



SYSTEM FUNDAMENTALS

Group Assignment

Arduino Based
Home Security Alarm System

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INTRODUCTION

At present, we basically live in a society where a home security system has become something essential. Nowadays, people tend to have cameras connected at home with the intention of providing security. This might be effective up to some level since you can identify who the intruder was. But what good will it do if you can't take any action before the intrusion actually happens?

Usually, when a certain home invasion happens, the owner gets to know about it after the damage is done. The intruder might have already entered the house and done enough damage by the time the owner hears about it. But with the technology that we're living with today, it is possible to find a solution to prevent this matter.

In this project, we have come up with a simple system which will notify a person when an intruder tries to break into the house. The specialty about this is, that the owner will get notified "before" the intrusion happens. An alarm will be activated when an intruder tries to break in, and also, the owner will get a voice call to his mobile phone the very minute an intruder tries to break in; therefore, he can take necessary actions to prevent it. Basically, this system helps you keep your home safe, regardless of wherever you are at that moment.



COMPONENTS OF THE SYSTEM

Given below are the various Hardware and Software components we used in making this system.

HARDWARE

- **PIR Motion Detection Sensor**
Passive Infra-Red or PIR Sensor, which is also known as motion detection sensor, detects motion by sensing the changes in infrared levels emitted by nearby objects.
- **Buzzer**
This acts as the alarm for the security system, which gets activated when the PIR sensor detects motion.
- **GSM Module**
We have used SIM 800A GSM Module with RS232 interface, for the purpose of sending a voice call when the PIR sensor is activated.
- **Arduino UNO**
This is the main controller used in this system, which detects the signals from the PIR sensor and then activates the buzzer and sends commands to the GSM module accordingly.

SOFTWARE

- **Arduino IDE**
We have used this software platform for the purpose of generating the relevant commands for the system and to upload them to the Arduino UNO board.

HOW THE SYSTEM WORKS

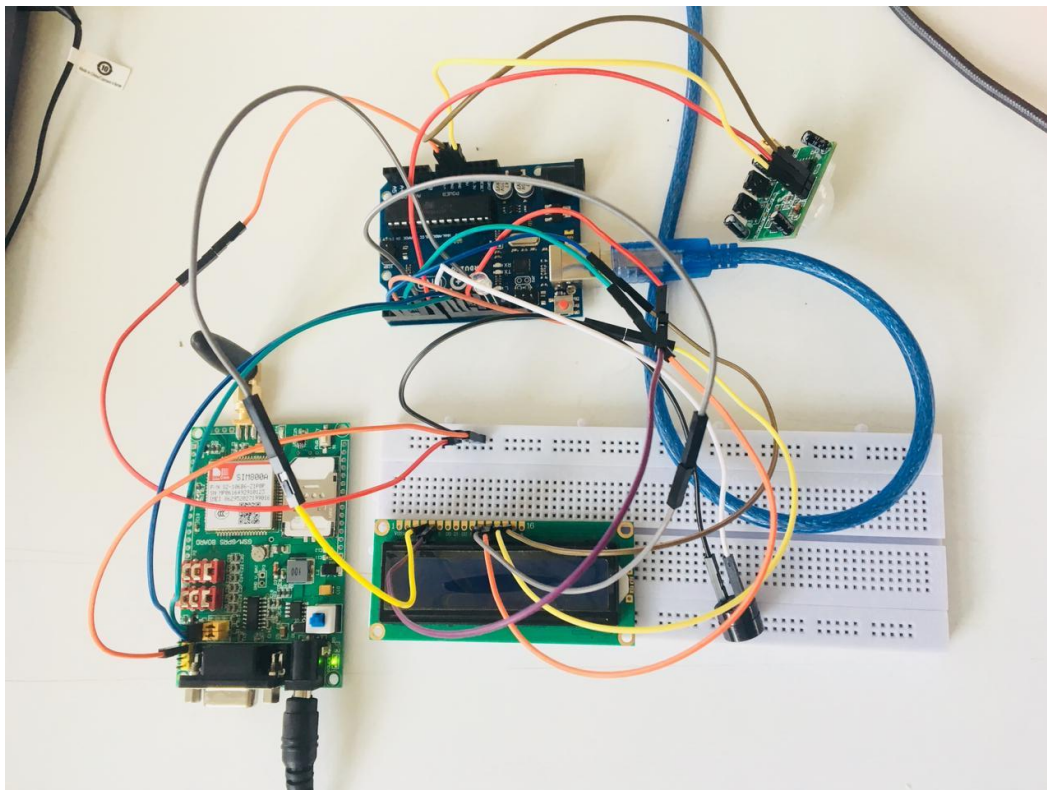
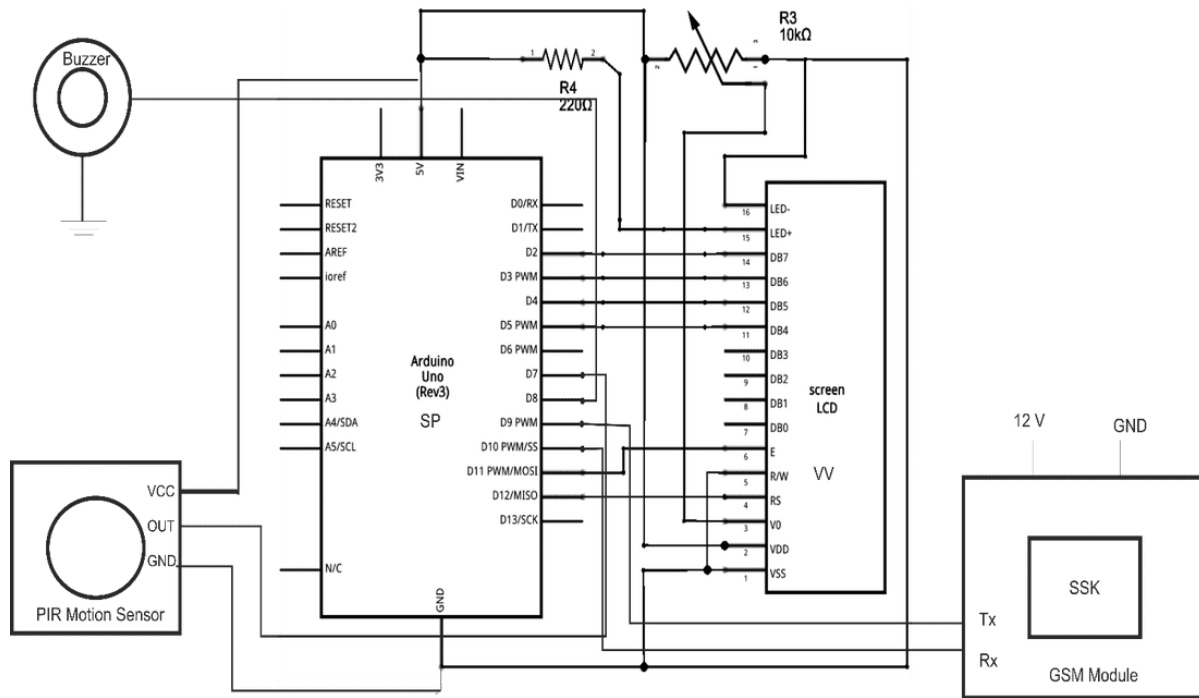
The system we have designed is a basic motion activated alarm. The objective of the system we propose is to notify or warn the owner of an intruder alert before it happens, by means of an alarm and a voice call being made to the owner's mobile phone. The way how the system works is as follows.

The PIR sensor of the system, detects motion by sensing the difference in infrared or radiant heat levels emitted by surrounding objects. Accordingly, when the system is activated and when the sensor detects any motion in the surrounding, the output of the sensor becomes high.

This is detected by the Arduino, the main controller of the system, which then activates an alarm to provide an immediate warning of the intrusion and then communicates with the GSM module via serial communication to make a call to the preprogrammed mobile number. Therefore, the owner will be notified soon of the intrusion so immediate action can be taken against the intrusion.



CIRCUIT DIAGRAM



IMPLEMENTED ARDUINO CODE

```
#include <SoftwareSerial.h>

SoftwareSerial mySerial(9, 10);

int sensor=7;           //The output of PIR sensor connected to pin 7 of Arduino
int push_switch=6;      // push button switch connected to pin 6 of Arduino
int buzzer=8;           // buzzer connected to pin 8 of Arduino
int sensor_value;       //variable to hold read sensor value
int sms_count=0;
int ledPin=13;

void setup()
{
  pinMode(sensor,INPUT);    // configuring pin 7 as Input
  pinMode(push_switch,INPUT); // configuring pin 6 as Input
  pinMode(buzzer,OUTPUT);   // configuring pin 8 as OUTPUT

  mySerial.begin(9600);
  delay(500);
}

void loop()
{
  Check_Burglar();
  Check_Reset();
}
```

```
void Check_Burglar()
{
{
sensor_value=digitalRead(sensor);
if(sensor_value==HIGH)      // Checking if PIR sensor sends a HIGH signal to Arduino
{
digitalWrite(ledPin, HIGH);
playTone(1000, 300);
delay(150);

while(sms_count<1)
{
SendTextMessage();      // Function to send AT Commands to GSM module
}
sensor_value=HIGH;

}}
}

void Check_Reset()
{
if(digitalRead(push_switch==HIGH))
{
digitalWrite(buzzer,LOW);
sensor_value = LOW;
sms_count=0;
}}
```



```

void SendTextMessage()
{
    mySerial.println("AT+CMGF=1"); // To send SMS in Text Mode
    delay(1000);
    mySerial.println("AT+CMGS=\"+94779685233\"\\r"); // user's phone number
    delay(1000);
    mySerial.println("INTRUDER ALERT!"); //the content of the message
    delay(200);
    mySerial.println((char)26);
    delay(100);

    sms_count++;
}

```

```

void playTone(long duration, int freq)
{
    duration *= 1000;
    int period = (1.0 / freq) * 100000;
    long elapsed_time = 0;
    while (elapsed_time < duration)
    {
        digitalWrite(buzzer,HIGH);
        delayMicroseconds(period / 2);
        digitalWrite(buzzer, LOW);
        delayMicroseconds(period / 2);
        elapsed_time += (period);
    }
}

```

LIMITATIONS OF THE PROPOSED SYSTEM

- Our security system does not contain cameras, therefore if the intruder escapes before an action is taken, there is no provided way to identify the intruder afterwards.
- The given alarm system detects the presence of the intruder only, and does not detect the number of people detected.
- An intruder can only be identified if he walks within the range of the PIR sensor (the range of a typical PIR sensor is around 6 meters or about 30 feet).
- For proper operation of the PIR sensor, it requires a warm up time of 20-60 seconds. This is required because the PIR sensor has a settling time during which it calibrates its sensor according to the environment and stabilizes the infrared detector.

During this time, there should be no motion in front of the sensor. If the sensor is not given enough calibrating time, the output of the PIR sensor may not be reliable.

- The owner won't get notified on his mobile phone if he is in an area where there is no network access.

ADVANTAGES OF THE PROPOSED SYSTEM

- The house owner gets notified or warned of the intrusion before it happens, regardless of where he is at that particular moment, since an immediate voice call is being made to his mobile number through the GSM module.
- No damage will be done to any lives or any property since the owner will get notified prior to the intrusion.
- The circuitry is not much complicated.

MILESTONES

Task	Time taken
Coming up with the project idea	1 week
Doing research on Hardware and Software components needed for the system	2 weeks
Getting familiar with the selected platforms (Arduino)	2 weeks
Purchasing the required materials for the system	2 weeks
Testing the basics	3 weeks
Connecting all the components as required and creating a prototype	3 weeks
Testing and presenting of the system	3 weeks

PROPOSED BUDGET

Equipment	Price
PIR Sensor	Rs.170
Arduino UNO board	Rs.900
GSM Module	Rs.3000
LED bulbs	Rs.50
Jumper wires	Rs.100
Adapter	Rs.650
Buzzer	Rs.50
Total	Rs.4920

COMPLICATIONS

Building a system where various components are connected in a way they communicate with each other, is not an easy task at all. We too faced various complications while making this project, which are mentioned below.

- Firstly, we had no clue what Arduino was. It was completely an alien platform for all three members of our group. We went through various projects done using Arduino and also went through many tutorials to gain a basic knowledge of it. This helped us immensely in understanding this platform which we knew nothing about. After like 2-4 weeks we were able to gain a satisfactory amount of knowledge on Arduino which helped us build our system successfully.
- We went through many tutorials and understood how the PIR sensor is connected to Arduino and then got an understanding on how the alarm is activated when the PIR sensor detects motion. This part was successfully completed by us without much difficulty. Therefore, half of our project was done, which was an alarm system activated by a sensor which detects motion.
- The next main part was to connect the GSM module. This had been the biggest obstacle for us in completing our system. None of us knew how to connect a GSM module to Arduino in order to get a SMS or a voice call to a given mobile number. Again, we went through so many tutorials and connected the module in the best way we could but it wasn't successful. We contacted our lecturer in charge, and got his advice too in completing this task. After getting his help, we were able to identify what the problem was. We realized that we haven't been giving enough power supply for the GSM module to keep working. It took us several days to overcome this obstacle.

ASSUMPTIONS

- We assume that the alarm used in the actual improved system is a much louder alarm than the one we have used in this prototype of our proposed system.
- We assume that the break in will occur only through doors or windows where the PIR sensor is mounted. (roofs, ceilings are not considered)

CONCLUSION

We have come up with a prototype of a simple home security system which activates an alarm when an intruder is detected and also sends a voice call to the mobile phone of the user in order to notify him of the intrusion regardless of where he is at that moment.

These type of security systems can help reduce crimes of the present society by a huge number. Why? Because an alarm system will scare off an intruder and will prevent him from proceeding with the intrusion, therefore the safety of the people at home and property is ensured. Also, the user will be notified on his mobile phone if an intruder even tries to break in, allowing him to take necessary actions immediately.

This kind of home security system is much safer than just having cameras everywhere, since cameras will only let you identify the intruder later on, but doesn't provide any way to prevent the intruder from breaking in. Therefore, our main objective of designing this system was to provide a practical solution for this matter, to help the user keep his/her home safe at all costs.

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