Introduction:

The increase in the development of technology and the human race, we failed to take care about the surroundings in which we live in. Thus, we polluted the environment and thereby reducing the quality of the place we live. Even though there are several aspects of pollution such as soil, air and water pollution, out of these air pollution acts as the serious aspect as the other can detected visually and by taste, but the polluted air cannot be detected as it can be odourless, tasteless and colourless.

Therefore, there is a growing demand for the environmental pollution monitoring and control systems. In the view of the ever-increasing pollution sources with toxic chemicals, these systems should have the facilities to detect and quantify the sources rapidly. Toxic gases are one that causes serious health impacts have to be monitored; such that increase in the normal level of them could be known and proper precaution measures can be taken. But the current systems available are not so portable and are costly and difficult to implement.

If these hazardous gases level exceeds normal level then the LEDs glow immediately. The system is affordable and can be easily implement in the in residential areas which is surrounded by the chemical industries or plants, to avoid endangering of human lives.

The system also supports to provide real-time monitoring of concentration of some particular gases which are present in the air. As this method is automatic the information can be given in time such that the endangering of human lives can be avoided and preventive measures can be taken. As we know that 'prevention is better than cure'.

The Device:

1. Features:

- ✓ Is multipurpose;
- ✓ Fully Automatic;
- ✓ Compact and faster;
- ✓ Cheap and affordable;

2. Components:

- ➢ Arduino Board (UNO R3);
- ➢ Bread Board;
- ➢ Compact dust sensor;
- ➢ Gas Sensor (MQ-2);
- ➢ DHT11 Sensor (Temp & Humidity);
- ➢ LCD display (20 X 4);
- ➢ Buzzer (if necessary);
- ➢ Resistances and capacitor;
- ➢ Jumper Cables;

The major part of this project is the hardware model consisting of Dust and MQ-2 sensor, Arduino board and other components. The sensors take samples as they are set to take. The dust sensor measures the amount of dust present in the environment while the MQ-2 gas sensor has been coded to give us values of CO, LPG and Smoke present in the environment. Any increase in them causes the LEDs to glow. While the DHT11 sensor the temperature and humidity of the surroundings.

The observations that we have taken has duly verified from reliable resources. Any discrepancies have been taken care of. Now, we take a closer look at the components that have been used to build the device.

The CIRCUIT:

Dust Sensor:

This Dust Sensor gives a good indication of the air quality in an environment by measuring the dust concentration.

The Particulate Matter level (PM level) in the air is measured by counting the Low Pulse Occupancy time (LPO time) in given time unit. LPO time is proportional to PM concentration. This sensor can provide reliable data for air purifier systems; it is responsive to PM of diameter 1µm.

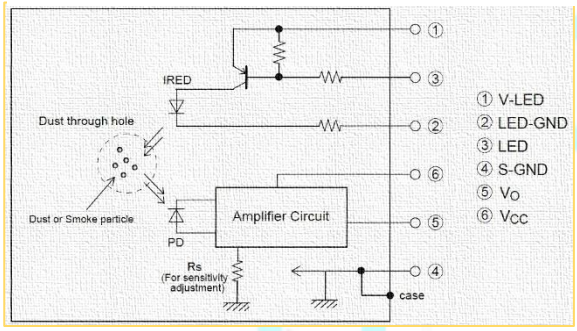
Specification:

PARAMETER	Ranges	Unit
VCC	4.75~5.75	V
Standby Current Supply	90	mA
Detectable range of concentration	0~28,000 / 0 ~ 8000	pcs/litre /pcs/0.01cf
Operating Temperature Range	0~45	°C
Output Method	Negative Logic, Digital output, High: over 4.0V(Rev.2), Low: under 0.7V	-
Detecting the particle diameter	>1	µm
Dimensions	59(W) × 45(H) × 22(D)	mm
Humidity Range	95% rh or less	

Basic output handling

・The output voltage Vo of this sensor is the sum of output voltage at no dust Voc and output proportional to dust density ΔV. Output proportional to dust density ΔV is shown as follows. $\Delta V = V_O - V_{OC}$ (V_O: monitor value)

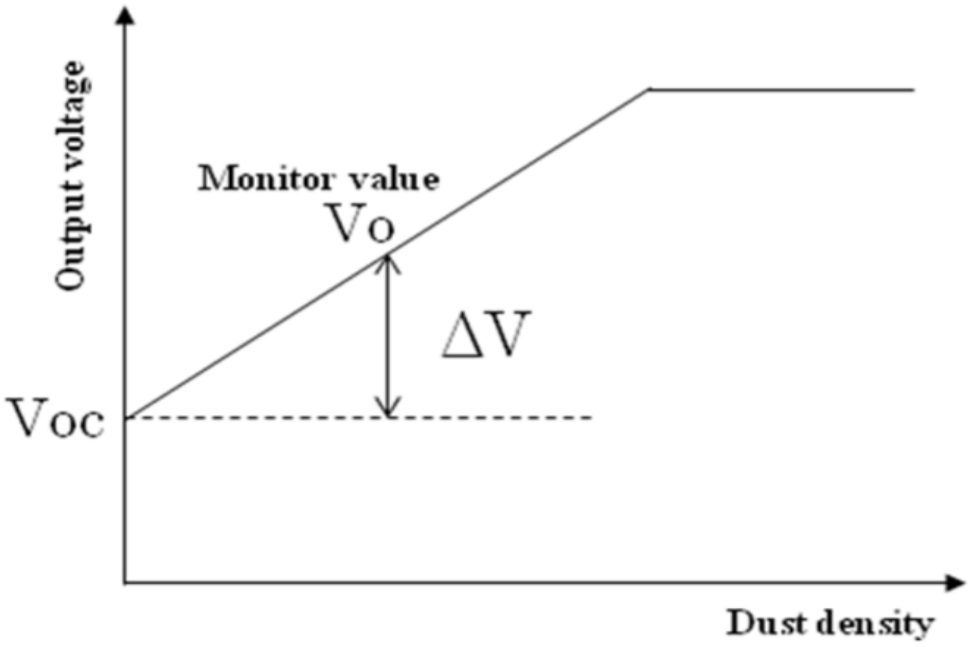
Fig: Connections



・Output voltage at no dust V_{OC} is caused by the stray light occurring in this sensor. This sensor makes V_{OC} voltage even at dust density 0mg/m3. If dust attached within this sensor increases, V_{OC} becomes bigger. On the other hand, if dust attached within this sensor decreases, V_{OC} becomes smaller.

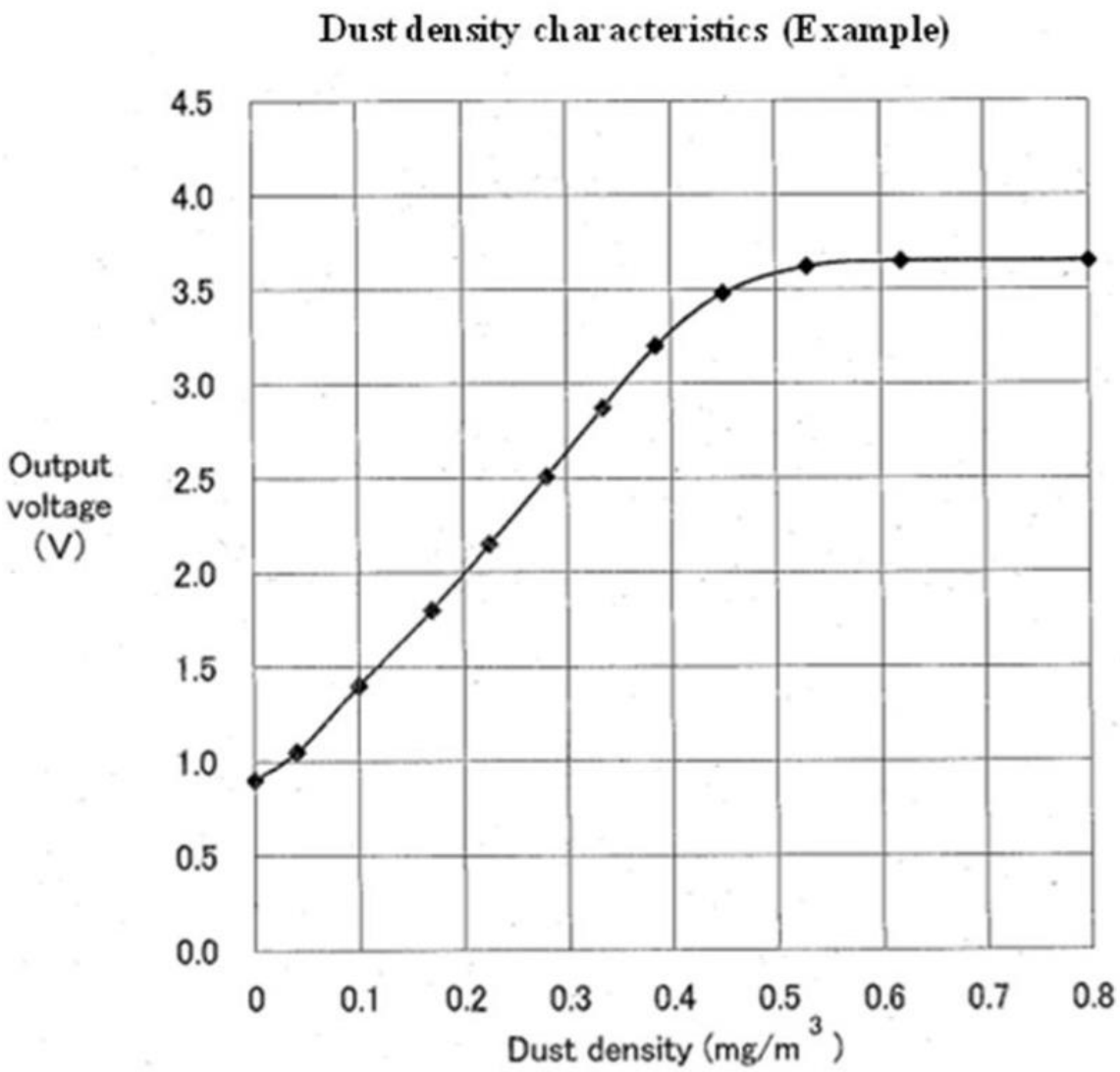
・To store V_{OC} in the memory of application is necessary to calculate ΔV from monitor value V_O. If monitor value Vo lower than the memorized V_{OC} appears, this monitor value V_O should be stored in the memory of application as a new V_{OC}.

・If monitor value Vo maintains a bigger value than the memorized V_{OC} for a certain period of time, this monitor value Vo should be stored in the memory of application as a new V_{OC}.



Dust density characteristics (Example)

Test condition: According to "Electro-optical characteristics" of the specification of GP2Y1010AU0F.



GAS Sensor(MQ-2):

The Gas Sensor(MQ2) module is suitable for detecting H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer. It is also very useful for gas leakage detection.

Features:

- Wide detecting scope
- Stable and long lifetime
- Fast response and High sensitivity

Specification:

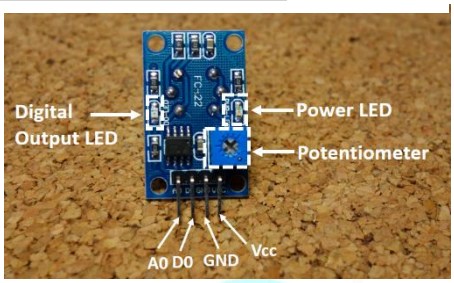
Item	Parameter	Min	Typical	Max	Unit
V_{CC}	Working Voltage	4.9	5	5.1	V
PH	Heating consumption	0.5	-	800	mW
R_L	Load resistance		adjustable		
R_H	Heater resistance	-	33	-	Ω
R_S	Sensing Resistance	3	-	30	kΩ

Hardware Overview:

This is an Analogue output sensor. It needs to be connected to any one Analog socket IN Arduino board. The pins used in this device make uses of A1 analogue pin. Connect this module to the A1 port of Arduino Board.

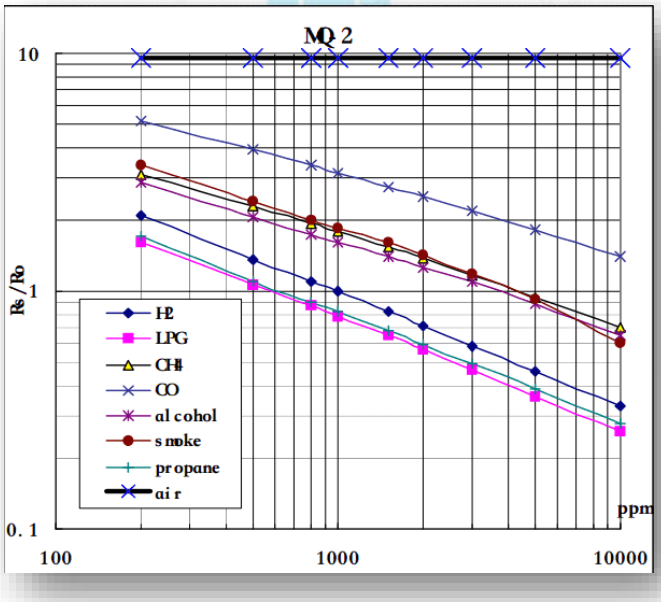
It is possible to connect the module to Arduino directly by using jumper wires, please refer to the connection in the table below:

Fig: Backside of the sensor



5V	VCC
GND	GND
Digital D0	No Connc.
Analog A0	SIG

The output voltage from the Gas sensor increases when the concentration of gas increases. Sensitivity can be adjusted by rotating the potentiometer. Please note that the best preheat time for the sensor is above 24 hours.



Graph: Concentration of different gases.

According to the graph, we can see that the minimum concentration we can test is 100ppm and the maximum is 10000ppm, in a other word, we can get a concentration of gas between 0.01% and 1%. However, we can't provide a formula because the relation between ratio and concentration is nonlinear.

DHT11 Sensor (Temp. and Humidity):

This temperature & humidity sensor provides a pre-calibrated digital output. A unique capacitive sensor element measures relative humidity and the temperature is measured by a negative temperature coefficient (NTC) thermistor. It has excellent reliability and long-term stability. The detecting range of this sensor is 5% RH - 99% RH, and 0°C - 80°C. And its accuracy reaches up to 2% RH and 0.5°C

Note: Please note that this sensor will not work when environmental temperatures is below 0℃.

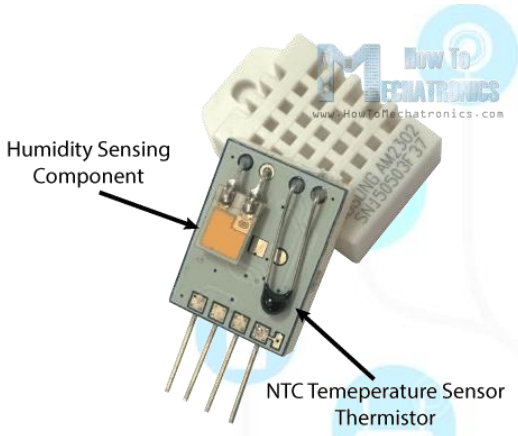
Specification:

Item	Min	Norm	Max	Unit
VCC	3.3	-	6	V
Measuring Current Supply	1	-	1.5	mA
Standby Current Supply	40	-	50	uA
Measuring range (Humidity)	5%	-	99%	RH
Measuring range (Temperature)	-40	-	80	°C
Accuracy (Humidity)	-	-	±2%	RH
Accuracy (Temperature)	-	-	±0.5	°C
Resolution (Humidity)	-	-	0.1%	RH
Resolution (Temperature)	-	-	0.1	°C
Repeatability (Humidity)	-	-	±0.3%	RH
Repeatability (Temperature)	-	-	±0.2	°C
Long-term Stability	-	-	±0.5%	RH/year
Signal Collecting Period	-	2	-	S
Respond Time 1/e(63%)	6	-	20	S

Features:

- Relative Humidity and temperature measurement;
- Full range temperature compensation Calibrated;
- Digital signal Long term stability;
- Long transmission distance;
- Low power consumption;
- Low Cost;

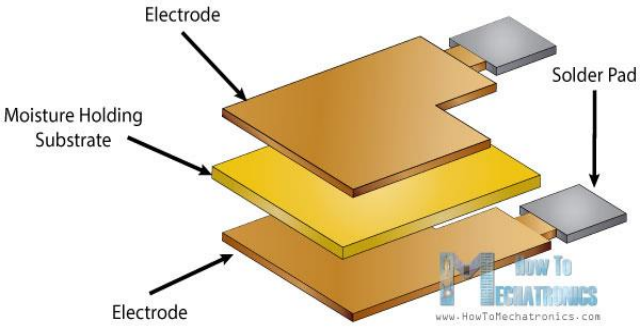
Hardware Overview:



For measuring humidity, they use the humidity sensing component which has two electrodes with moisture holding substrate between them. So as the humidity changes, the conductivity of the substrate changes or the resistance between these electrodes changes. This change in resistance is measured and processed by the IC which makes it ready to be read by a microcontroller.

On the other hand, for measuring temperature these sensors use a NTC temperature sensor or a thermistor.

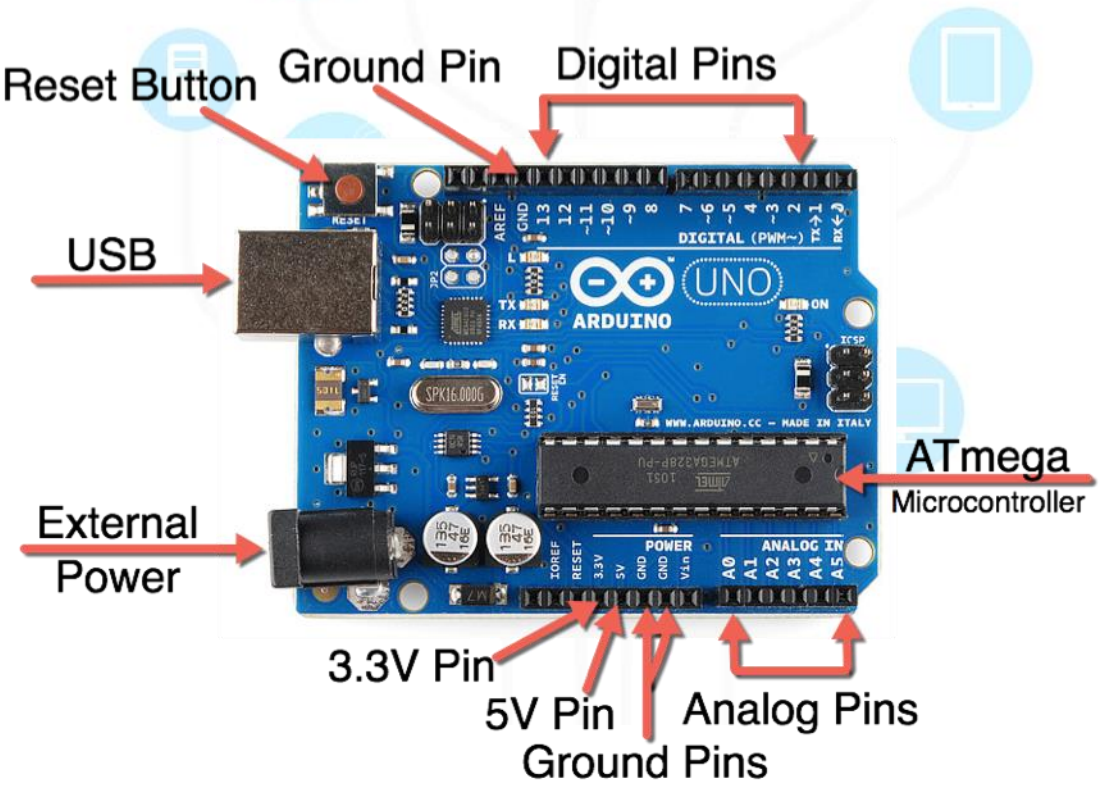
A thermistor is actually a variable resistor that changes its resistance with change of the temperature. These sensors are made by sintering of semi conductive materials such as ceramics or polymers in order to provide larger changes in the resistance with just small changes in temperature. The term “NTC” means “Negative Temperature Coefficient”, which means that the resistance decreases with increase of the temperature.



Arduino Board:

Arduino Uno is a microcontroller board based on the ATmega328P.It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analogue inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform.

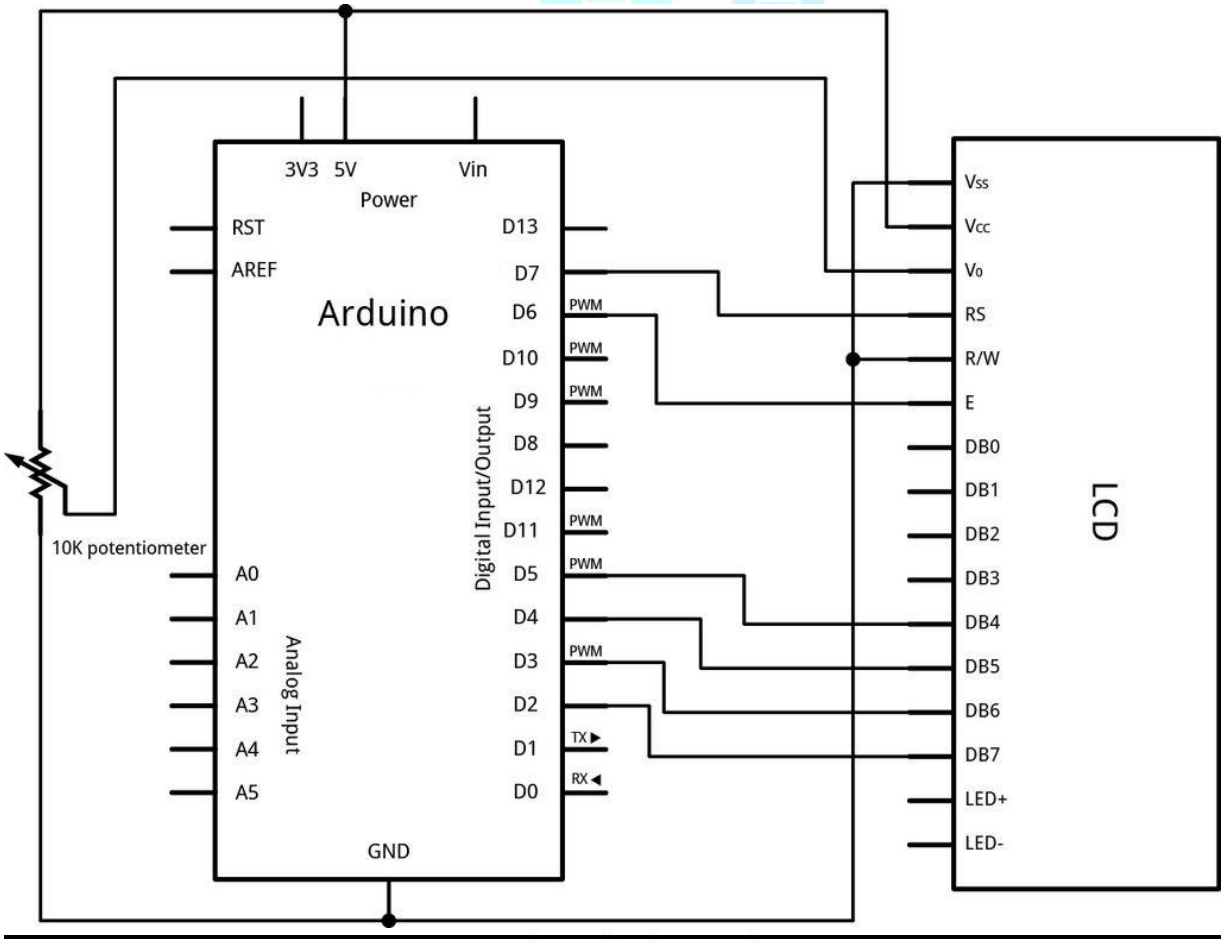


LCD Display(20X4):

A liquid-crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly.

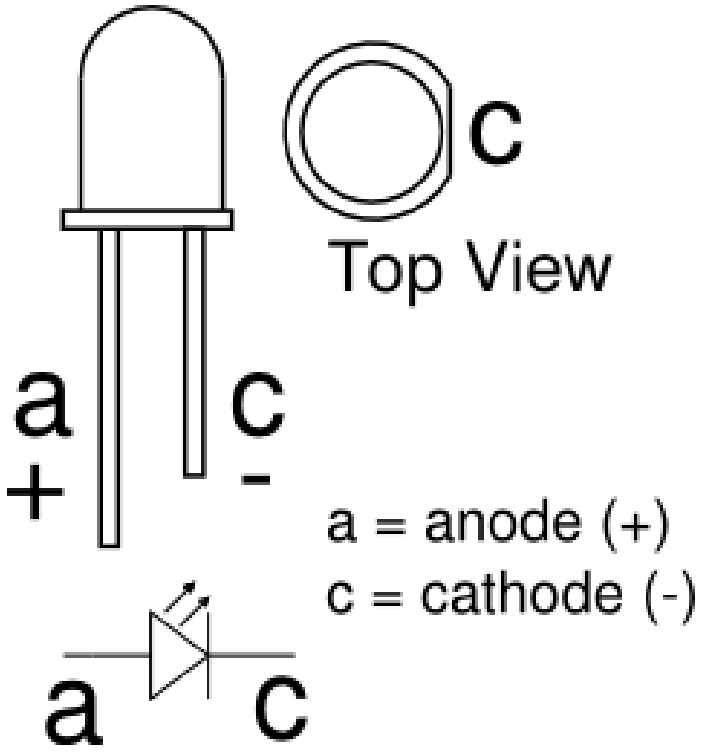
Here, in this project we have used a monochromatic 20x4 alphanumeric LCD. 20x4 means that 20 characters can be displayed in each of the 4 rows of the 20x4 LCD, thus a total of 80 characters can be displayed at any instance of time.

Circuit Diagram:



LEDs:

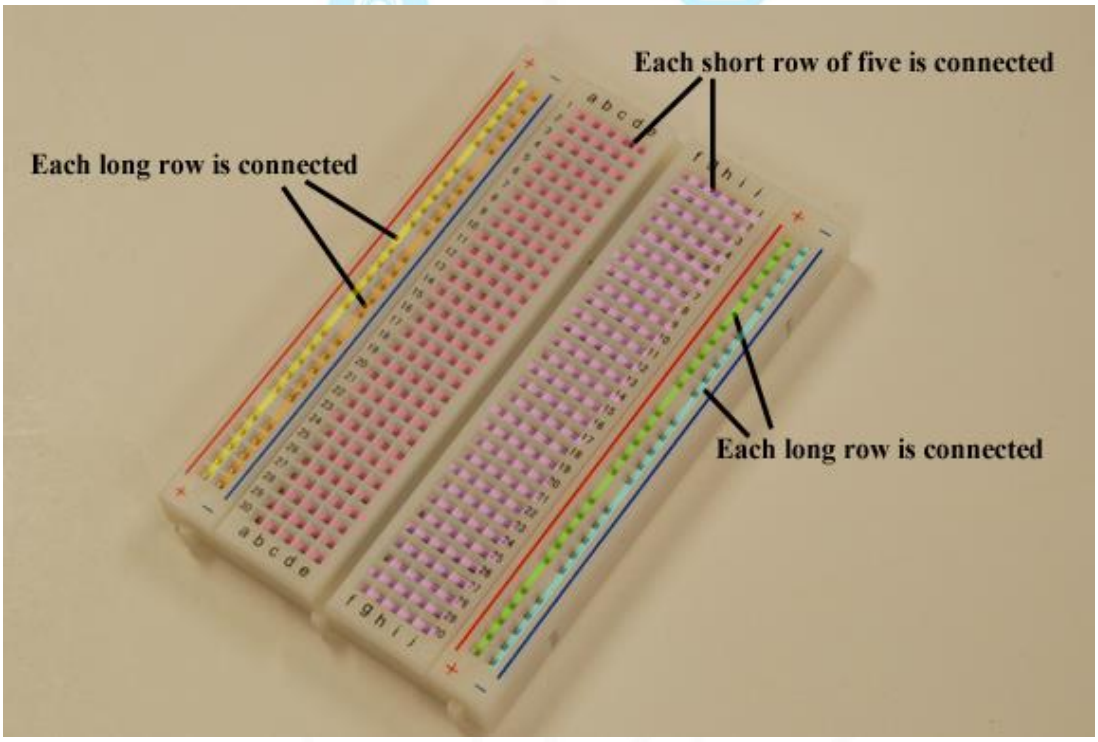
A **light-emitting diode** (**LED**) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the colour of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm^2) and integrated optical components may be used to shape the radiation pattern.



Breadboard:

A **breadboard** is a construction base for prototyping of electronics. Originally it was literally a bread board, a polished piece of wood used for slicing bread. In the 1970s the **solderless breadboard** (a.k.a. **plugboard**, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these.

Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education.



The Real Setup:

BIBLIOGRAPHY:

1. http://www.instructables.com/id/Interfacing-20x4-LCD-with-Arduino/
2. http://www.instructables.com/id/How-to-Interface-With-Optical-Dust-Sensor/
3. www.google.com
4. www.wikipedia.org
5. https://www.arduino.cc/

Thanks for reading. The Information on each of the components was taken from these reliable sites. Hope this project helps the unprivileged or to someone who is new to this field.