HOME SECURITY SYSTEM USING ARDUINO

INDEX

ABSTRACT:

Our project is "**Home Security System Using Arduino Uno**" which is designed for security purposes of home by using different sensors like Flame Sensor which is used to detects the presence of fire, Gas-Sensor which is used to detect the concentration of gases in the environment, PIR Sensor used to detect any human being(intruder) in the secure Mode, Vibration Sensor which is used to detect any forced entry through windows, Infrared Sensor which is used to detect if someone tried to enter through the door. We interface all these sensors with Arduino Uno in Proteus Software and make the Security System for home. It can be used in wide applications where we need security from fire, Gas, theft etc…not only in home but also in banks, industries.

INTRODUCTION:

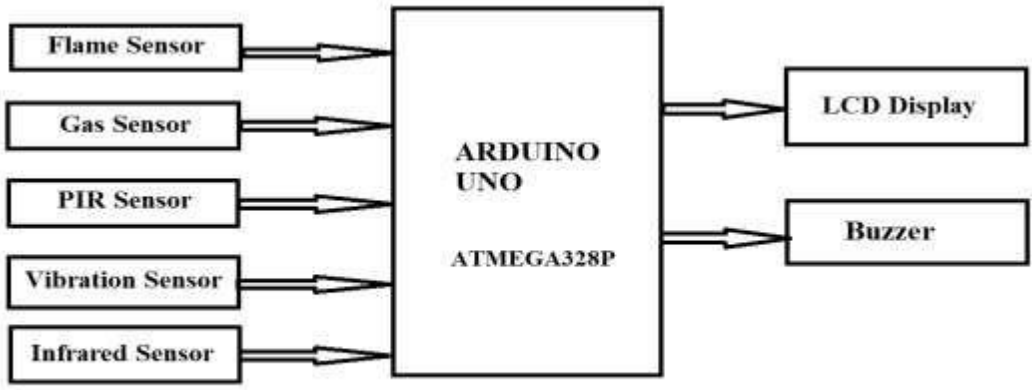
- Incidents like thefts, fire and LPG gas leakage are very common these days. What is uncommon, is people's awareness about different systems like a smoke detector, gas leakage detectors, etc.

- Installing all these different detectors in order to keep the house secured is also something that is difficult to maintain.

- Here, we have designed an integrated home security system that would help people secure their houses from such incidents.
  IOT and Arduino based Home Security System project is designed to help an individual secure his/her house from theft, fire and LPG gas leakage – all in one.

- This project uses four different sensors, from which data is sent over a website through IOT. Internet of Things (IoT) is basically, the network of 'things' by which physical things can exchange data with the help of sensors, electronics, software, and connectivity. These systems do not require any human interaction.

BLOCK DIAGRAM:



HOME SECURITY SYSTEM

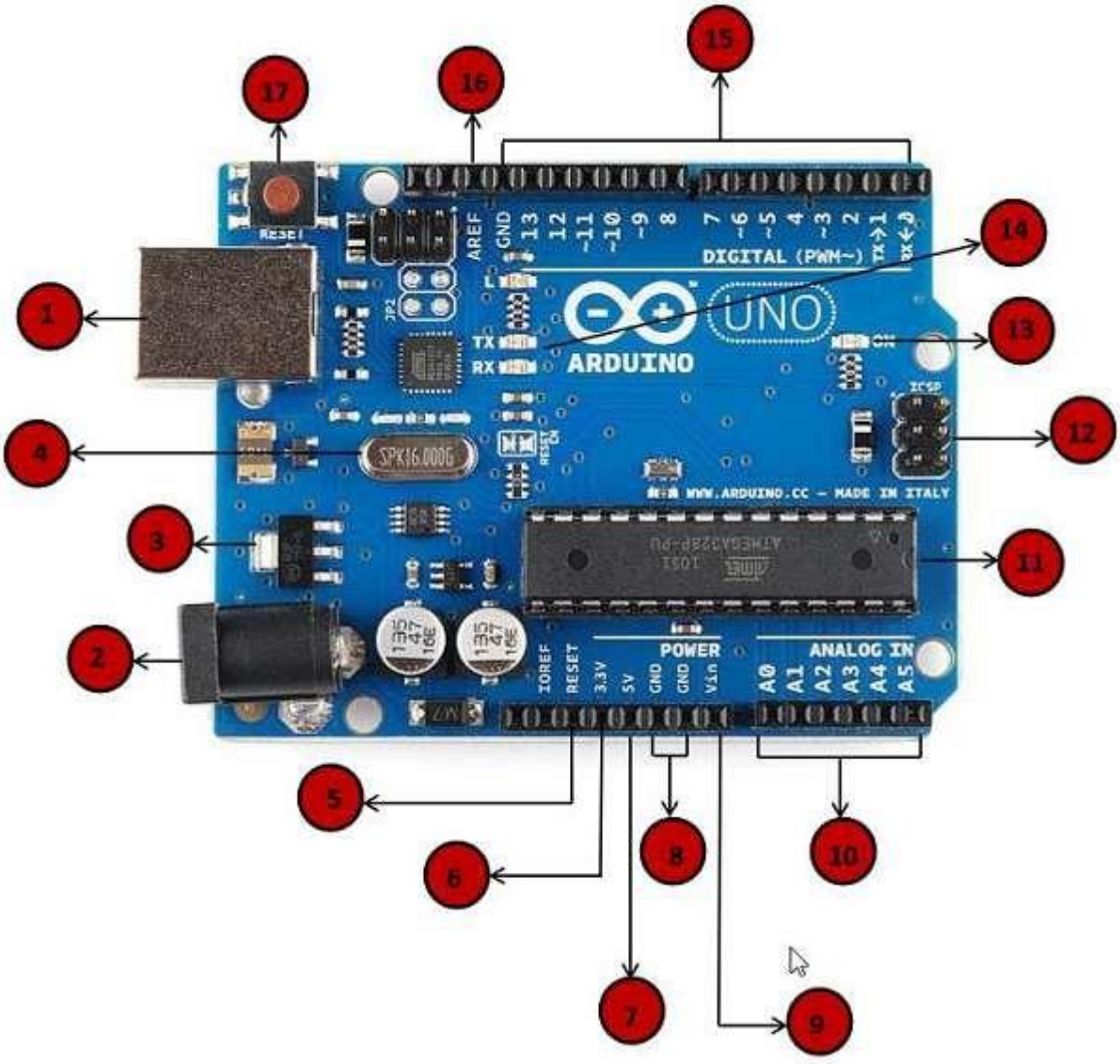
Components:

S. No	Component	Quantity
1.	Arduino Uno	1
2.	Flame Sensor	1
3.	Gas Sensor (MQ-6)	1
4.	Infrared Sensor	1
5.	Vibration Sensor (SW-420)	1
6.	10K potentiometer	1
7.	Jumper Wires	Set
8.	LCD Display 16x2	1

Components Description:

Arduino UNO:

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits. The board has 14 digital I/O pins(six capable of PWM output), 6 analog I/O pins, and is programmable with Arduino IDE(Integrated Development Environment),via a type B USB cable.



1	**Power USB** Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection (1).

2	**Power (Barrel Jack)** Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack (2).
3	**Voltage Regulator** The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.
4	**Crystal Oscillator** The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.
5,17	**Arduino Reset** You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labelled RESET (5).
6,7 8,9	**Pins (3.3, 5, GND, Vin)** • 3.3V (6) − Supply 3.3 output volt • 5V (7) − Supply 5 output volt • Most of the components used with Arduino board works fine with 3.3 volt and 5 volt. • GND (8)(Ground) − There are several GND pins on the Arduino, any of which can be used to ground your circuit. • Vin (9) − This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.
10	**Analog pins** The Arduino UNO board has six analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.
11	**Main microcontroller** Each Arduino board has its own microcontroller (11). You can assume it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from

	board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet.
	**ICSP pin** Mostly, ICSP (12) is an AVR, a tiny programming header for the Arduino consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often referred to as an SPI (Serial Peripheral Interface), which could be considered as an "expansion" of the output. Actually, you are slaving the output device to the master of the SPI bus.
	**Power LED indicator** This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.
	**TX and RX LEDs** On your board, you will find two labels: TX (transmit) and RX (receive). They appear in two places on the Arduino UNO board. First, at the digital pins 0 and 1, to indicate the pins responsible for serial communication. Second, the TX and RX led (13). The TX led flashes with different speed while sending the serial data. The speed of flashing depends on the baud rate used by the board. RX flashes during the receiving process.
	**Digital I/O** The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labeled "~" can be used to generate PWM.
	**AREF** AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

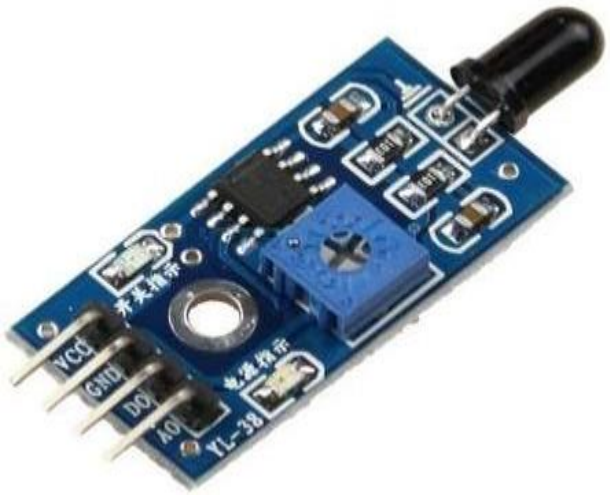
Flame Sensor:

A flame-sensor is one kind of detector which is mainly designed for detecting as well as responding to the occurrence of a fire or flame. The flame detection response can depend on its fitting. It includes an alarm system, a natural gas line, propane & a fire suppression system. This sensor is used in industrial boilers. The main function of this is to give authentication whether the boiler is properly working or not. The

response of these sensors is faster as well as more accurate compare with a heat/smoke detector because of its mechanism while detecting the flame.

This sensor/detector can be built with an electronic circuit using a receiver like electromagnetic radiation. This sensor uses the infrared flame flash method, which allows the sensor to work through a coating of oil, dust, water vapor, otherwise ice.

The pin configuration of this sensor is shown below. It includes four pins which include the following. When this module works with a microcontroller unit then the pins are



- Pin1 (VCC pin): Voltage supply rages from 3.3V to 5.3V
- Pin2 (GND): This is a ground pin
- Pin3 (AOUT): This is an analog output pin (MCU.IO)
- Pin4 (DOUT): This is a digital output pin (MCU.IO)

The features of this sensor include the following.

- Photosensitivity is high
- Response time is fast
- Simple to use
- Sensitivity is adjustable
- Detection angle is 600,
- It is responsive to the flame range.
- Accuracy can be adjustable
- Operating voltage of this sensor is 3.3V to 5V
- Analog voltage o/ps and digital switch o/ps
- The PCB size is 3cm X 1.6cm
- Power indicator & digital switch o/p indicator
- If the flame intensity is lighter within 0.8m then the flame test can be activated, if the flame intensity is high, then the detection of distance will be improved.

GAS Sensor(MQ-6):

The MQ-6 module is used in gas leakage detecting equipment in family and industry, This module has high sensitivity to LPG, iso-butane, propane and LNG. It can also be used to detect the presence of alcohol, cooking fumes, and cigarette smoke.

The module gives out the concentration of the gases as a analog voltage equivalent to the concentration of the gases. The module also has an onboard comparator for comparing against an adjustable preset value and giving out a digital high or low. It can be easily interfaced with your Arduino or Raspberry Pi.

This is a simple-to-use MQ-6 Liquefied Petroleum, iso-butane, propane gas Sensor module, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm.This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance.

The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC.Sensitive material of MQ-6 gas sensor is SnO2, which with lower conductivity in clean air.

When the target combustible gas exist, The sensor's conductivity is more higher along with the gas concentration rising. Please use simple electrocircuit, Convert change of conductivity to correspond output signal of gas concentration.MQ-6 gas sensor has high sensitity to Propane, Butane and LPG, also response to Natural gas. The sensor could be used to detect different combustible gas, especially Methane, it is with low cost and suitable for different application.

The features of this sensor include the following.

- Voltage: 5V
- Detecting concentration :
- 200-10000 ppm LPG
- iso-butane
- propane
- LNG
- Analog and Digital Output
- Digital Out is High or Low based on a adjustable preset threshold.

Infrared Sensor:

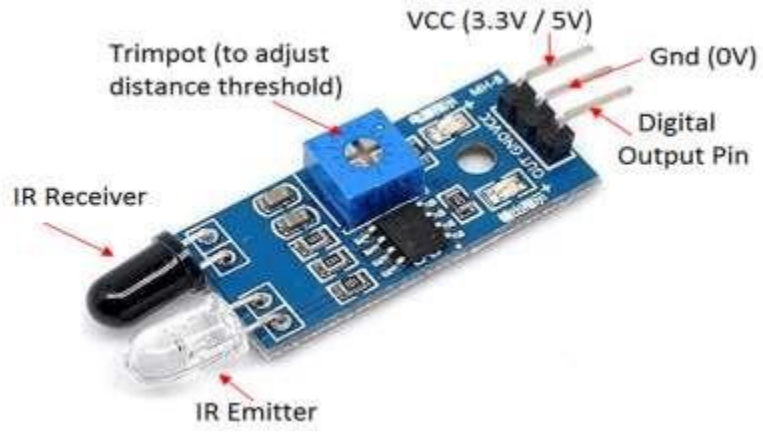
An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herchel in 1800. While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest. IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum). Anything that emits heat (everything that has a temperature above around five degrees Kelvin) gives off infrared radiation.

There are two types of infrared sensors: active and passive. Active infrared sensors both emit and detect infrared radiation. Active IR sensors have two parts: a light emitting diode (LED) and a receiver. When an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected by the receiver. Active IR sensors act as proximity sensors, and they are commonly used in obstacle detection systems (such as in robots).

An infrared sensor includes two parts namely the emitter & the receiver (transmitter & receiver), so this is jointly called an optocoupler or a photo-coupler. Here, IR LED is used as an emitter whereas the IR photodiode is used as a receiver.

The photodiode used in this is very sensitive to the infrared light generated through an infrared LED. The resistance of photodiode & output voltage can be changed in proportion to the infrared light obtained. This is the fundamental IR sensor working principle.

The type of incident that occurred is the direct otherwise indirect type where indirect type, the arrangement of an infrared LED can be done ahead of a photodiode without obstacle. In indirect type, both the diodes are arranged side by side through a solid object ahead of the sensor. The generated light from the infrared LED strikes the solid surface & returns back toward the photodiode.



The features of this sensor include the following.

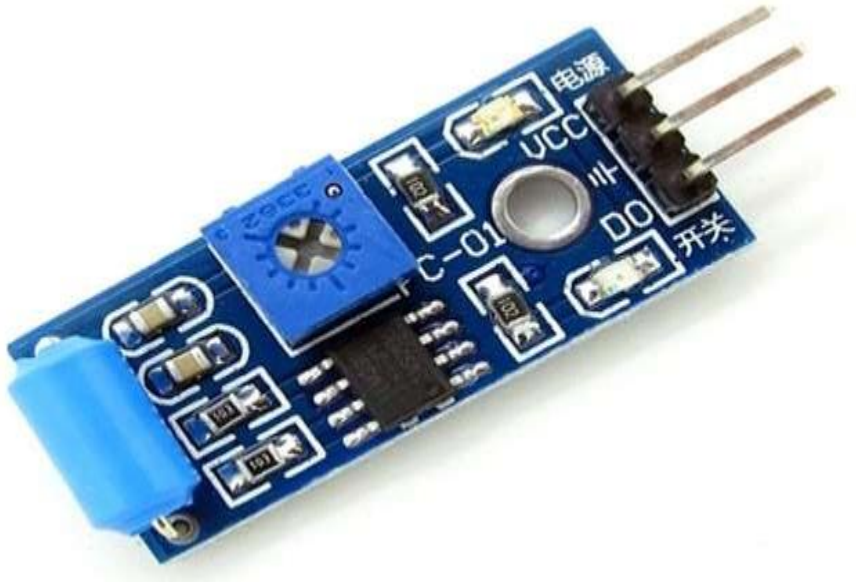
- The operating voltage is 5VDC
- I/O pins – 3.3V & 5V
- Mounting hole
- The range is up to 20 centimeters
- The supply current is 20mA
- The range of sensing is adjustable
- Fixed ambient light sensor.

Vibration Sensor:

The vibration sensor is also called a piezoelectric sensor. These sensors are flexible devices which are used for measuring various processes. This sensor uses the piezoelectric effects while measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge. This sensor is also used for deciding fragrances within the air by immediately measuring capacitance as well as quality.

The working principle of vibration sensor is a sensor which operates based on different optical otherwise mechanical principles for detecting observed system vibrations.

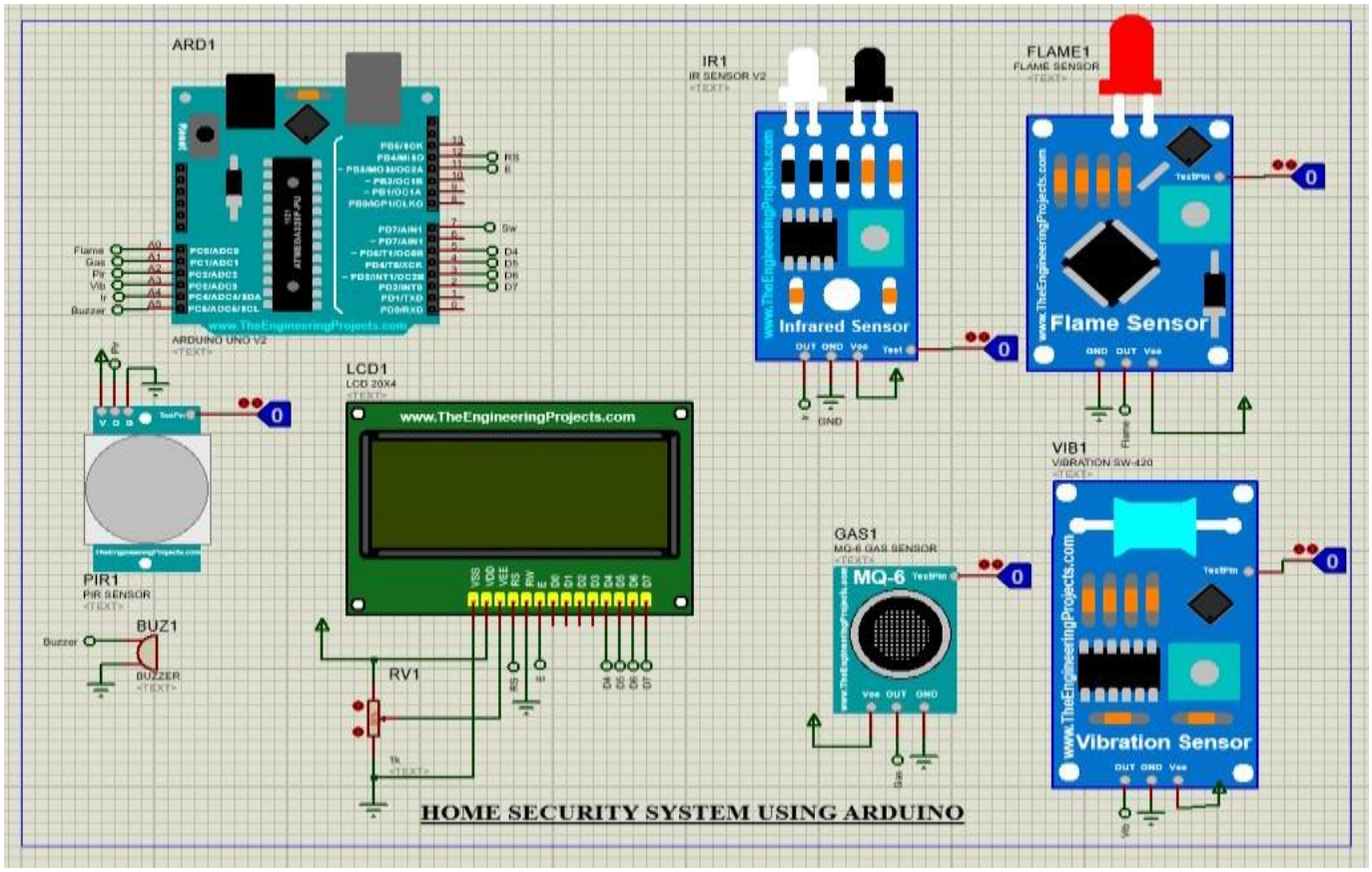
The sensitivity of these sensors normally ranges from 10 mV/g to 100 mV/g, and there are lower and higher sensitivities are also accessible. The sensitivity of the sensor can be selected based on the application. So it is essential to know the levels of vibration amplitude range to which the sensor will be exposed throughout measurements.

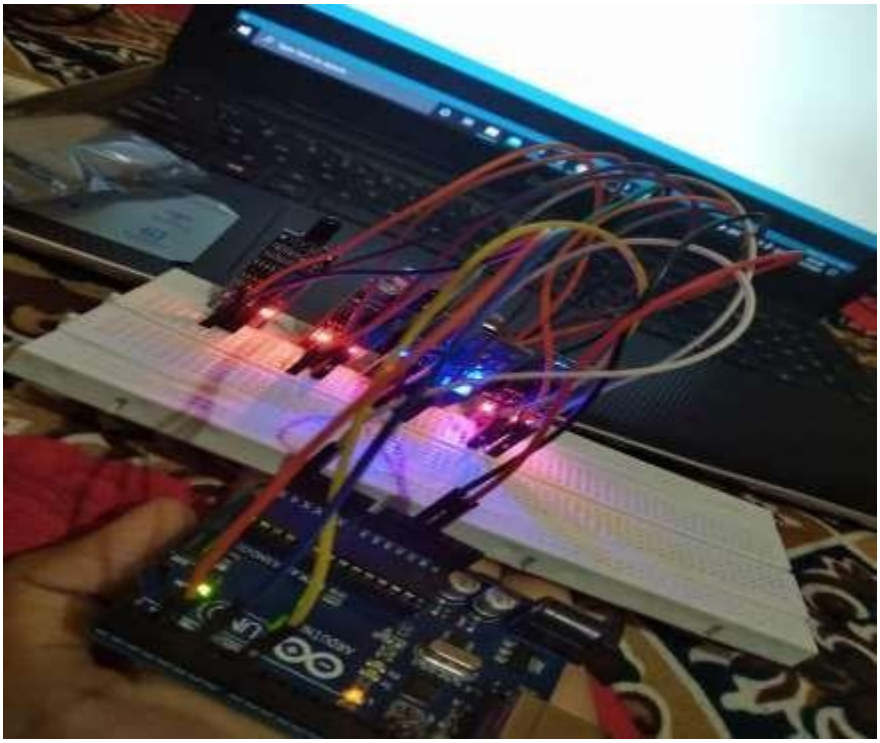


The features of this sensor include the following.

- Operating Voltage: 3.3V to 5V DC
- Operating Current: 15mA
- Using SW-420 normally closed type vibration sensor
- LEDs indicating output and power
- LM393 based design
- Easy to use with Microcontrollers or even with normal Digital/Analog IC
- With bolt holes for easy installation
- Small, cheap and easily available

Circuit:


ARD1
IR1
IR SENSOR V2
FLAME1
FLAME SENSOR
Infrared Sensor
Flame Sensor
LCD1
LCD 20X4
www.TheEngineeringProjects.com
VIB1
VIBRATION SW-420
Vibration Sensor
GAS1
MQ-6 GAS SENSOR
MQ-6
PIR1
PIR SENSOR
BUZ1
BUZZER
RV1
HOME SECURITY SYSTEM USING ARDUINO



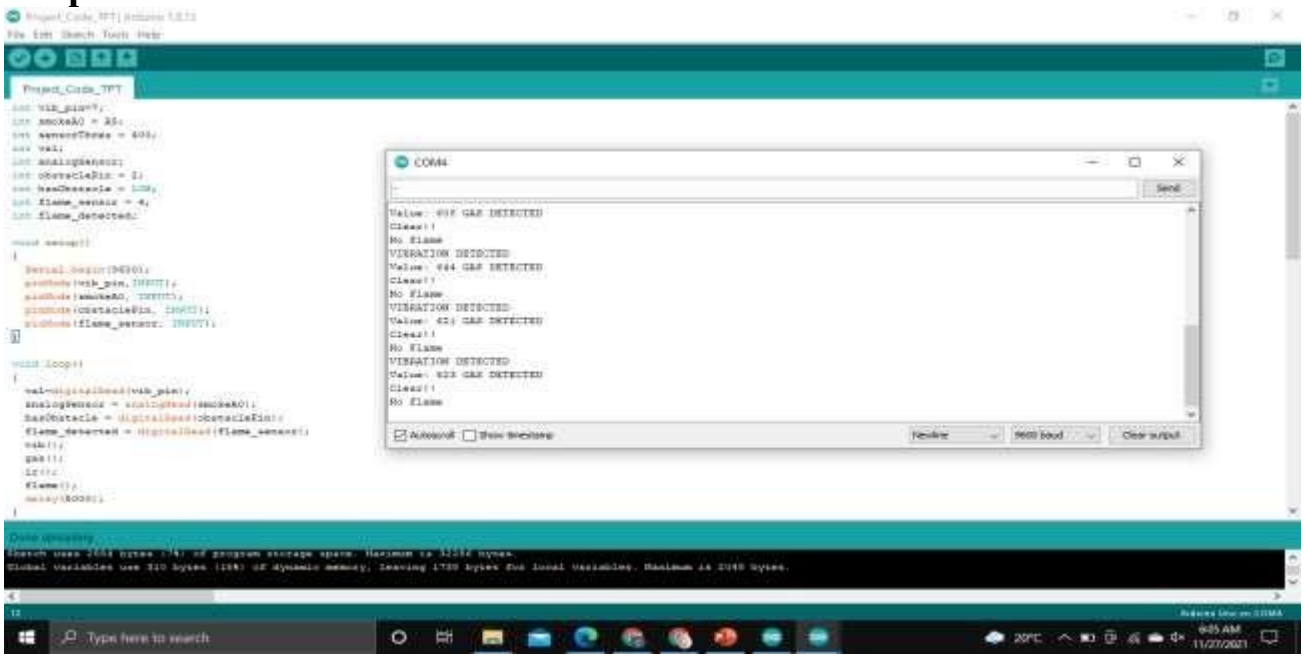
Code:

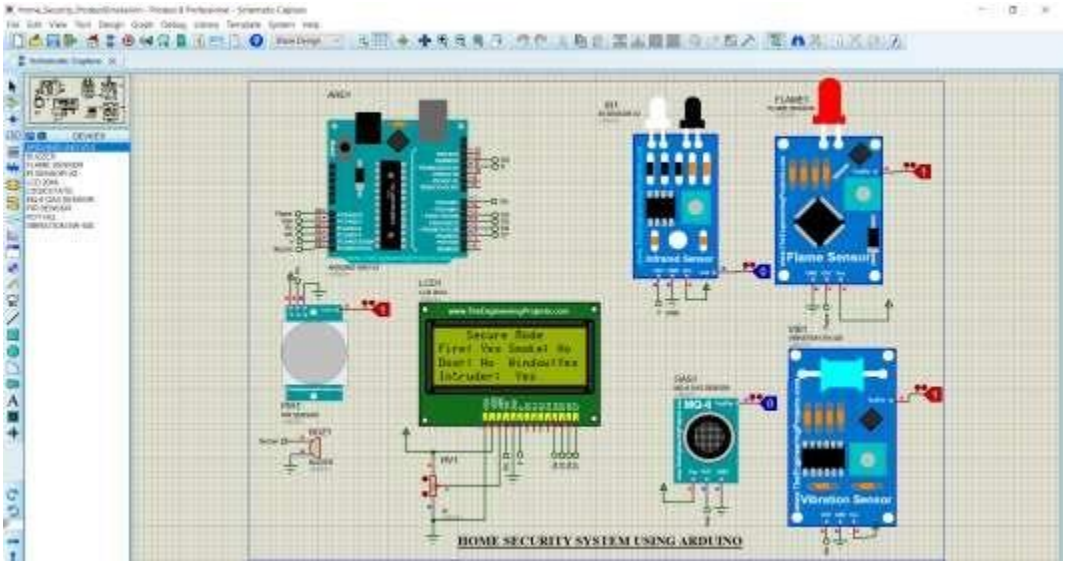
```
#include <LiquidCrystal.h>
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
#define Flame A0
#define Gas A1
#define Pir A2
#define Vib A3
#define Ir A4
#define Buzzer A5
boolean Fire, Smoke, Intruder, Window, Door;
void setup() {
   pinMode(Flame,INPUT);
   pinMode(Gas,INPUT);
   pinMode(Pir,INPUT);
   pinMode(Vib,INPUT);
   pinMode(Ir,INPUT);
   pinMode(Buzzer,OUTPUT);
   lcd.begin(20,4);
   lcd.setCursor(0,1);
   lcd.print("HOME SECURITY SYSTEM");
   lcd.setCursor(0,2);
   lcd.print(" USING ARDUINO UNO ");
   lcd.setCursor(7,3);
   delay(500);
   lcd.clear();
   SensorDisplay();
}

void loop()
{
   Fire  = digitalRead(Flame);
   Smoke = digitalRead(Gas);
   Intruder = digitalRead(Pir);
   Window = digitalRead(Vib);
   Door = digitalRead(Ir);
   SensorValues();

   if((Fire == HIGH) || (Smoke == HIGH) || (Intruder == HIGH) || (Window == HIGH) || (Door == HIGH)){
     digitalWrite(Buzzer, HIGH);
   }
   else
   {
     digitalWrite(Buzzer, LOW);
   }
}

void SensorDisplay()
```

```
{
  lcd.setCursor(0,1);
  lcd.print("Fire:");
  lcd.setCursor(10,1);
  lcd.print("Smoke:");
  lcd.setCursor(0,2);
  lcd.print("Door:");
  lcd.setCursor(10,2);
  lcd.print("Window:");
  lcd.setCursor(0,3);
  lcd.print("Intruder:");
}



void SensorValues()
{
  if(Fire == true){
    lcd.setCursor(6,1);
    lcd.print("Yes");
  }
  else{
    lcd.setCursor(6,1);
    lcd.print("No ");
  }

  if(Smoke == true){
    lcd.setCursor(17,1);
    lcd.print("Yes");
  }
  else{
    lcd.setCursor(17,1);
    lcd.print("No ");
  }

  if(Intruder == true){
    lcd.setCursor(11,3);
    lcd.print("Yes");
  }
  else{
    lcd.setCursor(11,3);
    lcd.print("No ");
  }

  if(Window == true){
    lcd.setCursor(17,2);
    lcd.print("Yes");
  }
  else{
```

```
    lcd.setCursor(17,2);
    lcd.print("No ");
  }
  if(Door == true){
    lcd.setCursor(6,2);
    lcd.print("Yes");
  }
  else{
    lcd.setCursor(6,2);
    lcd.print("No ");
  }
}
```

Output:





Conclusion and Analysis:

- Security being the main intent of the project, the most important application of this system is any domestic security. By using this project, a person will be intimidated about any incident likely to be caused by fire, theft, LPG gas – REMOTELY.
- This project can be used at Restaurants, Industries, Manufacturing units, Banks, etc.
- The main advantage of this system is that it is fully automated. Once installed, it does not require any kind of human interaction. Also, it is very cost-effective.
- Today, we have designed a very simple Home Security System, where we interfaced few sensors and have only placed a Buzzer.
- We will continue this project and will add smart features to it.
- Let's have a look at few features, which we can add to this project:
    - We can interface the GSM module to send messages, in case of emergency.
    - We can add more sensors i.e. ultrasonic sensors, different types of Gas sensors in it.
    - We can also improve our code by using interrupts instead of polling.
    - We can also add a camera for facial recognition.
    - To improve the security, we can add a keypad and only authorized persons will have the access to enter.
    - The fingerprint sensor can also be used for identification purposes.

References:

https://www.theengineeringprojects.com/2021/05/home-security-system-using-arduino-uno-in-proteus.html

https://www.electricaltechnology.org/2018/11/types-sensors-applications.html