1. Introduction

1.1 Introduction/Motivation

In rapidly growing world we are facing so many issues because of altered environment conditions by human being. On the other hand, Internet of Things changing the lot of things to get a better life style many other things.

The motivation behind this project is decreasing air quality index. According to a report it is found that most of air pollution is done indoor. With the help of Internet of Things concepts, we have designed an Air pollution monitoring sensor using Raspberry Pi which can be implemented in house so that we can keep the track of air pollution in our houses. This small step can make a big difference to air quality in order to keep environment clean.

Air pollution is the biggest problem of every nation, whether it is developed or developing. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization and growing number of vehicles leads to release of lot of gaseous pollutants. Harmful effects of pollution include mild allergic reactions such as irritation of the throat, eyes and nose as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma.

1.2 Brief History and development in the fields of IOT

- IOT is invented by Kevin Ashton.
- The Internet of Things originally came to life as the title of a presentation Ashton made for Procter and Gamble when he was still working there as a brand manager. Before showing his Internet of Things presentation to Procter and Gamble's senior executives, Ashton found out that shade of lipstick from a line of cosmetics he was assigned to launch got sold out every time he passed by his local store.
- The people in charge of Procter and Gamble's supply chain then told Ashton that there was plenty of stock of the lipstick shade that supposedly got sold out at his local store.
- Ashton started to wonder how products can be tracked more accurately so that anyone would know where they are and if they're available at the moment or not.
- At roughly the same time, RFID – or radio frequency identification – tags containing bits of data that could be transferred wirelessly were also being developed.
- The presentation that Ashton made for Procter and Gamble sought to propose how RFID tags can be used to manage the said corporation's supply chain so that the location and stock at hand of each item coming out of it can be more easily monitored.

1.3 Literature Survey

The drawbacks of the conventional monitoring instruments are their large size, heavy weight and extraordinary expensiveness. These lead to sparse deployment of the monitoring stations. In order to be effective, the locations of the monitoring stations need careful placement because the air pollution situation in urban areas is highly related to human activities (e.g. construction activities) and location-dependent (e.g., the traffic choke-points have much worse air quality than average). IOT Based Air Pollution Monitoring System monitors the Air Quality over a webserver using internet and will trigger an alarm when the air quality goes down beyond a certain level, means when there is amount of harmful gases present in the air like CO_2, smoke, alcohol, benzene, NH_3, NO_x and LPG. The system will show the air quality in PPM on the LCD and as well as on webpage so that it can be monitored very easily. Temperature and Humidity is detected and monitored in the system.

1.4 Aim of the project

Aim of this project is to detect quality of air in particular area or home and take required actions on the basis of data provided by sensor.

1.4 Problem Definition

➢ Air pollution is a developing issue nowadays. It is important to screen air quality and monitor it for a superior living for all.

➢ Here framework propose an air quality and also framework that enables us to screen and check live air quality pollution specifically territories.

1.4 Objectives

➢ To regulate the air quality to the required amount.

➢ Creating an awareness about health related issues in people.

➢ Supply data to research investigation.

2. Block Diagram

Figure 1: Block diagram

3. System Design

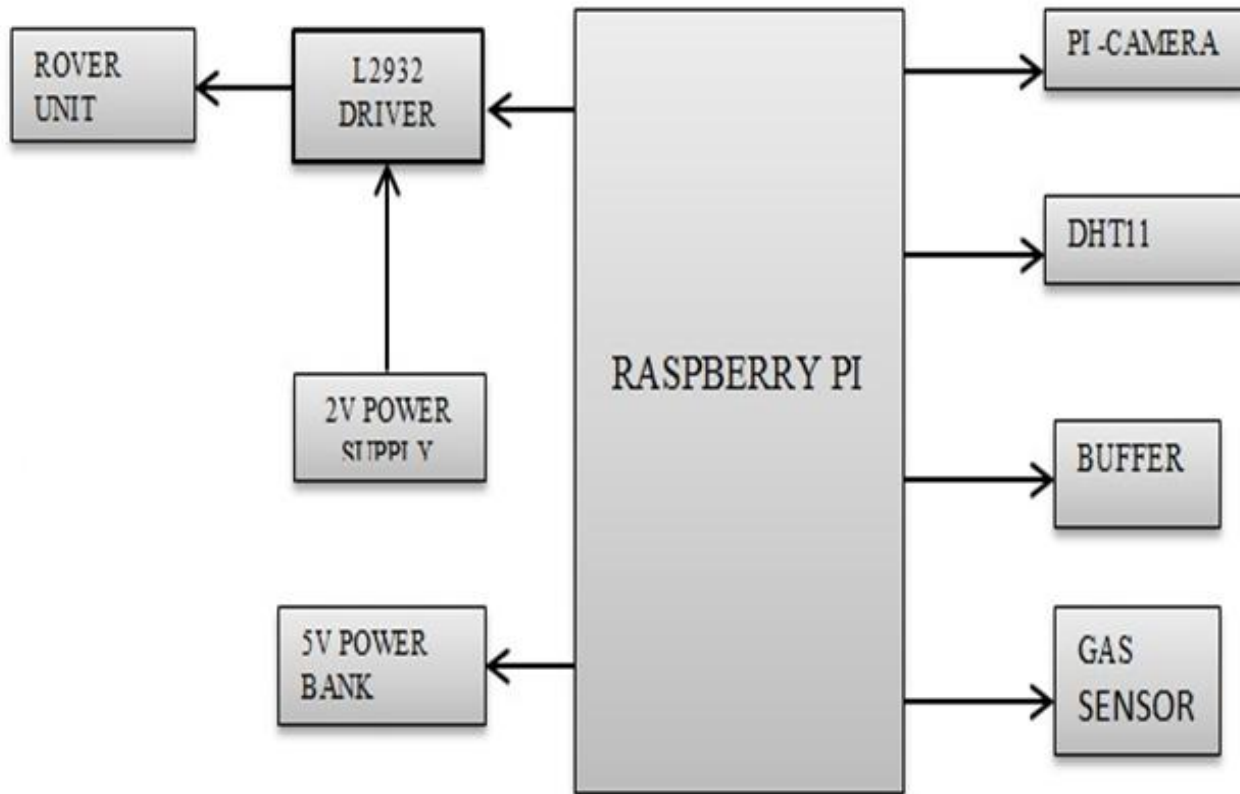## 3.1 Design of each block

3.1.1 DHT11 sensor with Raspberry PI

Figure 2: DHT11 sensor with Raspberry Pi

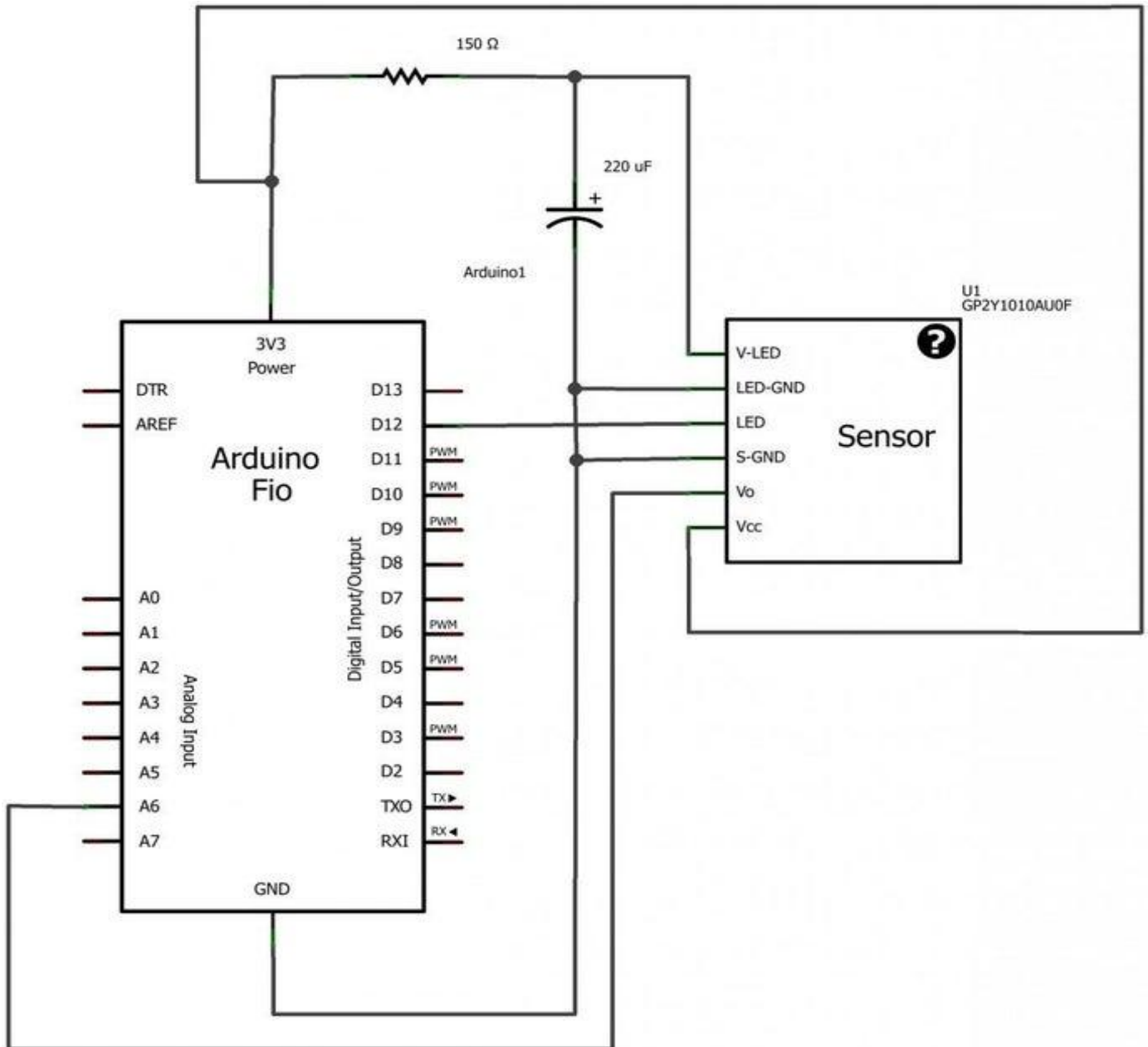**3.1.2 PM2.5 Dust and Particle Sensor Connection Diagram**

Figure 3: PM2.5 Dust and Particle sensor with connection

3.2 Selection of Component and Justification

1) **DHT11 Temperature and Humidity Sensor:**

Operating Voltage: 3.5V to 5.5V

Operating current: 0.3mA (measuring) 60uA (standby)

Output: Serial data

Temperature Range: 0°C to 50°C

Humidity Range: 20% to 90%

Resolution: Temperature and Humidity both are 16-bit

Accuracy: ±1°C and ±1%

2) **PM2.5 Dust and Particle sensor:**

Power supply voltage: DC5 ± 2V

Sensitivity: 0.5V / (0.1mg / m3)

The minimum detection level of particles: 0.8 m

Clean air voltage: 0.9V typ.

Low consumption current (Icc: MAX. 20 mA)

The presence of dust can be detected by the photometry of only one pulse

Enable to distinguish smoke from house dust.

3.3 Working of Block

1) DHT11:

Humidity is the measure of water vapour present in the air. The level of humidity in air affects various physical, chemical and biological processes. Humidity measurement determines the amount of moisture present in the gas that can be a mixture of water vapour, pure gas etc. DHT11 is a digital temperature and humidity sensor. Sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature. The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them.

The IC measure, process this changed resistance values and change them into digital form.

2) PM2.5:

Easy knowing that you can track and sense the quality of the air around you with the PM2.5 air quality sensor with breadboard adapter particulate sensor. This sensor + adapter kit is great for monitoring air quality and super easy to use. We have code for both Arduino and CircuitPython. 9600 baud data streams out once per second.

PM2.5 concentration in both standard and environmental units. Particulate matter per 0.1L air, categorized into 0.3um, 0.5um, 1.0um, 2.5um, 5.0um and 10um size bins. The sensor box as well as the cable and a 0.1 / 2.54mm breakout board so you can wire it easily. We only need power plus one data pin (UART TX), power is 5V and logic is 3.3V.

3.4 Algorithm and Flowchart
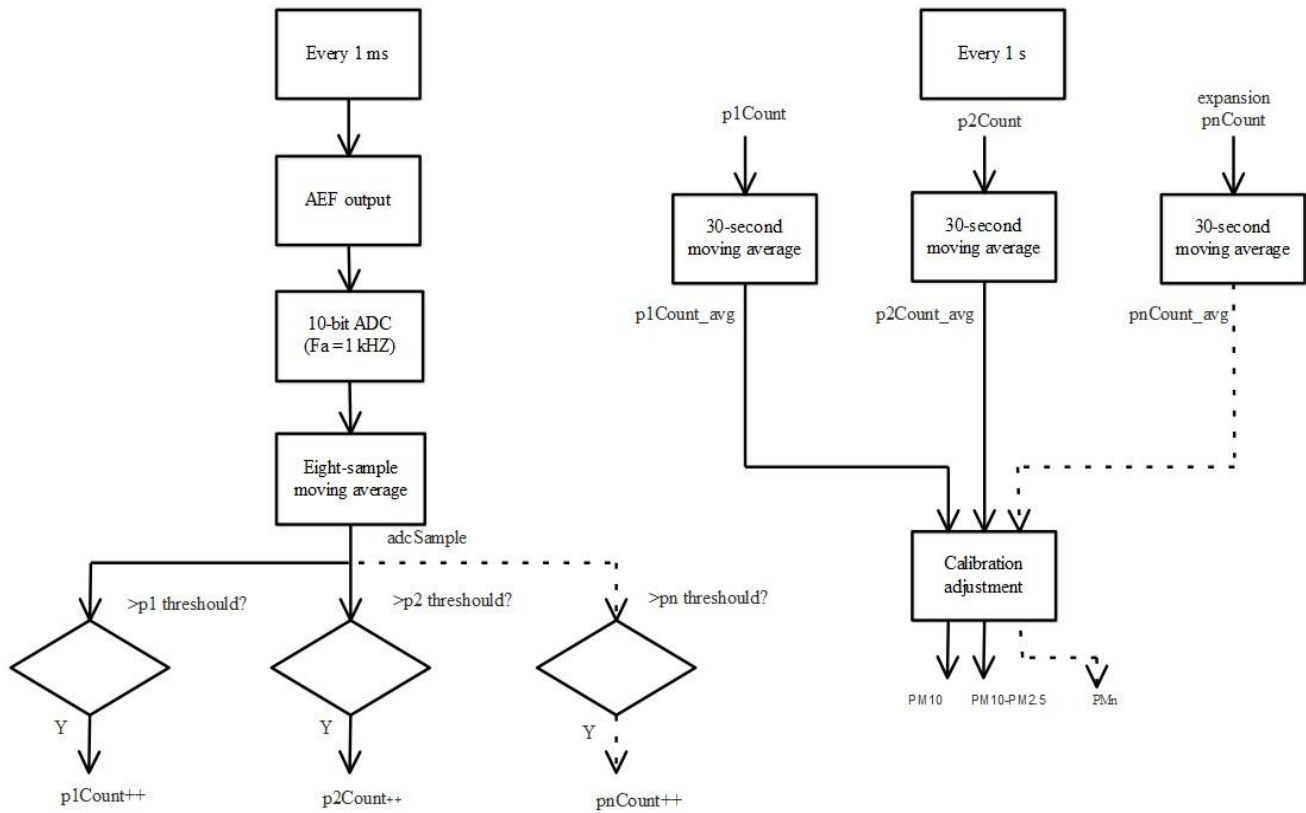
Figure 4: Algorithm and Flowchart

3.5 Software specification

1) Raspbian: A free and open source operating system that is based on Linux. It is optimized for the Raspberry Pi, making it light yet powerful.

2) Python: A high-level programming language that lets you work more rapidly and integrate your systems more effectively. It is the main method that used to interact with the GPIO (General Purpose Input Output) port. Like the Raspbian, python is free and open source software.

3) Dependencies Software:

    i) pip: Allows the installation of python modules easily, reducing time waste and complexity.

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ii) RPi-GPIO: Software that allows the Pi to interface with the GPIO ports.

3.6 Testing

IOT testing is a type of testing to check IOT devices. Today there is increasing need to deliver better and faster services. There is a huge demand to access, create, use and share data from any device. Let's investigate the broad testing types.

Usability Testing:

There are so many devices of different shape and form factors are used by the users. That's why checking usability of the system is very important in IOT testing.

Compatibility Testing:

There are lots of devices which can be connected though IOT systems. These devices have varied software and hardware configuration. That's why checking the compatibility in IOT system is important.

Reliability and Scalability Testing:

Reliability and Scalability is important for building an IOT test environment which involves simulation by utilizing virtualization tools and technologies.

Data Integrity Testing:

It's important to check the Data integrity in IOT testing as it involves large amount of data and its application.

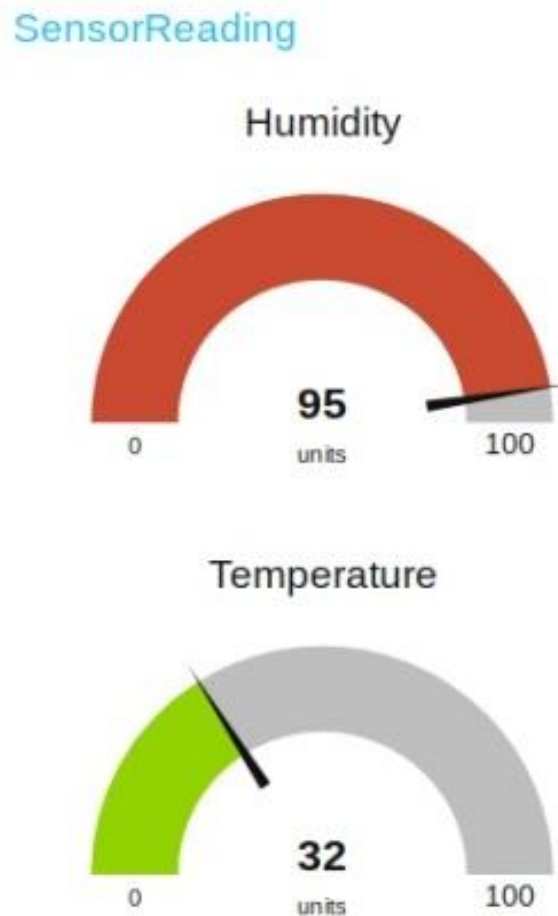**Performance Testing:**

Performance testing is important to create strategic approach for developing and implementing an IOT testing plan.

4. Results

4.1 Input Output Screens

Mobile App:

SensorReading

Humidity

95
units

0   100

Temperature

32
units

0   100

Figure 5: Humidity and Temperature sensor reading
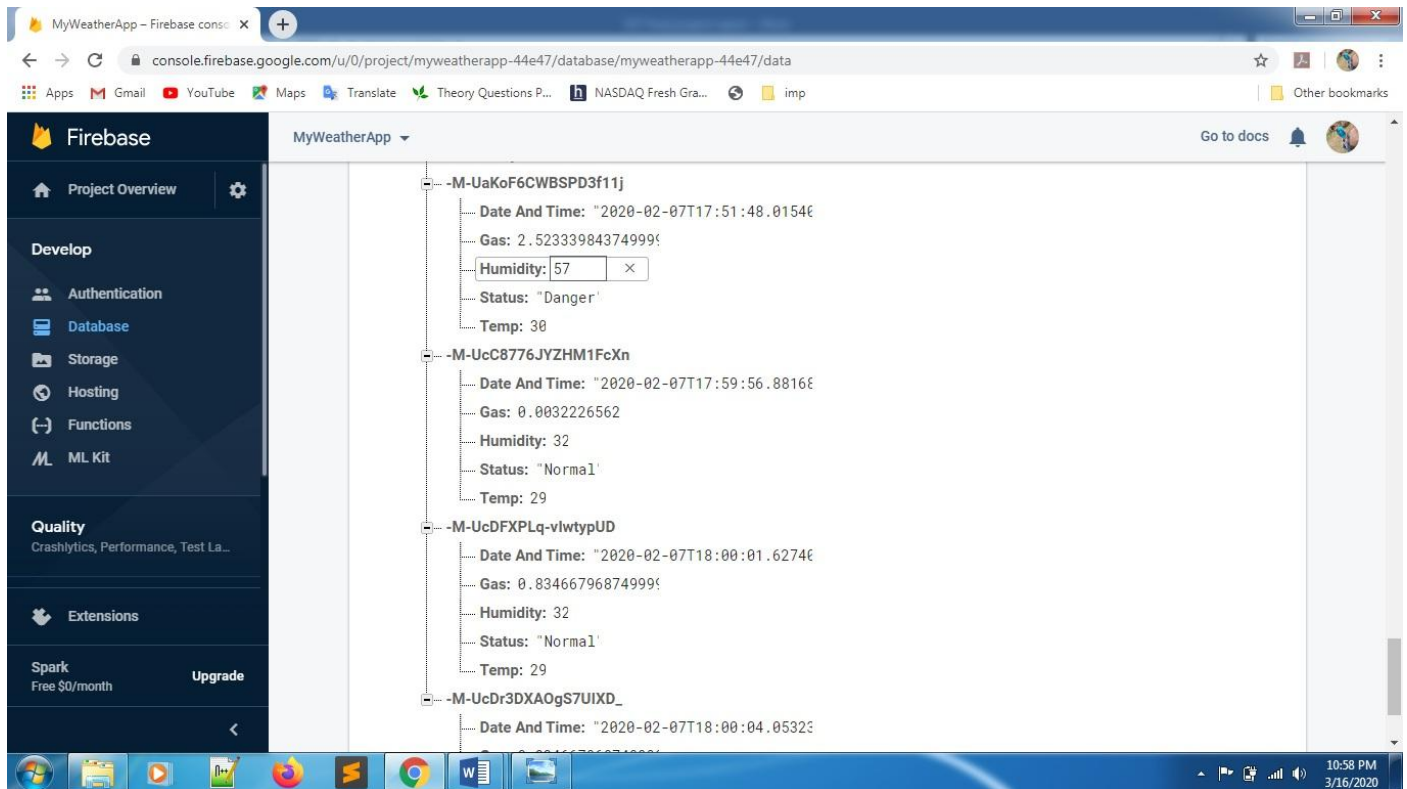
Firebase:

Figure 6: Firebase Database

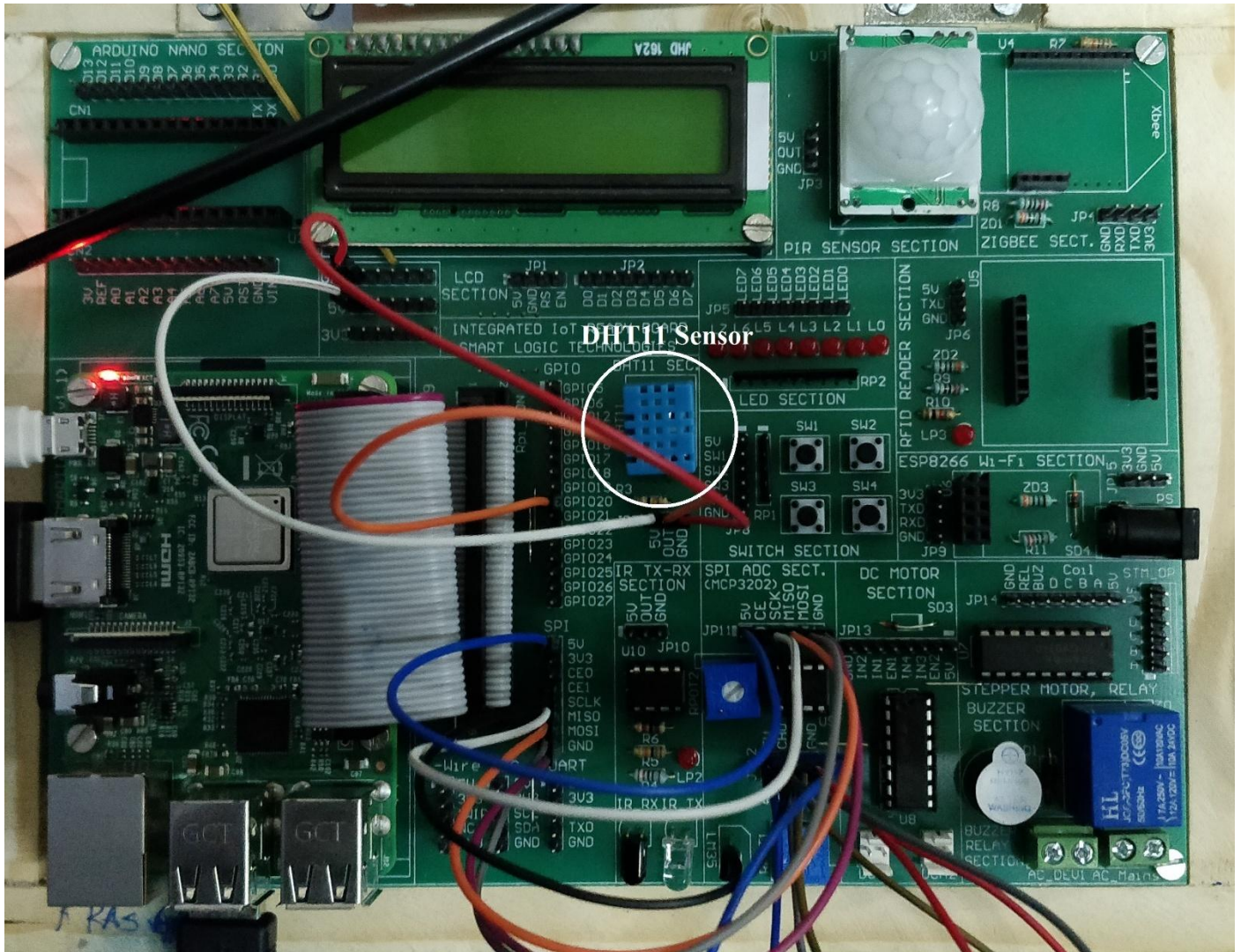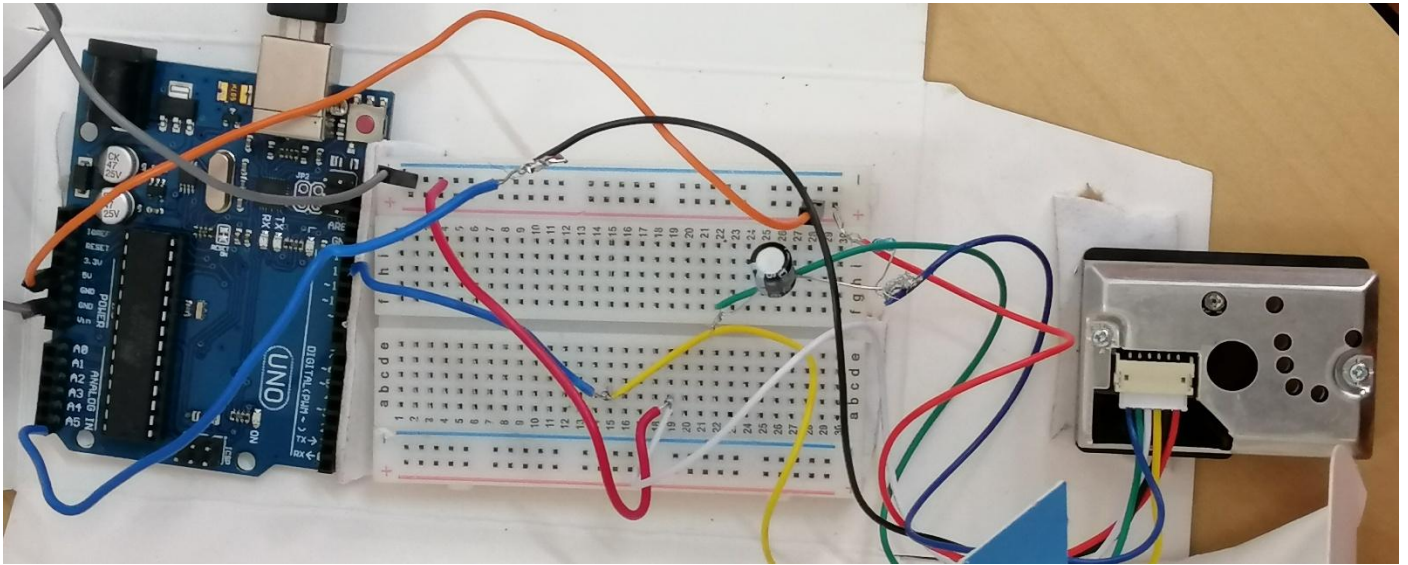## 4.2 Photo of Prototype

1) DHT11:

Figure 7: DHT11 sensor

2) PM2.5:

Figure 8: PM2.5 sensor

4.3 Project Result

Air quality status is successfully displayed on mobile app as normal, moderate or danger. Also temperature and humidity of air is displayed on mobile application shown in figure 5(Humidity and Temperature sensor reading), simultaneously sensor reading data like gas, humidity, temperature and status are saved in firebase database shown in figure 6(firebase database).

5. Future Scope

Increasing air pollution is a one of the big problem for us in upcoming years. This Air Pollution Monitoring System will help people to know that they are living in area with bad air quality. This is a very good step to make a ground level change to make big difference if this sensor integrated with IOT framework used for collect data and make use of it to keep our air clean.

6. Conclusion

The proposed IOT based air pollution system is a good device to measure the air quality in outdoors and indoors. This device can be useful to measure the level of gases in a highly dense area like hospitals, home school etc. If data is stored, we can use the data for further experiments which can conclude a significant result. This system is IOT based so it can be used in the smart home for the purpose of cooling, ventilation and other purposes. IOT will enhance the artificial intelligence in the world, so the system can be used in automated systems in factories and industries. This device can be used to understand the air quality in different condition and can be helpful to understand their effects on the environment and human life. These systems can become very helpful for the society as the respiratory health conditions are increasing day by day. Due to their high sensitivity these systems can be used in chemical industries.

7. References

1) www.wikipedia.org

2) www.arduino.cc/

3) https://circuits.io/