Group - 11

Soumava Paul 16EE10056
Yerramsetty Rohit 16EE10055

Experiment 5

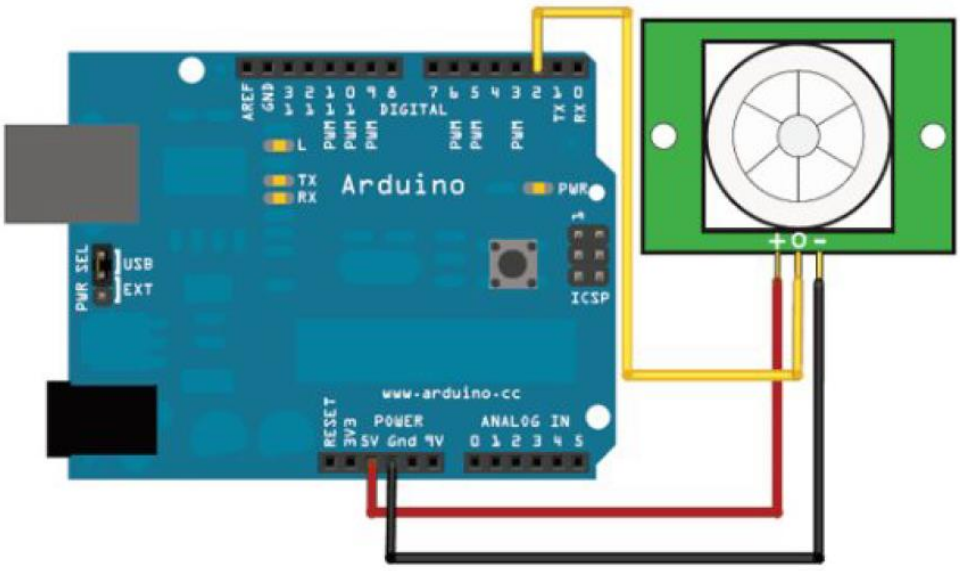
Aim:

- Interfacing a passive infra-red (PIR) proximity sensor
- Display PIR activation on PC via serial monitor
- Display PIR activation on PC via Processing
- Interfacing an ultrasonic range sensor (HC-SR04)
- Activate ultrasonic range sensor when PIR is activated
- Display range measurement on PIR activation on PC via serial monitor
- Display range measurement as colour changing animation on PC via Processing

Interfacing a passive infrared (PIR) proximity sensor and displaying activations via Serial Monitor and Processing

PIR sensors are used to sense motion, almost always to detect whether a human has moved in or out of the sensor's range. PIRs are basically made of a pyroelectric sensor which can detect levels of infrared radiation.

Circuit Diagram and Code



PIR_Sensor

```
int irPin=7; //
int ledPin=13;
int objectDetected=LOW; //
void setup() {
  pinMode(ledPin, OUTPUT);
  pinMode(irPin, INPUT);
  digitalWrite(irPin, HIGH); // internal pull-up
  Serial.begin(9600);
}
void loop() {
  objectDetected=digitalRead(irPin);
  Serial.println(objectDetected);
  if (LOW==objectDetected) {
    digitalWrite(ledPin, HIGH);
    }
  else {
    digitalWrite(ledPin, LOW);
    }
}
```

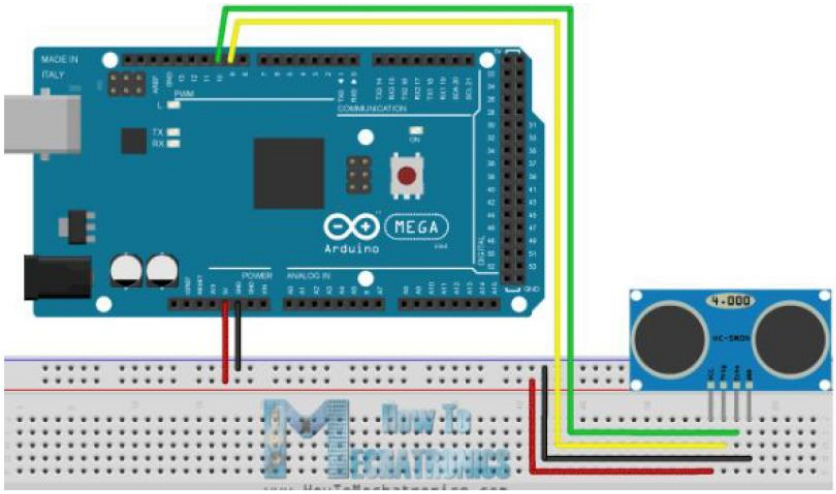
Interfacing an ultrasonic range sensor (HC-SR04)

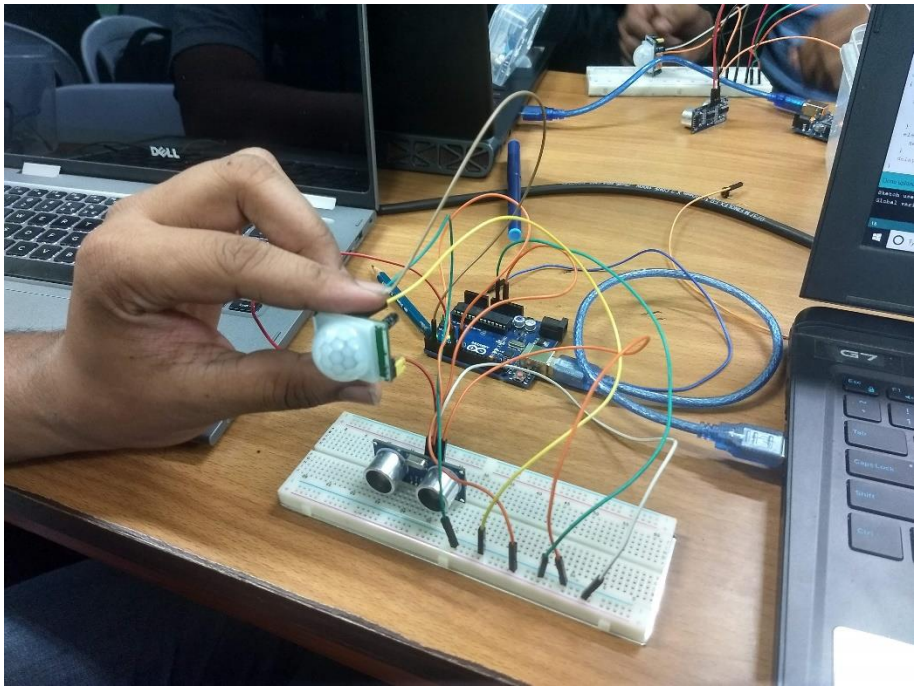
Activate HC-SR04 when PIR is activated

Display range measurement on PIR activation via Serial Monitor

Display range measurement as colour changing animation via Processing

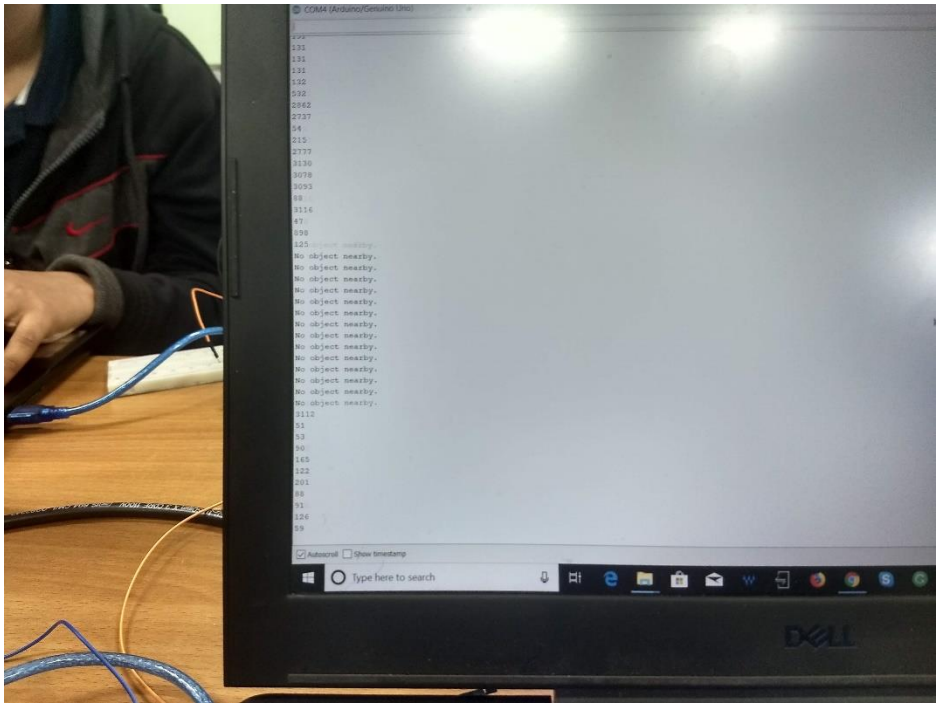
Circuit Diagram and Code





Ultrasonic_Sensor

```
int trigPin = 8; //
int echoPin = 7; //
int irPin=2; //
int objectDetected=LOW; //
float v=331.5+0.6*20; // m/s //
void setup() //
{
  Serial.begin(9600); //
  pinMode(trigPin, OUTPUT); //
  pinMode(echoPin, INPUT); //
  pinMode(irPin, INPUT);
  digitalWrite(irPin, HIGH); // internal pull-up
}
float distanceCm(){ //
  // send sound pulse //
  digitalWrite(trigPin, LOW); //
  delayMicroseconds(3); //
  digitalWrite(trigPin, HIGH); //
  delayMicroseconds(5); //
  digitalWrite(trigPin, LOW); //
  // listen for echo //
  float tUs = pulseIn(echoPin, HIGH); // microseconds //
  float t = tUs / 1000.0 / 1000.0 / 2.0; // s //
  float d = t*v; // m //
  return d*100; // cm //
}
void loop() //
{
  objectDetected=digitalRead(irPin);
  if (LOW==objectDetected) {
    int d=distanceCm(); //
    Serial.println(d, DEC); //
  }
  else{
    int d = -1;
    Serial.println(d);
  }
  delay(200); // ms //
}
```



Color_Changing_with_Distance

```
import processing.serial.*;
Serial myPort;
String d = "";
float distance;
void setup(){
size(300, 300);
myPort = new Serial(this, "COM5", 9600);
myPort.bufferUntil('\n');
}
void serialEvent (Serial myPort){
d = myPort.readStringUntil('\n');
}
void draw() {

  distance = float(d);
  print(distance);
  background(0, 0, 0);
  if(distance>=5 && distance<=20){

    background(255,0,0);
    textSize(32);
    text(distance, 120, 120);
  }
  if(distance>20 && distance<=40){

    background(0,0,255);
    textSize(32);
    text(distance, 120, 120);
  }

  if(distance>40){

    background(127,0,255);
    textSize(32);
    text(distance, 120, 120);
  }

  if(distance==-1){

    background(0,255,0);
    textSize(32);
    text(distance, 120, 120);
  }
}
```

Conclusion

The proximity sensor only gives a digital output - if the human being is near, a low voltage otherwise a high voltage. The PIR is tuned in such a way that it sends out infrared signals at an interval of few seconds to replicate the effect of reflection from an object at a long distance, because reflected signal from a distant object will take some time to return back and so will not have instantaneous response on the sensor. As it is not possible to have such long distances for lab purposes, we set its signal frequency in a fashion to see a time delay in its response, i.e., it sends out pulses at an interval of few seconds, which can be set by setting values of components inside the sensor.

The ultrasonic sensor firstly transmits an ultrasonic pulse and then recollects the reflected pulse, it calculates the time after which reflected pulse came back, this when multiplied by speed of sound in a particular medium will give us the distance of the object. Both the sensors were incorporated together, the ultrasonic sensor only activated when motion or an object was detected by the PIR sensor and the corresponding distance was printed. The ultrasonic sensor calculates echo time in microseconds and converts it into distance in cm.