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AIR QUALITY INDEX MONITORING SYSTEM

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ABSTRACT

The amount of pollution has grown through time due to a variety of causes such as population growth, increasing vehicle usage, industrialisation, and urbanization, all of which have negative impacts on human health by directly impacting the health of those who are exposed to it. In order to keep track of things, In this project, we will create an IOT Based Air Pollution Monitoring System in which we will monitor the Air Quality over a web server using the internet when any parameter falls below a certain level, which means when a sufficient amount of harmful gases, such as CO, smoke, alcohol, benzene, and NH3, are present in the air. It will display the air quality in PPM on the LCD and on the web, allowing us to conveniently monitor it. You may use your computer or mobile device to check the pollution level in this IOT project from anywhere.

The increased demand for internet-based services needed effective data gathering and exchange. The Internet of Things refers to a fast-expanding network of linked items that may gather and share data via embedded sensors. It is currently widely used in every industry and plays an important role in the planned environmental monitoring system. The convergence of IoT and cloud computing offers a revolutionary way for improved data management from various sensors, gathered and communicated using the low power, low-cost microcontroller "Arduino UNO." Thingspeak, an open-source website, is utilized to update the parameter measurements. Thingspeak is an open-source Internet of Things application and API that uses the HTTP Protocol to store and retrieve data from sensors via the Internet.

Keywords: Air Quality, Iot, Arduino, Weather Station, Wireless Sensors.

I. INTRODUCTION

Air pollution is the most serious environmental issue, wreaking havoc on human health, water bodies, and the climate. Vehicles are the primary cause of air pollution in all large cities, with industry being the secondary source. The widespread usage of automobiles has resulted in a significant rise of pollutants in the environment. Vehicles are the primary cause of pollution in all large cities, with industry coming in second. The widespread usage of automobiles has resulted in a significant rise of pollutants in the environment. The widespread usage of automobiles contributed to a significant increase in pollutants in the environment.

As a result, the suggested approach addresses this key problem. The air pollution monitoring system is put in a specific location where there are evidence of acute air pollution in order to identify the constituent gases of air that might cause harm to human health and other living species. This system predicts the quantity of several dangerous gases such as CO, NH3, particulate matter, and smoke using Arduino and many gas sensors. Carbon monoxide is given top priority since it is a greenhouse gas and a major polluter that is warming the globe. Previous goods had no benefit in terms of bringing pollution rates up to date. As a result, the Android app is utilized to overcome.

The measured air quality level is also presented in the Android application, which allows users to receive updates on current air quality. Users may view the quality of the air in both numerical and graphical formats. Furthermore, the present pollution level's Air Quality Index (AQI) is calculated and shown in the application, along with health impacts. As a result, this program enables users to take proactive efforts to protect themselves from any detrimental effects. The high demand for internet-based services needed effective data gathering and sharing. The Internet of Things refers to a fast-expanding network of linked items that may gather and share data via embedded sensors. It is currently widely used in all sectors and also plays an important part in the proposal of an environmental monitoring system. The convergence of IOT and cloud computing offers a revolutionary way for improved data management. Data from various sensors are gathered and transferred via the controller "Arduino UNO." An open-source website is the highhearted on the cloud environment to the consider are there of where the parameter measurement is updated. At the present, Thingspeak is an open-source project.

Internet of Things application and API for storing and retrieving data from sensors via the Internet through the HTTP Protocol. Thingspeak is a cloud-based IoT platform service that aggregates, visualizes, and analyzes real data streams. The cloud is used for graphic visualization activities and is provided in the form of a virtual server for users, and objects connect with the cloud through possible.

OBJECTIVE

The high demand for internet services needed effective data gathering and sharing. The Internet of Things refers to a fast-increasing network of linked items that can gather and share data via embedded sensors. It is currently widely used in almost every industry and also plays an important part in the planned environmental monitoring system. The convergence of IoT and cloud computing provides a revolutionary way for better management of data received and transferred by low power, low-cost microcontrollers on "Arduino UNO." Thingspeak is a popular open-source website where parameters are measured and updated. Thingspeak is an open-source Internet of Things application and API that can be used to connect to any store and retrieve data from sensors over the HTTP Protocol via the Internet.

Thingspeak is a cloud-based IoT analytics platform solution that allows you to gather, view, and analyze live data streams. The cloud employs the operations of graphic visualization and makes them available to users in the form of virtual servers, and the objects communicate with the cloud via possible wireless internet connections. The majority of objects use sensors to provide environmental analogue data. The Internet of Things connects everything and allows us to communicate with our devices. These metrics may be examined in these scripts in formats such as JSON, XML, and CSV. The environmental parameters in the proposed system may be accessible directly by the user, removing the requirement for third parties.

II. LITERATURE SURVEY

Vehicles are the leading source of urban air pollution. Vehicle pollution causes a significant rise in the discharge of several pollutants into the environment. Commercial systems on the market are devices that employ semi-conductor sensors in car smoke emission ports to monitor pollution levels and display this level to the vehicle's owner using a meter. When the pollution level exceeds a specified level, an alarm will sound in the car to notify that the limit has been reached, and the vehicle will automatically stop operating after a set amount of time [3][11]. This sort of individual usage scheme does not aid the public in becoming more conscious. Bharat stage emission standards are emission standards established by the Indian government to limit air pollutants produced by internal combustion engines in motor vehicles.

Several rules have also been enacted by the government over the years to control and reduce car emissions, but to little avail. Other cost-effective ways to decrease air pollution were also implemented, such as estimating the amounts of each pollutant [5][7][10]. The air quality index for the region is computed using the observed data, and the results are made public via a web page. However, the downside of this approach is that users are not given with a portable program to see pollution levels on the spot, and a graphical format for convenient viewing is also lacking [8][1].

A real-time air pollution monitoring system was created, which accurately detects the levels of practically all pollutants [2].

Libelium wasp nodes are utilized for wireless communication, and data is shown in both graphical and numerical format via a web interface. However, the use of these libelium wasp nodes has led in the creation of a costly system for public use since it uses more energy from the batteries [8][4].

The authors of [12] created a sensor gadget that can detect flash flooding and traffic congestion in metropolitan areas. An ultrasonic sensor and a passive infrared temperature sensor are used in this device. To forecast the water level, machine learning techniques such as ANN, fuzzy logic, and nonlinear regression were employed. In their experiment, they measured raw distance.

To increase measurement accuracy, a neural network is employed to analyze ultrasonic echoes. Over a distance of up to 500 mm, their technology could limit the inaccuracy to 0.5 mm. All of the ultrasonic liquid level sensing 5technologies listed above have various application regions, measurement ranges, and temperature ranges.

None of the approaches discussed above clearly evaluated the influence of relative humidity as well as a temperature and humidity gradient in the measuring medium. As a result, in this paper, we present an ANN-based adaptive UMS for measuring distances with greater precision and accuracy, with errors confined to millimetres.

Sensors Worked in Arduino System:

Sensors are electrical devices that detect and respond fast to physical changes such as distance, pressure, temperature, and touch. These are used commercially in a variety of devices for temperature monitoring, warning circuits, and home automation kits, among other things. In the real world, the goal is to provide a user-friendly environment in which information from multiple devices can be managed, delivered, and monitored. This is made feasible by interfacing numerous sensors with an Arduino board. Arduino is named after the Italian king 'Arduin of Ivrea' and was created in the year 2000.

Because it is open-source, it has the potential to succeed on the microcontroller platform. The appropriate Arduino Sensor boards can be selected based on the applications required and the availability of a selection of sensors. Arduino is made up of a working microcontroller and an IDE, which is the software platform where the code will be uploaded into the hardware. The Arduino board is becoming increasingly popular, and sensors are compatible with it. With the development of Arduino boards, it is now easy to construct the necessary sensors for new applications through interfacing. The Arduino's versatile environment has made it tremendously popular in the realm of electronics. Only a breadboard, ground, connecting wires, and, most importantly, a power source is necessary for these Arduino boards to be initialized and function. The motion will be detected by the PIR sensor connected to the Arduino. The sensor allows you to modify its sensitivity and latency using two variable resistors. It is widely used in robotic applications. The distance will be measured using an ultrasonic sensor interfaced by Arduino. The sensor uses the SONAR principle to determine the distance between two objects.

Sensors are no longer merely utilized in engineering; they are also vital instruments in medicine and biotechnology for measuring biological or physical processes. Environmental science as we know it today would not exist without reliable sensors, and sensors are used in almost every profession that requires physical information. Every smart thing is clever because of its sensors, and as we look around, more and more objects are becoming smart.

You've probably heard of the Internet of Things (or IoT), which is the concept of connecting objects around us in an internet-like network. This means that the "things" would be equipped with sensors and software and would be able to interact with one another. A smart home, for example, is a fantastic illustration of how the IoT might function: your smart thermostat would switch on the heat automatically if the temperature drops below a particular threshold, or, say, 30 minutes before you leave work, so your home is lovely and comfortable when you arrive. Sensors would detect and switch off lighting when it was not in use, and smoke/gas detectors would operate continuously in the background. The smart house isn't the only IoT concept. Driverless cars would also need to be connected to the Internet of Things in order to avoid collisions and keep drivers safe. An IoT strategy might help almost anything that benefits from automation, from health to high-end technology. But for all of this future technology to operate, you need sensors that are precise, strong, and linked.

Our environment is replete of sensors, and this is unlikely to change very soon; in fact, sensors may become even more vital in our lives.

III. EXISTING SYSTEM

There are already a number of commercially available automated air pollution management systems that employ a variety of technologies and sensors to control irrigation. The majority of these systems rely on a timer to water the plants at regular intervals, independent of soil moisture levels. This strategy has the potential to result in over-watering and waste of water resources. Soil moisture sensors are used in certain current systems to determine soil moisture levels and to initiate irrigation when the levels fall below a specified threshold. These systems, however, may be expensive and difficult to install and maintain. The utilization of meteorological data to optimize irrigation is another technique utilized in automated irrigation systems. This device predicts plant water needs based on weather forecasts and previous data and adjusts irrigation accordingly. This

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technique, however, needs sophisticated sensors and weather forecasting algorithms, making it pricey and difficult to install. In this proposal, we propose an automated irrigation system that controls irrigation using a rain sensor and a moisture sensor. The rain sensor detects rain and suspends irrigation to prevent over-watering, whereas the moisture sensor determines soil moisture levels and activates irrigation when they fall below a specified threshold.

Our technology provides a low-cost and practical solution that homes and small-scale farmers can simply install and manage. To increase measurement accuracy, a neural network is employed to analyze ultrasonic echoes. Over a distance of up to 500 mm, their technology could limit the inaccuracy to 0.5 mm.

All of the ultrasonic liquid level sensing 5technologies listed above have various application regions, measurement ranges, and temperature ranges. None of the approaches discussed above specifically evaluated the influence of relative humidity and a temperature and humidity gradient in the measuring medium. As a result, in this paper, we present an ANN-based adaptive UMS for measuring distances with greater precision and accuracy, with errors confined to millimetres.

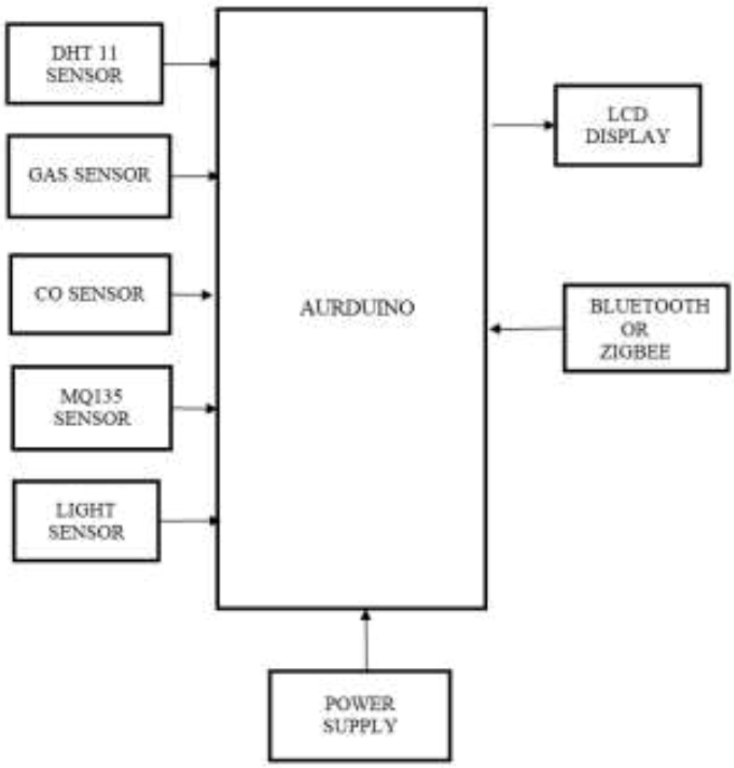


Fig 3.1: Block Diagram of Existing System

IV. PROPOSED SYSTEM

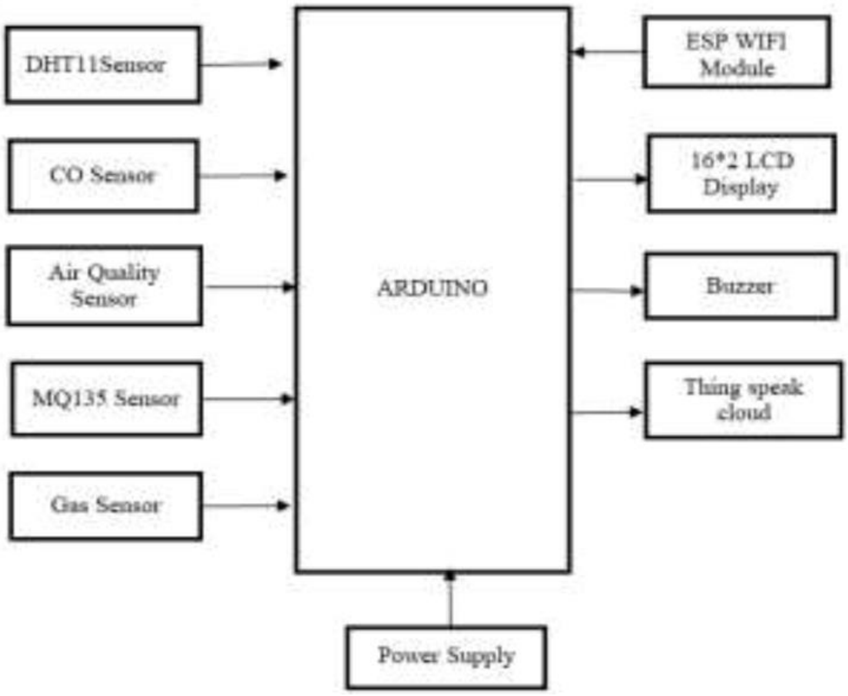
The suggested system uses real-time sensors to monitor characteristics such as moisture, temperature, humidity, rainfall, gas concentration, and seismic intimation. An open-source platform called Thingspeak monitors these metrics every 2 minutes. The data may be accessed in either of three formats: JSON, XML, or CSV. The suggested system's sensors capture data such as temperature, humidity, soil moisture, pollution level, rain water level, and earth surface movement. The Wi-Fi network facilitates the transmission of gathered data to the open-source platform Thingspeak. In addition, an app is created to make viewing the collected data easier.

The user will be able to learn about the state of his or her own agricultural land through the application/Thingspeak, and counter-measures may be implemented after careful examination of the land's characteristics.

Thingspeak. Furthermore, computational models must be able to use movement measurements to efficiently discriminate fluid intake from other possible actions such as bottle refilling. Furthermore, the system must appropriately categorize fluid intake activities from a wide range of users, each with their own signal patterns and characteristics. LIDS must respond to varied settings, such as varying lighting conditions or employing LIDS with transparent, translucent, or opaque containers.

DESIGN CONSIDERATIONS:

The purpose of this article is to construct an air pollution monitoring system that can be put in a specified location and to improve the system from the previously built system by establishing an android app that is open to the public. Anyone may use this app to receive real-time information about pollution in their area. It makes use of an Arduino that has been combined with individual gas sensors such as carbon monoxide, ammonia, particulate matter, humidity, and smoke to monitor the concentration of each gas independently. At regular intervals, the gathered data is transferred to the cloud via the Thingspeak platform. The Ethernet shield connects the Arduino to the cloud. Thingspeak can display a pictorial or graphical depiction of values. Furthermore, computational models must be able to use movement measurements to efficiently discriminate fluid intake actions from other possible movements such as bottle refills. Furthermore, the system must appropriately categorize fluid intake activities from a diverse set of users with distinct signal patterns and characteristics. LIDS must respond to various situations, such as changing light levels or employing LIDS with transparent, translucent, or opaque containers.



Users may install an Android application to keep up with the latest updates and graphical material. MATLAB is used to assess the average concentration of each gas. Then, depending on the standard level of each gas monitored, a time control is applied, and the result may be seen in an Android application. Figure depicts the design of an air pollution monitoring and awareness-creation system. Each gas's concentration level may be examined as a graph as well as numerically. The air quality index value is generated based on these readings, and the type of the air quality in that location is assessed, which is also shown through the app. In addition, the health impacts of the associated air quality are shown to raise public awareness. They might also learn about the temperature and weather in that area. Users will not be distracted by unnecessary data because the figures provided are area specific and will keep them up to date on the current state of air pollution.

The suggested system's hardware configuration.

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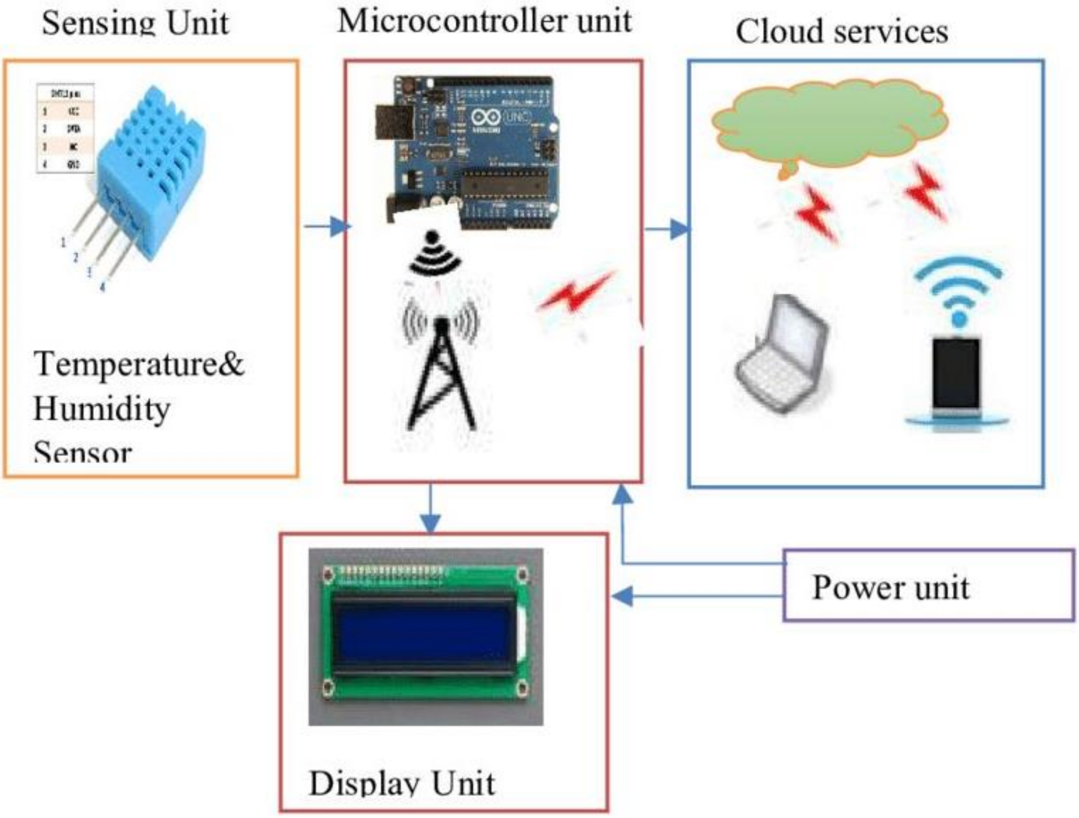

HARDWARE PLATFORM:

Climate change raised the need of environmental monitoring. Continuous surveillance of additional environmental parameters is required to determine the quality of the environment. As the most recent technology, the Internet of Things (IoT) plays a crucial role in gathering data from sensing units. The study employs an Arduino UNO, Wi-Fi module to aid in processing and uploading the detected data to the Thingspeak cloud. As a result, the parameters obtained are saved on the cloud platform. The cloud computing approach updates the changes in the environment in the form of a database. Thing talk also has the ability to construct a public-based channel for analyzing and estimating it. For immediate access to the measured parameters, an Android application is constructed.

Furthermore, a low-cost wireless monitoring system based on a multilayer distributed architecture using the Arduino platform and Xbee was built to assess the amounts of dangerous gases. In addition, a software component written in C/C++ was created to facilitate data transmission.

The data is gathered and transferred to a webpage, where it is viewable in real time. The system is highly sophisticated since it employs many software languages, including Java for the computer system and C/C++ for the conversion of analog data to digital form [9][6]. We utilize the MLX90614 infrared thermometer for non-contact temperature sensor to measure the temperature. Each sensor is sampled by an Arduino microcontroller, and the sensor readings are sent through Bluetooth.

Bluetooth Mate Gold) data transmission to a mobile device for processing. LIDS may also log the data captured on an SD card (through the Adafruit Micro-SD card breakout board). To power the complete hardware board, a rechargeable LiPo battery with a capacity of 500 mAh is employed. All of the sensor system's components cost less than $2,000 to build an economical prototype for fluid intake monitoring.

Method of operation:

To enhance air quality, a method for monitoring environmental air quality utilizing an Arduino microcontroller and IOT technology is presented. The use of IOT technology improves the process of monitoring many environmental factors, such as the air quality monitoring issue described in this research. The MQ135 gas sensor is used in this project to detect several types of harmful gases, and the Arduino is the project's heart, controlling the entire process. The Wi-Fi module connects the entire process to the internet, while the LCD is

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utilized for visual output. The Automatic Air & Sound Management System is an important step in finding a solution to the most serious hazard. The air and sound monitoring system solves the primary problem of extremely polluted locations. It promotes innovative technologies while also effectively promoting the notion of a healthy lifestyle.

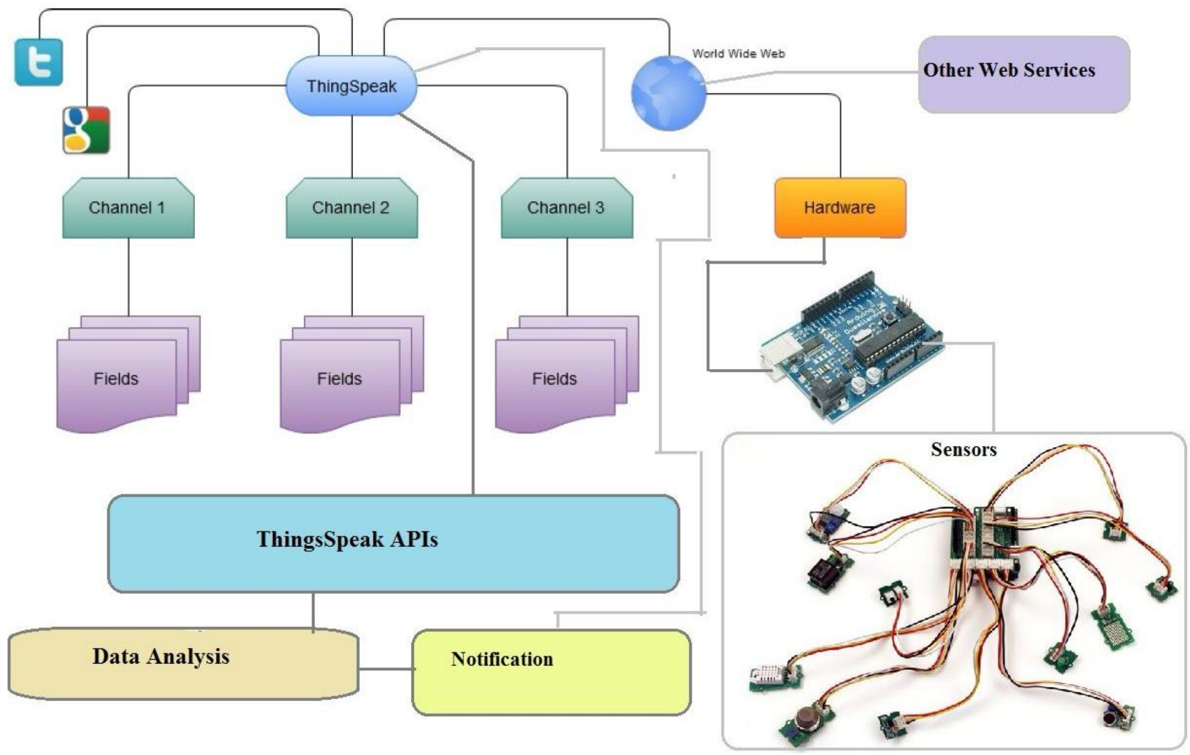
This system includes capabilities that allow users to monitor the level of pollution on their mobile phones via an app.

DESIGN FLOW:

The suggested environment monitoring system's design technique is described in the following sub-sections to store and analyze data on various environmental indices continuously:

A. SYSTEM MODEL:

Figure 1 depicts the general architecture of the network system in this project. The nodes in an environment can be deployed at random by the user. The star topology is chosen to keep the network design simple. A failing device in a star topology has no effect on the other devices in the network, and there is no data collision. A gateway connects the internet to the nodes. This gateway is wired or wireless, allowing us to utilize it anywhere. The gateway also handles the bulk of Internet connectivity while keeping the node's power consumption to a minimum.



V. RESULTS

In this project, I will create an IoT-based Air Pollution Detection Monitoring System in which I will monitor the air quality over a web server using an ESP8266 Wi-Fi device and will set off an alarm when the air quality falls below a certain level, indicating the presence of harmful gases.

The project is an Arduino-based implementation of an IoT (Internet of Things)-based air pollution monitoring system. Air pollution is becoming more of a problem, and it is critical to monitor air quality in order to ensure a brighter future and a healthier lifestyle for everybody. IoT is becoming more popular by the day, and standards are on the way. As a result, gathering information on air quality is simplified.

We can estimate how terrible air pollution is from day to day by analyzing monitoring data.

According to a recent report, Dhaka, Bangladesh's capital, ranks third among the most polluted cities. As a result of this increase in the number of automobiles, pollution is spreading swiftly, affecting people's health. This air pollution protects the nervous, regenerative, and respiratory systems against sickness and injury. It can also cause death in rare situations. As seen in the overview, we had 50000 to 100000 unexpected losses just as a

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result of air pollution [2]. Along these lines, there is a duty to inspect and monitor air quality. The Internet of objects (IoT) is a network of physical devices, automobiles, household appliances, and other objects that are outfitted with hardware, programming, sensors, and connectivity, allowing these items to communicate and exchange data. IoT enables objects to be detected and controlled. In this research, I propose and plan to trial an IoT-based methodology for screening air pollution. 1.3 Air Quality Monitoring Objectives The design of the air quality monitoring program is dependent on it.

The primary goals stated for the development of an air quality measurement and surveillance program may be to facilitate background concentration(s) measurements, monitor current levels as a baseline for assessment, check the air quality relative to standards or limit values, detect the significance of individual sources, allow comparison of air quality data from different areas and countries, collect data for air quality management, tr.

HARDWARE IMPLEMENTATION:

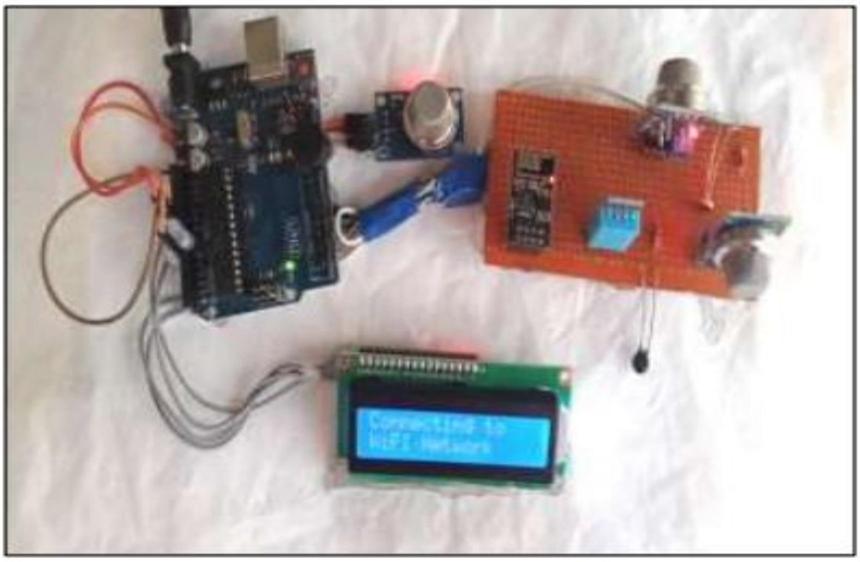

Figure 5.1.1 Hardware Implementation with all Sensor

Figure 5.1.2Temperature and Humidity values in Lcd display.

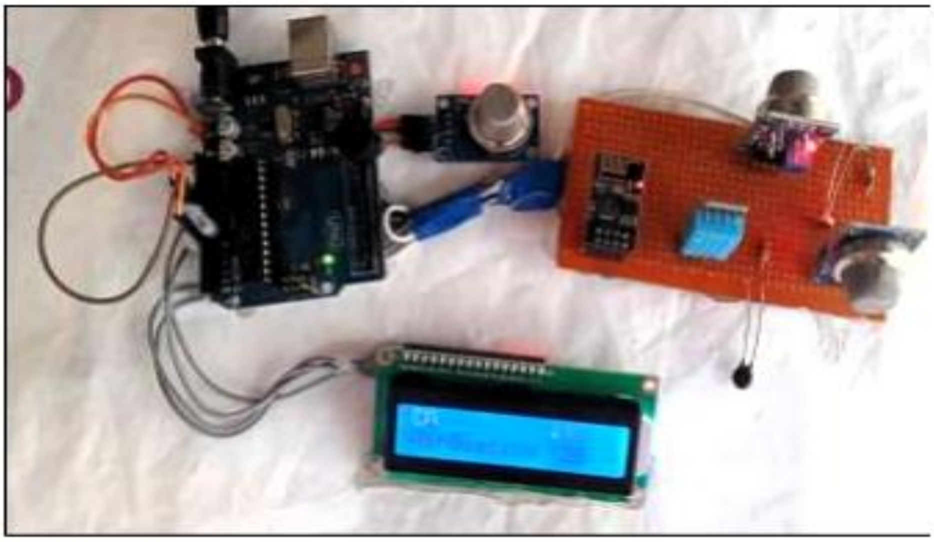

Figure 5.1.3CO Sensor and AirQuality values in Lcd display.

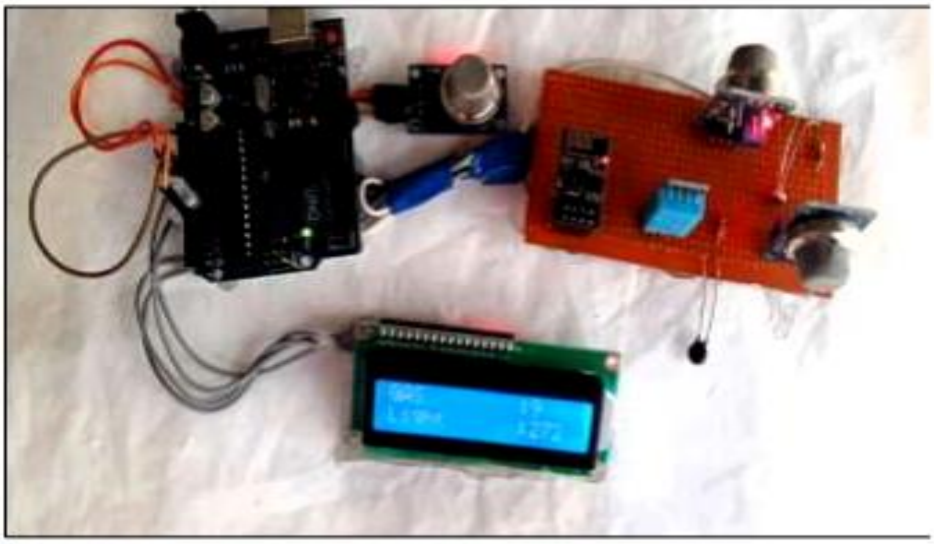

Figure 5.1.4 Gas Sensor and Light sensor values in Lcd display.

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THING SPEAK IOT CLOUD OUTPUT:

FIG 5.2.1 TEMP AND HUMIDITY READINGS

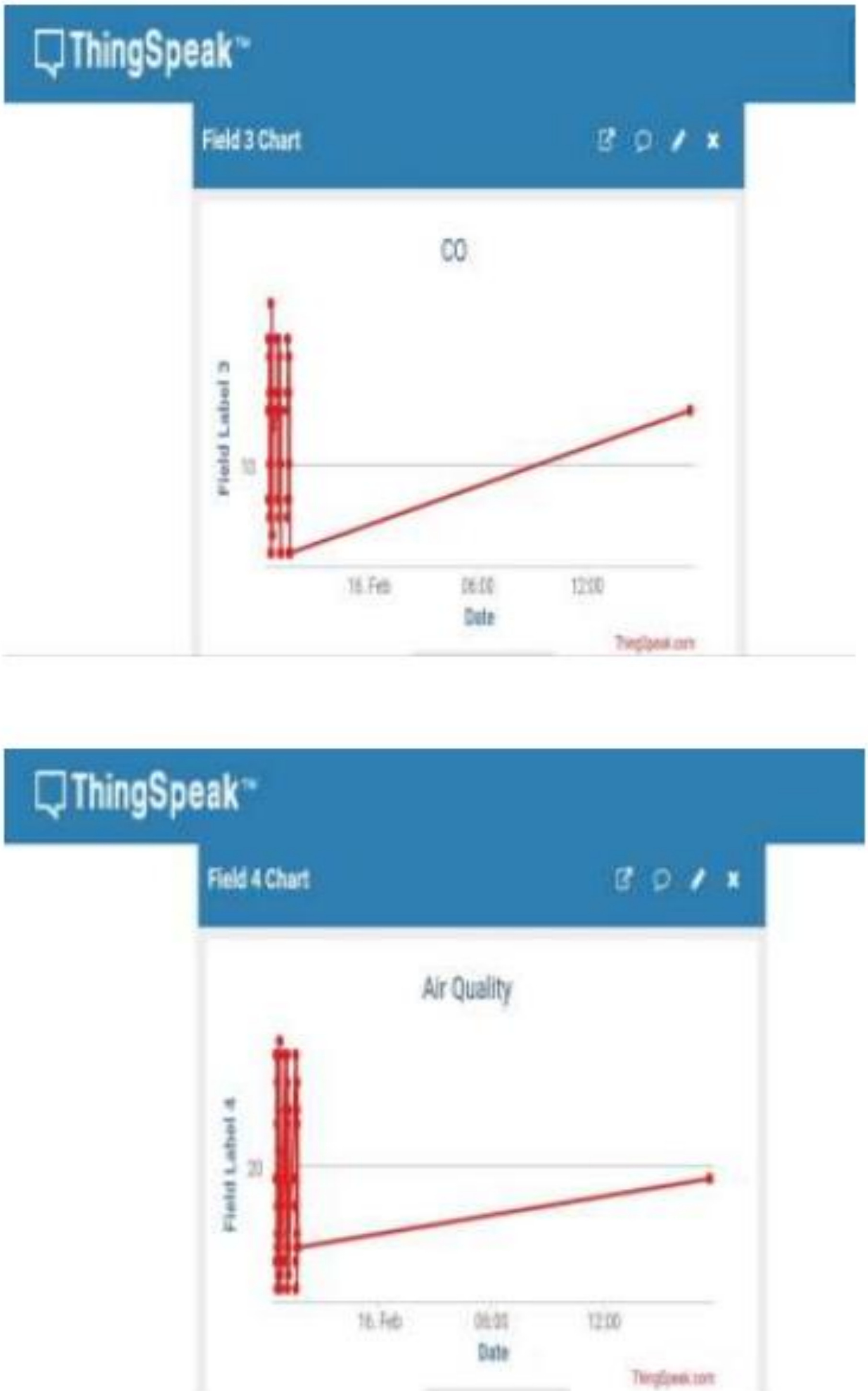

FIG 5.2.2 CO andAir Quality Readings

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FIG 5.2.3 Gas and Light Readings

VI. CONCLUSION

To enhance air quality, a method for monitoring environmental air quality utilizing an Arduino microcontroller and IOT technology is presented. The use of IOT technology improves the process of monitoring many environmental factors, such as the air quality monitoring issue described in this research. The MQ135 and MQ6 gas sensors are used in this project to detect several types of harmful gases, while the Arduino serves as the project's brain. Which regulates the entire procedure. The Wi-Fi module connects the entire process to the internet, while the LCD is utilized for visual output.

In this project, IoT was used to monitor and display the Air Quality Index (AQI), humidity, and temperature of the environment. Air Quality in PPM may be calculated using the project information. The downside of the

MQ135 sensor is that it cannot indicate the quantity of Carbon Monoxide or Carbon Dioxide in the environment, but it can detect smoke, CO, CO2, NH4, and other dangerous gases.

After multiple testing, it is easy to infer that the setup can accurately monitor air quality in ppm, temperature in Celsius, and humidity in %. The findings of the studies are validated using Google data. Furthermore, the led indicators assist us in detecting the degree of air quality surrounding the setup. However, the project has a shortcoming in that it cannot individually quantify the ppm levels of the pollutant components.

This may have been enhanced by the addition of gas sensors for various contaminants. However, it would eventually raise the cost of the system and would no longer be an essential feature for monitoring air quality.

Because it is an IOT-based project, a stable internet connection will be required for uploading data to the Thingspeak cloud. As a result, it is reasonable to infer that the developed prototype may effectively be used to measure air quality, humidity, and temperature in the surrounding environment.

VII. FUTURE SCOPE

The system's suggested design will aid in real-time analysis of air quality for a specific environment, allowing authorities to obtain reliable data for action.

To combat air pollution, several towns throughout the world have used pollution sensors.

Sensors are projected to become increasingly ubiquitous in the next years, with cities using novel tactics such as placing sensors on public transportation to protect inhabitants from the negative effects of air pollution exposure. Collecting and sharing real-time air pollution levels allows specialists to better understand the nature of air pollution and make effective adjustments to enhance air quality in cities, particularly those plagued by traffic congestion. Sensors can identify the times of day and regions of the city with the most pollution. This can help policymakers target the worst-affected areas and undertake problem-solving strategies to lessen the source of the heightened pollution.

In recent years, air pollution monitors have grown in popularity. Currently, a variety of sensors that properly monitor levels of air pollution are available. Many of these air sensors are linked, allowing the internet of things (IoT) to be used to automate traffic management systems and other pollution-reduction techniques in reaction to growing pollution levels.

A slew of novel sensors has lately hit the market, ranging from sensors put on electric scooters and other forms of transportation to simple, portable sensors that anybody can set outside their window. In this section, we will cover the many types of sensors and how they will evolve in the future to combat urban air pollution.

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