IT890 - Professional Practice / Seminar

Presented To:
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Abstract

Air is one the most important aspect of human life, but now a days due to smoke from vehicles, harmful gases from air-conditioners and refrigerator, burning of crops and forests have degraded air quality in our country as well as globally. Air pollution is among the most dangerous issues to human life. To monitor the quality of air in our surroundings is important in getting information about pollution and harmful it is to our health. In this project, I have made an indoor air quality monitor which will show what is the air quality in our surrounding as well as what is what is danger level associated with it.

Introduction

Air inside the house may seem harmless but there can be colorless and odourless substances in air like carbon monoxide etc. which can affect human health. So for this project, I made Indoor Air Quality Monitoring System which consists of hardware , IOT data aggregation and visualisation platform and an Android App which will show the Air quality status at real time.

HARDWARE COMPONENTS

- Arduino UNO
- MQ135 Gas Sensor
- MQ7 Carbon Monoxide Sensor
- ESP8266 Wifi Chip
- Breadboard
- Wires etc.

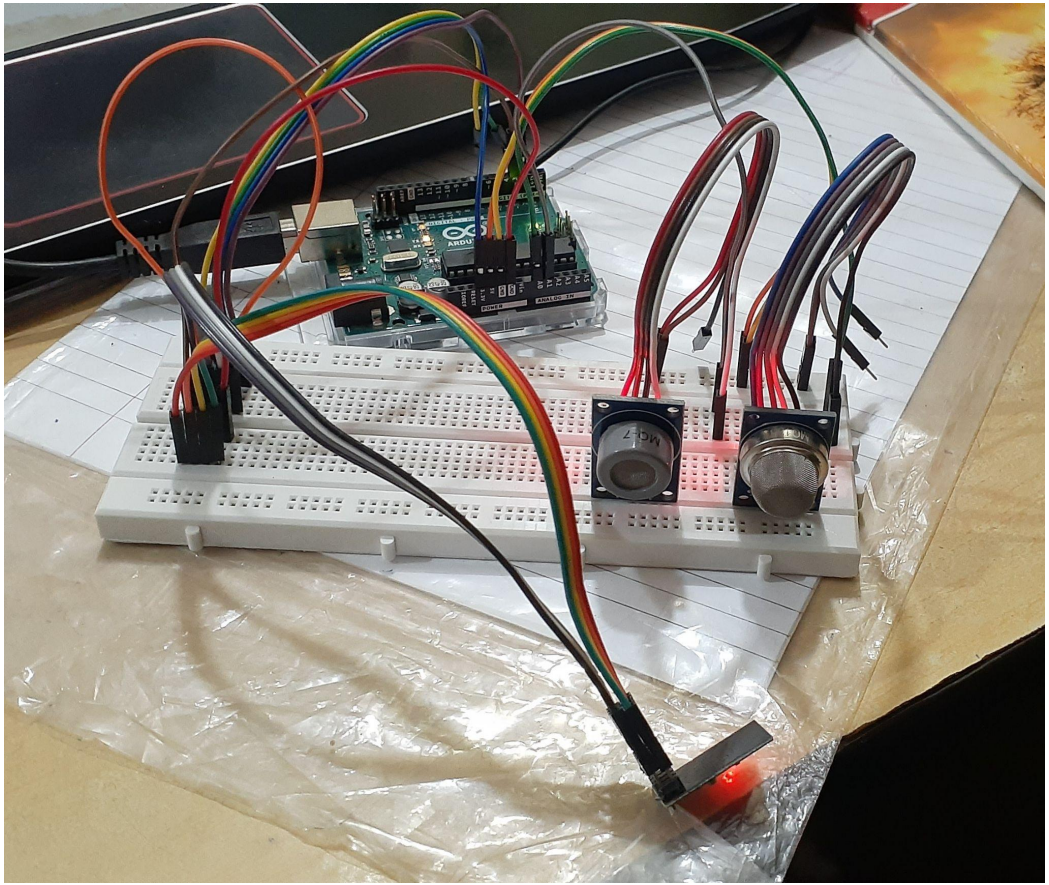


Fig 1 : Air Quality Sensor Connected And Running With Arduino

Arduino IDE

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

Fig 2: Arduino IDE

ARDUINO CODING

Step 1 : I have written the code such that on initialization, it connects to the wifi.

Step 2 : Once connected, it will read values from sensor and push them to thingspeak channel.

Repeat Step 2 after every 1.5 second.

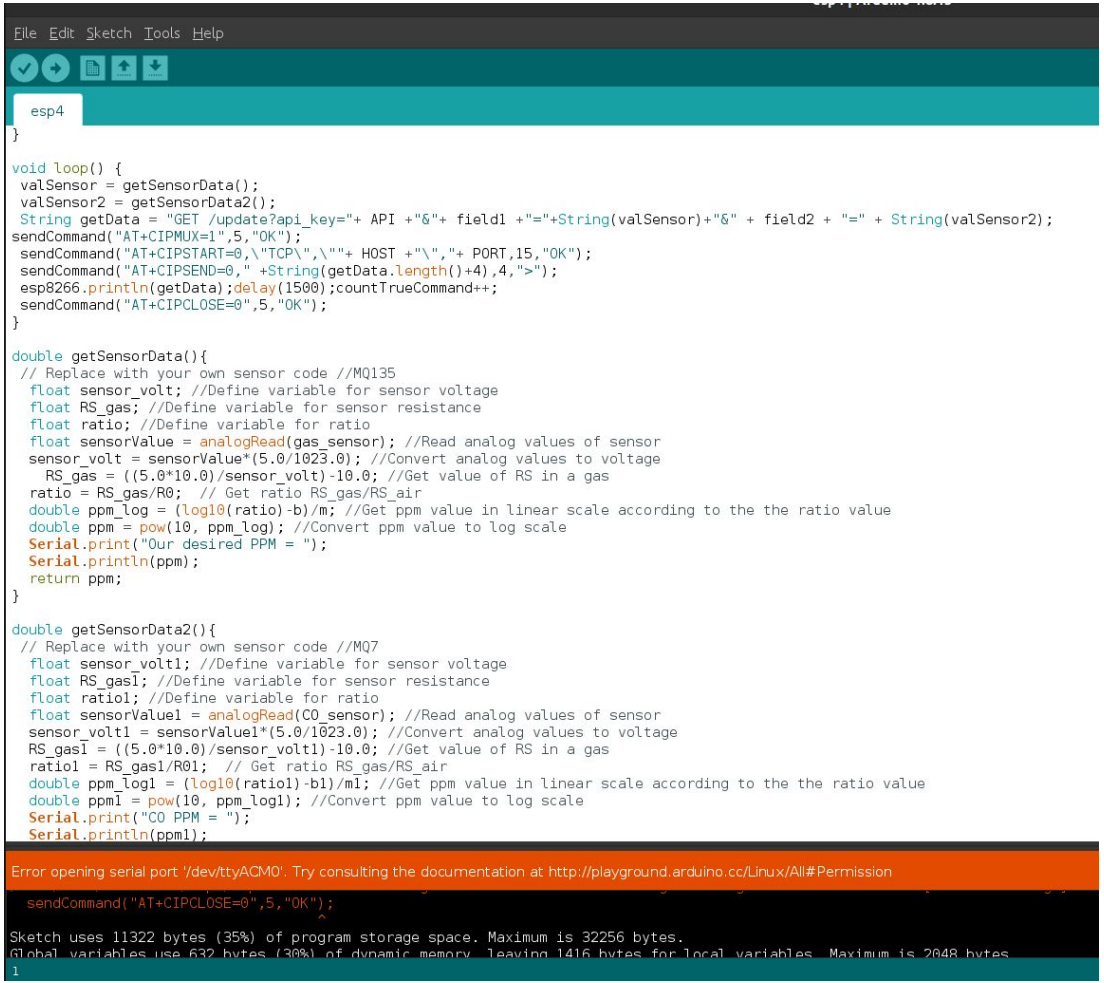
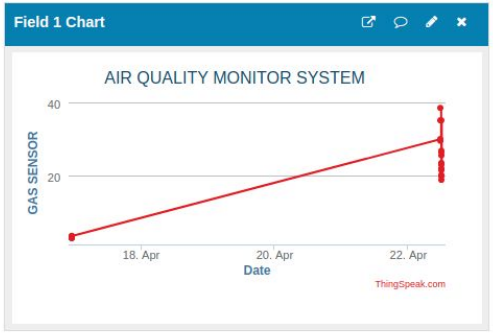


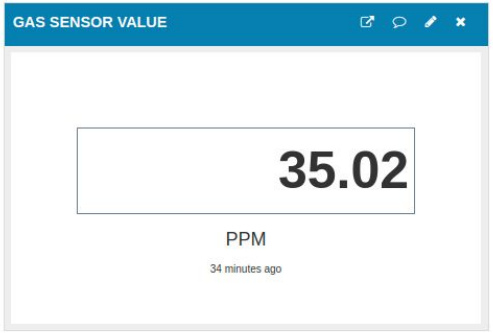
Fig 3 : Code on Arduino IDE

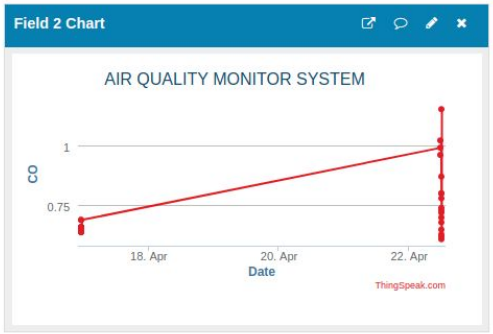
ThingSpeak Channel

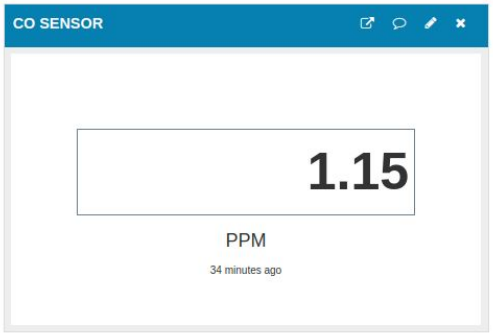
ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize, and analyze live data streams in the cloud. You can send data to ThingSpeak from your devices, create instant visualization of live data, and send alerts.

For data aggregation I have made a thingspeak channel where i am collecting gas sensor and carbon monoxide sensor values.









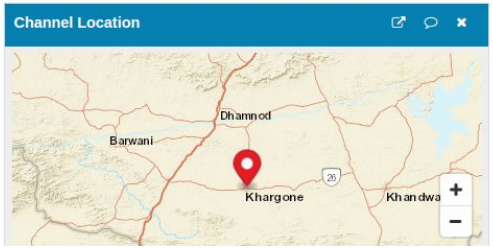


Fig 4 : ThingSpeak Channel Values

Android

I build the android app on Android Studio IDE using Java, XML. It basically shows the air quality in ppm. Based on air quality it shows status also whether air is good,moderate,unhealthy,very unhealthy and hazardous. You can also view current reading of gas sensor as well as Carbon Monoxide sensor as well as the previous trend graph of the data. I have also added text to speech feature in gas sensor pages. I have attached screenshots of all the screens.

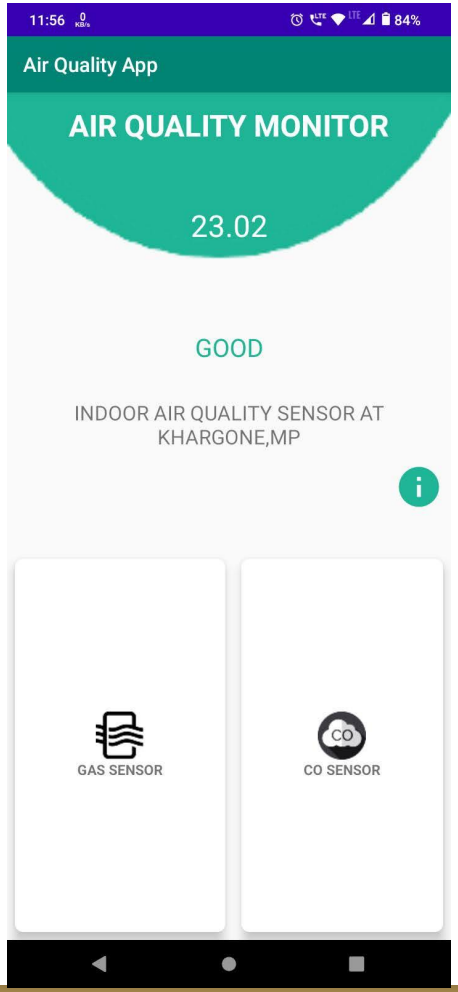


Fig 5 : Home Page

Fig 6: Info Page

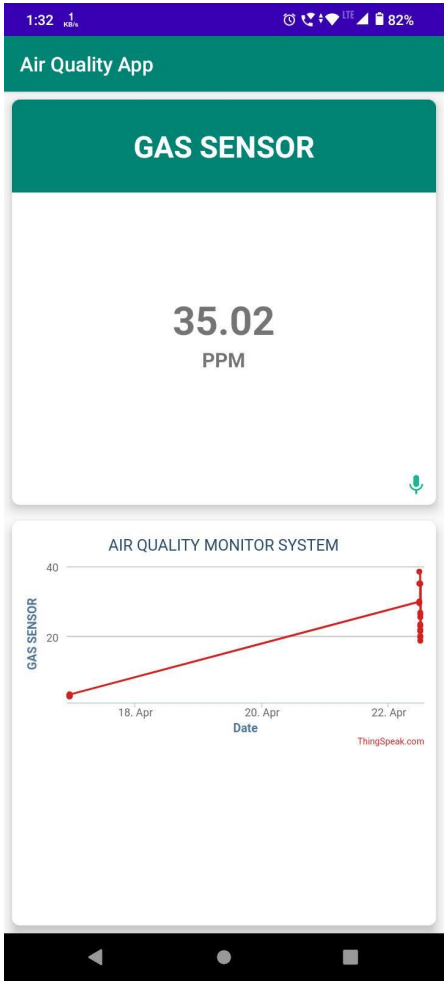


Fig 7 : Gas Sensor Page

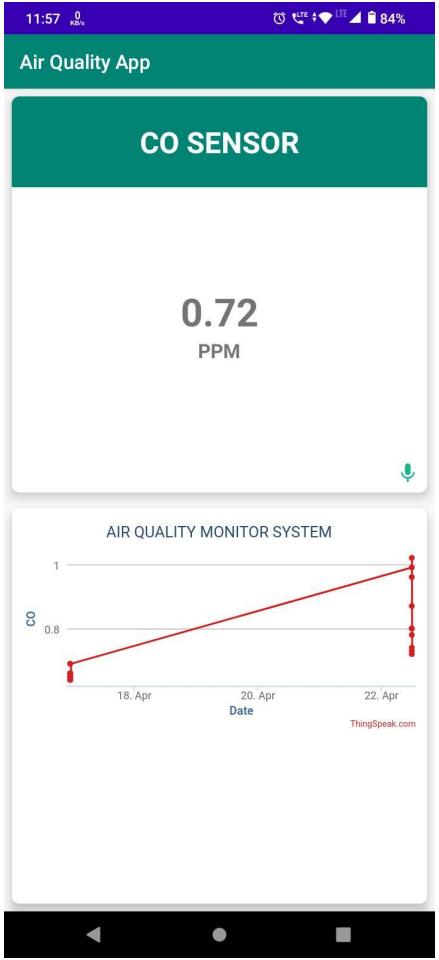


Fig 8 : Carbon Monoxide Sensor Page

ANALYSIS FROM DATA

	entry_id	GAS_SENSOR	CO_SENSOR
count	500.000000	500.000000	500.000000
mean	287.500000	5.190940	0.274000
std	144.481833	3.939452	0.129026
min	38.000000	1.490000	0.150000
25%	162.750000	2.750000	0.200000
50%	287.500000	4.250000	0.240000
75%	412.250000	6.020000	0.280000
max	537.000000	26.280000	0.930000

ANALYSIS FROM DATA

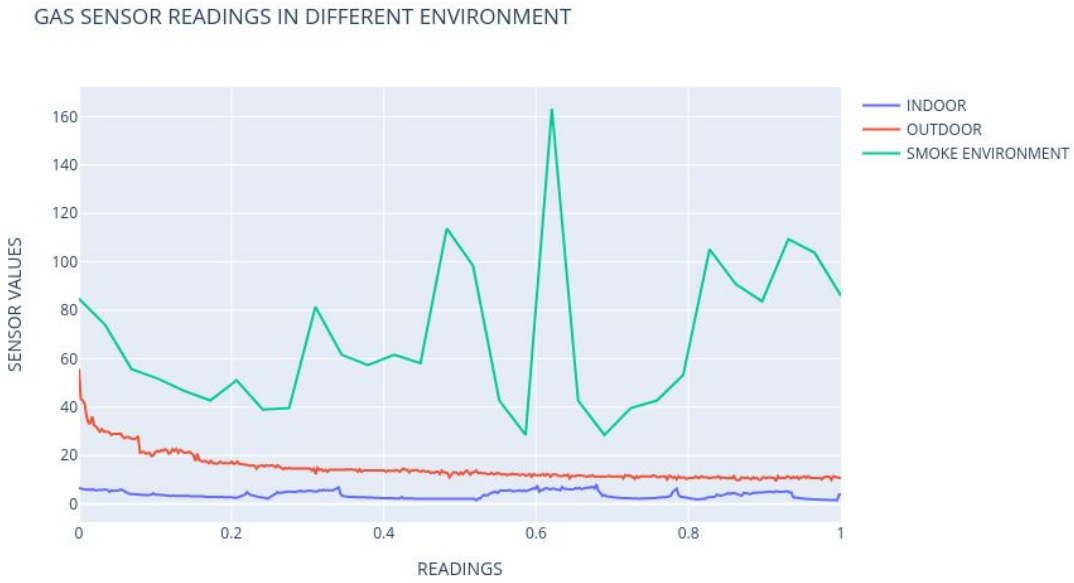


Fig 9 : GAS SENSOR DATA

ANALYSIS FROM DATA

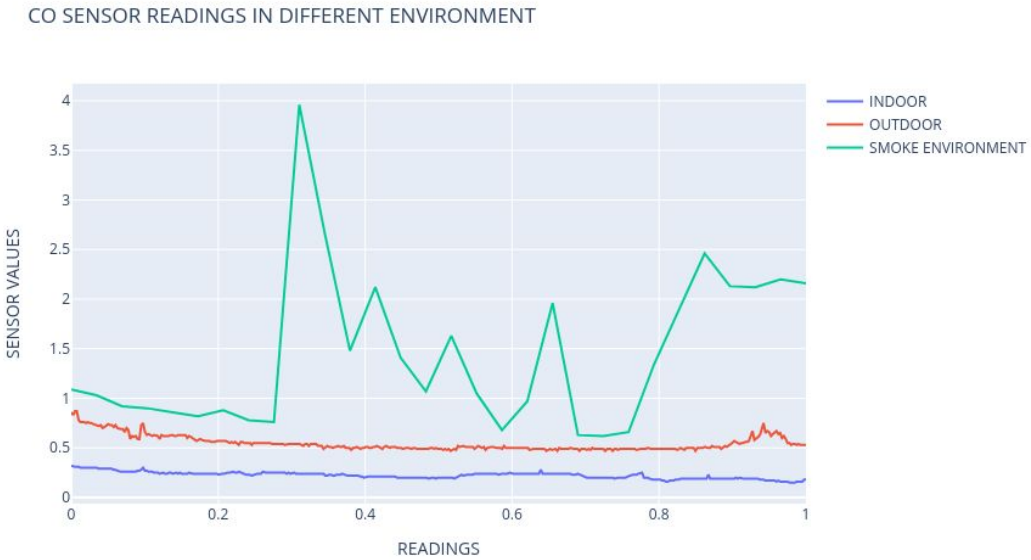


Fig 9 : CO SENSOR DATA

Results

Property	Base Paper	This Project
Sensors Cost	48$ Alphasense brand sensors	5$
Power Supply	0.5 Watt for AQ device	2.5 Watt for Arduino
Sensor Used	O3,NO2	Gas Sensor, CO
Microcontroller	Raspberry pi	Arduino UNO
Cloud Service	Kairos DB, Graphana	ThingSpeak
Total Cost of Setup	500$	50$
Android App	NO	YES

Market Analysis

Device Name	Price	Mobile App	URL
Kaiterra Laser Egg 2 Air Quality Monitor	9,990	No	tinyurl.com/34wdpsr6
Prana Air Quality Monitor	6,490	Yes	tinyurl.com/vtvptew7
Xuuxu Air Quality Monitor	3599	No	tinyurl.com/mae64426
SMILEDRIVE® Portable Air Quality Pollution Meter	7299	No	tinyurl.com/wsp5wsdm
AIRATOM Air Quality Monitor	8,999	No	tinyurl.com/kfz6nkvs

Market Analysis

Device Name	Price	Mobile App	URL
HealthInnovative G7015	5,149	No	tinyurl.com/34wdpsr6
Crusaders AQI	4999	No	tinyurl.com/vtvptew7
IQAir Air Visual Air Quality Monitor	25,300	Yes	tinyurl.com/mae64426
Airveda Air Quality	9,499	Yes	tinyurl.com/wsp5wsdm
Airveda Air Quality With humidity	19,008	Yes	tinyurl.com/kfz6nkvs
Our Air Quality Monitoring System	3000	Yes	

Conclusion

I have made an end to end air quality monitoring system. Now a days, there is a need of this kind of sensors because pollution is increasing day by day. Also the cost of the sensors should be reduced to as minimum as possible. Here the cost of overall system is very less as compared to any other air monitoring system in the market. And none of the commercial air quality monitoring devices gives you monitoring via an android app. I have tried to keep the hardware expenses at minimum but it can be further reduced by using cheaper hardware or different programmable boards. Now a days, There is age of smart systems and with the advancement of IOT we want everything at our fingertips so an Android App is ideal choice for monitoring purpose. Also I used thingspeak as data aggregation platform. This platform is easy to use, but it is little bit slow. Also i used the free version of thingspeak which has a daily limit of fixed messages.

Applications

- Smart monitoring of house in case of gas leak which can cause fire.
- Smart notifications for people who are sensitive of bad air quality can be notified.
- Smoke detection from crop burning in nearby areas.
- Connect with smart devices to close your windows automatically if smoke is coming from outside.
- Air Quality monitoring at large scale in case of smart cities along with humidity and temperature.

Limitation And Future Work

Cost of hardware can be reduced further by using cheaper hardware or other NodeMCU based devices which can bring down cost further.

For Monitoring of multiple sensors situated at multiple locations the current thingspeak channel will not scale. A Database for handling data from all the different air quality sensor monitor units can be created.

References

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