IoT Enabled Air Pollution Level Meter
Group : TUE-32

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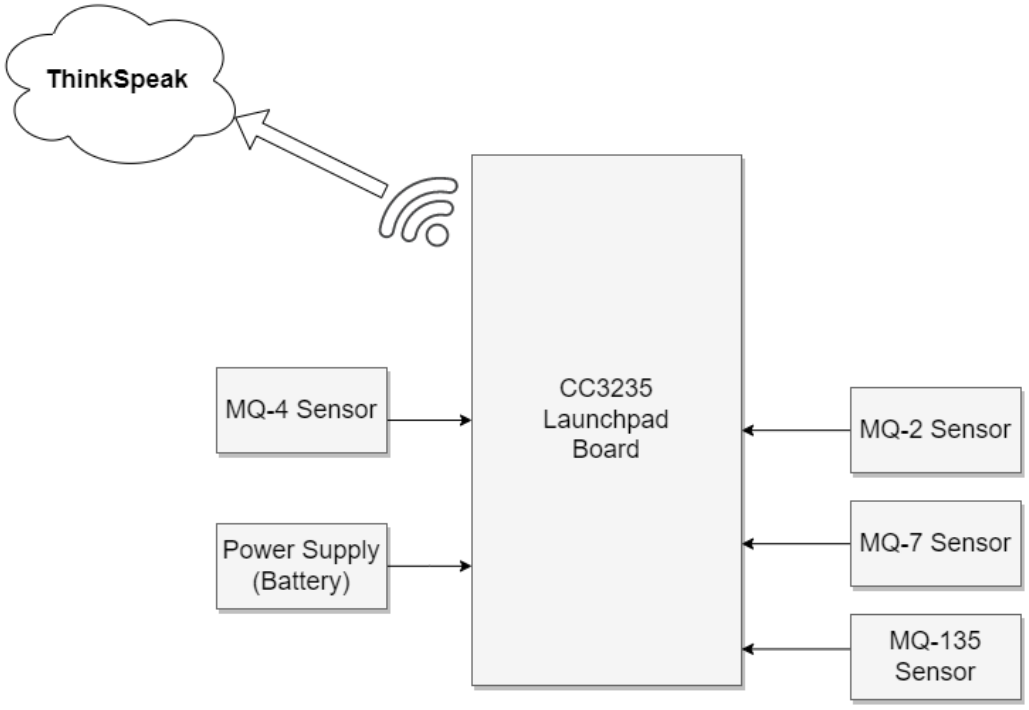
1 Introduction

Our immediate environment now has dangerously high air pollution levels. It is crucial to continuously monitor and record this pollution level, and alerts must be sent if it exceeds a set point. As a result, it is necessary to install numerous pollution level sensor nodes at various locations throughout our campus and log the data on a central server. The IoT part needed to build the project's little pollution level sensor node is the CC3235SF Launchpad. The sensor node will be installed in a remote location, and measurements are taken and sent to the central server at predetermined intervals.

The MQ-2, MQ-4, MQ-7, and MQ-135 sensors are being used to gauge the level of air pollution. Additionally, we have connected an LCD module to display the concentration of pollutants locally. The CC3235SF Launchpad's built-in Wi-Fi module will be used to transmit the data. ThingSpeak Server, an IoT analytics platform service that enables us to aggregate, visualize, and analyze live data streams in the cloud, will display this data. On this server, real-time data will be displayed and saved. Data from sensors will be read, processed, and transmitted to the web server and webpage via the internet using the CC3235 Launchpad Board. In order to display pollution levels, which will include individual pollutant levels, AQI, etc., we will apply a threshold to the value of the pollutant concentration.

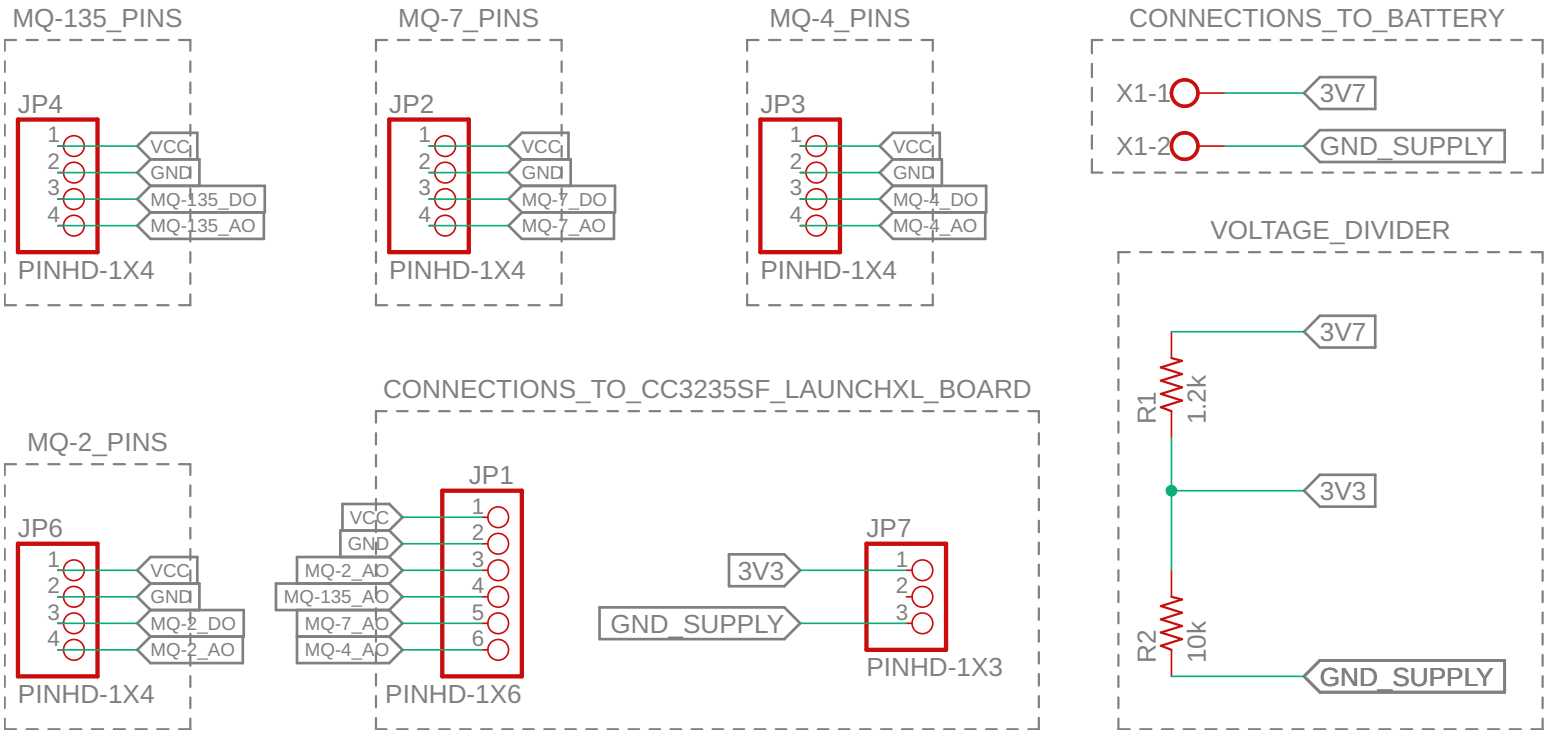
The report contains block diagram of the designed air pollution meter. The Circuit Schematic and PCB layout of the meter. Bill of the materials required for building the meter. The CAD model designed and printed as an enclosure of the meter. The change in sensor readings obtained when changing the environment of the meter. Photographs, video links of the working of the meter which clearly shows how the data is being read by the meter and being sent on the Thingspeak server. Conclusions we obtained and proposed future work which can be done to make the readings more accurate.

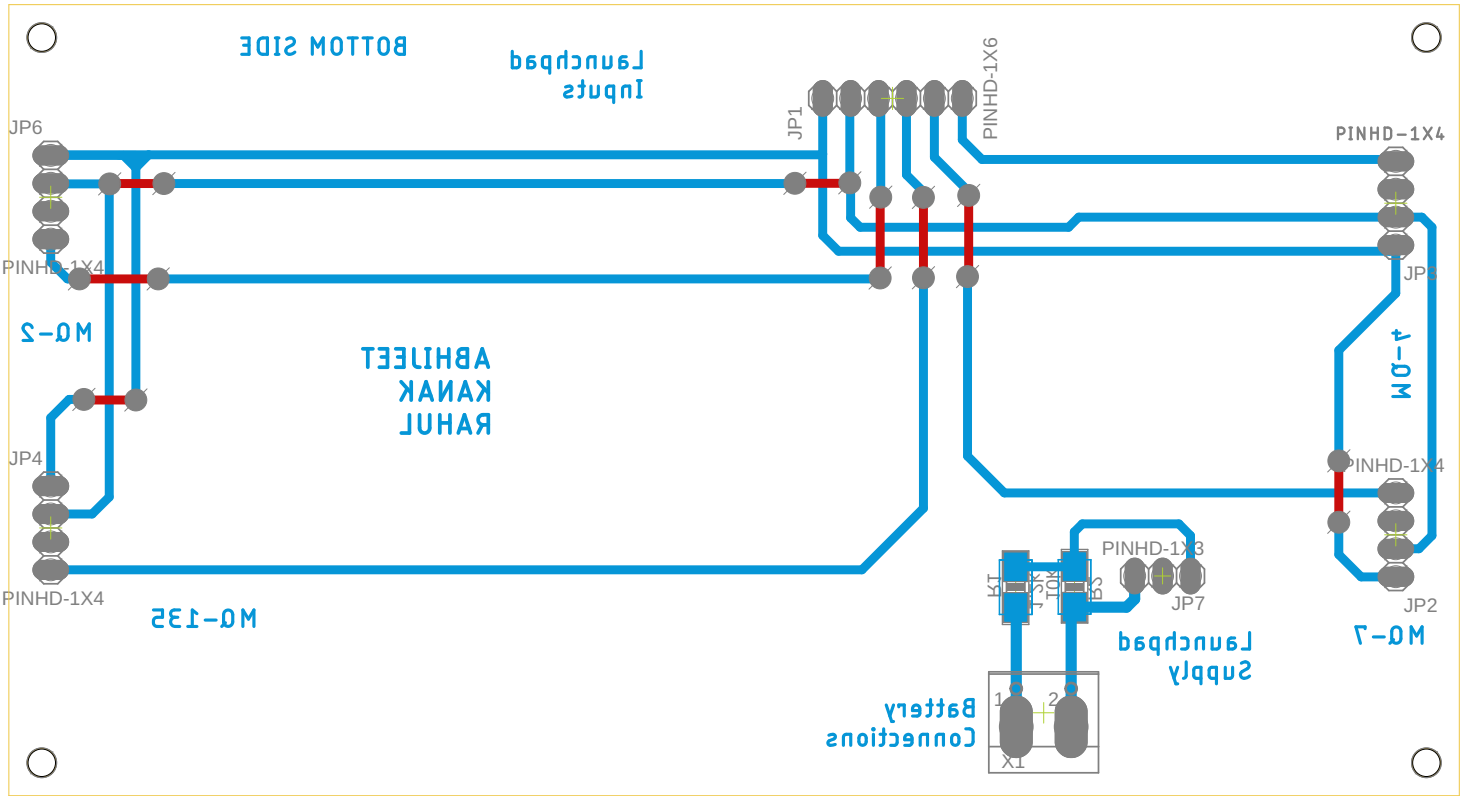
2 Block Diagram



3 Circuit Schematic and PCB Layout

Schematics of our PCB design provide a graphical representation of the electrical connections and components that make up our circuit.
The circuit schematic and the complete PCB layout are given below:


MQ-135_PINS
JP4
1
2
3
4
VCC
GND
MQ-135_DO
MQ-135_AO
PINHD-1X4
MQ-7_PINS
JP2
1
2
3
4
VCC
GND
MQ-7_DO
MQ-7_AO
PINHD-1X4
MQ-4_PINS
JP3
1
2
3
4
VCC
GND
MQ-4_DO
MQ-4_AO
PINHD-1X4
CONNECTIONS_TO_BATTERY
X1-1
3V7
X1-2
GND_SUPPLY
VOLTAGE_DIVIDER
3V7
R1
1.2k
3V3
R2
10k
GND_SUPPLY
MQ-2_PINS
JP6
1
2
3
4
VCC
GND
MQ-2_DO
MQ-2_AO
PINHD-1X4
CONNECTIONS_TO_CC3235SF_LAUNCHXL_BOARD
JP1
1
2
3
4
5
6
VCC
GND
MQ-2_AO
MQ-135_AO
MQ-7_AO
MQ-4_AO
PINHD-1X6
3V3
GND_SUPPLY
JP7
1
2
3
PINHD-1X3


BOTTOM SIDE
Launchpad
Inputs
JP1
PINHD-1X6
JP6
PINHD-1X4
PINHD-1X4
JP3
MQ-2
ABHILEET
KANAK
RAHUL
4-DM
JP4
PINHD-1X4
PINHD-1X4
PINHD-1X3
JP7
JP2
MQ-135
MQ-7
Launchpad
Supply
Battery
Connections
1
2
X1

The distance between the launchpad input pins and the launchpad supply is 4.4 cm vertically and 1.4 cm horizontally from the rightmost pin. This is the exact distance as in the CC3235SF Launchxl Board. The MQ-2 pins denote the female pins to which the MQ-2 sensor will be connected. The MQ-135 pins denote the female pins to which the MQ-135 sensor will be connected, the same will be done with the MQ-7 and MQ-4 pins. The Battery Connections denote the point sets to which the Battery of 3.7 V will be connected to the breakout board. The Launchpad supply is the voltage obtained (3.3V) after the voltage divider circuit. The Launchpad is supplied 3.3V using these pins.

4 Bill of Materials

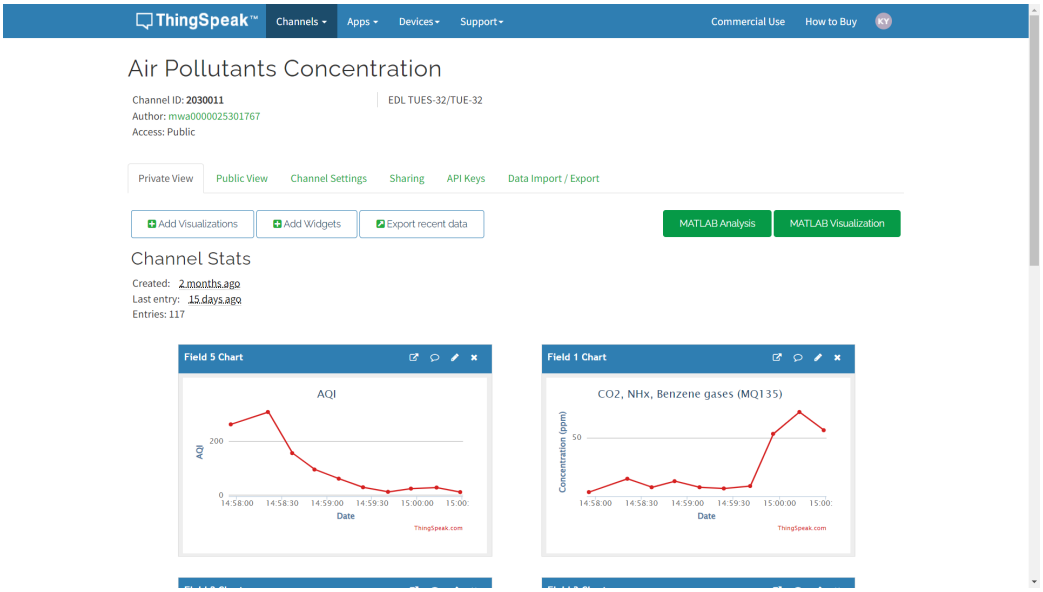
Below is the list of electronic components such as microcontroller launchpad boards, sensors, batteries, speakers and lcd modules which would be required. We have also considered some spare components in the list for safety.

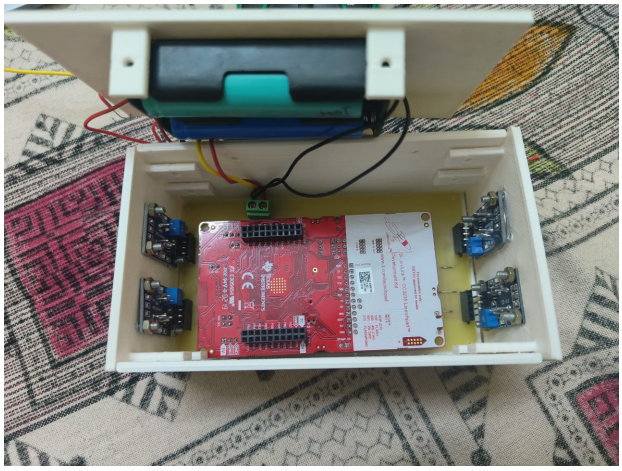
S.No.	Component	Price per unit	Quantity	Requirement
1	LAUNCHXL-CC3235SF	Rs. 5,339.8	1	CC3235 Microcontroller with a built-in Wifi module
2	MQ-2	Rs. 121	3	To detect gas and smoke
3	MQ-4	Rs. 121	3	To detect methane concentration in air
4	MQ-7	Rs. 115	3	To detect CO concentration in air
5	MQ-135	Rs. 125	3	To detect smoke, benzene vapors, and other hazardous gases
7	Power Supply (Battery)	Rs. 150	2	A power supply to provide power to the circuit
8	Battery Holder	Rs. 30	2	To keep the battery attached to the 3D-printed enclosure.

5 CAD Model

6 Results and Observations

We were able to read the sensor values and send them to the Thingspeak server using HTTP Protocol. The sensor values were read using the four ADC channels available on the CC3235SF LaunchXl board. The results are shown in the images below:





This video shows the updation of values from our air pollution meter to the ThingSpeak server in real-time.
This video shows the complete working of the air pollution meter and updation on the server.

7 Conclusions

We were able to build an air pollution meter which was able to measure the change in concentration of pollutants. However, the sensor callibration was done using data available online. Hence, the readings were not too accurate. We observed that the sensors gave higher value when burning paper was placed near it.

8 Future Work

The CC3235SF Launchxl used was damaged, so we will need a replacement for it. The sensors can be calibrated properly using closed chamber gas concentrations for giving accurate results. We need to place multiple air pollution meters across an area so that they can communicate and give overall AQI of an area. This will be the IoT part of the project. A speaker could be added which would produce a sound when AQI levels are too high. This can make people aware that the concentration level of pollutants is too high and wearing masks is advisable. Also, an LCD can be added to show AQI levels on a local scale.