IOT-BASED AIR CONDITION SUPERVISING SYSTEM

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***Abstract*—This research presents a novel method of air quality monitoring within an Internet of Things (IoT) framework. The suggested system makes use of sensor nodes. positioned thoughtfully in key areas to continuously gather data on the state of the air. Particulate matter (PM2.5, PM10), volatile organic compounds (VOCs), carbon monoxide (CO), nitrogen dioxide (NO2), and ozone (O3) are only a few of the characteristics that these nodes assess using a range of sensors. These sensors send wireless data to a central server, where it is evaluated, processed, and made available via an intuitive user interface. Real-time monitoring, data analytics, and the providing of insights into patterns in air quality are made possible by utilizing IoT technologies. This system also provides remote access, which speeds up decision-making and raises public awareness. The approach includes creating a strong IoT infrastructure, methodologies for data display, data transmission protocols, and sensor calibration. By comparing the system's accuracy and dependability to those of conventional air quality monitoring stations, it is validated. There is a lot of promise for using such a system in public health, urban planning, and environmental conservation, among other areas. This Internet of Things (IoT)-based solution gives stakeholders the information they need to make wise decisions and take proactive steps to solve the problems associated with air pollution by offering historical and real-time data on air quality.**

***Keywords*—IoT, PM Sensors, PRS/GSM, Arduino, Android App.**

I. INTRODUCTION

The air we breathe is a vital component of life, but the effects of modernization are progressively endangering its purity. Pollutants that pose serious health concerns and environmental challenges are released into the atmosphere as a result of urbanization, industrialization, and other human activities. Conventional air quality monitoring technologies have been vital in identifying and evaluating these problems over the years. They are constrained, nonetheless, in terms of coverage, adaptability, and real-time data accessibility. The application of Internet of Things (IoT) technology has emerged as a game-changing solution in the field of air quality monitoring in response to these difficulties This study aims to investigate in detail the design, execution, and consequences of a cutting-edge Internet of Things-based air quality monitoring system. This system is based on a network of sensor nodes that are placed strategically in various situations. Every node has a variety of sensors that can identify and quantify a wide range of air pollutants, such as different-sized particulate matter, volatile organic compounds, nitrogen dioxide, carbon monoxide, and ozone levels. The real-time data transfer from these sensor nodes to a centralized data hub is made possible by the seamless integration of IoT technology into this monitoring infrastructure. The data that has been gathered is processed, examined, and shared using this hub as a single store. The processed data is made available to stakeholders through user-friendly interfaces, providing Stakeholders have access to data that provides in-depth insights on trends, patterns, and historical discrepancies.

II. LITERATURE SURVEY

[1] In today's urban landscapes, the intersection of transportation and air quality presents a pressing challenge. Mobile environmental sensing systems offer a pioneering solution by leveraging technological advancements to monitor and manage air quality associated with transportation. These systems, integrated with mobile platforms, sensors, and data analysis, provide a comprehensive approach to understanding and mitigating the environmental impact of urban transportation. This essay explores the critical role of mobile environmental sensing systems in managing urban air quality affected by transportation, shedding light on their significance, functionality, and potential for transforming our approach to sustainable urban living. The fusion of mobile environmental sensing systems with transportation management signifies a pivotal stride towards sustainable urban environments.

[2] Air pollution monitoring coupled with Geographic Information System (GIS) modeling represents a transformative approach in comprehending and managing the complexities of air quality. By integrating advanced monitoring technologies with

GIS, we gain a powerful tool to visualize, analyze, and predict air pollution patterns in spatial contexts. This essay delves into the significance of this synergy, exploring how the amalgamation of air pollution monitoring and GIS modeling contributes to a comprehensive understanding of the sources, distribution, and impacts. Embracing and expanding the use of air pollution monitoring and GIS modeling is pivotal for creating resilient, environmentally conscious communities and shaping policies that address the urgent need to curb air pollution.

[3] IoT-based air quality monitoring systems have emerged as a beacon of hope. This advancedtechnology amalgamates Internet of Things (IoT) devices with air quality sensors, providing a sophisticated framework for real-time monitoring, analysis, and management of air pollutants. This essay delves into the profound significance of IoT-based air quality monitoring systems, exploring their pivotal role in revolutionizing the way we comprehend, track, and address air pollution. It highlights the potential of these systems in providing not just data but actionable insights for policymakers, urban planners, and communities. As we navigate the challenges of escalating air pollution, these systems emerge as a vital tool, promising a future where clean, breathable air is not just an aspiration but a tangible reality.

[4] In metropolitan areas, the quality of the air we breathe is a critical concern. Real-time air qualitymonitoring through mobile sensing presents a revolutionary solution to this issue. With the pervasive use of mobile devices, this technology harnesses the power of interconnected sensors to provide instant,granular data on air quality, enabling both authorities and individuals to make informed decisions about their health and environment. By leveraging the capabilities of these sensors, this approach offers a comprehensive and accessible means to monitor air quality levels, detect pollutants, and take proactive steps to address environmental concerns. However, to realize this potential fully, it’s imperative to address challenges such as sensor accuracy, data security, and standardization. As technology continues to evolve, the integration of real-time air quality monitoring through mobile sensing stands as a promising strategy in our pursuit of cleaner, healthier metropolitan areas.

[5] The design, characterization, and management of a wireless sensor network for smart gas monitoring mark a significant advancement in the realm of environmental safety and industrial efficiency. This innovative technology harnesses the power of wireless sensors to continuously monitor gas levels in various environments, offering real-time data and insights that can revolutionize safety protocols and resource management. By exploring the intricacies of this wireless sensor network, this paper delves into the design principles, the characterization of data obtained, and the comprehensive management strategies essential for effective gas monitoring. This technology holds the promise of enhancing safety measures in industrial settings, ensuring a swift response to potential hazards, and optimizing resource utilization. In this context, the paper examines the crucial components and methodologies employed in this wireless sensor network, elucidating its significance in modern safety protocols and its potential impact on industrial.

[6] Air excellence monitoring in addition management has gained abundant attention latterly as the impact of air quality on several aspects of life. Besides the detrimental effects of toxic emissions on the environment and health, work productivity and energy efficiency are affected by air quality. This potential can be attributed to their attractive characteristics’ can be monitored remotely. WSNs adapt well to mobility. Potentials of WSNs in air quality monitoring have not been exploited to their fullest. Some WSN-based air quality monitoring systems have been introduced recently but they are not appealing enough to industry. Most of these are too difficult to implement, require specific instrumentation that is not open- hardware or open software, and are application and location dependent. Thus, the planned framework provides measurements of various air quality metrics which might facilitate in evaluating the impact of industrial emissions.

[7] The integration of IoT technology into air quality monitoring and forecasting marks a significant advancement in environmental science and public health. The "IoT-based air quality monitoring and forecasting system" represents a fusion of interconnected sensors and predictive analytics that provide real-time data on air quality parameters. This paper explores the significance of this system, delving into its components, functionalities, and the potential impact on environmental management and public welfare. By leveraging the power of IoT, this system aims to offer not just data but foresight, empowering authorities and communities to anticipate and address air quality issues before they escalate, thus fostering a healthier and more sustainable environment. This amalgamation not only aids in understanding current air quality conditions but also equips decision-makers with the foresight needed to prepare for and potentially prevent adverse air quality situations. However, the system's effectiveness is contingent upon addressing challenges relate

III. EXISTING SYSTEM

Existing Method for air quality monitor system using IOT is several existing methods utilize IoT technology for air quality monitoring, each with its limitations:

1.Sensor Network-based Systems:

Typically, a sensor network-based system for monitoring air quality entails setting up a network of sensors that are capable of measuring a wide range of environmental factors, including humidity, temperature, and air contaminants. These sensor nodes are frequently joined to form a network via wireless communication technologies, and the data they collect is typically forwarded to a central server for oversight and analysis. With this widely used method, a network of sensor nodes outfitted with different air quality sensors (such as PM, gas, etc.) is deployed.

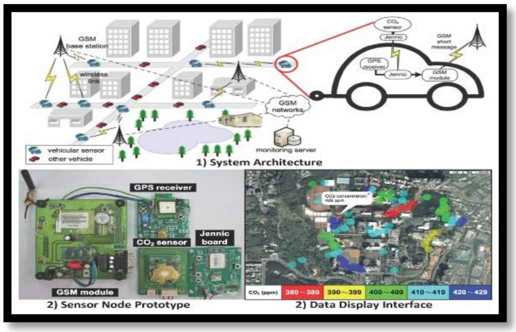

Fig-1: Sensor Network-based Systems

Sensor Nodes:

1. Gas sensors: These sensors are able to identify certain air pollutants, such as ozone (O3), sulfur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO), and particulate matter (PM).

2.Environmental Sensors: Take measurements of other factors like humidity, temperature, and air pressure.

Communication Technologies:

1. Wireless Sensor Networks (WSN): Wi-Fi, cellular networks, Zigbee, LoRa (Long Range), and other wireless protocols are used by sensor nodes to interact with one another and a central server.

2. IoT Protocols: In Internet of Things applications, MQTT (Message Queuing Telemetry Transport) and CoAP (Constrained Application Protocol) are frequently utilized for effective data transport.

Data Aggregation and Processing:

1.Edge Computing: Certain systems optimize bandwidth utilization by processing data at the edge, or sensor nodes, minimizing the quantity of data transmitted to the central server.

2.Cloud Computing: Cloud systems or centralized servers compute, analyze, and produce insights from aggregated data.

Centralized Server or Cloud:

1. Database: Store and manage the collected data in a structured database.

2. Analysis and Visualization: Utilize algorithms to analyze data and display air quality parameters either periodically or in real time.

Power Management:

Energy-Efficient Design Since sensor nodes frequently run on batteries, energy-efficient design is essential. To increase battery life, use sleep cycles and low-power modes.

Security:

Data Encryption: Use encryption techniques to safeguard data transfer and prevent unwanted access.

Authentication: Make sure that the sensor network and central server can only be accessed by authorized devices.

User Interface:

Web Interface or Mobile App: Provide stakeholders with an easy-to-use interface so they can see trends, receive alerts, and access historical and real-time data on air quality.

Alerting System:

Thresholds and Alarms Establish established air quality parameter thresholds that, when exceeded, will sound an alert. This facilitates prompt action in response to declining air quality.

Calibration and Maintenance:

Regular Calibration: To guarantee precise and trustworthy readings, calibrate sensors on a regular basis.

Maintenance Alerts: Install a system that can identify sensor issues and send out maintenance notifications.

2.Mobile and Personal Air Quality Monitors:

Fig- 2 : Mobile and Personal Air Quality Monitors.

Mobile sensor: This tiny, lightweight gadget measures the air quality as you walk around by clipping onto your clothing or luggage. Usually, it has sensors for VOCs, CO, PM2.5, PM10, and CO2.

Microcontroller: This processes sensor data and transmits it wirelessly to a smartphone app or cloud platform

Connectivity: Due to its dependable connection to smartphones and low power consumption, Bluetooth is the most often used communication option for mobile sensors.

Smartphone app: Due to its dependable connection to smartphones and low power consumption, Bluetooth is the most often used communication option for mobile sensors.

System Design:

a. Compact Sensors: Fitted with sensors that are usually aimed at PM2.5 and/or certain gases like CO2, NO2, and O3, these monitors gather information about your immediate environment continually.
b. Data Processing: The raw sensor data is processed by onboard microcontrollers or linked smartphone apps, which then convert it into metrics that are simple to interpret, such as pollutant concentrations or the air quality index (AQI).
c. User Interface: The majority of the devices have LCD screens or smartphone app interfaces that provide historical data patterns, current air quality readings, and occasionally even contextual data like weather updates.
d. Additional Features: Some advanced models offer:

e. GPS tracking: Records your air quality exposure along your journey.
f. Vibration or audible alerts: Notifies you when safe air quality thresholds are exceeded.
g. Data sharing: Allows you to contribute to community air quality maps and research initiatives.

3.Satellite and Remote Sensing Methods:

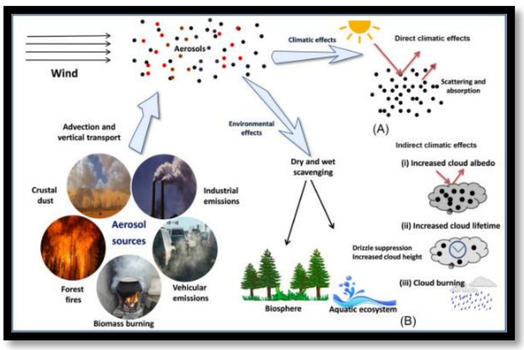

Fig-3: Satellite and Remote Sensing Methods**.**

a) Satellites and remote sensing Satellites: These spacecraft orbit the planet and gather vast amounts of data on a range of air quality markers.
b) The Aerosol Optical Depth (AOD) measures the quantity of suspended particulate matter in the atmosphere.
c) Nitrogen dioxide (NO2): Associated with power generation and emissions from traffic.
d) Ozone (O3): Ozone (O3): Its effects on human health can be either beneficial (stratospheric) or damaging
e) Carbon Monoxide **(CO):** Primarily from incomplete combustion processes

IOT Network:

a) Ground-based sensors: Located at specific sites, these
b) monitor metrics related to local air quality, such as PM2.5 and PM10, which are fine and coarse particulate matter that are detrimental to respiratory health.
c) Carbon Dioxide (CO2): An association with greenhouse gas emissions and global warmingVarious sources emit volatile organic compounds (VOCs), which have an impact on both air quality and human health.Wireless data transmission from sensors to a central HUD or COVID platform

Remember that the information you wish to gather and your individual needs will determine which air quality monitoring method is best for you. Integrate disparate techniques, such as personal monitors, ground-based networks, and satellite data, to gain a thorough picture of air quality at diverse scales.

Disadvantages:

a) Limited individual-level data
b) High technological complexity.

4.Low-cost Sensor and DIY Approaches:

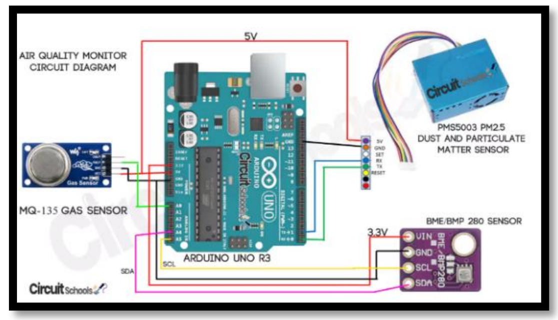

Fig -4: Low-cost Sensor and DIY Approaches

Components:

Low-cost sensors: For detecting important air pollutants, sensors such the MQ135 (CO2), MQ7 (CO), and SDS018 (particulate matter) provide cost-effective solutions.

a) Microcontroller: Popular options for processing sensor data and facilitating connectivity include Arduino boards and Raspberry Pi.
b) Connectivity: Your system can be remotely monitored by connecting it to the internet using LoRa or Wi-Fi modules.
c) Cloud platform: You can save and view your sensor data online using free platforms like Blink or Thing Speak.

DIY Approach:

Pick your sensors:

a) Make your selections based on your budget and the air pollutants you wish to keep an eye on.
b) Construct the hardware:
c) Assemble sensors in accordance with the schematics and libraries that come with your selected microcontroller.

Compose the code:

a) You may program the microcontroller to read, process, and send sensor data to the cloud platform of your choice.

b) On the platform of your choice, create an account and set it up to receive and display sensor data.

Remember, low-cost sensor and do-it-yourself approaches offer a compelling choice to investigate whether you're an enthusiast, researcher, or just worried about the purity of your air. Although learning and troubleshooting will take time and effort, the benefits of taking control of your air quality data and helping to raise awareness 75 of this important environmental issue are priceless.

IV PROPOSED METHODOLOGY

The fundamental aim behind this project is to implement the concept of IoT to monitor the temperature, humidity and air quality of the surroundings. The design of this Air Quality Monitoring involves incorporation of Q6 Sensor, MQ2 Sensor, DHT11 and LCD Display. Here an Arduino development board will be used to process the data which will be received from various sensors and display it in the LCD.

Here's a proposed methodology for an air quality monitoring system using IoT:

1. System Design:

Sensor Network: Deploy a network of air quality sensors at strategic locations like traffic junctions, industrial zones, residential areas, or any specific area of interest. Choose sensors for relevant pollutants like particulate matter (PM2.5, PM10), ozone (O3), nitrogen dioxide (NO2), carbon monoxide (CO), and sulfur dioxide (SO2). Consider additional sensors for factors like temperature, humidity, and noise to understand the environment's influence.

1.Microcontroller/Gateway:

Each sensor connects to a microcontroller or a gateway that collects and processes data locally. Microcontrollers can manage simpler setups, while gateways offer more processing power and communication capabilities for larger networks.

a) Connectivity: Use a reliable wireless communication protocol like Lora WAN, NB-IoT, or cellular networks to transmit data from the sensors/gateway to the cloud platform. Choose a protocol based on factors like range, power consumption, and cost.

2. Data Acquisition and Transmission:

a) Sensor Calibration: Regularly calibrate sensors to ensure accurate data collection.
b) Data Preprocessing: Perform basic data cleaning and filtering to remove outliers and noise on the microcontroller/gateway before transmission.
c) Data Security: Implement encryption mechanisms to secure data transmission to the cloud platform.
d) 3. Cloud Platform and Analytics:
e) Cloud Storage: Choose a secure and scalable cloud platform to store the collected air quality data. Services like Google Cloud Platform, Microsoft Azure, or Amazon Web Services offer relevant solutions.
f) Data Analysis: Employ data analytics tools and techniques to analyze the collected data.
g) Visualization: Develop an interactive dashboard or mobile app to visualize air quality data in real-time. Represent pollutant levels using color-coded maps, charts, and graphs.
h) Notifications and Alerts: Implement algorithms to trigger alerts when pollutant levels exceed safe limits. Send notifications to relevant authorities or citizens via SMS, email, or mobile app notifications.

4. System Maintenance and Expansion:

a) Remote Monitoring: Monitor the system remotely for sensor health, data transmission, and power levels. Implement mechanisms for remote firmware updates and troubleshooting.
b) Scalability: Design the system with expansion in mind. Include modularity and flexibility to add new sensors, locations, or functionalities as needed.
c) Additional Considerations: Power Management: Utilize low-power sensors and communication protocols to extend battery life for remote deployments.
d) Cost Optimization: Choose cost-effective hardware and software solutions. Consider open-source platforms and DIY options to reduce costs.
e) Regulation Compliance: Ensure the system adheres to relevant air quality regulations and data privacy laws.
f) This is a general framework, and you can customize it based on your specific needs and budget. Remember to factor in the purpose of the air quality monitoring system, target audience, and desired functionalities when refining your methodology.

IV. BLOCK DIAGRAM

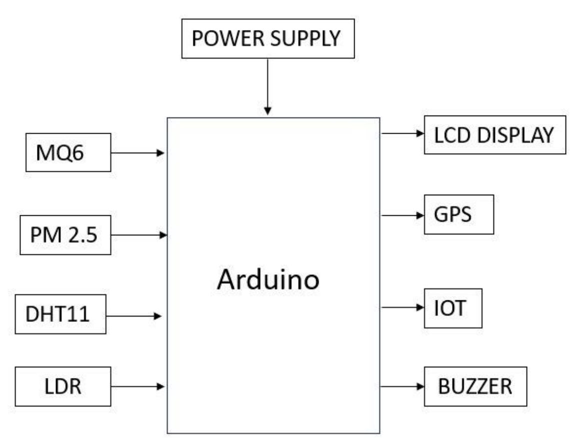

Fig.5.Air Quality Monitoring IOT Block Diagram

IV. HARDWARE REQUIREMENT

The design comprises of various Hardware components for implementation. Arduino UNO has been employed in this design for the primary processing which contains AT mega 328p micro con- troller. An IoT module (ESP8266) has been used for trans- mission of data to and from mobile application to wheel chair. MQ6 Sensor is used for sense the gases such as LPG and Butane Gas. PM2.5 Sensor is used to sense the PM2.5 particles in surroundings. DHT11 is used to detect Humidity and Temperature. GPS is used to track the air quality concentration in particular concentrations. LCD module is used for displaying concentration of air pollutants.

The following hardware is used in our project:

1. Arduino
2. IOT module
3. MQ6 Sensor
4. PM2.5 Sensor
5. LDR
6. DHT11
7. Power Supply
8. LCD display
9. GPS
10. Buzzer

1. ARDUINO:

Arduino is an electronics platform available as open-source software and hardware components.

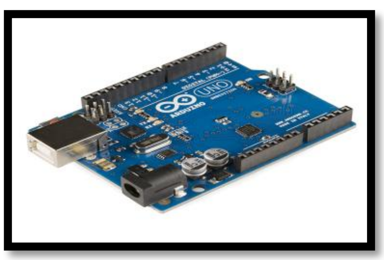

Fig -6: Arduino.

The Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

2. IOT MODULE:

The NodeMCU ESP8266 has a variety of features that make it well-suited for IoT development, including:

- Built-in Wi-Fi connectivity
- 11 GPIO pins
- 1 analog input pin
- Serial communication pins
- Micro USB port for programming and power
- Open-source firmware and development kit

Fig-7: IOT Module.

The Node MCU ESP8266 can be programmed using either the Arduino IDE or the Lua scripting language. It is also compatible with a variety of development platforms, making it easy to get started with your IoT projects.

3. MQ6 SENSOR:

MQ-6 Semiconductor Sensor for Combustible Gas. MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible steam, it is with low cost and suitable for different application.

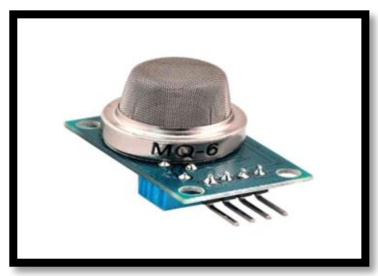

Fig8: MQ6 Sensor.

- Good sensitivity to Combustible gas in wide range
- High sensitivity to LPG, Propane and Hydrogen
- Long life and low cost
- Simple drive circuit
- Sensor Type - Semiconductor

4. PM2.5 SENSOR:

PM2.5 sensors, also known as fine particulate matter sensors, are devices used to measure the concentration of tiny particles in the air, specifically those with a diameter of 2.5 micrometers or less. These particles are invisible to the naked eye and can pose significant health risks when inhaled. Air quality monitoring: PM2.5 sensors are used to monitor air quality in homes, offices, and outdoor environments. This information can be used to assess health risks and take steps to improve air quality

Fig-9: PM2.5 Sensor

. Air purifiers: Some air purifiers use PM2.5 sensors to monitor the air quality and adjust their settings accordingly

5. LDR:

LDR (Light Dependent Resistor) sensors detect ambient light levels, indirectly indicating air quality. LDRs operate based on the principle of photoconductivity, where their resistance changes in response to incident light intensity. As air quality worsens due to pollutants like smoke or smog, light penetration decreases, causing a decrease in LDR resistance

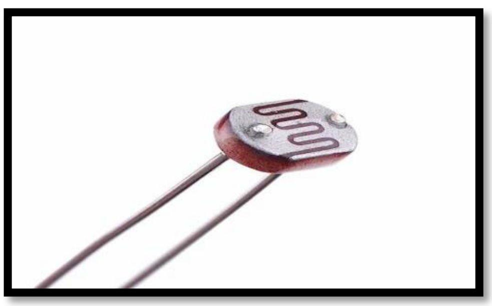

Fig-10: LDR

This change is measured and transmitted to an IoT system, alerting users to deteriorating air quality. Through continuous monitoring of LDR output, users can take timely actions to mitigate pollution levels, promoting healthier living environments and reducing health risks associated with poor air quality.

6. DHT11:

The DHT11 sensor uses thermistor-based temperature detection and capacitive humidity sensing as its operating principles. The sensor measures the environment's temperature and humidity while it is in use.

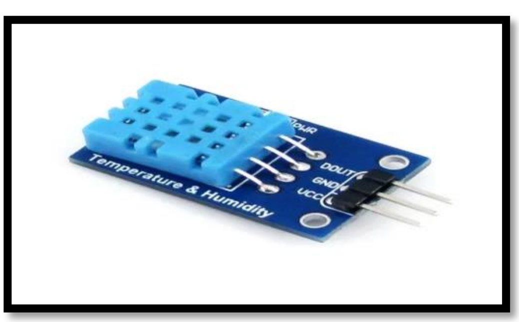

Fig-11: DHT11

It uses Internet of Things technology to transform these measurements into digital signals, which are then sent to a central server. Real-time temperature and humidity data are often included in the output, giving customers information about the environmental conditions necessary for efficient air quality management and monitoring.

7.POWER SUPPLY:

The power supply plays a crucial role in any electronic device, including IoT modules like the NodeMCU. Its primary function is to provide the necessary electrical energy for the operation of the device's components and peripherals. Here's a breakdown of the roles of a power supply in the context of an IoT module the power supply ensures that the voltage supplied to the IoT module remains within the acceptable operating range. For example, the NodeMCU typically requires a stable voltage of around 3.3 volts. The power supply regulates the input voltage to ensure it meets this requirement, preventing damage to the module from overvoltage or undervoltage conditions.

8.LCD DISPLAY:

The term LCD stands for liquid crystal display. This particular type of electronic display module is utilized in a wide range of circuits and gadgets, including TV sets, computers, calculators, cell phones, and more. Seven segments and multi-segment light-emitting diodes are the major applications for these displays. The primary advantages of utilizing this module are its low cost, easy programming, animations, and limitless display options for unique characters, special effects, and animations, among other things. Liquid Crystal Display also called as LCD is very helpful in providing user interface as well as for debugging purpose. The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. The most commonly used LCDs found in the market today are 1 Line, 2 Line or 4 Line LCDs which have only 1 controller and support at most of 80 characters, whereas LCDs supporting more than 80 characters make use of 2 HD44780.

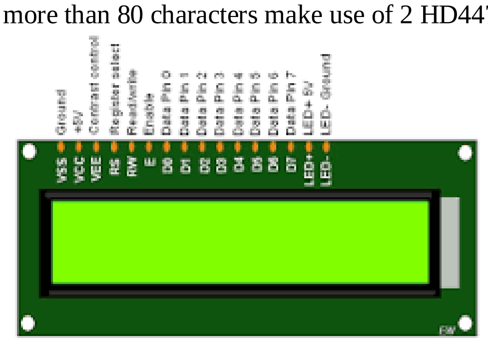

Fig-12: LCD displays

LCD displays have a number of benefits, such as their thinness, low power consumption, and flicker-free image presentation. Comparing them to other display technologies like OLED (Organic Light-Emitting Diode), they do, however, have certain drawbacks, such as restricted viewing angles and contrast ratios.

9. GPS:

Global Positioning System (GPS) technology is changing the way we work and play. You can use GPS technology when you are driving, flying, fishing, sailing, hiking, running, biking, working, or exploring. With a GPS receiver, you have an amazing amount of information at your fingertips.

Fig 13: GPS

The Global Positioning System (GPS) is a satellite-based navigation system that sends and receives radio signals. A GPS receiver acquires these signals and provides you with information. Using GPS technology, you can determine location, velocity, and time, 24 hours a day, in any weather conditions anywhere in the world—for free GPS, formally known as the NAVSTAR (Navigation Satellite Timing and Ranging) Global Positioning System, originally was developed for the military. The USA owns GPS technology and the Department of Defense maintains it.

GPS technology requires the following three segments

- Space segment
- Control segment
- User segment

10. Buzzer:

Buzzers are essential for informing users of changes in air quality through auditory notifications. Buzzers work on the basis of electromagnetic or piezoelectric vibration, which is the process by which sound waves are produced when an electric signal vibrates a diaphragm. The buzzer alerts people to the need for quick action when sensors identify dangerously high levels of air pollution.

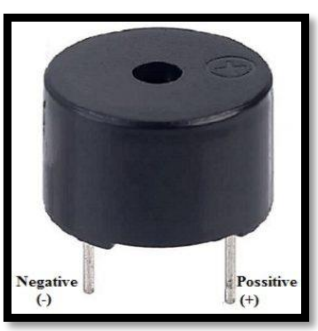

Fig-14: Buzzer

In order to improve overall safety and well-being in both indoor and outdoor situations, this audio feedback guarantees that users are instantly informed to potential health hazards. This allows for swift steps to minimize exposure and improve air quality.

V. Software Requirement

A. Arduino:

The Arduino IDE (Integrated Development Environment) is the program used to write code, and comes in the form of a downloadable file on the Arduino website. The Arduino board is the physical board that stores and performs the code uploaded to it. Both the software package and the board are referred to as "Arduino". To begin, download the Arduino IDE from the Arduino website. Make sure to select the right version for your Operating System (OS). For a full getting started guide for each OS, please refer to the Arduino guide. Once the arduino.zip file has been downloaded, extract the file to a folder somewhere on your computer. There is no install simply open the folder and double click the.exe.

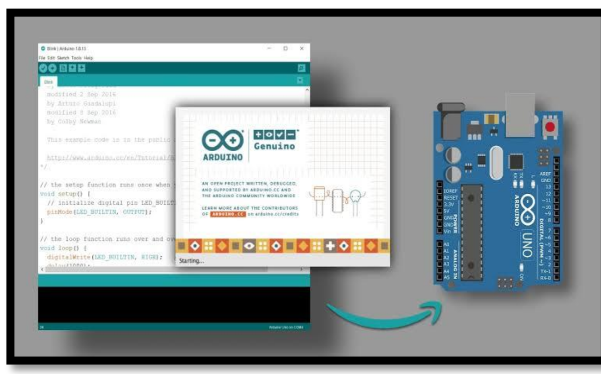

Fig-15: Arduino IDE

Key Features:

- Text editor: Write and edit your Arduino code.
- Compiler: Converts your code into a format that the Arduino board can understand.
- Uploader: Uploads your code to the Arduino board.
- Serial monitor: Allows you to communicate with your Arduino board from the IDE.
- Board manager: Install additional libraries and boards for extended functionality.

B. TELEGRAM APPLICATION USING IOT:

Using Telegram with the Internet of Things (IoT) for air quality monitoring is a brilliant and practical idea. It allows us to remotely track our environment's air quality and receive real-time updates right on our phone. Here's a breakdown of how it works:

Components:

1. Air quality sensors: These capture data on various pollutants like PM2.5 particles, LPG gas, Butane gas, Humidity and Temperature. Popular options include the MQ6, PM2.5, and DHT11.
2. Microcontroller board: This processes sensor data and transmits it to the cloud. Arduino Uno, ESP8266 are common choices.
3. Telegram bot: Sends air quality information and alerts to your Telegram app. You can create one using Bot Father or third-party services.

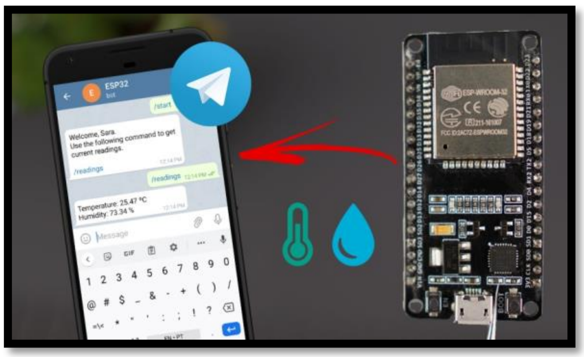

Fig-16: Telegram Application Using IOT.

Process:
1. Sensor data collection: The sensors gather air quality readings at regular intervals.
2. Data processing: The microcontroller board cleans and formats the sensor data.
3. Data transmission: The data is sent to the cloud platform via Wi-Fi or cellular network.
4. Data visualization: The cloud platform stores and visualizes the data over time. You can access it through a web dashboard.
5. Telegram notifications: The Telegram bot retrieves data from the cloud and sends you alerts if air quality levels exceed safe limits.

Benefits:
1. Remote monitoring: Track air quality from anywhere with an internet connection.
2. Data visualization: Analyze air quality trends over time.
3. Actionable insights: Take steps to improve indoor air quality, like opening windows or using air purifiers.

IV. WORKING AND PERFORMANCE

An IoT-based air conditioning supervising system is designed to monitor and optimize the performance of air conditioning units in various environments.

- The system integrates various sensors such as temperature sensors, humidity sensors, and perhaps even air quality sensors to monitor the environment in real-time.
- Data collected from these sensors are transmitted to a central server or cloud platform via the internet.
- The collected data is analyzed using algorithms to identify patterns, trends, and anomalies.
- Based on the analysis, the system can remotely control the air conditioning units to optimize their performance.

Fig-17: Hardware Setup.

- The system typically includes a user interface, such as a mobile app or web dashboard, that allows building managers or homeowners to monitor the status of the air conditioning system, view historical data, and adjust settings as needed.
- The IoT-based air conditioning supervising system can also integrate with other smart building systems, such as lighting controls or security systems, to further optimize energy usage and overall building performance.
- Overall, an IoT-based air conditioning supervising system offers numerous benefits

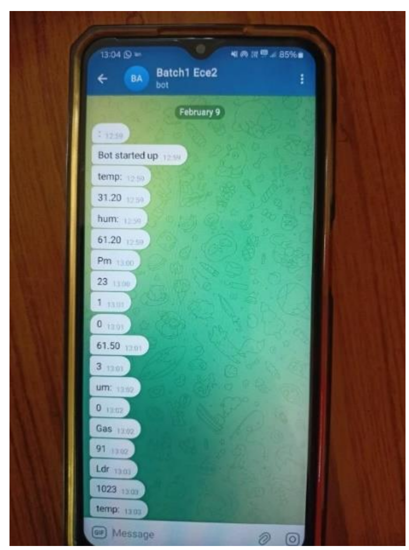

Fig-18: Displayed Values from Telegram Application

VI. RESULTS

The above circuit diagram consists of combination of various sensors to Arduino and the information will be shared through IOT. The LCD Display will display all the outputs of various sensors.

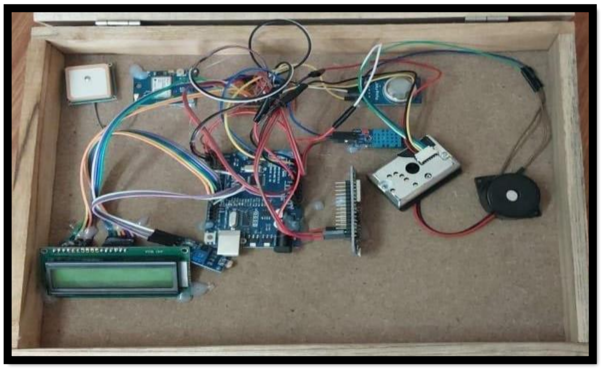

Fig:18: Circuit Connection Diagram

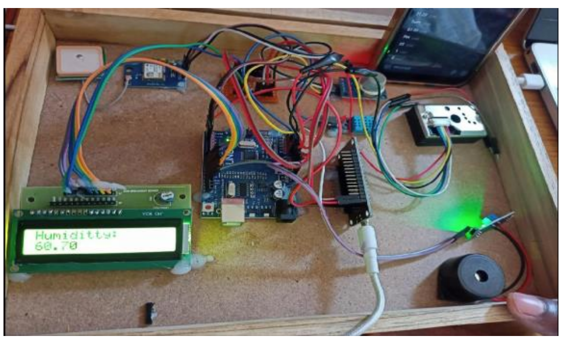

Fig-19: LCD Display of humidity Value

Fig-20: LCD Display of PM2.5 Particle Value

Fig-21: LCD Display of Co2 Value by using gas sensor

Fig-23: LCD Display of LDR Value

VII. CONCLUSION

The MQ6, PM2.5, LDR, and DHT11 sensors are utilized in this project to monitor the harmful PM2.5 particles in the surrounding region as well as temperature, humidity, CO2, LPG, and butane gas concentrations in the air. Moreover, the LDR sensor is employed to identify ambient light levels, which serve as an oblique indicator of air quality. Burzer rings appear when light penetration decreases when smog or smoke taint the air. The numbers for the temperature, humidity, gas concentrations, and PM2.5 particles will be shown on an LCD display. Arduino and IOT will update the data each time the concentration of air in our surroundings varies. GPS is used to track the concentrations of air quality in certain areas. S. When smoke or smog contaminate the air, light penetration decreases and buzzer rings occur. The numbers for the temperature, humidity, gas concentrations, and PM2.5 particles will be shown on an LCD display. Arduino and IOT will update the data each time the concentration of air in our surroundings varies. GPS is used to track the concentrations of air quality in certain areas. As a result, we can judge if the environment is clean or not. When air quality is dangerous, a buzzer will activate, triggering the sending of an alarm. This project's main objective is for everyone to embrace adopting new habits by safeguarding the environment, preventing the release of hazardous gasses into the atmosphere, and employ fewer cars for both community and critical transportation. Thus, it follows that If settlements are near industries, the unplanned release of industrial fumes across the Many people can die of respiratory failure at night. Thus, by maintaining this project's With the hamlet's apparatus, hearing the buzzer can save lives from impending death.

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