



Implementation of Security Alarm using Arduino with P.I.R Motion Sensor and GSM Module

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Abstract

A security alarm or detection system is precisely a system by which one or something is sheltered through a system of interworking devices and components called the internet of things (IoT). When a user activates the system, the Arduino microcontroller will read the data when the PIR sensor detects an intruder. The Arduino Uno Microcontroller activates the buzzer and sends a signal to the LCD Showing the intruding. The GSM modem gets the information from the Microcontroller it will send a short message service to the designated Mobile number registered in the system. To communicate between the Mobile phone and GSM modem, AT command is applied to this research. This is because the GSM modem can only understand AT command declaration. From this, it can communicate with Mobile phones, computers, and Arduino microcontrollers. To accomplish this project, the whole component must work effectively. The GSM modem acts as a medium to receive the instructions from the microcontroller and Sends a message to the designated mobile number.

Keywords: Security system, Arduino, P.I.R sensor, Theft, Kidnapping, and GSM Module.

1. Introduction

The development of the security detection system begins with the creation of man. To alert frightening information, man implements a form of a signal, through shouting and sound. He then later replaced it with the help of the clapping of hands and with the introduction of signals to inform society or to blowout a certain message if they are any kind of abduction or burglary, during the early periods of some African society especially in my country Nigeria [1]. All such methods of notifications or warnings are necessary, undependable, and unmethodical. The earliest electronic fire, a security detection system was established by a man named William .F. Channing. Later on, an electrical electronics engineer called Mr.

Moses .G. Farmer invented the construction of the system. The alarm detector uses an automatic indicator box to label the position of the fire outbreak and was first lunch in Boston, United States of America. The advancement of the alarm detector by Dr. William was then followed by the advancement of distinctly beautiful and arduous intruder and fire security alarm system technology that is so many to measure. The most noteworthy among this security detection system technology is the use of remote signaling thief security alarm. This kind of security alarm system was the first design in the early 1970s. This administers a fast inventive reaction to alarm calls. Nonetheless, industries and organizations are based on the supply of security service apparatus that usually come in dissimilar designs to keep burgles and thugs away from

the environment that are not built for them. Straightaway, we have an innovative group of electronic security alarm systems with complexity at various levels. With the latest flow in crime rates in the world, it has become very essential to safeguard our buildings and our property with the aid of sophisticated stages of various advanced security alarm devices [2]. The prices of such kinds of security alarm devices depend on their apparatus technology and solicitation desires. The alarm security gadget is characterized by present electronic security detection systems. Some this nowadays modern security detection systems are threat alarms, housebreaker alarms, industrial alarms, anti-theft vehicle alarms, and speed limit alarms. This intruder security alarm is initiated by a cycle, from a comprehensive automated circuit loop that is close with an alarm at its output, or an indication to inform the owner of danger. They are a central control box that normally observe different gesture indicators and the perimeter protections that give an alarm or notify the owner when any of this sensor is a trigger. Some of the intruder's security detection system normally functions delicately on the conception of magnetic contact. For those types of security systems operating with the sensor, these devices are usually positioned at any entering of the industries, organizations, and building. In this case, the sensor will activate an alarm if the device gets a signal above its set inception. In the case of motion detection, the ultrasonic sensor is normally used; the point indicator can be used in the concession of a criminal alarm, theft, or illegal individuals at certain points such as doors or windows [3]. For instance, when a precise environment needs to be looked over the awareness of the burglar in the protected environment is used, which is executed with the help of ultrasonic sensors and is normally fixed at an appropriate location. A security detection system can be used to identify trespassers, illegal entry, or break-ins into a secure zone or buildings. These days Security detection alarms are usually used in hospitals, commercial, residential, industrial, schools, and universities. This security detection system can also be used in prisons to monitor the prisoners and their

movements. Today, the security detection system and closed-circuit television (CCTV) are an important part of any modern programmed security detection system. The design of any security detection starts with considering the needs of the residents, measuring existing hardware and technology, reviewing the costs of the system, taking into account the watching choices, and lastly scheduling the installation. Now if we are going to look at the world's one of the richest countries which are the United States of America we can see that they are placed 6th in auto theft and 9th in the break-in. Their investigation also indicates that most of the break-ins happened in banks, residential areas, as well as offices. Non-Automated security detection systems were found non-reliable. Doors were fitted with a lock and key system, which can be opened easily. Even with the help of human presence as a security guard may not be reliable. Every system from the past is very much vulnerable. Our home is a place where security is a must need, to keep all the appliances and vulnerable safe. You as the homeowner should have the full assurance to step out from your house with the feeling that nothing is going to happen to your home or organization. This feeling will only arise when the house or organization needs to be secure is fully equipped with a reliable security detection system [4].

2. Literature Review

In 2013, a security detection system was designed using a fingertip or fingerprint-based verification system to unlock a door or curtain closed place. This type of security system aids users to unlock a certain place because they are the ones whose fingerprint is registered to the system so if you put the unregistered fingertip it will not unlock the place or anything the finger is registered to [5, 6]. This type of security detection system is connected with some more alarm security protection features this includes fire accidents and gas leakage sensors or detection devices. However, a great system, fingertip devices are complex and expensive, as they want amplified sensor resolution to join into the internet of things system [7]. Some

professionals likewise argue that merely depending on a fingertip sensor is not wise because it is quite simple to put someone fingertip on something and reproduce it, that is to duplicate the fingertip, that is why it is consistently considered to make use of fingertip scanners in a two ways authentication systems whereby an added layer of security system is made in the form of the passcode, PIN, or voice recognition. Some researchers suggested an idea of a powerful internet of things security system whenever a defect in one of the components used in the security system would not fail the whole security system. The knowledge of making use of numerous gadgets, which may not be directly or may be suitable with one another, however, it can be made to work in such a way that they can interchange a present item of the security detection system in case they are a failure. In a lineup with this, the prototypical can use connection among several appliances, which may result in conserving energy, therefore, making the prototypical more effective. The design of this said model will use a Wi-Fi component, temperature sensor, and an entrance sensor to change an unreliable system [8]. LDR and Laser rays sensor are also used to identify an invasion using the intruder's movement were suggested. The method the system will work is that a light ray is a face towards the LDR sensor and if they are an interruption between the light ray and the LDR, the alarm linked to the sensor start alarming and sends SMS to the house owner or place where the intrusion takes place. This type of system will assist in solving the problems of securing the spaces, which may be out of range from your immovable cameras, but may face the same problems, which is faced with systems involving GSM components to send a short message service, which is that the transmission of the message is dependent on network coverage. Likewise, due to the condition of the light rays, which is a straight light beam, the intruders who knew about the security detection system and will be capable of dodging the light beams since it is only made up of one light-emitting diode and one light-dependent resistor facing each other's, rendering the whole security system useless, since an intruder can avoid it. An

innovative method of implementing and design an electronic lock security system using the internet of things technology and Morse code. The authors said that this is a unique awareness, which has never been done previously and is going to be the first of its kind "optical Morse code-based electronic locking system". This type of system makes uses LED as an encipher intermediate to send signals. To make it more available to the overall community, the LED in our mobile phones has been made use of. On the side of the receiver is a photosensitive resistor as well as a microcontroller such as an Arduino processor, which normally can crack the photosensitive signal after collecting it from the LED. Upon untangling this signal, it can then transfer the present situation of this lock to a cloud system this will be going to be from where these owners of the house, organizations, or industries can be monitoring the whole security system. This author has made an experiment on the system in real-life time and it has shown to perform underneath various brightness surroundings with all the features functioning, as they are designed to operate. For this purpose, this research has focused on the upkeep of home security. A security alarm system evolved to protect any of the walls that are interrupted. The walls are the east, north, west, and south walls. The walls are designed to be in a form of a square environment, each of the walls has a LED that functions as a transmitter and an LDR that functions as a Receiver. A CCTV was used to capture the real-time video of any of the crossed walls. An LCD was used to display the status of these walls and display the name of the crossed walls. A magnetic buzzer is also used to alert the security personnel after a system has displayed the name of the crossed wall on the LCD. A Microcontroller (PIC16F877A) is used as the brain of the developed security system. A Computer system is used to display the system status through the computer parallel port, to display the real-time video captured by the CCTV camera, saving the video on the computer hard drive, and to control the developed system from the computer such as activating, deactivating and resetting the developed system [9].

In this research, if the user activated the system, the microcontroller will read the information when the PIR sensor detects an unknown person or motion. The Arduino Microcontroller activates the buzzer, and then sends a signal to the LCD displaying Intruding and then the GSM modem gets a signal from the Arduino and sends SMS to the designated Mobile phone number registered in the system. To communicate between the GSM modem and Mobile phone, AT command is applied to this research. This is because the GSM modem can merely comprehend AT command statements. From this, it can communicate with Mobile phones, computers, and Arduino. To complete this research, the whole module must work successfully. The GSM modem used acts as a medium to receive the instructions from the Arduino and Sends a message to the designated mobile number. C programming is used for Arduino applications to develop a program.

3. Method and materials

The materials used in this research are shown in Table I below.

Table I: materials used in this research

S/N	Name of components	Number used
1	Arduino Uno Board	1
2	Passive infrared rays sensor	1
3	Liquid crystal display	1
4	SIM900	1
5	GSM module	1
6	Buzzer	1
7	Jumper wires	20
8	Resistor	2
9	Number of connections	10

3.2. Method

This section of research handles the operation of the whole system. When the user activates the system, the Arduino microcontroller will read the data when the PIR sensor detects an intruder. The Arduino activates the buzzer, and also sends a signal to the LCD Displaying the intruding. The GSM modem gets information from the Arduino and sends SMS to the designated Mobile number registered in the system. Communication between the GSM modem and phone, AT command is applied to this research. This is because the GSM modem can merely comprehend AT

command statements. From this, it can communicate with phones, computers, and Arduino. To complete this research, the whole component must work efficiently. The GSM modem acts as a medium to receive the instructions from the Arduino and Sends a message to the designated mobile number. C programming is used for the Arduino application to develop the program.

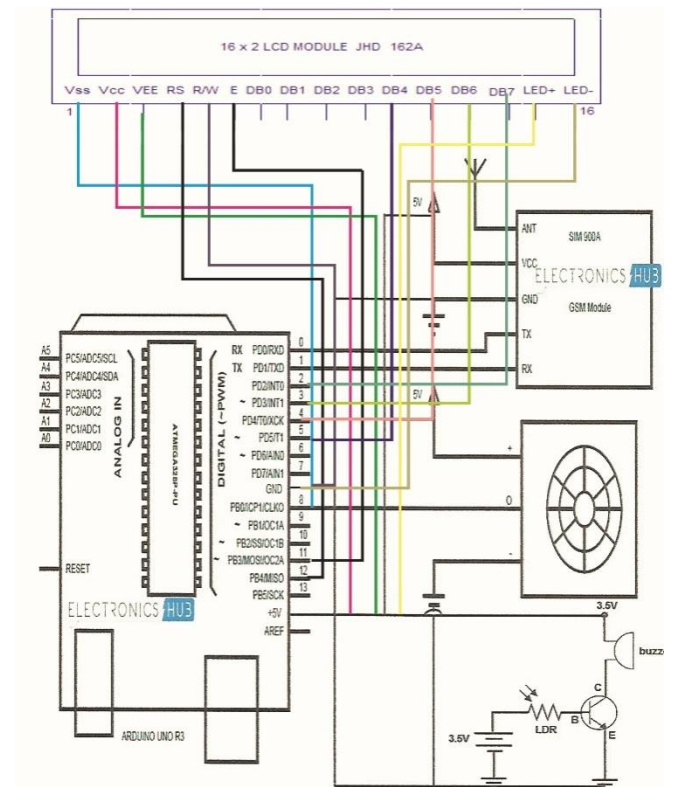


Fig. 1(a): Circuit Diagram Showing all the Connections between the Components

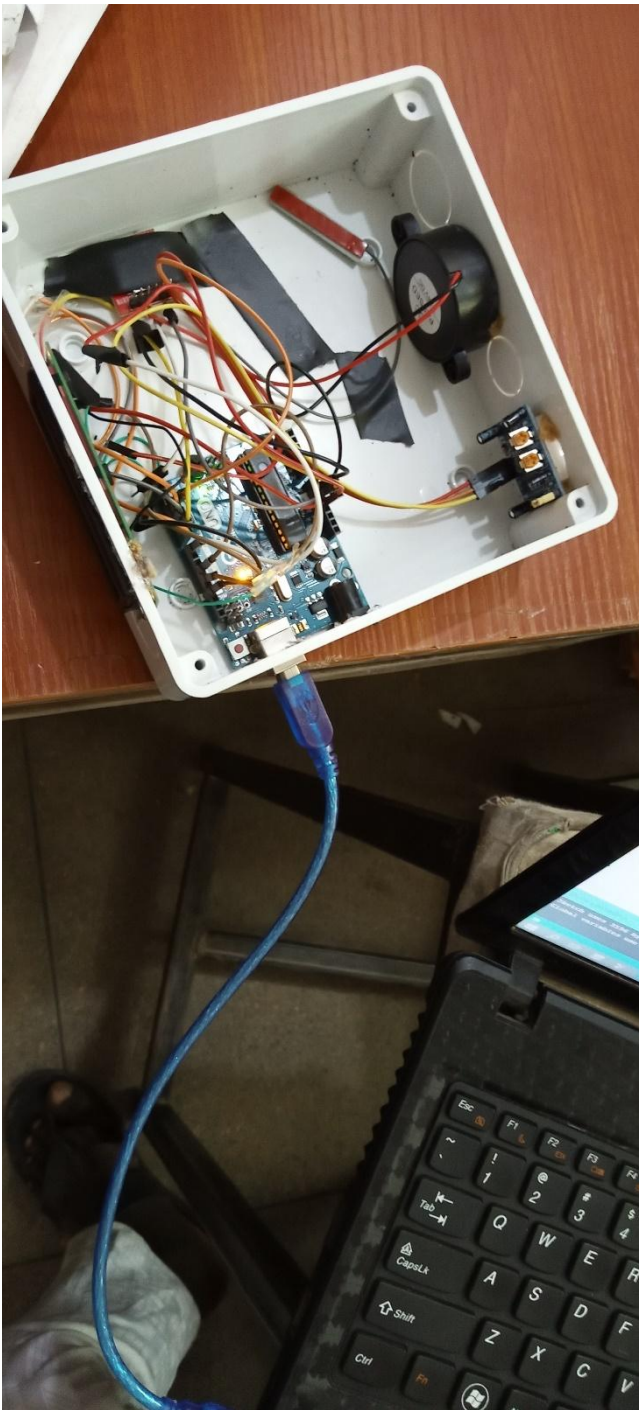


Fig. 1(b): Implementation of the whole circuit showing all the connections between the Components

3.2.1. Interfacing Arduino to the buzzer

The ground of the buzzer is connected to the ground pin of the Arduino and the Positive terminal of the buzzer is connected to Arduino Digital Pin 8.

3.2.2. Sending a message in text mode

To send an SMS message in text mode using the AT+CMGS command.

The format of this command is as follows:-

AT+CMGS="<destination number>" [, <type of destination>] <CR>

The GSM machine will then respond with a > prompt,

next enter the message to send followed by Control-Z. The Appliance will then retort with a reference number or an error.

Example:

```
At+CMGS="+2347036982781"
```

```
>test\Z
```

+CMGS: 1880K Note:

The Conexant device does not correctly support the <type of destination> Held, the <destination number> field must be an international ISDN number as in the example above and the <type of destination> file must be left outright.

3.2.3. Interfacing of Arduino to GSM module

To join the GSM module to the Arduino Uno microcontroller we have to connect the Tx pin of the GSM module to the Rx pin of Arduino and the Rx pin of the GSM module to the Tx pin of Arduino. The ground pin of Arduino is then connected to the ground pin of the GSM module.

3.2.4. PIR motion sensor for sensing an intruder

The PIR motion sensor serves as the medium for detection of motion or movement, the Vcc pin of the PIR motion sensor is connected to the 5-volt pin of the Arduino, while the ground of the PIR sensor is connected to the ground of Arduino as well as the output of PIR connected to the pin 7 of Arduino. After establishing these connections, the system will work. Below is the circuit diagram showing the connection of PIR motion to Arduino.

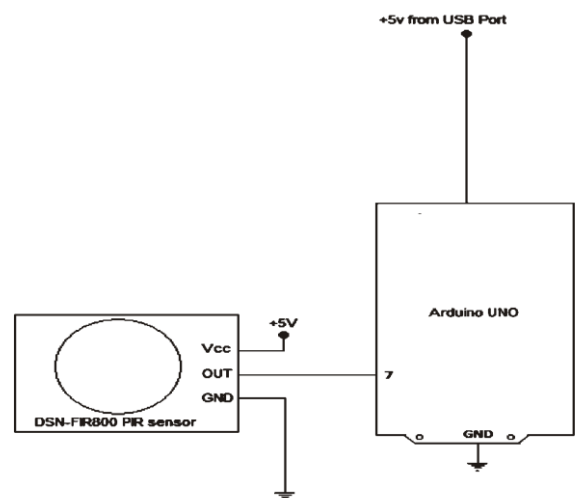


Fig. 2:Circuit Diagram of Interfacing PIR Motion Sensor to Arduino

4. Results

PIR sensor was tested by connecting the output pin to the digital pin port of the Arduino. The motion was used to test the performance of the PIR sensor. The SIM900 GSM module was connected properly and AT commands codes that communicate with the controller were written and uploaded in the Arduino Uno through the Arduino Integrated Development Environment (IDE). The designed PIR sensor, which is meant to detect a motion and alert users through alarm action using a buzzer and send SMS through a GSM modem, was tested. Physical testing was done to ensure that the system is working properly.

Table II: Shows the simulation testing and results obtained

S/N	Test conducted	Result obtained
1	System Activated	Initializing, please wait for one minute's figure 3 (a and b)
2	After one minute	No motion was detected in figure 4 (a and b)
3	If they are an intrusion	Motion detected in figure 5 (a and b)
4	Message sent to the registered phone number	Hello boss, motion detected, please check your door! (figure 6)



Fig. 3 (a): Showing the result from the implementation of the circuit, wait for one minute.

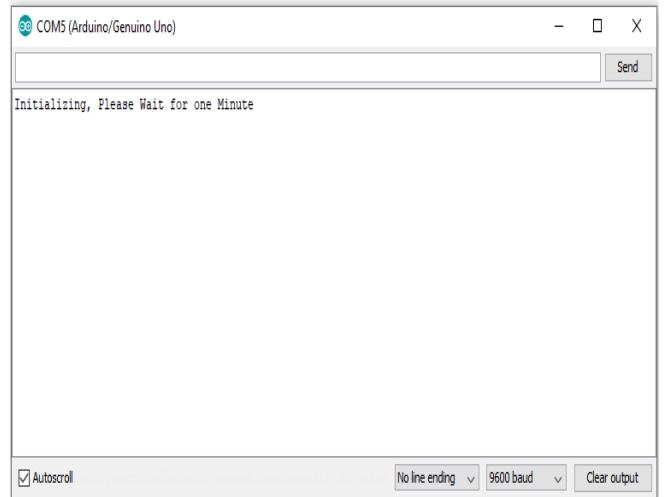


Figure 3 (b): Showing the simulation result displaying, please wait for one minute



Fig. 4(a) Showing the result from the implementation of the circuit, Relax no motion

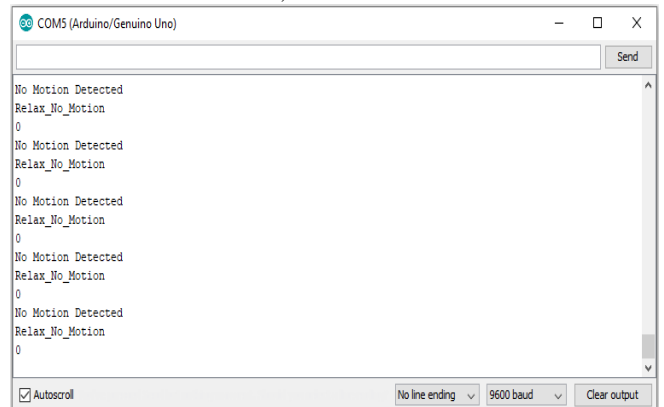


Fig. 4(b): Simulation result showing, no motion detected

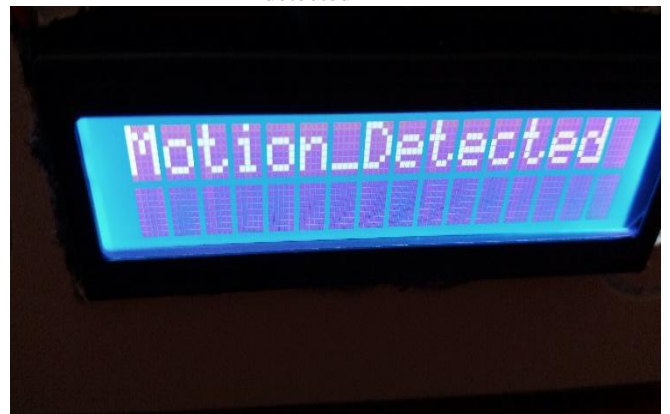


Fig. 5 (a): Showing the result from the implementation of the circuit, motion detected

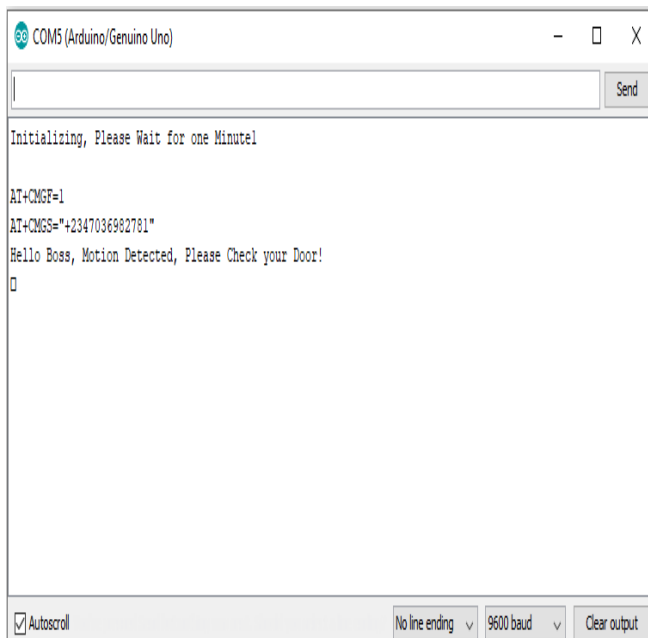


Fig. 5(b): Simulation result showing motion detected

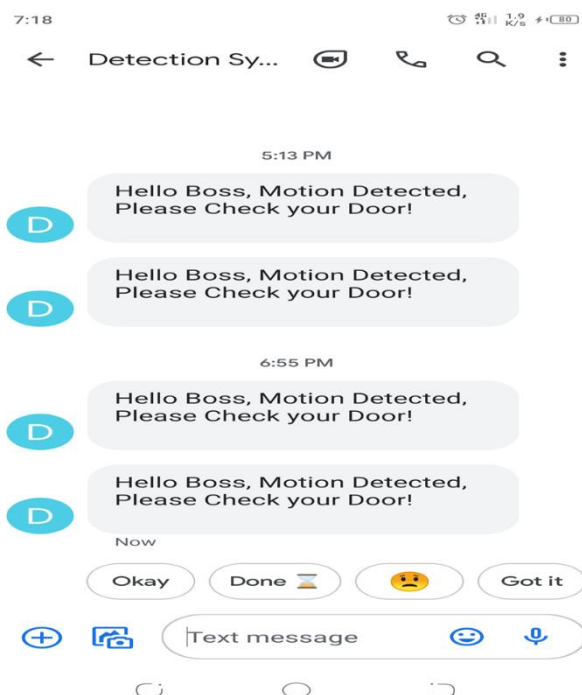


Fig. 6: Message sent to registered phone number from the security system

5. Conclusion

I have designed and implement a security alarm system using Arduino and a passive infrared ray sensor, which is portable, cost-effective, and highly effective as well. Such alarm systems are hugely in demand for security purposes, and thus the given system can be proved useful and effective because of the above features.

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