

Arduino based Automobile Security System

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Abstract

Substantial increase in automobile theft figures internationally calls on for a robust automobile security system which can offer real time monitoring and control rather than just intimating about theft. In this paper, an embedded system is designed in such a way that, when the owner gets intimation about intrusion he can remotely start or stop the engine and also obtain the image of intruder. This is achieved by interfacing GSM system with ARDUINO. An accelerometer acts as a sensor to intimate towing.

Keywords: Arduino, GSM Module, Miniature Serial TTL JPEG Camera, Relay

1. Introduction

Safety and security of any car is one of the most primary concerns. The increasing risk of stolen vehicles and new ways of burglary have made it crucial to enhance safety. Today's security systems include immobilizers, Lo-Jack, Viper which are very costly. Thus a cost-effective and fast-reactive security system is needed. Here the design is a prototype of such system which consists of door pin sensors, a microcontroller unit- Arduino Uno board and a SIM300 GSM module. Arduino Uno is the processing and controlling unit of this system which receives and processes the data from all the components. The GSM unit act as an interface between Arduino and user's mobile and is responsible for communication between them. The mobile phone can be used as a controller from anywhere in the world if the GSM network is available to switch on/off the system and to receive the alert messages. The door pin sensor detects if any intruder enters the car. If there is a change in door pin sensor value then Arduino will be triggered and send an alert message to the mobile station.

By the message sent by the owner, the ignition kill switch will be closed or an hidden camera will be switched on.

System Model

2.1 To Build Up the Model

This paper gives design, and implementation of a newly proposed methodology system, that uses the popular social communication media, mobile as a value added service for traditional overseer system. The proposed methodology is focused on improving the technology used to improve the security of the car. In this security of car can be further increased by adding an accelerometer sensor which helps in towing purpose. In the previous system security lock and alarm is implemented in a car. If a burglar can break open the lock, then it becomes easy for the burglar to steal the car. And in old security system if the car is stolen then it is out of the owner control. User doesn't have any awareness about the current location of the vehicle. You can investigate your vehicle by calling to

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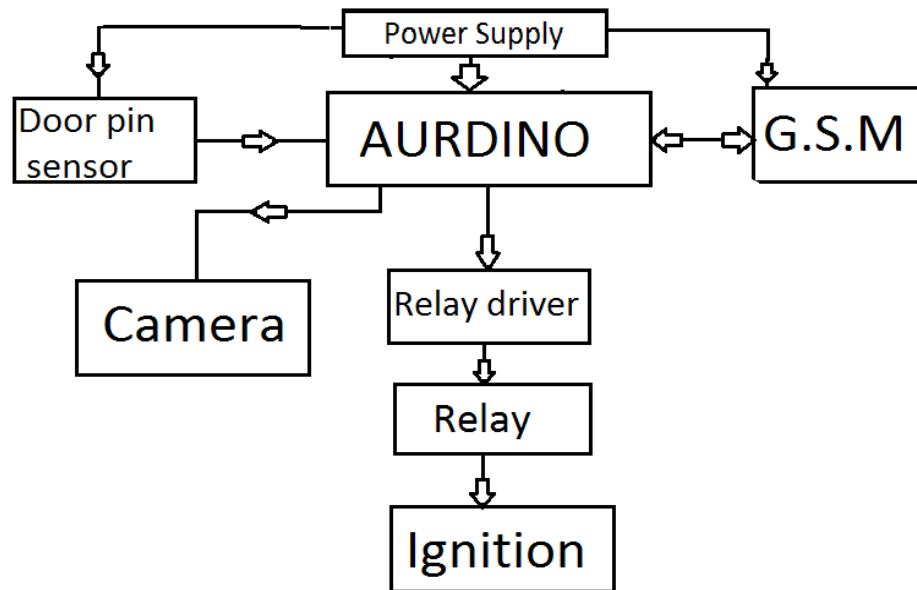


Figure 1. Internal Block diagram.

the driver over mobile phone but this not convenient as your driver might give you false information. Here, we are implementing an ignition kill switch which can be closed only by owner's message. So, the car wouldn't start unless owner sends the message. There is a spy camera in the car which helps in getting the photo of intruder.

In this proposed system the door pin sensor which is in the vehicle acts as sensor. This data will be continuously transmitted to the Arduino microcontroller from the door pin sensor. If the door gets opened then Arduino sends message to the owner through GSM module. If the owner sends e0 then the ignition kill switch gets closed and engine starts. If the owner sends e1 then the spy camera clicks the images of the intruder.

3.Components Used

3.1 GSM Module

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a

fixed telephone line while a wireless modem sends and receives data through radio waves. It can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer.

Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate. The GSM module is interfaced with computers using AT commands to control modems. Both GSM modems and dial-up modems support a common set of standard AT commands. In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With the extended AT commands, GSM module can perform the following operations:

- Reading, writing and deleting SMS messages.
- Sending SMS messages.
- Monitoring the signal strength.

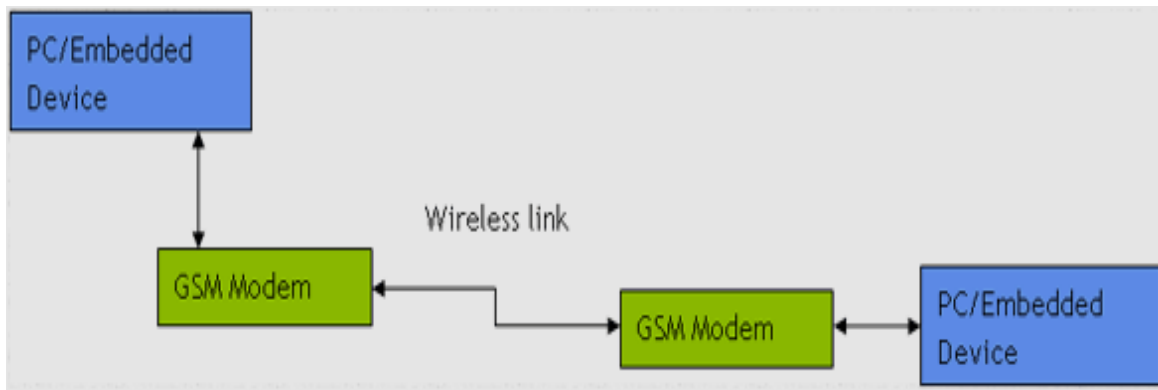


Figure 2. Working of GSM Module.

- Monitoring the charging status and charge level of the battery.
- Reading, writing and searching phone book entries.

3.2 Arduino

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the ATmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

3.3 ATMEGA328P Microcontroller

The ATmega328P is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC (Reduced Instruction Set Computer) architecture. By executing powerful instructions in a single clock cycle, the ATmega328P achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed. The ATMEGA328P provides the following features: 32K bytes

of ISP flash memory with Read While-Write capabilities 1K bytes EEPROM, 2K bytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timers/counters with compare modes, internal and external interrupts, a serial programmable USART, an SPI serial port, a 6-channel 10-bit ADC, a programmable watchdog timer with internal oscillator and 5 software selectable power saving modes.

3.4 Miniature Serial TTL JPEG Camera

It was designed to be used in security systems and does two main functions. This camera can snap pictures at 640x480, 320x240 or 160x120 and they are pre-compressed JPEG images which makes them nice and small for easy storage to an SD card. It's perfect for a data-logging, security, photography, or robotics projects. One nice thing about this particular camera is all the extras that come with it. For example, it has manually adjustable focus, auto-brightness, auto-white-balance, and auto-contrast taken care of for you as well as motion detection built in. It means it can give information if something is moved in a frame and produce an alert information.

3.5 Relay

A relay is a simple Electromechanical switch made up of an electromagnet and a set of contacts. Relays are found hidden in all sorts of devices. In fact, some of the first computers ever built used relays to implement Boolean

gates. The heart of a relay is an electromagnet (a coil of wire that becomes a temporary magnet when electricity flows through it). Relay as a kind of electric lever, switch it on with a tiny current and it switches on (“leverages”) another appliance using a much bigger current. As the name suggests, many sensors are incredibly sensitive pieces of electronic equipment and produce only small electric currents. But often it is needed them to drive bigger pieces of apparatus that use bigger currents. Relays bridge the gap, making it possible for small currents to activate larger ones. That means relays can work either as switches (turning things on and off) or as amplifiers (converting small currents into larger ones).

4. Proposed System

This system consists of door pin sensor which acts as sensor, Arduino which is the heart of system, GSM module which is used for communication purpose, Camera module to get the images of intruder and an SD card shield which is integrated with camera to store the images. Initially door pin sensor will be in closed state. When any one opens the door, the sensor will be opened which intern sends a signal to Arduino. The Arduino board send the alert message to the owner (i.e. to the predefined number). If it's the owner himself then he would send the message as e0 which closes the relay placed between the key and ignition. So if the message is not received, the ignition will not turn on even if the key is inserted or hot wired. The relay should be closed in order to start the car. If the owner thinks that its an intruder then he will sends the message as e1 which turns on the spy camera and gets the images of the intruder, so that the intruder can be identified easily. The images captured is stored in the SD card shield which is integrated with camera module.

5. Software Design

5.1 Algorithm

This system starts functioning by getting signal input from sensors. Whenever it gets the signal from sensor,

system will send SMS to the vehicle owner's cell phone informing that someone has entered his car. Next step of the working of the system is based on reply of the owner.

- Include the GSM library functions before starting the main program.
- Set the SMS buffer rate high so that the message is read irrespective of length.
- Set the baud rate for the GSM module and wait for the response.
- Define the variables required for storing the message and phone number.
- If the baud rates are equal then the output reads as “Status = ready”.
- Add the recipient's phone number and the text that should be sent.
- Now the output reads as “SMS sent ok”.
- Wait for the reply.
- Display the text after receiving the message.
- 10. Based on the message the car will start or turns on the camera.

6. Hardware Design

This system consists of three basic functioning ranging from alert indication, turning on the engine and turning on camera. The alert indication is carried out using door pin sensor. Switching the ignition the on and a camera is based on the aurdino, G.S.M module. Engine is switched on by closing ignition kill switch with the help of relay and a driver circuit. The basic communication media between the owner and the system is the integrated G.S.M module Via SMSThe hardware consists of Aurdino, G.S.M module SIM 900A, ignition kill switch, relay circuitry, camera.

6.1 Arduino Uno

The microcontroller is heart of system. It is required to integrate all the other modules together and work in a

programmed fashion responding to the commands of the users. It receives the input from the door pin sensor when the intruder tries to get in the car and provides necessary commands to the G.S.M module to alert owner. It provides the signal either to ignition kill switch or to camera based on the owners message. The pins of the Arduino are:

Pin2: TX for GSM
 Pin 3: RX for GSM
 Pin 4: Input from Door Pin sensor
 GND: Common for circuit
 Pin9: Ignition kill switch
 Pin10: Camera

Digital pins are only used in. Analog pins are not used because in this project switches are made high or low but not varying the voltage.

6.2 GSM 900A

GSM modem is built with Dual band GSM 900A, works on frequency 900/1800 MHz. the baud rate is configurable from 9600-115200 through AT command.

The GSM module performs following operations:

- Reading, writing and deleting SMS messages.
- Sending SMS messages.
- Monitoring the signal strength.
- Monitoring the charging status and charge level of the battery.
- Reading, writing and searching phone book entries.
- The modem needs AT commands, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by controller or processor.

6.3 Implementing GSM Module

The set of AT commands used for communication are

- AT- To test if the module is synchronized with micro controller.
- AT +CMGF - This command is used to set the SMS mode.

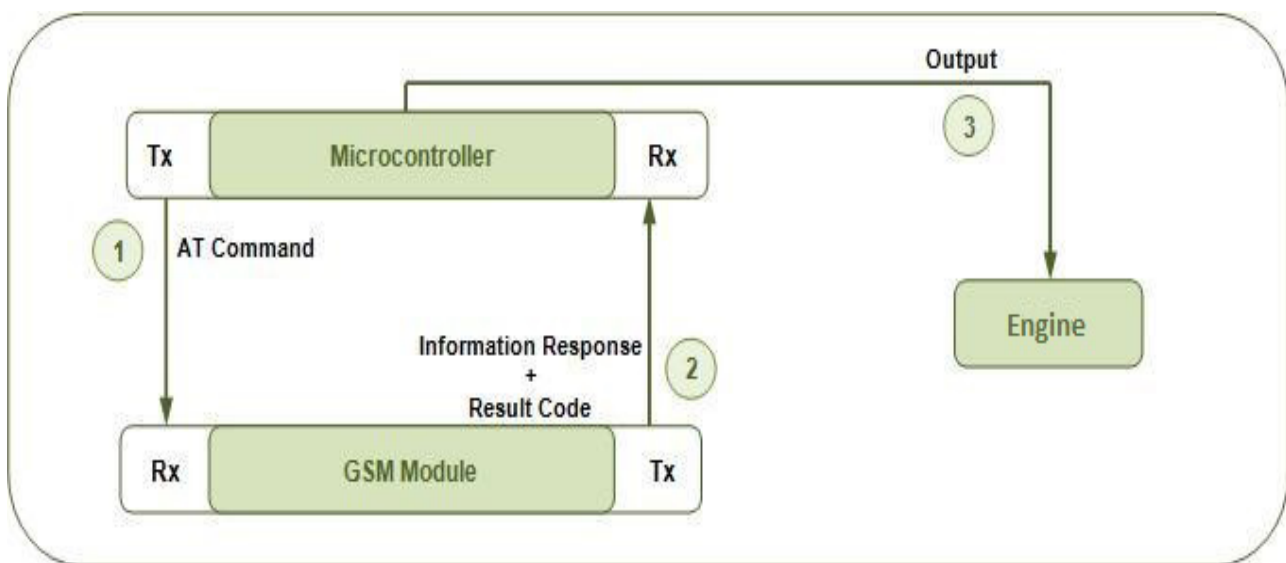


Figure 4. Working of System

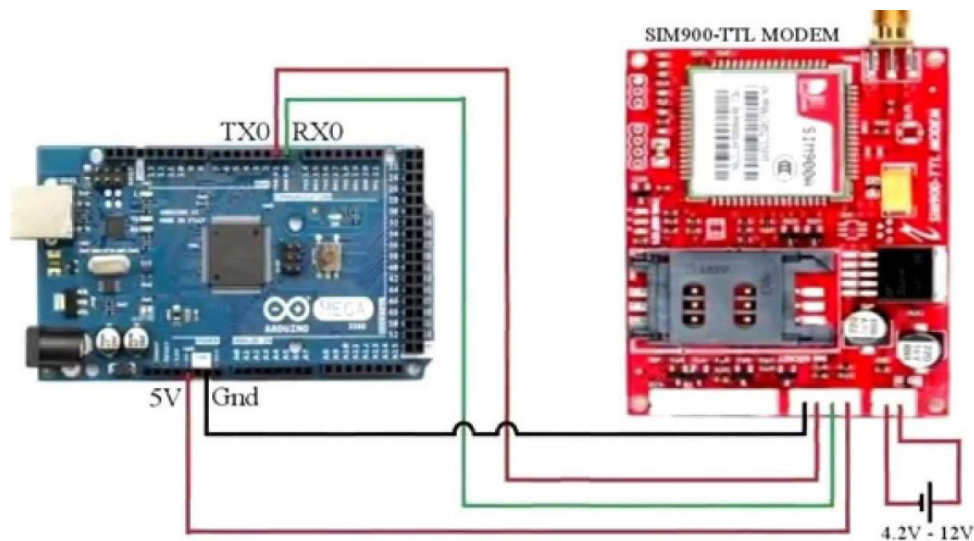


Figure 5. Interfacing Arduino with GSM.

- **AT+CMGW** - This command is used to store message in the SIM.
- **AT+CMGS** - This command is used to send a SMS message to a phone number.
- **ATH** - This command is used to disconnect remote user link with the GSM module.

6.4 Connecting Arduino with GSM Module

There are two ways of connecting GSM module to arduino. In any case, the communication between Arduino and GSM module is serial. So we are supposed to use serial pins of Arduino (Rx and Tx). So if you are going with this method, you may connect the Tx pin of GSM module to Rx pin of Arduino and Rx pin of GSM module to Tx pin of Arduino. GSM Tx → Arduino Rx and GSM Rx → Arduino Tx. Now connect the ground pin of arduino to ground pin of gsm module. 3 connections and the wiring are over. Now GSM Module can be loaded with different programs and get the outputs.

The problem with this connection is while programming. Arduino uses serial ports to load program from the Arduino IDE. If these pins are used in wiring, the

program will not be loaded successfully to Arduino. So programmer have to disconnect wiring in Rx and Tx each time you burn the program. Once the program is loaded successfully, you can reconnect these pins and have the system working.

To avoid this difficulty, Its better using an alternate method in which two digital pins of arduino are used for serial communication. In this method two PWM pins has to be selected. This method is made possible with the Software Serial Library of Arduino. Software Serial is a library of Arduino which enables serial data communication through other digital pins of Arduino. The library replicates hardware functions and handles the task of serial communication.

7. Conclusion

This final verdict on this project is its evolution as an accomplished system with ingredients such as social relevance and accountability to enhance its image. This project has every possibilities of expansion in different dimensions creating new possibilities and thinking and can be subjected to various changes in order to provide

best possible control mechanism to the system. In lieu of the fact that the communication sector in India is developing immaculately connecting each and every corner of the nation mobile communication is tipped to be an integral part of it. This is an added advantage for the system to be introduced in India. To end with the objective of the project has been fulfilled that is to be developed into an integrated system which can sense and control the ignition of the vehicle and in the course of being developed into a product it aims at redefining the vehicle theft control system.

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