Design and Development of Air Purification

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Abstract - The presence of dust is the most pervasive issue in today's atmosphere. Human routine will become unstable as a result of health problems caused by dust stability in the air. It is likely that a less expensive and more cost-effective filtration system will help alleviate this problem by removing these types of impurities from the air. Since it has such a negative impact on people's health, declining air quality has been elevated to the status of a major environmental concern. Many of these fine particles are related to airborne infections and other fine particles. In India, people are paying close attention to and debating the dangers of urban air pollution to their health. On the other hand, policymakers are primarily concerned with controlling specific sources, but the wide variety and complexity of sources makes it difficult to see the action taken and its subsequent influence on improved air quality quickly. Traffic intersections in many cities throughout the world, but particularly in Indian cities, have seen elevated levels of air pollution. It's possible that site-specific air pollution control can help reduce pollution levels in particularly contaminated areas. Recent years have seen an increase in environmental pressure, which has resulted in a lot of people's attention to air purification. As modern society progresses and pollution levels rise, people's expectations for a better quality of life rise. Adsorption and decomposition or transformation of various air pollutants in the pedestrian environment can be accomplished by a mobile biological air purifier. This device can improve air quality while saving energy, protecting the environment, and looking good. Its purifying effect can be maximised, and it has a wide range of applications. Our proposed work details the design and implementation of a portable air purifier that is both efficient and convenient. Small places can benefit from the device's improved air quality. Our proposed system has the capability of air filtration. This system is fully internet of thing based that can be communicate with our developed android application. We can remotely monitor the status of the air Purifier like air parameters, current temperature, and humidity, etc.. We can on and off our air filter via our designed android application and also check feedback, this is a very cost-effective system and this sends real-time data to a database that data can be retrieved via the android application.

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1. Introduction

While the economy, quality of education, agriculture, industry, and many others are all crucial to the world's long-term development, the environment is arguably the single most significant component. A clean, pollution-free, and risk-free environment is essential for the survival of humanity and the development of any nation. As a result, keeping an eye on it is crucial for making sure people in any country may live long, healthy lives. Monitoring the environment (EM) entails preparing for and responding to natural disasters, reducing pollution, and coping with the difficulties that emerge from unsanitary external conditions. Environment and emergency management (EM) is concerned with issues like water pollution, air pollution, dangerous radiation, weather changes, earthquakes, and so on. Both human activity and natural phenomena contribute to pollution levels, and it is EM's job to find solutions to these problems so that the environment can continue to support a thriving human population. Recent developments in science and technology, especially in the fields of artificial intelligence (AI) and machine learning, have elevated EM to the status of a smart environment monitoring (SEM) system, allowing for more precise monitoring of the factors affecting the environment and better regulation of pollution and other negative outcomes. Smart city planning and design are gradually replacing conventional approaches to the development of metropolitan areas. Using wireless networks, smart city planners can keep tabs on how much pollution vehicles are adding to the air. Environmental problems, such as those caused by poor air quality, polluted water, and radioactive waste, are on the rise. In order to keep the global population healthy and promote long-term economic growth, proper monitoring is essential. In recent years, thanks to developments in the IoT and cutting-edge sensors, conventional environmental monitoring has given way to a more sophisticated smart environment monitoring (SEM) system. In light of this, the purpose of this publication is to conduct a critical evaluation of significant contributions and research studies on SEM, particularly as they relate to the monitoring of air quality, water quality, radiation contamination, and agricultural systems.

2. Literature Review

Md Mamunur Rashid et. Al(2019) The main goal of this research is to create a low-cost, high-tech, wirelessly-operated face mask that purifies the air around the user. This system can be operated wirelessly, but it can also be used manually. Both the battery-powered operation and the whisper-quiet air pump ensure the test subjects' safety and comfort. At about $21.825 USD, the system is affordable in both poor and developed countries. A low-power component (using no more than 55 mA) is essential to the operation of this system. On a single charge, it may last for about 8 hours. Future design revisions may make it more cost-effective. [1]

Jonas Matulevicius et. Al (2014) In order to provide air filtration, electro spinning was utilized to deposit electrospun polymer fibers onto a mat, giving the mat malleable qualities that could be manipulated. Both the concentration of the polyamide 6 and polyamide 6/6 solutions and the solvent content had a notable effect on the diameter and shape of the electro spun nanofibers. Our research shows that polyamide 6/6 has a wider electrospinnable range than polyamide 6, which results in a more uniform fiber diameter (60-511 nm) (90–236 nm). Fibers of consistent diameter were collected in formic acid and formic acid/acetic acid 3: 2 (vol/vol) solvents at lower polymer concentrations, while formic acid and formic acid/dichloromethane 3: 2 and 3: 1 (vol/vol) solvents at higher concentrations produced fragmented and continuous spider-net like structures. At greater electric field strengths, thicker polyamide 6 electrospun fibers were made, while at lower electric field strengths, finer polyamide 6 fibers were formed. The voltage was raised to create thicker polyamide 6/6 fibers. [2]

Yaeseul Sung et. Al(2019) The created smart air quality monitoring system can assess multiple types of indoor air pollution and keep the users updated on the findings. By spending less time in polluted areas, users would be less likely to be negatively impacted by the pollution. Particulate matter (PM), carbon monoxide (CO), carbon dioxide (CO2), volatile organic compounds (VOCs), temperature, and humidity were all monitored to enhance air quality. Connectivity to the smart app was guaranteed by establishing three separate networks: Bluetooth, Wi-Fi, and the farther-reaching Lora network. The communication chain begins with the smart air monitoring device sending data to the application, which in turn sends the data to the server. The data gathered by the created gadget is uploaded to a cloud server for further use in air quality predictions. The accuracy of the air quality monitoring system was verified by comparing the transmitted data to that from other, trusted devices, showing that the data was consistent with both. [3]

Kyu-Ho Kim et. Al(2021) The demand for air purifiers has soared in recent years due to the rising levels of both air pollution and public awareness of the health risks posed by small particles. Due to increased public awareness of the health risks associated with breathing in fine and ultra-fine dust, the demand for high-efficiency air purifiers that are able to efficiently filter out particles as small as PM2.5 has increased dramatically. An entirely new category of always-useful household gadgets was birthed when humidification was added to air purifiers. [4]

Mohd Ridzuan Daruna et.Al(2020) This research provides a theoretical framework for realising the potential of learning factories in bridging the gap between the professional and academic spheres. Using blockchain technology in the learning factory for Air Purifier production can boost students' knowledge and abilities through industrial partnerships. After these students complete their education, the industry will have access to a new pool of talent. Without widespread participation from businesses and the right infrastructure, the concept of the "learning factory" would never take off. Research focuses on the procedures, facilities, and educational plans. It was discussed at length how the learning factory is connected to the outside world. While blockchain technology has the potential to be a game-changing tool for manufacturing, it is still plagued by technical issues like scalability and security. Blockchain's scalability problem has been addressed by proposing remedies such as extensive optimization and a complete rebuild of the network. More data on the blockchain necessitates more storage space, which increases the likelihood of consolidation. Although it has many benefits, a learning factory can be challenging to establish and maintain. A lot of people and resources are needed, but that's alright since it's an investment in the future, and investments in the future normally provide better returns than anticipated. The primary difficulty is assigning sufficient resources to pay the costs of student travel related to increased mobility. Since projects can lead to living costs, we need to meticulously define credit hours, equipment, processes, and diversity. Colleges and institutions should use caution when assigning students to projects within this framework, as there are variable degrees of complexity. [5]

Jonathan Sidwel (2014) There is a broad variety of air purifiers on the market today, each employing a somewhat different technique. Some may use HEPA, charcoal, ionising, ultraviolet (UV), and possibly many other technologies. Moreover, some purifiers use a combination of technologies, allowing for more intricate operation and improved performance, and ultimately better results. Therefore, go with the alternative that meets your requirements without breaking the bank. The purpose of a high-efficiency particulate air (HEPA) filter is to filter out infectious airborne particles. Therefore, a HEPA filter is a worthwhile investment for those who suffer from dust or pollen allergies. High Efficiency Particulate Air (HEPA) filters are required to be extremely effective before they can be marketed as such. HEPA filters are designed to remove airborne particles as fine as 0.03 microns with a typical efficiency of 99.97 percent. [6]

Khaja Jamaluddin (2021) The proposed technology, an automated air management system, offers a substantial improvement in minimizing the greatest threat. If you're concerned about the state of the air around you, the air-monitoring system can help. As well as being technologically cutting-edge, it's a fantastic tool for encouraging healthy living. In the future, more sensors may be added to determine the precise composition of all gases in the air, an SD card could be used to store data, a GPS module could be added to track pollution in real time, and the information could be made publically available. [7]

JOHAN BODIN et. Al (2010) This chapter addresses the research topics posed by the project through examination of the relevant literature, interviews, observations, and development carried out in China. Success in achieving objectives is documented in this chapter as well. Poor indoor air quality is common in urban homes because of the increasing industrialization that pollutes outdoor air with toxins including industrial dust, smog, and other particles from transportation. A home air purifier is the recommended solution from the perspective of the end user. A purifier can help those who have trouble breathing. [8]

Ertie Abana et. Al (2020) In order to accurately convert the PM2.5 concentration sensed by the fan controller of an indoor air purifier into AQI levels of health concern, fuzzy logic is required. After the defuzzification was finished, the motor's input voltage was analyzed. Based on the results of the tests, installing an automatic fan controller in an indoor air purifier can help save money on utility bills while maintaining a satisfactory level of air quality for the most part. Proponents of the current invention propose converting the voltage regulator and servo motor of an indoor air purifier into a dimmer circuit, allowing for more precise control over the voltage supplied to the fan. Also, a digital potentiometer, rather than a mechanical one, should be used to control the voltage, as it provides finer-grained resistance adjustments. [9]

Noah Bergam et. Al (2020) The proposed module has the potential to make public spaces like dining halls, classrooms, and workplaces safer where people congregate around tables by separating the tables and purifying the air surrounding and between them. This module has the potential to greatly improve public health programmes all across the world as quarantine laws are relaxed and public life is resumed. The next stage of development for this module is to create a working prototype of the air purifier. The prototype would be evaluated in both standalone and building-wide configurations. Once the module is developed to the stage of mass production, the manufacturing process will be assessed and refined to increase productivity without sacrificing quality. [10]

Xiaoke Yang et. Al (2017) In this paper, we'll discuss how to monitor and control indoor air quality using an open-platform, WiFi-enabled system. The offered hardware and software design is validated by experiments executed in a realistic office context. The current study is primarily concerned with controlling PM2.5 levels in the air, but it can be extended to regulate other environmental parameters such as humidity and the networked control of wireless sensor and actuator networks. [11]

Jing Lianga et.Al (2019) The above analysis can be used to deduce the user's opinion on the air purifier's outlet design. Users favored positioning the outlet on the air purifier's upper edge, away from potential obstructions, to increase the device's efficiency in recalculating clean air. An air outlet area between 50% and 75% is the sweet spot where user preferences and practicality meet. A more substantial vent is desirable if you wish to clean the air in a room. On the other hand, this trend is not reflected in shoppers' favorite locations. It will show signs of physical and mental exhaustion if the air intake is too large. An eye-tracking study has a defined purpose, in contrast to the semantic differential method. Because it measures the subject's actual physiological reaction and provides insight into the subject's subconscious processes, the eye-tracking study falls under the category of biometric research. For instance, the scale score had trouble taking into consideration the fact that people's eyes would be naturally pulled to the purifier's upper when viewing the experimental photo. The semantic differential is an effective method for analysing thought processes. Your score on the exam is the end result of all of your mental thought. [12]

Yining Wang et. Al (2020) With the use of a microcontroller (STM32F407), a particle matter (PM2.5) sensor, and a Bluetooth (BLE) connection module, we propose a novel method for designing air purifiers in this study. It is not possible to check the indoor air quality remotely and in real time with a regular air purifier. Therefore, modern smart air purifiers seem very different from their ancestors. The smart air purifier uses computer programming to accomplish its primary purpose of intelligent and automatic sensing of air quality. Additionally, it can monitor the indoor air quality in real time. In this study, we proposed a smart and simple design process that enables remote system monitoring and control using mobile devices. The stability of the fan's rotational speed is affected by MATLAB's simulation of low harmonic current, which is performed during the background modeling phase. By incorporating a filter circuit, we are able to get rid of the low-harmonic current. The testing results show that this filter circuit is more successful at reducing the low harmonic current caused by the fan's rotation. [13]

Akanksha Dhamija et. Al (2019) The Internet of Things (IoT) is a system that enables the interconnection and networking of disparate items for the exchange and manipulation of information. This suggested initiative intends to reduce the time and effort expended on mundane, routine activities. The system is fully automated, meaning that every five seconds, it analyses the air quality index and turns on the air filter if it's not good to breathe. In order to conserve energy, the system turns off the air filter when the air quality reaches a preset threshold. By having the system automatically turn on and off the air filter, the filter's lifespan can be increased (HEPA). It is thanks to this system that we are able to keep the air in our cities clean. [14]

Atharv Bharaswadkar et. Al (2022) More and more research is being done on the topic of how people make use of things like tools and gadgets. Many man-hours have been invested by researchers into creating a simple method of requesting services. Using Internet of Things (IoT) technology to manage devices is becoming more and more common, which speaks well for future progress. Appliances that can connect to the internet are used in the proposed system as well, including an air purifier. The findings not only demonstrate the system's progress towards end-user satisfaction, but also address their issues. Due to the fundamental idea of IoT, it may be necessary to reevaluate current procedures, implement new ways of gathering and transmitting data, or even start over. Researchers might focus on a number of crucial research issues even while they iron out the flaws in the final operational definition. [15]

Yangjun Li et. Al (2017) We evaluate the existing status of indoor air and the necessity of developing an air monitoring system in this study. With so many potential sources of indoor air pollution to consider, we chose on the GP2Y1010AU0F optical air quality sensor to measure dust levels and the MQ138 sensor module acquisition to gauge the prevalence of volatile organic compounds (VOCs) such aldehydes, alcohols, and ketones. We also measured the humidity and temperature of the room with a DHT11 sensor. After collecting data, we display it on a time-synchronized LCD12864 using the wireless transceiver module and sound an alarm if the air quality index climbs above a certain threshold. The potential of the monitoring and purifying device is high because of its small size, low power consumption, and numerous uses. [16]

Paola Fermo et.Al (2021) Extensive testing has shown that the HYLA-EST gadget effectively reduces airborne concentrations of volatile organic compounds (VOCs) and PM. Reducing PM10 and PM2.5 was shown to be 16.8- and 7.25-times as effective as before. Both PM10 and PM2.5 concentrations have decreased drastically as a result, by roughly 90% and 80% respectively. For indoor situations with VOCs concentrations in the hundreds of parts per billion up to more than 1 ppm, the level frequently observed in homes, using the HYLA device as an air purifier resulted in a reduction of around 40%. Finally, tracking the device's performance in relation to the concentration of VOCs deliberately released into the environment reveals that the initial VOCs concentration can be restored in under 2 hours. Focusing difficulties would increase until they were intolerable if the air filter weren't used. Therefore, it can be stated that the HYLA-EST device can be used to improve the indoor air quality by reducing airborne particles and volatile organic compounds that may be present as pollutants emitted by various domestic activities like, for example, cleaning operation, cooking of food, personal cleanliness, beauty product use, etc. Due to the need for improved indoor air quality in connection with the spread of the COVID-19 pandemic, air purifier systems could be efficiently implemented in densely populated and critical sites (like schools or waiting rooms in physicians' offices, for example). Also, it was observed that the number of particles, especially the fine fraction, decreased while the device was in operation, which is good news for indoor air quality since smaller particles are more likely to reach the pulmonary alveoli. [17]

Arnon Jumlongkul et. Al (2021) In this study, we outlined the procedures necessary to make a water-based air filter suitable for both indoor and outdoor use. Within 5 minutes of using an air pump-based purifier, particle counts decreased, as predicted. It is suggested that the water storage tank be chlorinated to aid in the disinfection process. Those who are curious about these methods can use the data presented here to construct their own devices. The next experiment should use a particle counter that can identify particles smaller than 0.2 m, extend the length of the test, clarify an optimal ratio of disinfectant technologies, link some monitoring instruments with the internet of things system, compare the efficacy with a HEPA filter air purifier, and so on. Finally, I think this proposal could help us jointly overcome the environmental crisis and the worldwide COVID-19 pandemic. [18]

3.1 Methodology

3.1 Proposed System

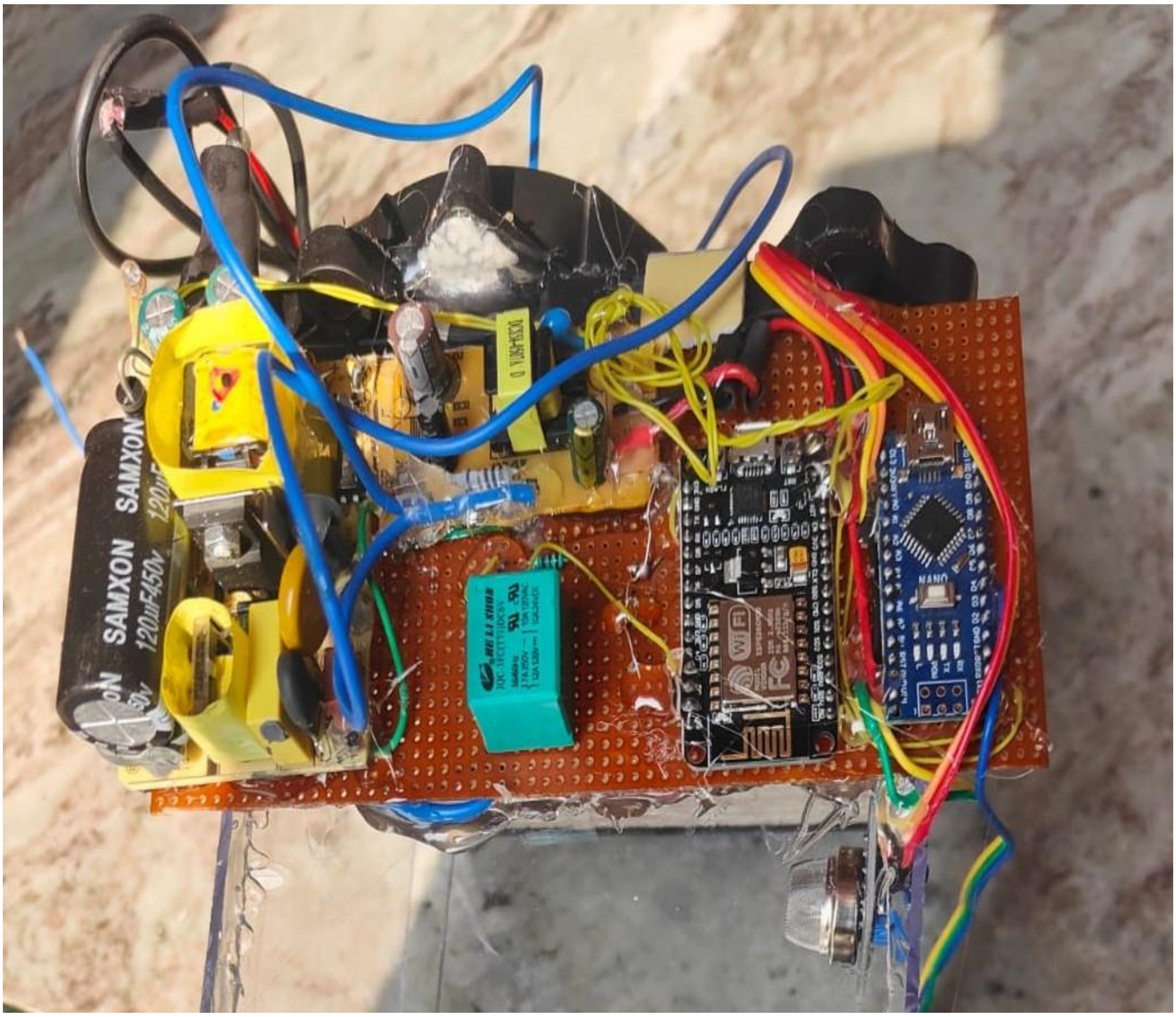

Figure: 3.1 Proposed System

In the above figure we can see our proposed designed system.

3.2 Proposed Work Design

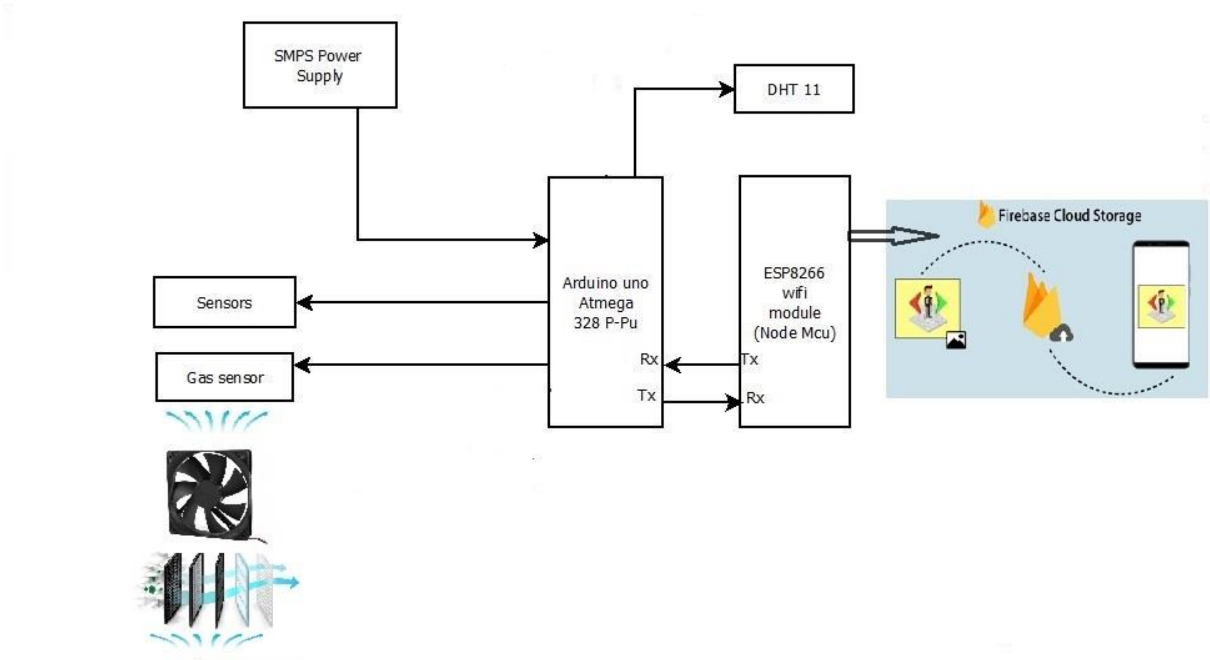

Figure: 3.2 Proposed Work Design

The above figure is the block connection diagram of our proposed work, in this figure we can see here we used two development boards that are are Arduino nano development board and the esp8266 wifi board, Arduino development board is used for processing all the sensors data that are connected to this board, here we used senor like air quality sensor, temperature, and humidity sensors their sensors are placed outlet air side after filtration, all the data processed by Arduino nano sends to esp8266 wifi module via serial communication protocol, then this data read by esp8266 with 9600 baud rate and esp8266 extract this data and publish this data to a real-time firebase database from firebase database android application retrieve data and print this data on the application screen.

3.3 Arduino Code Flow Chart

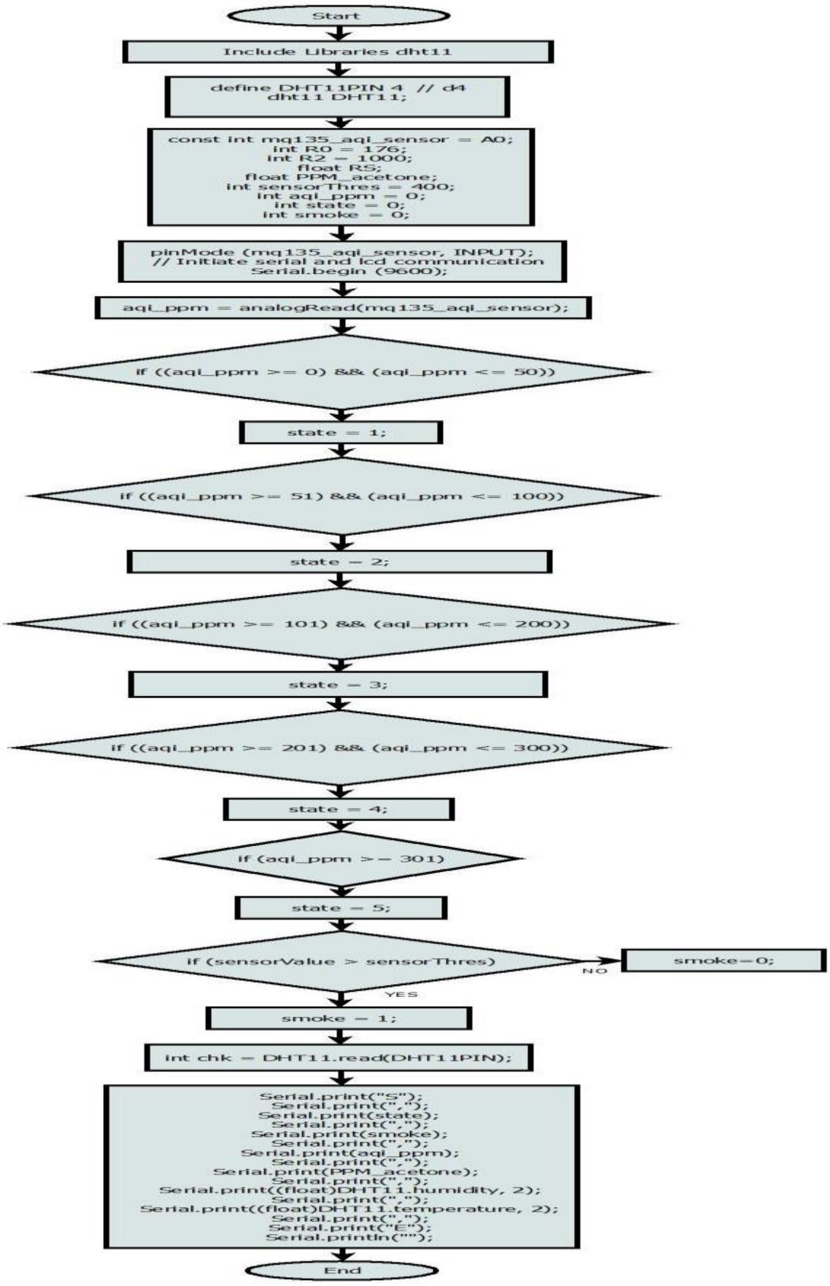

Figure: 3.3 Arduino Code Flow Chart

The above flow chart is our Arduino code flow chart, in this flow chart we can see 1st code starts then all the libraries include including dht11 for getting the temperature and humidity data then the pin is defined for connecting the sensor on pin number 4 of the Arduino that is digital pin 4, then initialize data type for record value, of the sensor, threshold value, state, smoke, etc. then initialize pin for air quality sensor and start serial communication with serial begin function with the baud rate of 9600, after this, a condition will be checked that is if AQI data between 0-50 then the state will be 1, then if AQI data between 51-100 then the state will be 2, if AQI between 101 to 200 then the state will be 3, if AQI between 201 to 300 then the state will be 4, if AQI greater then 301 then the state will be 5, then other condition will be check that is if senor value above from the threshold value then smoke =1 it means

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smoke is detected if this condition is not true then smoke = 0, it means smoke not detected, after this process temperature and humidity data read from dht11 sensor, then all the data send to node MCU (esp8266) via serial communication by using serial.print function all the data sends in the form of a string, this string start from S, and end form E and all the sensors data is split with a comma(,).

3.4 NodeMcu Flow Chart

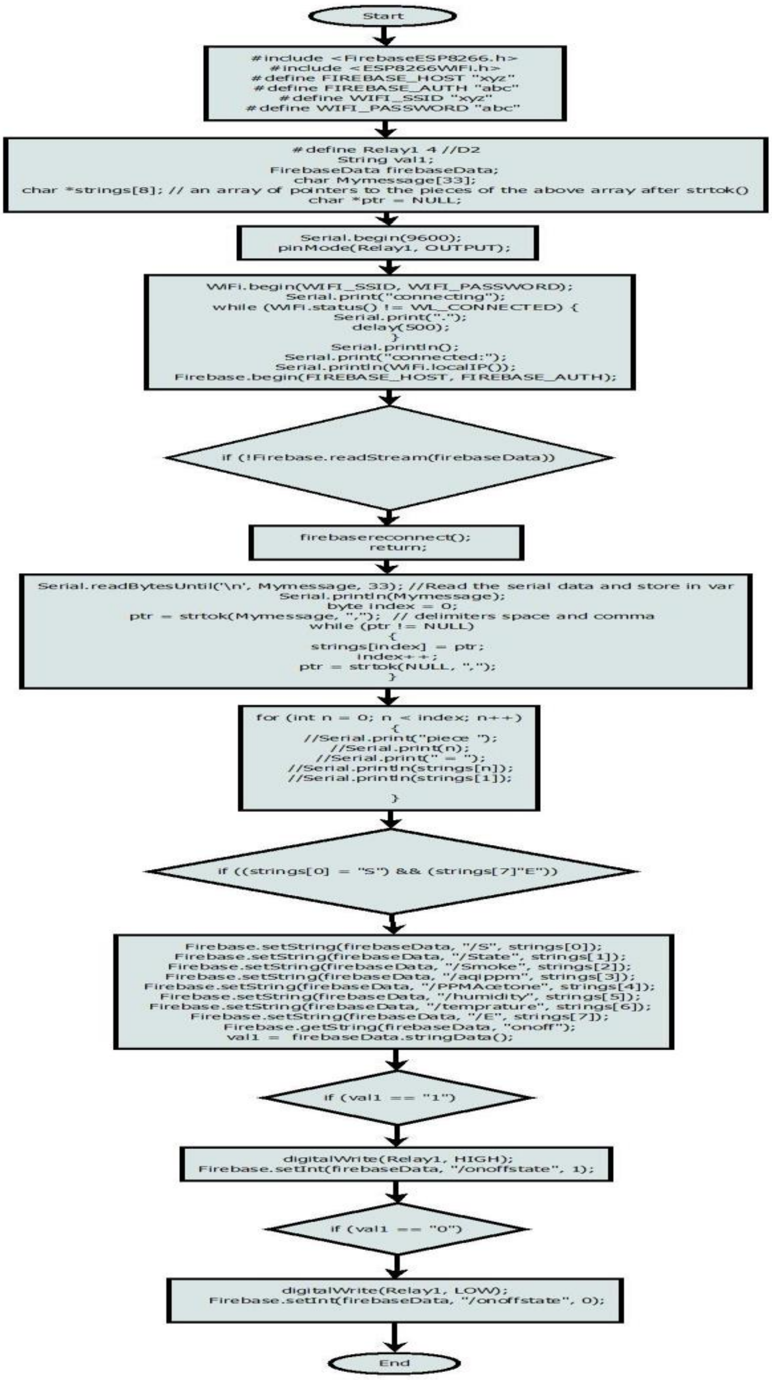

Figure: 3.4 NodeMcu Code Flow Chart

The above flow chart is our node MCU code flow chart in this flow chart we can see 1st all the libraries including that is firebase, and esp8266, and define the firebase host and authentication and wifi SSID and password for establishing wifi connection to the router. then relay pin is defined at pin number 4 of the nodemcu is digital pin number 2 of the nodemcu and the val1 string is defined for record data get from firebase, and a pointer is defined for save comma separated value, then serial communication starts with the baud rate of 9600, then wifi is started and try to connect with pre-saved SSID and password if that match then prints on the serial monitor connected else print connecting, once wifi connected to the router then also print local Ip on the serial monitor. after this process connect to the firebase database. then read serial data from the RX pin. then this string data is extracted by using comma-separated values with strtok function and adding all the data in the different index. then a condition will be checked that is if the received string starts from "S" and end with "E" then all the separated data publish on the firebase database. then a condition will be checked if val1==1 (data get from database “onoff” string), if this is true then relay pin is high and “onoffstate” on the database is 1 this is for feedback and if val1==0 then the relay is low and “onoffstate” is 0 then code ends and this loop repeats again and again till then system connected to a power source.

3.5 Data Base Communication Flow Chart

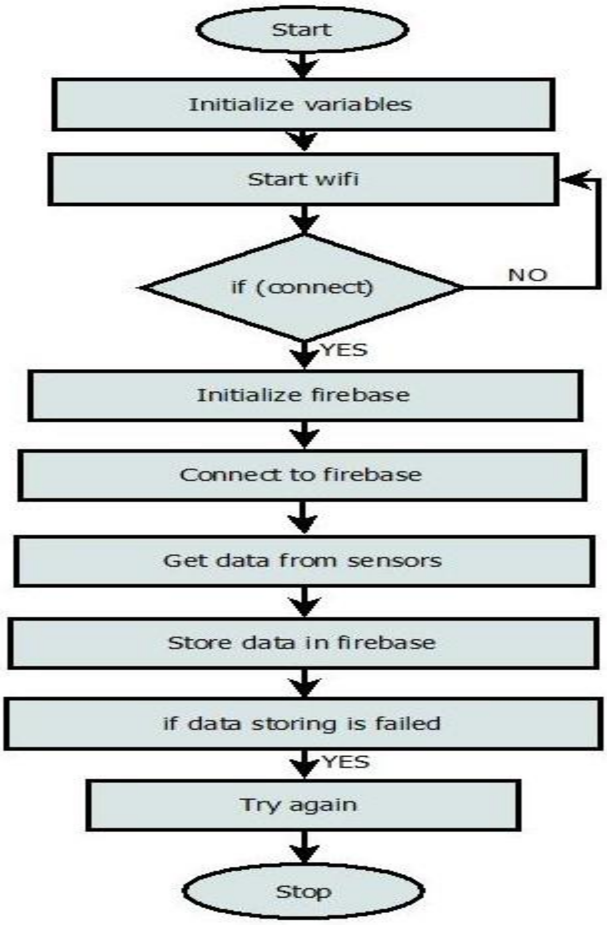

Figure: 3.5 Data Base Communication Flow Chart

The above figure is the flow chart of data communication flow chart from database, in this figure we can see 1st start then initialize all the variables then start searching the wifi network then a condition will be checked that is if connect, if this true then initialize firebase and connect to firebase database if it is not true then again search wifi networks, after connect to the firebase realtime database, get sensors data and store this data on a firebase in different strings. if data storing is failed then try again then stop, this loop repeat continuously.

4. Results

4.1 Serial Results

In the below figures we can see serial results generated by the arduino board, here we can see different data of different sensor with different time interval.

```
COM6

Air Quality: 137
AQI Unhealthy
PPM_acetone:-222.52
Smoke not Detected
Air Quality: 135
AQI Unhealthy
PPM_acetone:-222.52
Smoke not Detected
Air Quality: 136
AQI Unhealthy
PPM_acetone:-239.53
Smoke not Detected
Air Quality: 134
AQI Unhealthy
PPM_acetone:-248.23
Smoke not Detected
Air Quality: 134
AQI Unhealthy
PPM_acetone:-266.02
Smoke not Detected
Air Quality: 132
AQI Unhealthy
PPM_acetone:-266.02
Smoke not Detected
Air Quality: 132
AQI Unhealthy
PPM_acetone:-266.02
Smoke not Detected
Air Quality: 131
AQI Unhealthy
PPM_acetone:-275.12
Smoke not Detected
Air Quality: 131
AQI Unhealthy
```

Figure: 4.1 Serial Data 1

In the above figure we can see air quality index in ppm, acetone ppm and smoke status and AQI type with time interval first.

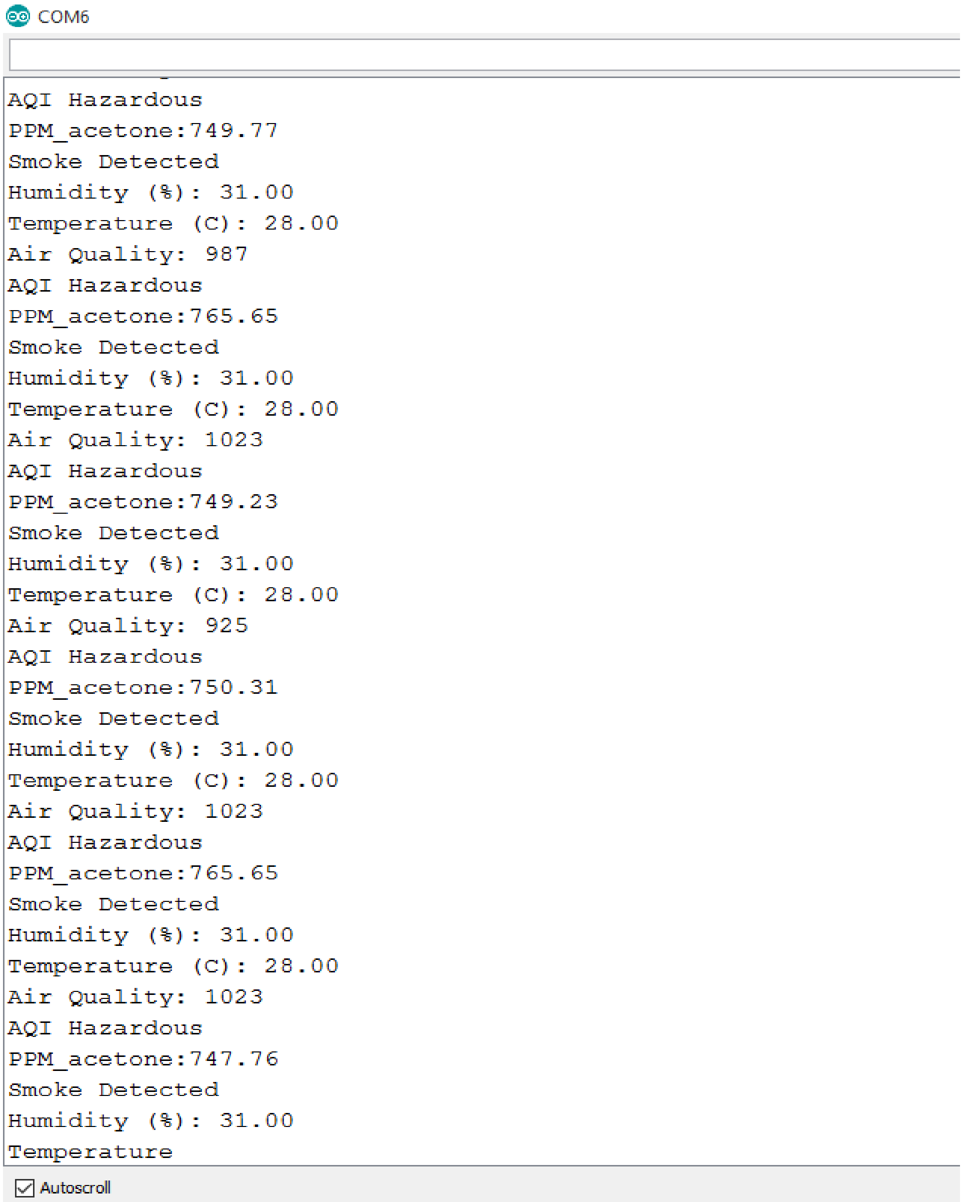

Figure: 4.2 Serial Data 2

In the above figure we can see air quality index in ppm, acetone ppm and smoke status and AQI type with time interval second with different environment.

```
COM6

Humidity (%): 31.00
Temperature (C): 28.00
Air Quality: 974
AQI Hazardous
PPM_acetone:765.65
Smoke Detected
Humidity (%): 31.00
Temperature (C): 28.00
Air Quality: 1023
AQI Hazardous
PPM_acetone:746.46
Smoke Detected
Humidity (%): 31.00
Temperature (C): 28.00
Air Quality: 927
AQI Hazardous
PPM_acetone:753.49
Smoke Detected
Humidity (%): 31.00
Temperature (C): 28.00
Air Quality: 1017
AQI Hazardous
PPM_acetone:765.65
Smoke Detected
Humidity (%): 31.00
Temperature (C): 28.00
Air Quality: 1023
AQI Hazardous
PPM_acetone:747.95
Smoke Detected
Humidity (%): 31.00
Temperature (C): 28.00
Air Quality: 932
AQI Hazardous
```

Figure: 4.3 Serial Data 3

In the above figure we can see air quality index in ppm, acetone ppm and smoke status and AQI type with time interval third with different environment.

COM6

```
S,4,0,214,311.70,36.00,23.00,E
S,4,0,284,431.28,36.00,23.00,E
S,5,0,331,491.34,36.00,23.00,E
S,5,0,374,523.77,36.00,23.00,E
S,5,1,391,542.77,36.00,23.00,E
S,5,1,420,555.86,36.00,23.00,E
S,5,1,427,560.02,36.00,23.00,E
S,5,1,423,552.46,36.00,23.00,E
S,5,1,416,556.70,36.00,23.00,E
S,5,1,430,552.46,36.00,23.00,E
S,5,1,425,549.00,36.00,23.00,E
S,5,1,422,549.00,36.00,23.00,E
S,5,1,420,534.45,36.00,23.00,E
S,5,1,409,532.55,36.00,23.00,E
S,5,0,404,529.67,36.00,23.00,E
S,5,0,397,503.83,36.00,23.00,E
S,5,0,389,517.68,36.00,23.00,E
S,5,0,386,510.34,36.00,23.00,E
S,5,0,382,476.83,36.00,23.00,E
S,5,0,370,490.17,36.00,23.00,E
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S,5,0,349,474.31,36.00,23.00,E
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S,5,0,343,476.83,36.00,23.00,E
S,5,0,352,475.57,35.00,23.00,E
S,5,0,351,475.57,35.00,23.00,E
S,5,0,351,475.57,36.00,23.00,E
S,5,0,350,469.19,35.00,23.00,E
S,5,0,345,466.59,35.00,23.00,E
S,5,0,326,462.62,35.00,23.00,E
S,5,0,341,458.59,35.00,23.00,E
S,5,0,335,450.30,35.00,23.00,E
```

☑ Autoscroll

Figure: 4.4 Serial Data in String form

In the above figure we can see all the sensors data converted in to a string format and send to nodemcu for publish data on firebase via serial communication protocol, here we can see string is start from “S” and end with “E”.

4.2 Database Results

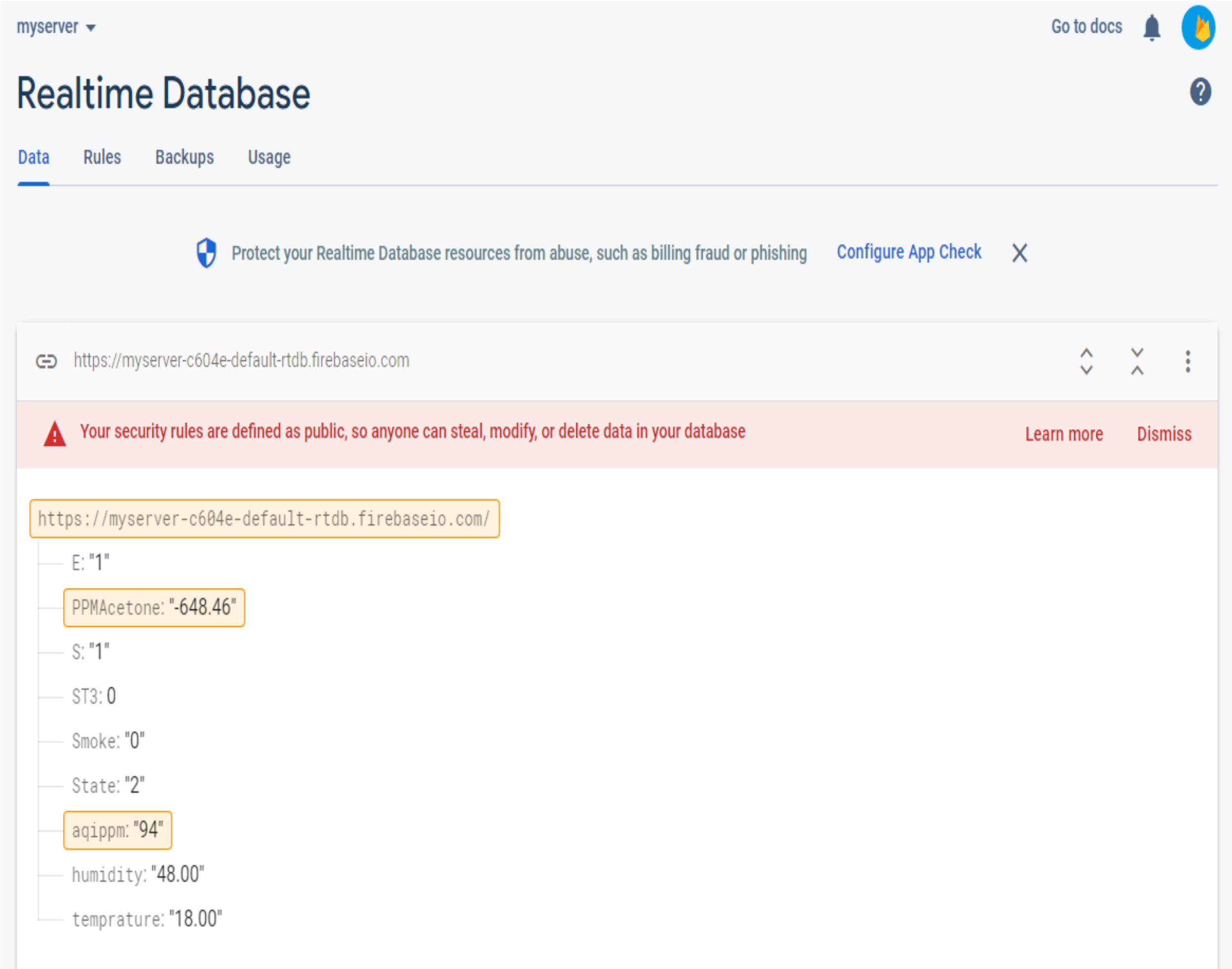

Figure: 4.5 Firebase Database Data 1

In the above figure we can see real time data published by nodemcu of all the sensors in different string with time interval 1, this data can be retrieve by our developed android application.

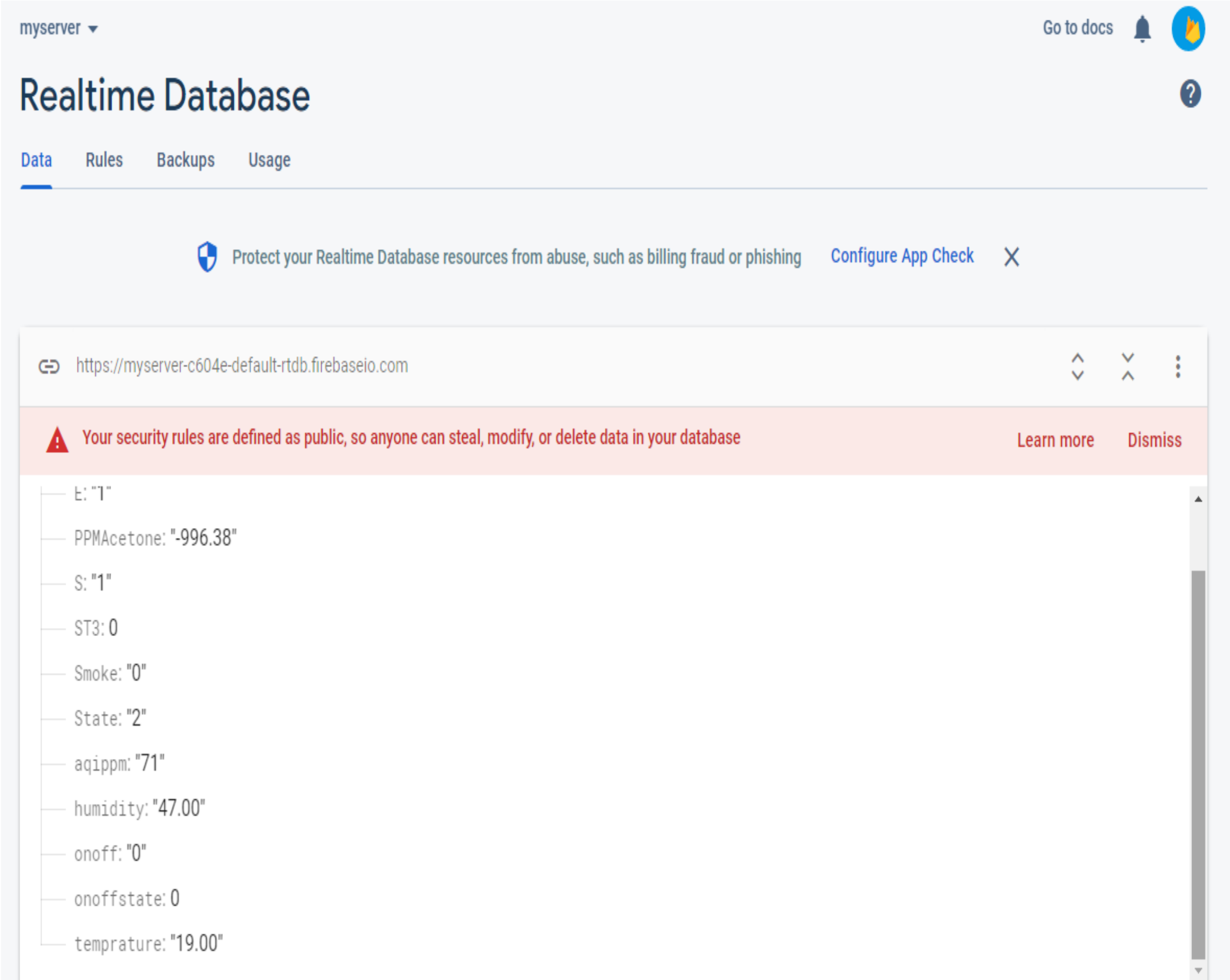

Figure: 4.6 Firebase Database Data 2

In the above figure we can see real time data published by nodemcu of all the sensors in different string with time interval 2, this data can be retrieve by our developed android application.

4.3 Android Application Results

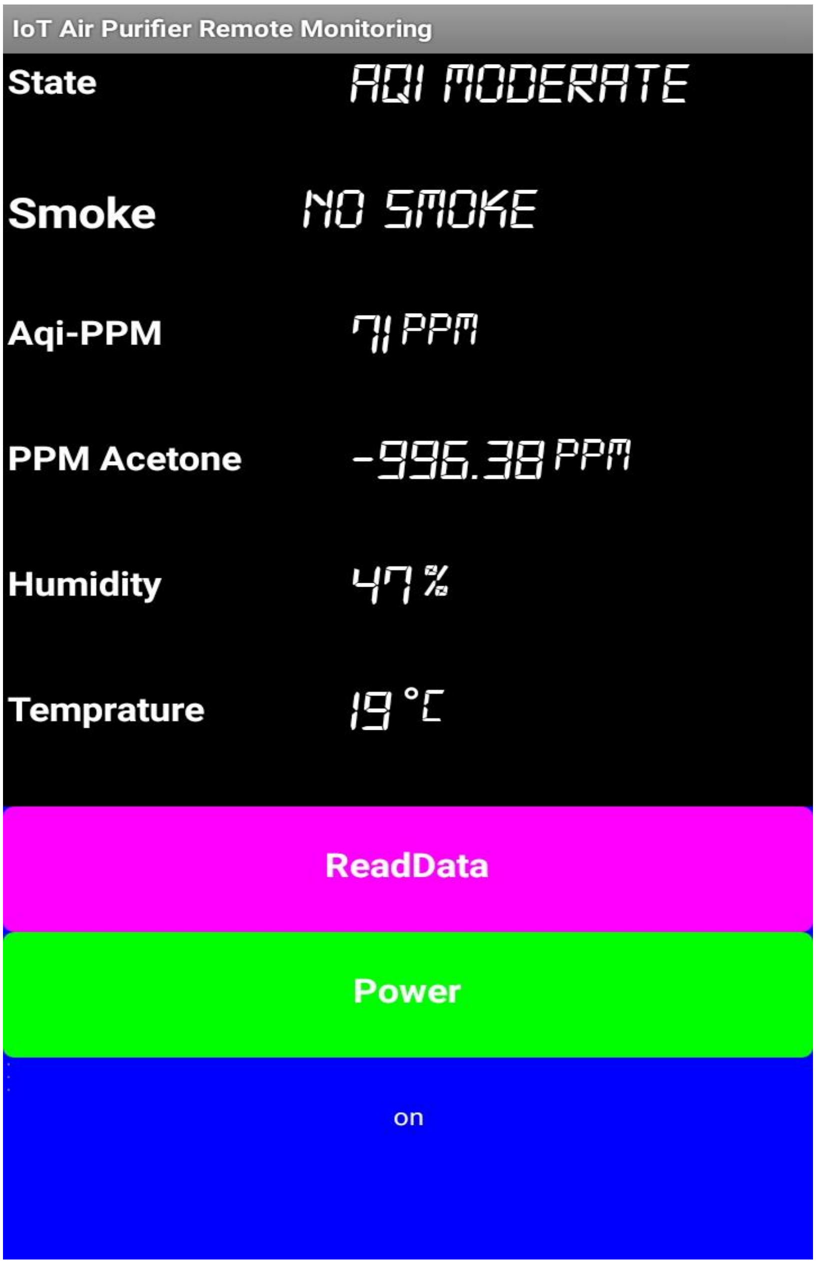

Figure: 4.7 Android Application Data 1

The above figure is the screen shot of the our developed android app in this figure we can see all the data received by android app form the real time firebase database, here is two buttons, 1st is read data that is used for receive data from firebase and print all data on the different labels and the second button is the power button that is used for power on and off the our air purifier. The shown data in above figure is the real time data in time interval 1.

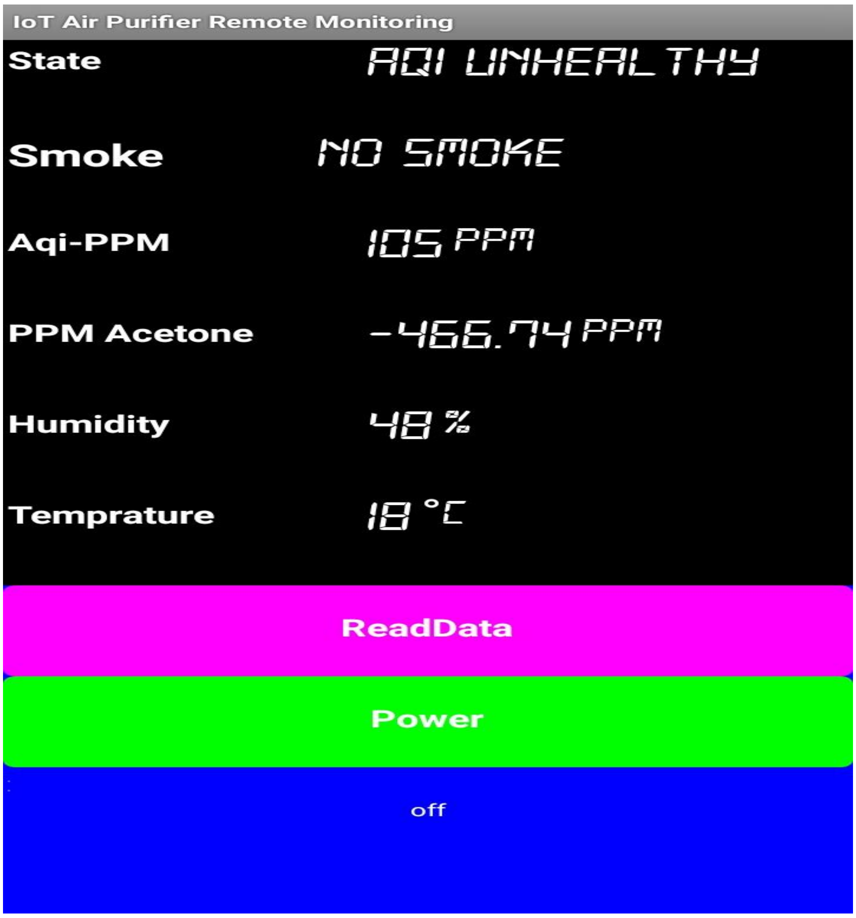

Figure: 4.8 Android Application Data 2

The shown data in the above figure is the real time data retrieve from the firebase database in time interval 2.

5. Conclusion and Future Scope

5.1 Conclusion

Pollution in air has been a major source of death in recent years, and it would be fair to argue that mankind has been rocked by the very existence of air pollution. Patients with allergic respiratory disease are frequently advised to use air filtration as part of their environmental control strategies. Air filtration has been shown to improve outcomes in the treatment of allergic respiratory disorders, according to research. Because different sized particles are filtered at different locations or segments of the filtrates, the filter cloth, cotton gauge cloth, absorbent cloth, and filter cloth all have varying porosities.

As a result, traditional air purifiers differ from intelligent air purifiers in their design. Programming the intelligent air purifier allowed it to detect air quality automatically and intelligently. In the meanwhile, it's possible to keep an eye on the air quality in your home at any time. Mobile devices can be used to monitor and control this design method, which is user-friendly and extremely clever. Our proposed work details the design and implementation of a portable air purifier that is both efficient and convenient. Small places can benefit from the device's improved air quality. Our proposed system has the capability of air filtration. This system is fully internet of thing based that can be communicate with our developed android application. We can remotely monitor the status of the air Purifier like air parameters, current temperature, and humidity, etc.. We can on and off our air filter via our designed android application and also check feedback, this is a very cost-effective system and this sends real-time data to a database that data can be retrieved via the android application.

5.2 Future Scope

According to experts, air pollution caused by firecrackers increases the risk of mortality among COVID-19 patients and also harms those who are recovering from the virus. Last year, according to SAFAR, the government-run monitoring agency and Central Pollution Control Board, certain parts of India were under the red category for air pollution during the festive season. We are planning to make our proposed system more efficient for future work, like very compact size, control via IoT and with artificial intelligence, and with low noise of DC fans. And also plan and started research for antibacterial and virus protection form the air.

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