

Tracking System using GPS and GSM: Practical Approach

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Abstract— The ability to track, trace and control anything by anyone from anywhere on the planet has been mankind's unfulfilled desire. The usefulness of GSM and GPS has made them popular in their own context; integrating these technologies can prove to be a flamboyant solution for many unsolved problems. The idea of this paper is to integrate these two technologies into one system and provide an effective application for vehicle tracking as well as personal tracking. To implement a multi tracking system use of the following two technologies can be made, firstly GSM(Global System for Mobile) which is a set of standards to describe technologies for Second Generation (2G) and GPS(Global Positioning System) which is a satellite-based navigation system consisting several satellites revolving around the earth. The system will provide solution for tracking and tracing of multiple movable objects at a same time, so the name Multi-Tracking System. We can see the current location of the object and other add-on features, for vehicles there will be live tracing and tracking via GPS, controlling its subsystem parts via GSM network using SMS or GPRS. The whole system will be implemented in Microsoft .Net Technology, for system components C#.net will be used and for web based parts ASP.net will be used.

Index Terms— GPS, GSM, KML, Microsoft.net, Multi-Tracking System, Socket Listener

1 INTRODUCTION

TRYING to figure out where we are is probably man's oldest pastime. Consider a transport company having many vehicles, managing all such vehicles keeping a track of their drivers, maintaining all the vehicles is a very hectic job. So there is a need of a system which could maintain all this essential details. We can provide an add-on to this by getting the live location of each vehicle and finding their path, also we can determine what their current speed is.

The GPS consists of 3 segments [1]

- Space Segment
- Control Segment
- User Segment

The Space Segment consists of a nominal constellation of 24 GPS satellites. Each satellite broadcasts RF ranging codes and a navigation data message. The Control Segment consists of a network of monitoring and control facilities which are used to manage the satellite constellation and update the satellite navigation data messages. The User Segment consists of a variety of radio navigation receivers specifically designed to receive, decode, and process the GPS satellite ranging codes and navigation data messages [1].

A GPS receiver calculates its position by precisely timing the signals sent by GPS satellites high above the Earth. Each satellite continually transmits messages that include

- The time the message was transmitted
- Precise orbital information the general system health and rough orbits of all GPS satellites.

The receiver uses the messages it receives to determine the transit time of each message and computes the distance to each satellite. These distances along with the satellites' locations are used with the possible aid of trilateration depending

on which algorithm is used, to compute the position of the receiver. This position is then displayed, perhaps with a moving map display or latitude and longitude; elevation information may be included. Many GPS units show derived information such as direction and speed, calculated from position changes [2], [3].

GPS tracking systems are used to track anyone and anything these days. Technology has rapidly advanced in the past few years and it has become very easy for the average person to use a tracking system. If you have a vehicle, then you may want to place a GPS tracking system under your dash or in your glove compartment. This way, if your car ever gets stolen, you will be able to locate it within seconds and you can catch the culprit.

If you have a small child, you will want to have a tracking system in place in case they get lost or wander off. Every second counts with a lost or abducted child, so a tracking device is imperative to avoid a possible disastrous and heartbreaking outcome. If you have valuable items in your home like jewelry, or electronics you will want a GPS tracking system in case they are ever stolen. There are also various tracking systems that can locate items inside buildings and parking garages.

If you have a teenager son or daughter, you will want to use a GPS tracking system to make sure that they are driving responsibly and they are going where they told you they were going. If you suspect your spouse or significant other of cheating, a good tracking system will be able to confirm or absolve your suspicions.

2 EXISTING TECHNOLOGIES

2.1 Automotive Navigation System [4]

An Automotive navigation system is a satellite navigation system designed for use in automobiles. We may see this system primarily in high cost cars. It typically uses a GPS navigation device to acquire position data to locate the user on a road in the unit's map database. Using the road database, the unit can give directions to other locations along roads also in its database. Dead reckoning using distance data from sensors attached to the drivetrain, a gyroscope and an accelerometer can be used for greater reliability, as GPS signal loss and/or multipath can occur due to urban canyons or tunnels, also this device can lead the driver to a particular destination by sensing the position of the car continuously.

The portable GPS devices have helped increase and enhance safety for the people. In addition, the GPS system is a phenomenal navigational tool that is vital to every traveler. This system is good for the driver but by this system the owner of the vehicle cannot know the current vehicle details as and when needed, so this system may be useful to the driver but it is not that useful to the owner of the vehicle who may want to keep a watch on the driver.

2.2 GPSylon System [5]

GPSylon is able to show maps downloaded from the expedia map servers. It may connect to a GPS device and track your position on the maps. At the moment, it is able to read GPS data in the NMEA standard from a serial GPS device, a file or a GPS daemon across a network. The main feature is the display of various maps. GPSylon allows the user to navigate around like in a digital atlas. It shows maps of different scales, so missing maps of one scale do not result in a black screen, but show the next larger scale.

It allows the download of a single map or for a given location or for multiple maps in a given rectangular area from mapblast or expedia map servers. In the download mouse mode the user may choose a single map or by dragging a rectangle with the mouse, the user may choose to download maps for a larger area. This functionality allows the user to download maps in a given scale for a larger area

2.3 Open GTS (GPS Tracking System) [6]

It is an open source project designed specifically to provide

web-based GPS tracking services for a "Fleet" of vehicles. It was designed to fill the needs of an entry-level Fleet tracking system.

There are many other applications similar to these applications which may have some advantages or disadvantages.

3 EXPLANATION OF THE PROPOSED SYSTEM

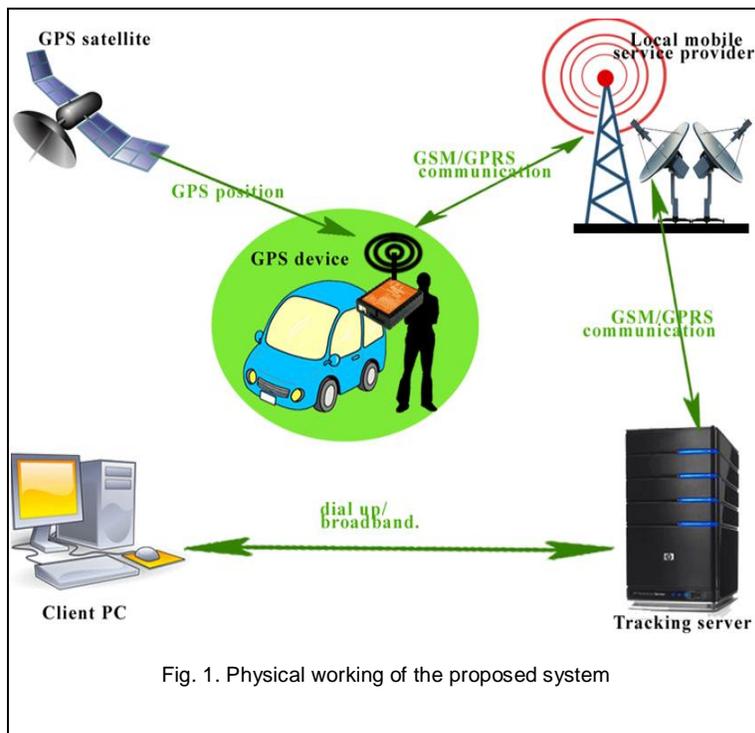


Fig. 1. Physical working of the proposed system

The Physical Components of Tracking System are

- GPS Satellite
- Car or Person with compatible Device
- GSM Service Provider
- Tracking Server
- Client PC

GPS satellite sends GPS data to the device which temporarily stores the data in case of car we use AVL (Advance Vehicle Locator) and in case of person we use a specially prepared device for personal tracking containing the panic button for the purpose of emergency. This device contains a SIM card which is used to communicate with the local GSM network thus the device uses GPS as well as GSM network.

The data on the device is sent to the tracking server via GPRS through the local network. On the tracking server there is a software component called as Socket Listener to get the data from the device on a particular socket. After the data is received in hexadecimal format it is parsed and converted to readable format by the parser and converter, the data is then stored into the database and further processing is done for alerts and reports generation.

Geo fence [10] can be created on the Google maps provided so whenever the device enters the geo fence or leaves it,

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an alert will be sent to the registered mobile number.

There are web pages integrated with Google map and other APIs for the purpose of viewing the vehicle or a person on the GUI.

4 WORKING OF THE SYSTEM

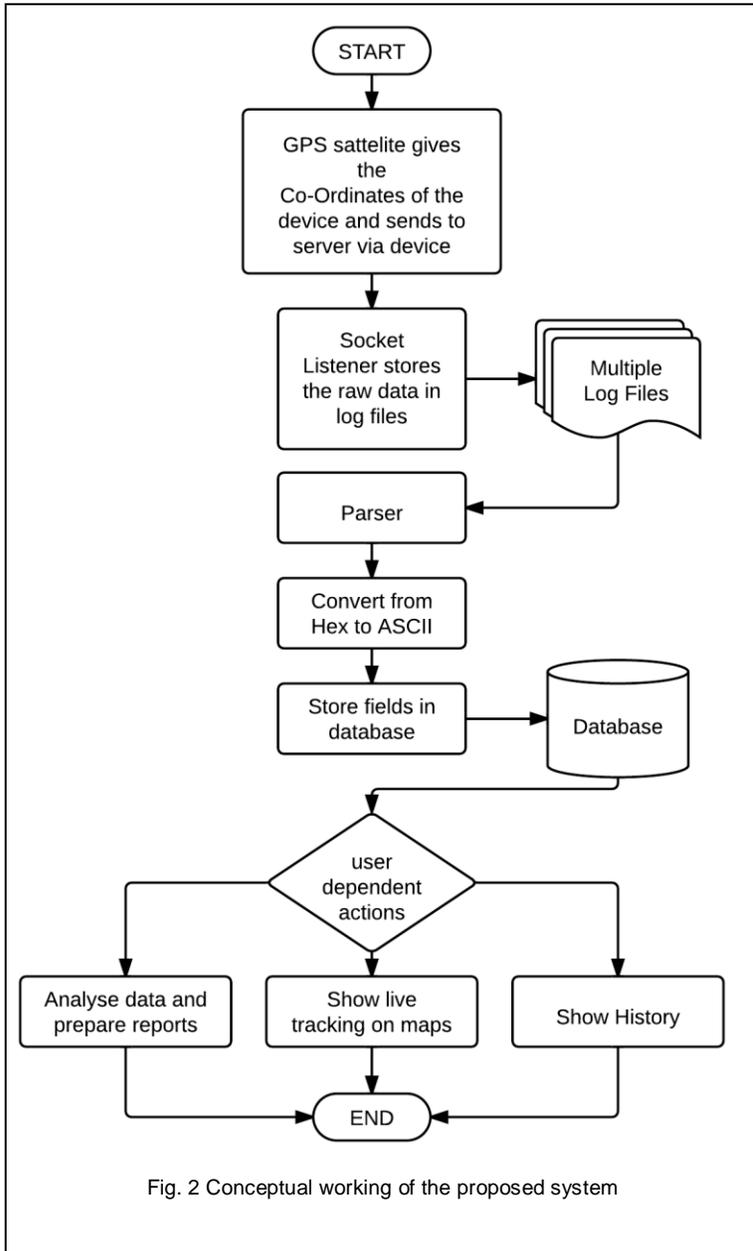


Fig. 2 Conceptual working of the proposed system

As we have seen in the previous section GPS Satellite gives the position of the AVL device in the form of latitude, longitude and altitude. All this information is then given to the Server which is received by the socket listener onto a particular port of the server. The data which is received is in the hex format which is non readable to humans.

By this raw data a log file is prepared, this log file is further given to the Parser which parses the data according to the protocols of the device[7]. After parsing the data the data is converted to ASCII format which is human readable and stored into various fields of the database table for further use.

As we store the data into database we can use the data whenever we want it for getting reports, for live tracking, for preparing KML and other purposes as well.

5 PROGRAMATIC IMPLEMENTATION

As it is a web based application so the performance of the it is a web based application so the performance of the system may be hampered by the lack of proper bandwidth, even if the bandwidth is available the performance may be hampered by the working of individual components as it is an asynchronous application depending upon the performance of other parts. If the performance of one part is below average the whole application may suffer, so the performance criterion for each component is important and it cannot be compromised.

Some of the components considered are as follows.

a) Socket Listener[15]: It is the most important and critical part of the system as the working of the application and its efficiency completely depends upon the working of this component. We can implement the socket listener with any language whether it be Java or C#.net. The component must be multi threaded to handle as many clients as it can. As this component may be overloaded so the maximum nummber of clients which can run on a single Port must be determined and the port must be changed automatically if it is loaded.

b) Generating KML for Google Maps : KML stands for Keyhole Markup Language[8] it is a file format used to display geographic data in an earth browser, such as Google Earth, Google Maps, and Google Maps for mobile. A KML file is processed in much the same way that HTML (and XML) files are processed by web browsers. Like HTML, KML has a tag-based structure with names and attributes used for specific display purposes[9]. Thus, Google Earth and Maps act as browsers for KML.

When we collect sufficient amount of logs in the database displaying that data on the maps in form of last track details will be much heavy for the google maps to load and will in turn affect the performance of the application, so for that purpose we can generate a kml file and give it to the user which can be viewed on google earth application.

c) Generating Tour based on KML: Using the google earth API we can generate a Tour for the user to view in a google earth application we can integrate this application in the browser which needs a plugin for viewing 3D maps in the browser.

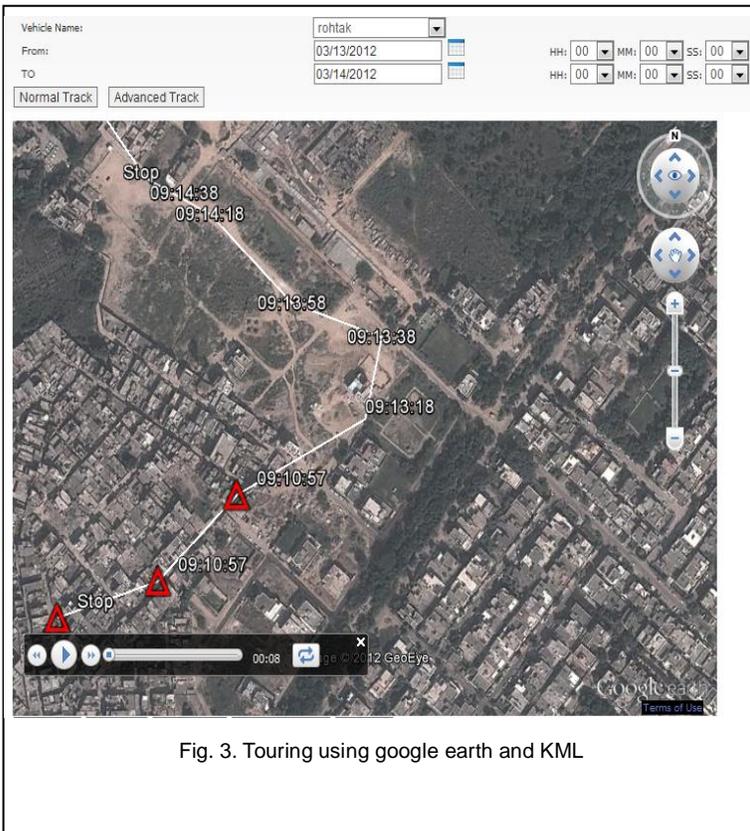


Fig. 3. Touring using google earth and KML

With the help of this we can see the history of the vehicle in the specified time span like a video of the places which it visited in that time period. This provides more interactivity to the application.

d) Organization of Data: As the number of clients increase it may be hectic job to find the data related to a particular carrier so the data organization also should be proper for quick retrieval, for this purpose data is organized into folders named according to users and ordered by dates

7 CONCLUSION

GPS and GSM integration for vehicle and other objects tracking can be very helpful instead of using GPS network alone.

This system can be further extended for multiple applications as follows

- Anti-theft system for cars and bikes.
- Managing of public transports likes buses and trains.
- Tracking of valuable assets.
- Fleet Management of cars.
- As a vehicle management software for transport companies

And many more similar applications thus, this system can prove to be very helpful in future.

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