جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

# كلية العلوم

# قسم الانظمة الطبية الذكية

**Intelligent Medical Systems Department**

**Lecture: ( 2 )**

**Sensors**

**Subject: Embedded System**

**Class: Third**

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## Sensors

### What is a sensor?

A sensor is an object (device, module, or subsystem) whose purpose is to detect events or changes in its environment, and then send the information to other electronics to provide a corresponding output.

## Light Sensor LDR (Light Dependent Resistor)

Also called photoresistor, Is a light-controlled variable resistor, Works by sensing the intensity of light in its environment. This sensor has an Integrated circuit which contains a built in potentiometer and resistor.

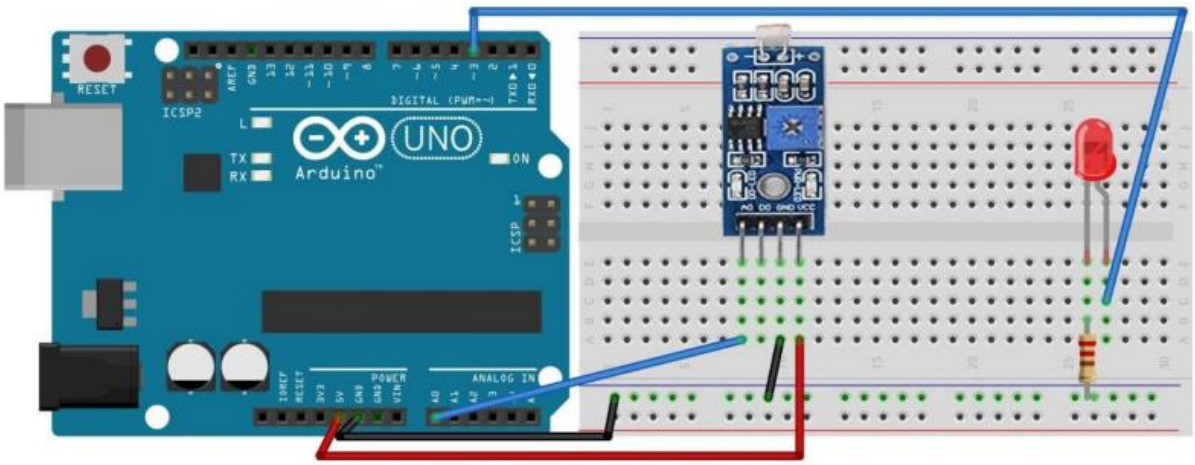
- **How does it Work:**
  The LDR gives out an analog voltage when connected to VCC (5V), which varies in magnitude in direct proportion to the input light intensity on it. That is, the greater the intensity of light, the greater the corresponding voltage from the LDR will be. Since the LDR gives out an analog voltage, it is connected to the analog input pin on the Arduino. The Arduino, with its built-in ADC (analog-to-digital converter), then converts the analog voltage (from 0-5V) into a digital value in the range of (0-1023). When there is sufficient light in its environment or on its surface, the converted digital values read from the LDR through the Arduino will be in the range of 800-1023 .

## Example

(Measurement of intensity of light)

Requirements :Arduino, BreadBoard, Resistor, LDR Sensor, Led, wires.

Connection map:

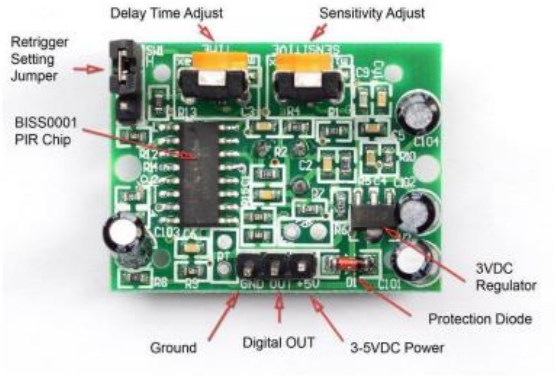


## Code:

```
int LDR =A0;
void setup(){
pinMode(LDR,INPUT);
pinMode(3,OUTPUT);
Serial.begin(9600); }
void loop(){
int LDRvalue=analogRead(LDR);
Serial.println(LDRvalue);
if(LDRvalue >= 900){
digitalWrite(3,HIGH);
}else{
digitalWrite(3,LOW);
}}
```

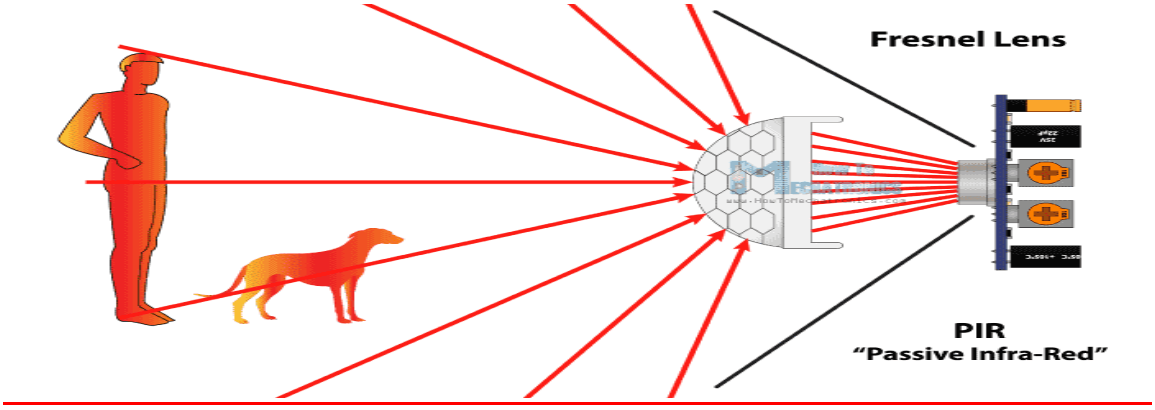
## PIR- Based motion sensor (passive infrared)

is a device that allow to sense motion, almost used to detect whether a human has moved in or out of the sensors range.




## How it works:

It used the infrared. Infrared is electromagnetic rays have all the basic properties of light, phenomena of diffusion, reflection, refraction, interference, diffraction and polarization. When analyze the light to its basic colors, and measure the temperature of the colored spectrum components using the thermometer. When the thermometer is moved from the violet field to the red field, the temperature is the greatest value in the dark part behind the red light. Anybody have infrared; have a certain range of frequencies for the infrared spectrum. For example, a human has a range of infrared with a wavelength of 4 to 11 micrometers.



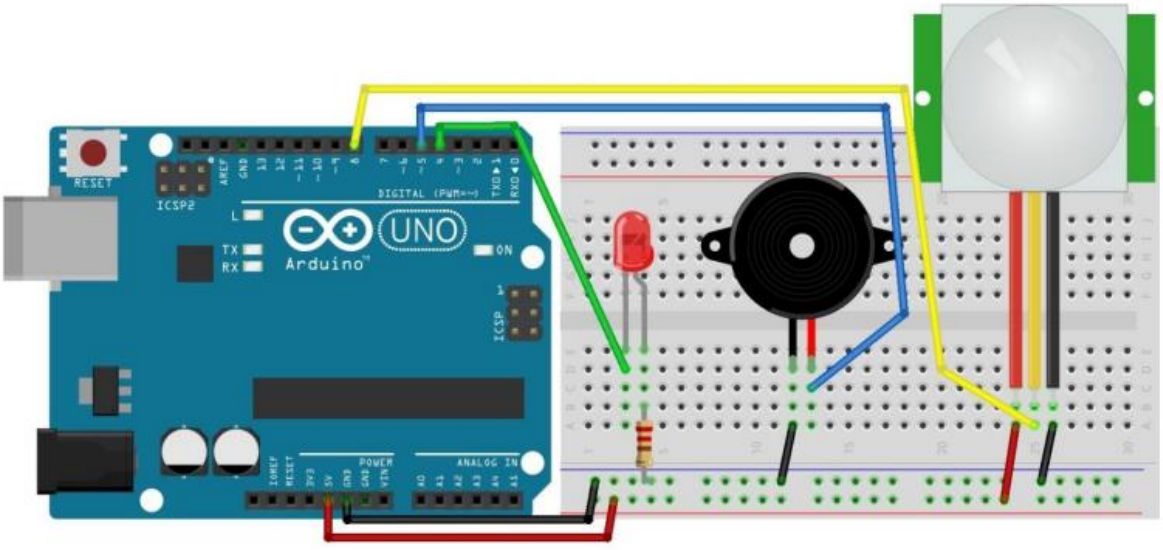
The sensor consists of a thermoelectric matrix of small size, where the matrix draws infrared radiation from the objects. As the change in the infrared level emitted from the observed objects, it works to change the resistance of the matrix, resulting in a voltage drop that produces a current that corresponds with Intensity of change in infrared .

## Example

### Requirements :

Arduino, BreadBoard, Resistor, PIR Sensor, Led, Buzzer, wire.

### Connection map:




**Code:**

```
int PIR=8;
int led=4;
int buzzer=5;
void setup() {
pinMode(PIR, INPUT);
pinMode(led, OUTPUT);
pinMode(buzzer, OUTPUT);
Serial.begin(9600); }
void loop() {
if(digitalRead(PIR) == HIGH)
{
digitalWrite(led, HIGH);
digitalWrite(buzzer, HIGH);
Serial.println("motion detected");}
else {
digitalWrite(led, LOW);
digitalWrite(buzzer, LOW);
Serial.println("scanning"); } }
```