Detecting Car Window Glass Break and Sending a SMS to the Car Owner using GSM Technology

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Abstract— This paper deals with the design & development of an embedded system, which is being used to prevent / control the theft of a vehicle. The developed instrument is an embedded system based on GSM technology. Here, we have made an attempt to develop an instrument based on AT89S52 microcontroller and operated using GSM technology. The device is a simple and low cost vehicle theft control embedded system. The entire system is installed in car along with GSM Modem. We make a system that will detect the broken window, if someone strikes it hardly. It will generate vibrations and a circuit will sense it, which will immediately activate the GSM alert circuit and sends a sms to the car owner's mobile. The owner's mobile number is authenticate device. The Global System for Mobile communications (GSM) is the most popular and accepted standard for mobile phones in the world established in 1982 and it operates in 900 MHz frequency.

Key words: GSM, Window Glass, AT89S52

I. INTRODUCTION

Now a days, automobile thefts are increasing at an alarming rate all over the world. So to escape from these thieves most of the vehicle owners have started using the theft control systems. The commercially available anti-theft vehicular systems are very expensive. Here, we make an attempt to develop an instrument based on AT89S52 microcontroller and operated using GSM technology. The instrument is a simple and low cost vehicle theft control embedded system.

The development of satellite communication technology is easy to identify the vehicle locations. Vehicle tracking systems have brought this technology to the day-to-day life of the common person. Today GPS used in cars, ambulances, fleets and police vehicles are common sights on the roads of developed countries. All the existing technology support tracking the vehicle place.

The Global System for Mobile communications (GSM) is the most popular and accepted standard for mobile phones in the world established in 1982 and it operates in 900 MHz frequency. The GPS/GSM Based System is one of the most important systems, which integrate both GSM and GPS technologies. It is necessary due to the many of applications of both GSM and GPS systems and the wide usage of them by millions of people throughout the world.

II. COMPONENTS

1) AT89S52 Microcontroller
2) DC Power Supply Unit
3) 16x2 Liquid Crystal Display (LCD)
4) SPDT Relay
5) GSM Modem
6) GSM Mobile
7) Piezoelectric Sensor
8) Crystal Oscillator

A. Microcontroller Unit:

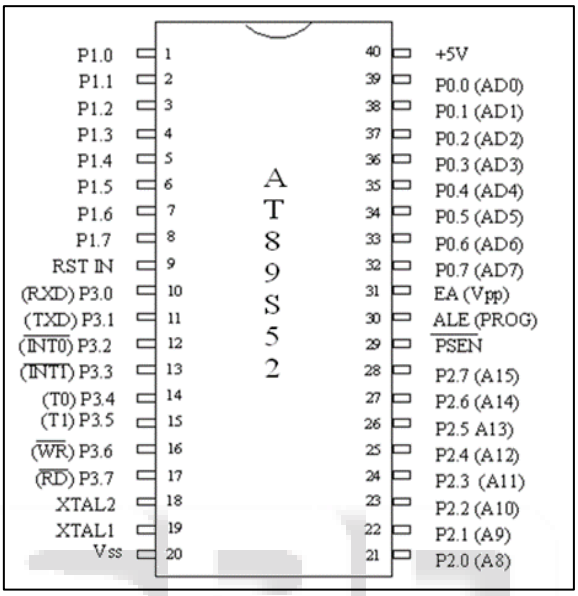

Fig. 1: Pin diagram of AT89S52 microcontroller

This is a low-power, high-performance CMOS 8-bit microcomputer with 8Kbytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. The on chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

Pin Description:

Port 0:

Port 0 is an 8-bit open-drain bi-directional I/O port. As an output port, each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high impedance inputs. Port 0 may also be configured to be the multiplexed low order address/data bus during accesses to external program and data memory. In this mode P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming, and outputs the code bytes during program verification. External pull-ups are required during program verification.

Port 1:

Port 1 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source

current (IIL) because of the internal pull-ups. Port 1 also receives the low-order address bytes during Flash programming and verification.

Port 2:

Port 2 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 2 also receives the high-order address bits and some control signals during Flash programming and verification.

Port3:

Port 3 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups. Port 3 also serves the functions of various special features of the AT89C52 as listed.

B. Power Supply:

The DC power supply unit is divided into 4 elements as below:

1) 12V SMPS.
2) 1000µF/25V Capacitor as a Filter.
3) 7805 Voltage Regulator IC.

The input AC supply of 230V is converted to 12V DC by SMPS. This DC supply is given to the GSM modem & the filter circuit. The filter is a circuit that reduces the variations of the pulsating DC. Here the capacitor is used as a filter. The filtered DC is then fed to a voltage regulator stage. The voltage regulator is used to maintain a constant voltage at the output. It also provides a further smoothing of the DC voltage. We are using an IC 7805 as a voltage regulator to get 5V voltage in output.

C. Liquid Crystal Display (LCD) Unit:

A program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to a controller is an LCD display. Some of the most common LCDs connected to the microcontrollers are 16x1, 16x2 and 20x2 displays. This means 16 characters per line by 1 line, 16 characters per line by 2 lines and 20 characters per line by 2 lines respectively. We are using 16x2 LCD display here. A 16x2 character line LCD module is a parallel port module. LCD requires 3 control lines as well as 8 I/O lines for the data bus. So this LCD will require a total of 11 data lines.

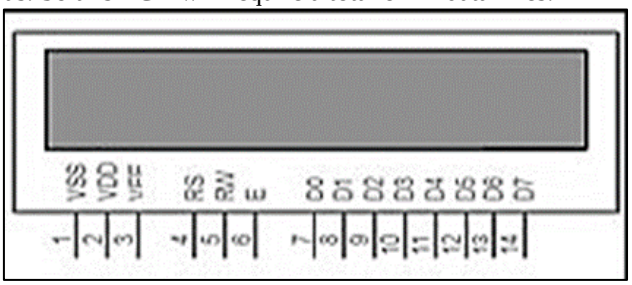

Fig. 2: Schematic diagram of LCD

The three control lines are referred to as EN, RS & RW. EN line is called "Enable". The enable pin used by the LCD latches the information presented to its data pins. When data is supplied to data pins, high to low pulse must be applied to this "EN" pin in order to latch the data present at the data pins. This pulse must be a minimum of 450 ns wide.

The RS line is the "Register Select" line. When RS is low (0), the data is to be treated as a command or special instruction (such as clear screen, position cursor, etc.). When RS is high (1), the data being sent is text data, which should be displayed on the screen. The RW line is the "Read/Write" control line. When RW is low (0), the information on the data bus is being written to the LCD. When RW is high (1), the program is effectively querying or the reading the LCD. Some commands are given below for reference.

Code (Hex)	Command to LCD Instruction Register
1	Clear Display of the screen
38	2 line, 5X7 Matrix
80	Force cursor to begin from 1st Line
C0	Force cursor to begin from 2nd Line

Table 1: LCD Command Codes

D. SPDT Relay:

The relay is an electromagnetic switch actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit. Relays are like remote control switches and are used in many applications because of their relative simplicity, long life and proven high reliability. SPDT (single pole double throw) is a simple type of changeover electrical switch. Normal closed is the terminal that can be powered on even if the relay doesn't receive any or sufficient voltage to operate. When relay is activated then our system circuit are closed and our signal reach to microcontroller.

E. GSM Modem:

The GSM modem is a specialized type of modem which accepts a SIM card operates on a subscriber's mobile number over a network, just like a cellular phone. It is a cell phone without display. The GSM modem specific commands are adapted to the services offered by a GSM modem such as: text messaging, calling a given phone number, deleting memory locations, etc. Since the main objective for this application is to show how to send and receive text messages, only a subset of the AT-commands set needs to be implemented. "AT command set for GSM Mobile Equipment" describes the main AT commands to communicate via a serial interface with the GSM sub-system of the phone as in [3]. In [4], the hardware and software of the GPS and GSM network were developed.

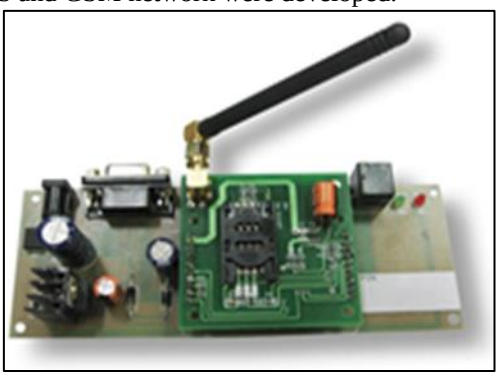

Fig. 3: GSM Modem

Command	Description
AT	Check if serial interface and GSM modem is working.
ATE0	Turn echo off, less traffic on serial line.
AT+CNMI	Display of new incoming SMS.
AT+CPMS	Selection of SMS memory
AT+CMGF	SMS string format, how they are compressed.
AT+CMGR	Read new message from a given memory location.
AT+CMGS	Send message to a given recipient.
AT+CMGD	Delete message.

Table 2: AT Command Sets

F. GSM Mobile:

We have used a GSM mobile to send the SMS sent by the unit regarding the engine status & receive the SMS regarding the location & engine status. The mobile number must be authenticated first by the unit. So that the control unit can send the SMS and in the same time the authorized person received the same SMS to take care of his vehicle.

G. Piezoelectric Sensor:

Based on piezoelectric technology various physical quantities can be measured; the most common are pressure and acceleration. For pressure sensors, a thin membrane and a massive base is used, ensuring that an applied pressure specifically loads the elements in one direction. For accelerometers, a seismic mass is attached to the crystal elements. When the accelerometer experiences a motion, the invariant seismic mass loads the elements.

The main difference in working principle between these two cases is the way they apply forces to the sensing elements. In a pressure sensor, a thin membrane transfers the force to the elements, while in accelerometers an attached seismic mass applies the forces.

Sensors often tend to be sensitive to more than one physical quantity. Pressure sensors show false signal when they are exposed to vibrations. Sophisticated pressure sensors therefore use acceleration compensation elements in addition to the pressure sensing elements. By carefully matching those elements, the acceleration signal (released from the compensation element) is subtracted from the combined signal of pressure and acceleration to derive the true pressure information.

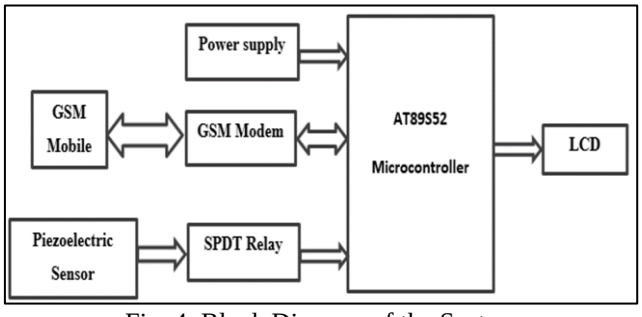

Fig. 4: Block Diagram of the System

III. ASSEMBLY OF THE SYSTEM

The assembly of the embedded system designed from is described below:

- A bridge rectifier is assembled on the PCB before capacitor filter. In case a separate supply is given to the PCB then it is used but here we are not using it instead we are taking 12V DC supply from adapter through modem.
- A 9-volt battery is used as power supply, but the requirement of the circuit is 5 volts.
- To obtained 5volt we use IC 7805 which regulate 5-volt power supply.
- After capacitor filter a 7805 voltage regulator is connected which regulates the voltage from 12V to 5V required by the microcontroller to AVCC port & LCD display. The LED connected after 7805 VR shows supply status. It glows when supply is there. The resistor is connected in parallel with the led. A variable resistor is connected to the LCD display which provides required resistance to the LCD display.
- The crystal oscillator provides clock cycles to Atmel AT89S52 microcontroller up to 12 MHz The microcontroller is then interfaced with LCD display.
- A SPDT Relay is connected to Amplify circuit to which LED is connected in its output. LED glows when relay contacts are closed. This glowing LED shows that our glass strike break.
- At the start of the device buzzer sound shows that modem has initialized. The LED shows that modem is working properly.
- In this project 3 interfacings are used i.e. LCD, Piezoelectric sensor, GSM Modem.

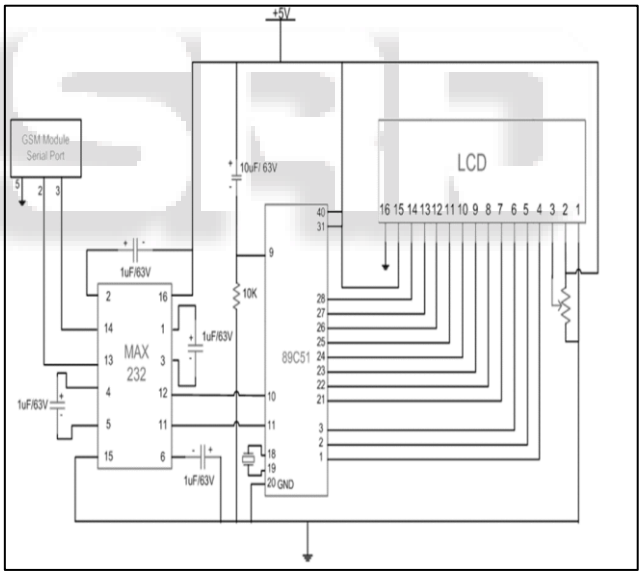

Fig. 5: Circuit Diagram of the system

IV. WORKING OF THE SYSTEM

- When power is switched on LED glows. The LCD displays project name "Glass Break Detector" & then "Initializing modem…". After this it displays "1 msg received" which shows modem is ready to work. Again when the project name is displayed then we have to press piezoelectric sensor which initiates the signals through various interfacings. If all components are working properly then a message "Ok" displays on the LCD.
- Initially the relay is open which means LED is off showing that our glass is ok. When glass strike break then piezoelectric sensor generated the signal which is amplify the amplifier circuit.

- Which turn on the relay and relay turn on gsm module.
- When gsm is turn on then it sends a sms to the mobile number which is specified by the user.
- Hence we can identify that someone try to break our glass of window and we easily caught them.

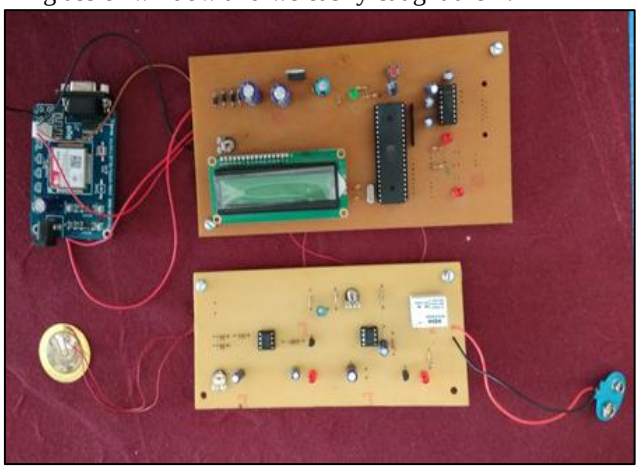

Fig. 6: Snapshot of the system

V. CONCLUSION

This method of controlling vehicle theft is a low cost & compact theft control system. It is a threat to vehicle thieves and it cannot be accessed by an unknown person since it is based on GSM technology. This system is designed to improve vehicle security and accessibility.

VI. FUTURE SCOPE

This embedded system will be used in all automobile vehicles in next generations due to its features & low cost. In this system more features can be added by using various types of sensors as described:

- We can use it in cases of emergency help after an accident by adding a sensor which senses the accident by opening of air bag & sudden large shock. The GSM modem can be used to communicate with nearest police station & hospital.
- We can add an alcohol sensor which gives signals to device when the driver is drunk & a SMS is sent to owner specifying this. The owner then can control the vehicle as in [6].
- We can add a sensor to sense door window glass breaking which sends SMS to owner by same procedure as above.
- Face detection camera sensing can also be integrated with this unit as in [7].
- 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.
- A Central Door locking System can also be integrated with this unit to ensure more safety.

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