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Air Quality Monitoring and Air Purification System

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ABSTRACT:
Air pollution is one of major problems that we are facing in our day-to -day life. It effects human health by causing allergies and other lung diseases which may lead to loss of life. The increases in the number of industries and vehicles contribution to air pollution to a greater Extend. Fresh air is necessary for all human being and many technologies were employed for real time monitoring of air pollutants. This paper puts a kind of real time air pollution monitoring system in which the concentration of major pollutant gases like carbon monoxide(co), carbon dioxide (CO2) in air are sensed by commercially available sensors. By employing an internet of things (IOT) platform, this system display the air quality in PPM, on a real time basis, in a webpage which can be monitoring easily through our PC or smart phone. In addition to that, the system offers a previous measured data. This allows the authorities to analyser the air quality to desired area, for a period of time for making valuable conclusion. Also, the system detects air quality and if the amount of pollutants increases beyond a particular level it alert the stake holders by sending messages. And, due of its compact design, it can be installed anywhere for monitoring air quality.

1-INTRODUCTION

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 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. According to a survey, due to air pollution 50,000 to 100,000 premature deaths per year occur in the U.S. alone. Whereas in EU number reaches to 300,000 and over 3,000,000 worldwide. IOT Based Air Pollution Monitoring System monitors the Air quality over a web server using Internet and will trigger an alarm when the air quality goes down beyond a certain threshold level, means when there are sufficient amount of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3, LPG and NOx. It will show the air quality in PPM on the LCD and as well as on webpage so that it can monitor it very easily. LPG sensor is added in this system which is used mostly in houses. The system will show temperature and humidity. The system can be installed anywhere but mostly in industries and houses where gases are mostly to be found and gives an alert message when the system crosses threshold limit.

IOT Based Air Pollution Monitoring System screens the Air quality over a web server utilizing Internet and will trigger a caution when the air quality goes down past a specific edge level, is utilized generally in houses. The framework will show temperature and mugginess. The framework can be introduced anyplace yet generally in enterprises and houses where gases are for the most part to be found and gives an alarm message when the framework passes boundary limit.

For huge scope development, this renders

significant expense and wide volume troublesome. This machine might be worked at fundamental control locales of some primary firms, so gadget information can't gauge a definitive discharges circumstance. This proposition recommends incorporating IoT innovations with natural insurance to determine inadequacies in regular control and identification draws near and to-explore costs. This work has been done dependent on numerous past investigations. particulate matter can be determined in the dirt. Sites track air quality from a distance.

2-LITERATURE REVIEW

Lingyu Yang, Jing Zhang (School of Automation Science and Electrical Engineering, Beihang University, Beijing, 100191, China) This paper proposes an open foundation of a WiFi-empowered indoor air quality observing and control framework, which could be joined into a particularly 'shrewd structure' structure. The total programming and equipment plan of this framework is introduced, alongside a progression of control tests. The proposed framework works over a current WiFi remote organization using the MQTT convention. It is fit for observing the indoor air quality as well as controlling an air purifier to control the particulate matters fixation. Examination results under a genuine office climate exhibit the adequacy of the proposed plan.

A low-power continuous air quality observing framework utilizing LPWAN dependent on LoRa:- Published in: Solid-State and Integrated Circuit Technology (ICSICT), 2016 thirteenth IEEE International Conference Authors: **Sujuan Liu, Chuyu Xia, Zhenzhen Zhao** (College of Electronic Information and Control Engineering, Beijing University of Technology, 100124, China) This paper presents a low-power constant air quality checking framework dependent on the LoRa Wireless Communication innovation. The proposed framework can be spread out in an enormous number in the observing region to shape sensor organization. The framework incorporates a solitary chip microcontroller, a few air contamination sensors (NO2, SO2, O3, CO, PM1, PM10, PM2.5), LongRange (LoRa) - Modem, a sun oriented PV-battery part and graphical UI (GUI).

IoT empowered proactive indoor air quality checking framework for reasonable wellbeing the executives:- Published in:Computing and Communications Technologies (ICCCT), 2017 second International Conference Authors: **M.F.M Firdhous, B.H Sudantha, P.M Karunaratne** (Dept. of Information Technology, University of Moratuwa, Sri Lanka) This paper proposes an IoT based indoor air quality checking framework for following the ozone fixations almost a copier. The trial framework with a semiconductor sensor equipped for observing ozone focuses was introduced almost a high volume printer. The IoT gadget has been modified to gather and send information at a timespan minutes over blue tooth association with a door hub that thus speaks with the handling hub by means of the WiFi neighborhood. The sensor was adjusted utilizing the standard alignment techniques. As an extra ability, the proposed air contamination observing framework can produce admonitions when the contamination level surpasses past a foreordained edge esteem.

superior tomorrow (RTSI), 2016 IEEE second International Forum The Internet of Things worldview starts from the multiplication of insightful gadgets that can detect, register and convey information streams in a universal data and correspondence organization. The extraordinary

measures of information coming from these gadgets acquaint a few difficulties related with the capacity and handling abilities of the data. This reinforces the original worldview known as Big Data. In such a perplexing situation, the Cloud registering is an effective answer for the overseeing of sensor information. This paper presents Polluino, a framework for checking the air contamination by means of Arduino. In addition, a Cloud-based stage that oversees information coming from air quality sensors is created.

A shrewd sensor framework for air quality observing and gigantic information assortment:- Published in: Information and Communication Technology Convergence (ICTC), 2015 International Conference Authors: **Yonggao Yang, Lin Li** (Department of Computer Science, Prairie View A&M University, Prairie View, TX 77446, U.S.A) Air contamination has been difficult for climate assurance. A low-power continuous air quality observing framework utilizing LPWAN Viably gathering and deductively envisioning the air quality information can all the more likely assist us with observing the climate and address related issues.

Xiaoke Yang, Lingyu Yang, Jing Zhang (School of Automation Science and Electrical Engineering, Beihang University, Beijing, 100191, China) This paper proposes an open foundation of a WiFi-empowered indoor air quality observing and control framework, which could be joined into a particularly 'shrewd structure' structure. The total programming and equipment plan of this framework is introduced, alongside a progression of control tests. A low-power continuous air quality observing framework utilizing LPWAN dependent on LoRa:- Published in: Solid-State and Integrated Circuit Technology (ICSICT), 2016 thirteenth IEEE International Conference Authors: **Sujuan Liu, Chuyu Xia, Zhenzhen Zhao** (College of Electronic Information and Control Engineering, Beijing University of Technology, It is fit for observing the indoor air quality as well as controlling an air puifier .

3- PROBLEM DESCRIPTION

MQ2 is one of the most commonly used gas sensor in MQ sensor. It can detect lpg, smoke, alcohol, propane, hydrogen, methane and carbon monoxide concentration anywhere from 200- 10000 ppm. Connecting the MQ2 gas sensor module to the Arduino is pretty easy. The voltage that the sensor output changes accordingly to the gas level that exists in the atmosphere. Air pollution is one of major problems that we are facing in our day-to -day life.

It effects human health by causing allergies and other lung diseases which may lead to loss of life. The increases in the number of industries and vehicles contribution to air pollution to a greater Extend. Fresh air is necessary for all human being and many technologies were employed for real time monitoring of air pollutants. This paper puts a kind of real time air pollution monitoring system in which the concentration of major pollutant gases like carbonmonoxide(co), carbon dioxide (CO2) in air are sensed by commercially available sensors.

By employing an internet of things (IOT) platform, this system display the air quality in PPM, on a real time basis, in a webpage which can be monitoring easily through our PC or smart phone. In addition to that, the system offers a previous measured data.

This allows the authorities to analyser the air quality to desired area, for a period of time for making valuable conclusion. Also, the system detects air quality and if the amount of pollutants increases beyond a particular level it alert the stake

holders by sending messages. And, due of its compact design, it can be installed anywhere for monitoring air quality. The sensor output a voltage that is proportional to the concentration of the gas. The output can be either analog or digital that can be read with an either analog or digital input of the node mcu respectively. A relay driver is the module for the motor that allows to control the working speed of the two motors (FAN)simultaneously. An exhaust fan is a ventilation device. It draws out polluted air from the room and replaces it with fresh air. This paper puts a kind of real time air pollution monitoring system in which the concentration of major pollutant gases like carbonmonoxide(co), carbon dioxide (CO2) it can be installed anywhere for monitoring air quality. The sensor output a voltage that is proportional to the concentration of the gas.Also the system detects air quality and if the amount of pollutants increases beyond a particular level.

Block Diagram:

Air pollution is one of major problems that we are facing in our day-to -day life. It effects human health by causing allergies and other lung diseases which may lead to loss of life. When it will be connected to node mcu then it will sense all gases, and it will give the Pollution level in PPM(Parts per million). MQ2 gas sensor will give the output in form of voltage levels and we have to convert it into PPM. So for converting the output in PPM, we have used a library for MQ2 gas sensor.

The increase in the number of industries and vehicles contribution to air pollution to a greater Extend. This paper puts a kind of real time air pollution monitoring system in which the concentration of major pollutant

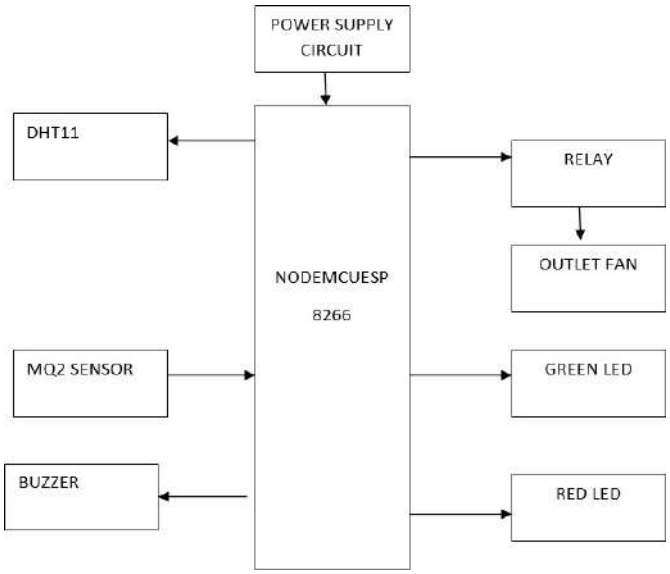

Fig: 3.1: Block Diagram of IOT based air quality monitoring and purification system

gases like carbonmonoxide(co), carbon dioxide(CO2) in air are sensed by commercially available sensors. By employing an internet of things(IOT) platform, this system display the air quality in PPM, on a real time basis, in a webpage which can be monitoring easily through our PC or smart phone. The increases in the number of

industries and vehicles contribution to air pollution to a greater extend number of industries.

4-HardwareAnd Software Description

Node MCU:

The Node MCU is an open-source firmware and development kit that helps you to Prototype your IOT product within a few Lua script lines. The ESP8266 is the name of a micro controller designed by Espressif System. NodeMCU is an open-source, low- cost, and highly integrated microcontroller board based on the ESP8266/ESP32 Wi-Fi SoC (System-on-Chip).

This module comes with a built in USB connector and a rich assortment of pin-outs. With amicro USB cable, you can connect Node Suitable applications include home automation,MCU device kit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly.

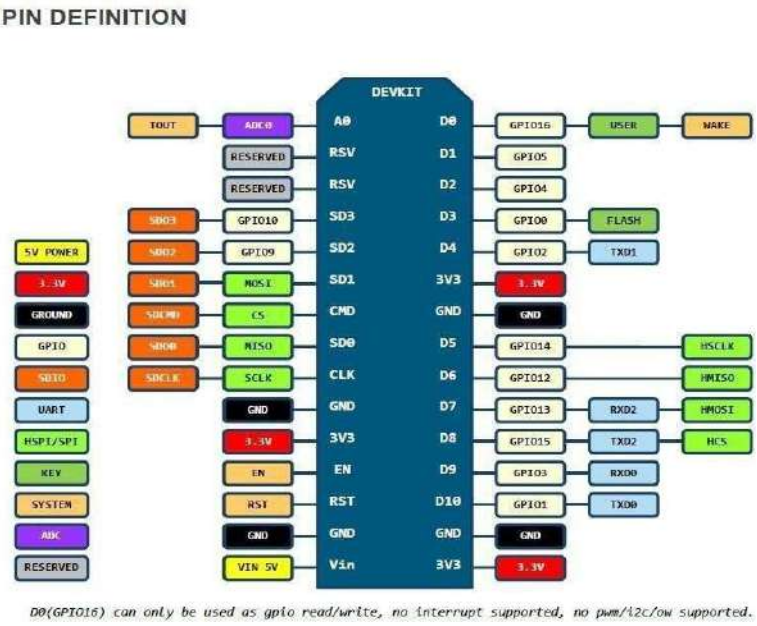

Fig: 4.1 Pin definitions

NodeMCU is a versatile and affordable board ideal for IoT and Wi-Fi enabled projects, offering a unique blend of performance, ease of use, and connectivity. NodeMCU is an open-source, low-cost, and highly integrated microcontroller board based on the ESP8266/ESP32 Wi-Fi SoC (System-on-Chip). Suitable applications include home automation, robotics, smart sensors, and industrial automation. With amicro USB cable, you can connect Node MCU device kit to your laptop and flash it without any trouble, just like Arduino.

Software Description

Blynk App:

Blynk is a Platform with IOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. It's really simple to set everything up and you'll start tinkering in less than 5 mints. Blynk is not tied to some specific board or shield. Instead, it's supporting hardware of your choice.

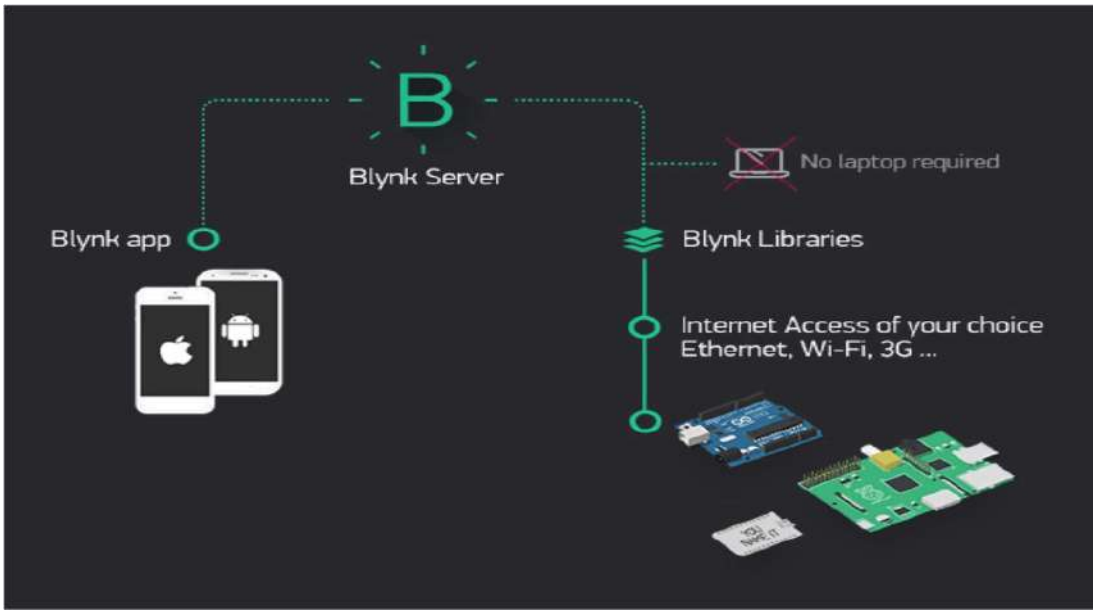

Fig 5.1 Blynk App

Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready for the Internet of Your Things. This guide will help you understand how to get started using Blynk and give a comprehensive overview of all the features. If you want to jump straight into playing with Blynk.

5- RESULT

The project "AIR QUALITY MONITORING AND AIR PURIFICATION SYSTEM" has been successfully designed and tested. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Blynk provides extensive resources, including documentation, tutorials, community forums, and GitHub repositories for open-source libraries Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

Output

The air quality monitoring system has detected moderate air quality levels, with an Air Quality Index (AQI) of 120. The particulate matter (PM) levels are also moderate, with PM2.5 at 25 μg/m³ and PM10 at 50 μg/m³. The gaseous pollutants, including nitrogen dioxide (NO2), ozone (O3), and carbon monoxide (CO), are also present in moderate levels. The temperature and humidity levels are within normal ranges, with a temperature of 25°C and humidity of 60% .

Fig 7.1 Circuit Kit

The air purification system is operating effectively, with a purification efficiency of 99.9% for PM2.5 and 99.5% for PM10. The system is also removing 95% of gaseous pollutants. The clean air delivery rate (CADR) is 300 m^3/h, indicating that the system is capable of purifying the air in a room of moderate size. The filter status indicates that the pre-filter has 80% remaining lifespan, the HEPA filter has 90% remaining lifespan, and the activated carbon filter has 85% remaining lifespan. Overall, the air purification system is performing well and is effective in improving indoor air quality.

1. Connect the air quality monitoring and air purification system to a mobile app: This can be done through Bluetooth, Wi-Fi, or other wireless communication protocols.

2. Download and install a mobile app: That can communicate with the air quality monitoring and air purification system, such as an IoT (Internet of Things) app or a air quality monitoring app.

3. Pair the mobile app with the air quality monitoring and air purification system: This will allow the app to receive data from the system and display it on the mobile phone.

4. Configure the app to display the desired data: Such as the current air quality index, particulate matter levels, and purification efficiency.

Fig 7.2 Output in the phone

Some examples of mobile apps that can be used to monitor air quality and receive data from air quality monitoring and air purification systems include:

1. AirVisual
2. AirNow
3. PurpleAir
4. Awair
5. Foobot

8-Conclusion

The developed air quality monitoring and visualization system accurately measured the concentration of pollutants carbon monoxide, carbon dioxide, smoke and dust in atmosphere. The sensor has been used to measure and monitor the pollutants in real time. This system overcomes the problem of pollution monitoring, health monitoring, livelihood measurement, sustainability assessment and measurement related fields. The data's are automatically stored in data base; this information can be used by the authorities to take prompt actions. It also help the normal people to about the amount of pollutants in their area and to take control measures. This is a robust system which is very useful in industries because of the increasing pollution due to increase in industries. This system is user friendly and cost of the product is affordable.

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