IOT BASED MONITORING AND CONTROLLING AIR AND NOISE POLLUTION IN INDUSTRY

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ABSTRACT

We want to create an Internet of Things (IoT)-based air pollution monitoring system that will use the internet to monitor air quality through a web server and sound an alarm when the air quality goes down beyond a certain level, means when there are sufficient number of harmful gases are present in the air like CO2, smoke, alcohol, benzene and NH3. It will show the air quality in PPM on the webpage and the LCD so that we can monitor it very easily. Previously we have built. This time, we utilized the MQ135 sensor, which is the greatest option for monitoring air quality since it can detect the majority of dangerous gases and estimate their level correctly. The LPG detector used the MQ6 sensor, and the smoke detector used the MQ2 sensor. With this Internet of Things project, you can use your computer or mobile device to remotely check the pollution level. We can install this system anywhere and can also trigger some device when pollution goes beyond some level, like we can switch on the Exhaust fan or can send alert SMS/mail to the user. Index Terms: Arduino, Gas sensor, Buzzer.

Keyword: - *Internet of Things (IoT) Embedded Computing System; Arduino UNO; Arduino Software, ESP8266, Smart Environment.*

I. PROBLEM STATEMENT

To know about which area contains more pollution and escape from that particular place easily.

II. AIM

To prevent, control and abate pollution of streams, wells, land and air to protect the environment from any degradation by effective monitoring and implementation of pollution.

III. INTRODUCTION

Our goal is to create an Internet of Things (IOT)-based air and noise pollution monitoring system that will use the internet to monitor air quality through a web server and sound an alarm when it drops below a certain threshold., means when there are sufficient amount of harmful gases are present in the air like CO2, smoke, alcohol , benzene and NH3. We will be able to quickly monitor the air quality thanks to the PPM display on the LCD and webpage.

Previously we have built the LPG detector using MQ6 sensor and Smoke detector using MQ2 sensor but this time we have used MQ135 sensor which is the best choice for monitoring Air quality because it can precisely measure the level of most dangerous gases and detect them. With this Internet of Things project, you may use a computer or mobile device to check the pollution level from any location. We can install this system anywhere and can also trigger some device when pollution goes beyond some level, like we can switch on the Exhaust fan or can send alert SMS or mail to the user.

When the objects like environment equipped with sensor A solution for monitoring the noise and CO levels i.e., any devices, microcontroller and various software applications parameter value crossing its threshold value ranges, for becomes a self-protecting and self-monitoring example CO levels in air in a particular area exceeding the environment and it is also called as smart environment. normal levels etc., in the environment using wireless embedded computing system is proposed in this paper. In such environment when some event occurs the alarm or the solution also provides an intelligent remote LED alert automatically.

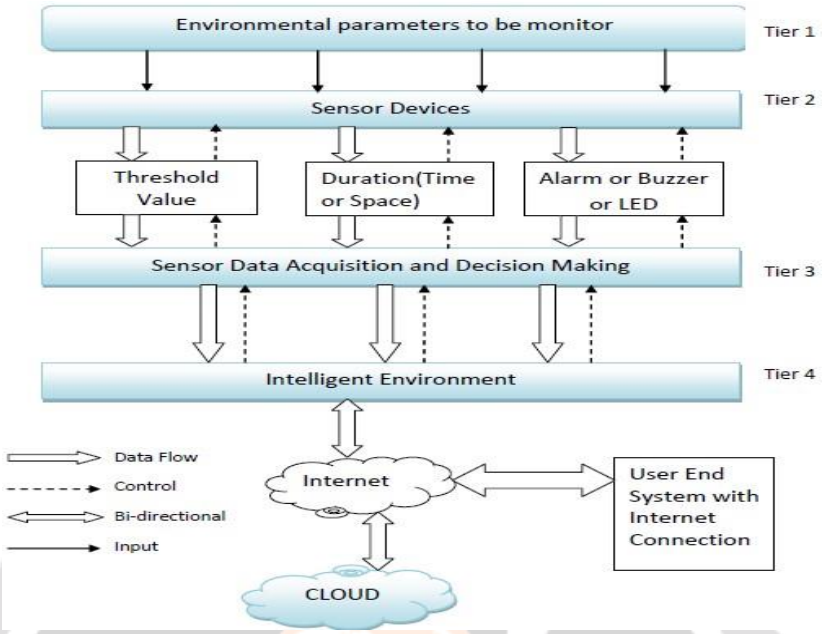
The effects due to the monitoring for a particular area of interest. In this paper environmental changes on animals, plants and human we also present a trending result of collected or sensed beings can be monitored and controlled by smart data with respect to the normal or specified ranges of environmental monitoring system. By using embedded particular parameters. The embedded system is an intelligence into the environment makes the environment integration of sensor devices, wireless communication interactive with other objectives, this is one of the which enables the user to remotely access the various application that smart environment targets. parameters and store the data.

IV. PURPOSE OF THE PROJECT

When dangerous materials, such as biological molecules and particles, are released into Earth's atmosphere, pollution of the air and noise results. In addition to harming other living things like animals and food crops, it can also cause infections, allergies, or even death in people. It can also degrade the built or natural environment. Both natural processes and human activities have the potential to produce noise and air pollution.

V. PROPOSED MODEL

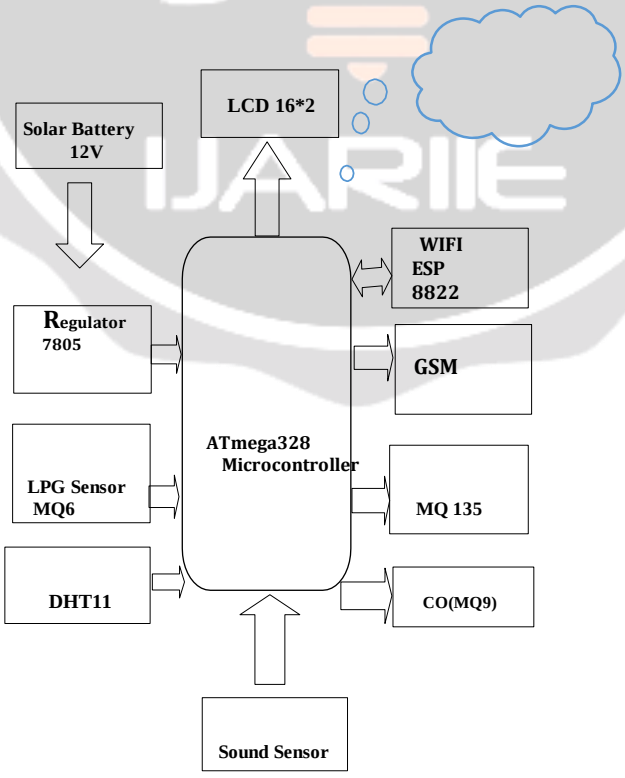
The proposed Embedded device is for monitoring Temperature, Humidity, Pressure, light intensity, sound intensity levels and CO levels in the atmosphere to make the environment intelligent or interactive with the objects through wireless communication. The proposed model is shown in figure 1 which is more adaptable and distributive in nature to monitor the environmental parameters. The suggested architecture is explained in a four-tier paradigm, with each module's functions designed for monitoring air pollution and noise. The proposed model consists of 4-tiers. The tier 1 is the environment, sensor devices in tier 2, sensor data acquisition and decision making in tier 3 and intelligent environment in tier 4. The proposed architecture is shown in figure 1. Here, the tier 1 provides information about the parameters under the region which is to be monitored for noise and air pollution control. Tier 2 deals with the sensor devices with suitable characteristics, features and each of these sensor devices are operated and controlled based on their sensitivity as well as the range of sensing. According to the circumstances, tier 2 and tier 3 will perform the necessary sensing and controlling actions in between. These actions may include setting the threshold value, frequency of sensing, messages (alarm, buzzer, or LED), etc. The parameter threshold values in critical scenarios or under typical working settings are established based on the data analysis carried out between tiers 2 and 3, as well as on prior experiences. In Tier 3, decision-making is covered along with data collection via sensor devices. which identify the parameter and condition that the data is representing. The intelligent environment is addressed in Tier 4 of the proposed paradigm. This suggests that it will identify variations in the sensor data and adjust the threshold value based on the noise or CO levels it detects. This layer processes the observed data, stores it in Google Spreadsheets on the cloud, and shows a trend of the sensed parameters compared to the specified values. Users of PCs, mobile devices, etc., can peruse the data.



VI. SYSTEM ARCHITECTURE

The microcontroller (ATmega328) in the built system serves as the primary processing unit for the entire system, and it may be connected to all sensors and devices. The microcontroller has the ability to control the sensors in order to retrieve data from them. It then uses the sensor data to process analysis and updates the data online via a Wi-Fi module that is attached to it.

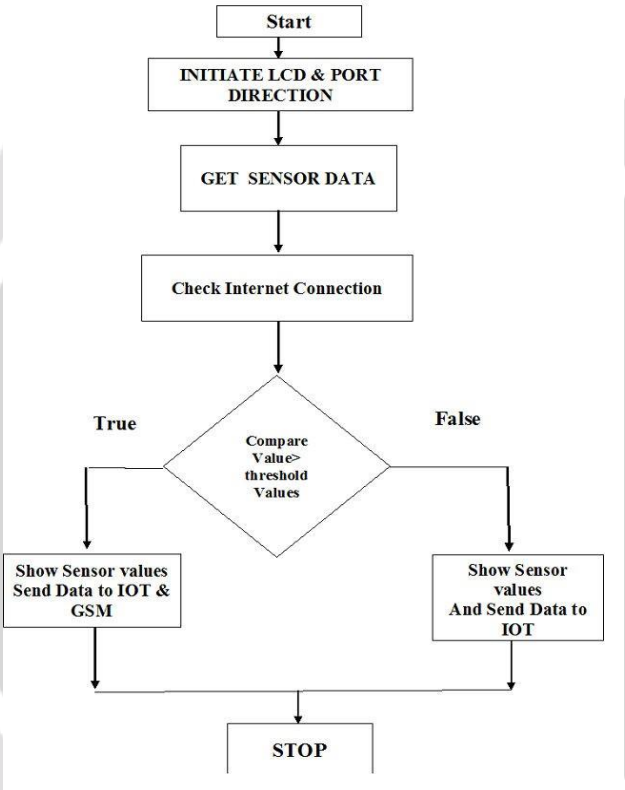
Block Diagram



VII. IMPLEMENTATION

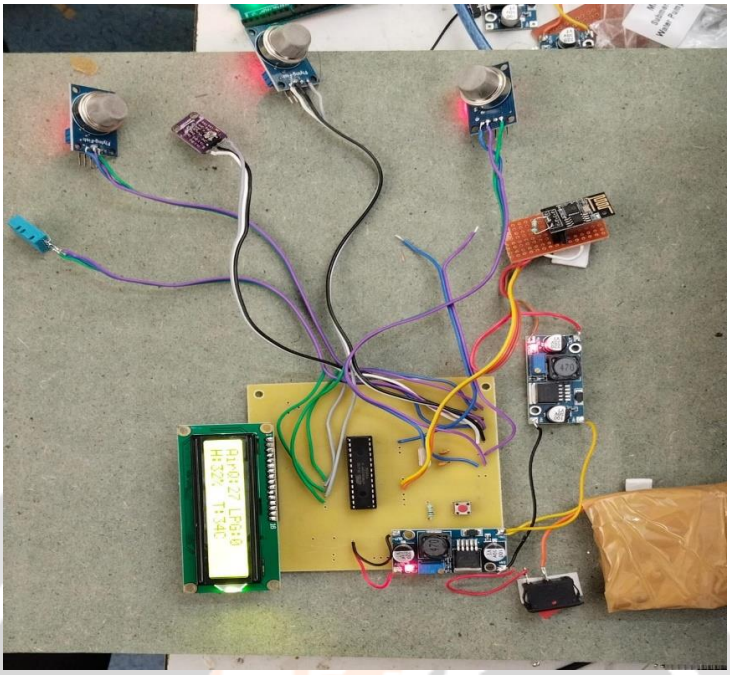
We have determined an appropriate implementation model, which comprises of several sensor devices and other modules, based on the architecture depicted in Figure 1. Figure 1 shows these modules' functionalities. We used an Arduino UNO board with a Wi-Fi module as an embedded device in this implementation model to sense data and save it in the cloud. The Arduino UNO board has built-in ADC, digital output pins (D0-D13), analog input pins (A0-A5), and a Wi-Fi module that links the embedded device to the internet. The Arduino UNO board is equipped with sensors for monitoring purposes. The sensor readings are converted to a digital value via an ADC, and the associated environmental parameter is then assessed based on that value.

Flowchart



In order to communicate sensor data to the end user and store it in the cloud for later use, a Wi-Fi connection must be made. An embedded system designed for environmental monitoring and its components are shown in figure 3. The embedded device is placed in particular area for testing purpose. The sound sensor detects sound intensity levels in that area and Carbon Monoxide (CO) sensor MQ-9 will record the air quality in that region, if the threshold limit is crossed the corresponding controlling action will be taken (like issuing message alarm or buzzer or LED blink). All the sensor devices are connected to internet through Wi-Fi module.

Below figure shows the embedded system with its components for reading and to store the pollution parameters in cloud. After successful completion of sensing, the data will be processed and stored in database for future reference. After completing the analysis on data the threshold values will be set for controlling purpose.



VIII. ADVANTAGES

- Cost Savings: While initial investments may be required to implement pollution control measures, over time, companies may realize cost savings through improved efficiency and reduced resource consumption. For example, implementing energy-efficient technologies not only reduces air pollution but also lowers energy costs
- Regulatory Compliance and Risk Mitigation: By proactively addressing air and noise pollution, industrial companies can ensure compliance with environmental regulations and reduce the risk of facing fines, penalties, or legal action. This can also enhance their reputation as responsible corporate citizens and improve relationships with regulatory agencies and local communities.
- Health and Safety Benefits: Improving air quality and reducing noise levels in industrial facilities can have direct benefits for the health and safety of workers. Reduced exposure to pollutants and noise can lead to fewer instances of respiratory illnesses, hearing loss, and other health issues among employees, resulting in lower absenteeism and higher productivity.

IX. DISADVANTAGES

- Quality of Life: Industrial air and noise pollution can significantly reduce the quality of life for people living in affected areas. Constant exposure to polluted air and excessive noise can lead to discomfort, irritation, and decreased overall well-being.
- Economic Costs: Pollution from industrial activities can result in economic costs for both businesses and communities. Health care expenses related to pollution-related illnesses, loss of productivity due to health issues, and damage to property and ecosystems all contribute to economic burdens.
- Regulatory Compliance Costs: Industries often have to invest in pollution control measures and comply with environmental regulations, which can increase operational costs and reduce profitability.

X. APPLICATIONS

- Construction Sites: Construction activities often produce high levels of noise pollution from equipment such as bulldozers, excavators, and jackhammers. Implementing noise control measures such as sound barriers, mufflers, and acoustic enclosures can help minimize the impact of construction noise on workers and nearby residents.
- Transportation and Logistics: Transportation-related activities, including trucking, shipping, and air travel, contribute to both air and noise pollution through vehicle emissions and engine noise. Implementing fuel-efficient technologies, optimizing transportation routes, and using electric or hybrid vehicles can help reduce air pollution and noise levels associated with transportation operations.
- Mining and Extraction: Mining and extraction operations can generate air pollution from dust emissions, vehicle exhaust, and blasting activities, as well as noise pollution from heavy machinery and equipment. Implementing dust suppression measures, improving ventilation systems, and using quieter equipment can help mitigate these impacts and protect the health and well-being of workers and nearby communities.

XI. FUTURE WORK

Innovative Pollution Control Technologies: Continued research and development of innovative pollution control technologies will be crucial for reducing emissions of air pollutants and mitigating noise levels in industrial settings. This may include the development of more efficient and cost-effective scrubbers, filters, catalytic converters, and noise reduction devices tailored to specific industrial processes and applications. For example, AI-powered predictive maintenance systems can optimize equipment performance and minimize emissions, while renewable energy sources can help reduce reliance on fossil fuels and decrease overall environmental impact.

XII. RESULT

XIII. CONCLUSION

IOT technology is suggested to enhance the quality of the air and sound, and an Arduino microcontroller is used in the system to monitor the environment's air and sound. The process of monitoring different environmental factors, including the air and sound quality monitoring issue raised in this study, is improved by the application of IOT technology. Here, the Arduino is the brains behind the project, while the MQ135, MQ6 gas sensor, and sound sensor provide a sense of several types of harmful gas. which oversee the entire procedure. The entire procedure is connected to the internet via a Wi-Fi module, and an LCD is used for visual output.

XIV. REFERENCES

1. Asmi, A., Putra, J. C. P., &Rahman, I. B. A., "A Study of Indoor Air Quality of Public Toilet in University's Building", in Humanities, Science and Engineering (CHUSER), IEEE Colloquium.
2. l-Haija, Q. A., Al-Qadeeb, H., & Al Lwaimi, A.,"Case study: Monitoring of air quality in king Faisal University using a microcontroller and WSN", Procedia Computer Science, volume.
3. l-Haija, Q. A., Al-Qadeeb, H., & Al Lwaimi, A.,"Case study: Monitoring of air quality in king Faisal University using a microcontroller and WSN", Procedia Computer Science, volume.
4. An intelligent automated emission quality monitoring system designed to test the vehicles in the signals", IEEE conference on Green Computing,