

Human Body Motion Detective Home Security System with Automatic Lamp and User Programmable Text Alert GSM Mobile Phone Number, Unique PIN to Allow Universal Users Using PIR Sensor

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ABSTRACT: Insecurity is not a credit to any responsible society, and the conventional use of watch-man has drawbacks of huge risk of life and cost intensive. The use home security system with user programmable text alert GSM mobile phone number with unique PIN to allow universal users with human body motion detective can overcome these limitations. This paper presents reliable security system that is able to recognize human body motion and send an alert message to inform the owner (at any location in the world where there is GSM mobile network coverage) of the house through an SMS alert when an unwanted visitor or thief enters the range of the sensor. 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. This system is design to only detect only (or part of human) body motion.

KEYWORDS - Human, body, Motion, Sensor, Microcontroller, SMS, Alert, Lamp, Mobile, Phone

I. INTRODUCTION

A high level of theft or insecurity calls for better security system. It is much safer to have a system that monitors and communicates to the device owner without putting human life to risk in the name of "Watchman". This insecurity has paved way to increasing rate of stealing packed cars, money and valuable things in the home even with security. In order to enhance an improved and life risk free security system, the purpose of this study is to aid a better security system of house with the use of GSM. This system monitors one's home against theft and has a text message sent to the house owner, telling him that there is an unauthorized person close to the house. The system will also notice what is happening around the building. With this home security system, the house is always protected. The total absence of sufficient security personnel in a house is a great discomfort to house owners.

This project has three basic modules along with a GSM module. GSM module is used to send the SMS whenever there are changes in any of the three modules. First module of this project detects the incidence of an intruder. This feature is helpful at night time or whenever we are out of our home. LED placed outside the house displays this status. And if person comes closer the more then the LED is turned on. Second part of project serves the functionality of the GSM network that quickly alerts the owner of the house through a sms sending this data to a GSM modem through serial port.

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[1,2], Bluetooth[3], and Global system for Mobile Communication[4] 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.

The system 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 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;

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

II. TECHNOLOGY USED

The proposed system is concerned with the design and construction of a Home Security System with User Programmable Text Alert GSM Mobile Phone Number, Unique PIN to Allow Universal Users and Human Body Motion Detective through PIR Sensor system. 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. 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. The electric signal can be connected to a burglar with lamp system which is used to alert the home owner or security service after it detects motion.

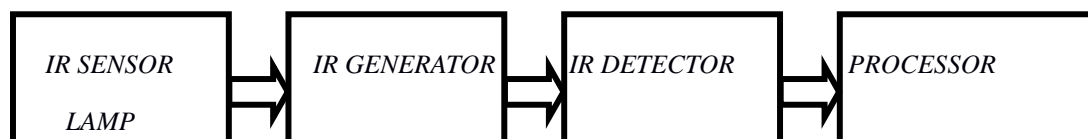


Figure 1: Block Diagram Motion Discernment (Detector) Circuit

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. The other housing contains an infrared reflector to reflect the infrared signal [7]. When positioned in front of an entrance to a protected area, the two housings establish an invisible beam.

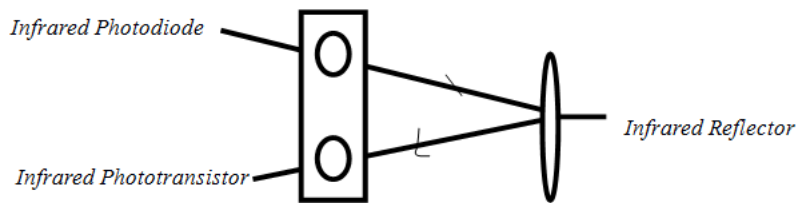


Figure 2: Passive infrared Motion detector for a Security System

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.3.

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

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.

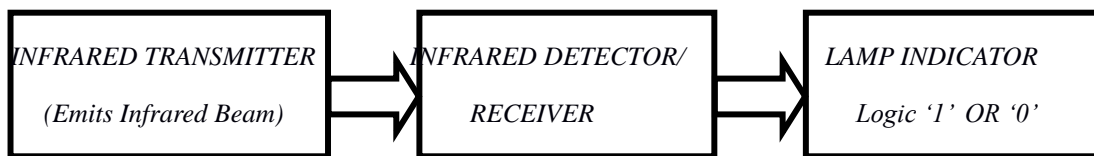


Figure 3: Block Diagram of Infrared Transmitter/ Receiver

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[8].

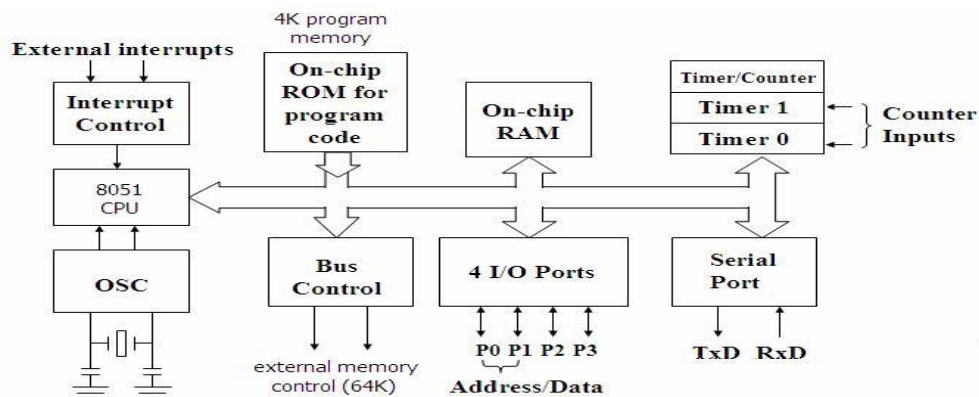


Figure 4: Internal Structure of a microcontroller

2.3 GSM Module

GSM module, Figure 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 frequently 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.

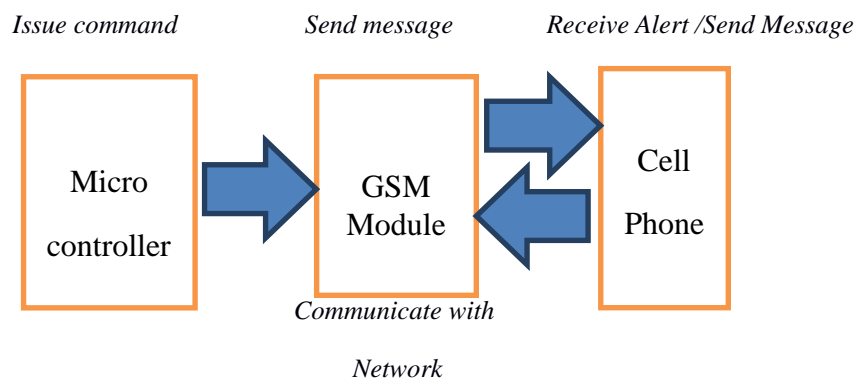


Figure 5: GSM Module Interaction

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



Figure 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 Short Message Service to Reprogrammed Alert Phone Number

SMS stands for Short Message Service. It is a technology that enables the sending and receiving of message between mobile phones. It was included in the GSM (Global System for Mobile Communication) standards right at the beginning. The reprogramming is done through the line 8 to 10 of the system processor algorithm in section 3.2 of this paper.

2.5 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. 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.

III. CIRCUIT DESIGN

In an attempt to implement the proposed system, it was divided into two parts which includes:

- a. Hardware design
- b. Software design

Figure 3.1 resembles the simple block diagram of the system.

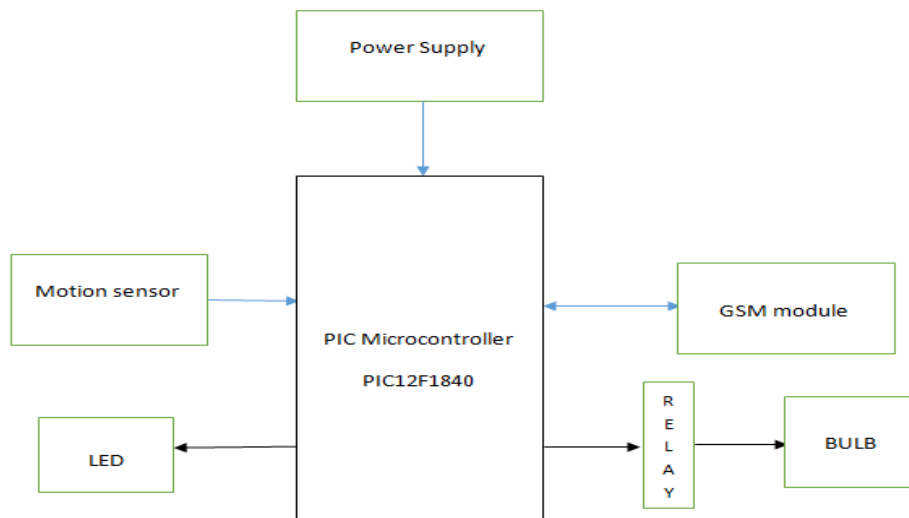


Figure 7: The System Block Diagram

3.1 Hardware design Consideration

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 8: Microcontroller

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

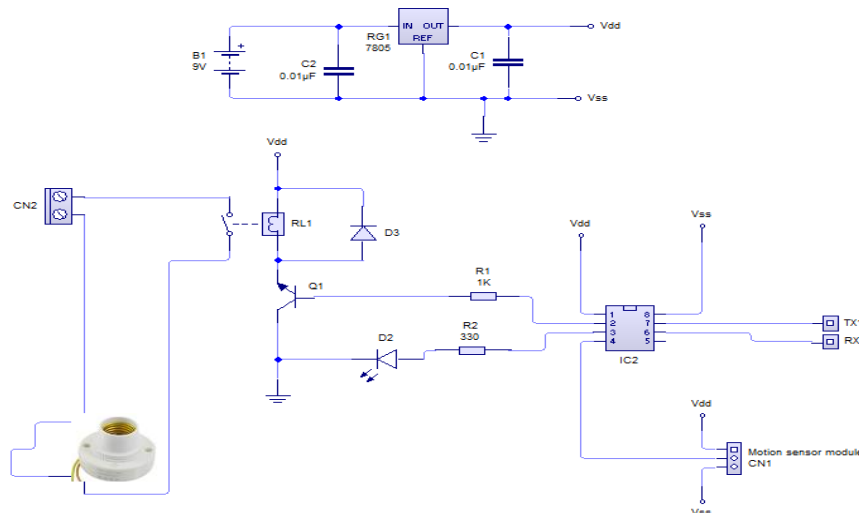


Figure 9: The System Microcontroller Circuit Diagram

3.1.2 GSM Module:

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

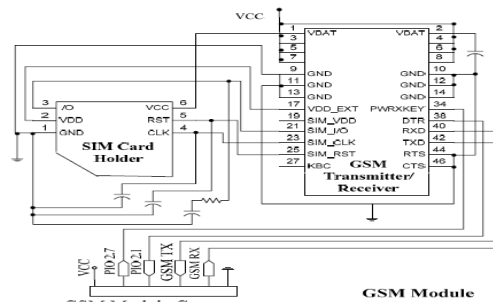


Figure 10: The Complete Circuit Diagram of the GSM Module

3.1.3 Relay

The relay acts as a mechanical switch to the SECURITY LIGHT either to ON or OFF.

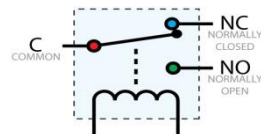


Figure 11: Relay Switch Connection

The relay driver is used to isolate both the controlling and the controlled device. The relay is an electromagnetic device, which consists of solenoid, moving contacts (switch) and restoring spring and consumes comparatively large amount of power. Hence the relay is used to switch the electrical supply to the Lamp indicator.

3.1.4 Motion Sensor



Figure 12: 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. The Motion sensors cannot detect still objects.

3.1.5 Light Emitting Diode (LED)

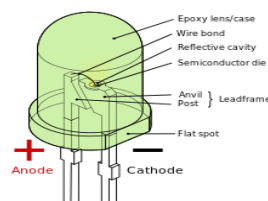


Figure 13: Light Emitting Diode

Light emitting diode is a two-lead semiconductor light source. It is a basic pn-junction diode, which emits light when activated. [5] 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 1mm²) and integrated optical components may be used to shape its radiation pattern [6].

3.1.6 Lamp/Bulb



Figure 14: Bulb

It's a device that produces light from electricity. Whenever a person is detected, it shines on the person to create awareness of being noticed.

3.1.7 Power supply

The power supply supplies electrical energy to the system.

3.1.8 Voltage Regulator 7805

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

3.1.9 Transistor Q1

The transistor acts as a driver for the bulb relay.

3.2 Software Design Consideration

The Processor Internal Control Program Algorithm is 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. Read if any message Received from GSM module
9. If "Pwd" received as message
 - a. Blink led for 7 times
 - b. Copy the phone number that sent the "Pwd" message to RAM of the microcontroller
 - c. Also saved the number to the EEPROM of the microcontroller
10. Send Acknowledge msg to the phone number.
11. 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
12. End an Infinity loop
13. End

IV. CONSTRUCTION

While constructing a microcontroller based system, it basically involves design and validation, veroboard 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 veroboard for permanent construction. The components were arranged and soldered on the veroboard such that each component can easily be identified. 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.

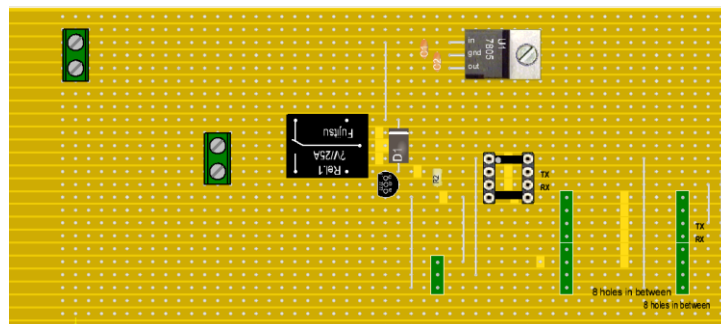


Figure 15: Vero board Layout of the System

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.



Figure 16 : Constructed Human Body Motion Detective Home Security System with Automatic Lamp and User

Programmable Text Alert GSM Mobile Phone Number, Unique PIN to Allow Universal Users Using PIR Sensor

V. 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.

VI. 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.

VII. 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.

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