

Tracking A Vehicle using GPS Technology

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Abstract-- In shipping industry where large fleet of vehicles were spread out over the vast expanses of ocean, the owner corporations often found it difficult to keep track of what was happening. As necessity is the mother of invention, so GPS tracking systems which originally were used in military operations found their application here. Now the commercial application grew popular for the all sorts of consumer's vehicle, using tracking systems to prevent theft and enhance retrieval. GPS (Global Positioning System) is the technology most commonly used for vehicle tracking these days. GPS tracking system can potentially give both real-time and historic navigation data on any kind of journey like location, vehicle speed, time and direction by using the GNSS (Global Navigation Satellite System) network.

Keywords-- Active & Passive tracking ,GPS system, triangulation, trilateration.

I. INTRODUCTION

Vehicle Tracking System is the technology used to determine the location of a vehicle using different methods like GPS and other radio navigation systems operating through satellites and ground based stations. The GPS tracking system uses the GNSS (Global Navigation Satellite System) network. This network incorporates a range of satellites that use microwave signal which are transmitted to GPS devices to give information on location, vehicle speed, time and direction. A GPS tracking system can work in various ways, mainly it works in two ways: Passive Tracking and Active Tracking. In Passive Tracking some systems will store data within the GPS tracking system itself. In Active Tracking systems send the information to a centralized database or a system via a modem within the GPS system unit on a regular basis. By following triangulation or trilateration methods the tracking system enables to calculate easy and accurate location of the vehicle. Vehicle information like location details, speed, distance traveled etc. can be

viewed on a digital mapping with the help of a software via. Internet. Even data can be stored and downloaded to a computer from the GPS unit at a base station and that can later be used for analysis. This system is an important tool for tracking each vehicle at a given period of time and now it is becoming increasingly popular for people having expensive cars and hence as a theft prevention and retrieval device. There are also other variants of AVL (Automatic Vehicle Location) that enable easy location of vehicles. The GPS modules with their satellite linked positioning technique make easy and accurate location of the vehicle possible. Advanced GPS modules may also have cellular or satellite transmitters that communicate with remote users apart from the central station from where the tracking is done. Trilateration is a mathematical principle which is used by GPS receiver to locate satellites and figure out the distance to each, and use this information to deduce its own location.

II. TYPES OF GPS TRACKING SYSTEM

Currently there are three types of GPS Tracking Systems. These types are based onto how GPS data is logged and retrieved.

1) **Data Loggers:** These are basic types of GPS tracking, it simply logs the position of the object at regular intervals and retains it in an internal memory. It also have flash memory on board to record data that is logged. The flash memory can then be transferred and accessed using USB or on the device itself.

2) **Data Pushers:** These are mainly used for security purposes. It sends data from the device to a central database at regular intervals, updating location, direction, speed and distance. Data Pushers are common in fleet control to manage trucks and other vehicles.

3) **Data Pullers:** These types of units push data or send data when the unit reach at a specific location or at specific intervals. These GPS units are usually always on and constantly monitoring their location.

III. FEATURES OF THE SYSTEM

The system consists of modern hardware and software components enabling one to track their vehicle online or offline. Any vehicle tracking system consists of mainly three parts mobile vehicle unit, fixed based station and, database and software system.

- 1) **Vehicle Unit:** It is the hardware component attached to the vehicle having either a GPS/GSM modem. The unit is configured around a primary modem that functions with the tracking software by receiving signals from GPS satellites or radio station points with the help of antenna. The controller modem converts the data and sends the vehicle location data to the server.
- 2) **Fixed Based Station:** Consists of a wireless network to receive and forward the data to the data center. Base stations are equipped with tracking software and geographic map useful for determining the vehicle location. Maps of every city and landmarks are available in the based station that has an in-built Web Server.
- 3) **Database and Software:** The position information or the coordinates of each visiting points are stored in a database, which later can be viewed in a display screen using digital maps. However, the users have to connect themselves to the web server with the respective vehicle ID stored in the database and only then she/he can view the location of vehicle traveled.

Device identifies the location of the vehicle on a real time basis. Just through internet you can easily track your exact position of the vehicle. Whether passive or active the tracking devices store all location and speed details that you can collect through your PC by using internet and a special software made for this purpose. Even one can set the speed limitation in the device attached. If somebody drives the car beyond the specified speed limit, it will alert you immediately.

Device helps not only to keep limit on its speed but also on its area. Similarly you can create safety zones so that

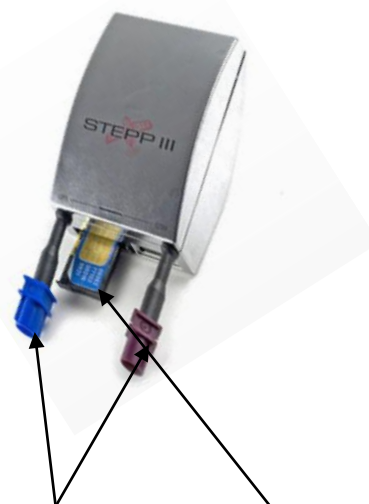
the moment your vehicle goes out of the designated area, the device alerts you through SMS, email or by using any other wireless media.

Best feature of the system is its easiness with which it can be used. From anywhere one can get the information about that particular vehicle by logging in the information required. Details about the car are displayed within seconds.

Some devices work even in a smarter way by making a chart of the entire activities of the vehicle over a period of time that you can analyses later on. Hence, these tracking devices have really revolutionized the communication medium by providing various cool features at your fingertips.

4) Devices Used:

- Mobile device which support GPRS and Bluetooth Connectivity.
- GPS device
- A Computer with the underlying specification:
 - Intel's Pentium Based Processor. Minimum of 433 MHz 650 MH recommended. Above 650 MHz ideal.
 - Minimum of 64 MB RAM recommended. 128 MB ideal.
 - Currently available HARDDRIVE with 80 GB. The system runs efficiently on even 10 GB of HARDDRIVE.
 - Internet connection and required server



ANTENNA SIMCARD

Fig. 1 VEHICLE TRACKING UNIT

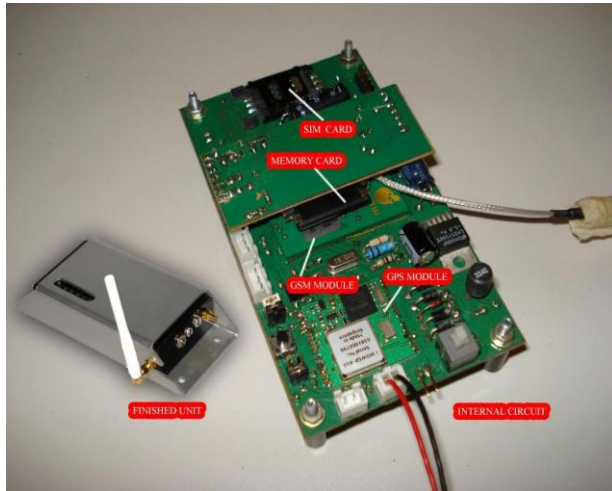


Fig. 2 Internal structure of Vehicle Tracking Unit

IV. WORKING OF THE SYSTEM

In view of the wide prevalence of Global Positioning System it has become necessary to know how it is handled. Following tips introduce some important parts of the system knowledge of which render it easy to use.

- First main thing is the 'panic button' used in times of emergency. This comprises of everything ranging from a fender bender to a carjacking. This button when pressed the operator at GPS centre can sense the happening. They can contact you or have communication with you to provide assistance if needed.
- In crowded parking area when one loses sight of one's car, system comes to your rescue to locate your car and thus avoid unnecessary toil on your part. In case one by mistake locks the car, information about the same can be communicated to the centre and they unlock within minutes.

Important advantage comes when car goes out of order in a solitary place having no service point you need not worry. Just a push on the button brings one out of the problem. This very important medium "button" is labeled as communication button.

Mainly it works in two ways: Active and Passive tracking.

A PASSIVE GPS TRACKING SYSTEM- will monitor location and will store its data on journeys based on certain types of events. The data stored on this kind of GPS tracking system is usually stored in internal memory or on a memory card which can then be downloaded to a computer at a later date for analysis. It may log data such as turning the ignition on or off or opening and closing doors.

AN ACTIVE GPS TRACKING SYSTEM- This kind of system is usually a better Option for commercial purposes such as fleet tracking and individual vehicle tracking as it allows the company to know exactly where their vehicles are, whether they are on time and whether they are where they are supposed to be during a journey. It is also known as a real-time system as it automatically sends information on the GPS system to a central computer or system in real-time as it happens.

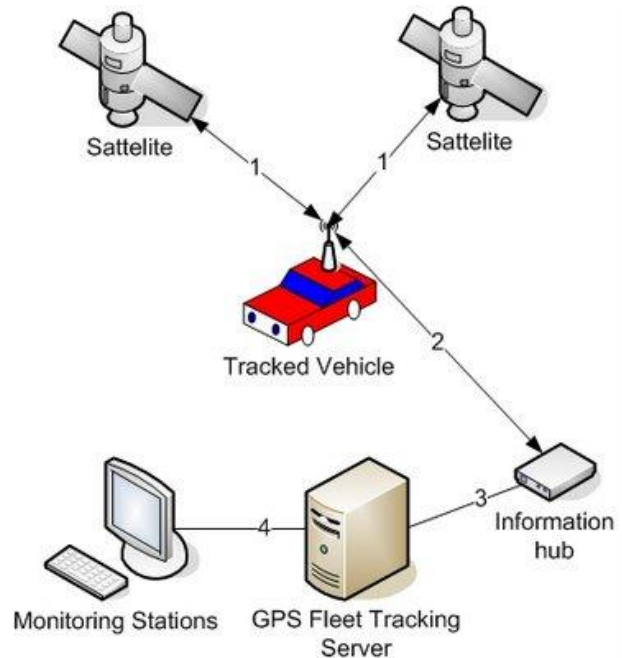


Fig. 3 System Architecture

V. TECHNOLOGY

The Global Positioning System (GPS) is a location system based on a constellation of about 24 satellites orbiting the earth at altitudes of approximately 11,000 miles. GPS was developed by the United States Department of Defense (DOD), for its tremendous application as a military locating utility.

The GPS system uses satellite signals. GPS satellite signals produce accuracies in the range of 50 to 100 meters. When using a technique called differential correction, users can get positions accurate to within 5 meters or less. These systems were originally developed by the government for defense purposes. The satellite part is thus available to civilians and commercial users free of cost. All the user needs to do is install the appropriate devices for sending out and receiving signals. This makes GPS an inexpensive technology.

The other AVL systems like Loran and LoJack are terrestrial based and use radio frequency (RF) transmitters. RF transmitters send out powerful signals that can pass through walls, garages and other indoor barriers. Terrestrial or otherwise, most of these do not need antenna to be in direct line of sight with the satellite. This is a major advantage of the technology's progress.

VI. APPLICATION OF THE GPS TRACKING SYSTEM

Commercial fleet operators are by far the largest users of vehicle tracking systems.

- These systems are used for operational functions such as routing, security, dispatch and collecting on-board information.
- These systems are also used in consumer vehicles as devices for preventing theft and retrieving stolen/lost vehicles. The signal sent out by the installed device help the police to track the vehicle.
- These tracking systems can be used as an alternative for traditional car alarms or in combination with it. Installing tracking systems can thus bring down the insurance costs for your vehicle by reducing the risk factor.
- Vehicle Tracking systems often have several alternatives, like sending automatic alerts to a phone or email if the vehicle is moved without due authorization. They can also work as one layer of several combined security measures.
- Apart from security concerns, the tracking systems can also help users such as taxi services to improve their customer service. The systems enable the operators to identify the empty taxis and direct the nearest one to pick up the customer.

- Vehicle tracking systems can also be applied for monitoring driving behavior for both commercial and individual situations.
- Parents for instance can use tracking devices to keep an eye on their teenage son's driving. Such device is a great help to those parents who remain worried about their children while on drive. They can access the information of whereabouts of their child at will.
- While handing over the vehicle to the children, there is always a rule book attached. But there are always chances of violation of the instructions given to children. Way out lies in the GPS vehicle tracking system. By this device one can easily monitor whether the rules are being followed by the child or not.

VII. CONCLUSION

No doubt, Vehicle tracking system whether it is GPS based or any other wireless medium has brought one of the most important technological advances in today's communication field. Now one doesn't have to leave a place to know where a particular vehicle is at a given period of time. The automatic vehicle locating system only with the help of a tinny electronic device and tracking software can detect the real-time location of a vehicle by using the conventional cell phone network and Internet. Vehicle tracking proves a mile stone in cases of theft. This provides a safety net to the vehicle as even if it is taken away by thief you can always find it out. So there are many positive outcomes in the use of GPS but it also becomes important to look into your requirements, options available in the market and then move to a service provider with a reasonable service fee.

The devices with various facilities help to keep a watch and control on them. You just need to attach a small tracking device with your vehicle and the service providers do the rest with tracking software that provides timely details of the vehicle.

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