

Development of a Sim800L Based Reprogrammable Household Smart Security System with Recipient Phone Call Alert

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Abstract:-Security has become a major issue everywhere. Home security is becoming necessary nowadays as the possibilities of intrusion are increasing day by day. A traditional home security system gives the signals regarding alarm or text alert through GSM. However, this paper proffers, also, a reprogrammable system that puts forward phone call straightway to the recipient anywhere in the world with GSM network coverage SIM800L (GSM Module) with PIC12F1840 Microcontroller and a motion sensor or detector.

Keywords: Microcontroller, SMS, Call, Security

1. Introduction

The new age of technology has redefined communication. Most people nowadays have access to mobile phones, and thus the world indeed has become a global village. At any given moment, any particular individual can be contacted by the mobile phone, but the application of mobile phone cannot just be restricted to SMS (Short Message Service) which is a service available on most digital mobile phones that permit the sending of short messages also known as text messaging service^[4]. New innovations and ideas can be generated from it that can further enhance its capabilities. Technologies such as Infra-red, Bluetooth to mention a few, have been developed in recent years to show the very fact that improvements are in fact possible and these improvements have eased our life and the standard of living.

GSM based distance administration control is a subject of growing interest which has found application in different areas. A system developed for Acquiring Water Level and

Temperature Status via SMS by utilizing PIC 16F877 and MPLAB IDE software for programming^[6]. He also suggested a system triggered by SMS to a home to notify the owner of any incident happening around the house such as robbery or fire. Sending text messages is very popular among mobile phone users. Instant messaging, as it is also known, allows quick transmission of short messages that allow an individual to share ideas, opinions and other relevant information^[6]. Hence, the development of information technology has led to the rapid change in human lifestyle. The use of electricity is also very important as one of the main sources of energy that is vital in modern life today. Presently, electrical energy is often used as one of the main source of power to operate any electrical device or appliance. Erratic supply of electricity leads to forgetfulness on the part of users to switch off home appliances; this could lead to energy wastage when the light is turned on continuously. Mechanism of information technology management could be used to reduce wastage in electricity usage. Home security has changed a lot since the last century and will be changing in the coming years^[1]. Security is an important aspect or

feature in the smart home applications [2]. The new and emerging concept of smart homes offers a comfortable, convenient, and safe environment for occupants. Conventional security systems keep homeowners, and their property, safe from intruders by giving the indication in terms of alarm. However, a home security system offers many more benefits.

This project mainly focuses on the security of a home when the user is away from the place. Two systems are proposed using SIM800L, one is based on GSM technology and the uses of motion detector to detect the intruder and send a message alert to the household manager with a phone call. The proposed system is aimed at the security of the Home against Intruders. The motion sensor will sensor presence of a human being with a coverage of 110 degree when it placed facing downward direction and immediately send a message alert to the owner. Security is a prime concern in our day to day life. Everyone wants to be as much secure as possible. Knowing your home is protected with a remote alert that provide home condition when you are away provides peace of mind. In anticipation to avoid text message hanging or delivery delay in the existing developed security system, this paper dwells on improving the alert with direct phone call that this device will put across to the

2. Literature review

Home security system is avoiding someone or some people entering a house without the knowledge of the owner for the purpose of committing a burglary. According to the FBI's uniform crime report in the year 2005, property crime makes up slightly more than 75% of all crime in the United States. A burglary takes places in the United States every 14.5 seconds according to the uniform crime reporting program crime clock. Home security systems are one of the most efficient, safe and cost effective ways to prevent a home security from burglary.

Today home security systems are far more advanced and inexpensive compared to the old day. Home security systems are also named home burglar alarm system. It is electronic equipment that is connected to sensors that sense and report any unwanted activity. Marie and Albert (1966) view that home security system are more advanced than ever. The idea of surveillance devices seemed almost

unthinkable. That was the year Marie and Albert brow's applied for an invention patent for a closed circuit television security [5]. The forerunner to the modern home security system brown's system had a set of four peep holes and a camera that could slide up and down to look out each one. Anything the camera picked up would appear on a monitor. An additional feature of browns invention was remote that a person also could unlock a door with a remote control.

Jawarkar et al. (2008) propose remote monitoring through mobile phone involving the use of spoken commands. The spoken commands are generated and sent in the form of text SMS to control system and the microcontroller on the basis of SMS takes a decision of a particular task [3]. Ahmed et al. (2011) describe how to manage and control home appliances using mobile phone, people can use this system to do thing in their home from far place before they reach home. To control an appliance the user sends a command in form of SMS from his/ her mobile phone to a computer which is connected to the appliance; once the message is received the computer will send the command to a microcontroller for controlling the appliance appropriately [2]. T.K Hareendran (2015) His project deal with the design & development of a theft control system for home which is being used to prevent/ control any theft attempt. The developed system makes use of an embedded system comprises an open hardware microcontroller and (GSM mobile) based on Global system for communication (GSM) technology [1]. The designed & development system can be installed in the home. An interfacing intrusion detector unit is also connected to the microcontroller based security system. In case of an intrusion attempt, a warning message is being transmitted by the system (as an SMS) to the owner's mobile phone or to any preconfigured mobile phone number for further processing. The security system comprises of an Arduino uno microcontroller and a standard SIM 900A based GSM/GPRS Modem. The whole system can be powered from any 12VDC /12A power supply unit / battery.

The microcontroller at the transmitter end will continuously monitors all the sensors and if any security problem is found then the microcontroller at the receiver end will switch on the alarm and the type of problem is displayed on the phone as SMS it uses a low power and operates in real time.

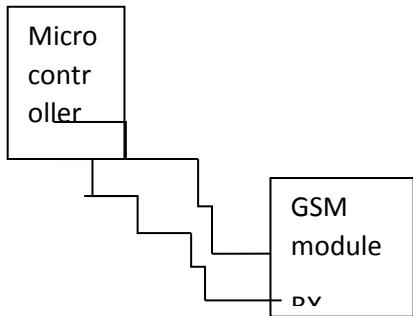


Figure 1. Two Ways Communication

3. Methodology

This project is based on three main components, basic: The GSM module, motion sensor and a microcontroller, Figure 2. By using the system we can secure industry or home very easily. This system consists of a sensor which monitors the area and gives an output whenever a person is moving at the premises. The output of the sensor is given to the control unit, when the control unit gets an input from the sensor then it produces an alarm also send a command to the GSM module so that the module sends an SMS to corresponding number which is preloaded in the circuit unit. This system continuously monitors the status of sensors connected to it. If any of the sensor gives the output indication, then microcontroller based system automatically sends the alerts to the user. After completion of the command implementation this system sends the confirmation messages back to the calling user.

3.1. Software used for the project

Basically the microcontroller is a device that cannot act on its own; it is a device that can be tailored to perform a specific function. The response of the microcontroller to signal or message from the phone is controlled through a program written in mikro C. The mikro C program was written to create links between the microcontroller and the phone (modem). The code of program could be written in High Level Language (HLLs) or Assembler language (Low Level Language). HLLs compilers for PIC microcontroller include: MikroC, PicBasic and PICC18. The assembly language for PIC microcontroller is MPLAB from MICROCHIP. HLLs will be selected over assembly language because the program codes are reused.

The MPLAB for writing assembly program code for PIC12F1840 is free to download, and the code length is not restricted. The code written in assembly language is not portable. It is not re-useable in another different assembly language or HLL

3.2 Hardware part of the project

The hardware part of the work involves the circuitry design that receives information from the phone and act on it. The circuitry design involves the microcontroller (PIC12F1840), LED, 9V Battery, Motion sensor, GSM Module and Capacitor. The block diagram, in Figure 1, 3, 4, 5 and 6 show how the power supply, LED, GSM Module, Motion sensor are connected to the microcontroller which is the input, the detector.

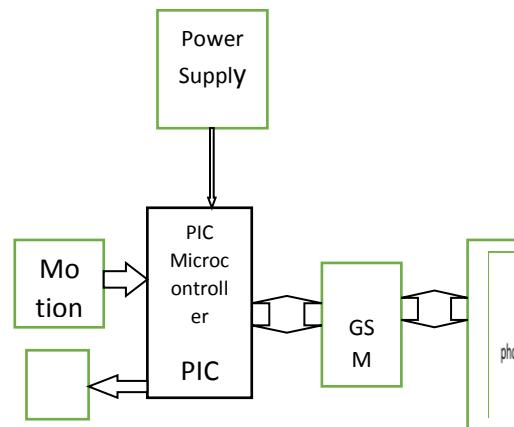


Figure 2. Functional Block Diagram

PIC12F1840 MICROCONTROLLER: Is a small computer (SOC) on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Microcontroller is designed for embedded applications in contrast to the microprocessor used in personal computer or other general purpose application consisting of various discrete chips and is used in automation controlled.

MOTION SENSOR: Is a security component (figure 3) when armed protecting a given space by creating an invisible zone that cannot be breached without sounding an alarm.



Figure 3. Motion Sensor

GSM MODULE: receives call and SMS from operator and sends back the error SMS to the operator. Is used to establish communication between a computer and a GSM—GPRS system global system for mobile communication (GSM) is architecture used for mobile communication in most of the countries

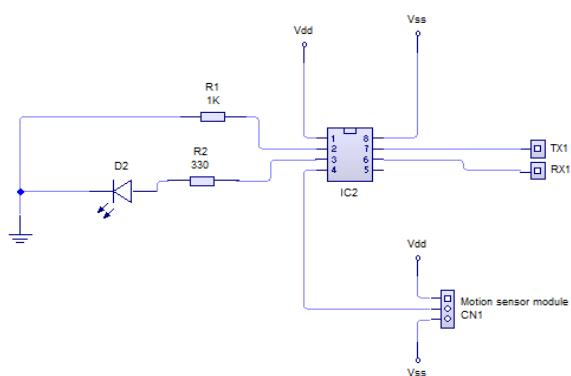
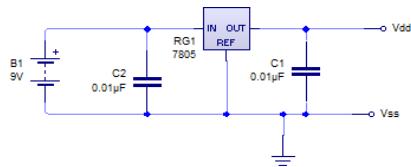


Figure 4. Circuit Diagram

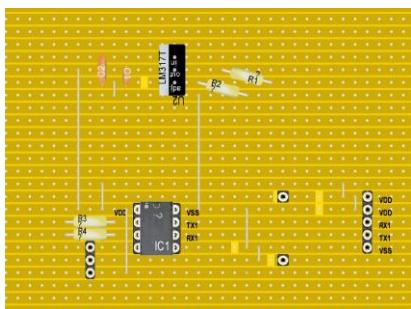


Figure 5. Component layout

Projection Algorithm

1. Start
2. Microcontroller configuration
3. Interrupt configuration
4. Baud rate configuration
5. GSM configuration & initialization
6. Baud rate configuration
7. Disable Command echo
8. Set message type as TXT
9. Wait until The GSM module is ready
10. Search SIM memory for phone number saved with "HOMESEC"
11. Begin infinity loop
12. If motion detected
13. Send SMS
14. Wait a while
15. Delete all messages
16. End infinity loop
17. End

4. Result

The major components used in the design include the microcontroller and GSM module. The microcontroller controls the GSM modules which perform the sending of text message and calling of phone no. The microcontroller requires 5.5v (DC) maximum for its operation while the GSM module needs a maximum of 4.2v. Thus, a voltage regulator is needed to step down the voltage of the microcontroller to 4.2v because the GSM module cannot operate more than 4.2v maximum. The microcontroller is programmed to trigger the GSM module into action based on its output. The programmed event was on the microcontroller using MP LAB from Micro Chip such that whenever the motion sensor scene the motion of an moving object or person immediately send a SMS text alert to user phone no in this format **HOME SECURITY SYSTEM!! Warning intruder(s) detected!!!** and also make calls after 32 seconds. And the phone number is programmable through phone and can be changed to any desirable number on the owner phone in this format **set+2348034691975z** to the SIM card provided inside the GSM Module as text message without going to the program code.

The out of the motion sensor goes to the input of microcontroller. When motion is detected is one (1) and when off comes back to zero (0). The microcontroller immediately neutralized it when motion is detected and

send the command to the GSM module. In which they both understand one protocol which is Universal Asynchronous Receiver Transmitter (**UART**) for their communication. The transmitter (TX) of the microcontroller transmits to the receiver (RX) of the GSM module in which they are called two way communications. Immediately the system is switch on the two LED light (i.e. Green and red light) will be on at the same time, after 4 sec the green light will turned off after system might have finished booting then, the green and red will blink for 10 times. Only the green will be on after blinking more than 2 to 3 times and the red light will be off. Whenever any motion is detected the red light will blink and a message will be sent automatically to the household manager. The LED indicates what is going on in the microcontroller. The motion sensor will sense presence of a human being at degree of 110, sensitivity range up to 20ft and tension of 10*70 degree. The design circuit diagram is shown below.

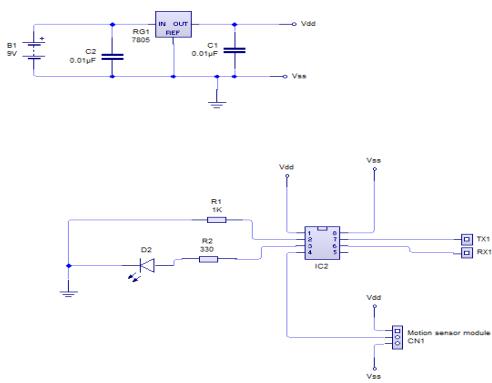


Figure 6. Design Schematic

Table 1: BEME—Bills Of Engineering Measurement Evaluation

S/N	COMPONENT	QTY	COST PER ONE	TOTAL COST
1	Motion sensor	1	5,000	5000
2	PIC 12F1840 Microcontroller	1	6000	6000
3	GSM MODULE	1	5000	5000
4	Capacitor	1	20	20
5	Resistor	1	20	20
6	SIM Card	1	100	100
7	LED	2	25	50
	TOTAL		16,190	16,190

The proposed systems are tested on the model of home security. The motion sensor detect the motion and send SMS alert to the house hold manager and also make call after some seconds and hang up. The system is very simple and easy to use. The developed microcontroller based home security system gives good response to the sensor and send SMS when it detects the motion of moving object or person. The phone number can also be change to any desirable number without going to the program code. The time taken by the system to deliver the SMS is dependent on the coverage area or range of the specified mobile network. If the mobile is in the range of the system then the SMS is delivered in 30-35 seconds.

Advantages of the proposed system:

1. The system is reprogrammable to suit any user or recipient phone number, it can be commercialized easily with minimal cost, see Table 1.
2. By receiving phone call alert in addition to SMS has reduced alert delay.
3. As the system is SMS based, there is no need to have extra circuitry to transmit SMS. Mobile networks are used for transmission.
4. It is very cost effective, as day by day the cost of SMS is reducing.

Drawbacks of the system:

- i. All over the world, there could be an area where mobile network is not established or with weak GSM network coverage; SMS may not be delivered.
- ii. Older people still are not familiar with the use of mobile and find it difficult to read the SMS on mobile.

5. Conclusion

The GSM based home security system has been designed and tested with the mobile network. The user can get alerts anywhere through the GSM technology, thus making the system location independent. A flexible way to control and explore the services of the mobile, AT commands is used in the system. The communication of home is only through the SMS and text alert which has been tested with the mobile networks and is working on any mobile network. This type of system is very useful when the owner is out of the station and the home is locked. By ensuring the system is placed downward, intruder can be

detected and owner can receive an SMS alert and calls alerting the user of an intruder entry at home.

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