**1.led theory & 2. multiple blinking led**

-> A light-emitting diode is a semiconductor diode which glows when a voltage is applied.

-> Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

-> LED light bulbs are designed to convert electrical energy into light through a microchip which then illuminates the tiny light sources which produce visible light.

-> This process uses up to 90% less power than traditional incandescent and fluorescent bulbs.

-> LEDS are used in headlamps, advertising, general lighting, traffic signals, camera flashes, lighted wallpaper, horticultural grow lights, and medical devices.

**3. push button**

-> a push button is a simple switch mechanism for controlling some aspect of machine or process.

-> buttons are usually made out of hard material, usually plastic or metal

->in industrial and commercial appliances the push button can be connected together by a mechanical linkage so that the act of pushing one button causes another button to be released . in this way a stop button can “force” a start button to be released

-> this method f linkage is used in simple manual operations in which the machine or process has no electrical circuits for control.

-> the push buttons have been utilized for calculators, push-button telephones, kitchen appliances and various other mechanical and electronic devices.

**4.potentiometer**

-> a potentiometer is a 3-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider.

-> if only 2 terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.

-> it is an electrical instrument that is used to measure the EMF of the given cell and the internal resistance of the cell. Also, it is used to compare the EMF of different cells.

-> It can also be used as a variable resistor in most of the applications.

**5.lcd**

-> LCD Is made up of 2 states of matter, the solid and liquid. It uses a liquid crystal to produce a visible image. LCDs are super thin technology display screen that are generally used in laptop computer screen, TVS, cell phones and portable video games.

-> LCD technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology. It is composed of several layers which include 2 polarized plane filters and electrodes.

-> LCD works on the principle of blocking light rather than emitting light. They require backlight as they not emit light by them.

-> we always use devices which are made up of LCD displays which are replacing the use of cathode ray tube. Cathode ray tube draws more power when compared to LCD and are also much bigger and heavy.

**6.ldr**

->the working principle of LDR is photo conductivity that is nothing but an optical phenomenon.

-> when the light is absorbed by the material then the conductivity of the material reduces.

-> When the light falls on the LDR, the electrons in the valence band of the material are eager to the conduction band.

-> but the photons in the incident light must have energy superior than the band gap of the material.

**7.pir**

-> the term PIR sensor is the short form of passive infrared. The term passive indicates that the sensor does not actively take part in the process, which means it does not emit the IR signals itself but passively detects the infrared radiations coming from the human body in the surrounding area.

-> the detected radiations are converted into electrical charge, which is proportional to the detected level of radiation. the PIR sensor ranges up-to 10 meters at an angel of +15 to -15 degrees.

->PIR sensor consists of 2 slots that are made up of special material which is sensitive to the IR. when a human body or animal passes by it, then it intercepts the first slot of the PIR sensor. This causes a positive differential change b/w the 2 bisects. When the body leaves the sensing area, it generates a negative differential change b/w the 2 bisects.

-> the infrared sensor itself is housed in hermetically sealed metal to improve humidity/temperature/noise. The window in the PIR is typically made of silicon material to protect the sensing element.

**8.ultrasonic**

**->**the HC-SR04 ultrasonic sensor is used to determine the distance of an object like bats do.

-> in this, we have to give a trigger pulse, so that it generates ultrasound of frequency 40Khz. After the generation of Ultrasound it makes the echo pin high. the echo pin remains high until it does not get the echo sound back.

->the width of the echo pin will be the time of the sound to travel to the object and return back. once we know the time, the distance can be calculated.

->HC-SR04 can measure up-to 2cm-400cm.

**9.temprature**

-> the tmp36 are low voltage, precision centigrade temperature sensors. they provide a voltage output that is linearly proportional to the Celsius temperature.

-> it does not provide any external calibration to provide typical accuracies of +/-1C at 25C and +/- 2C at -40C to 125C temperature range.

->the low output impedance of the tmp36 and its linear output and precise calibration simplify interfacing to temperature control identity to temperature control circuitry.

->they are intended for single supply operation from 2.7V to 5.5V.

**10.gas**

->MQ2 gas sensor is an electronic sensor used to sense the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide. It is also known as chemiresistor.

->it contains a sensing material whose resistance changes when it comes in contact with the gas.

-> it is a metal oxide semiconductor type gas sensor. Concentrations of gas in sensor is measured using a voltage divider network present in sensor.

-> it works on 5V DC voltage and can detect gases in concentration of range 200 to 1000pm.

-> they can detect the presence of gases but cannot distinguish b/w them.