ECS 1001 Engineering Clincs

HOME SECURITY SYSTEM USING GSM MODULE

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ABSTRACT

Modern times have created a significant need for home security alarm systems. There must be some measure in place to keep us safe, given the daily rise in crime. Traditional security measures, which are frequently used to safeguard people and property, have certain drawbacks, including the inability to monitor and regulate activities such as invaders in the form of people, fire, smoke, and other hazards in real time. Smart home security system solves these problems, but such systems can be costly. Our project is a GSM based smart home security system which consists of a PIR motion sensor and a gas/smoke detector. This project's fundamental premise is that all living things produce thermal energy in the form of infrared, which is invisible to the human sight. But an electronic motion sensor can pick it up. Whenever the sensors detect some intrusion or fire, a message will be send to the registered mobile via the GSM based modem.

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ABBREVIATIONS

Abbreviation	Meaning	Page
ICSP	In-Circuit Serial Programming	7
IDE	Integrated development environment	5
IR	Infrared radiation	5
GSM	Global System for Mobile communication	3
GPRS	General Packet Radio Services	5
NCBR	National Crime Records Bureau	3
PIR	Passive infrared sensor	3
SIM	Subscriber Identity Module	5
SMS	Short message service	5
SMT	Surface-mount technology	6
USB	Universal Serial Bus	7

INTRODUCTION

Home security isn't a new concept. In fact, evidence shows that back in 2,000 BC the Ancient Egyptians were using wooden pin tumbler blocks with a lock and key mechanism to protect their homes and themselves. Today, we are in the age of smart home security systems. These are systems that are connected to the internet, allowing the user to view live footage from a mobile app, receive notifications when alarms go off and control the system remotely.

A security system safeguards a home or building from intruders by securing entry points, like doors and windows, as well as its interior space. In most cases, outside forces will trip a home security system's alarm and alert law enforcement or homeowners so that they can interfere. Every complete home security system package typically includes sensors, control panels, door or window sensors, floodlights, doorbells and cameras. Together, these elements will keep a home as safe as possible. Multi-system implementations, however, will unquestionably present more organisational and computational challenges. Therefore, an effective, practical, and budget friendly approach is required. This project is aimed at designing a subpar-smart home security system based on GSM which will solve the said problems. The proposed system consists of two sub systems — a PIR sensor, and a smoke detector. For practical application, both subsystems are combined into a single automated system even though they each function individually. The whole system communicates with the home owners through a GSM module.

BACKGROUND

Every 3 minutes, a burglary, robbery or a break-in takes place in India. As per the NCRB 7,208 deaths (56.7% of total deaths caused by fire) occurred due to fire incidents in residential buildings. Around 100,000 cars are stolen each year in India. In view of above facts, it becomes crucial to install a home security system to secure your family and property so that you can fully relax knowing that you are safeguarded from theft, vandalism, fire, and other threats. But 64% people in India are not equipped to handle home safety threats and 61% people don't want to upgrade to high tech safety for homes. The cost of a home security

system is the main reason people hesitate to get one, especially in India where average income of families is Rs 23,000. Thus there was need of a inexpensive and competent security system. We designed a security system which is based on the GSM technology that effectively monitors the household at a low cost.

PROBLEM DEFINITION

Home security systems currently available in the market are not cheap, thus making it inaccessible to a wide range of individuals. Moreover such security systems also require periodical maintenance. Our objective is to provide an easy to use, budget friendly and portable home security system which includes motion detection, smoke and fire detection.

OBJECTIVES

- **Detection motion of an Object with Sensor:** The sensors installed in the system senses the intrusion and gives the information to the Arduino, which then alerts the house owner through GSM module.

- **Detection of smoke with sensor:** The smoke sensor installed in the system detects smoke in case of a fire and gives the information to the Arduino, which then alerts the house owner through GSM module.

- **Give alerts to the home owner:** In case of an intrusion or fire, the house owner must be alerted through the GSM module.

METHODOLOGY

The Home Security system composes of two different sensors which can monitor the home conditions. PIR (Passive infrared) sensor and MQ-2 smoke and gas sensor. SIM900A module allows to send/receive data over GPRS, send/receive SMS. The sensors and the GSM module are connected to a Arduino Uno R3. The program is then loaded on to the microcontroller using Arduino IDE.

Components

1. PIR Sensor

PIR sensors allow you to sense motion. They are used to detect whether a human has moved in or out of the sensor's range. They are commonly found in appliances and gadgets used at home or for businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors. PIRs are made of pyroelectric sensors, a round metal can with a rectangular crystal in the centre, which can detect levels of infrared radiation. Everything emits low-level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is split in two halves. This is to detect motion (change) and not average IR levels. The two halves are connected so that they cancel out each other. If one-half sees more or less IR radiation than the other, the output will swing high or low. PIRs have adjustable settings and have a header installed in the 3-pin ground/out/power pads.

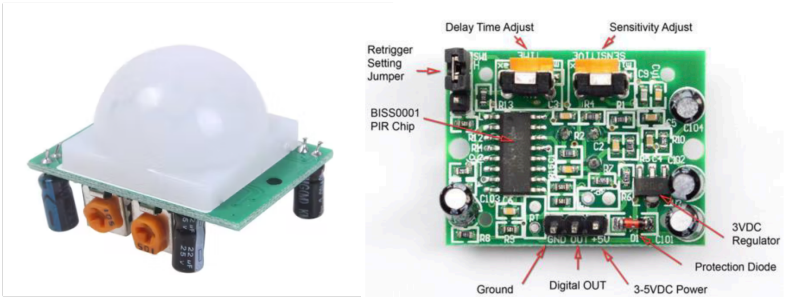

Figure 1: PIR Sensor

2. **MQ-2 Smoke/Gas Sensor**

MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide. MQ2 gas sensor is also known as chemiresistor. It contains a sensing material whose resistance changes when it comes in contact with the gas. This change in the value of resistance is used for the detection of gas. MQ2 is a metal oxide semiconductor type gas sensor. Concentrations of gas in the gas is measured using a voltage divider network present in the sensor. This sensor works on 5V DC voltage. It can detect gases in the concentration of range 200 to 10000ppm.

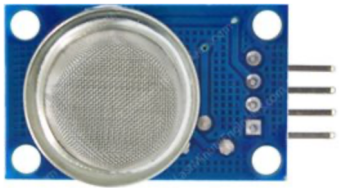

Figure 2: MQ-2 Gas Sensor

3. **SIM900A**

SIM900A Modem is built with Dual Band GSM/GPRS based SIM900A modem from SIMCOM. It works on frequencies 900/ 1800 MHz. SIM900A can search these two bands automatically. The frequency bands can also be set by AT Commands. The baud rate is configurable from 1200-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. SIM900A is an ultra compact and reliable wireless module. This is a complete GSM/GPRS module in a SMT type and designed with a very powerful single-chip processor integrating AMR926EJ-S core, allowing you to benefit from small dimensions and cost-effective solutions.

Figure 3: SIM900A RS232

4. **Arduino Uno R3**

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button.

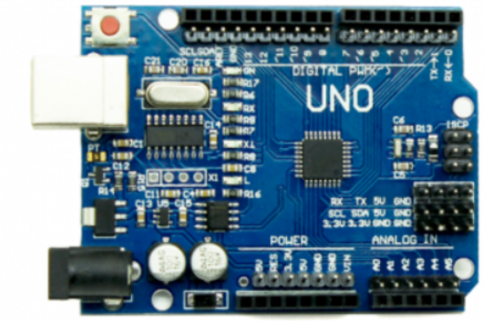

Figure 4: Arduino Uno R3

Circuit Diagram

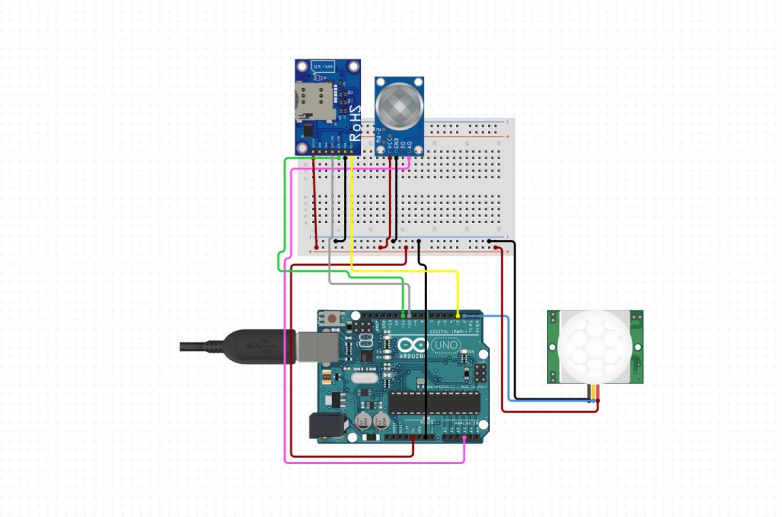

Figure 5: Circuit Diagram

Working

On providing power to the home security system, the PIR sensor will continuously detect if there any presence of motion. The information is given to microcontroller where it is processed. When certain conditions meet, an SMS is sent to the user (home owner) using the GSM module. The gas sensor also continuously detects for presence of smoke/gas. The data is passed on to the Arduino, where it is processed. If the level of the gas goes over the threshold limit, a SMS is sent to the user through the GSM module. It also to be noted that a SIM card must be inserted into the SIM900A GSM module and must be within a mobile network area.

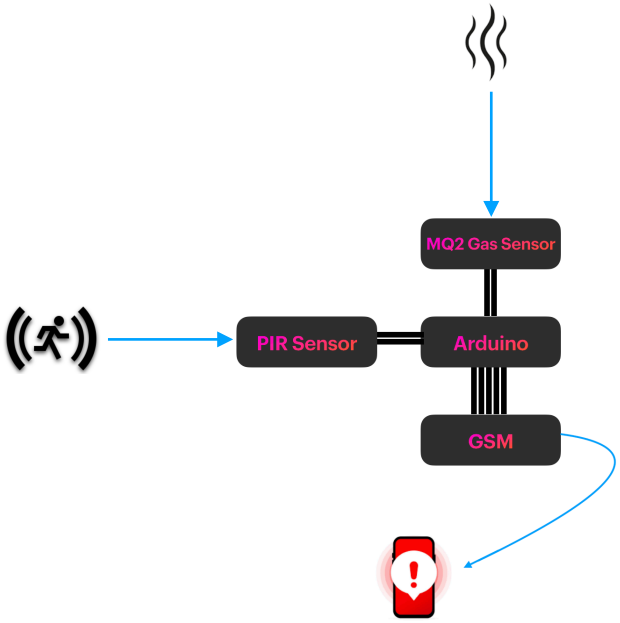

Figure 6: Pictorial Representation of the working

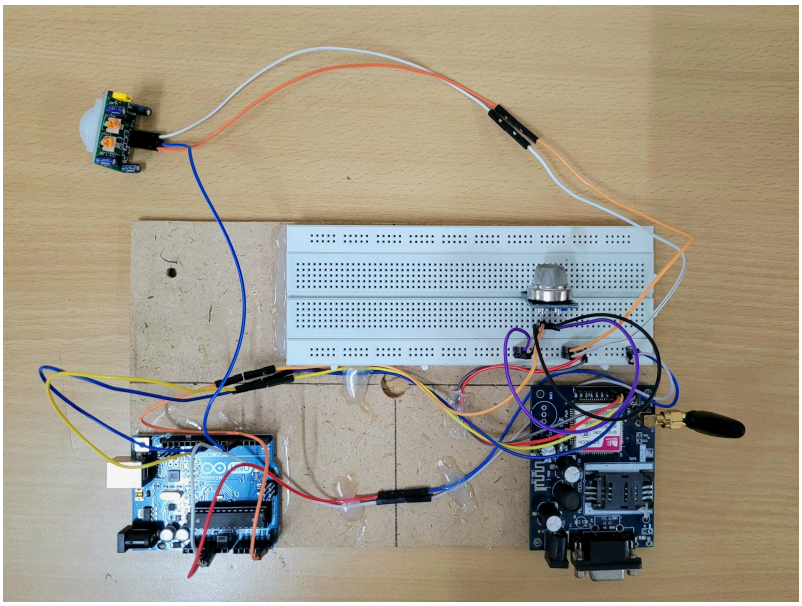

Figure 7: Physical Circuit Implementation

RESULTS AND DISCUSSION

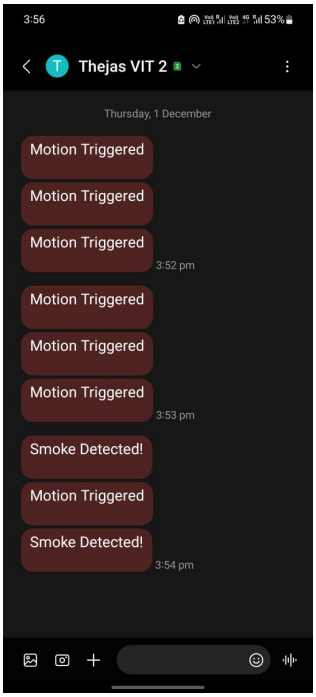

Figure 8: SMS Alerts sent to the registered mobile number

Advantages

- The given system is power efficient and inexpensive.
- The system is fully automated once the power supply is provided.
- The circuitry is not very complex, making troubleshooting simple.

Cost Breakdown

ITEMS	COST
ARDUINO UNO	₹ 700
HC-SR501 PIR MOTION SENSOR	₹ 80
GSM Module (SIM900A)	₹ 750
MQ-2 Gas Sensor	₹ 130
Connecting Cable	₹ 40
Other Costs	₹ 400
Total	**₹ 2100**

Table 1: Cost breakdown of the project

CONCLUSION

This project introduces a low cost, secure, widely accessible, auto-configurable, and remotely operated solution for home automation. We have developed this project for the fundamental level of home security using Arduino, GSM, PIR sensor and Gas sensor. We have also completed all the objectives mentioned.

FUTURE SCOPE

- Addition of a camera module for live streaming and storing visual information.
- Making the entire system portable by adding a battery.
- Create an application for easy control and access over the home security system.
- Apply face detection detection to differentiate between intruders and residents.

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[2] https://robu.in/mq2-sensor-interfacing-with-arduino-gas-and-smoke-detection/

[3] https://www.instructables.com/GSM-SIM900A-With-Arduino/

[4] https://youtu.be/vmhPQb4rdPw

[5] https://youtu.be/nUcrrCJd1sY

[6] https://youtu.be/g-NvPPEj3oQ

APPENDIX

```
#include <SoftwareSerial.h>
SoftwareSerial mySerial(9, 10);
int calibrationTime = 10;
long unsigned int lowIn;
long unsigned int pause = 5000;
boolean takeLowTime;
boolean lockLow = true;
int pirsensor = 5;
int smokeA0 = A5;
int sensorThres = 1000;
String textForSMS;

void setup()
{
  randomSeed(analogRead(0));
  mySerial.begin(9600);   // Setting the baud rate of GSM Module
```

```
  Serial.begin(9600);     // Setting the baud rate of Serial Monitor
(Arduino)
  Serial.println("Logging Time Completed!");
  pinMode(pirsensor, INPUT);
  pinMode(smokeA0, INPUT);
  digitalWrite(pirsensor, LOW);
  Serial.print("Calibrating Sensor ");
  for(int i = 0; i < calibrationTime; i++)
  {
    Serial.print(".");
    delay(1000);
  }
  Serial.println("\nDone");
  Serial.println("SENSOR ACTIVE");
  delay(50);
}
void loop()
{
 if ( digitalRead(pirsensor) == HIGH)
  {
    textForSMS =  "Motion Triggered";
    sendSMS(textForSMS);
    Serial.println(textForSMS);
    delay(1000);
    Serial.println("Message sent.");
    delay(9000);
  }
  takeLowTime = true;
  if(digitalRead(pirsensor) == LOW)
  {
    if(takeLowTime)
```

```
    {
        lowIn = millis(); //save the time of the transition from high
to LOW
        takeLowTime = false;
    }
     //if the sensor is low for more than the given pause,we assume
that no more motion is going to happen
    if(!lockLow && millis() - lowIn > pause)
    {
      //makes sure this block of code is only executed again after a
new motion sequence has been detected
      lockLow = true;
    }
  }
  int analogSensor = analogRead(smokeA0);
   if (analogSensor > sensorThres) // Checks if it has reached the
threshold value
  {
    textForSMS =  "Smoke Detected!";
    sendSMS(textForSMS);
    Serial.println(textForSMS);
    delay(1000);
    Serial.println("Message sent.");
    delay(5000);
  }
  else
  {
    delay(1000);
  }
  delay(1000);
}
```

```
void sendSMS(String message)
{
   mySerial.println("AT+CMGF=1");      //Sets the GSM Module in Text
Mode
  delay(1000);  // Delay of 1 second
  mySerial.println("AT+CMGS=\"+918921644146\"\r");
  delay(1000);
  mySerial.println(message);// The SMS text you want to send
  delay(100);
   mySerial.println((char)26);// ASCII code of CTRL+Z for saying the
end of sms to  the module
  delay(1000);
}
```