project

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ABSTRACT

The rapid growth of urbanization and industrialization has led to a significant increase in air pollution, posing severe threats to human health and the environment. This paper presents an IoT-based air quality monitoring and low-cost air filter system that aims to provide real-time air quality data and purify the surrounding air. The system employs a DHT11 sensor, ESP8266 WiFi module, Arduino microcontroller, MQ135 gas sensor, MQ7 carbon monoxide sensor, and the ThingSpeak platform for data visualization and analysis. The proposed system offers an affordable and efficient solution for monitoring air quality and mitigating the adverse effects of air pollution.

Keywords: IoT, air quality monitoring, low-cost air filter, DHT11, ESP8266, Arduino, MQ135, MQ7, ThingSpeak

SUMMARY

The system is involved with monitoring and controlling the environmental factors that are present in an area via sensors, such as temperature, relative humidity, and CO level. The data is transmitted to the website, where it is subsequently displayed as graphical statistics.

The main objective of this project is to create and implement a reliable monitoring system that will enable internet-based remote monitoring of the critical parameters, cloud storage of sensor data, and web-based trend visualization.

The Internet of Things (IoT), an emerging sector in which all devices are connected to a channel created by the self (private channel), is the foundation of this project. With the specific API key of the channel belonging to a certain user, the channel is used to examine the pollution parameters. For access, each channel has separate Read and Write API keys. The micro Arduino is interfaced with a Wi-Fi module as well as sensors for temperature, humidity, gas, and dust. The user is requested to enter the channel's API key. The key is read by the ESP8266-01 and sent to the Arduino nano. Data transfer between the channel and the microcontroller is possible if the key matches. The module has a Wi-Fi connection.

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1.INTRODUCTION

"Fine particulate matter" (FPM) is the term used to describe tiny solid and liquid particles floating in the air. They are the primary source of air pollution and have the most detrimental impact on people when compared to other air pollutants. All living creatures suffer from the consequences of poor air quality, which can be harmful to their health. It's critical to be knowledgeable about the local air quality in order to avoid situations that can exacerbate existing health issues. It's crucial to often examine the local air quality as a result. As part of the process of monitoring the quality of the air, it is possible to detect the temperature, humidity, and chemicals found in the air, such as ozone, sulfur dioxide, carbon monoxide, and particulates. Thanks to developments in sensor technology, we can now measure the proficiency level metrics to evaluate the status of the air quality. The development of the IoT (Internet of Things) has also benefited remote monitoring technologies. In this work, we create a location-specific IoT-based monitoring system to measure the air quality over time. Information is gathered for monitoring purposes from various remotely accessible sensors. A number of preceding studies served as the foundation for this one. The air quality in the area has previously been regulated and observed in research. Our research into the creation of remote communication for monitoring air quality and providing a cure by erecting a purification system is also the basis for this work. The device will measure a number of airborne elements, including O3, SO2, CO, and particles, as well as temperature and humidity. Websites will be used to remotely monitor the air quality, and purification will take place in response to input that is based on a predetermined value that we set as a threshold in our programming and that will be obtained via a web browser in real time.

2.PROBLEM STATEMENT

To display the weather conditions in a region and alert people about the air quality there. Its purpose is to inform the public of any changes in the local area's air quality.

In the case that the parameter is exceeded (for instance, when commotion, CO, or radiation levels are beyond the parameter's recommended level), an efficient natural observation framework is crucial to monitor and evaluate the conditions. When a situation equipped with sensor devices, smaller-scale controllers, and diverse programming applications transforms into one that is self-securing and self-observing

The ESP8266 Wi-Fi module, a self-contained SOC with a built-in TCP/IP protocol stack, enables any microcontroller to connect to your Wi-Fi network. The ESP8266 is capable of hosting an application or delegating all Wi-Fi networking duties to another application processor. The ESP8266 module comes pre-programmed with an AT command set software. Thanks to its extensive on-board processing and storage capabilities, this module may be connected with sensors and other application-specific devices through its GPIOs with a minimum of initial programming and runtime loading. It can work in any environment and doesn't require any extra RF components thanks to its integrated self-calibrated RF.

3.HARDWARE SPECIFICATIONS

Components required

- Nano Arduino
- WIFI Module (ESP8266)
- Temperature Sensor (DHT11)
- MQ6 Sensor
- Gas Sensor(MQ135)
- LCD Display
- Battery
- Purifier

- **Components overview**

1. ARDUINO UNO

The UNO is one of Arduino's common boards. Here, "one" is denoted by the Italian term UNO. The name UNO was given to Arduino Software's original release in order to distinguish it. Additionally, it was the first USB board ever made by Arduino. It is said to be a sturdy board that is used in several tasks. Arduino.cc is the company that made the Arduino UNO board.The Arduino UNO's ATmega328P microcontroller serves as its core. It is easier to use than other boards, such as the Arduino Mega board, etc. Shields, different circuits, and digital and analogue Input/Output (I/O) pins make up the board.

FIG 3.1 Arduino Uno

2. MQ-6

Gasses like butane and LPG can be measured or recognised by the MQ-6 Gas monitor. When you only need to detect one particular gas, the MQ-6 sensor module may function without the aid of a microcontroller thanks to its built-in Digital Pin. The analogue pin, which is also TTL driven, operates on 5V, and is compatible with the majority of widely used microcontrollers, must be used to measure the gas in ppm.

FIG3.2 MQ-6

3. ESP8266 WIFI MODULE:

Any microcontroller may connect to your Wi-Fi network using the self-contained SOC and TCP/IP protocol stack known as the ESP8266 Wi-Fi module. The ESP8266 is capable of hosting an application or assigning another application processor to handle all Wi-Fi networking tasks.

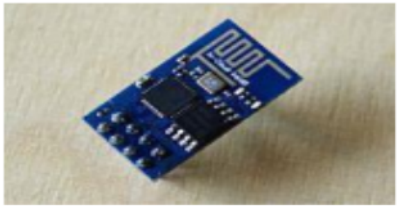

FIG 3.3 ESP8266

An AT command set software is pre-programmed into each ESP8266 module. This module can interface with sensors and other application-specific devices through its GPIOs with a minimum of upfront programming and runtime loading because of its robust on-board processing and storage capabilities. The strong on-chip integration means that less extra circuitry is required.

4. DHT11

The DHT11 sensor is available in a single row 4-pin package and requires a 3.5 to 5.5V power source to function. It has an accuracy of 2°C for measuring temperature from 0 to 50 °C and 5% for measuring relative humidity from 20 to 95 %. For the two measures, the sensor offers completely calibrated digital outputs. The connection between the sensor and a microcontroller is not feasible through a direct interface with any of its peripherals since it has a unique proprietary 1-wire protocol.

Fig 3.4 DHT11

5. MQ135

A device for detecting toxic gasses is ideal for ammonia, aromatic compounds, sulphur, benzene vapor, smoke, and other gasses. It may also be used to measure the concentration of gas-sensitive elements. A broad variety of gases can be detected by an air quality sensor, including NH3, NOx, alcohol, benzene, smoke, and CO2.
Alcohols, aromatic compounds, sulfides, CO2, ammonia, nitrogen, oxygen, and smoke are among the gases that the MQ-135 gas sensor can detect. Polluting gases are present in the atmosphere, but when their concentration rises, the gas sensor's conductivity does too.

FIG 3.5 MQ-135 Sensor

4. SOFTWARE SPECIFICATIONS:-

1. Arduino(1.8.0)

2. Android studio.

3. THINGSPEAK-

ThingSpeak is a cloud-based analytic IoT platform service that enables you to gather, visualize, and examine real-time data streams.

- ThingSpeak is an open data platform for the Internet of Things that lets you use the API to access data from other channels and gather data in your own channel.

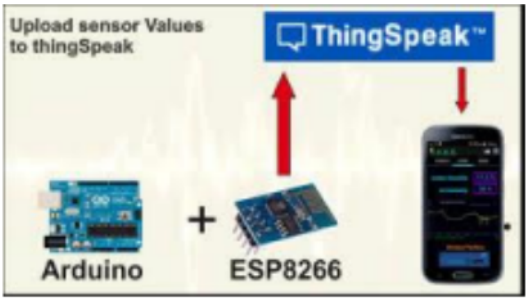

FIG 4.1 THINGSPEAK

5.BLOCK DIAGRAM

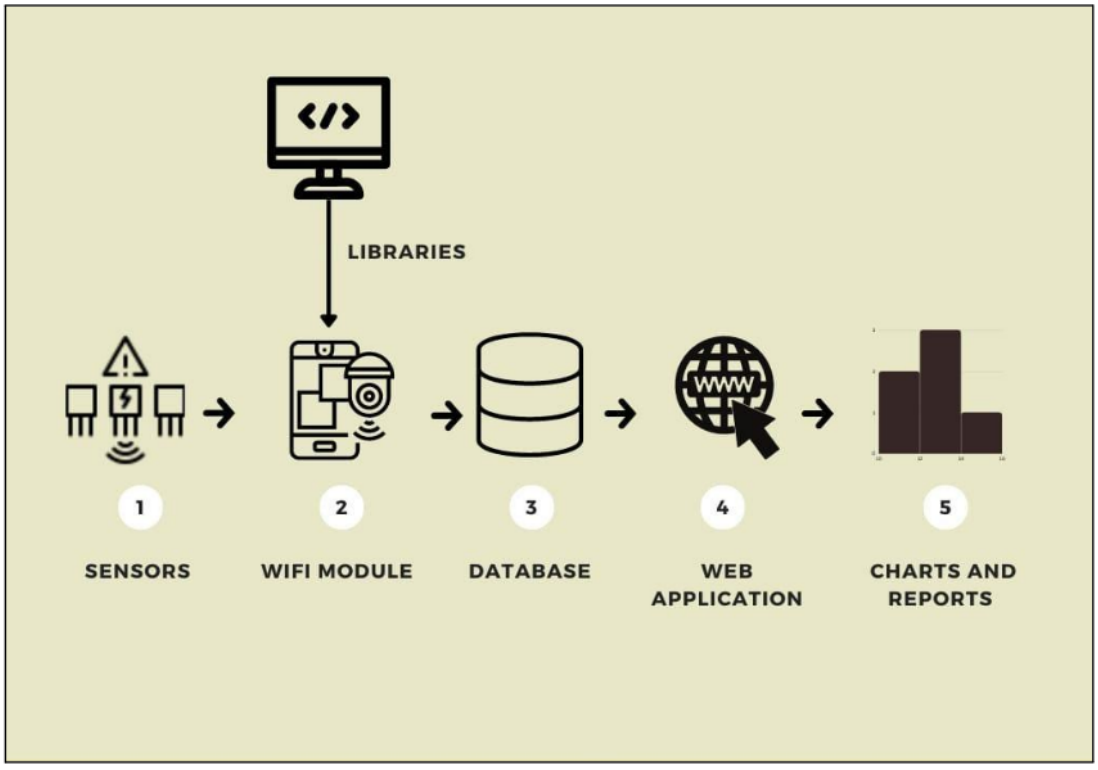

FIG 5.1 Process Flow

6.FLOWCHART

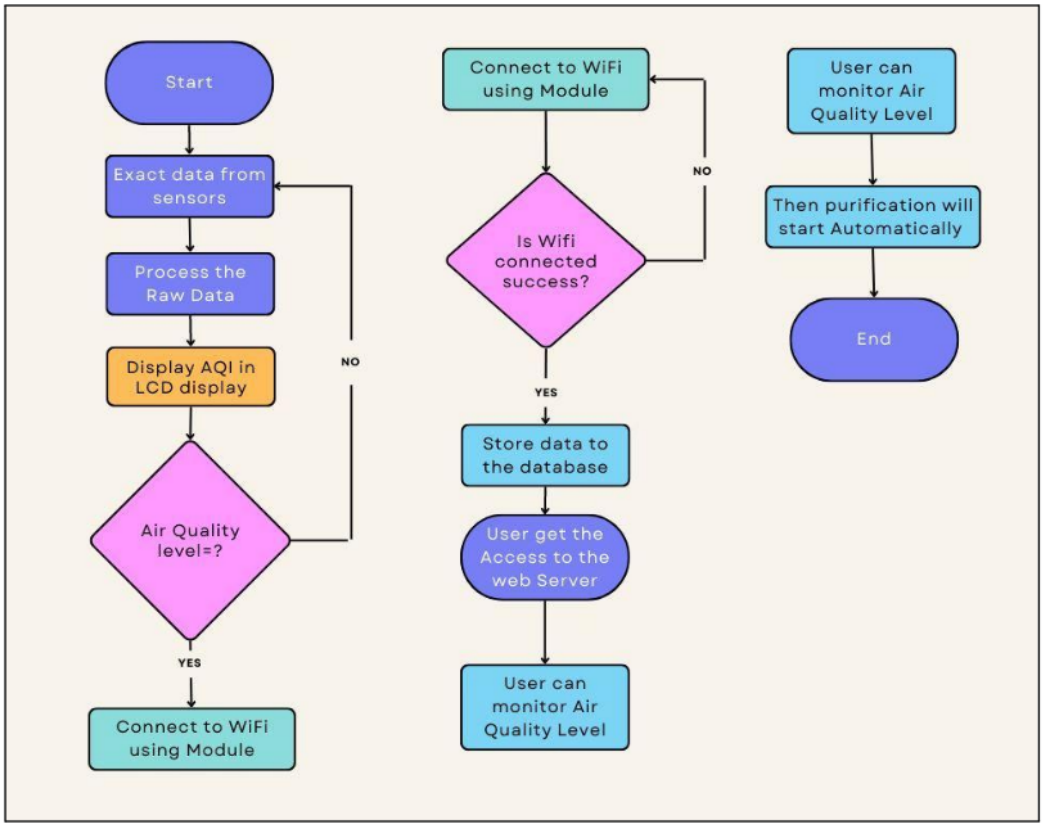

FIG 6.1 Implementation Flowchart

7.WHAT'S NEW

The proposed IOT based project is for monitoring pollution parameters like temperature**, humidity and CO** levels in the air to use wireless communication to give the environment intelligence or make it interact with the things.

This proposed project monitors pollution parameters along with air quality.The suggested paradigm is more distributive and adaptive to track environmental parameters.

Following analysis, interpretation, and presentation, monitoring provides data on air pollution concentrations. We can evaluate how terrible air pollution is on a daily basis by routine examination of monitoring data.

The air quality is becoming adverse these days majorly due to the concentration of dust particles, which is like a silent killer as it is extremely small in size and enters into the nose tract and leads to many respiratory problems. Our project includes an optical dust sensor to measure PM2.5 which leads to the precise measuring of air quality.

8.PROGRESS

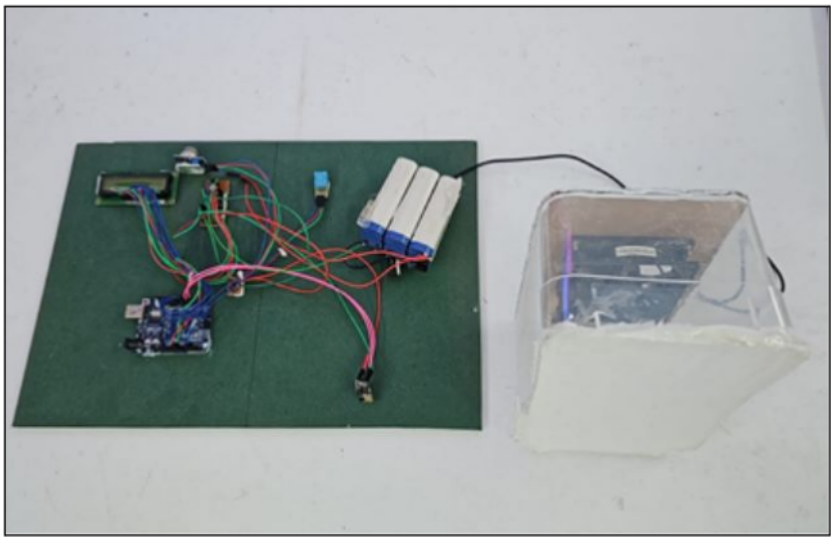

FIG 8.1: PROGRESS

- The status of the proposed Air Quality Determination and Purification Using IOTsystem is on track.
- The circuit designing and all software related work to the proposed project has been done.
- The hardware work for air quality monitoring is completed. Coding for the project has also been finished.

10.ADVANTAGES OF THE PROJECT

- The Arduino Uno-based IoT monitoring system project is fully automated.
- It doesn't need any assistance from people.
- On Thingspeak, we may get information on the AQI.
- In this system, the cheap cost and effort are reduced.
- High accuracy.
- a clever approach to keep an eye on pollution levels.
- Efficient

11.APPLICATIONS OF THE PROJECT

The fact that indoor air pollution causes more than 3.8 million fatalities per year is pretty alarming. Particulate matter and harmful substances lower air quality when breathed in, which can cause serious illnesses including asthma, decreased lung function, and even cancer.

Although both the industrial and the commercial sectors are represented in the statistics, the impact of air pollution on workers is greater due to the higher concentration of toxins. As a consequence, the indoor air quality monitoring technology aids businesses in establishing healthier working environments and managing AQI. Businesses may guarantee appropriate ventilation, manage the production of pollutants in their facility, and maintain temperature and humidity levels in a comfortable range by comparing the present air quality data with optimum conditions.

12.FUTURE SCOPE OF THE PROJECT

- One may add a few more sensors and link them to the satellite to make this system a worldwide one.
- Increasing the number of environmental sensors to track CO2, pressure, and oxygen sensors
- This real-time technology is widely used in the military, aeroplanes, and navigation.
- It may also be used in medical facilities like hospitals to conduct research and study on the "Effect of Weather on Health and Diseases" and to improve warnings about precautions.
- It's possible that we'll integrate a weather monitoring system with the current one.

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