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# IoT Based Air Quality Monitoring

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**ABSTRACT**: Pollution levels are increasing rapidly due to factors such as industry, urbanization, population growth, vehicle use, which can affect human health. IOT Based Air Pollution Monitoring System is used to monitor air quality through web server using internet. It triggers an alarm when the air quality drops below a certain level, that is, when there are enough harmful gases such as CO2, smoke, alcohol, benzene, NH3 and NOx present in the air. It will show the air quality in PPM on the LCD as well as on the cloud, so air pollution can be monitored very easily.

## I. INTRODUCTION

The Air Excellence Guide (AEG) can be a common indicator of air quality. Air Quality Indicator (AQI) is calculated and supported for air pollutants such as CO and NO2 compounds that consume opposing assets found in the atmosphere and human health. An air quality indicator can be a range that represents the finest meditation of a particular unused air mass at a particular time. I am designing an air quality and air pollution monitoring system that allows us to monitor and control the air quality and air pollution in a certain area in real time through the Internet of Things (IoT).

It uses air sensors (Gas Sensor MQ135) to detect the presence of harmful gases/compounds in the air and transmits this data continuously. In addition, the system continuously measures and reports the air level. The sensors work with an Arduino Uno (microcontroller), which processes and transmits this data through the application. This allows the authorities to monitor air pollution in different areas and take action against it.

In addition, authorities can monitor air pollution near schools and hospitals. Normally, small concentrations per unit area measured use ppb (parts per billion), which represents units of mass of material per one billion units of total mass. Parts per million (ppm) can be a similar and meaningless unit used to measure pollutant concentrations. Determines new system requirements and analyzes product requirements and resources required for a successful system.

A product requirement contains requirements for inputs and outputs that give the desire in terms of input to produce the required productivity. Resource requirements briefly define the hardware that is needed to achieve the desired functionality.

## II. RELATED WORK

1) Raspberry Pi controlled cloud air and sound pollution monitoring system with temperature and humidity sensing.

Saha, A.K., (2018) developed a raspberry Pi controlled cloud based air and sound pollution monitoring system with temperature and humidity sensing using Raspberry Pi, Wi-Fi module. The authors stated that control and careful monitoring of the situation has become necessary so that the necessary steps can be taken to mitigate the situation. In this research, an IOT-based technique was proposed to monitor the air quality index and noise intensity in the region. The air quality index monitoring module, the sound intensity detection module, the cloud-based monitoring module and the anomaly notification module are the four modules that make up the recommended technology. For starters, the air quality index is calculated based on the presence of five specific pollutants in the air. The sound intensity is then detected using the appropriate sensor. After that, the Cloud-based Monitoring Module ensures the data collection process with the Wi-Fi support of the Raspberry Pi module and regularly achieves the goal of data analysis. Finally, the anomaly notification module alerts the user if a problem occurs.

Advances in wireless communication and sensor technologies have resulted in a kaleidoscope of changes in the air pollution monitoring paradigm in recent years. The Internet of Things has made it possible to create smart

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environments in which items communicate and collaborate. To avoid tragic accidents, scientists used Raspberry Pi and IoT to monitor dangerous gas leaks and air quality.

2) Smart IoT system for monitoring vehicle noise and pollution

Patil, P. (2017) developed a smart IoT system to monitor vehicle noise and pollution. Both the hardware architecture and the software implementation are thoroughly developed. IoT technology is also used to verify system performance. The smart intelligent environmental protection system that has been built monitors the pollutants produced by cars and alerts vehicle owners to take measures to reduce pollution. Data on pollution levels is also sent to a server for further study. Air pollution authorities can examine the data and identify car registration numbers that contribute to increased air pollution. The proposed system is cheap, easy to use and can be placed in any place. The created system outperforms the old system in terms of accuracy and cost

3) Internet of Things based air pollution monitoring system for smart cities

Gupta and colleagues (2019) developed an IoT-based air pollution monitoring system for smart cities. Smart cities are under pressure to remain livable as the world's population becomes increasingly urbanized. Air quality in urban centers has become a major source of concern worldwide in recent years. Consequently, to make a city smart and livable, it is vital to regularly evaluate its air quality index. In this research, we design and construct an IoT-based air quality monitoring system for smart cities. Air quality data is collected in real time through smart devices and analyzed to determine the impact on city residents. Temperature, humidity, carbon monoxide, LPG, smoke and other harmful particles. The Android application makes the obtained data available to everyone in the world.

4) IoT-based air pollution monitoring and information system.

Yamunathangam et al in November 2018 used IoT by measuring gas concentration using various sensors that were observed through an Arduino serial monitor. This data is collected in Thing speak channels using an ethernet shield which is available for further processing. These analyzed results were viewed through matter-of-fact speech in a graphical format. The mean pollution level was then calculated using Matlab analysis and the timed results were displayed via an Android application. Furthermore, based on the location, the air quality index value was obtained through an Android application. Along with this, the health effects have also been displayed in this app so that users can be aware of the pollution levels.

5) IoT-based air pollution monitoring and prediction system on Beagle Bone Black

NitinSadashiv Desai et al. in 2017, he designed a system that consists of a beagle bone connected to air pollution measurement sensors such as carbon dioxide [CO2], carbon monoxide [CO], and a noise sensor. The analog output from the sensor was read from the Analog Pin of Beagle bone black which reads the input signal in the range of 0v to 1.8v. The data from the sensor was uploaded to Azure Cloud using python SQL. The reserved database was created in the very bone of the beagle in the form of a .CSV file. At the end of each day, the same data contained in the .CSV file is uploaded to the cloud database. The old data in the beagle bone was deleted using an automatic shell script.

Data from another sensor was stored in an Azure database. This data from the database was loaded as input for the machine learning service. A machine learning service was used to train the module using previous data. Power BI was used to represent sensor data read by a bone black beagle.

6) IoT based air pollution monitoring system using Arduino

Poonam Pal et al. in October 2017 he developed an air monitoring system using an Arduino microcontroller. They used an MQ135 gas sensor to sense different types of hazardous gas and an Arduino to control the entire process. The MQ135 gas sensor provides output in the form of voltage levels and needs to be converted to PPM. A Wi-Fi module was used to connect the entire process to the Internet, and an LCD was used for visual output. When the value is less than 1000 PPM, the LCD and web page will display "Fresh Air" and when the PPM exceeds the limit, the buzzer will beep and the LCD and web page will display "Bad Air, Open Windows". If it increases by 2000, the buzzer will keep beeping and the LCD and web page will show “Danger! Move to fresh air.”

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## III. METHODOLOGY

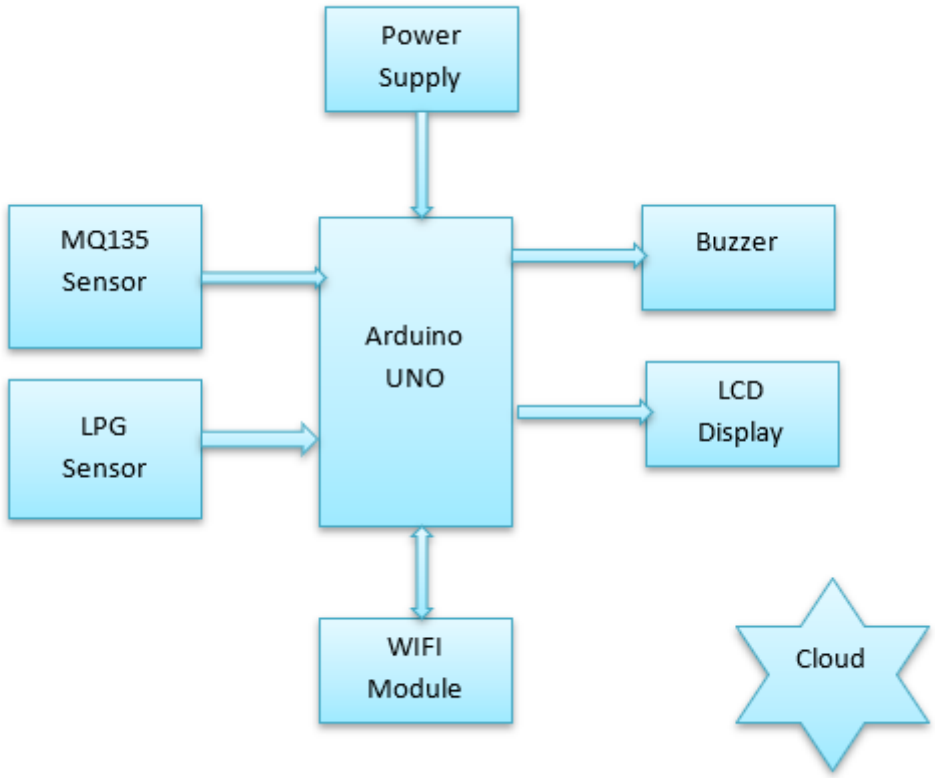


Fig: 3.1block diagram

- **Arduino UNO**

It's an open-source proto-typing platform , based on easy to use hardware and software. Arduino boards are able to read an input a light on a sensor, a finger on a button, or a message on Twitter and turn it into an output activate a motor, light an LED, publish something online.

- **LCD display**

LCD's are ideal for displaying text/characters only. For example, a 6×12 character LCD has an LED backlight and can display 32 ASCII characters in two rows of 16 characters each**.**

- **LPG gas sensor**

Nowadays, security is a major concern in many areas due to robberies, fires and explosions due to LPG leakage. Currently, LPG gas can be used in a car, in a tank or at a gas station, but due to certain reasons, LPG gas can leak from the cylinder, which can cause damage to the house by the explosion of the cylinder and endanger the lives of people living in the house. To overcome this problem, an LPG gas sensor is used to detect the presence of hazardous LPG gas at various locations.

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- **MQ135 Sensor**

An MQ135 air quality sensor is one of MQ gas sensor used to detect, measure and monitor a wide range of gases present in air like ammonia, alcohol, benzene, smoke, carbon dioxide, etc.

## IV. RESULTS

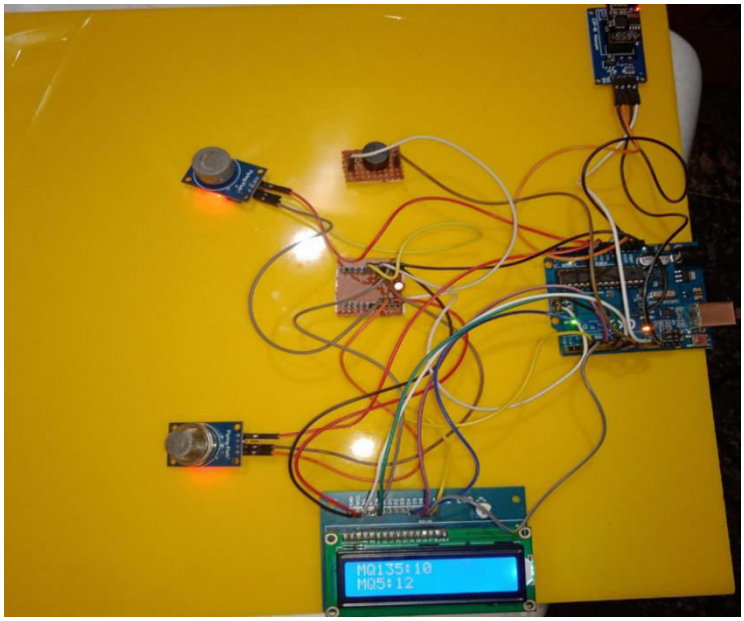
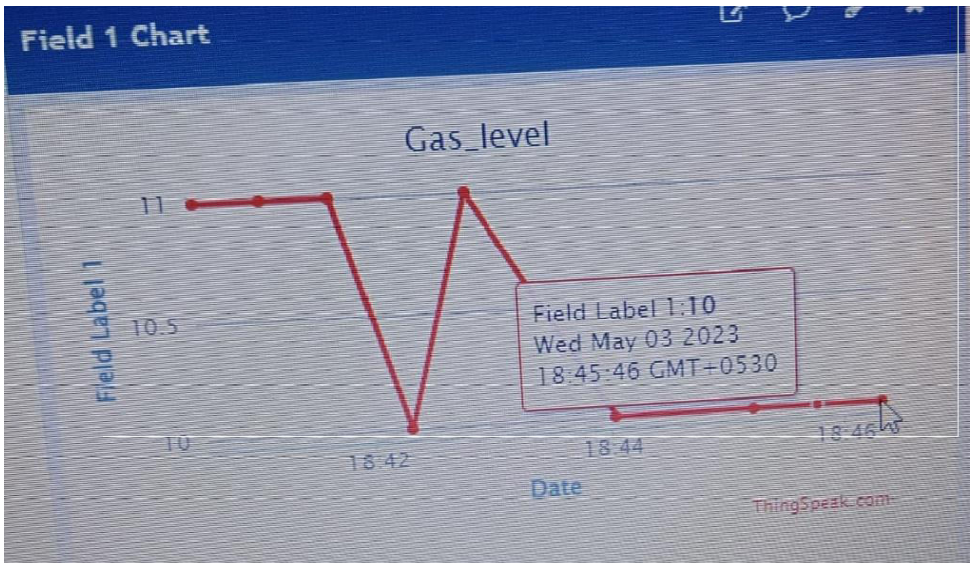



Fig 4.1 Working model



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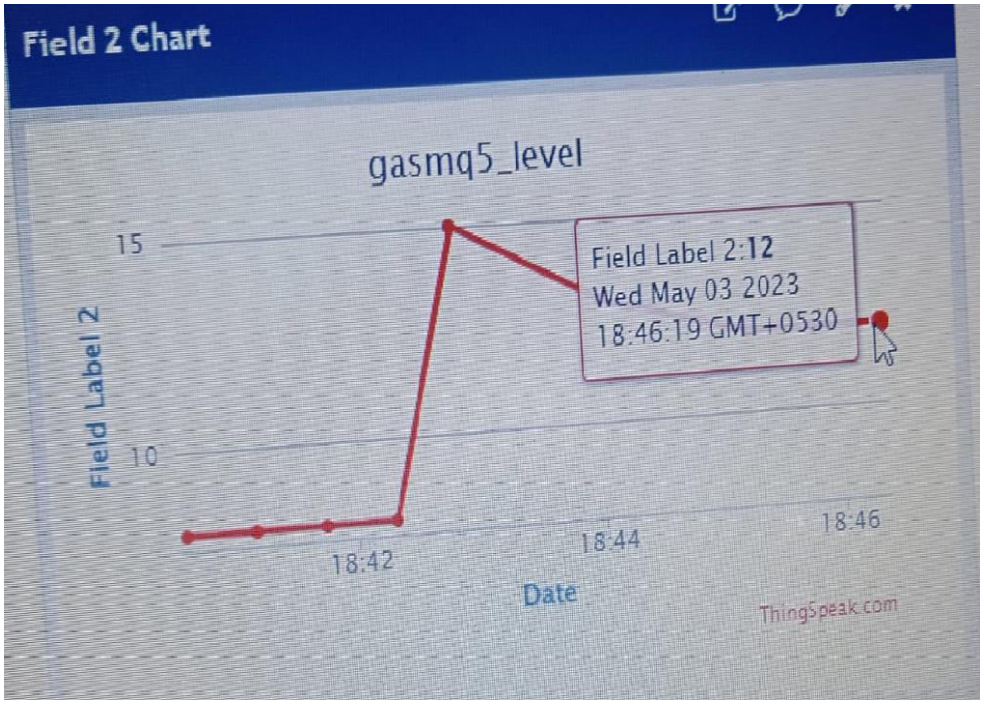


Fig 4.2 Level of Carbon Present in MQ135 and MQ7 sensors

## V. CONCLUSION

Air monitoring system, usingArduino microcontroller, IoT technology is designed to improve air quality. With the use of IoT technology, the process of monitoring various aspects of the environment is improved, such as the air quality monitoring problem proposed in this work. Here the use of MQ135 gives the feeling of a different type of dangerous gas and Arduino is the heart of this project. Which controls the whole process, the Arduino module connects the whole process with the LCD and the serial monitor is used for visual output and we also upload the data to the cloud.

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