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# Design of a GSM Cell – Phone based Vehicle Monitoring & Theft Security System

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**Abstract** - This project will focus on developing an enhancement of the vehicle alarm security system via SMS. The system will manipulate a mobile phone to send SMS (Short Message Service). Even though the SMS can be sent using the features available in the mobile, the objective of this project is to activate the SMS sending by the mobile phone using external program, connected physically to the mobile phone. The study of telecommunication is an interesting field because it involves digital signal processing, signal and systems, programming and more. This inspires people to improvise the technology into daily use. In this project, the technology of telecommunication, to be specific; SMS, is integrated or improvised to the present vehicle security system. Instead of human to human telecommunication, this system creates new entity which is machine to human telecommunication. This system is an upgrading and improving vehicle security system by integrating SMS features to alert vehicle owners whenever intrusion occurs. This project involves hardware and software parts construction and the integration of both parts to create the system. We succeed in achieving the objective and in fact, add another feature to the system which will initiates a call to the owner after sending the SMS. In the end of this project, we will document all the hardware and software development and provide a simulation model of the system. An interfacing mobile is also connected to the microcontroller, which is in turn, connected to the engine. Once, the vehicle is being stolen, the information is being used by the vehicle owner for further processing. The information is passed onto the central processing insurance system which is in the form of the sms, the microcontroller unit reads the sms and sends it to the Global Positioning System (GPS) module and using the triangulation method, GPS module feeds the exact location in the form of latitude and longitude to the user's mobile. By reading the signals received by the mobile, one can control the ignition of the engine.

**Keywords** - *Embedded systems, A GSM Cell Phone, Global Positioning System (GPS), Global System for Mobile communication (GSM), Advanced Virtual Risc architecture (AVR).*

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## I. INTRODUCTION

These day's vehicle theft cases are higher than ever, give your vehicle an excellent protection with the only reliable anti-theft device. Vehicle central locking system ensures the best guarantee to protect your vehicle from different kinds of theft cases. It is a vehicle security device that offers excellent protection to your vehicle [1, 2]. A vehicle with central locking security system helps the user to lock and unlock ignition at the press of a button. Mainly two types of central locking systems are used in Auto industry - Automatic central locking system and Manual central locking system that ensures smoother and secured operation. Again this system could not prove to provide complete security and accessibility of the vehicle in case of theft. So a more developed system makes use of an embedded system based on GSM technology. The designed & developed system is installed in the vehicle [2, 3]. The main concept in this design is introducing the mobile communications into the embedded system. In its simple construction irrespective of the systems available in

market this project has three different types of theft detection sensors namely, rider sensor, vibration sensor and battery removal sensor. There is a timer circuit based on advance AT98C52 Micro Controller that is connected to an IR receiver, a buzzer and an electromagnetic relay [4, 5]. The whole system gets its power from a separate battery of 9vDC. Thus this system works without vehicle's own battery. The system can be made on and off using an IR Based remote. The rider sensor senses any person trying to sit on the seat of two wheeler, the vibration sensor senses any vibrations those occurs in the vehicle body, and the battery removal sensor as the name suggests senses the removal of battery. Any theft event thus captured is passed on to the AT89C52 where it gets processed as an theft event and the same IC makes the buzzer and the relay on for the time set in the program flow. After the specific time is up the IC will stop the buzzer and the relay and thereafter retrigger the entire system to work in normal mode in the same session again an event of theft occurs the system runs the buzzer and the relay for longer time

that in previous case. Thus whenever a thief tries to indulge in the activity of theft in concern with the same vehicle in repeated manner the system still stand as it retriggers itself after every theft event and increases the running time span of buzzer and the electromagnetic relay. This system in mass manufacturing may cost around 550/- only to the end customer. This system as stated uses three different types of theft sensors whereas the systems available in market use only one sensor that is vibration sensor. Also this antitheft system uses its own power supply for working so by mere cutting the wire from vehicular battery won't let this system die, it will work instead. This economical antitheft system is compact in nature and can be fitted into very small cavity available inside any vehicle [7]. The economical antitheft system is add on in nature that is this system can be fitted to any vehicle within no time and while doing so no major changes are to be done to the vehicles own fitments and lay out.

## II. OBJECTIVE

The main aim of the project is to design and develop an advanced vehicle locking system in the real time environment. Whenever someone wants to stole vehicle then the system which is feed in vehicle sends a SMS to the owner of the vehicle if owner did not saw the SMS then system will call on owners mobile and when owner receives call, owner will recall the system and after that system will turn off the ignition of the vehicle The user can send a STATUS message from his cell phone and as soon as the GSM module gets the message, it will check for the user's authentication and if found to be valid, it will immediately send the details of the locations like the latitude and the longitude using GPS module. So the user can get to know the exact location of the vehicle. At the same time message will b sent to a personal computer where user can get the exact location of vehicle pointed out on the Google maps. These days' car theft cases are higher than ever, give your car an excellent protection with the only reliable anti-theft device. Car central locking system ensures the best guarantee to protect your car from different kinds of theft cases. It is a car security device that offers excellent protection to your car. A car with central locking security system helps the user to lock and unlock doors at the press of a button. Mainly two types of central locking systems are used in Auto industry - Automatic central locking system and Manual central locking system that ensures smoother and secured operation. Again this system could not prove to provide complete security and accessibility of the vehicle in case of theft. So a more developed system makes use of an embedded system based on GSM technology. The designed & developed system is installed in the vehicle.

The main concept in this design is introducing the mobile communications into the embedded system.

## III. SYSTEM DEVELOPMENTS

- Vehicle owner can lock/unlock his vehicle with the help of a simple SMS (Short Message Service).
- Also the vehicle can be tracked with the exact location using GPS module in case of theft.
- In this system we developed the overall method in two ways. First one is that the targeted devices can be controlled by sending DTMF [2] (dual tone multi frequency) sent by user. Another way is that targeted devices can be controlled by voice messages.

### A. BLOCK DIAGRAM

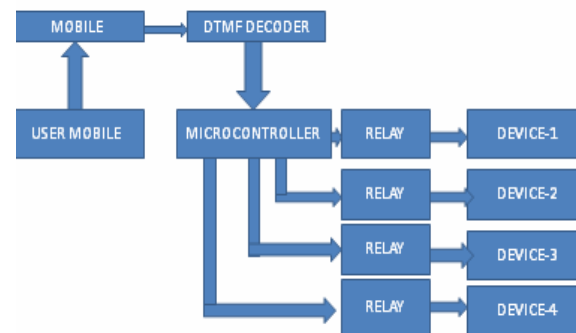


Fig. 1: Block diagram of the system using DTMF.

In this system, there is a control unit/module. The control unit is able to connect to the cellular network automatically, to receive DTMF [8] and will be able to decode for password identification and instructions to be sent to the microcontroller. The microcontroller [5] within the control unit will issue the command to the electrical appliances through a simple control circuit.

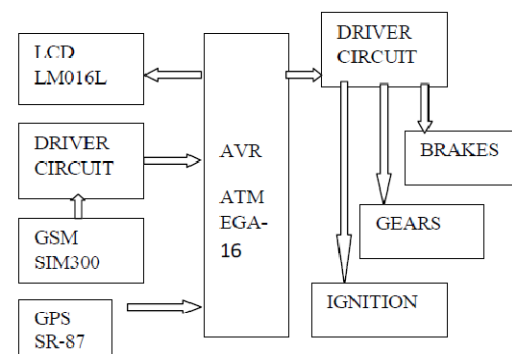


Fig. 2 : Block schematic for vehicle locking and tracking system.

- An AVR Microcontroller will be interfaced to GSM module, GPS Receiver and also to the vehicle locking system.
- Micro controller will keep listening to the New SMS arrival. If a sms arrived, it will check for authentication and after authentication is verified it will read the GPS location and will send it to the user’s cell phone in the form of sms, also same information will be sent to a host pc.
- This will extract the sms information from GSM modem or cell phone, and it will plot the latitudes and longitudes on the Google maps. For plotting on the Google maps pc must have an internet connection.
- Also, the vehicle can be locked/unlocked by sending a message to the system; say ‘L’ or ‘U’.

B. CIRCUIT DIAGRAM FOR VOICE MESSAGE

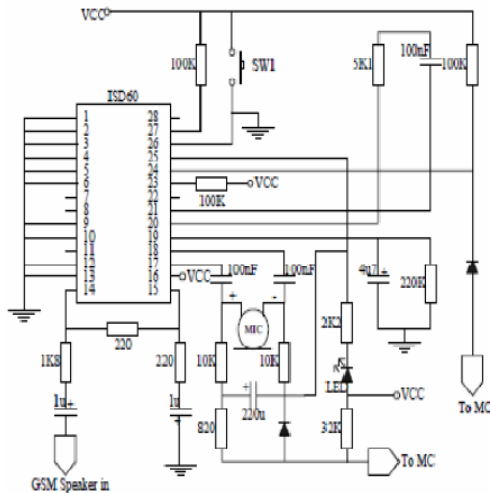


Fig. 3 : Circuit diagram for voice message.

In the circuit diagram, the system’s mechanism has described. Here, a cell phone is connected in the control unit via headset. When a call is made the cell phone in the control unit auto answered. Then password is being pressed. These DTMF decoded by a dedicated decoder MT-8870 .Then decoded output sent to the microcontroller, which issues command to control devices connected to it(shown in Figure3: circuit diagram (2) for the system). Device switching is performed The circuit diagram for the voice message unit is shown in Fig4.When the microcontroller detects a triggering signal from the scanned units, the numbers recorded on the SIM card of the mobile phone are called sequentially by relay and the MC activates the voice

message unit. The MC also sends a deactivation signal when the recorded message is played back. This operation continues in the same manner until the last call is performed. The speaker output of the ISD is connected to the cellular phone speaker so that the recorded message is directly heard by the receiving end of the phone that has been called.

III. THE DTMF GENERATION AND DECODING

1	2	3	A	697 Hz
4	5	6	B	770 Hz
7	8	9	C	852 Hz
*	0	#	D	941 Hz
1209 Hz	1336 Hz	1477 Hz	1633 Hz	

Fig. 4: Typical DTMF keypad

DTMF is Short for **Dual Tone Multi frequency** and the system used by touch-tone telephones. DTMF assigns a specific frequency (consisting of two separate tones) to each key so that it can easily be identified by a microprocessor. DTMF generation is a composite audio signal of two tones between the frequency of 697Hz and 1633Hz [2], [3]. The DTMF keypad is arranged such that each row will have its own unique tone frequency and also each column will have its own unique tone. The figure-5 is a representation of the typical DTMF keypad and the associated row/column frequencies. The tone frequencies were selected such that harmonics and intermodulation products will not cause an unreliable signal. The DTMF spectrum is shown in figure-5.

As the above frequency spectrum illustrates, each tone must fall within the proper band pass before a valid decoding will take place. If one tone falls outside the band pass spectrum, the decoder will become unreliable or not operate at all. The purpose of DTMF decoding is to detect sinusoidal signals in the presence of noise. In many cases, the DTMF decoder IC interfaces with a microcontroller.

Here it is logical that the microcontroller should not be used to decode the sinusoids. Because the typical microcontroller based decoder requires an A/D converter. In addition, the signal processing associated with the decoding is usually beyond the scope of the microcontroller's capabilities. So the designer is forced

to use the dedicated IC or upgrade the microcontroller to perhaps a more costly digital signal processor.

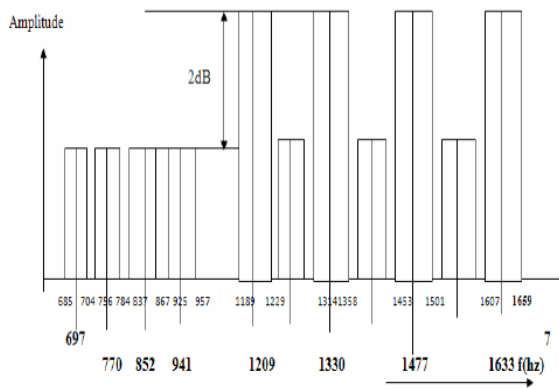


Fig. 5 : Dual Tone Multi Frequency (DTMF) spectrum.

The theory is quite similar to the "classical" signal processing technique [4]. One brute force way to detect DTMF signals is to digitize the incoming signal and compute 8 DFT's (discrete Fourier transforms) centered on the 8 DTMF composite frequencies. DFT's are preferred over FFT's because the frequencies are not equally spaced (in fact, they are logarithmically spaced). In its simplest form, the DFT goes something like so:

#### A. GSM MODEM

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a sub -scriptions 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. A GSM modem could also be a standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port or USB port on your computer.

#### B. 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 Defence (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.

### IV. HARDWARE UNITS

#### A. GPS Engine SR-87

- The ProGin SR-87 series GPS modules incorporates high sensitivity, high performance SiRF StarIII chipset solution in a compact design.
- The module tracks up to 20 satellites at a time while offering fast time-to-first-fix and 1Hz navigation update.
- The unit is very suitable for broad applications such as Handheld, PDA, PPC or other battery operated navigation system.

#### B. SIM300 – a Tri-band GSM/GPRS engine

- The hardware interface of the SIMCOM SIM300 module connects to the specific application and the air interface.
- SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz

### V. TESTING

The software code which is in C is to be compiled debugged and tested. The software PROTEUS ISIS is used to create the circuit design and then simulate it with the help of AVR Studio which controls the execution of C programs for different resources on AVR microcontroller. Also a PCB layout for the circuit implementation is created using PROTEUS ARES software.

### VI. CONCLUSIONS AND FUTURE SCOPE

This project deals with the design & development of a theft control system for an automobile, which is being used to prevent or control the theft of a vehicle. The simulation of the circuit design and its implementation is done using PROTEUS software. This system is designed to improve vehicle security and accessibility. With the use of wireless technology vehicle owners are able to enter as well as protect their automobiles with more passive involvement.

Ideally, this project could be made more convenient and secure with the use of satellite modems instead of cell phones as tracking device as the system may fail when there is no network coverage. This design can be made more enhanced in future to support camera, handset phone / hands free, mobile data LCD display, web based tracking software, and also PC based stand alone software. In our project the security system is based on embedded control which provides security against theft. The GSM modem provides information to the user on his request. The owner can access the

position of the vehicle at any instant. He sends a message in order to lock the vehicle. The GPS receiver on the kit will locate the latitude and longitude of the vehicle using the satellite service. This is reliable and efficient system for providing security to the vehicles through GSM, GPS and serial communication. The maximum speed according to the standard is 20kbits/sec.

## VII. ACKNOWLEDGMENT

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