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GPS and GSM Based Vehicle Tracking System

Aditya Raj Sharma[1], Diksha Verma[2]

U. G. Student, Department of Computer Science & Engineering, Oriental Institute of Science & Technology, Bhopal, Madhya Pradesh, India[1]

U. G. Student, Department of Computer Science & Engineering, Oriental Institute of Science & Technology, Bhopal, Madhya Pradesh, India[2]

ABSTRACT: The paper describe a practical model for routing and tracking of mobile vehicles in a large area outdoor environment based on the Global positioning system (GPS) and Global system for mobile communication (GSM). The supporting device GPS continuously move with the car and will calculate the co-ordinates of each position and when required by the owner it can be communicated with the help of GSM modem which is installed in both Transmitter and receiver section. GSM modem is controlled by a 32 bit ARM7 LPC2148. The device will collect position to supervised center by the SMS (Short Message Service) or GPRS (General Package radio service) and which can be located in the Google Earth and so the current position of the car can be known.

KEYWORDS: Tracking device, SMS, GSM, GPS, arduino.

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 has causes many mishaps like rape, burglary etc. Therefore the proposed tracking system will help us 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 [1]. A GPS based vehicle tracking system will inform where your vehicle is and where it has been, how long it has been. 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 Geophone 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 [2]. Therefore, we need to use an alternative technique that allows continuous monitoring of travels, obtaining information of probable deviations or even emergency situations.

II. RELATED WORK

This invention relates to an apparatus and method for tracking a vehicle and, more particularly, to an apparatus and method wherein the location of a vehicle is recorded during a predetermined event.

A wide variety of tasks are performed using vehicles. These often include pickup and delivery of persons or goods. It is sometimes desirable to have a record of the time and place of the performance of these tasks. Various methods exist for creating such records. These typically consist of simple handwritten logs kept by drivers of the vehicle, such as those commonly used by truck drivers. One of the disadvantages of existing systems for recording a vehicle's position is that they generally require manual action on the part of the driver. This can result in the recording of incorrect information or the omission of information, either unintentionally or intentionally. For this reason, it would be desirable to have a system, which determines the location of a vehicle automatically without requiring any action on the part of the operator.

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GNSS (Global Navigation Satellite System)

GPS (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) [3].

GPS has provided positioning, navigation, and timing services to military and civilian users on a continuous worldwide basis since first launch in 1978. 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 [3].

The system makes use of a medium earth orbit 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.

A GPS receiver can measure the pseudo range, i.e. the apparent range between satellite and receiver, using the code phase measurements, which provide an estimate of the instantaneous ranges to the satellites, or the carrier phase measurements, which is the difference between the phase of the carrier signal generated at the receiver and the carrier received from a satellite at the instant of the measurement [4].

The carrier phase measurement is given in a fraction of a cycle, but this does not contain any information about the number of complete cycles (called integer ambiguity).

Requirements for developing the GPS systems from the signaling point of view are as follows:

a) Multiple access capabilities so that no interference in the GPS signals from other satellites should take place.

b) Avoiding some amount of multipath interference.

c) Minimization of interference from jamming, spoofing of signal etc. up to a certain level.

d) Low power signal so that it should not interfere with the microwave line of sight communication signals.

Features:

- Satellite Constellation: 32 Satellites(initially run on● 21 active and 3 redundant satellites)
- Multiple Access: CDMA
- Modulation schemes used: BPSK (1), BPSK (5), BPSK (10), BOCsin(10,5), TMBOC(6,1,1/11).
- Center Frequency: 1575.42 MHz, 1227.60 MHz, 1176.45 MHz
- Frequency Bands: L1, L2 and L5 [7].

GLONASS

GLONASS is another new emerging Radio based satellite navigation system. Initially the GLONASS was developed for the use by soviet military in 1976, to overcome the problems of Tsikada system. Tsikada system was able to provide accurate position but required 1 to 2Hrs signal processing [5].

In this way till 1995 twenty six satellites were obtained in orbit, but due to failures and satellite design expiry older satellites were taken away from the project.

Hence, till 2018 only eight satellites were present in GLONASS. As the Russian Government was an invested lot of fund in this project, to change this situation. The Russian government organized a program Global Navigation System‖ on August 20, 2001[5].

The Indian government also joined this program and become a partner of GLONASS to ensure funding.

On May 18, 2017 Russian president _Vladimir Patin‘signed a decree (wwwGLON), to provide open access to civilian navigation signals of the GLONASS system to Russian and foreign consumers for free of charge and without any limitations.

As the development and maintenance of GLONASS system is conducted by Petrol space agency (ROSCOSMOS, MOD). By 2010 GLONASS had achieved 100% coverage of Russia‘s territory and in Oct 2011 the full orbital constellation of 24 satellites was restored, enabling full global coverage.

Features:

- Satellite Constellation: 24 Satellites (21 Active + 3 Redundant)
- Multiple Access: FDMA
- Modulation Schemes used: BPSK(0.511), BPSK(5.11), BPSK(4), BPSK(2), BPSK(8)
- Center Frequency: 1598.0625 MHz-1605.375 MHz, 1242.9375 MHz-1248.625 MHz, 1201 MHz
- Frequency Bands: L1, L2 and L3 [7].

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GALILEO

Galileo, the first satellite positioning, navigation and timing system specifically designed for civil use, will offer state-of-the-art services with outstanding accuracy, availability, integrity and guarantee [6]. It is a joint initiative of the European Commission (EC) and ESA.

Definition, completed in 2003, produced the basic specifications for the system. It will be validated by deploying four satellites of the overall constellation together with the ground stations and control centre. Four satellites are the minimum to guarantee precise positioning and time services at specific locations [6].

Early in this phase, the GIOVE (Galileo In-Orbit Validation Element) mission will employ two satellites, GIOVE-A and GIOVE-B, and their mission- and ground-control segments. GIOVE is securing access to the Galileo frequencies allocated by the International Telecommunications Union (ITU), characterizing the radiation environment of the Medium Earth Orbits(MEOs) planned for the Galileo satellites, testing the most critical technologies (such as the on-board atomic clocks, signal generator and user receivers), and characterizing the novel features of the Galileo signal design [8].

Galileo will begin full deployment, covering the entire ground network and launching the remaining 26 satellites to complete the constellation.

Features:

- Satellite Constellation: 30 Satellite (27 active +3 redundant).
- Multiple Accesses: CDMA.
- Modulation Scheme : CBOC(6,11,1/11), BOC(15,2.5), BPSK(5), BOCcos(10,5), AltBOC(15,10).
- Center Frequency: 1575.42 MHz, 1278.75 MHz, 1191.795MHz
- Frequency Bands: E1, E6 and E5 [7].

Suggestion:

According to survey GLONASS & GALILEO provides more accuracy then GPS but their receiver costs very high.
As per the project 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.

III. METHODOLOGY

The above block diagram explain the working of the system which can be designed from this research paper a ARM processor LPC2148 is used here for automation and controlling of the other supporting devices those are GPS, GSM, Accelerometer sensor compass sensor. Actually this paper gives the practical model of a vehicle tracking system which can do routing, tracking of moving vehicles in large area. It consists of two sections, first which will be inbuilt in the car which is having GPS in it and as the car moves the location of the car goes on changing continuously, the GPS find the location in terms of two co-ordinates that are Longitude and latitude. These co-ordinates are communicated to another section by GSM modem, as shown in the block diagram both the part consist of GSM for communication. This GSM is connected to the computer through RS232 which should have internet connection in it. So, that as soon as the co-ordinates are received, it can be located in the Google Earth. As shown in block diagram the two more sensors are used that are accelerometer sensor to sense weather the vehicle is moving or steady and a compass sensor for identifying the direction of moving vehicle.

Software Required

Two software's were used; one for the Arm processor i.e. is Embedded C for interfacing and controlling of different devices and in another section Visual Basic software is used for interfacing of Google Earth. So that co-ordinates can be located in the Google map.

Terminology

Latitude & Longitude

Both are the angles that are uniquely defined on the sphere. Together the angle comprises the co-ordinate scheme that can locate or identify the geographic position on the planet. Latitude is defined with respect to the equatorial reference, the value becomes positive as it moves towards north and it becomes negative towards south. Longitude is measured with reference to prime meridian and is positive towards east and negative towards west.

Routing

Routing means a compass sensor is used to calculate the angle between the current direction of mobile vehicle and magnetic north direction [1].

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Tracking

Tracking allows the base station to continuously track the vehicle without any interference of the driver or the method of continuously collecting the co-ordinates of moving vehicle that is getting from GPS receiver.

Vehicle Disabling

Vehicle can be disabled just by sending the SMS from the GSM modem of owner to the GSM modem which is in car. The form which is generated in Visual Basic in the computer is connected to the GSM. If the message is send to disable the vehicle than the vehicle can be disabled. This feature is not present with the any of the vehicle security system.

IV. EXPERIMENTAL RESULTS

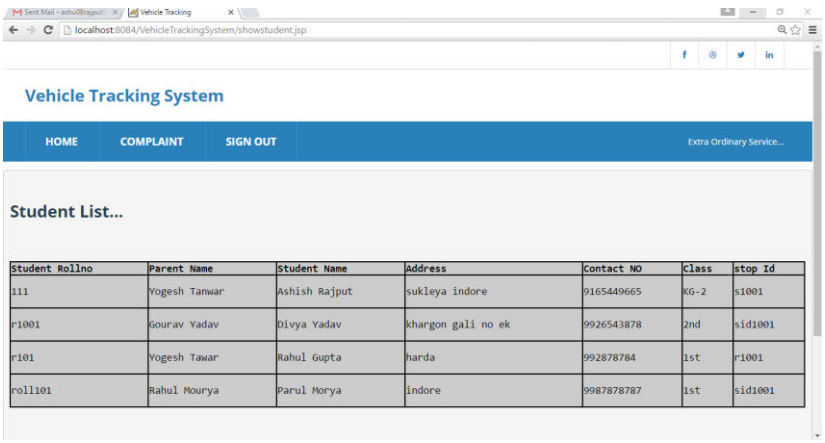

Figure 1. Student List Form

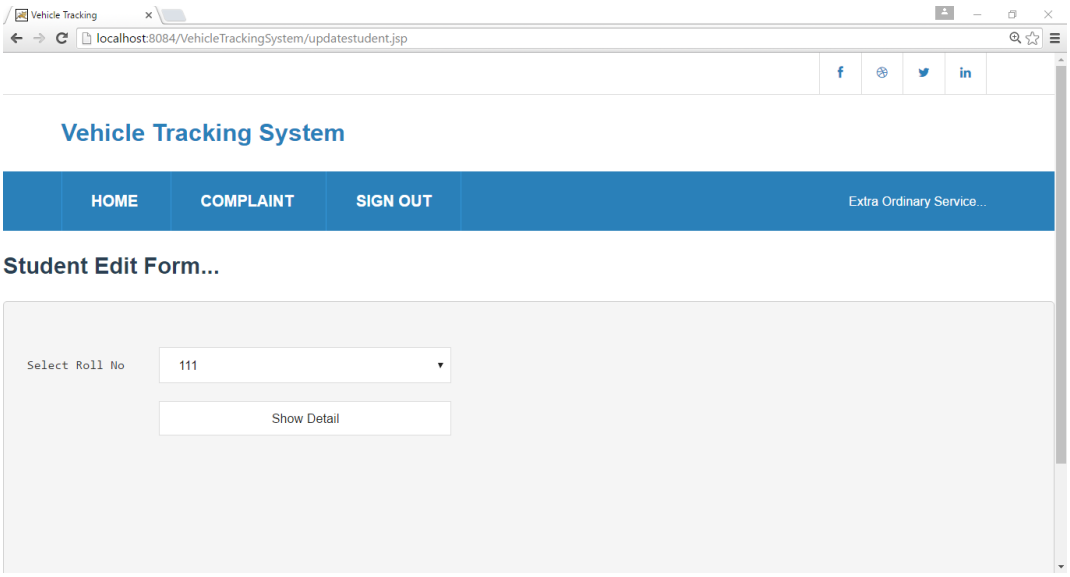

Figure 2. Student Update Form

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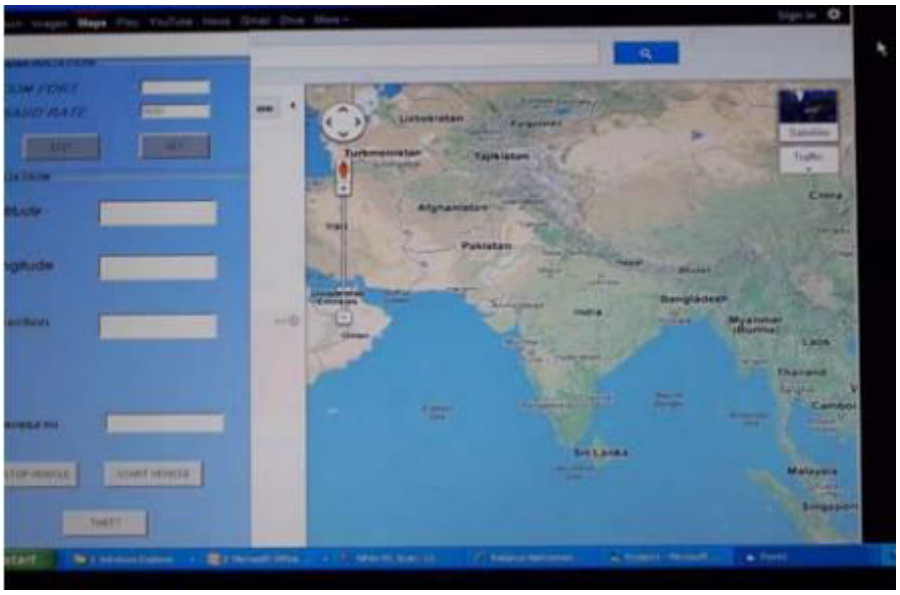

Figure 3: Receiver section with Owner

The results on the user interface of supervised center will show the routing and tracking function of the system. The project is locating the position of the car. By designing this project the ignition of the project can be stopped or the speed can be locked so that the thief can be catch easily, this is one of the additional features of the project. There are some approaches affect the accuracy of the system such as the delay of sending and receiving data via GSM network, the multi path effects can make the position error on the GPS receiver, the weather and the assuming of the variation between True North Direction and Magnetic North Direction is zero etc.

A practical system for routing and tracking mobile vehicle is presented in the project. In some cases GPS may give us no answer, the wrong answer, or an answer with insufficient accuracy which was one of the main reasons for the limitations of GPS accuracy. The accuracy of system is affected by some factors such as weather, environment around the mobile vehicle, GPS receiver, compass sensor and the variation between True North Direction and Magnetic North Direction, etc. The future works include optimizing the hardware system, choosing a suitable GPS receiver and compass sensors and for more accuracy one can go for DGPS i.e. Differential Global Positioning System, by using DGPS accuracy can be increased up to 1-4 meters whereas in GPS it is 5-10meters.

V. CONCLUSION

Automobile theft and accidents in the transportation systems have caused significant loss of lives, waste of energy, and loss in productivity. To improve the safety, security and efficiency of the transportation systems and enable new mobile services and applications for the traveling public, the project have been developed, which apply rapidly emerging information technologies in vehicles and transportation infrastructures. It is one of the most challenging and critical issues for the industries. The practical model of this paper proved to be very efficient, cheaper, and reliable system for security.

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