Google Maps Based Vehicle Tracking using GPS and GSM/GPRS

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Abstract: With ARM7 as the core, this paper discusses a kind of design of vehicle location system. The vehicular module is used to track, monitor, and surveillance and finds the accident spot and intimate to the monitoring station. The proposed design provides information regarding vehicle Identity, speed, and position on real time basis. This information are collected by the ARM7 TDMI-S core processor LPC2148 by using different modules in the system and dispatch it to the monitoring station where it stores the information in database and display it on graphical user interface (GUI) that is user friendly. GUI is built on Microsoft Visual Basics. The system consists of cooperative components of MEMS accelerometer, microcontroller unit, GPS receiver and GSM module. In the event of accident, this wireless device can send SMS indicating the position of vehicle by GPS system to family member, emergency medical service (EMS) and nearest hospital. The threshold algorithm and speed of motorcycle are used to determine fall or accident in real-time.

Keywords: GPS, GSM, ARM Embedded System, ARM7 TDMI-S, MEMS Accelerometer, GPS, GSM, LPC2148, Wireless Monitoring Station.

I. INTRODUCTION

Mankind has always reacted to problems with strong determination aimed at providing better solutions to if difficulties. From the use of celestial navigation to the use of compass man has always searched for a means of accurately locating his position on the globe with precision and accuracy necessary to avoid tragedy and to reach his intended destination. One could also want to locate a specific place in a locality familiar to him. This could be a shopping mall, a petrol station, a hotel, or even an office. The Global Positioning System (GPS) is a popular satellite navigation system which makes use of a constellation of more than two dozen GPS satellites to transmit precise radio wave signals in any weather, day or night, anywhere on Earth. This allows a GPS receiver in an unobstructed line of view to synchronize with the satellite to determine its current horizontal location to the nearest 15 meters radius in latitude, longitude and altitude by connecting to just four satellites in its horizon. It provides accurate three dimensional positions (latitude, longitude, and altitude), velocity and precise time traceable to Coordinated Universal Time (UTC). To make the device user friendly, the information from the GPS is translated to information that can be understood via a map.

The aim of this work is to integrate readily available materials with the implementation of the knowledge of software engineering and basic electrical and electronics to build an easy to use, computerized navigation/tracking system capable of tracking the movements of a remote target. Because of the tracking capabilities of the device it can easily be used to monitor the movements of a vehicle as well as for vehicle recovery. With the development of GPS technologies and the improvement of 3G wireless communication network, the communication mode of GSM/GPRS-based positioning and monitoring system is constantly changing as well as its developing technology, aiming to build an efficient, reliable and wide range covered system by integrating the latest communications technology and the newest wireless network environment. The traditional positioning and monitoring system consists of three parts: the GPS terminals, wireless communication network and control center as shown in Fig.1.

Fig.1. Positioning and monitoring system architecture.

In today’s world as the population increases day by day the numbers of vehicles also increases on the roads and highways. These results in more accident that intern leads to the traffic jams and public gets help instantaneously. This module provides information about the accident to the
hospital and police station. As a result, sudden help public life may save and the traffic jams are reduced. To improve the level of supervision and management for cargo transport vehicles, especially trucks carrying coal it is important to develop transport vehicles remote monitoring module. A server computer at the (remote) monitoring station that is continuously waiting for data from the system, should record the actions of the vehicle into a database. This contains the information regarding Vehicle velocity, position, identity and temperature in two fashions. The Information given to monitoring station is in continuous manner. The project requires a suitable microcontroller to co-ordinate all activities. This includes reading data sent by the GPS receiver module and communicating this data to the GSM modem. This ideal controller should be able to handle these operations in terms of memory and processing speed.

II. PROBLEM DEFINITION

Location Based Services Location based services (LBS) define the broad spectrum of technologies which can calculate the position of a receiver. There are many types of LBS which function at varying degrees of accuracy and scope. The global positioning system (GPS) is an outdoor LBS which is capable of determining the location of a receiver within 15 to 100 meters of accuracy. GPS tracking and monitoring describes the use of GPS to determine the location of a receiver and consequently following its movements.

III. MEMS

Micro electro mechanical systems (MEMS) are small integrated devices or systems that combine electrical and mechanical components. Their size range from the sub micrometer (or sub micron) level to the millimeter level and there can be any number, from a few to millions, in a particular system. MEMS extend the fabrication techniques developed for the integrated circuit industry to add mechanical elements such as beams, gears, diaphragms, and springs to devices. Examples of MEMS device applications include inkjet-printer cartridges, accelerometers, miniature robots, micro engines, locks, inertial sensors, micro transducers, micro mirrors, micro actuators, optical scanners, fluid pumps, transducers and chemical, pressure and flow sensors. Many new applications are emerging as the existing technology is applied to the miniaturization and integration of conventional devices. These systems can sense, control and activate mechanical processes on the micro scale and function individually or in arrays to generate effects on the macro scale. The micro fabrication technology enables fabrication of large arrays of devices, which individually perform simple tasks, but in combination can accomplish complicated functions.

MEMS are not only about miniaturization of mechanical systems but they are also a new pattern for designing mechanical devices and systems.

IV. SYSTEM BLOCK DIAGRAMS

Vehicular Unit The complete block diagram of vehicle unit is as shows in fig.2. The vehicular system [VS] includes hardware that consists of an ARM 7 TDMI core processor, Accelerometer, GPS module, GSM module, SD memory card, 16x2 LCD, and temperature sensor. The whole VS works on a 5V or 9V dc regulated power supply. The GPS receiver module interfaced with UART1 of ARM processor provides speed and location information. The identity of a vehicle is fixed that is saved in a flash memory of a processor. The temperature sensor provides temperature

![System Block Diagram – The Vehicular Unit](image)

A. Per Degree Celsius To An ARM Processor

The temperature sensor is interfaced to an ADC1 of ARM processor. Vehicular speed, position and temperature are stored in a SD card. The SD card is interfaced to an ARM processor using SPI (Serial Peripheral Interface). All this information are shown on LCD that is interfaced with a GPIO 0 and send it to a monitoring station(receiver side) by GSM module wirelessly that is interfaced with UART0 of ARM processor. Also the same information is given to a concern person to get that information anywhere anytime. The module requires GSM SIM (Subscriber Identity Module). As per the definite event stored in a program and when collision/accident occurs that is sense by an Accelerometer which is interfaced to ADC0 of ARM processor.

V. DESCRIPTION OF INDIVIDUAL UNITS

A. GSM Module

Global System for Mobile communications (GSM) is the almost popular wireless standard for mobile phones in the world. GSM module allows transmission of Short
message service (SMS) in TEXT mode and PDU mode. The proposed design uses SIM 300 GSM module in text mode. This design uses SIM300 GSM module that provide 900/1800/1900MHz Tri-band for VOICE, SMS, DATA, and FAX. This module operates on AT command over TTL interface. AT command is an abbreviation for Attention command that is recognized by GSM Module. This abbreviation is always used to start a command line to be send from TE (Terminal Equipment) to TA (Terminal Adaptor). The information contains information speed, position (longitude, latitude), identity and temperature of a vehicle that is transmitted to the monitoring station by the SMS through the GSM network.. SIM 300 Module works on 12V, 2A power supply. The module is configured at 9600 baud rate. Fig.3 shows interfacing of GSM module with ARM Processor on UART1 where TxD pin of ARM processor is connected to RxD pin of GSM module and vice versa. The transmitted data from ARM processor using UART1 module contains information about Vehicle Identity that may be checked and displayed.

![GSM Module Interfacing](image1)

**Fig.3. Interfacing of GSM module on UART1.**

**B. GPS Module**

Global Position System (GPS) is a space-based satellite navigation that provides location and time information in all weather conditions, anywhere on or near the Earth. GPS Receiver MT3318 Module is used. The GPS receiver tracks 51 satellites simultaneously. The module is mounted on the PCB along with the 3.3V low drop voltage regulator, transmit, receive and power indication LEDs, Schmitt trigger based buffer for 5V to 3.3V logic level conversion as shown in Fig.4. This GPS receiver gives data output in standard National marine electronics association (NMEA) format. The GPS receiver gives -157dBm tracking sensitivity. The module is configured at 9600 baud rate. Module requires a 5V supply and can be interfaced with the 5V TTL / CMOS logic.

![GPS Module Interfacing](image2)

**Fig.4. Interfacing of GPS Module.**

**VI. CONCLUSION**

The Vehicular System provides information of a vehicle like velocity, position, through a GPS module and identity of a vehicle to a monitoring station and to a mobile phone according to a definite event stored in a program or a query from a monitoring station. Accelerometer senses the collision of the vehicle and sends this information in real time to a hospital/police station. The monitoring station display these information in GUI also stored these information in database for further process according to a program. The system is useful in much application such as surveillance, security, tracking, which may be installed in cargo trucks, cars, motorcycle, and boat. The system can be used in many applications.

**VII. REFERENCES**


