Vehicle's Telematics Unit

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Abstract:

The goal of this paper is reviewing the past work of vehicle tracking systems and improve the existing system to a vehicle's telematics unit. The system will be taking care of telematics related functionality in vehicle like providing vehicle position, over speed detection, geo fencing detail and vehicle stolen detection. It is a combination of a GPS (Global Positioning System) receiver and a GSM (Global System for Mobile Communications) Module. This combination of technology will produce a system having capability of tracking and monitoring different parameters of vehicle. It's an integration of two system having communication through UART (universal asynchronous receiver-transmitter) port for transmission and reception of data.The telematics information will be sent through SMS on registered number. The registered number and other parameters will be configurable through SMS.This project can be divided into two main blocks hardware and software development. The hardware development includes connection of microcontroller with GPS module and power supply. The software development includes writing the microcontroller source code, configuring the UART for NMEA (National Marine Electronics Association) data through GPS and writing GSM message configurations commands.

Keywords: Vehicle telematics unit, GPS, GSM, UART, SMS, NMEA.

1. INTRODUCTION

Transportation is the backbone for today's growing economy its fully responsible for the availability of the resource and product.
As the need of different products increased so the transportation of work force increased which leads to increase in different modes of transportation.

One such means of transportation is use of vehicles like cars, buses etc. Owning a vehicle now a dayis not merely a

symbol of luxury but has become a necessity. However, considering vehicles, any catastrophic situation can take place. Therefore, there is always an urgent need to arrange appropriate measures to increase the safety, security as well as monitor the vehicles to avoid any mishap.

It would help us in the situations such as:

- Locating a vehicle.
- Detecting the over speed.
- Detecting geo fencing of the vehicle.
- Monitoring different parameters of vehicle like distance covered, OFF time, ON time and speed.
- Diagnostic information of system.

One way is the use of tracking technology using the GPS (Global Positioning System). Such trackers require a microcontroller and different other sensors to make it possible.

This base station is used for data collection and storing. It is accompanied by maps such as Google maps, Here maps, Bing maps etc. for the representation of the location. The system is linked to Global Positioning Satellites which helps to acquire the time as well as the position.

The electronic device installed on the vehicle consists of a GPS receivers and a GSM modem. GPS developed by the American Military. It's a global system which uses a combination of satellites to calculate the location by latitude and longitude. Also it receives other information from satellite like dateand time. The satellite cluster is a combination of 24 satellites. It requires at least 4 satellites to be visible to find an accurate location.

GSM was developed by the ETSI(European Telecommunications Standards Institute) with the aim to back the mobile communication, has now become worldwide accepted standard. The transmission of data is done as GSM communication protocol on a specific frequency band.

The system is responsible for fetching data from GPS, processing it to know various parameters like speed, distance etc. and sending the required information to registered mobile number.

The system is itself responsible for configuring itself remotely for parameters like changing owner information, changing registered mobile numbers, changing speed limit etc.

2. RELATED WORK

Various approaches to vehicle tracking, monitoring and alerting system has been proposed so far.

Ankit Kesharwasni, Vaishali Sadaphalt worked on a system to overcome problem in public transportation system it uses wireless networkfor finding and monitoring of bus transportation system and record of arrival time of buses at bus stops. The system informs about the delay in arrival time of bus at the bus stops [1].

Kunal Maurya, Mandip Singh and Neelu Jain worked on anti-theft system. Vehicle tracking system proposed was likea real time system which works on the GPS and GSM technology to provide the location of vehicle to the vehicle owner. It can be used for wildlife animal tracking, different assets tracking and in vehicletracking and stolen vehicle recovery [2].

Xing Jianping, Zhang Jun, et al. proposed GPS real time vehicle monitoring and alerting system used GPRS on the embedded system. Compared with the conventional single mode of GPRS, this method makes up the disadvantage of the high time delay of GPRS communication in data transmission also it requires an active GPRS plan always [3].

Transportation is a very important shared resource that requires an efficient and effective way to manage that can be possible by locating the vehicles with use of resources like GSM modem and GPS. This system is located on the bus and GSM modem communicates via SMS to user or server configured to receive SMS [4].

Y. Kakuda proposed a technology for tracking children's. The child safety is a big concern for the parents and to prevent crimes against children. The technology is based on mobile communication network. The system is helpful to parent to know the safety level information and in andout information of students in school [5].

Farooq, U. M. Amar, M.U. et al. proposed GPS-GSM integrated transportation management systems consist of four modules such as bus station, in bus, base station and bus stop module. The developed system is useful for facilitating people using public transportation services [6].

Communication between the systems will be useful to transmit information to the bus unit making it possible for system and driver to know the vehicle is on the way. This system helps in driver pre information of the traffic estimation and usefulinformation to find a particular vehicle of same transportation [7].

In reference to the above work the system is focused to increase its capability and make it a complete vehicle telematics unit which will not only provides the location but provides various other parameters which optimizes the vehicle maintenance and transportation system.

3.Methodology

The below diagram gives a pictorial representation of the system.

Fig. 1 Proposed system.

The system will be installed in vehicle. It will accomplish its task with the help of a mobile device, GPS and GSM communications.

3.1 Hardware Required.

The chosen hardware Q2686 is an ARM9 based GSM module manufactured by Wavecom now Sierra wireless.
It's an automotive grade power pack module having robust design to sustain in harsh automotive environment.
It has facility of interfacing various peripheral with supported UART, I2C, SPI communication.

It has 42 GPIOs for general purpose uses.
It provides an easydebugging interface by communication through UART and doesn't requires extra hardware for code burning or debugging.

The supplier supports product development through there developer forums by discussing the issues and suggesting solutions.

Fig. 2 Q2686 development board.

3.2 Software Required
The wavecom provides a proprietary RTOS platform for the application development which is OpenAT.
It has built in stack for GSM and GPRS communication. It supports wide range of communication interface like SMS, FTP, HTTP etc.

The software is developed using Embedded C.
The IDE used is Developer studio provided by Sierra wireless which provides an easy way of code editing compiling and debugging.

The platform supports GNU GCC compiler and hence provides a chance for full use of Embedded C to develop wide range of application.

4.PRACTICAL MODEL

The implementation starts with creating a OpenAT project inDeveloper studio for microcontroller Q2686.

The work is divided in below segments.

4.1 UART driver development.

The GPS module is needed to interfaced using UART so first target is to make UART communication possible.
UART is configured on baud rate 9600 bps and its command and data handler activated through OpenAT API. Once any data is received in data handler it sends the data to internal processing unit for further checks.

Here GPS works on NMEA protocol so the string format of NMEA is analyzed and different parameter like latitude, longitude, speed, degree, direction etc. identified from the string.

GPS receives data from satellite and it requires a minimum set of satellites (Count 4) to provide an accurate data otherwise it gives garbage data which we filtered out using Embedded C logics.

The proper GPS data is taken for further processing and derive various functionality out of it.

4.2SMS configuration

The system is required to provide data to a registered number hence SMS functionality is activated.

It receives SMS from a valid number only so a password mechanism is developed to match the password in received message and only valid message can change the configuration e.g. Speed limit, registered mobile number etc.

4.3 Functionality development

Individual functionality is developed with Embedded C logics.For detecting over speed the speed received is monitored.

Geofencing is checked by finding the distance between the received location and a set of predefined location if the location distance is in range geo fencing is detected and its alert is generated through SMS.

System ON/ OFF time is saved by syncing RTC with received GPS time and sending the update whenever required through SMS.

The system itself monitors various system setting values and update the used for any corruption of data.

It calculates the distance travelled and generates alerts through SMS after covering a certain distance. The user can monitor the vehicle running distance especially useful for logistics company to monitor large number of vehicles remotely.

4.4 Results

The alerts are sent to the registered mobile number.

We receive individual message for ON, OFF, over speed alert etc.

The message contains the date, time and goggle map location of the corresponding alert.
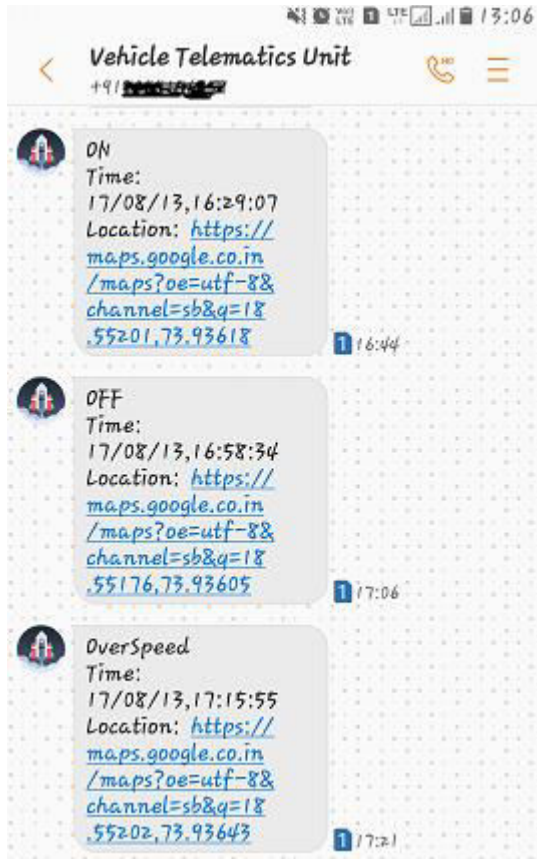

Fig. 3 Screenshot of received messages. ON, OFF, OS.

The received message is having a google map link which can be directly plotted on android google map or we can plot the location on internet browser by using latitude and longitude provided in message.

For getting the alert of ON OFF, we need to send a request message to the system and system reply with the date, time location.

Other alerting parameter like Over speed and geo fencing alerts will be sent automatically as soon as the condition matches. It will also have record of different Over speed instances and when device will be connected through PC that can be checked and downloaded.

On PC, we can have considered the memory location of device where different parameters are stored.
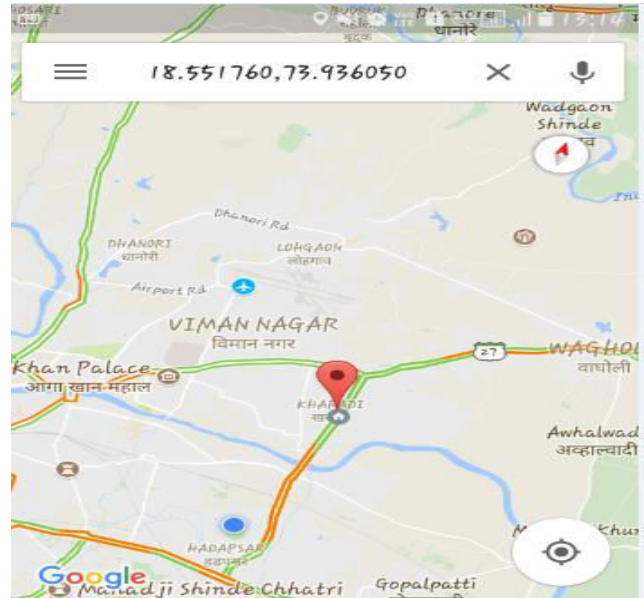

Fig. 4 Screenshot of location on Google Map.

5 Conclusions

In this paper, we have done review of various existing techniques of vehicle tracking, monitoring and alerting system. We have gone through various useful technologies, algorithms and methods for tracking, monitoring and alerting system.

Every system has their own importance; different authors have tried different methods based on applications.

The proposed system is implemented and tested with different scenarios. As the system development is done on a widely used OpenAT platform we get a chance to get into automotive domain.

Present system provided an entry point for Automotive domain which can be widely elaborated in future.

5.1 Future perspective of Work

- The data communication can be done through GPRS.
- The On-demand things can be configured for auto update and hence device will continuously send the data to a server. We can create a database

with that and maintain complete vehicle information of years.
- The telematics data can be shared with manufacturers and they can optimize their vehicle performance by analyzing it e.g. vehicle mileage can be monitored and improved.
- Other vehicle parameters can be added like Door lock status, engine RPM, engine temperature etc.

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