Assignment no.1

AIM:

Design and implement IoT system using Arduino Uno/ Raspberry Pi using 'Ultrasonic sensor and Servo motor' such as 'Door opener in home automation'.

Theory:

In order to develop Door opener in home automation system we must require following hardware module.

Hardware:

1. **Ultrasonic sensor (HC-SR04).**
2. **Arduino uno Microcontroller board.**
3. **Servo motor.**
4. **LED**
5. **Buzzer**
6. **Jumper wires.**
7. **BreadBoard**

Ultrasonic Sensor HC-SR04:

- Ultrasonic sensors work by emitting sound waves at a frequency too high for humans to hear. They then wait for the sound to be reflected back, calculating distance based on the time required. This is similar to how radar measures the time it takes a radio wave to return after hitting an object.
- While some sensors use a separate sound emitter and receiver, it's also possible to combine these into one package device, having an ultrasonic element alternate between emitting and receiving signals. This type of sensor can be manufactured in a smaller package than with separate elements, which is convenient for applications where size is at a premium.
- While radar and ultrasonic sensors can be used for some of the same purposes, sound based sensors are readily available they can be had for just a couple dollars in some cases and in certain situations, they may detect objects more effectively than radar.
- For instance, while radar, or even light-based sensors, has a difficult time correctly processing clear plastic, ultrasonic sensors have no problem with this. In fact, they're unaffected by the color of the material they are sensing.
- On the other hand, if an object is made out of a material that absorbs sound or is shaped in such a way that it reflects the sound waves away from the receiver, readings will be unreliable.

- If you need to measure the specific distance from your sensor, this can be calculated based on this formula:
  Distance = ½ T x C
  (T = Time and C = the speed of sound)
  At 20°C (68°F), the speed of sound is 343 meters/second (1125 feet/second), but this varies depending on temperature and humidity.
- Specially adapted ultrasonic sensors can also be used underwater. The speed of sound, however, is 4.3 times as fast in water as in air, so this calculation must be adjusted significantly.

Servo Motor:

- A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft.
- The motor is paired with some type of position encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.
- The very simplest servomotors use position-only sensing via a potentiometer and bang-bang control of their motor; the motor always rotates at full speed (or is stopped). This type of servomotor is not widely used in industrial motion control, but it forms the basis of the simple and cheap servos used for radio-controlled models.

Arduino UNO Microcontroller Board

- The Arduino Uno is a popular microcontroller board based on the ATmega328P microcontroller. It has digital input/output pins, analog input pins, a USB connection for programming, and a power jack. Arduino Uno is widely used for various electronic projects and prototyping due to its simplicity and versatility.

LED

- An LED is a semiconductor light source that emits light when current flows through it. LEDs are widely used for indicating the status of electronic devices, creating visual feedback, and adding illumination in various applications.

Buzzer

- A buzzer is an electronic component that produces sound when an electric current is passed through it. It is commonly used for audio signaling, alarms, and notifications in electronic projects.

Jumper Wires

- Jumper wires are essential components in electronics prototyping. They are used to create electrical connections between various components on a breadboard or a circuit board. Jumper wires come in different lengths and colors, allowing easy and organized wiring of electronic circuits.

While implementation of IoT based door opener system we need to perform following steps:

Step 1: Connect BreadBoard with Arduino Uno Board

- **Connect VCC (5V) Pin -** Take a jumper wire and connect one end to the Arduino's VCC pin. Insert the other end of the jumper wire into the positive power rail of the breadboard.
- **Connect GND (Ground) Pin -** Take another jumper wire and connect one end to the Arduino's GND pin. Insert the other end of the jumper wire into the ground (GND) rail of the breadboard, which is usually located right next to the positive power rail.

Step 2: Connect Ultrasonic sensor with Arduino Uno Board:

- Connect Echo pin of Ultrasonic sensor to GPIO pin 6 of ArduinoUno.
- Connect Trig pin of Ultrasonic sensor to GPIO pin 11 of ArduinoUno.
- Connect VCC pin of Ultrasonic sensor to positive power rail on the breadboard.
- Connect GND pin of Ultrasonic sensor to ground (GND) rail on the breadboard.

Step 3: Connect Servo Motor with Arduino UNO Board:

- Connect data pin of Servo Motor to GPIO pin 8 of ArduinoUno.
- Connect VCC pin of Servo Motor to positive power rail on the breadboard.
- Connect GND pin of Servo Motor to ground (GND) rail on the breadboard.

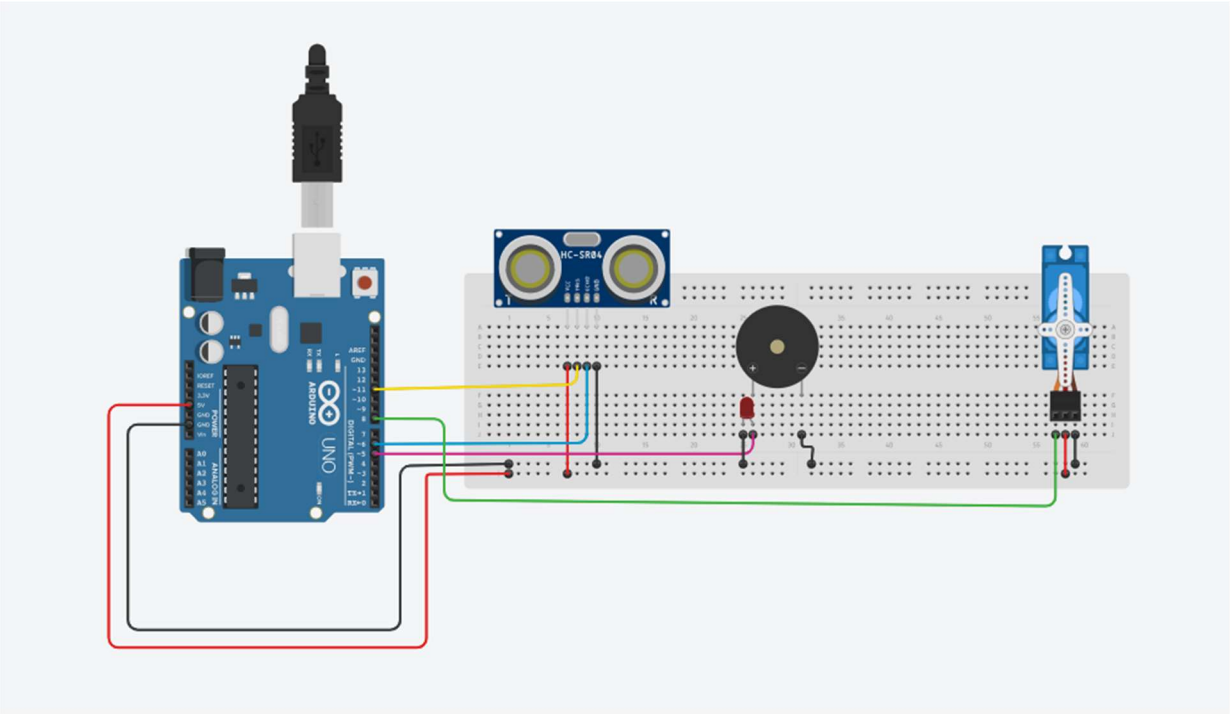
Step 4: Connect Buzzer and LED with Arduino UNO Borad:

- Connect Anode Pin of LED to GPIO pin 5 of ArduinoUno
- Connect Positive Terminal of Buzzer to GPIO pin 5 of ArduinoUno
- Connect Cathode Pin of LED to ground (GND) rail on the breadboard.
- Connect Negative Terminal of Buzzer to ground (GND) rail on the breadboard.

Step 5: Install and Open Arduino IDE software platform on your computer.
Step 6: Connect Arduino Uno with the computer by using Arduino data cable.
Step 7: Select Board as Arduino Unor3 from Board manager on Arduino IDE.
Step 8: Verify and Upload the code into Arduino Uno Board.
Step 9: check the output result.

Conclusion:
In this way we have designed and implemented IoT based door opener home automation system using Arduino Uno microcontroller board, Ultrasonic sensor, Servo motor, Buzzer and LED successfully.

Circuit and Connection Diagram:



Code:

```
#include<Servo.h>
Servo servoMain;
int trigpin = 11;
int echopin = 6;
int distance;
float duration;
float cm;

void setup()
{
        servoMain.attach(8);
        pinMode(trigpin, OUTPUT);
        pinMode(echopin, INPUT);
}
```

```
void loop()
{
        digitalWrite(trigpin, LOW);
        delay(2);
        pinMode(2, OUTPUT);
        pinMode(5, OUTPUT);
        digitalWrite(trigpin, HIGH);
        delayMicroseconds(10);
        digitalWrite(trigpin, LOW);
        duration = pulseIn(echopin, HIGH);
        cm = (duration/58.82);
        distance = cm;

        if(distance<100)
            {
                digitalWrite(5, HIGH);
                servoMain.write(180);
                delay(1000);
            }
        else
        {
                digitalWrite(5, LOW);
                servoMain.write(0);
                delay(1000);
        }

}
```