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# A NOVEL IoT BASED AIR AND WATER QUALITY MONITORING SYSTEM

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## ABSTRACT

*The four main types of pollution caused by industries are air pollution, water pollution, soil pollution, . Globalization and industrialization are throwing off untreated harmful and toxic elements into the atmosphere, which has led to the contamination of fundamental ecosystem elements like water, air, and soil that humans depend on for survival. This causes infections that can spread to humans and animals through the air and water. Controlling these pollutant characteristics is therefore quite difficult. The major goal of this project is to design an effective and reliable system to monitor the parameters that are creating pollution. This paper provides an industrial Internet of things (IoT) based air, water, and sound pollution monitoring system. This project's/system's working approach is to read and track pollution parameters, alerting pollution control authorities when any of these pollutants are released in excess of what is considered acceptable by the industry. Using a variety of sensors, including PH, MQ6, MQ9, temperature, humidity, noise, and dust density sensors, the system analyzes the amount of PH in industrial effluents, the level of CO, carbon dioxide, combustible gas, humidity in the air, and the minute optical dust particles released during industry processes. It also assesses the amount of sound produced by the industry. The system uses wireless technology (i.e., the Internet of Things) with a GPRS modem and cloud technologies to record the values of pollutants released at a specific date and time. It also notifies the environmental pollution monitoring authorities via email and SMS when there is an increase in emissions.*

**KEY WORDS:** *Co, Mq6, Mq9, Iot, Gsm, Gprs, Dust Density Sensor, Cloud Technologies,*

## I.INTRODUCTION

A significant and critical aspect that is adversely affecting millions of people's quality of life is pollution.This leads to the majority of environmental contaminants.A significant and critical aspect that is adversely affecting millions of people's quality of life is pollution.

With the world's population rising and industries developing, environmental pollution has become a major concern. The majority of pollutants in the environment come from untreated emissions and the discharge of industrial waste from factories into the environment. Three main categories of pollution are mostly caused by the manufacturing and processing sectors by air and water

Air pollution results from the release of a significant amount of untreated industrial waste, including carbon dioxide, carbon monoxide, sulfurous oxides, nitrous oxides, optical dust, and minute particulate matter. Additionally, a significant amount of polymer vapours, such as methane and butanes, are released into the atmosphere when burning coal, natural oils, fossil fuels, and petroleum products for industrial processing.According to estimates from the Indian Pollution Control Authority, airborne illnesses claim the lives of around 1.2 million Indians annually.

Similar to this, the main cause of industrial water pollution stems from the release of untreated industrial waste produced during different processing operations. Examples of industrial waste include asbestos, lead, mercury, nitrates, phosphates, sulfur, and other petrochemicals. Untreated acidic wastewaters that are dumped into natural reservoirs lower the pH of the water in the reservoir, which reduces microbial activity and inhibits the growth of algae and other aquatic plants, which lowers the BOD level.

One of the most effective instruments in today's technology is the Internet of Things (IoT), which enables data access from far-off places and cloud storage. As pollution levels rose and sophisticated technology proliferated, a number of novel approaches were developed to monitor the swift rise in pollution more effectively. One such approach that saw significant success in this area was the Internet of Things. The Internet of Things (IoT) has become the most widely used instrument for information exchange amongst devices connected to the internet due to the rise in the use of the internet and gadgets that operate on the basis of artificial intelligence.

This study offers a GSM and GPRS based pollution monitoring system that enables us to track the amount or level of pollutants released by different industries in different areas. The system uses a variety of sensors, including temperature, humidity, dust density, noise, MQ-6, MQ-9, PH, CO, CO2, combustible gas, humidity in the air, and the amount of minute optical dust particles released during the industrial manufacturing process, to collect various analog data, including the level of PH in industry effluents, CO, CO2, combustible gas, humidity in the air, and the

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level of minute optical dust particles released during the industrial manufacturing process.

Additionally, the system logs the amounts of pollutants released at a specific date and time. It also notifies the environmental pollution monitoring authorities via email and SMS when emissions exceed pre-established industrial standards, allowing for additional control measures to be taken over pollution release.

## II.LITERTURE SURVEY

[1] Prem Kumar S. and Zumyla Shanaz looked into "IoT-based Industrial Pollution Monitoring System." In order to provide a healthy atmosphere for industry workers, the author suggested developing a reliable system that continuously monitors the air quality surrounding the industry by measuring the amount of different pollutants generated during the industrial process with less human interaction. Here, the author analyzed the amount of CO, CO2, and smoke quality discharged into the atmosphere using MQ-6 and MQ2 sensors. GSM technology was utilized to facilitate the data interchange between the sensors and the monitoring authority.

[2] Karan Kapoor, Ms. Aarthi, spoke on "Air and Sound Pollution Monitoring System Using IoT."The author of this study creates a system that uses a variety of sensors, such as the MQ-135 to measure the amount of CO2 in the atmosphere, the DHT11 sensor to measure temperature and humidity, and the LM393 sensor to measure sound intensity, to monitor the quality of the air and the level of noise generated during industrial processes. The Raspberry Pi 3B module, an ARM-based credit card-sized SBC (Single Board Computer) with an integrated Wi-Fi and Bluetooth module, is used to integrate the system. Through the Internet of Things, the author employed GPS technology to transfer data from the sensors to the designated places.

[3] Deepa Jose and Kavitha B.C. B.C. proposed a "Raspberry Pi-based Internet of Things Pollution Monitoring System." In this instance, the author creates a system that includes a number of sensors, including MQ-6, MQ-7, MQ-135, LDR, and DHT11 sensors, to track the presence of different pollutants, such as carbon monoxide, carbon dioxide, smoke, and butane. The system also tracks the rise in atmospheric temperature and humidity brought on by the release of pollutants. The Raspberry Pi microcontroller, which has an integrated WiFi module, is used. When pollution emissions above the pollution board's predetermined thresholds, the system continuously monitors data on the amount of pollutants in the atmosphere and notifies the relevant authorities.

[4].The topic of "Designing an IoT-based air quality monitoring system" was covered by T H Nasution and M A Muchtar [4]. In order to exchange data from the sensors, the author of this research developed a system using a variety of analog sensors, including the MQ-135, MQ-7, and dust density sensor. The Arduino microcontroller is connected to an ESP822 Wi-Fi module. The author also used a mobile application called ThingsSpeak cloud, which stores the data collected by the sensors in cloud storage and facilitates access to the data recorded even in remote locations.

[5] "Design and implementation of IoT based Portable Outdoor Dust Density Monitoring System" was the idea put forth by Mahammad D.V. Here, the author uses an Arduino microcontroller interfaced optical dust density sensor to measure the amount of minute optical pollutants in the form of microparticles. The data is transmitted through the internet of things, a smartphone application known as the Blink app, and a Wi-fi module being utilized.

[6] "An IoT Based Automated Noise and Air Pollution Monitoring System" was the idea put out by Palaghat Yaswanth Sai. with the intention of keeping an eye on the level of noise pollution and the state of the air in hospital and school zones. The sensors are connected to an Arduino microcontroller with an integrated Wi-fi module slot. The author employed an LM393 sensor to obtain the analog data of the noise and a MQ-135 sensor to monitor the presence of any dangerous or combustible chemicals, such as butane or LPG. Data is transmitted to the authorities using the ESP8266 Wi-fi module and a mobile application.

[7] B. Koteswarrao and Vennam Madhavireddy presented a "smart water quality monitoring system using IoT."Here, the writers created a system that continuously assesses the water's purity. The suggested system is made up of a number of sensors, including a temperature sensor to gauge the water's temperature, a pH sensor to determine the water's pH, a water level sensor, and a CO2 sensor to determine the percentage of CO2 dissolved. The Arduino microcontroller and Wi-fi module are interfaced with these sensors to enable data transmission from the sensors to the user via the internet. In addition, the system notifies the user of any alarms and logs the comprehensive information gathered by the sensors at a certain date and time.

[8] The "IoT Based Low-Cost System for Monitoring of Water Quality in Real Time" concept was developed by Anuradha and Bhakti with the intention of monitoring several water parameters in order to gauge the level of pollution in the water. The system uses a Raspberry microcontroller to interface with various sensors, including a turbidity sensor that counts the number of particles dissolved in the water, a pH sensor that gauges the water's pH, and a temperature sensor that detects changes in water temperature that could lead to thermal pollution. Sensor data is transferred from the device to the user via a Wi-fi module and the smartphone app ThingsSpeak, which allows for device position tracking and sensor logging.

[9] The authors of this research developed a system that includes sensors such as pH, turbidity, temperature, and flow to measure various parameters like the presence of minute particles in the water, pH of the water, water flow, and temperature of the water. The sensors are controlled by an Arduino microcontroller and a

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Wi-fi module to transmit data received from the sensors to the user. Vaishnavi V. Daigavane and Dr. M.A. Gaikwad proposed the "Water Quality Monitoring System Based on IoT." The information is shown on the webpage. The system automatically notifies the user through warning messages if any parameter exceeds its predetermined value.

## III.THE PROBLEM

The creation of a reliable industrial pollution monitoring system that tracks the levels of all pollutants produced on a given date and time, along with monitoring all forms of pollution, is vital. In order to further regulate the discharge of pollutants, the system must also have the capability to transmit warning notifications to the environmental pollution monitoring authorities when there is an increase in the emission.

## IV.PROPOSED SYSTEM

An "IoT based industrial air, water, and noise pollution monitoring system" is presented in this study. The following techniques are employed by the suggested system to monitor the four different types of pollution that are brought about by the industries.

1. By analyzing the levels of carbon dioxide and carbon monoxide, flammable gases like butane and LPG, humidity in the surrounding air, and the presence of minute particulate matter like optical dust that is released during industrial processes, air pollution is monitored using MQ-6, MQ-9, humidity, and dust density sensors.
2. A pH sensor is used to monitor water pollution by determining the industrial waste effluents' pH before discharging them into a natural reservoir.

A microcontroller called the Arduino Mega 2560 is used to interface all five sensors. The digital data that the sensors' analog data is transformed to allows for data transmission across the internet of things via a GSM modem and an Android mobile application. In addition, the suggested system sends alerts and warnings to the user's email and SIM card at specific times based on the sensor data.

## V.METHODOLOGY

The block diagram of the system has been shown in fig.1.

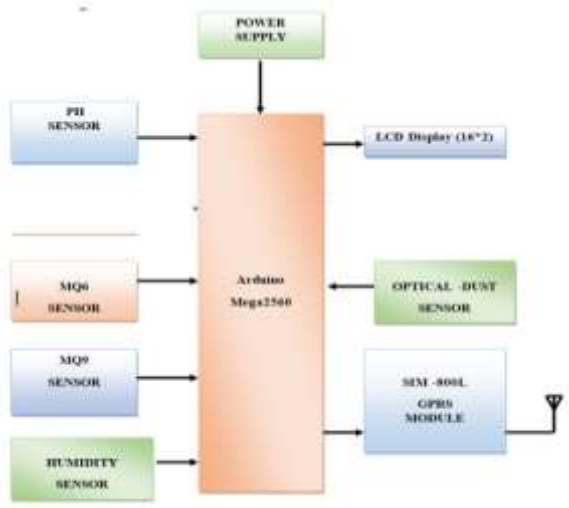


**Fig.1.Transmitter section of proposed system**

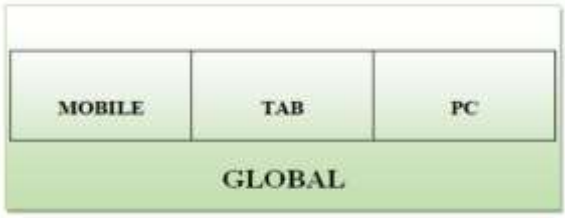


**Fig.2. Reciever Section**

The transmitter segment and the reception section are the two parts of the system. The transmitter section is made up of an Arduino Mega 2560 microcontroller-interfaced power supply unit that powers the system as well as a number of analog sensors, including temperature, humidity, dust density, noise, and PH, MQ-6, and MQ-9 sensors. The data is sent over the internet to the receiver part using the GPRS module. Typically, the receiver component consists of a smartphone on which an embedded C and Android programming are used to construct the project's webpage application.

The data received from the transmitter section is shown and recorded in the receiver part. It also shows the email and SMS notifications that the transmitter section sends. In order to regulate environmental pollution, the receiver section may consist of the industry's owner or the pollution control authorities that monitor industrial emissions.

To power the system, the power supply unit is initially turned on. In order to establish connection between the transmitter and receiver sections over the internet, both sections need be linked to Wi-Fi.The system's sensors have been initialized. The sensors record data from the industrial setting. For instance, the MQ-6 sensor records analog data about the concentration of flammable gases like butane and LPG.Similar to the MQ-9 sensor, the temperature, humidity, pH, dust density, and noise sensors all record analog data about the presence of carbon monoxide and carbon dioxide, as well as the temperature of heat-treated water,

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ambient humidity, industrial effluent pH, and the amount of optical dust particles in the atmosphere.

The microcontroller Arduino Mega 2560 receives this analog data. The sensor's analog data is converted to digital data by the Arduino Mega 2560 microcontroller, and the corresponding data values are shown on the LCD panel. Using the internet, the GPRS module sends the data to the receiver section's project webpage. On the webpage of the receiving section, a table represents the data series that was acquired from the transmitter section.

When the values of any specific data obtained by the sensors go above the preset value, indicating an increase in the emission of the respective pollutants by the industries—for example, if there is an increase in the emission of CO by the industries—the MQ-9 sensor captures high-value analog data, which is then converted into high-value digital data. This allows the transmitter section to send warning messages to the recipient's email or mobile SIM.The Arduino microcontroller transmits an alarm about the rise in CO emissions from the industry when it compares the data from the sensor with the predetermined value.

## V.HARDWARE DESCRIPTION

*1.Power Supply Unit:*

Power supply unit has been shown in fig.2.

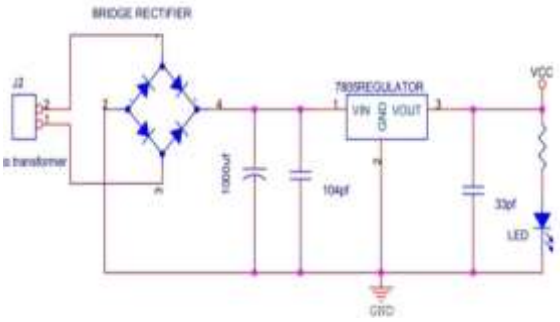


**Fig.2.Power supply Unit**

At first, the adapter had 5.5mm AC connectors and a 9V/1A output power. The bridge rectifier in the power supply unit's circuit rectifies the main AC input to the DC output, converting 9V AC power to 5V DC power that is supplied to the system. A 1000uf filter capacitor is connected in parallel with the rectifier's output to create a linear power supply. It is employed in the circuit to filter out undesirable frequencies. The bridge rectifier and 7805 regulator are linked in parallel to supply the system with a steady voltage and an LED light to show when power is present.

*2.MQ-9 sensor:*

The MQ-9 Sensor measures the amount of CO present in the atmosphere. In addition to being highly sensitive to CO, the MQ-9 sensor is also capable of detecting a wide range of other gases that contain CO.

When the concentration of gases increases, the conductivity of the sensor increases from its initial low value in clean or neat air. 5V is the maximum operational voltage.

**Fig.3.MQ-9 Sensor**

*3.MQ-6 Sensor*

The MQ-6 Sensor is used to measure the concentration of natural gases as well as other flammable gases like as propane, butane, and LPG in the atmosphere. The MQ-6 sensor has a detection range of almost 200 to 10,000 parts per million for gases. The analog resistance determines the sensor's output. There is a 5V maximum operational voltage.

*4.pH Sensor*

Before releasing industrial effluents into a natural reservoir, the pH sensor is used to evaluate the acidity or alkalinity of the wastewater. The potential of hydrogen, which is a measure of the presence of hydrogen ions, determines pH. 0 to 14 is the range of the pH scale.which classifies pH values as acidic (1-6), neutral (-7), and basic (e.g., 8-14). Industrial effluents with significant concentrations of lead and mercury have an acidic pH of 2-3, but effluents containing asbestos have a higher pH of 12–14. The pH sensor measures the wastewater's acidity or alkalinity before to releasing industrial effluents into a natural reservoir. pH is determined by the potential of hydrogen, which is a measurement of the existence of hydrogen ions. The pH scale, which divides pH values into acidic (1-6), neutral (-7), and basic (e.g., 8–14) ranges from 0 to 14. The pH of industrial effluents containing asbestos is higher at 12–14 than that of effluents with considerable lead and mercury contents, which are acidic at 2-3.


**Fig.4 pH sensor**

*5.Arduinomega 2560 Controller*

Fifty-four of the microcontroller's digital pins (of which fifteen can be used as PWM outputs) are found on the Arduino Mega 2560. It has four UARTs hardware serial input, a reset button, an ICSP header, a USB jack, a 16 MHz crystal oscillator, and sixteen analog inputs. It can be powered using an AC to DC adapter or with a USB cable. 5 volts is the operational voltage.There is a 6–20 volt maximum input voltage limit. In terms of physical size, it is larger than any other Arduino microcontroller. It also offers more flexibility for handling massive amounts of data or memory.

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More sensors can be used with it than with any other Arduino board.


**Fig.5.Arduino controller**

*6.SIM 800L GPRS Modem:*


**Fig.6.SIM800L GPRS Modem**

The SIM 800 is a quad-band GSM/GPRS module that operates at the 850MHz GSM frequency. It has two ports: one for updating firmware and debugging, and the other is a USB port for the universal asynchronous receiver/transmitter. Additionally, it has a number of audio channels, including receiver output and microphone input.The single SIM card slot on the SIM 800 is integrated with the TCP/IP protocol. It uses between 3.4 and 4.4 V of power to run. The SIM800L is used for internet-based data transmission and reception, audio calls, and message sending and receiving.

*Circuit Description*

The circuit is shown in fig 7.

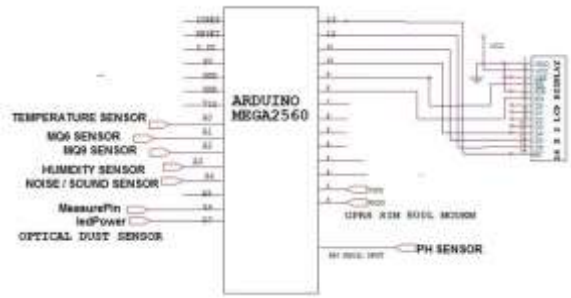


**Fig.7.Circuit Connection**

The schematic depiction of the complete system is displayed in the above figure. The Arduino Mega 2560 microcontroller and the sensors are powered by a USB cable that is connected to a laptop or power bank. The connections are made by soldering the wires using a flat circuit board to reduce the possibility of loose connections. The LCD panel and the GPRS modem are powered by the main power supply unit. When using an adapter with 5.5mm AC plugs and a 9V 1A output power, the circuit of the power supply unit is made up of a bridge rectifier, which rectifies the primary AC input to the DC output, converting the 9V AC power to a 5V DC power.

## VI.RESULTS

The Results taken at various air and water condition are shown in fig.8 and fig.9


**'Fig.8.Gas sensor output**


**Fig.9.pH sensor output**

Fig.10.showshardware prototype.

**Fig.10.Hardware prototype**

## VII.CONCLUSION

The purpose of the "Iot based industrial Air, water, and Noise pollution monitoring system" is to cost-effectively and extremely securely monitor and regulate the pollution produced by the emission of hazardous, untreated industrial pollutants. With seven sensors interfaced to an advanced controller that gathers and records real-time data on the various pollutants released by industries, this system is more effective than the previous one in helping environmental pollution control authorities monitor industrial environmental conditions.The purpose of the "Iot based industrial Air, water, and Noise pollution monitoring system" is to cost-effectively and extremely securely monitor and regulate the pollution produced by the emission of hazardous, untreated industrial pollutants. This system works better than the current one.

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