Air Quality Monitoring

Objective:-

To create a air quality monitoring system and sending its reading to cloud.

Hardware Used:-

A. Arduino Uno:-

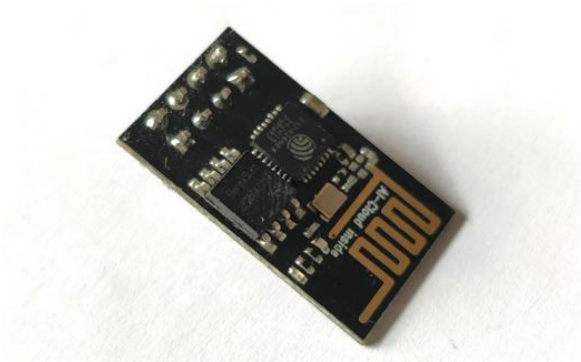
Arduino Uno is one of the most popular prototyping boards. It is small in size and packed with rich features. The board comes with built-in Arduino boot loader. It is an Atmega 328 based controller board which has 14 GPIO pins, 6 PWM pins, 6 Analog inputs and on board UART, SPI and TWI interfaces. In this IOT device, 9 pins of the board are utilized. There are six pins used to interface the character LCD. There are two pins utilized to interface the

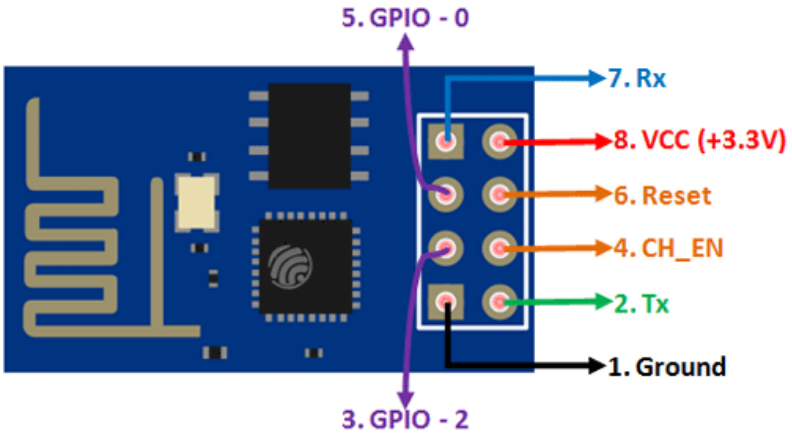
ESP8266 Wi-Fi Module and an analog input pin is used to connect the MQ-135 sensor.

B. MQ-135 Gas Senser:-

The MQ-135 gas sensor senses the gases like ammonia nitrogen, oxygen, alcohols, aromatic compounds, sulfide and smoke. The operating voltage of this gas sensor is from 2.5V to 5.0V. MQ-135 gas sensor can be implementation to detect the smoke, benzene, steam and other harmful gases.

C. ESP8266 ESP-01 WIFI MODULE:-





The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application networking functions from another application Each ESP8266 module comes pre-programmed with an AT command.

The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

- 802.11 b/g/n
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLLs, regulators, DCXO and power management units
- +19.5dBm output power in 802.11b mode
- Power down leakage current of <10uA
- 1MB Flash Memory
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 1.1 / 2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU & A-MSDU aggregation & 0.4ms guard interval

D. 16X2 LCD:-

The 16X2 LCD display is used to monitor the sensor values read by the Arduino board from MQ-135. It is interfaced with the Arduino Uno by connecting its data pins D4 to D7 with pins 6 down to 3 of the controller respectively. The RS and E pins of the LCD are connected to pins 13 and 12 of the controller respectively. The RW pin of the LCD module is connected to the ground.

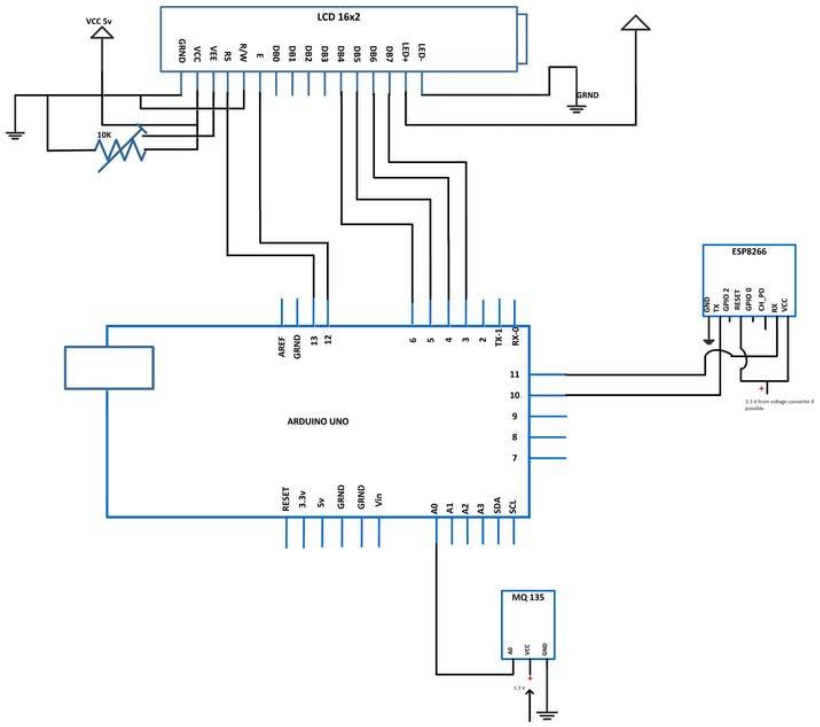
E. JUMPER WIRE

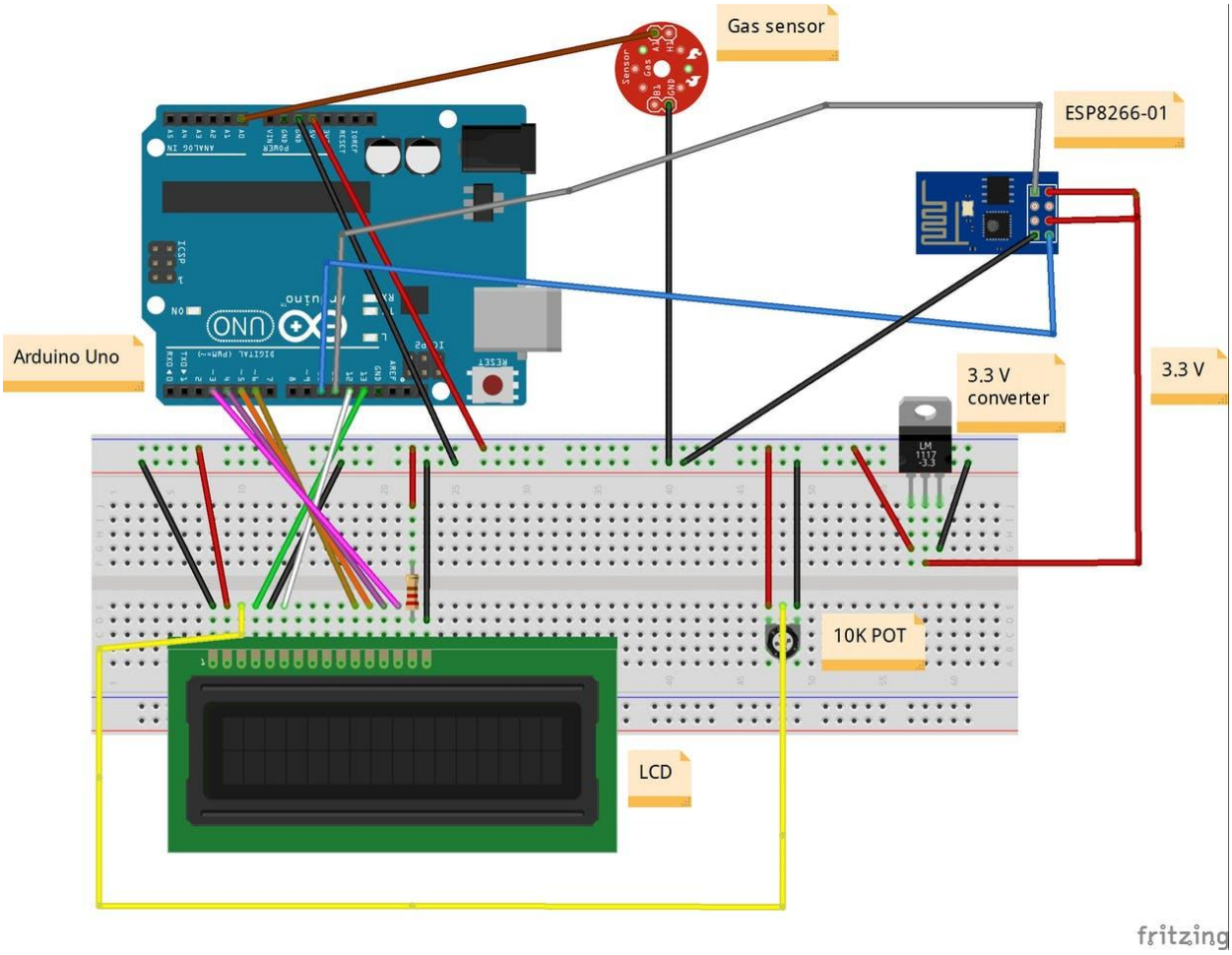
F. BREADBOARD

Software Used:-

- IBM CLOUD
- Arduino IDE

Circuit Diagram:-





Connections:-

ARDUINO ==> LCD

- GND ==> GND
- 5 V ==> Vcc
- D13 ==> RS

- GND ==> R/W
- D12 ==> Enable
- D6 ==> DB4
- D5 ==> DB5
- D4 ==> DB6
- D3 ==> DB7
- 5V ==> LED+
- GND ==> LED-

Arduino ==> Gas sensor

- GND ==> GND
- 3.3 V ==> Vcc
- Analog0 ==> A0

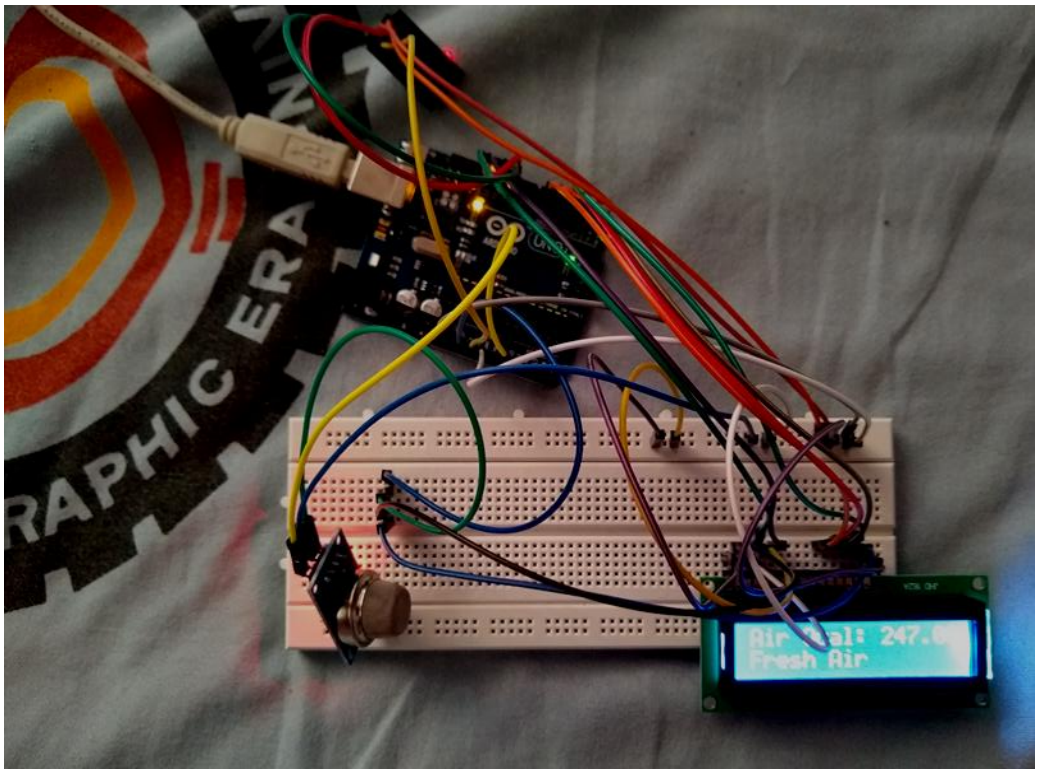
Arduino ==> ESP8266

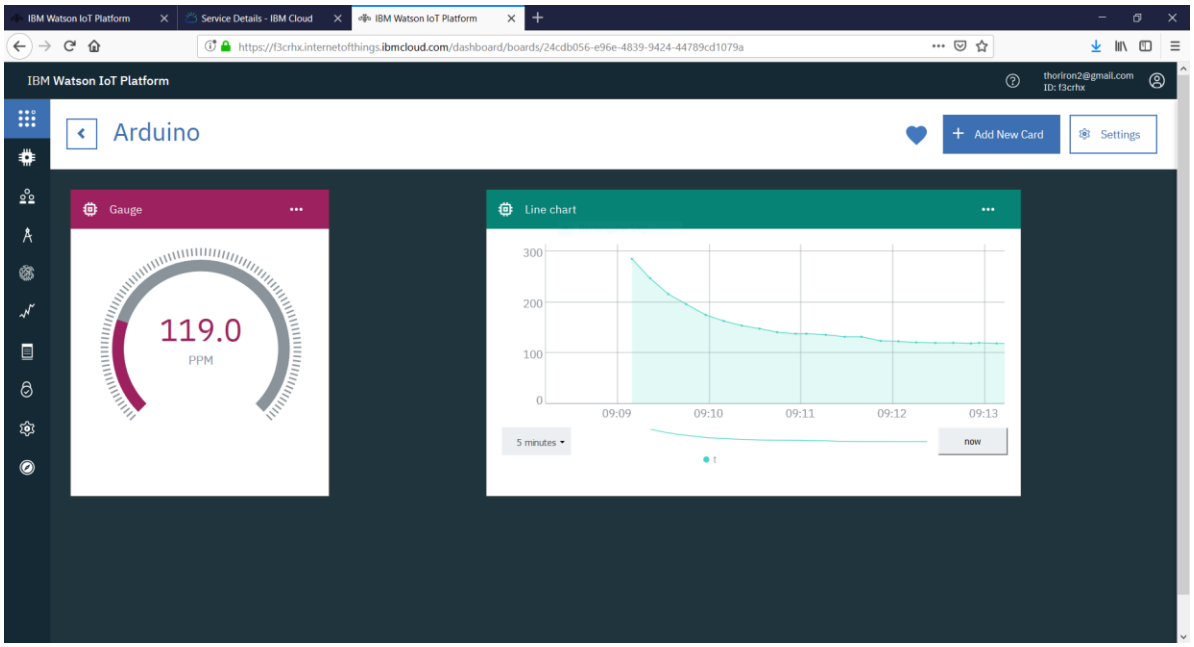
- D10 ==> Tx
- D11 ==> Rx
- GND ==> GND
- VCC ==> 3.3V

Theory:-

As the device is powered, the Arduino board loads the required libraries, flashes some initial messages on the LCD screen and start sensing data from the MQ-135 sensor. The sensor can be calibrated so that its analog output voltage is proportional to the concentration of polluting gases in PPM. The analog voltage sensed at the pin A0 of the Arduino is converted to a digital value by using the in-built ADC channel of the Arduino. The Arduino board has 10-bit ADC channels, so the digitized value ranges from 0 to 1023. The digitized value can be assumed proportional to the concentration of gases in PPM. The read value is first displayed on LCD screen and passed to the ESP8266 module wrapped in proper string through virtual serial function. The Wi-Fi module is configured to connect with the IBM IOT platform. IBM Watson provides instant visualizations of data posted by the IOT devices to IBM server.

Result:-


Fresh Air


IBM Watson IoT Platform
Service Details - IBM Cloud
IBM Watson IoT Platform
https://f3crhx.internetofthings.ibmcloud.com/dashboard/boards/24cdb056-e96e-4839-9424-44789cd1079a
IBM Watson IoT Platform
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ID: f3crhx
Arduino
Add New Card
Settings
Gauge
119.0
PPM
Line chart
300
200
100
0
09:09
09:10
09:11
09:12
09:13
5 minutes
now