IMPLEMENTATION OF VEHICULAR MONITORING AND TRACKING BASED ON ARM

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Abstract- **Design of Vehicular monitoring and tracking system based on ARM using GSM and GPM is proposed. The vehicular module is used to track, monitor, and surveillance and finds the accident spot and intimate to the monitoring station. Also this paper presents that while we send a predefined message to hardware kit which is placed in the vehicle, it replies to the same number by sending a message which contains the vehicle longitude and latitude details of the vehicles. The executive results of laboratory tests show that the system fulfils real time control and functional parameter monitoring of a vehicle.**

Index Terms- **ARM7 TMI-S, MEMS Accelerometer, GPS, GSM, LPC2148.**

I. INTRODUCTION

Intelligent transportation system is a crucial part of China's information construction. With the increasing city holdings of cars, there are more and more traffic jams, so requirements are that Intelligent Transportation needs more improvement. The key technology of Intelligent Transportation is Vehicle positioning system, while the key of which is positioning system. Nowadays the most widely used positioning system is a system consisting 24 satellites whose searching area embrace the globe. It can ensure that more than 4 satellites will be observed at one time, that they can collect the longitude and latitude of the view point, and furthermore realizing the function of navigation, positioning, and time service.

This contains the information regarding Vehicle velocity, position, identity and temperature in two fashions. The information given to monitoring station is in continuous manner and when the accident occurs. The development of vehicular design brings public many convenience in life but also brings many problems at the same time, for example, traffic congestion, difficulty in monitoring dispersive vehicle, theft and other series of problems[4].

The Vehicle Monitoring and Security System is a GPS based vehicle tracking system that is used for security applications as well. The project uses two main underlying concepts. These are GPS (Global Positioning System) and GSM (Global System for Mobile Communication). The main application of this system in this context is tracking the vehicle to which the GPS is connected, giving the information about its position whenever required. This is done with the help of the GPS satellite and the GPS module attached to the vehicle which needs to be tracked. The GPS antenna present in the GPS module receives the information from the GPS satellite in NMEA (National Marine Electronics Association) format and thus it reveals the position information. This information got from the GPS antenna has to be sent to the Base station wherein it is decoded. For this we use GSM module which has an antenna too. Thus we have at the Base station; the complete data about the vehicle. For real time monitoring an automatic monitoring system can be established with GSM, in this vehicle automatically identify and upload critical data about the vehicle and operating conditions.

Key feature of this design include:

a. Vehicle real-time monitoring by sending "its" information regarding velocity, Position (longitude, latitude) to the monitoring station and to the user/owners mobile that should help them to get medical help if accident or the theft.

b. Display that information on GUI and also at the same time these information are stored in the database if needed.

c. User/owner has an access to get real-time position of a vehicle in real time.
d. Also in case of theft vehicle should be stop at the same time where this system is ported on the mobile vehicle.
e. It includes a temperature sensor that gives temperature in degree Celsius for monitoring the environmental conditions around the goods or other stuff in the transport vehicle.

II. RELATED WORKS

In this chapter, we will discuss about the information found by study and research that is critical and have an important value in the contribution of the whole project. It also gives some basic knowledge or theoretical base and is used as a foundation to successfully achieve the main objectives. Most of the literatures are from the related articles, journals, books and previous works of the same fields. These literatures are then compiled and use as a guidance to the work of this project. GSM and GPS based vehicle location and tracking system will provide effective, real time vehicle location, mapping and reporting this information value and ads by improving the level of service provided**.**

Tracking systems were first developed for the shipping industry because they wanted to determine where each vehicle was at any given time. Passive systems were developed in the beginning to fulfil these requirements. For the applications which require real time location information of the vehicle, these systems can't be employed because they save the location information in the internal storage and location information can only be accessed when vehicle is available. To achieve Automatic Vehicle Location system that can transmit the location information in real time, Active systems are developed. Real time vehicular tracking system incorporates a hardware device installed in the vehicle (In-Vehicle Unit) and a remote Tracking server. The information is transmitted to Tracking server using GSM/GPRS modem on GSM network by using SMS or using direct TCP/IP co nnection with Tracking server through GPRS. Tracking server also has GSM/GPRS modem that receives vehicle location information via GSM network and stores this information in database. This information is available to authorized users of the system via website over the internet.

In 1976 GM introduced SDM module (Sensing and Diagnostic Module), which was improved to so called DERM (Diagnostic and Energy Reserve Module) in 1990. The main target of this module consists of recording and saving data from measuring sensors including error messages at the time when the airbag is activated.

In 1990 GM installed the first sophisticated electronic accident data recorder in F1 cars. Firstly the mentioned units were designed as a diagnostic tool for a determination of the reasons for the airbag activation. Later, units were used for accident reconstructions. It was asked by insurance companies and police.

In 2005, thanks to the co-operation of Great Britain, the Netherlands and Belgium the European project called SAMOVAR (Safety Assessment Monitoring on Vehicle with Automatic Recording) came into existence. This project is targeted on motor cars monitoring by black boxes and its possibilities to improve road – traffic safety. During years, there were more attempts of some alternatives of the black box but it was not wide spread used.

III. PROPOSED SCHEME

The proposed design provides information regarding vehicle Identity, speed, and position on real time basis. This information is collected by the ARM7 TDMI-S core processor (LPC2148) by using different module and dispatches it to the monitoring station. The complete block diagram is as shows in fig.1.The vehicular system [VS] includes hardware that consists of an ARM 7 TDMI core processr, Accelerometer, GPS module, GSM module, SD memory card, l6x2 LCD, and temperature sensor. The whole Unit 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 per degree Celsius to an ARM processor.

The temperature sensor is interfaced to an ADC1 of ARM processor. All this information are shown on LCD that is interfaced with a GPIO0 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. The detail descriptions of all modules are as follows.

A. Sensor: A sensor is a device used for the detection of changes in quantities and it provides a corresponding output, generally as an electrical or optical signal.

1). Temperature Sensor (LM35): The Temperature-LM35 sensor continuously monitors the temperature of surface at which it is mounted, generally vehicle engine and body. If the Temperature exceeds predefined value, the microcontroller will send alert to the driver by means of buzzer usually fixed near to Dash board.

2). MEMS Accelerometers (ADXL335): The ADXL335 is a low power, thin, small, complete 3-axis accelerometer with signal conditioned voltage outputs. Product processes acceleration with a minimum full-scale range of ±3 g. They can measure the static acceleration of gravity in tilt-sensing device, as well as dynamic acceleration resulting from vibration, shock, or motion. X-axis is connected with controller and continuously checks that "g" value change. The output of accelerometer provides 1.65V to 3.3V in positive direction and in negative direction the voltage drop from 1.65V to 0V. The output of accelerometer is in analogue form with three different output voltages each representing X, Y and Z direction of motion. These three voltage signal are processed through ADC0 on three different Channels available on ARM. ADC0 is configured at 4.5MHz clock from system peripheral clock. The 8 bit digital output from ADC0 is fed to UART1 of ARM. Accelerometer is used in this design for the collision detection. The maximum output voltage of accelerator module is 3.3V that is a CMOS voltage of the processor.

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B. LPC 2148 Microcontroller: This is a 32-bit ARM7-TDMI-S microcontroller with 32kB of on-chip static RAM and 512 KB of on-chip flash memory. It has 128-bit wide interface/accelerator that permits 60MHz of operation. Also it has In-System Programming using on-chip boot loader software, 400ms of full chip erase and 256 B of programming in 1ms. For interfacing of sensors, it has 10-bit ADC with 8 analog inputs and a conversion time as low as 2.44µs per channel. CPU operating voltage is 3V to 3.6V so that the proposed system requires only lower power consumption as the same mentioned before. The Architecture is based on RISC principles and its simplicity yields in a high instruction throughput and real-time interrupt response form a small and cost effective processor core. It also has another architectural approach such as 16-bit Thumb instruction along with 32-bit ARM instruction set which will enhance the code density in restricted memory conditions while recurring most of the ARM's performance.

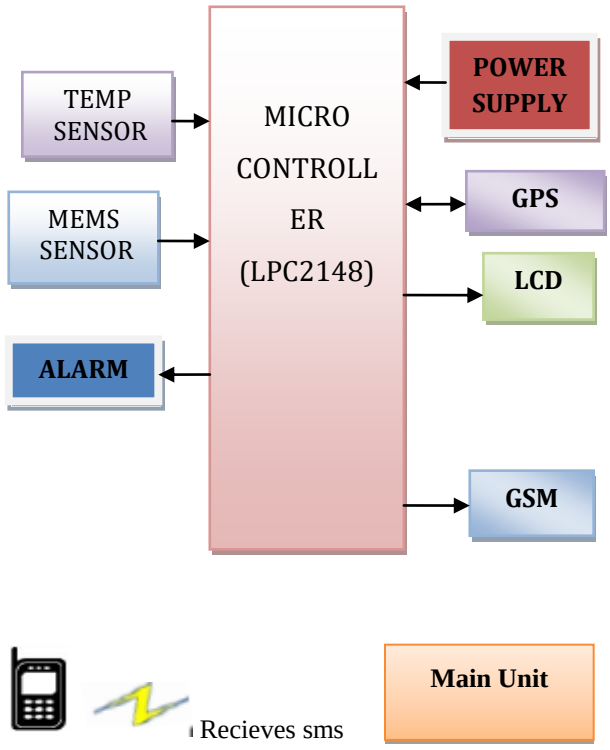

Fig.1. Block diagram of system

C. Global system for mobile communication (GSM) : GSM is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM Time Division Multiple Access (TDMA) is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA) and operates in the 900 MHz, 1800 MHz, or 1900 MHz frequency bands.

It is composed of following information:
1. An international mobile subscriber identity (IMSI), that uniquely identifies a
subscriber within GSM.
2. A secret subscriber authentication key (Ki).
3. A cryptographic algorithm A3, which provide security functions for authenticating the SIM.
4. Temporary network related data: temporary mobile subscriber identity (TMSI), Location Area Identity (LAI) and Kc.

D. GPS Modem:A GPS modem is used to get the signals and receive the signals from the satellites. In this project, GPS modem get the signals from the satellites and those are given to the microcontroller. The signals may be in the form of the coordinates; these are represented in form of the latitudes, longitudes and altitudes. Position (longitude, latitude) identity and temperature to the monitoring station and to the user/owners mobile that should help them to get medical help if accident or the theft. We are intended to make this monitoring wireless using ARM7 hardware platform. In today's world accidental deaths are increasing day by day in all most all accidents the death caused due to lack of treatments in time, because of not getting information to the nearest hospitals and police station immediately due to the present existing method of calling any person to the hospital and police station.

IV. ALGORITHM AND WORKFLOW OF THE SYSTEM

A. Algorithm of System Work
1) Start
2) Sense the parameter from various parts of the vehicle
3) Send the collected information to the ADC
4) Then ARM process the data
5) If sensed parameters exceed their limit then ARM LPC2138 send command to relay to stop the ignition.
6) Send the data over GPS and GSM
7) If the parameter does not exceeds the limit it will continued.
8) Exit

B. Work flow of the system

The work flow of the project is discussed in the flow chart that makes us understand the complete working of vechiler system.

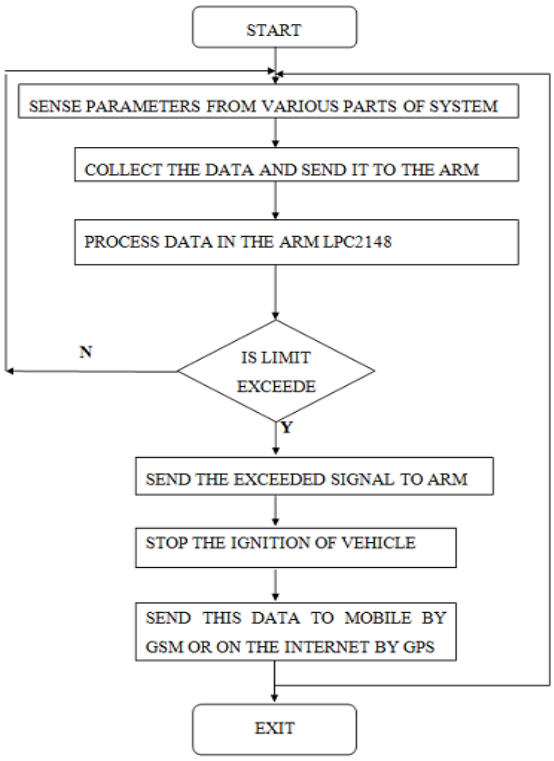

Fig. 2 Flow Chart

V. EXPERIMENTAL RESULTS

Fig. 3 shows snapshot of hardware unit that contains all the sensors and GPS,GSM and Prototype Car.

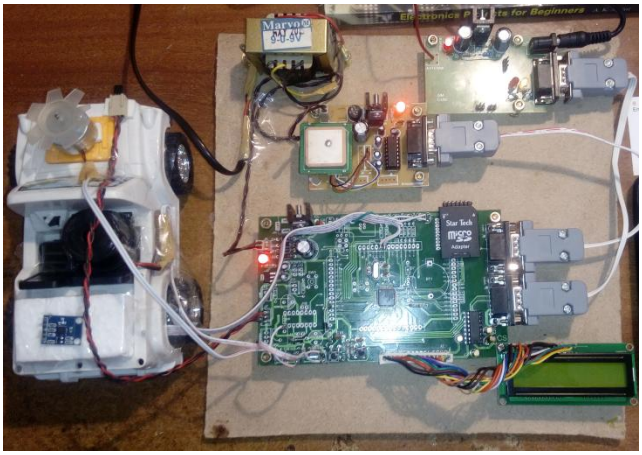

Fig.3 .Experimental Setup

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 system is useful in much application such as surveillance, security, tracking, which may be installed in cargo trucks, cars, motorcycle, and boat.

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BIODATA

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