VEHICLE TELEMATICS WITH REAL TIME OPERATING SYSTEM

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Abstract

Vehicle Telematics has Vehicle tracking employs the use of an electronic module or device, regarded as Vehicle Tracking Device, and installed in the vehicle to empower the owner or other person in charge to track the location of vehicle. Global Positioning Systems (GPS) modules are being used by most of the vehicle tracking devices and systems for accurate location of the vehicle. Real Time Operating System (RTOS) on the device ensures determinism among the execution of tasks of data collection and transmission to the server at distant location. Location of the vehicle along with rest of the information can be observed on electronic maps through Internet. Vehicle tracking systems can be used for the purpose of fleet management functions such as routing and dispatch as well as for collection of on-board information, monitoring driver's behavior, vehicle's status and security.

Keywords: *Vehicle Tracking System, GPS, RTOS and Embedded System etc.*

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1. INTRODUCTION

With advancements in fields of embedded system, telecommunication and vehicular technologies, sending and retrieving the on-board information of a vehicle has become quite possible [1]. Automatic Vehicle Location (AVL) is now being used for gaining access to the location of the vehicle through devices and modules vehicle tracking [2][3]. The location of vehicle can be observed by the owner of vehicle or someone else in charge, using vehicle tracking system, which is an electronic device or module placed in vehicle. Global Positioning System (GPS) modules are being used by most of the vehicle tracking devices and systems for accurate location of the vehicle. GPS modules are not only used to determine the location of the vehicle but also the speed and direction, along with timestamp. Vehicle tracking systems also include a cellular transmitter and receiver to communicate the location of vehicle to a remote server or user. Thereafter information retrieved from the VTS module regarding the vehicle can be observed on electronic maps such as GOOGLE Maps through the Internet.

Among navigation systems, GPS is regarded as the lone fully functional Global Navigation Satellite System [4]. GPS satellite system is now available free of cost to the civilians. GPS is an integral part of VTS devices for the sake of receiving the location of vehicle along with other information. A constellation of 24 to 32 Medium Earth Orbit satellites is used by GPS, precise microwave signals transmitted by these satellites are used by GPS receiver to determine its position and time [5].

A clear view of the sky is required by the GPS receivers, so the present technology is mainly used outdoors. The data transmitted by each satellite indicates the current time and its location. Operations are synchronized by the GPS satellites so as to transmit the repeating signals at the same instant. Each satellite's orbit is tracked accurately by the ground stations. GPS satellites generally transmit signals on two main carrier frequencies regarded as L1 and L2. Although the signals from the GPS satellites move at the speed of light, there is a difference among their reception at GPS receiver since some satellites in orbit are farther away than others. By estimating the amount of time taken by the signals from a GPS satellite to reach the receiver, the distance in between the GPS receiver and the GPS satellite is determined. When the distance from at least four GPS satellites is estimated by the GPS receiver, it calculates its own position at ground in three dimensions [4][5].

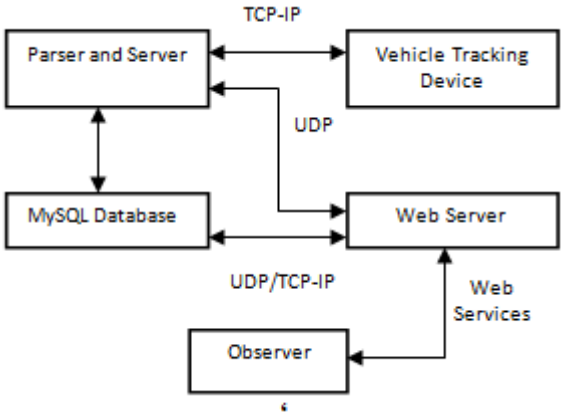

Fig-1: Block Diagram of Vehicle Tracking System

A variety of wireless modules based Global System for Mobile Communication (GSM)/General Packet Radio Service (GPRS)/Enhanced Data rates for GSM Evolution (EDGE) are integrated in the VTS module for the cellular transmission of the information retrieved by GPS module to the remote user or server [6]. Data rates from 56 to 114 Kbit/s are provided through GPRS which is a packet oriented mobile data service. For Internet and Wireless Application Protocol (WAP) access along with Short

Message Service (SMS) and Multimedia Messaging Service (MMS), GPRS module has been used in VTS which enables communication with the remote user or server.

1.1 Types of VTS Module

There are several types of Vehicle Tracking System (VTS) modules, which are classified as Passive VTS and Active VTS. Passive VTS devices store the information regarding location, time stamp along with the data that may include triggering of events such as turning key on or off and opening/closing of the door [6]. After the vehicle reaches or returns to a predetermined location, the device is removed from the vehicle and the data is downloaded to a computer or server for evaluation of the information retrieved [7][8].

Active VTS devices also collect the same information as the Passive VTS modules do but the data collected by them for the evaluation is transmitted in real-time through cellular data or satellite networks to a server or data center without the need of removing the device from the vehicle or to wait over a period of time to collect the information [8].

2. BLOCK DIAGRAM

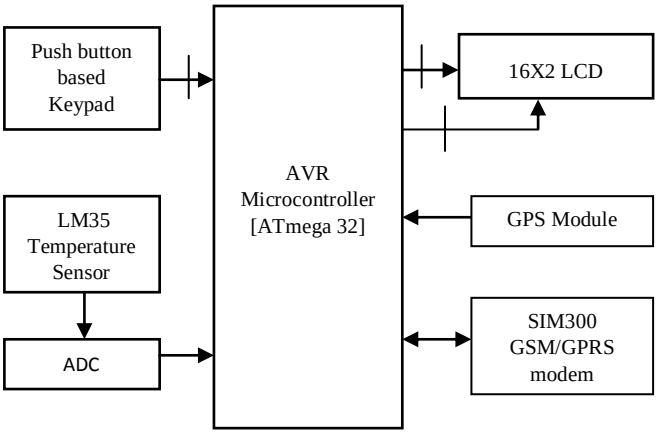

Fig-2: Block Diagram of Vehicle Tracking Device

The embedded system for the Vehicle Tracking device to be placed at the vehicle end compromises of a GPS module for receiving the location of vehicle, SIM300 GSM/GPRS modem (modulator-demodulator) for cellular transmission, 16x2 Liquid Crystal Display (LCD) for displaying the current information retrieved and the tasks being performed, push button based keypad, LM35 temperature sensor along with AVR microcontroller Atmega32. AVR microcontroller ATmega32 has been used to serve the purpose of microcontroller unit which operates at the frequency of 16 MHz and has 32 input/output pins with 40 pins in total. FreeRTOS is being ported over Atmega32 to perform the real time processing of the application data retrieved by the vehicle tracking device to maintain determinism among the tasks of obtaining location of the vehicle, confining the data into packet and transmitting the data-packet to the remote server by avoid the buffering delays.

3. FLOW CHART/ALGORITHM

The flow chart for the designed vehicle tracking system is as follows:

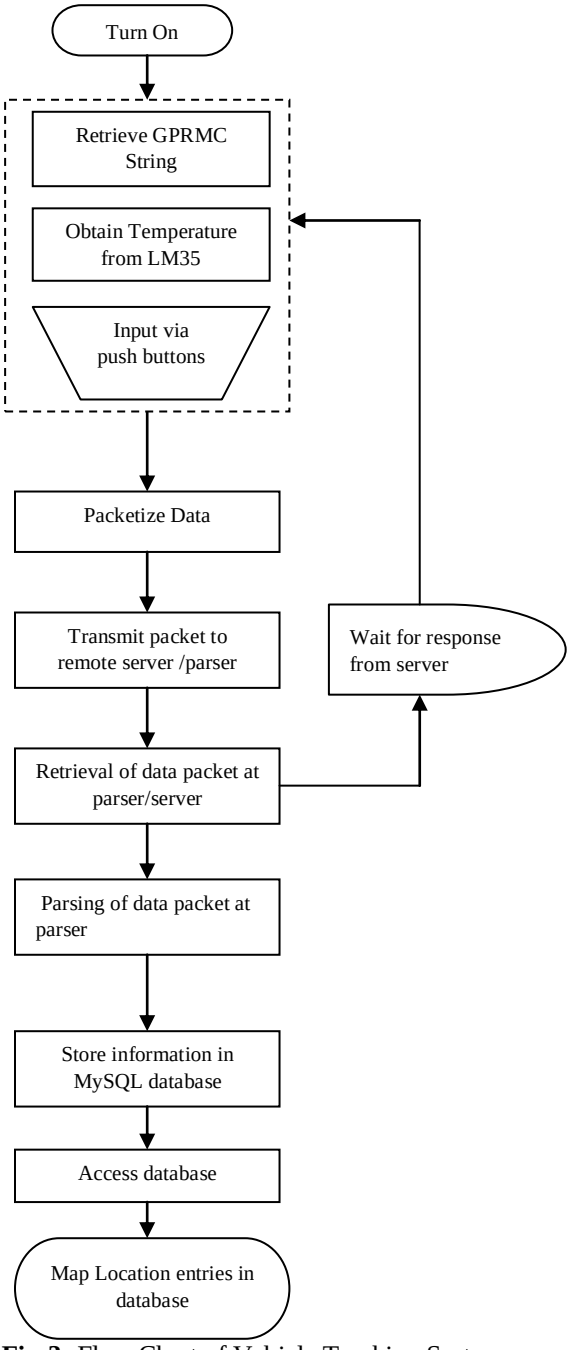

Fig-3: Flow Chart of Vehicle Tracking System

When the vehicle tracking device placed in the vehicle is turned on, the tasks are executed in their designated order for the purpose of retrieval of GPRMC string through the GPS module, temperature readings for the temperature of the vehicle and vicinity are obtained from the LM35 temperature sensor and the inputs are retrieved from the push buttons. After all the data and information is retrieved, it is packetized as per protocol for containment of the information, the data packet is transmitted to the remote server using GPRS modem [9][10].

The data packet is retrieved over to the remote server and parser after which the data packet is parsed and longitude, latitude, true course, speed, temperature readings from LM35 temperature sensor, input values from the push buttons are parsed over the server. Longitude and latitude values are fed into the MySQL database. The last values or the data entries in the database are mapped on the GOOGLE Map over the web server [11][13].

4. PACKETIZING OF GPRMC STRING ALONG WITH DATA FROM LM35 SENSOR AND PUSH BUTTONS

The transmission of the information over GPRS to remote server, this is done as per a specific protocol to ease out the parsing of data at the parser end. The protocol for the packetizing marks the beginning and end of the packet transmitted over a session and the input values from push buttons, temperature readings received from LM35 temperature sensor and GPRMC string retrieved from the GPS module are included with separations.

Fig-4: Display of Latitude and Longitude

5. PARSING OF DATA PACKET

TCP/IP server at the remote site to retrieve the data packet from the vehicle tracking system parses the data packet to separate the information regarding location i.e. longitude and latitude of the vehicle along with other parameters such as true course, speed, temperature readings received by LM35 temperature sensor and input values from push buttons.

6. APPLICATIONS

The Vehicle Telematics can enhance and improve the functionality of an enterprise; there are many applications of vehicle telematics among which freight and container tracking for observing the shipments and ensuring safe and timely deliveries of the freight containments are prominent.

Monitoring of true course and location of the vehicle tracking are achieved by combining the GPS and mobile data communication along with web services. This may ease fleet management for the purpose of vehicle financing and routing of vehicles [12].

7. ADVANTAGES AND LIMITATIONS

The embedded system designed enables the real time tracking of the personal or corporate vehicle from a remote site and locating and mapping the vehicle over the web server, thus providing options for tracking the freights and containers along with personal vehicles, ensuring the accurate and timely shipments. FreeRTOS ensures that the jitters and buffering delays are reduced so as to enable the real time operation the application.

The Vehicle Tracking System designed may face inaccuracies in instances of bad and cloudy weather and the network delays in retrieval of the packet at remote server may appear in case of network congestion.

8. RESULT

The designed server and parser for the data packet enables to retrieve the information from the data packet transmitted from the vehicle tracking device placed in the vehicle and the location of the vehicle can be mapped using GOOGLE Maps[13]. At the same time temperature of the vehicle and SOS alerts are visible at the server interface.

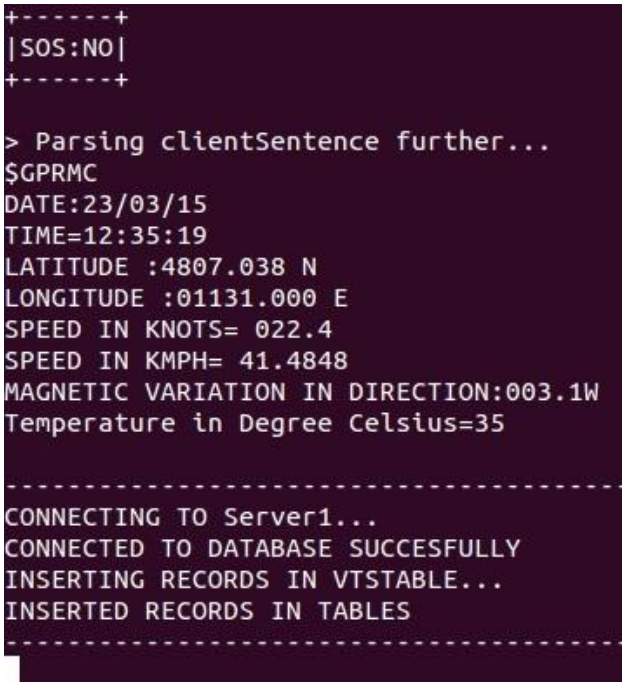

Fig-5: Interface of Parser

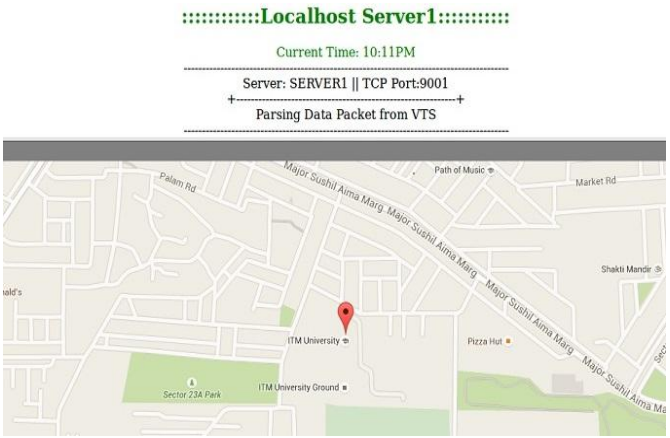

Fig-6: Mapping of location entry of Server1

9. CONCLUSION AND FUTURE SCOPE

The whole of the Vehicle Tracking system [1] is designed to conveniently and easily track and observe the vehicles from the remote site. The designed embedded system enables the logging of location information database and along with mapping of last location.

There is future scope for the designed embedded system with improvement in retrieval of true course readings for the purpose of auto-fare meter development.

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BIOGRAPHIES

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