

Real Time Position Tracking System Using Google Maps API V3

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Abstract- Vehicle Sensor Networks (VSN) are emerging as a new tool for effectively monitoring the physical world, especially in urban areas where a high concentration of vehicles equipped with on board sensors is expected. A vehicle tracking system combines the installation of an electronic device in a vehicle, or fleet of vehicles, with purpose-designed computer software at least at one operational base to enable the owner or a third party to track the vehicle's location, collecting data in the process from the field and deliver it to the base of operation.

IndexTerms - Tracking system, Google Maps, ARM Controller, GPS, GPRS

I. INTRODUCTION

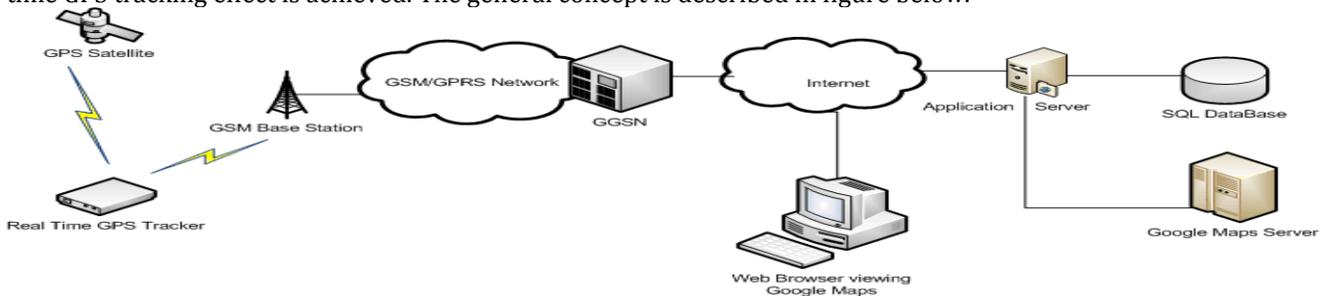
Several types of vehicle tracking devices exist. Typically they are classified as "passive" and "active". "Passive" devices store GPS location, speed, heading and sometimes a trigger event such as key on/off, door open/closed. Once a vehicle returns to a predetermined point, the device is removed and the data is downloaded on a computer for evaluation. Passive systems include auto download type that transfer data via wireless download. "Active" devices also collect the same information but usually transmit the data in real-time via cellular or satellite network to a computer or data-center for evaluation.

II. EXISTING SYSTEMS AND ITS LIMITATIONS

Modern vehicle tracking systems commonly use GPS or GLONASS technology for locating vehicle. However, these systems that are developed and designed by the vehicle developer are not available to the general public. Also, these systems are designed using a proprietary software and hardware. Due to the high cost of these systems, urban transit agencies cannot afford the systems. To overcome such problems we have proposed a system designed using open source software and hardware, keeping the cost of the system to a bare minimum.

III. PROPOSED SYSTEM

To tackle the above issues, we propose to build a mobile realtime GPS tracker with integrated Google Maps API V3. In the proposed system, the GPS chip outputs the positioning information which is transferred over a GPRS link to the mobile operator's GGSN (Gateway GPRS Support Node) and then to a remote server over a TCP connection. The TCP server stores the incoming positional data. When a user click on the tracking page, the page serves up an HTML page with an embedded JavaScript code. The JavaScript would run in the user's browser and has instructions to retrieve the positional information from an XML file. It then integrates this information into Google Maps through Google Maps API V3 which displays the position on a map. Since the positional Information is retrieved every second and the maps are updated at the same frequency, a real time GPS tracking effect is achieved. The general concept is described in figure below.



This system represents a significantly novel deployment scenario, considerably different from more traditional tracking systems.

IV. COMMUNICATION SERVICES USED

A detailed review of literature on Mobile GPS tracking systems and applications is explained below.

A. Global Positioning System, GPS:

Global Positioning System (GPS) is becoming widely used for tracking and monitoring vehicles. Many systems have been created to provide such services, which make them popular and needed more than ever before.

B. General Packet Radio Service, GPRS:

With the development of the modern traffics, it becomes more important to locate the vehicle running on highway. The system we have proposed is based on GSM network. The center and client can communicate with each other based on short message service and general packet radio service. The client is designed in 8-bit microprocessor to send global positioning system (GPS) information by SMS or GPRS.

C. Global System for Mobile Communication, GSM:

Our proposed system uses an existing GSM cellular network. A software based system is proposed that sends specialized requests to the GSM cellular networks to call any particular vehicle ID. The vehicle ID is actually a particular SIM kept in a special kit inside the vehicle that is capable of receiving a phone call automatically. As soon as the call is established, the particular cell information is available to the BSC, which is then passed to the software. Based on the information collected, the software will initiate forced handover of the call to another suitable cell and then receive the information of that cell too. Upon completion of two consecutive forced handovers, i.e., receiving cell information of the vehicle ID from three different cells and sending them to the software, it will automatically disconnect the call. The software will analyze the cell info and extract three timing advances data along with the GPS location of the individual cells. An algorithm has been developed for this system, which then calculates the exact location of the vehicle.

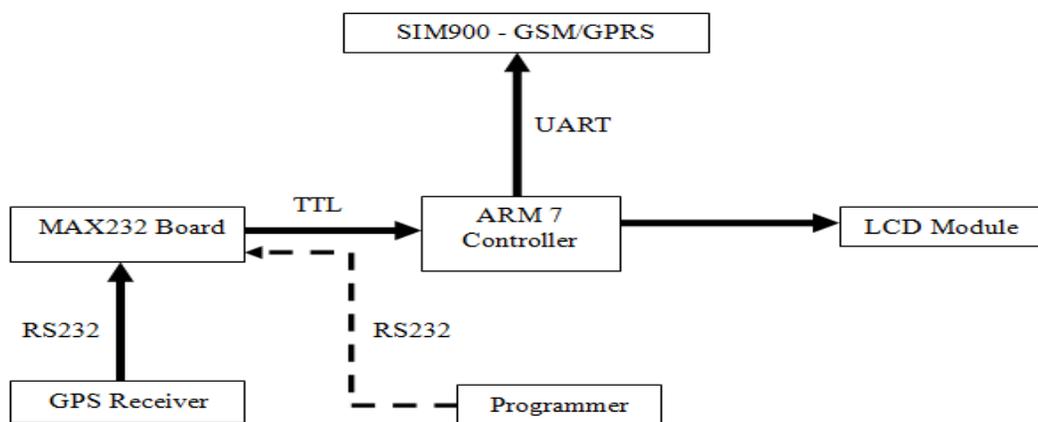
D. Google Maps API:

The Google Maps is a web mapping service application and technology provided by Google, that powers many map-based services, including the Google Maps website, Google Ride Finder, Google Transit, and maps embedded on third-party websites via the Google Maps API. The Google Maps JavaScript API lets you embed Google Maps in your own web pages. By using the Google Maps API, it is possible to embed Google Maps site into an external website, on to which site specific data can be overlaid. Version 3 of this API is specially designed to be faster and more applicable to mobile devices, as well as traditional desktop browser applications.

V. BLOCK DIAGRAM AND WORKING

A detailed review of the Block Diagram and Working of the proposed system is described below.

1. Block Diagram:



2. Working:

Figure above gives the block diagram of the system. ARM7TDMI controller is the main controller of the system.

- Controller is programmed to initialize ports used by buzzer and LCD panel.
- LCD panel displays relevant information.
- Controller initializes SIM900 module by printing AT commands at UART.
- Controller reads data given by GPS receiver from its serial pin, this is raw data and needs processing before it can be understood.
- The GPS data is calibrated by controller to provide NS EW longitude and latitude.

- This data along with xml format code is passed on to sim900 which pushes data to remote-server using GPRS via GGSN interface.
- RS232 is the standard format of data sent by GPS; this data is not compatible with controller, and hence the voltage levels need to be converted. MAX232 chip is utilized for this.
- The controller can also be re-programmed by serial-port programming.

VI. HARDWARE MODULES

1. Microcontroller

The microcontroller will be from ARM7TDMI family and it will monitor all the operations. ARM7TDMI allows 16 bit thumb mode instructions with enhanced debug and on chip multiplier with low power consumption and low cost making it most appropriate for this system.

2. GSM/GPS Module

In our system we propose SIM900 module. It is a quad-band GSM/GPRS engine that works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. It is designed with power saving techniques that the current consumption is as low as 4.5mA in SLEEP mode. Its physical interface to the mobile application is a 68-pin SMT pad, which provides all hardware interfaces between the module and the customer's boards.

3. GPS Module

The GPS module Proposed is EM-406A. It is a compact, high performance, low power consumption GPS engine board. It is based on the SiRF star III. The SiRF Star III LP Single GPS chipset enables the receiver to track up to 20 satellites at a time, and can perform extremely fast TTFF (Time to First Fix) in weak signal environments.

4. MAX232

MAX232 converts signals from signal from RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits and vice-versa. In the proposed we use it convert TTL commands of micro-controller to RS232 protocol used by the GPS module and used for communication between computer and micro-controller while programming.

5. Voltage Stabilizer

Logic circuits require 5V stable Vcc and anything above that may burn the chip and circuit inside it. Hence, IC 7805 is required to provide stable voltage to logic circuits. 7805 does not require additional components to provide a constant, regulated source of power, making them easy to use, as well as economical. They have a built-in protection against a circuit drawing too much power and additional protection against overheating and short-circuits, making them quite robust in most applications.

VII. FEATURES

The most prominent of the proposed system are:

1. Open Source

All the hardware components are open source and all the programming languages required are also open source. This means the system can be modified further as per requirements.

2. Low Cost

The hardware used in the system is cheaply available and the programming languages and softwares used are free to use, thus making the system cost efficient.

3. Availability

The hardware components, software and programming languages used are easily available and are easy to understand making the system understandable to beginners.

VIII. SOFTWARE AND PROGRAMMING LANGUAGES USED

Software used:

1. Keil for Embedded C Programming.
2. Hyper Terminal to check communication between micro-controller and computer while programming.

Programming languages used are:

1. Embedded C
2. Python Script
3. PHP Script
4. JavaScript
5. XML
6. Google Maps API

IX. APPLICATION AND FUTURE SCOPE

The above proposed system can have a large number of application and a huge future scope. Some of the applications are:

1. Sensors can be interfaced with the micro-controller to monitor amount of CO₂, humidity in a particular area, and temperature, etc.
2. Can be used for stolen vehicle recovery.
3. Can be used for fleet management.
4. Can be used in field service management.
5. Can be used for Logistic tracking.

Mentioned above are few of the many applications of the system.

X. COCNLUSION

GPS tracking of vehicles is not very new, but the system highlights the improvements in end user experience. End user experience is of prime importance, and display of GPS coordinates of a vehicle on a dedicated website enhances it. It allows a fair access to all users. Not only that, the system can be scaled further to display more information about the vehicle by adding various sensors. Addition of sensors doesn't require change of any hardware components, and effect on power requirement is negligible. This system can be provided as a premium service to consumer, which will help it, make sustainable. Alternatively releasing its code open-source under GNU-GPL V3 will allow developers to build further on this project by predicting highly localized observational parameters like environmental pollution, local weather and humidity point, etc. Finally this system provides a low cost solution to localized data acquisition which is highly scalable.

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