Monitoring device is able to track the position of the vehicle using the data from Firebase.

## II. LITERATURE SURVEY

In [1] the authors, S.Sonika, Dr.K.Sathiyasekar and S.Jaishree, published their work in the journal"International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 2, February 2014" titled "Intelligent accident identification system using GPS, GSM modem" has proposed to minimize the delay caused by traffic congestion and to provide the smooth flow of emergency vehicles. The concept of this scheme is to green the traffic signal in the path of ambulance automatically with the help of RF module. So that the ambulance can reach the spot in time and human life can be saved.

In [2] the authors, Md. Syedul Amin, Mohammad ArifSobhan Bhuiyan, Mamun Bin IbneReaz andSalwa Sheikh Nasir presented the work in "IEEE Stuednt Conference on Research and Development(SCOReD), 16-17 December 2013, Putrajaya, Malaysia" under the title "GPS and Map Matching Based Vehicle Accident Detection System" has proposed to detect an accident from the map matched position of a vehicle by utilizing the GPS speed data and map matching algorithm and send accident location to an Alert Service Center. The GPS provides speed and position in every 0.1 second. The position data will be used in the map matching algorithm to locate the vehicle on the road and the accident is detected based on comparing speed with previous speed.

In [3] the authors, Corrado de Fabritiis, Roberto Ragona and Gaetano Valenti presented their work in "Proceedings of the 11th International IEEE Conference on Intelligent Transportation Systems Beijing, China, October 12-15, 2008" with the title "Traffic Estimation And Prediction Based On Real Time Floating Car Data"present a large-scale working application of FCD-system, developed and operated by OCTOTelematics, delivering real-time traffic

speed information throughout the Italian motorway network and along some important arterial streets located in major Italian metropolitan areas. Traffic speed estimates are deduced at an interval of 3 minutes from GPS traces transmitted in real-time from a large number (and still growing) of privately owned cars (about 600.000) equipped with a specific device covering a range of insurance-related applications.

In [4] the authors, Pankaj Verma and J.S Bhatia published their work in the journal "International Journal of Computer Science, Engineering and Applications (IJCSEA) Vol.3, No.3, June 2013" under the title "Design And Development Of Gps-Gsmbased Tracking System With Googlemap Based Monitoring" and proposed that their tracking system can inform you the location and route travelled by vehicle, and that information can be observed from any other remote location. It also includes the web application that provides you exact location of target. This system enables us to track target in any weather conditions. This system uses GPS and GSM technologies.

In [5] the author Mohammad A. Al-Khedher has published his work in "International Journal of Computer Science & Information Technology (IJCSIT) Vol 3, No 6, Dec 2011" under the title "Hybrid GPS-GSM Localization of Automobile Tracking System" and proposed to track vehicles using Google Earth application. The remote module has a GPS mounted on the moving vehicle to identify its current position, and to be transferred by GSM with other parameters acquired by the automobile's data port as an SMS to a recipient station. The received GPS coordinates are filtered using a Kalman filter to enhance the accuracy of measured position. After data processing, Google Earth application is used to view the current location and status of each vehicle. This goal of this system is to manage fleet, police automobiles distribution and car theft cautions.

In [6] the authors, Salas K Jose, X. Anitha Mary and Namitha Mathew has published in the journal "International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-2, Issue-4, March 2013" which is titled as "ARM 7 Based Accident Alert and Vehicle Tracking System" and proposed an approach to eliminating the delay between accident occurrence and first responder dispatch is to use in-vehicle automatic accident detection and notification systems, which sense when a traffic accident is likely to occur and immediately notify emergency occurred by the use of ARM7 Controller, which can automatically detect traffic accidents using accelerometers and immediately notify a central emergency dispatch server after an accident, using GPS coordinates. Along with the data it will send the number of the vehicle too.

In [7] the authors, C.Prabha , R.SunithaandR.Anithahas published in the journal "International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 3, Issue 7, July 2014" which is titled as "Automatic Vehicle Accident Detection and Messaging System Using GSM and GPS Modem" and proposes to use an accelerometer, that can be used in a car alarm application so that dangerous driving can be detected. It can be used as a crash or rollover detector of the vehicle during and after a crash. With signals from an accelerometer, a severe accident can be recognized. according to this project when a vehicle meets with an accident immediately Vibration sensor will detect the signal or if a car rolls over, and Micro electro mechanical system (MEMS) sensor will detects the signal and sends it to ARM controller. Microcontroller sends the alert message through the GSM MODEM including the location to police control room or a rescue team. So the police can immediately trace the location through the GPS MODEM,after receiving the information.

In [8] the authors, R.Ramani, S.Valarmathy, Dr. N.SuthanthiraVanitha, S.Selvaraju and M.Thiruppathihas published their work in "Iinternational Journal on Intelligent Systems and Applications, 2013, 09, Page No :86-93" with the title " Vehicle Tracking and Locking System Based on GSM and GPS" proposed that locking system installed in the vehicle, to track the place and locking engine motor. The place of the vehicle identified using Global Positioning system (GPS) and Global system mobile communication (GSM). These systems constantly watch a moving Vehicle and report the status on demand. When the theft identified, the responsible person send SMS to the microcontroller, then microcontroller issue the control signals to stop the engine motor. Authorized person need to send the password to controller to restart the vehicle and open the door. This is more secured, reliable and low cost.

In [9] the author Ajay Hemant Jethwa published his research work in "International Journal of Recent Scientific Research Vol. 6, Issue, 6, pp.4805-4808, June, 2015" titled as "VEHICLE TRACKING SYSTEM USING GPS AND GSM MODEM- A REVIEW" where he proposed that using GPS and GSM technology to track and provide complete location and sped information to user over mobile phone. This project gives Minute-by-minute updates about vehicle location by sending sms through GSM modem. This SMS contains longitude and latitude of the location of vehicle. Microcontroller is the central processing unit CPU of this project. Microcontroller gets the coordinates from GPS modem and then it sends this information to the user in Text SMS. GSM modem is used to send this information via SMS. SMS will be sent to the owner of the vehicle

In [10] the authors, Amol Dhumal, Amol Naikoji, Yutika Patwa, Manali Shilimkar and Prof. M. K. Nighot has published their work in "International Journal of Advanced Research in Computer Engineering and Technology( IJARCET) Vol. 4 Issue 4, April 2015" under the title "Vehicle Tracking System using GPS and Android OS" , where they proposed a GPS based tracking system for an organization to help to find addresses of their vehicles and locate their positions on the mobile device. This system allows organization to track real time information about their organizational vehicle during travel.

In Vehicle Tracking System for tracking the vehicle any tracking device is required. Now a days, three navigation systems are available and people use those for tracking any object. The GNSS consist of three main satellite navigation systems. They are GPS (Global Positioning System), GLONASS and Galileo. The comparative study of these three navigation systems is mentioned in following table:

| **Parameters** | **GPS** | **GLONASS** | **Galileo** |
|---|---|---|---|
| Satellites per complete constellation | 32(Block III) | 24 | 27+3 spares |
| Orbital Planes | 6 | 3 | 3 |
| Plane Inclination | 55 deg | 64.8 deg | 56 deg |
| Radius of Orbit | 26650 km | 14100 km | 23222 km |
| Period required for complete cycle | 12 hrs | 11 hrs 15 min | 11 hrs 15 min |
| Civil Data Rate of Satellite | 50 bps, up to 100 sps | 50 bps | 50 bps, up to 100 sps |
| Accuracy | 5-20 m | 50-70 m | Claimed 1 m |
| Operation Bands of Satellite | L1,L2,L5 | L1,L2,L3,L5 | E1,E5,E6 |

Table 1.1: Comparison of GNSS.

The Table 1 shows the comparison of three GNSS technologies from which we conclude that GLONASS and Galileo provide more accurate location then GPS but they are still under construction and costly. GPS (Global Positioning System) is highly available GNSS technology. As per the system is concern, GPS is the best technology considering its availability and receiver cost. Because today every Android phone comes with inbuilt GPS receiver installed in it. Therefore there is no need of purchasing a separate GPS receiver for each client. In this system author is decided to use an android mobile which consist of inbuilt GPS and GSM modem.

In existing system owner use to get SMS from tracking device. But it didn't provide the exact location of the tracked vehicle. So as to overcome this system author made a solution. As per the observation existing system provides only some features like SMS services and tracking user location. The contribution which author made was like locating multiple vehicles location on Google Map. This will enhance the user

with complete information about his organization vehicle location. This will be useful for organization to easily track their vehicles. And help the organization to Ban the illegal activities performed by the vehicle carrier.

## III. PROPOSED METHODOLOGY

GPS based vehicle tracking system uses the GPS technology, GSM service and Android mobile. As shown in Fig. 1 this system has three main modules transmitting unit, monitoring unit and server. Transmitting side performs tracking functionality. It tracks the vehicle by requesting coordinates from GPS and updating those values Firebase Database. While monitoring unit connects to Firebase database and obtains the data and locate the vehicle on the Google Map. Firebase woks as a bridge connecting the transmitting unit and monitoring unit. As both transmitting side and monitoring side communicate with each other through Firebase only. As shown in Fig. 1 mobile application communicates with Firebase via GPRS(Internet) and access the remote database. Where Transmitting part of the tracker application continuously requests for location updates at equal interval time period from Satellites and obtained values are being updated on to the Firebase Database.

Fig 1. Proposed Architecture.

### *A. Project Components*

The Proposed Work Consists of two units

1.Transmitting Unit:

Transmitting unit contains Android mobile which has inbuilt GPS, GSM modem with processor attached and GPRS functionality. Therefore the mobile will be used as transmitting unit.

*a) GPS:*

GPS stands for Global Positioning System. The Global Positioning System (GPS) is a satellite radio navigation system developed by the Department of Defense (DoD) owned by the United States Government (USG) and operated by the United States Air Force (USAF). An unlimited number of users with a civil or military GPS receiver can determine accurate time and location, in any weather, day or night, anywhere in the world. The system makes use of a medium earthorbit satellite constellation transmitting microwave signals allowing a GPS receiver to determine its position, velocity and time. Different types of positioning can be carried out using GPS receivers depending on the algorithms, type of measurements and corrections used in the navigation solution.

GPS is a main module in this Vehicle tracking system. As vehicle is tracked using GPS technology. Author has used it to get the exact location of respective vehicles. But to get exact location of any vehicle it need to be in a focus of four satellites.

*b) GSM:*

GSM is a Global System for Mobile Communications. It is developed by European Telecommunications Standards Institutes (ETSI). It describes the protocol for Second Generation digital cellular networks. A GSM modem is wireless modem that works with a GSM wireless network. It behaves like a Dial-up modem. The working of GSM modem is based on commands; The Commands always start with <AT> (ATention) and finish with a <CR>CRacter. The AT Commands are given to the GSM Modem with the help of PC or Controller.

In Vehicle tracking system author is using GSM service for communication between all three modules.

2. Monitoring Unit:

Monitoring unit is the part of the Android application through which user will get to know the actual position of proposed vehicles. This application provides the user interface through which user communicate with system. It provides login to the system. After user logs into the system user will get google map with exact location of vehicles.

*B. Work Flow*

The workflow of GPS based Vehicle Tracking System is as per the given Fig.2. Users can use this system by performing actions mentioned in Fig. 2.

Tracking Device:

1) The tracking device will continuously request the GPS satellites for its location information at equal interval period of time.

2) In the time GPS satellite will provide the location information to tracking device installed in vehicle.

3) The tracking device will update location information on to Firebase through GPRS and continuously update the database.

Fig. 2 Work flow

Monitoring Device

1) Monitoring device will start accessing database upon login.

2) The device continues to access the Firebase data and use it to plot the vehicle's location.

3) The monitoring device updates location upon detecting the motion of the tracking device and keeps the user updated with current location.

## IV. IMPLEMENTATION

Monitoring unit, tracking unit and Firebase service are the main pillars of GPS based vehicle tracking system. In this system GPRS service is used to perform communication between monitoring and tracking unit to Firebase. Author has used Android platform and Java language for implementation of Monitoring as well as tracking unit. Monitoring unit consists of Login page, Signup page and Google Map to display the location of monitoring vehicles. The application is easy to use, as the application is user friendly and will gain complete access to the application upon completing Signup Activity, if user is using app for

the first time, else user can easily login and continue monitoring activity. At monitoring side Google Map is obtained by using Google APIs. Author has used Firebase database (Free service provided by the Google for the developers) to store the information receiving from tracking and monitoring units. The database operations are performed through the java programming language. Tracking device will continuously communicate with GPS satellites and satellites will provide the current location of vehicle. The tracking device will receive its current location in the form of longitude and latitude and it will send the update to Firebase. On the Google map the tracked location of vehicle will get plotted. And we are plotting it with by using the Java Script.

## V. RESULT

After successful implementation of Vehicle Tracking System, the following results are obtained:

At monitoring side, initially user needs to perform Login activity. Login page shown in Fig. 3 provides Login interface to the user. When user enters Email and password then system will perform validation to ensure whether the entered Email and password is correct or not. If the entered Email or password do not match with any of the existing users in database then system displays error message. And if the username and password are valid the user gets directed to next page with successful login.

Fig 3. Login Page

If user is operating the application for the first time then he/she is requested to perform register activity. Where in the Register activity collects important information required for the future activities such as Full Name, Email ID and Password. Fig. 4 shows the necessary fields which user must fill while registering up. The entered data gets stored in Firebase along with an unique user ID. The Email and password provided at a time of register is used for further login activities of the application.

Fig.4 Register Page

After successful login, the user is presented with a dashboard, where the user has to choose whether he/she is willing to Share Location or Ttrack Location.

Fig. 5 Dashboard.

As shown in Fig. 5 Dash board has two buttons i.e. Share Location and Track Location. When the user clicks on Share Location, the device checks if the GPS service is enabled, upon successful enabling of the GPS service device requests location updates from satellite and a persistent notification bar is displayed to indicate the location sharing service is active.

Fig. 6 Map displaying the location of the vehicles.

When the user clicks the Track Location button, the application then retrieves the location data along with the username and displays vehicles with their name on the map using markers to indicate each vehicles.

## VI. CONCLUSION

This proposed system allows organizations to track their vehicles and to get exact location of vehicle. The system allows those companies to monitor the travelled routes through a web client that uses the Google Maps API and shows colors on the map to indicate if the devices on route. The general evaluation result is that the system proved to be reliable as to view the positioning of the devices.

## VII. FUTURE SCOPE

In the proposed system we can add features like Car locking, thief photo capturing. This will help the user to have an anti-thief feature. Upgrading this system is very easy which make it open to future requirement without the need of rebuilding everything.

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