

# Home Security System with Text Alert and Motion Detective

Oyebola Blessed Olalekan

Department of Electrical/Electronics Engineering Technology  
Gateway (ICT) Polytechnic Saapade, Nigeria  
EMAIL: [blessedolalekan@gmail.com](mailto:blessedolalekan@gmail.com)

## Abstract

*The comfort of being able to secure your house through a sensory system is imperative as it saves a lot of time and effort. Ordinary, human body motion detective security system without GSM Module has drawbacks of limited working alert range; however, the incorporation of GSM module overcomes this limitation. It provides comfort of being able to secure your house through a sensory, control over certain things that required constant attention. Instead of using a watchman that might eventually sleep off on post. Remotely the system allows the user to effectively monitor the house even when the house owner is at work; he can easily put his mind at rest. This paper presents dependable security system that is able to recognize human body (intruder) motion and send a notification text message to inform the owner(at any location in the world where there is GSM mobile network coverage) The system design is in three main phases: generally, the sensory, processing and the task. The sensory is the perception section that is done through PIR sensor mounted at watch-area, the processing is done by a programmed microcontroller, and the action (task) is done through an interaction of an attached GSM module to the processor (the microcontroller) that then send an SMS alert to the user.*

## Key Words:

Human; Motion; Microcontroller; Text; Phone

## 1. Introduction

This work tends to utilize the availability of GSM network, mobile module and electronics circuit to achieve an automated system which is programmed to work as a thinking device to accomplish this purpose. By simply sending message to the phone number of the SMS attached to a slot in the circuit, this automatically puts the system to either “active or inactive” state, and on any attempt of theft the system sends a text message to the device owner, With this, the house is always protected. The total absence of sufficient security personnel in a house is a great discomfort to house owners.

This project “Microcontroller Based Home Security System with SMS Alert Using Human Body Motion Detective and GSM Module ” is developed to build a security system for a home/office to prevent other persons to enter into the important room/chamber using GSM networks, an alert system has been proposed that will act as an embedded system which can be used to alert the owner through SMS of movement of unauthorized persons. Remotely the system allows the user to effectively monitor the house/office via the GSM module by sending commands in the form of SMS messages.

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 with the mobile phone. But the application of mobile phone cannot just be restricted to sending SMS or starting conversations. New innovations and ideas can be generated from it that can further enhance its capabilities. Technologies such as Infra-red, Bluetooth (Tajika et al., 2003), ZigBee (Gill, 2009; Jin, 2008) and Global system for Mobile Communication (Yuksekkaya et al, 2006) to mention a few, have been developed in recent years to show the very fact that improvements are in fact possible and these improvement have eased our life and the standard of living.

These days, apart from the use of mobile phone for calls and messages, we make use of GSM to secure our homes from intruders by simply receiving message after a sensor device has sensed the presence of an intruder. We have designed a sensor system which is based on the GSM module that effectively allows the monitoring of an unauthorized person close to the house. The application of our suggested system is immense in the ever changing technological world. It allows a greater degree of freedom to a house owner regarding its security. The need to employ a 'watchman' to guard a house is eliminated with the use of our system.

The comfort of being able to secure your house through a sensory system is imperative as it saves a lot of time and effort. The objective of this project is to develop a system that is capable of identifying intruder and send information to user regarding a break-in at their resident. The proposed approach for designing this system is to implement a microcontroller-based GSM module that sends notification from a GSM module over the GSM network to the user about the presence of an intruder in the

house. The microcontroller then will carry out the issued commands and then communicate the status of an intruder.

## 1.2 Aims and Intended Users

This work was highlighted into three main objectives as follows:

- I. Develop a system that is capable to identify intruder and send information to user regarding a break- in at their resident.
- II. The necessities of the home security system should have low cost, easy installation, fast response, and low power consumption and a better way of security.
- III. To improve home security systems and eliminate the need of watchman to guard a house.

This system is aimed toward all the average users who wish to secure their household/office with a sensor that can be used to detect the presence of an intruder. This guarantees safety to the user.

## 1.3 Limitations of the Project

The system has certain limitations and a list of such is mentioned below;

- I. The receiver must be located in in a location where a signal with sufficient strength can be received from the GSM module.
- II. Operation of the SIM card in the GSM module when sending SMS is only achievable with the accessibility of credit on it.
- III. The GSM module users have to recharge the SIM card by removing it, via ATM or online.

## 2. Technology Used

The proposed system is concerned with the design and construction of microcontroller based home security system with sms alert using human body motion detective and GSM module. The system design is in three main phases: the sensitivity, central processing and action. The sensitivity is the perception section that is done through PIR sensor mounted at watch-area, central processing is performed by a programmed microcontroller, and the action (task) is done through an interaction of an attached on-board GSM module to the processor (the microcontroller) which then send an SMS alert to the user or owner mobile phone number (Oyebola, 2015). This system is design to only detect only (or part of human) body motion.

### 2.1 The Motion Discernment (Detector)

#### Circuit

A motion detector is contains a motion sensor and is either incorporated with or connected to other devices that alert the user of the pre-sense of body motion. An electronic motion detector contains a motion sensor that transforms the detection of motion into an electric signal.



Figure 2.1: Block Diagram Motion.

#### Discernment (Detector) Circuit

In the Passive system each sensor consists of two housings. The first housing contains an infrared-emitting diode and an infrared-sensitive phototransistor as the infrared detector (<http://www.google.com.ng>). The

other housing contains an infrared reflector to reflect the infrared signal. When positioned in front of an entrance to a protected area, the two housings establish an invisible beam.

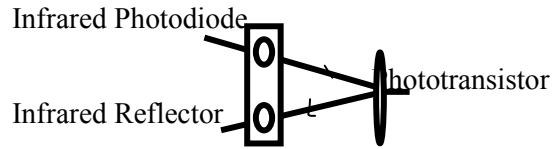


Figure 2.2: Passive infrared Motion Detector for a Security System.

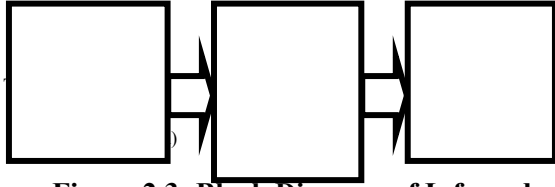
The infrared motion detector circuit is based on two basic principles of passive infrared motion detector which are the infrared transmitter and infrared receiver as shown in Figure 2.2.

#### Infrared transmitter

For the infrared transmitter which is also known as emitter circuit, it is on a basic design of timer 555 astable operation. This means that the 555 timer can operate repeatedly; it will switch 'on' and 'off' continually to generate data for the infrared transmission (Mior).

#### Infrared receiver

The infrared receiver which is also known as infrared detector receives the data transmitted by the infrared transmitter circuit. This infrared detector can be directly connected into the controller circuit to produce logic high '1' or low '0' from the output terminal thus activate or deactivate the controller system operation. The range of infrared detector components according to datasheet stated that the infrared detector can fully operates on detecting the infrared signal of 38 to 45 KHz (<http://www.google.com.ng>).



**Figure 2.3: Block Diagram of Infrared Transmitter/Receiver.**

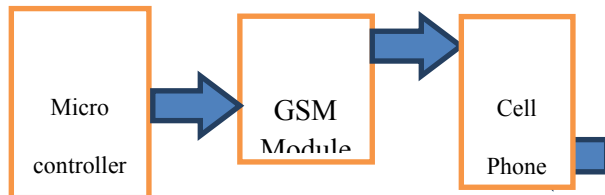
**2.2 The Microcontroller circuit**

The controller systems that use to control the motion detector system and other electronic devices are the microcontroller PIC16F1508 – expended mode. In expended mode configuration, external ROM and RAM are used to add the data memory to be more than internal memory provided by the Intel manufacture. The purpose of using an expended mode for the project is to expend more data available on developing and designing an excellent operation of the security system.

**2.3 GSM Module**

GSM module, Figure 2.5, is a specialized type of modem which accepts SIM card, and operates over a subscription to mobile operators. When the GSM modem and computer are interconnected, there is communication over the mobile network. Though these GSM modems are most used to provide mobile internet connectivity, most of them can also be used for sending and receiving SMS and MMS messages. This device can also receive and process GSM signals from virtually all GSM bands.

Issue command    Send message    Receive Alert



Communicate with

Network

**Figure 2.5: GSM Module Interaction.**

GSM module and this will send Message to the user and also receive instruction from the user cell phone for reprogramming the phone number.



**Figure 2.6: GSM module.**

Mechanical motion detection devices can be simple to implement, but at the same time, it can be defeated easily by interrupting the devices mechanics like “cutting the wire”.

**2.4 Technology Considerations**

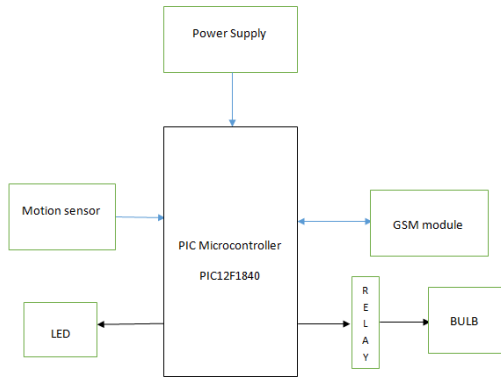
The considerations for this system will include a choice of networks, communication protocols and interfaces. Serial I/O is considered as options for connection between the GSM receiver and the microcontroller. The proposed system is designed to detect motion of either authorized or non-authorized persons around a house (Oyebola, 2015). The system is designed with a GSM module, The GSM module system uses mobile network and is battery powered which makes home automation system safer from internet hacks.

**3. System Design**

In an attempt to implement the proposed system, it was divided into two modules which are hardware and software design considerations.

**3.1 Hardware Design Considerations**

Fig. 3.1 resembles the simple block diagram of the system.



**Figure 3.1: The System Block Diagram.**

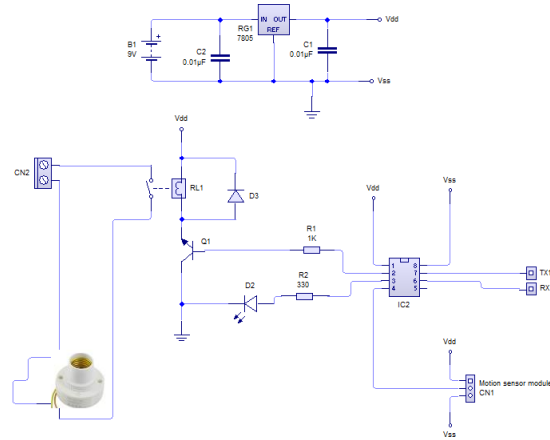
### 3.1.1 Microcontroller (IC2)

This is the heart of the system wherein central processing of data takes place. The was developed with PIC12F1840 microcontroller; it collects the data or information from sensor and GSM module (with terminal Tx and Rx) for preprogrammed task.



**Figure 3.2: Microcontroller.**

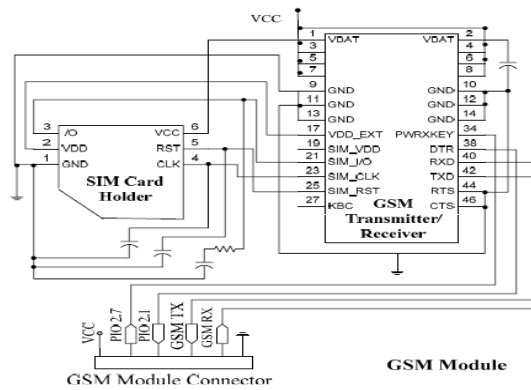
By receiving the sensor signals, it takes the corresponding course of action by sending commands to the output devices (Oyebola, 2015). It is the CPU (central processing unit) of system and functions include reading of the digital input from infrared receiver, find out if person is within the house then, send the data to GSM Module transmitter to eventually relay the alert to the owner mobile phone.



**Figure 3.3: The System Microcontroller Circuit Diagram (Oyebola, 2015).**

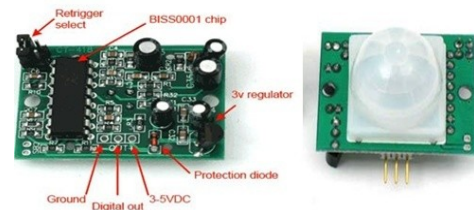
### 3.1.2 GSM Module:

The GSM Module provides a remote GSM mobile to control the system using the SMS. (Oyebola, 2015) The complete circuit diagram of the GSM Module is given in Fig. 2.6.



**Figure 3.4: The Complete Circuit Diagram of the GSM Module.**

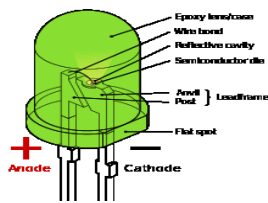
### 1.3 Motion Sensor



**Figure 3.5: Motion Sensors.**

Motion sensors are used in a motion detector which is a device that contains a physical mechanism or electronic sensor that quantifies motion that can be either integrated with or connected to other devices that alert the user of the presence of a moving object within the field of view. They form a vital component of comprehensive security systems (Mior). The Motion sensors cannot detect still objects.

### 3.1.4 Light Emitting Diode (LED)



**Figure 3.6: Light Emitting Diode.**

Light emitting diode is a two-lead semiconductor light source. It is a basic pn-junction diode, which emits light when activated. (LED, 2015) When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energies in the form of photons. An LED is often small in area (less than  $1\text{mm}^2$ ) and integrated optical components may be used to shape its radiation pattern (Moreno and Sun, 2008).

### 3.1.5 Power supply

The power supply supplies electrical energy to the system.

### 3.1.6 Voltage Regulator 7805

RG1 7805 is voltage regulator. It brings the input voltage down to 5V the microcontroller needed.

## 3.2 Software Design Considerations

The processor internal control program algorithm is as follows.

1. Start
2. Microcontroller configuration

3. Interrupt Configuration
4. GSM module configuration
  - a. UART initialization
  - b. Baud rate negotiation
  - c. Issue Disable command echo
  - d. Set message type as TXT
  - e. Delete all messages (if any)
5. Blink the LED for 5 times
  - a. Read EEPROM for any saved number
6. Copy the saved number to microcontroller RAM
7. Begin infinity loop
8. If motion detected
  - a. LED off
  - b. SECURITY LIGHT is ON
  - c. If the last message is over 30 seconds or thereabout
  - d. Send SMS message
  - e. Delay 10 seconds
  - f. LED is ON
  - g. SECURITY LIGHT is OFF
9. End an Infinity loop
10. End

## 4. Construction

The stages involved in the construction of the proposed systems are: design and validation, Vero board implementation, testing and result and packaging.

### 4.1 Design and Validation

PIC12F1840, 8 bit, microcontroller was used to implement this work. In order for the microcontroller to be able to perform its function in the system, it was required to write code of program onto it. The MikroC

was selected over assembly language based on its advantages: reusable, Code portability, easy to write, and High programmer efficiency. The program was run successfully.

## 4.2 Veroboard Implementation

After proper verification, the design was transferred to a Vero-board for permanent construction. The components were arranged and soldered on the Vero-board such that each component can easily be identified (Oyebola,2015). Before proper soldering, component layout plan was drawn paying particular attention to minimizing the distances involved between point to be connected and the prevention of the overcrowding.

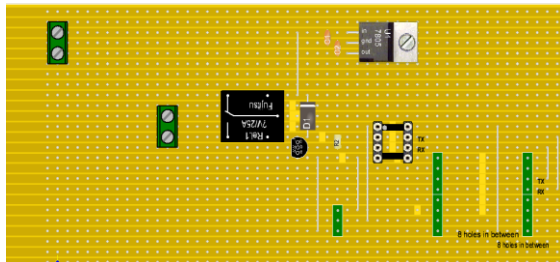


Figure 4.1: Vero board Layout of the System.

## 4.3 Testing and Result

It is of paramount importance to establish a highly efficient testing technique in other to minimize cost. The testing instrument used for examining logical signal, testing and troubleshooting application in the course of this project were: digital multimeter, logic probe and oscilloscope. Testing involves troubleshooting the hardware system to detect, isolate and correct internal or external fault such as malfunction in the internal circuitry, input or output shorted or  $V_{cc}$  input or output open circuited, short circuit between two pins broken wire, poor of dry connection, bent or broken pins, or an IC and faulty ICs socket.

The hardware system was properly tested because the software cannot work without the proper functioning of the hardware. The testing of the entire circuit was carried out in stages:

- I. Each of the components was first tested using the multimeter in order to check for their state of performance and accurate values.
- II. In the connection, each component on the veroboard was then tested. This was done in other to carry out the continuity, which is meant for proper connection of the circuit and to detect any wrong connection.
- III. The sensory unit circuitry was tested to ascertain the degree of sensitivity.

## 4.4 Packaging

After proper testing was conducted, the packaging of the design into a model and casing was considered. The connecting wires were properly connected and well insulated; also the wires were well packed and bounded together.

## 5. Applications

### 5.1 Security use

This project has its main application in security system. This project can be used in home as GSM based domestic security system. It can be used in our house for theft detection at night time. It can also be used for farm monitoring and automatic animal prevention.

### 5.2 Industrial Use

Various parameters monitored in this project like theft detection and are also applicable for industrial purpose as well. So

this system can also be used in industries as a GSM based industrial security system.

### 5.3 Commercial Use

We can use this project in banks as well as other business organizations, since it has a sensor detector to detect any misconduct of persons. And, most importantly it's alert mobile phone number was flexible to change with a PIN.

### 5.4 Remote Indication

With the use of GSM technology owner of the house or industry get remote indication through SMS. So even if the user is away from home or industry, he/she will be informed of the presence of anyone within the house.

### 5.5 Automation Use

The system is fully automated. So once this system is installed inside home or industry, then it does not require any human interaction to operate.

## 6. Future Improvements

The future implications of the project are very great considering the amount of time and resources it saves. This system can be used as a reference or as a base for realizing a scheme to be implemented in other projects of greater level including audio-visual camera by sending the captured image to an e-mail instantly..

The project itself can be modified to achieve a complete Home Automation System which will then create a platform for the user to interface between himself and his household.

## 7. Conclusion

The practical application of this developed system is immense with vast level

of implementation. The model can be used in places such as banks, office and many other related places where continuous monitoring and regulation is needed.

It is definitely challenging to have implemented this work with tremendous applications and possibilities; the realization of a full automation, a real time system may be engaged and a biometric scanner that will provide an apt monitoring and security purposes. This makes it feasible for users to have a respite that their belongings are protected. A more effective and sensitive sensor is recommended for better performance.

## References

- [1.] Tajika, Y. T., Saito K. Termoto, N. Oosaka and M. Isshiki (2003). Networked home appliance system using bluetooth technology integrating appliance control/monitoring with internet service. *IEEE Trans. Consumer Electron.*, Vol. 49, no. 4, pp. 1043-1048.
- [2.] Gill. K, S.H. Yang, F. Yao and X. Lu (2009). A Zigbee based home automation system, *IEEE Transactions On Consumer Electronics*, Vol.55, No.2, pp. 422-430.
- [3.] <http://www.google.com.ng/url?q=http://www.cse.iitm.ac.in/~vplab/courses/DVP/PDF/>
- [4.] LED (2015). The American heritage science dictionary. Houghton Mifflin company. ltd and LED
- [5.] M. H. Jin, C. J. Fu, C. H. Yu, H.R. Lai and M. Whei (2008). IBM3 Zigbee positioning method for smart home applications, *International Journal Of Smart Home*, Vol.2, No. 2, pp.127-133.



- [6.] Mior Mohammad Hafiizh Bin Abd. Rani. Active infrared motion detector for house security system."Universiti Malaysia Pahang
- [7.] Moreno I. and Sun C. C. (2008). Modeling the radiation pattern of LEDs. *Optics Express* 16(3): PMID 18542260.
- [8.] Oyebola, B. O. (2015). Microcontroller based motion detection alarm system using PIR (infrared) sensor. *The Saapade Journal of Management, Science and Technology*, Vol. 1, No 1, (SJMST).
- [9.] Yuksekkaya. B, A., Kayalar, M.B., Tonsun M. K., Ozean and A.Z. Alkar (2006). A GSM internet and speech controlled wireless interactive home automation system. *IEEE Transactions on Consumer Electronics*, Vol.52, No.3, pp. 837-843.