# Automotive Security and Safety System Using ARM Microcontroller

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**Abstract:** *Road accidents are a human tragedy. This involves high human suffering and pecuniary costs in terms of untimely sudden death, injuries and loss of inherent income. In this paper, a system is proposed where the main objective is to detect road signs from a moving vehicle and also enables intelligent detection of an accident at any place and reports about the accident on predefined numbers of dear one. The system will use one signal transmitter in each and every symbol or message board at road side and whenever any vehicle passes from that symbol the receiver situated inside the vehicle i.e. In-Car System will receive the signals and display proper message or the symbol details on display connected in car. Road Traffic Sign Detection is a technology by which a vehicle is able to recognize the traffic signs which are on the road e.g. "speed limit" or "school" or "turn ahead". This infrastructure is expected to deliver multiple road safety and driving assistance applications.*

**Keywords:** ARM7, GPS Modem, RF module, Vibration sensor, GSM Modem.

## 1. Introduction

With increase in population it increases of the vehicles on road, safety and traffic jam have become three tremendous problems. Road traffic injuries (RTIs) and casualty have emerged as a major public health concern, with RTIs having become one of the leading causes of deaths, disabilities and hospitalizations which impose severe socio-economic costs across the world. Chained accidents in highway result in numerous losses of lives and properties. On the other hand, sometimes a minor accident in downtown triggers traffic congestion, this situation is much worse in metro city during the heavy traffic [1]. World Health Statistics 2008 cited in Global Status Report on Road Safety states that RTIs in 2004 were the 9th leading cause of death and at current rates by 2030 are expected to be the 5th leading cause of death, overtaking diabetes and HIV / AIDS [2]. Car accidents are one of the leading causes of death in present days in India.

In 2005 near about 1 lakh of deaths resulted from 4.4 lakh of traffic accidents. In 2008 this figure reaches to 1.2 lakh of death and in 2010 death toll is near about 1.36 lakh for a 5 lakh accidents [2]. Hence the United Nations has rightly proclaimed 2011-20 as the decade of action on road safety and have called upon all member countries to prepare a decadal action plan for implementation in their respective countries so that the present rising trend of road accidents stabilizes and is reversed by the year 2020.

Moreover, survey shows that each minute that an injured crash victim does not receive emergency medical care can make a large difference in their survival rate, e.g., analysis shows that reducing accident response time by one minute correlates to a six percent difference in the number of lives saved.. An effective approach for reducing traffic fatalities, therefore, is to reduce the time between when an accident occurs and when first responders, such as medical personnel, are dispatched to the scene of the accident.

The current scenario of road sign boards is shown in fig.1.

These pictures state the problems which are faced by a driver while driving the vehicle. These problems derive due to various reasons as shown in fig.1. Here some symbols are rusted, partially collapsed or hidden in the bushes.



**Figure 1:** Current Scenario

So, to help the driver we are implementing this system. Generally road signs consist of three properties; firstly they are represented by colors such as Red, Blue and Brown etc. Secondly they consists of a particular outlying shape such as Circular, Triangular, Octagonal, Square etc. The inner contents of the roadside symbol represent the third property, which may fluctuate depending on the application of the road side symbol.

The challenge is to process queries in this highly mobile distributed database stored at fixed sites that is updated with an acceptable delay, overhead and accuracy. The main aim of this system is to alert the driver about the upcoming symbol. The system prevents future accidents that are likely to occur.

## 2. Related Work

Block diagram [4] of proposed system is as shown in Fig. 2. Here our system can detect the accident using Vibration sensor. Vibration sensor changes its resistance depending

upon amount of bend due to accident. Connected to ARM7 micro-controller. There are threshold values of these sensor outputs. If sensor's output is more than this threshold value then it indicates that accident has occurred. But when the condition of breaking comes it is extremely difficult. System consists on board and road side unit.

## A. Microcontroller

In this project the controller used is ARM7 LPC2148. LPC2138 CPU module is based on LPC2148 SOC from NXP is an ideal platform for applications which such as Industrial control and monitoring device and any such application which needs migration from 8 bit to 32 bit. This CPU module board supports peripherals such as ADC, SPI, I2C, RTC etc
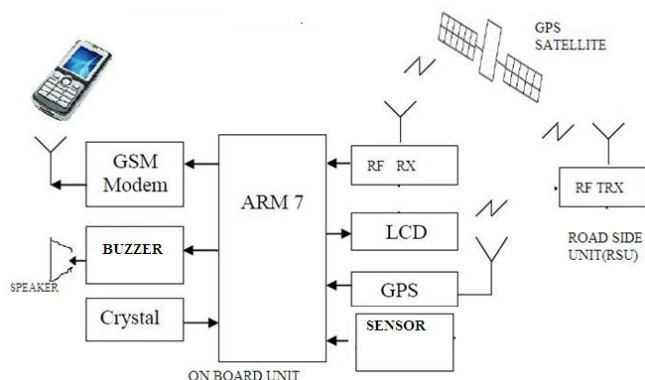


**Figure 2:** Block diagram

## B. GSM Modem

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it may be a mobile phone that provides GSM modem capabilities. It is used to send an SMS to the contacts of the user about the location of the vehicle. It is beneficial in emergency situations.

## C. GPS Modem

The Global Positioning System (GPS) is a space based radio-navigation system consisting of a constellation of satellites and a network of ground stations used for monitoring and control. GPS is operated and maintained by the Department of Defense (DOD). The GPS is a constellation of satellites in orbit around the Earth which transmit their positions in space as well as the precise time. It is the receiver that collects data from the satellites and computes its location anywhere in the world based on information it gets from the satellites
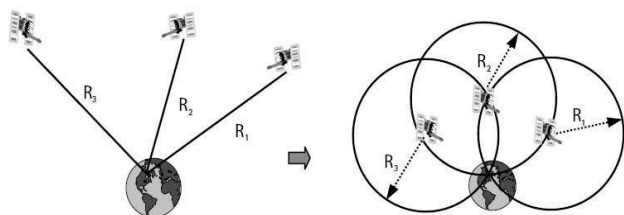


To extract the desired coordinates of the observer from these measurements, we construct a sphere of radius ri about each of four satellites. The equations these spheres are given by

$$(x - x_1)^2 + (y - y_1)^2 + (z - z_1)^2 = r_1^2$$
$$(x - x_2)^2 + (y - y_2)^2 + (z - z_2)^2 = r_2^2$$
$$(x - x_3)^2 + (y - y_3)^2 + (z - z_3)^2 = r_3^2$$
$$(x - x_4)^2 + (y - y_4)^2 + (z - z_4)^2 = r_4^2$$

## D. Alcohol Sensor

It is used to sense the alcohol. The analog output of which is applied to the ARM7 board.

## E. RF Module (Rx/Tx)

The corresponding frequency range varies between 30 kHz and 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. First, signals through RF can travel through bigger distances making it suitable for long range applications. Also, while IR operates in line-of sight mode, RF signals can travel even when there is obstruction between transmitter and receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The RF module is mainly used along with a pair of encoder/decoder.

## F. Vibration Sensor

Vibration sensor is used originally as vibration switch because of its high sensitivity; it is sensitive to environment vibration, and generally used to detect the ambient vibration strength. When module did not reach the threshold in shock or vibration strength, DO port output gets high level and when external vibration strength exceeds the threshold, D0 port output gets low level.

In vibration sensing, Mass & Stiffness is important parameter. Mass is represented by an object that wants to move or rotate. Stiffness is represented by springs or constraints of that movement
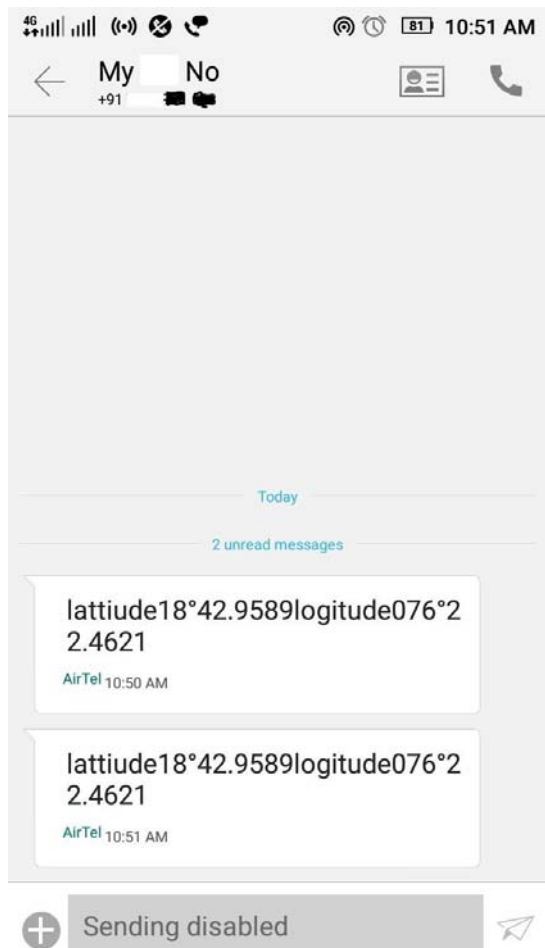
$fn = 1/2\Pi \sqrt{k/m}$

Where: fn = natural frequency (Hz)

k = stiffness (lb/in)

m = mass mass = weight/gravity weight (lb) gravity (386.1 in/sec2)

Received SMS Image.

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## 3. Conclusion

This paper presents a system for detecting the road side symbols from moving vehicle and a novel approach for Driver Guidance System. The system designed is used to assist driver and is capable to show the symbol details so that the driver can concentrate on driving only. An In-car system is designed with GPS and receivers which is placed inside car. And the road side symbols are built with the transmitters. Thus, the data emitted by transmitters is received by the In-car system and displayed on LCD. The real time implementation of the system will assure safe driving. If further implemented; this system can provide more applications such as text reorganization on the road side boards. This system is very much useful on highways for assisting the driver.

## References

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