WORKSPACE AUTOMATION

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For the Completion of

19AIE114 - PRINCIPLE OF MEASUREMENTS AND SENSORS

CSE-AI
4th August 2021

INTRODUCTION:

In the modern world, there is always a scope for improvement. We are always concerned to look for ways to improve performance levels and gain an edge over the competition. The worldwide scenario proves that automation is the key to stay ahead in the run. It simplifies human activities and reduces operational costs in the long run. It minimizes the cost, saves our valuable time. It makes a task consistent and gives us improved security. As a whole, it improves performance significantly.

The word automation is a Greek word, which means '*self-extracting*, which refers to '*automatons*. It denotes the process of following a predetermined sequence of operations with little or no human labour, using specialized equipment and devices that perform and control the manufacturing process. Automation involves the usage of various sensors, actuators, devices, and techniques that is possible for the machine to take decisions and control the manufacturing process. It either fully or partially replaces human labour work. This term was originally introduced in the automobile industry in 1946 to describe the increased use of automatic devices.

Right from the beginning of human origin, automation too started. In the stone age period, people used to break a coconut with the help of tools made from stone, rather than in hand. Then in the coming eras, automation too evolved with time. During the last few centuries, many industries were arising. Their machines were used, which reduced human labour and gave larger production in lesser time. The first automated machine produced was a spinning mill. That automation created the massive industrial revolution.

Then in the later years, computers were invented. Those are too automated to perform various mathematical calculations. As time evolved, computers became so powerful that they began controlling the automotive world. They helped in increasing automation even further. Now, this automation is growing at another level. In this trending era, automation is itself having its pride. It has its standard.

In this project, an automated workspace is designed. The workspace designed in this project includes an *automated light system*, an *automated fan system*, and an *automated door system* with a *password locking system*. In case of fire accidents, for protection *gas and smoke detection systems* are also embedded. To protect the highly important documents, a *burglar alarm system* is implemented to protect the workspace from robbery. An *automated dustbin* is designed for the ease of the busy workers working there. All this automation is done with safety and power

consumption in mind. Automating a workspace creates a perfect, distraction-free environment.

Automated Dustbin:

This is a very useful application as it maintains cleanliness in a workspace. This is designed such that, only when the person who wants to throw the dust into it, comes near it, the bin opens. It is designed such that, for the rest of the time, it will remain closed. So, there won't be any insects residing in it. And when the dustbin is full, it won't open making it an efficient device.

Automated Fan System:

A fresh breeze makes one active and helps to think creatively. So, it is obvious that good ventilation is essential for a workspace. This system is designed in such a way that, if a person is detected then the fan will be automatically switched on and, in their absence, it is switched off automatically. PIR sensors, dc-motors, temperature sensors are made to work together and to bring this application into a reality. A lot of power is saved as a result of this.

Automated Light System:

Due to heavy workload and mental pressure, people often forget about their surroundings and basic works which they should do in a place, like switching lights off when leaving a room. As a result, the power consumption goes to its peak resulting in a tremendously high electricity bill. Keeping this in mind, there comes an urge for the automated lights, which can switch on when there is a human presence and that too during the night-time, i.e., in the absence of daylight. This idea is made into a reality with 2 sensors, namely the PIR sensor and LDR sensor.

Automated Door System:

Automated doors are energy savers. They even reduce annual heating and cooling costs. These doors open only when the PIR sensor detects human motion and automatically closes when Photoresistor when is not under activation. This is designed in this project, such that these doors get activated in the presence of humans. This idea is made into a reality with a PIR sensor and servo motor in this project. It is a wise application, as it prevents air-conditioning inside the workspace from escaping out and outside air and dust from entering.

Burglar alarm system:

This system is a series of electrical equipment that detects any unauthorized or forceful access in the premises and alerts using the alarm. This application is

designed such that, based on the location of the burglar, different frequencies of sound will be buzzed from the alarm. This makes the identification of the burglar easy.

Door with a password lock:

This system improves safety. There is a lower possibility for the burglars to steal the documents. In this project, the application is designed in such a way that the user should enter the pin to open the door. Access would be granted and the door would open when the correct pin is given by the user. If there is any mistake in the pin entry a buzzer is triggered.

Gas and Smoke detection systems:

In any place safety is important. There is a high risk of catching fire in a workspace due to short circuits or accidental fires. So, this system detects the gas, and an alarm is triggered in case of any accidents. Gas detection and smoke detection sensors bring this application to put to practice in the real world.

OBJECTIVE:

1. Automated Dustbin
2. Automated Fans
3. Automated Light System
4. Automatic Door Opening System
5. Burglar Alarm Security System
6. Door Lock Using Password
7. Gas and Smoke Detection System

HARDWARE AND SOFTWARE REQUIREMENTS:

1. Arduino uno
2. Led
3. Connecting wires
4. Ultrasonic distance sensor
5. Servo motor
6. Resistor
7. Breadboard
8. Gas sensor
9. Piezo buzzer
10. PIR sensor

11. LCD display
12. DC motor
13. Temperature sensor
14. Diode
15. NPN transistor
16. Photoresistor
17. Keypad(4x4)

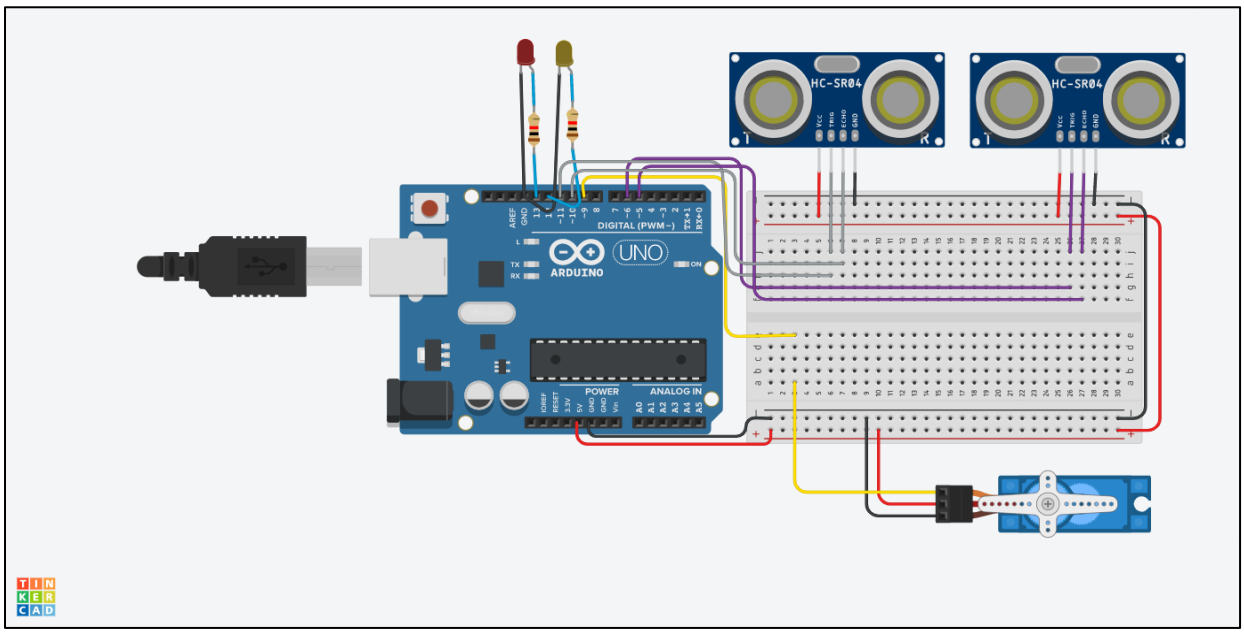
TOOLS:

TINKERCAD: CIRCUIT AND 3D DESIGN.

IMPLEMENTATION AND OUTPUTS:

1.AUTOMATED DUSTBIN:

Circuit Design:



Components used in this circuit:

1. Arduino Uno.

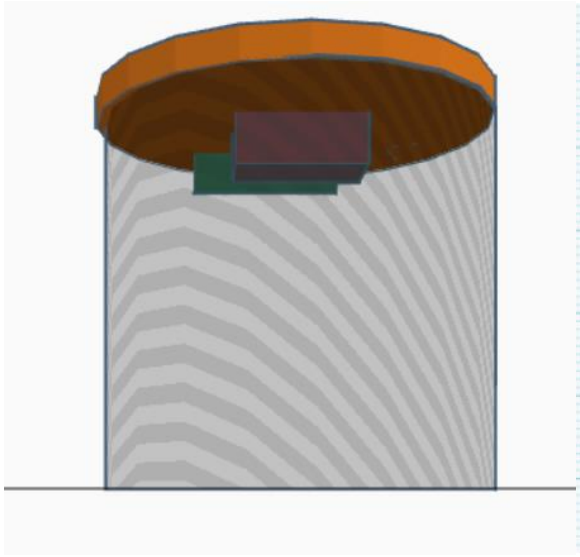
2. Resistors.
3. LED.
4. Servo Motor.
5. Ultrasonic distance sensor.
6. Connecting wires.
7. Breadboard.

Working Logic:

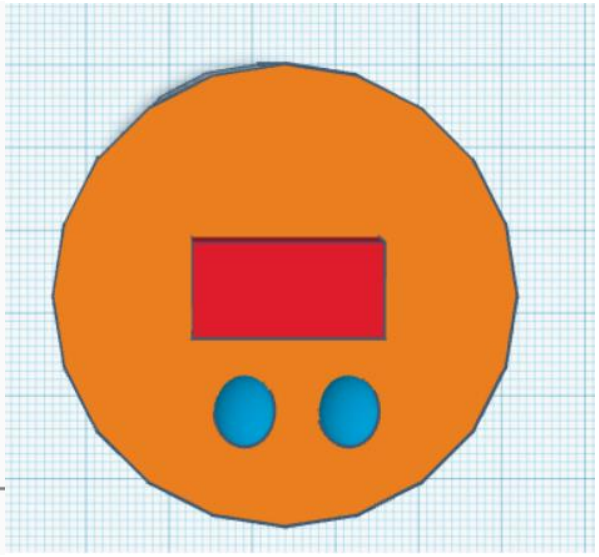
This circuit is mainly focused on helping us keep track of the amount of garbage in the dust bin and also helps us in automating the opening and closing of the dustbin using an Ultrasonic sensor. Here totally two ultrasonic sensors are used. One sensor is used to trace the level of garbage in it. While the other is used to automate the process (i.e., when movement is detected near the dustbin, this sensor detects and opens the dustbin's Lid).

The lid of the dustbin is powered by the servo motor for automating. So, when motion is detected in the proximity of the dustbin, the lid automatically opens for 5 seconds. A LED is attached to the dustbin to indicate the amount of garbage inside. The LED emits Yellow light when the dustbin is not full and emits Red Light indicating that the dustbin is full and the garbage is to be disposed of. And also, the lid does not open when the dustbin is indicated as full. The resistor is used to limit the current through the LED and to prevent excess current that can burn out the LED.

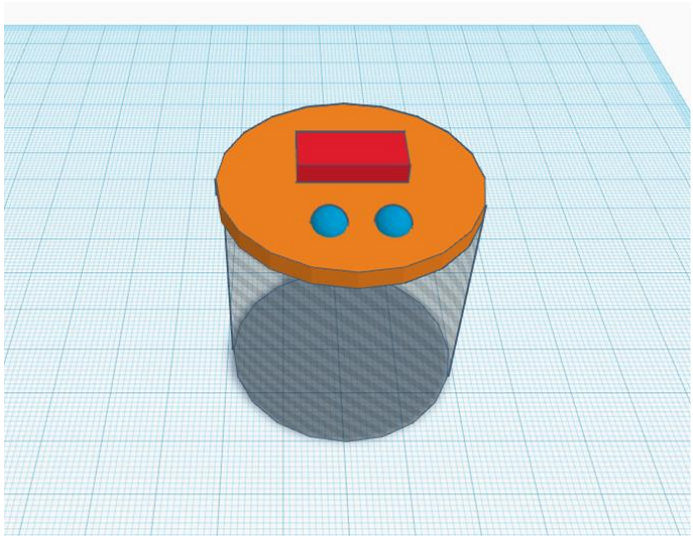
3D-DESIGN:



FRONT VIEW



TOP VIEW



3D-VIEW

Here the red rectangle indicates the Ultrasonic distance sensor, it is used to detect human motion. While the Ultrasonic sensor inside the dustbin is used to detect the amount of garbage inside the dustbin. Depending on the distance measured by the sensor inside the dustbin the LED emits different lights accordingly (i.e., Indicating the amount of garbage). The blue hemisphere indicates the LED. The green block inside the bin indicates the servo motor. The orange block is used to represent the lid of the bin.

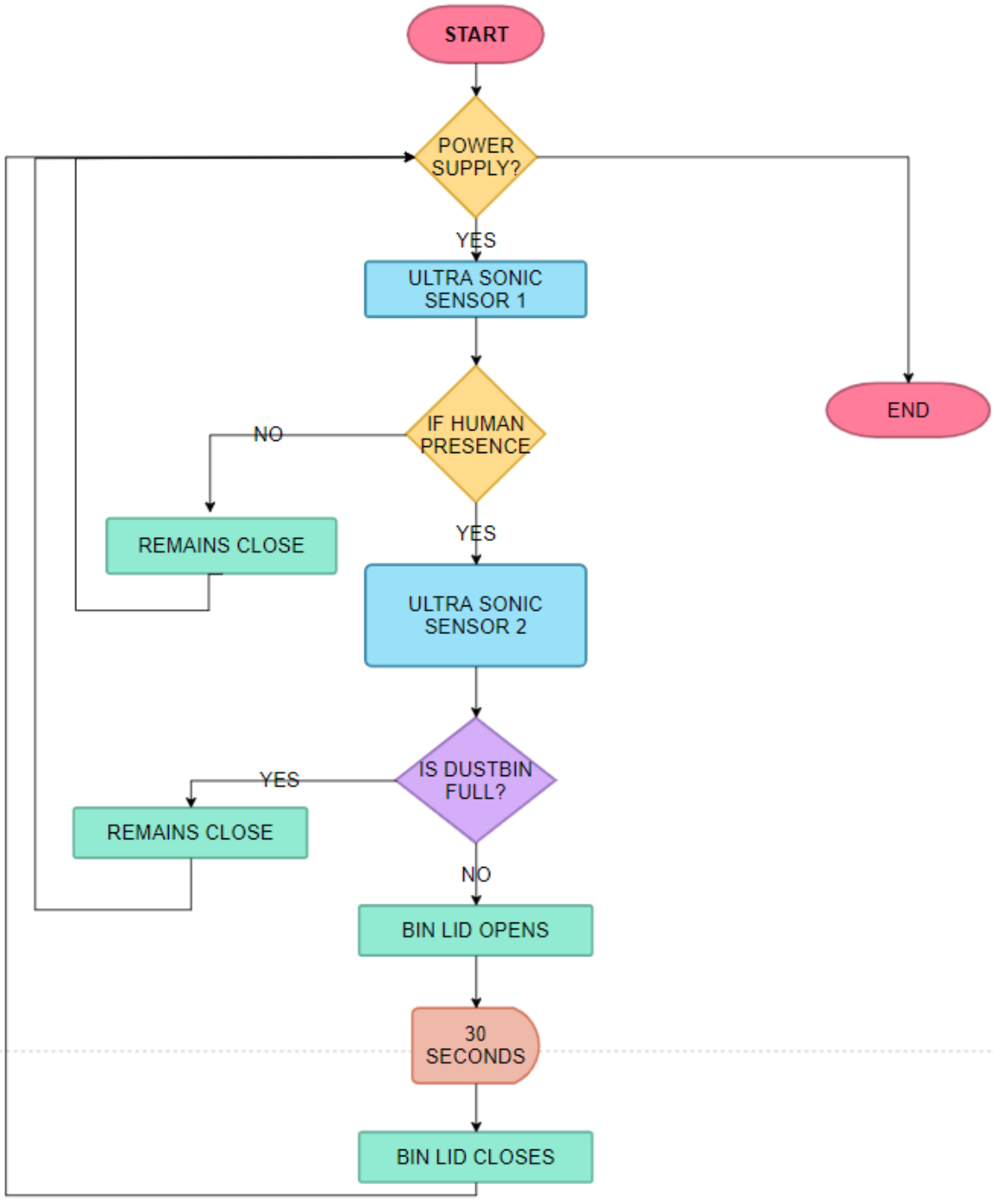
Code:

```
#include <Servo.h>
Servo motor;
unsigned long duration;
unsigned long duration2;
unsigned int distance = 0;
unsigned int distance2;
int position = 0;

void setup()
{
  motor.attach(9);
  // Setting pinmode for sensor1
  pinMode(10,INPUT); // Setting echo-pin as input
  pinMode(11,OUTPUT);// Setting trigger-pin as output
  // Setting pinmode for sensor2
  pinMode(5,INPUT); // Setting echo-pin as input
  pinMode(6,OUTPUT);// Setting trigger-pin as output
  motor.write(position);
```

```
  pinMode(13,OUTPUT);
  pinMode(12,OUTPUT);
}

void loop()
{
  Serial.begin(9600);
  digitalWrite(11,LOW);
  delayMicroseconds(2);
  digitalWrite(11,HIGH);
  delayMicroseconds(10);
  digitalWrite(11,LOW);

  digitalWrite(6,LOW);
  delayMicroseconds(2);
  digitalWrite(6,HIGH);
  delayMicroseconds(10);
  digitalWrite(6,LOW);

  duration = pulseIn(10,HIGH);
  distance = duration*0.017; // ((340*100)/10e6)/2

  duration2 = pulseIn(6,HIGH);
  distance2 = duration*0.017; // ((340*100)/10e6)/2

  if (distance2 <= 300 && distance2 >= 100){
    digitalWrite(12,HIGH);
    digitalWrite(13,LOW);
  }
  else if(distance2 <100){
    digitalWrite(12,LOW);
    digitalWrite(13,HIGH);
  }

  if (distance < 50){
    for (position = 0; position < 160; position += 1) {
    motor.write(position);
    delay(10);
    }
    delay(5000);
    for (position = 160; position > 0; position -= 1) {
    motor.write(position);
    delay(10);
    }
```

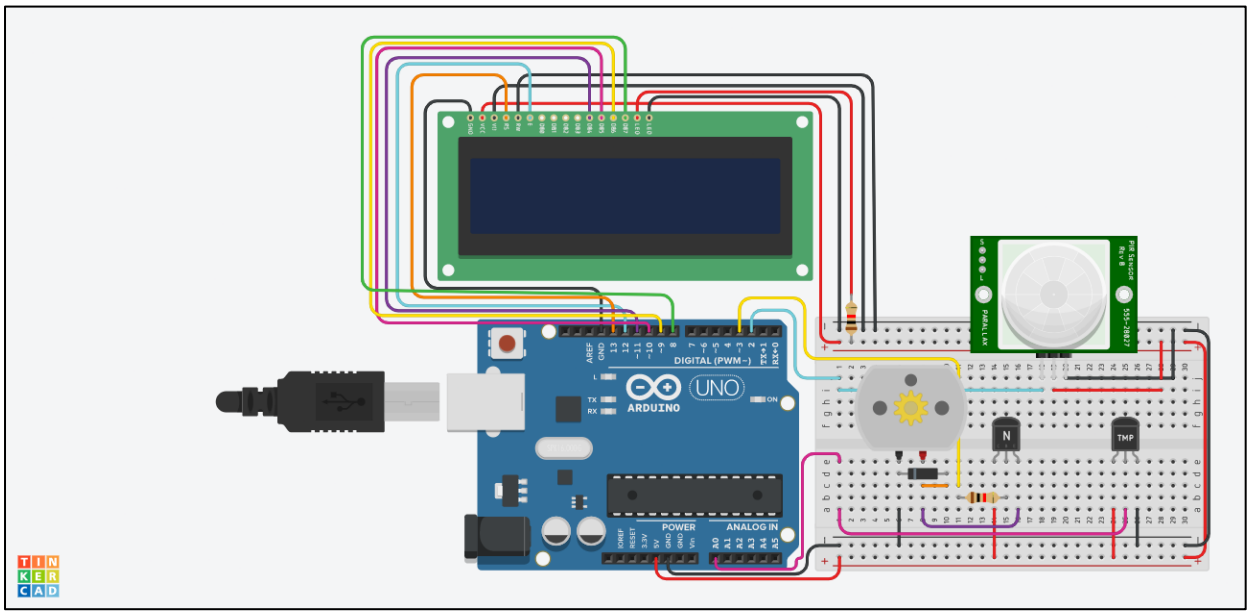
```
  }
  else{
    motor.write(position);
  }
  delay(2500);
}
```

Algorithm:



2.Automated Fans:

Circuit Design:



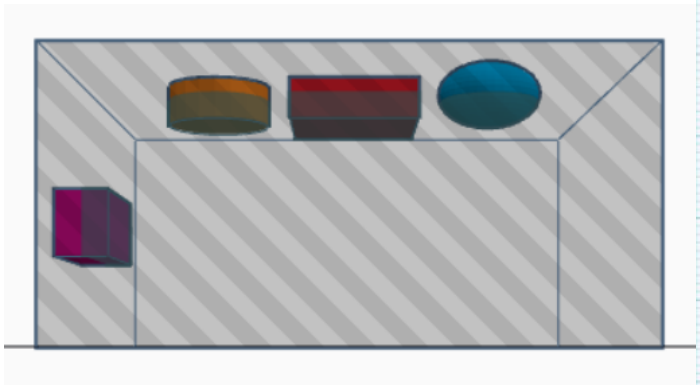
Components used in this circuit:

1. LCD Display.
2. Arduino Uno.
3. DC Motor.
4. Breadboard.
5. PIR Sensor.
6. Temperature Sensor.
7. Resistor.
8. Connecting Wires.
9. Diode.
10. NPN Transistor.

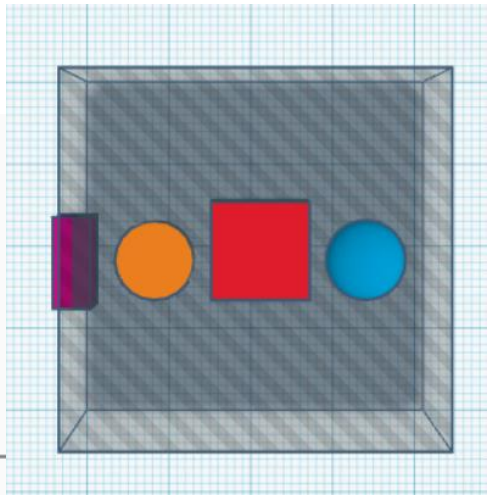
Working Logic:

This circuit is designed to detect humans and turn on the fans based on the temperature in the room. Here the PIR sensor detects the human presence inside the room and indicates that the fan must be turned on. The temperature sensor denotes the temperature in the room and sends appropriate signals to the DC motor which powers the fan. And the diodes and transistors are used in the circuit for proper current flow to DC Motor.

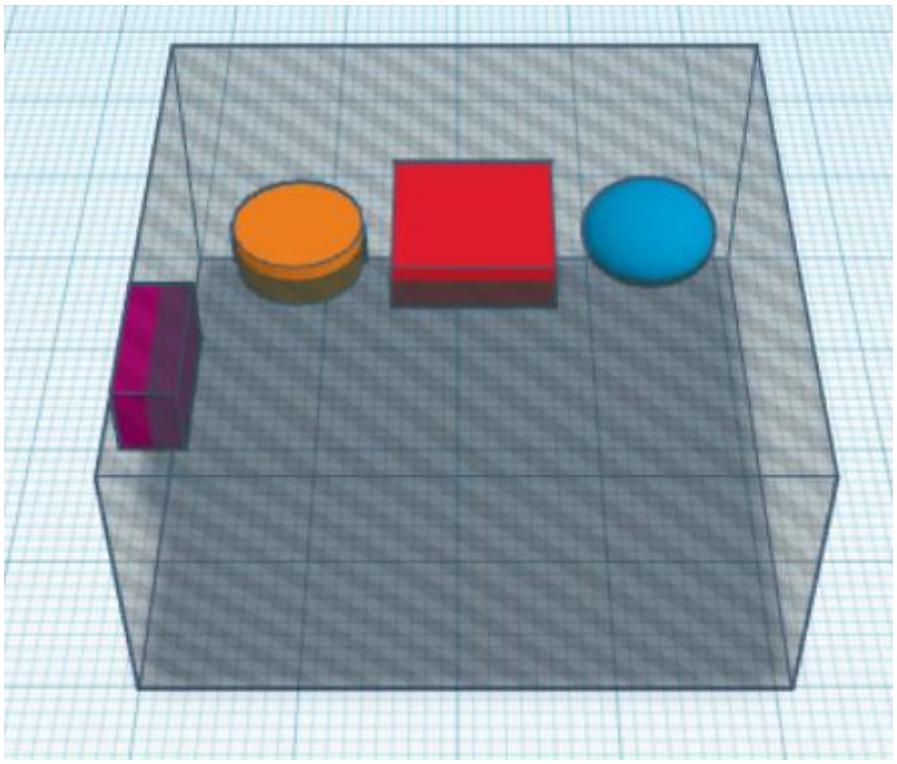
3D-DESIGN:



FRONT VIEW



TOP VIEW



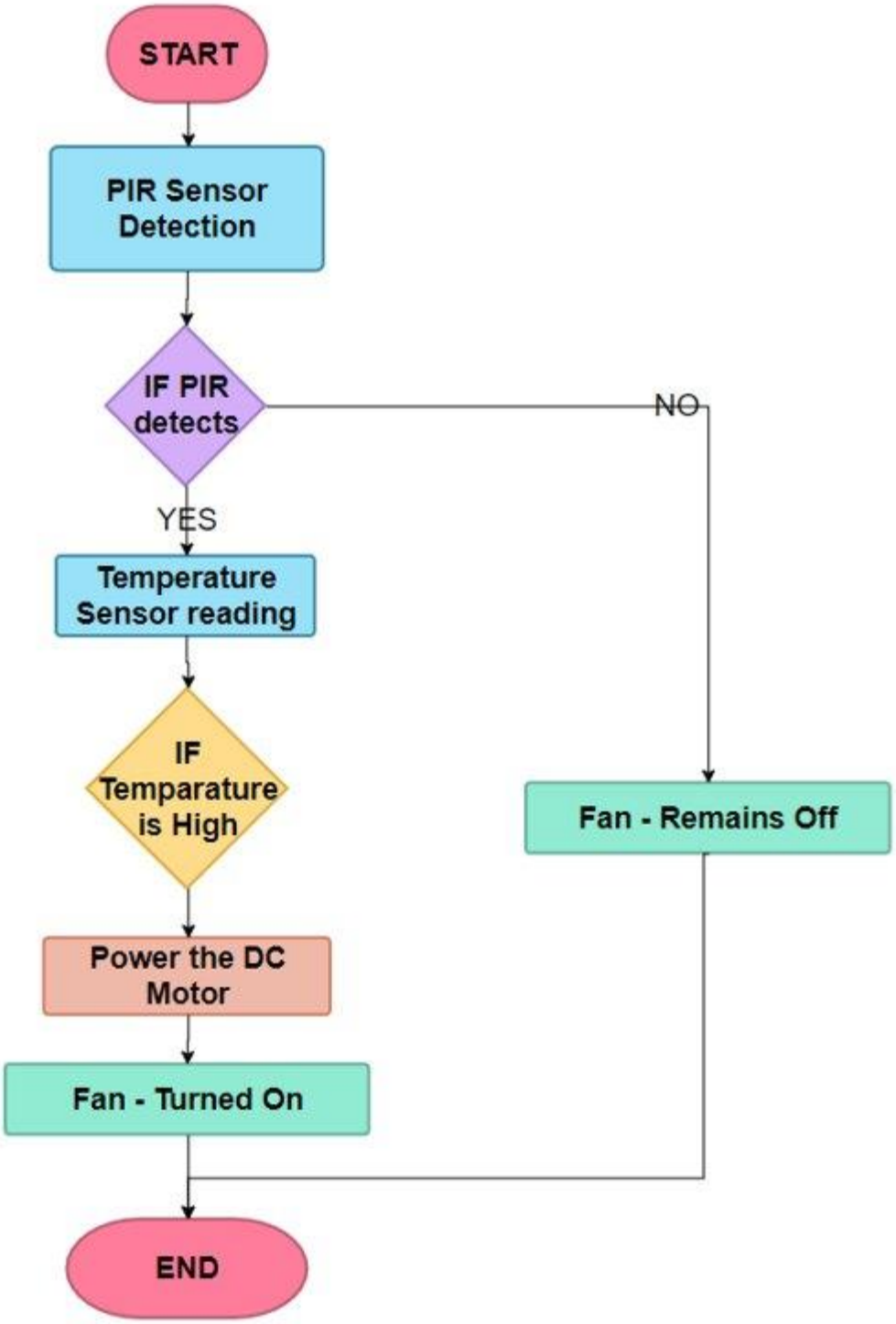
3D-DESIGN

The Red Box is a Fan. The Orange circle is a PIR sensor used to detect human presence. The Blue sphere is a Temperature sensor that detects the temperature and accordingly controls the fan. The Pink rectangular box is an LCD display that displays the room temperature.

Code:

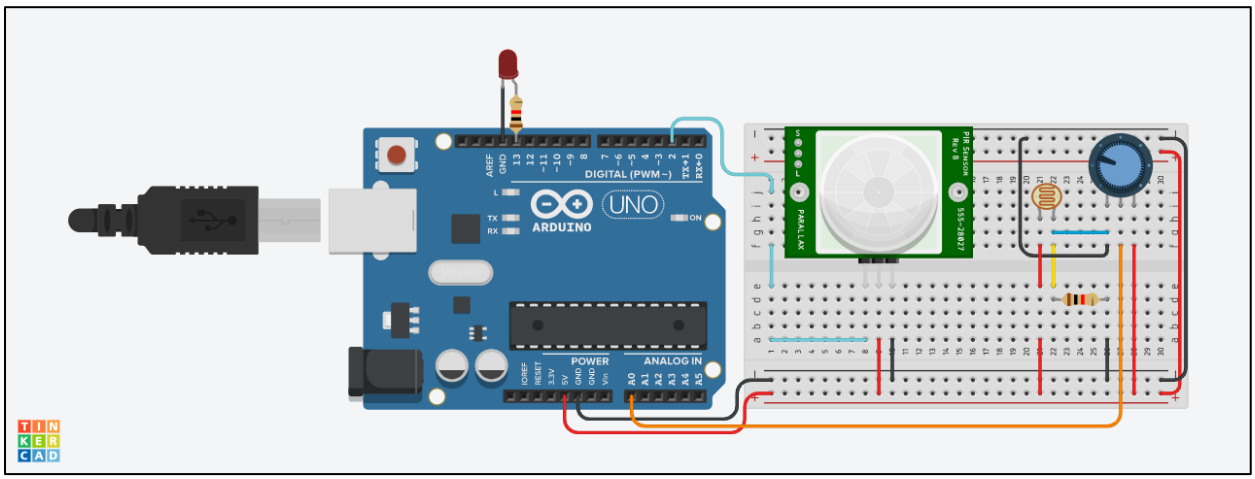
```
#include <LiquidCrystal.h>
int rs = 13;
int enable = 12;
int d4 = 11;
int d5 = 10;
int d6 = 9;
int d7 = 8;
LiquidCrystal lcd(rs, enable, d4, d5, d6, d7);

int celsius;
int PIR;

void setup()
{
  lcd.begin(16,2);
  pinMode(2,INPUT);//Setting pin mode of PIR Sensor
  pinMode(3,OUTPUT); //Setting pin mode of DC Motor
}

void loop()
{
  celsius = map(((analogRead(A0)-20)*3.04),0,1023,-40,125);
  lcd.home();
  lcd.print("Temperature(C):");
  lcd.setCursor(4,2);
  lcd.print(celsius);
  delay(1000);
  lcd.clear();

  PIR = digitalRead(2);
  if(PIR==HIGH && celsius > 27){
    //DC Motor should run - Fun is on
    digitalWrite(3,HIGH);
  }
  else{
    //DC Motor should not run - Fun is off
    digitalWrite(3,LOW);
  }
}
```

Algorithm:


START
PIR Sensor Detection
IF PIR detects
NO
YES
Temperature Sensor reading
IF Temparature is High
Fan - Remains Off
Power the DC Motor
Fan - Turned On
END

3.Automated Light System:

Circuit Design:



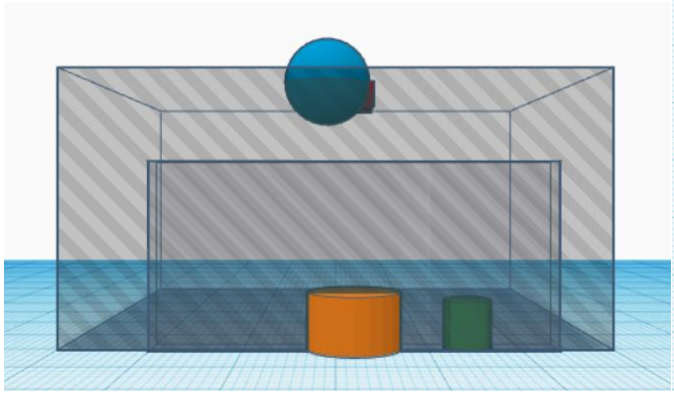
Components used in this circuit:

1. Arduino Uno.
2. LED.
3. Resistor.
4. Connecting wires.
5. PIR Sensor.
6. Photoresistor (LDR).
7. Breadboard.
8. Potentiometer

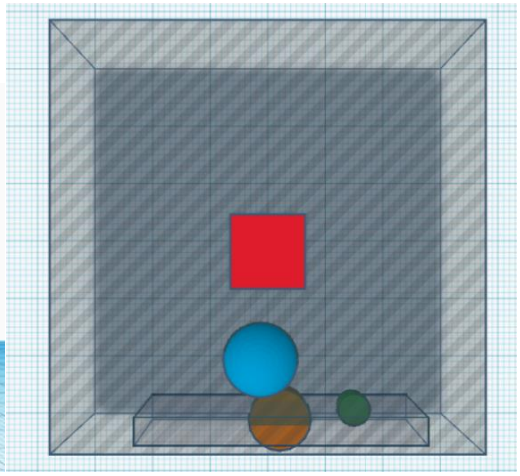
Working Logic:

This circuit is designed for automating the on and off of the lights inside the room. A PIR sensor is used to detect human presence inside the room. And if the human presence is detected the photoresistor detects what time of day it is based on the amount of sunlight captured. When the photoresistor indicates a night or around evening time and human presence is also indicated then the Light is turned on. The LDR tends to recognize a day time as night time when the humidity is high, to overcome this problem a potentiometer is included in this. The potentiometer adjusts the resistance in the circuit to overcome the problem of humidity. This extra addition also helps in generalizing the circuit for kinds of geographical conditions.

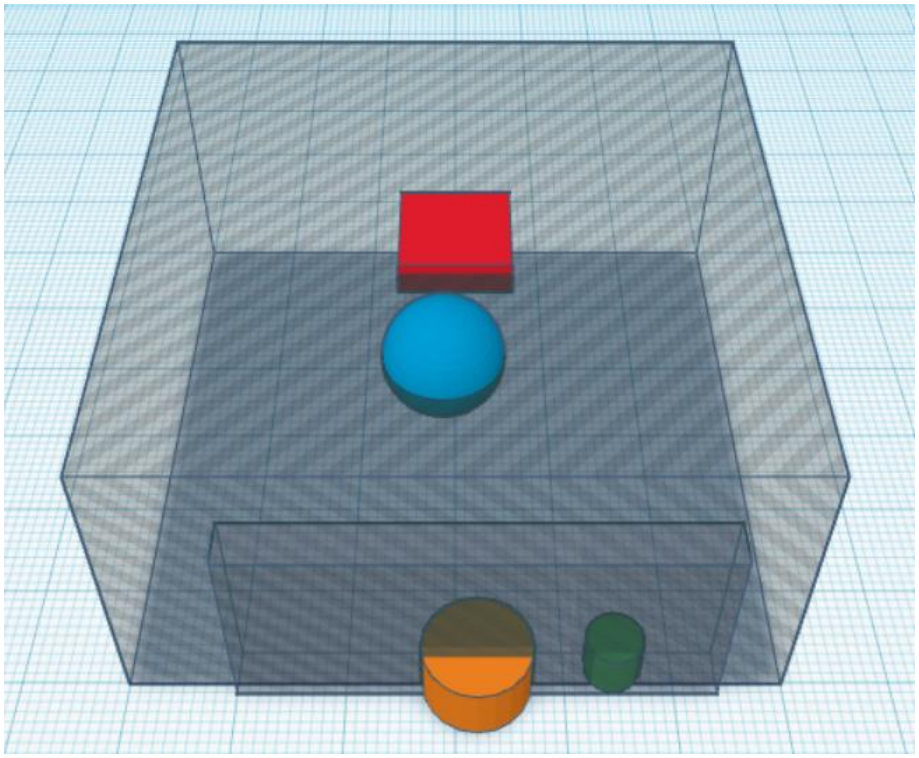
3D-DESIGN:



FRONT VIEW



TOP VIEW



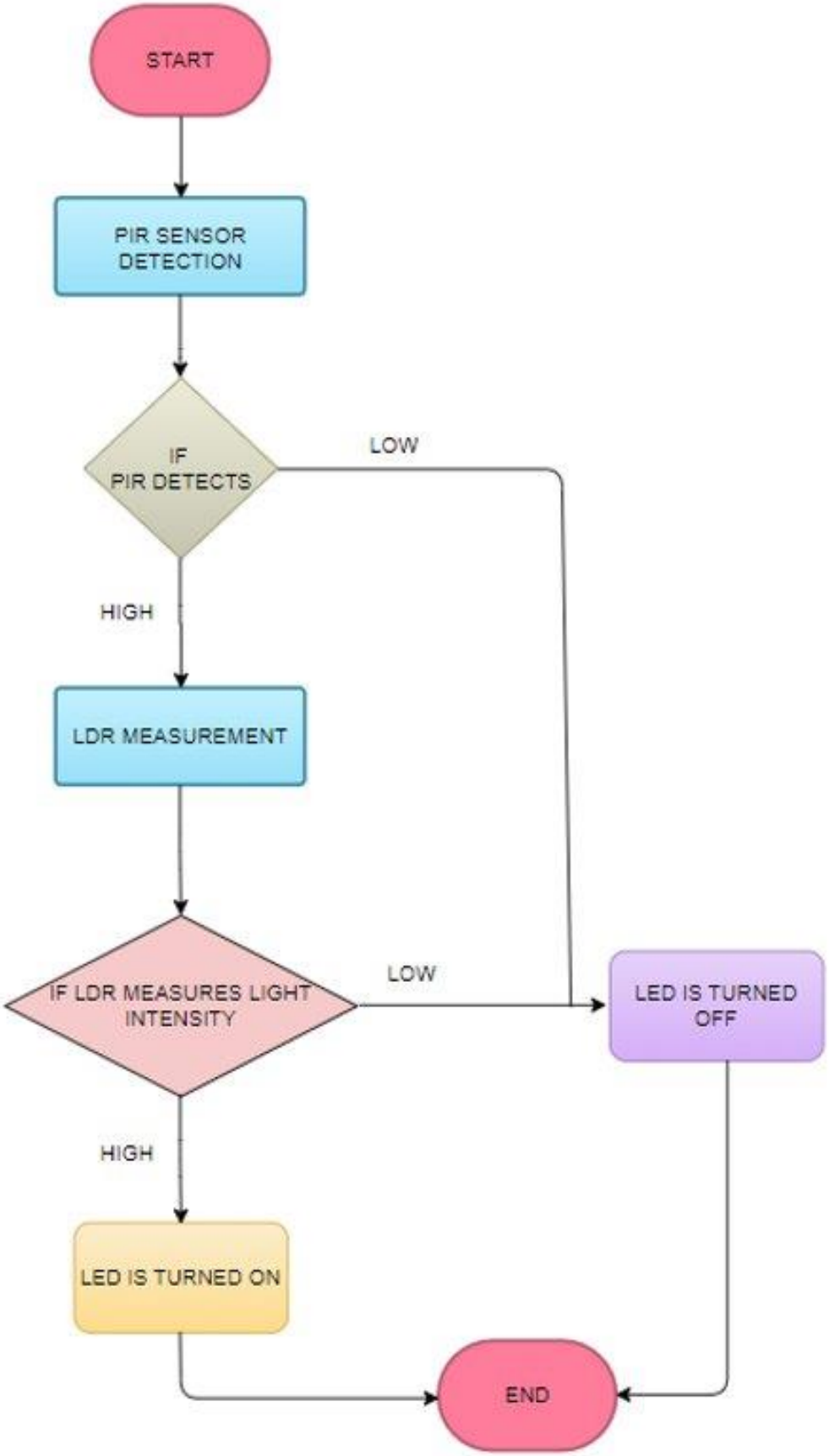
3D-DESIGN

The red box here represents an electrical light that is turned on when it's evening and if there is a human presence detected. The Blue sphere is a PIR sensor that is used to detect human presence. The Transparent small rectangular box represents a window. The Orange cylinder is a Photoresistor that detects the amount of sunlight. The Green Cylinder is a Potentiometer that allows us to overcome the problem of humidity.

Code:

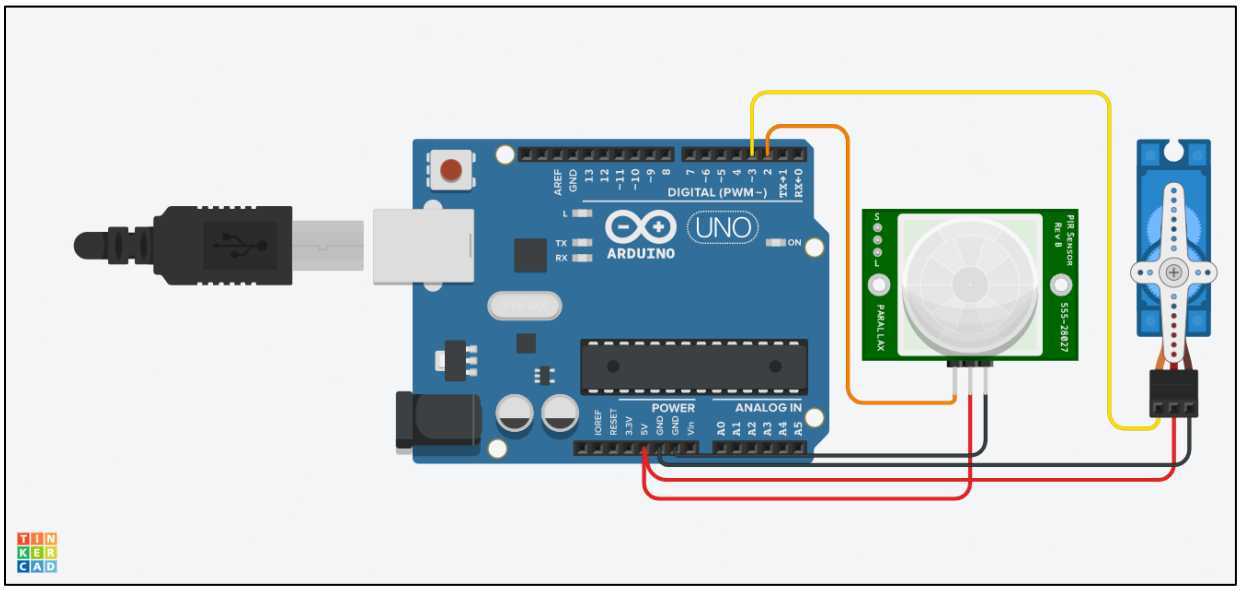
```
int val;
int a;

void setup()
{
  pinMode(13,OUTPUT); //Setting pin mode for led
  pinMode(2,INPUT); // Setting pin mode for PIR Sensor
}

void loop()
{
  val = analogRead(A0);
  a = digitalRead(2);
  if (val<500 && a==HIGH){ //If there is presence of human and
is evening or night
    digitalWrite(13,HIGH);
  }
  else{
    digitalWrite(13,LOW);
  }
}
```

Algorithm:


START
PIR SENSOR DETECTION
IF PIR DETECTS
LOW
HIGH
LDR MEASUREMENT
IF LDR MEASURES LIGHT INTENSITY
LOW
LED IS TURNED OFF
HIGH
LED IS TURNED ON
END

4.Automatic Door Opening System:

Circuit Diagram:



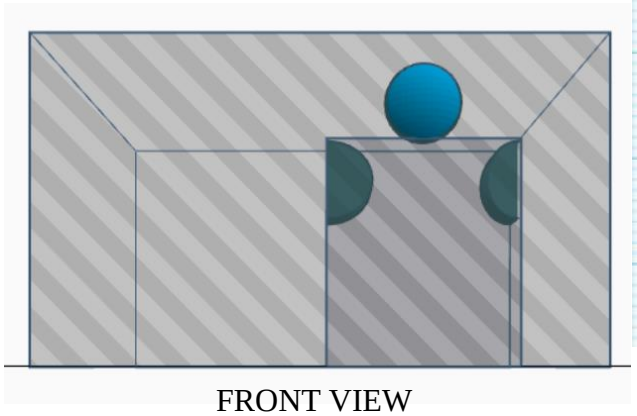
Components used in this circuit:

1. Servo Motor.
2. PIR Sensor.
3. Connecting Wires.
4. Arduino Uno.

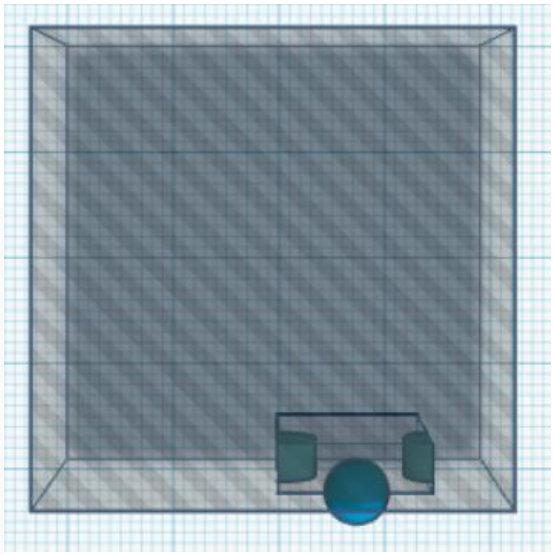
Working Logic:

A PIR sensor is attached to the Main door powered by a Servo motor for automating the door opening and closing. Here the PIR sensor is used to detect human motion near the door. If a human presence is detected the PIR sensor sends a signal indicating the servo motor to automate the door open and also the door is set to close automatically after 5 seconds the door opens giving enough time for a person to enter.

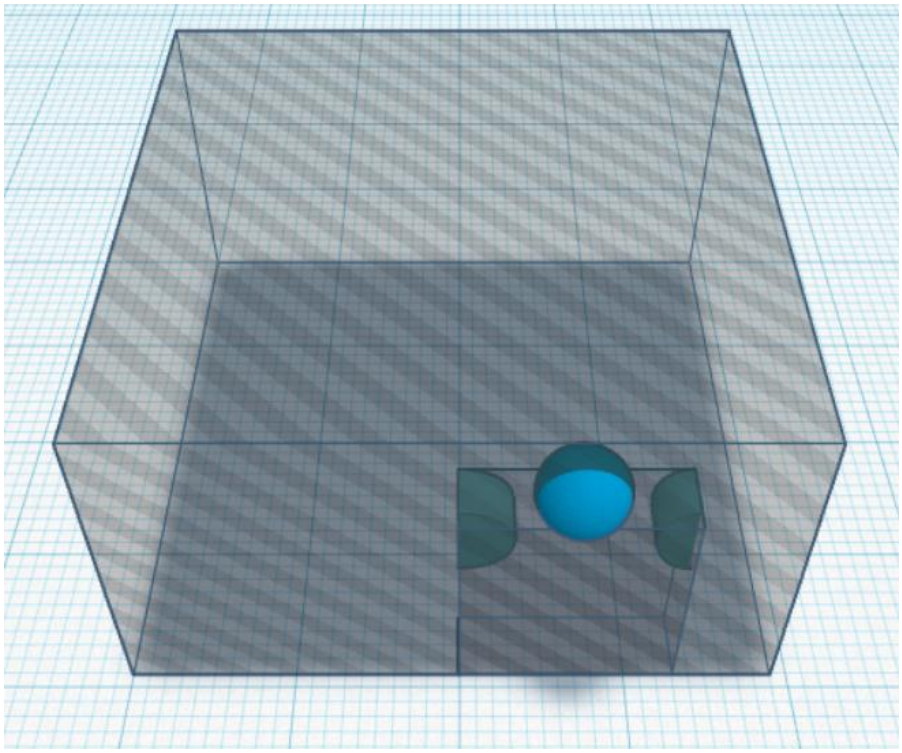
3D-CIRCUIT:



FRONT VIEW



TOP VIEW



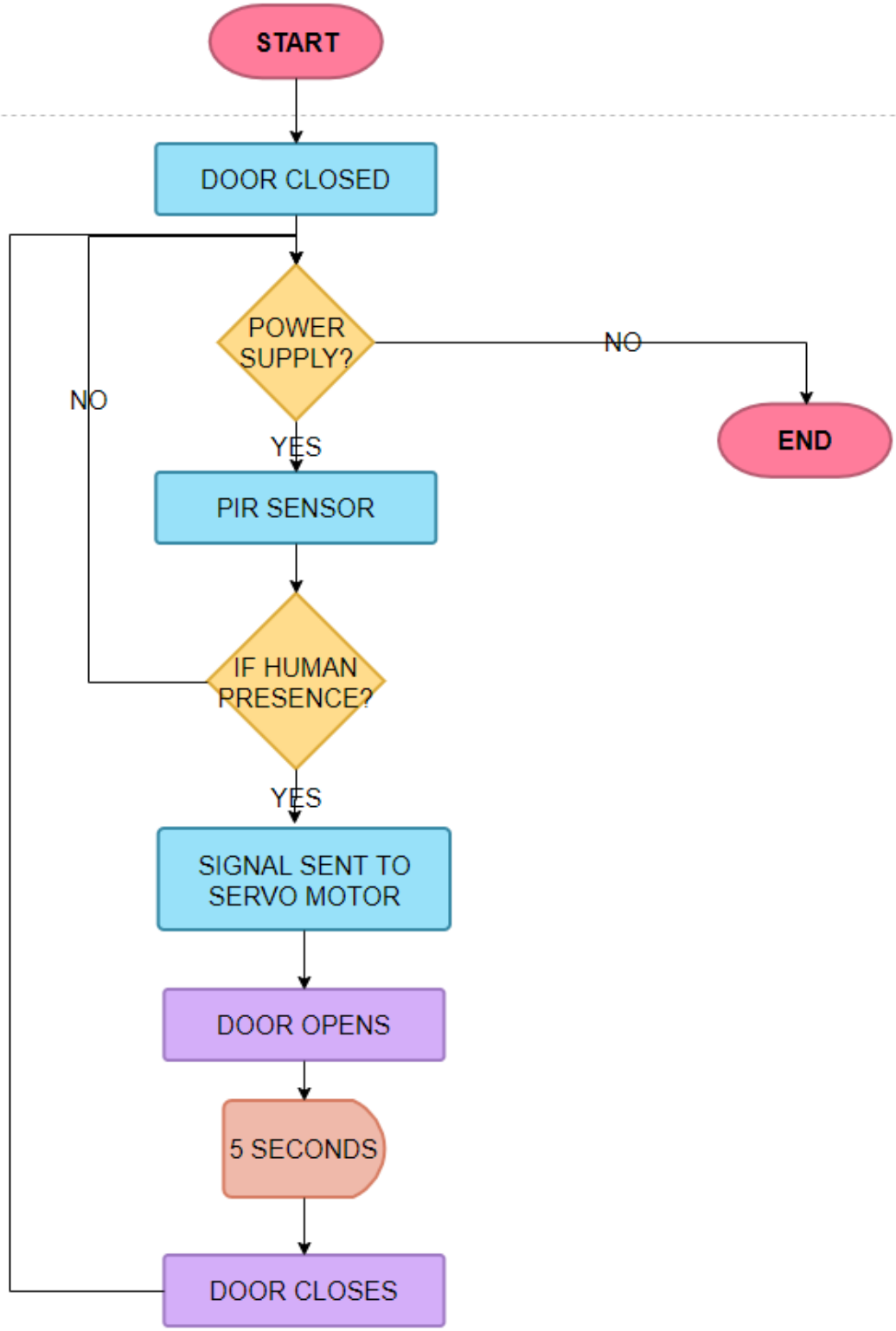
3D-VIEW

Here the Blue Sphere represents the PIR sensor which is used to detect humans nearby. The two-round roof shapes represent the Servo motor which is required to power the door automation. The transparent Small box which is attached with PIR and Servo motor is presumed to be the main door.

Code:

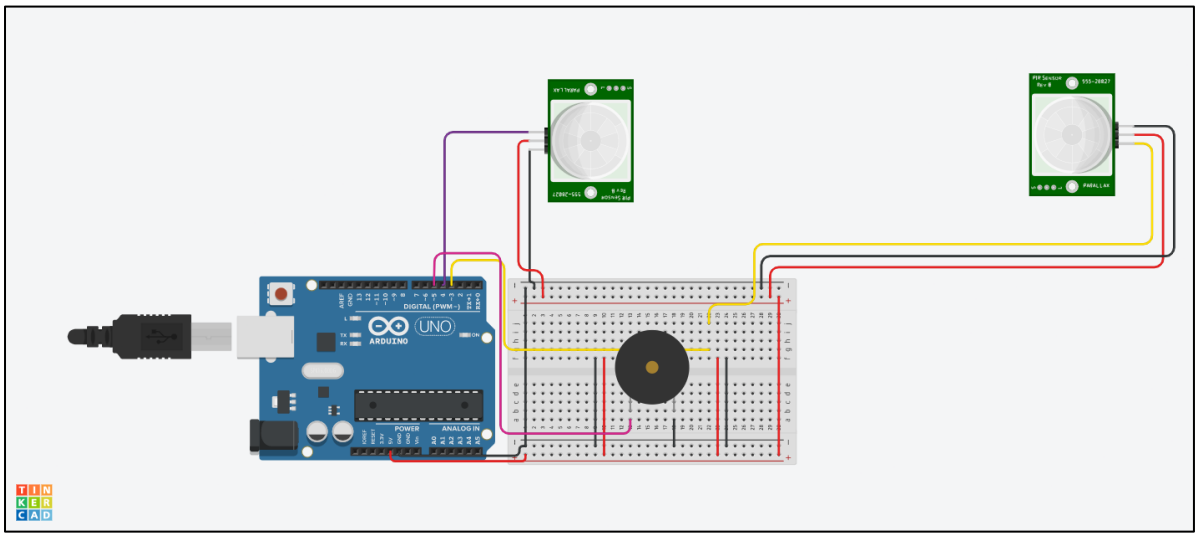
```
#include <Servo.h>
Servo motor;
int PIR;
int position = 0;
void setup()
{
  pinMode(2,INPUT); //Setting mode of PIR Sensor pin
  pinMode(3,OUTPUT);//Setting mode of servo-motor pin
  motor.attach(3);
  motor.write(position);
}

void loop()
{
  PIR = digitalRead(2);
  if(PIR==HIGH){ //If human stands in front of door, the door
opens automatically
    for (position = 0; position < 160; position += 1) {
    motor.write(position);
    delay(10);
    }
    delay(5000);
    for (position = 160; position > 0; position -= 1) {
    motor.write(position);
    delay(10);
    }
  }
  else{
    motor.write(position);
  }
}
```

Algorithm:


START
DOOR CLOSED
POWER SUPPLY?
NO
END
NO
YES
PIR SENSOR
IF HUMAN PRESENCE?
YES
SIGNAL SENT TO SERVO MOTOR
DOOR OPENS
5 SECONDS
DOOR CLOSES

5.Burglar Alarm Security System:

Circuit Design:



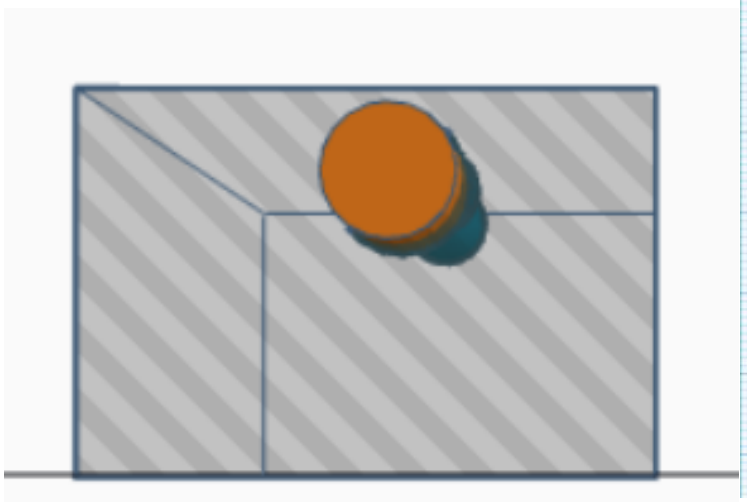
Components used in this circuit:

1. Arduino Uno.
2. PIR Sensor.
3. Piezo Buzzer.
4. Breadboard.
5. Connecting Wires.

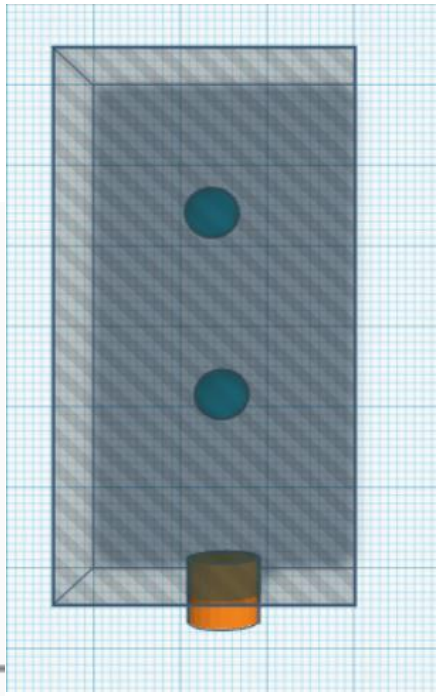
Working Logic:

Here the PIR Sensor is used to detect any attempt to break in and trigger the alarm. A short-range and a long-range sensing is used for an efficient alarm system. This alarm is turned only if it's activated. So first the long-range alarm is triggered when there is any detection of humans in proximity alerting the staff by producing a noise. As the person tends to move forward the other sensor too is triggered hence producing a high-frequency noise which is to indicate that the burglar might be close to breaking the locker door open.

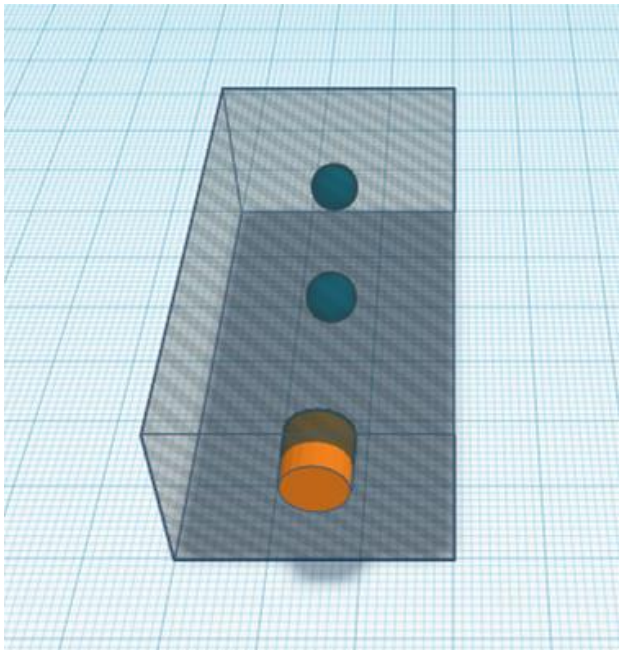
3D-DESIGN:



FRONT VIEW



TOP VIEW



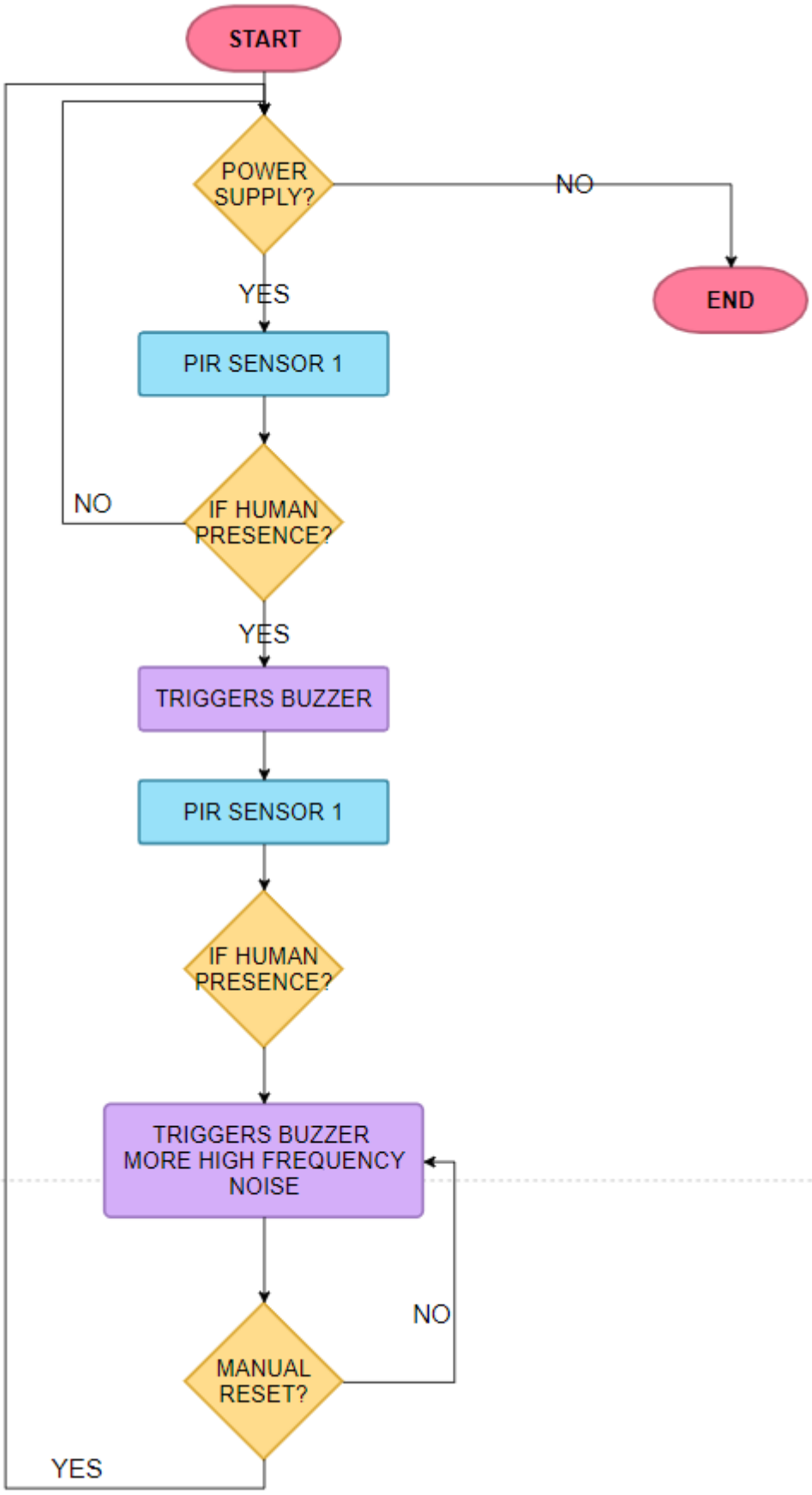
3D-VIEW

The Blue Spheres here represent the PIR sensor that detects the human at two various points. And the Orange cylinder is used to represent a buzzer which is triggered based on the PIR sensor.

Code:

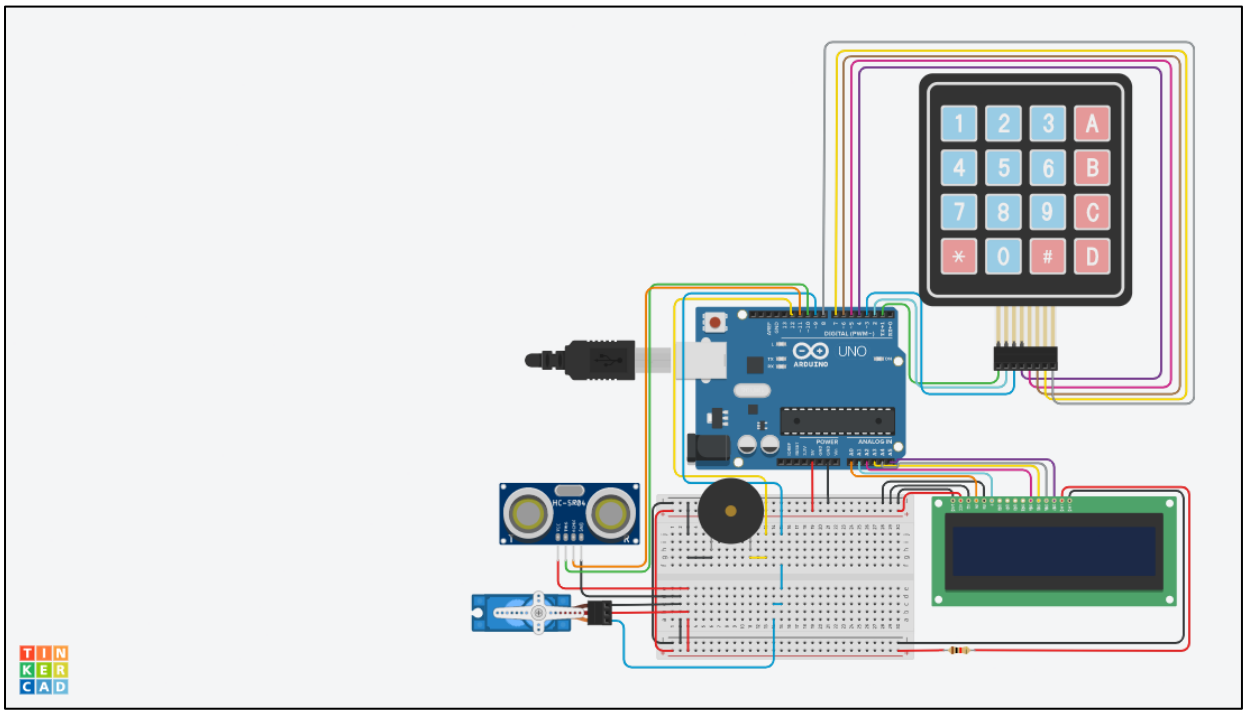
```
int a;
int b;

void setup()
{
  pinMode(4,INPUT); //Setting mode of PIR Sensor pin
  pinMode(3,INPUT); //Setting mode of PIR Sensor pin
  pinMode(5,OUTPUT);//Setting mode of Buzzer
}

void loop()
{
  a = digitalRead(4);
  b = digitalRead(3);
  if(a==HIGH && b==HIGH){
    tone(5,1000,100000);//When the burglar is caught in both
sensors, high frequency sound is emitted
  }
  else if(a==HIGH || b==HIGH){
    tone(5,500,100000);//When the burglar is caught in any one
of the sensors, moderate frequency sound is emitted
  }
  else{
    noTone(5); //When the burglar is not caught in any of the
sensors, no sound is emitted
  }
}
```

Algorithm:


START
POWER SUPPLY?
NO
END
YES
PIR SENSOR 1
NO
IF HUMAN PRESENCE?
YES
TRIGGERS BUZZER
PIR SENSOR 1
IF HUMAN PRESENCE?
TRIGGERS BUZZER MORE HIGH FREQUENCY NOISE
NO
MANUAL RESET?
YES

6.Door Lock Using Password:

Circuit Design:



Components used in this circuit:

1. Arduino Uno.
2. Ultrasonic distance sensor.
3. Piezo Buzzer.
4. LCD Display.
5. Servo Motor.
6. Bread Board.
7. Keypad.
8. Connecting wires.

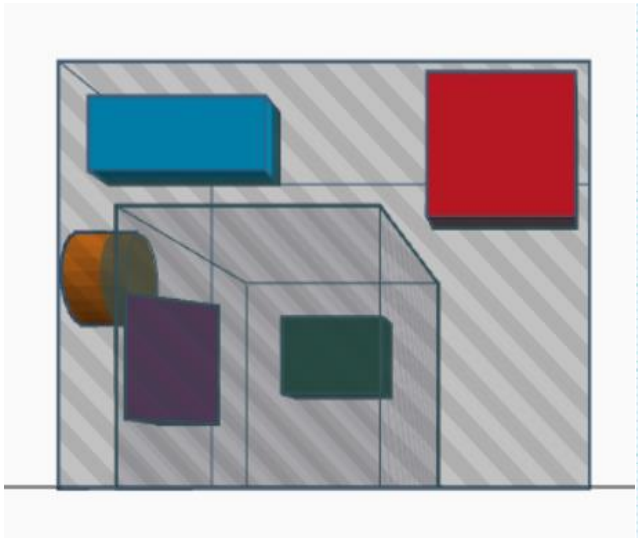
Working Logic:

The Door Lock system here is used as a security system to safeguard all the important documents and money kept inside a Locker. This Locker also contains a Password Lock. The Keypad attached serves as an input (i.e., password) to verify the Password. If the password is correct it is indicated on the LCD and opens the door for about 2 minutes. And if the Password is wrong the LCD

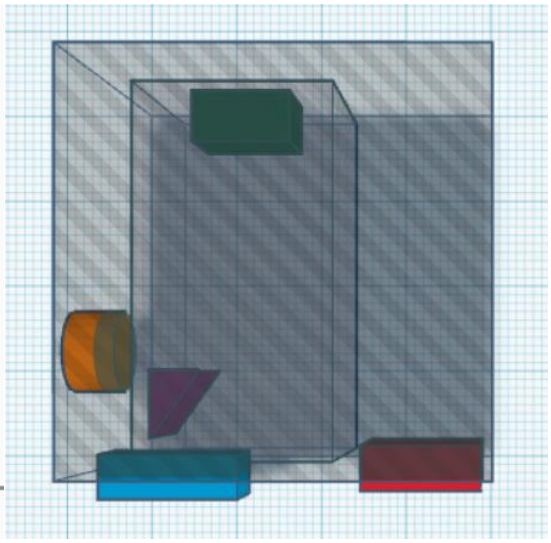
displays “Access Denied” and doesn't open the door. The servo motor helps in powering the automation of the door.

To further prevent Burglar an Ultrasonic sensor is placed at the opposite side of the Cupboard and is set to always measure the distance from the door. So, when the distance of the door changes it is set to trigger the alarm alerting the people nearby. But here there is a chance of triggering the sensor when a legit person opens the door with a password since there is a chance in the distance when the door is open. To avoid this, we allow a time gap, so when the password is entered and verified, there is a time gap of 2 mins for which the buzzer is turned off. After the time gap, the Ultrasonic sensor is turned on and starts monitoring the distance.

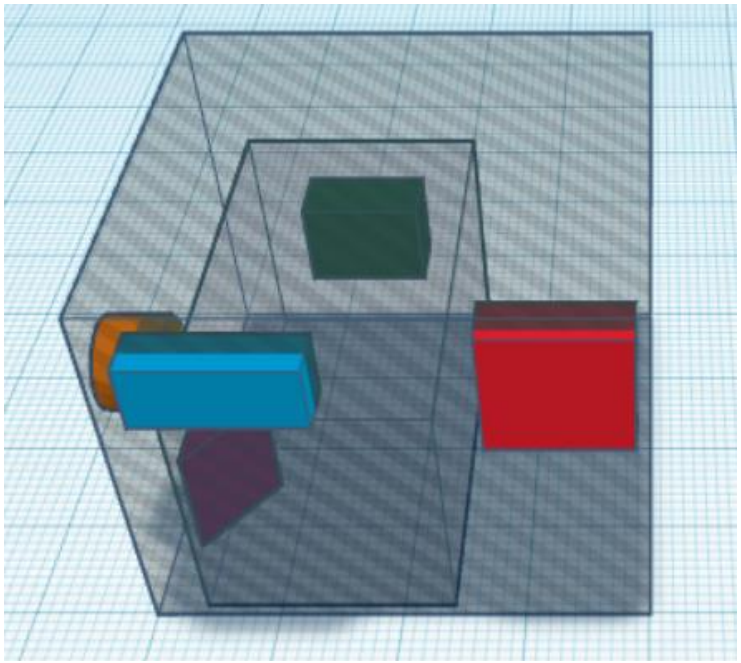
3D-DESIGN:



FRONT VIEW



TOP VIEW



3D-
DESIGN

The smaller transparent box is a Safe in which the documents or money is supposed to be kept.
The Red coloured cuboid is a Keypad in which the password is taken as the input.
The Blue coloured cuboid is a display that is used to display whether the password entered is correct or not.
The Green coloured cube is an Ultrasonic sensor that constantly monitors the distance from the door and triggers the buzzer if the distance changes.
The Orange coloured cylinder is a Buzzer that is triggered if it detects a door breakage.
The Violet coloured cuboid is a Servo motor that powers the door to automate the opening.

Code:

```
#include <Keypad.h>
#include <LiquidCrystal.h>
#include <Servo.h>

unsigned long distance;
unsigned int duration;

int rs = A0;
int enable = A1;
```

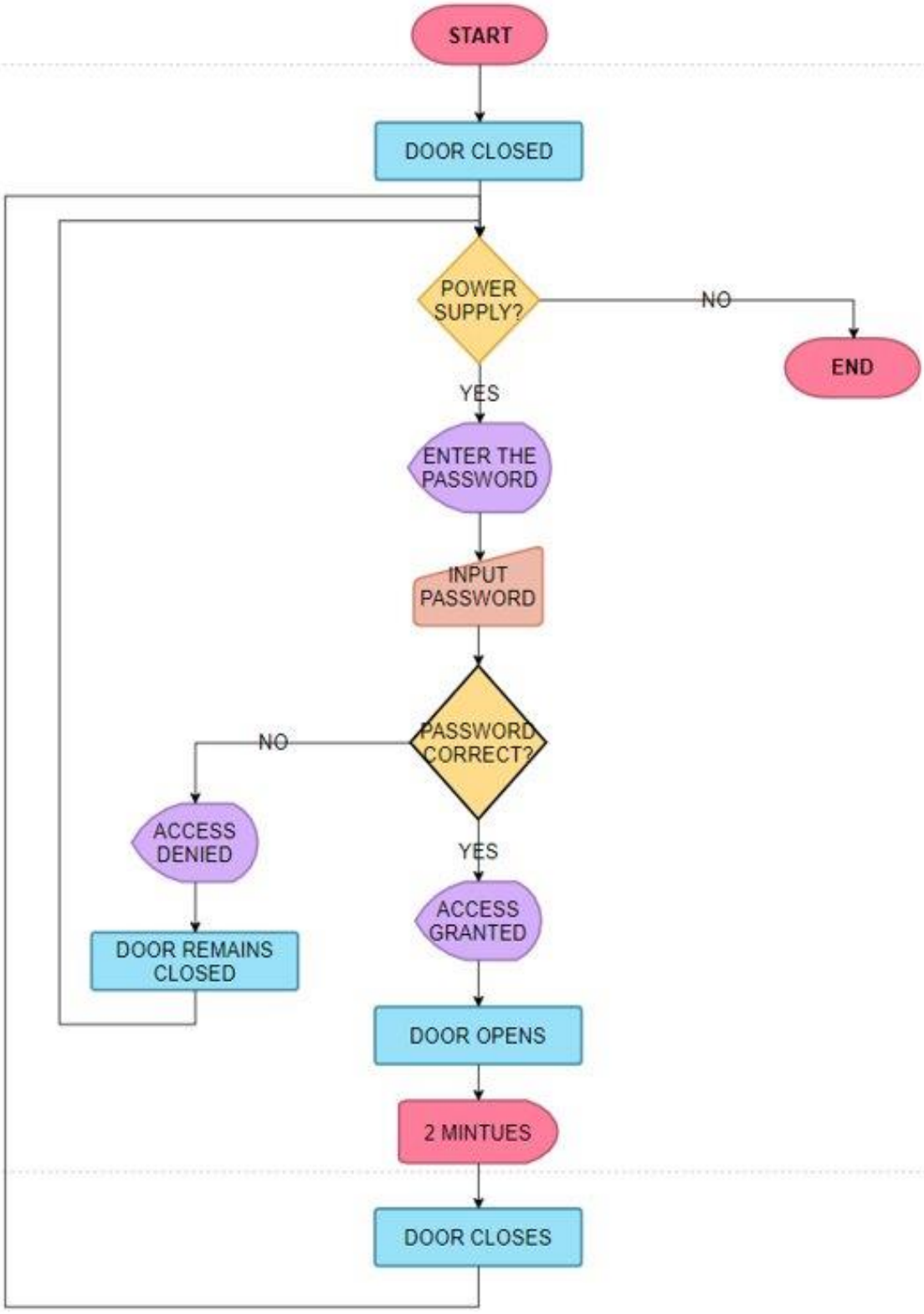
```
int d4 = A2;
int d5 = A3;
int d6 = A4;
int d7 = A5;
LiquidCrystal lcd(rs, enable, d4, d5, d6, d7);

const int num_of_rows = 4;
const int num_of_columns = 4;

char keys[num_of_rows][num_of_columns] = {
  {'1','2','3','A'},
  {'4','5','6','B'},
  {'7','8','9','C'},
  {'*','0','#','D'}
};
byte row_pins[num_of_rows] = {1,2,3,4};
byte column_pins[num_of_columns] = {5,6,7,8};
Keypad                          keypad                          =
Keypad(makeKeymap(keys),row_pins,column_pins,num_of_rows,num_o
f_columns);

const String password = "7654";
String input_password;

Servo motor;
int position = 0;

void setup(){
  lcd.begin(16,2);

  lcd.setCursor(2,1);
  lcd.print("Welcome!");
  delay(1500);
  lcd.clear();
  lcd.home();
  lcd.print("Password: ");
  lcd.setCursor(2,1);
  input_password.reserve(6); //Maximum input characters is 6

  motor.attach(9); // Servo motor attached to 9th pin of arduino
  motor.write(position); //initial angle - Here zero degree
means closed door
```

```
  pinMode(12,OUTPUT); //Setting the pin of buzzer as output
pin

  pinMode(10,OUTPUT); //Setting trig pin as output
  pinMode(11,INPUT);  //Setting echo pin as input
}

void loop(){

  // Generating pulse from trig pin of ultrasonic sensor
  digitalWrite(10,LOW);
  delayMicroseconds(2);
  digitalWrite(10,HIGH);
  delayMicroseconds(10);
  digitalWrite(10,LOW);

  duration = pulseIn(11,HIGH);
  distance = duration*0.017; // ((340*100)/10e6)/2

  if (distance > 50 ){ // If distance is greater than 50, it is
meant that door is broken
    tone(12,1000,100000);
  }
  else{
    noTone(12);
  }

  // Password System
 char key = keypad.getKey();

 if(key){
  lcd.print(".");

  if(key=='*'){
    input_password = "";//Clearing the password given as input
by the user
  }
  else if(key=='#'){
    if(password == input_password){
      lcd.clear();
      lcd.home();
      lcd.print("Correct Password!");
      lcd.setCursor(1,2);
      lcd.print("Access Granted!");
```

```
    delay(100);

     // Work of servo motor
   for (position = 0; position < 160; position += 1) {
    motor.write(position);
    delay(10);
    }

    lcd.clear();
    lcd.home();
    lcd.print("5 SEC TIME TO ");
    lcd.setCursor(8,2);
    lcd.print("ENTER!");
    delay(5000);

    for (position = 160; position > 0; position -= 1) {
    motor.write(position);
    delay(10);
    }
    lcd.clear();
    lcd.home();
    lcd.print("Door Locked!");
    delay(2000);
    lcd.clear();
    lcd.home();
    lcd.print("Welcome!");
    }
    else{
      lcd.clear();
      lcd.home();
      lcd.print("Incorrect");
      lcd.setCursor(3,2);
      lcd.print("Password!");
      // Work of buzzer
      tone(12,1000,100000); //Buzzer buzzes
      delay(100000);
    }
    input_password = ""; //Clearing the input_password
  }
  else{
    input_password+=key;  //Append  next  new  character  to  the
password string
  }
 }
```

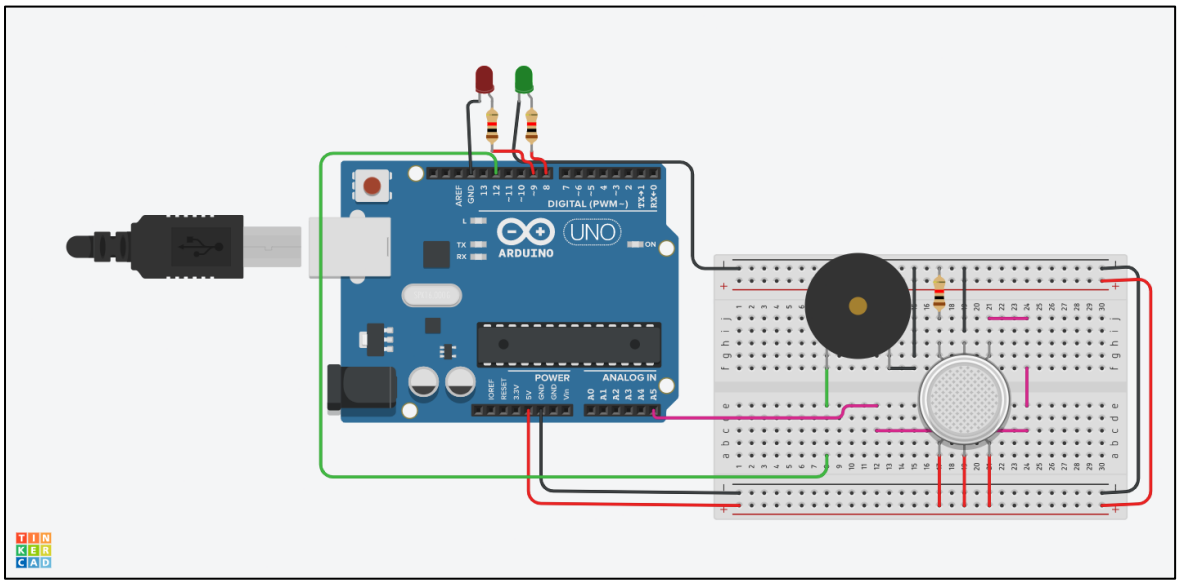
}

Algorithm:


START
DOOR CLOSED
POWER SUPPLY?
NO
END
YES
ENTER THE PASSWORD
INPUT PASSWORD
PASSWORD CORRECT?
NO
ACCESS DENIED
DOOR REMAINS CLOSED
YES
ACCESS GRANTED
DOOR OPENS
2 MINTUES
DOOR CLOSES

7. Gas and Smoke Detection System

Circuit Design:



Components used in this circuit:

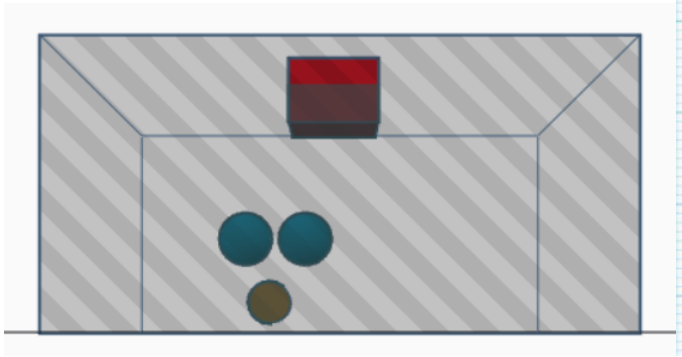
1. Arduino Uno.
2. Resistor.
3. LED.
4. Piezo buzzer.
5. Gas sensor.
6. Breadboard.
7. Connecting Wires.

Working Logic:

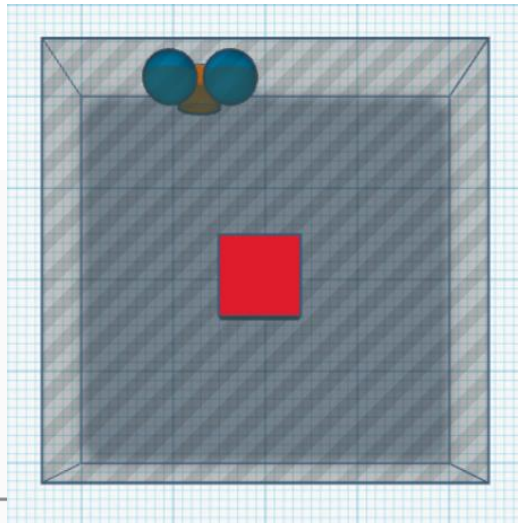
Generally, in a workspace, there is a lot of wiring done for the electronic gadgets. So, there is a chance for a short circuit which may cause a huge power failure eventually destroying all the gadgets. This circuit helps us in detecting the short circuit through smoke detection. So, when smoke is detected it triggers the Piezo buzzer. A LED is also attached to the circuit to indicate and alert if there is any short-circuiting. The LED emits green when there is no short-circuiting detected and emits red when there is a short-circuiting. The resistor is used to limit the current through the LED and to prevent excess current that can burn out the LED.

The Arduino here is used to take input and output from these sensors and perform some operation(calculation) on it.

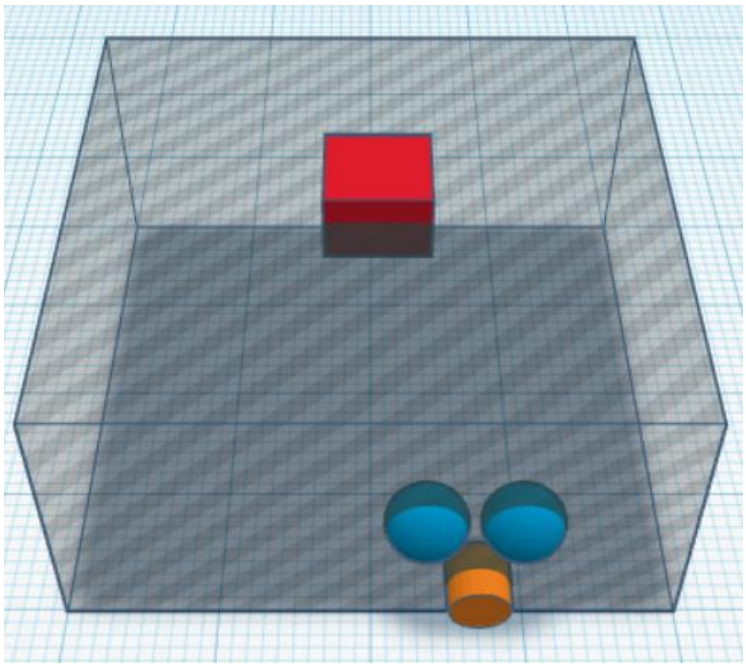
3D-CIRCUIT:



FRONT VIEW



TOP VIEW



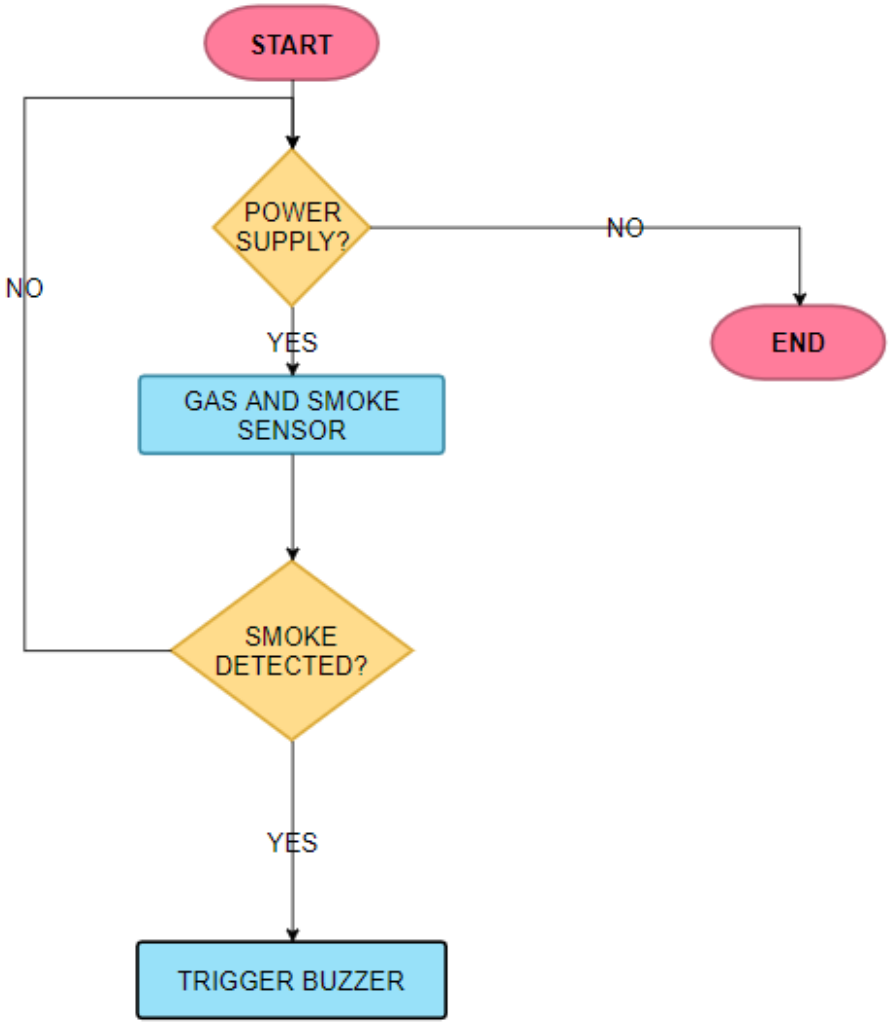
3D-
CIRCUIT

The Red cube represents a Smoke Sensor that detects the smoke presence during short-circuit. The Blue Spheres are LED lights that indicate the smoke presence. The Orange cylinder is a buzzer that is triggered when smoke is detected.

Code:

```
int threshold_volt = 250;
int gas_sensor_val;

void setup(){
  Serial.begin(9600);
  pinMode(A5,INPUT); //Setting mode of the pin of the gas sensor
  pinMode(12,OUTPUT);//Setting mode of the pin of the buzzer
  pinMode(9,OUTPUT); //Setting mode of the pin of led_red
  pinMode(8,OUTPUT); //Setting mode of the pin of led_green
}
void loop(){
  gas_sensor_val = analogRead(A5);
  Serial.println(gas_sensor_val);
  if(gas_sensor_val > threshold_volt){
    Serial.println("GAS LEAKAGE!");
    digitalWrite(9,HIGH);
    digitalWrite(8,LOW);
    //digitalWrite(12,HIGH);
    tone(12,1000,200);
  }
  else{
    digitalWrite(8,HIGH);
    digitalWrite(9,LOW);
    digitalWrite(12,LOW);
  }
  delay(100);
}
```

Algorithm:



Measurement System Error:

The Measurement error system is defined as the difference between the calculated value (Output) and the actual value (Input).

E - Measurement System Error.
IN - Input to the sensor or measurand.
OUT - Output of the sensor or calculated value.

Equation:
E = OUT-IN.

Error percentage:

The error percentage can be calculated by using this formula,
EP - Error percentage.
MV - Measured Value.
EV - Exact Value.

EQUATION:
EP = ((MV - EV)/EV) * 100.

Here, both the input values and output values are noted. Then these values are calculated using the Equation.

CODE FOR EQUATION: (in JAVA)

```
package sample;
import java.util.Scanner;

public class PMS_project {

     int AV[] = new int[15];//AV is actual value.
     int OV[] = new int[15];//OV is observed value.
     int E,EP,IN,OUT;//E is error, EP is error percentage, IN
is input values given to the system, OUT is output values from
the system.



     public void AV_input() {
          Scanner AV_inputv = new Scanner(System.in);
          for(int i=0;i<15;i++) {
               AV[i]=AV_inputv.nextInt();
          }
     }

     public void OV_input() {
          Scanner OV_inputv = new Scanner(System.in);
          for(int i=0;i<15;i++) {
               OV[i]=OV_inputv.nextInt();
```

```
        }
    }

    public void error_percentage(int av[],int ov[]){
        int mean,acc;
        int dup=0;
        int value[] = new int[15];
        for(int i=0;i<15;i++)
            value[i]=(av[i]-ov[i])/ov[i]*100;
            dup=dup+value[i];

        mean=dup/15;

        System.out.println("The error percentage is: "+
                                                        mean);

    }

    public void error(double in,double out) {
         double e;
         e= out -in;
         System.out.println(e);

    }

    public static void main(String[] args) {
         // TODO Auto-generated method stub

         PMS_project obj = new PMS_project();


         System.out.println("enter your Actual values");
         obj.AV_input();
         System.out.println("enter your Observed values");
         obj.OV_input();
         obj.error_percentage(obj.AV,obj.OV);
         System.out.println("The error value is:");
         obj.error(10,9.5);
         obj.error_percentage(obj.AV,obj.OV);
    }

}
```

CONCLUSION:

This project has been designed to initiate workspaces of starter offices to get automated efficiently. Workspace automation gives the connection between all the functional elements. It helps in great power saving and energy efficiency. Every successful company invests a fortune in creating an environment where the employees feel inspired and motivated to work. The smart automation technology delivers a truly connected experience for the employees and clients and gives a high-tech workspace experience. It gives an unparalleled competitive edge. Workspace automation offers a unique platform to start-ups and upcoming businesses to build a truly smart workplace that impresses visitors, reduces anomalies, and optimizes operational costs.

In the future, this project can be extended to the next level, where all the applications done here can be extended, so that they can be accessed from a smartphone. This gives employees a nice work pleasure.