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Article Title: **IOT Based Air Quality Monitoring and Lamp Alert System Using Arduino**

IOT Based Air Quality Monitoring and Lamp Alert System Using Arduino

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ABSTRACT

The entrance of particles, biological molecules, or other dangerous gases into Earth's atmosphere results in air pollution, which harms other living essentials like food products, humankind, and the ecosystem. Over the past ten years, air quality has drawn considerable attention. Recently, China's major cities have come under the focus due to their extremely polluted air. Every three minutes, a message packet containing temperature, humidity, and pollution data was broadcast by the air quality nodes. The most popular way to inform the public about air quality is through the Air Quality Index (AQI), a value with one less unit. To assess a required level of worker safety, air monitoring identifies and quantifies airborne pollutants. To make sure the air in the workplace or other environments complies with legal requirements and to assist operational hygienic and safety and health experts in determining employee exposure to airborne dangers, air sampling is done. Determining the state's air quality and evaluating its influence on human health are the main goals of ambient air quality monitoring programmes. The papers include anything from public accessibility to calibration. We want to create a system that will serve as the basis for such a solution, and we do this by putting different components of it into practise while also evaluating their effectiveness. This paradigm holds up under scrutiny in the disciplines of contaminant observation, health monitoring, employment estimation, maintainability assessments, and estimation-related fields. This paradigm only examines five variables, therefore it can be expanded to take into account additional variables, notably those caused by projects that lead to pollution. The model consumes too much energy, thus in the future we can use solar energy as an external source of energy, which would increase the stability of the framework.

Keywords: Gas sensors, Air Quality Index, Pollutants, Arduino board

1. Introduction

Deteriorating air quality is a new issue brought on by growing cities. Numerous health conditions are caused by the contaminated air. The biggest culprits are factories that emit smoke and vehicular emissions. The pollutants have been cut to safer levels in many nations. Regulations on these gases' levels have been passed by the United States and the European Union, and they are regularly enforced. In order to assist the primary and secondary members of the population, they have put up air quality monitoring stations around the cities. A

population with sensitive members includes infants, expectant moms, and elderly people who require care. Wildlife and public wellbeing are considered secondary. A base station, which receives data from the monitoring stations, generates an Air Quality Index, or AQI, for that city or region. It gives the general people useful information to help them decide how to move around. The articles cover a range of topics, from public accessibility to calibration. The ones that draw the most attention are those that include public participation, and in connection with them, adoption is almost certainly influenced by affordability and user friendliness. They can be divided into two main groups: those that attempt to empower the public by providing a plug-and-play air quality monitor and those that provide the system's component pieces separately. The former has also seen an increase in the number of neighborhood-based efforts, which also are better referred to as citizen awareness projects. Here, a group or an individual installs a home-based version of an air quality station and sends data on the level of pollution to a public website. Many cities now have community-based systems that have raised public awareness of the severity of air pollution and prompted local government to take action to reduce the dangerous levels of pollutants. In conclusion, current work has demonstrated that it is reliable and competitive with high-end systems for monitoring commonly detected contaminants. By putting different aspects of the system into practice and analyzing its effectiveness, we want to provide a system that has the building blocks for such a solution.

2. Recent Works

Haomin Yu et al [2020] Due to increased use of energy and other natural resources, air pollution is becoming increasingly significant. Authorities' static monitoring systems often give precise data on air pollution, however they are sparsely dispersed throughout the environment. Micro stations, a type of inexpensive air monitoring device, however, can be widely dispersed despite having a poor level of precision. In this research, we suggest a deep calibration method (DeepCM) for inexpensive air quality monitoring numerous sensors in the micro stations, which comprises of an encoding and a decoding. Multilevel time-series features, such as local, global, and periodic significant components, are extracted during the encoding step. These features not only help reduce cross-interference and noise effect, but they may also capture local, global, and periodical trend indicators.

Galo D. Astudillo et al [2020] considering business, electricity, transport, and agricultural, there are many policies to reduce air pollution. Furthermore, there is not enough monitoring of air quality in urban and rural regions to ensure that these policies are being implemented. An obstacle to overcome is the fact that reliable monitoring of air pollution often relies on costly two stations. The design, installation, and assessment of a tiny, inexpensive station for tracking air pollution are presented in this study. Ozone (O3) and carbon monoxide (CO) are measured by the prototype using cheap sensors. It is suggested a calibrating approach based on the highest performance assessment of the major methods of machine learning multiple linear regression, artificial neural networks, and random forest, to ensure high level of reliability of the measurement results by the various sensors in this station. The sampling timestamp is taken

into account as a chronological heuristics at the input into the system, supposing similarity in the daily external conditions and a decision procedure is built to choose an ideal mix of sensors for the estimating models. For the purpose of evaluating the station under actual circumstances, the calibrating and assessment sets were gathered across two separate time frames of one and two months, correspondingly. Utilizing reference information from an authorized fixed station for air pollutants in the city of Cuenca, Ecuador, the entire operation was completed.

Dan Zhang et al [2020] there has been a surge in interest in studies that evaluate and forecast the quality of the air around people. Monitoring air pollution is now easier than ever thanks to the IoT, which is widely used in many industries to improve people's quality of life by linking numerous sensors in various locations. The traditional method of placing stationary sensors cannot effectively provide a full perspective of air pollution in people's immediate surroundings because the closest sensors may be kilometers away. Our research focuses on using both stationary and mobile IoT sensors that are mounted on vehicles that patrol the area to simulate the pattern of air quality in that area. Our method allows for the complete spectrum of how air quality fluctuates in nearby areas.

Markus Lücking et al [2020] Recorded environmental data are susceptible to manipulation since such PMSs centrally handle the environmental data they collect. Additionally, the examination of pollution data is frequently opaque to outsiders, which could result in poor conclusions about environmental restrictions. We suggest a software architecture for PMSs based on distributed ledger technology (DLT) and the long-range (LoRa) protocol for adaptable, open, and resource-conserving environment monitoring and data management in order to address these issues. We performed a thorough analysis of the needs for PMSs in order to design the PMS. To properly build the PMS and satisfy the mentioned requirements, we benchmarked various consensus methods (such as BFT-SMaRt and Raft) and digital signature schemes (such as ECDSA and EdDSA). On the basis of this, we created and tested a prototype PMS.

3. Proposed Work Explanation

A wireless sensor network will be created as the mechanism to track air pollution. The sensors are placed at various sites where the pollution levels are to be measured in order to implement this system. At various times and under various environmental conditions, the sensor data are read and recorded. To gather data sets for the values of contaminants at various environmental areas, this is done. Real-time data obtained is checked against these threshold values to determine whether there is any violation of or threat to the air quality. These datasets are utilised to choose the threshold value for various gases. The Arduino board, which houses the microcontroller and all of the sensor outputs, receives the sensor data from the devices.

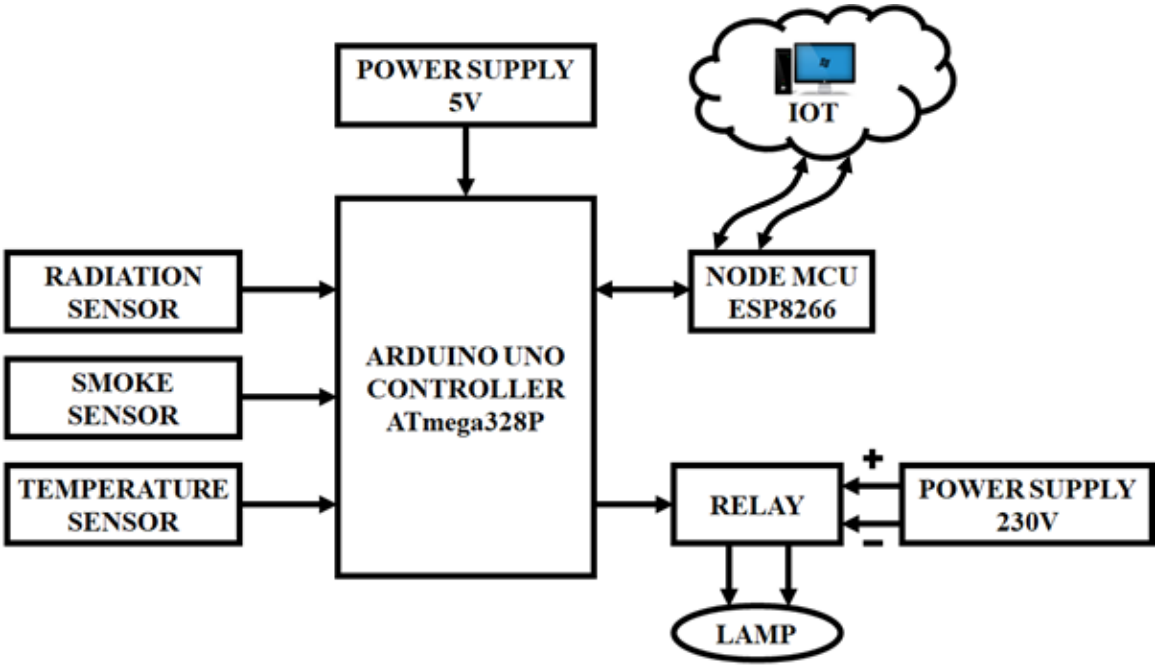


Figure 1: *Block diagram for proposed system*

The preceding Arduino board, which includes a microprocessor, several gas sensors, and gas sensors utilised are specific to the different gases, make up the suggested system concept. The Arduino hardware connects to the network so that the real-time data captured is delivered to the cloud for storage in the cloud server. The location is also provided as real-time data and stored in the cloud thanks to the use of a global positioning system. Additionally, a purifying system is installed that can be operated remotely via IoT.

The project aims to develop an air pollution monitoring system that can be implemented in a specific area, improve the system over recently developed frameworks, and address previous shortcomings by creating a publically accessible android application. Anyone can use this program to receive real-time updates regarding the contamination in their neighborhood.

Mathematical Expressions and Symbols

Parts per million (ppm) or a percentage is used to express how many contaminants are present in a given volume of air.

A few conversion factors are as follows:

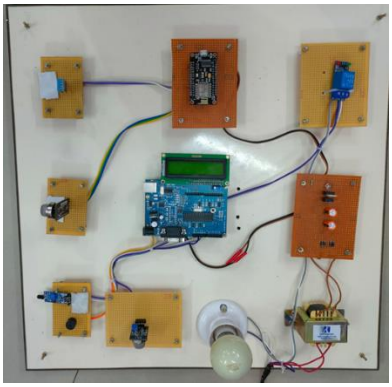
1 ppm = 1.145 mg/m3 1 mg/m3 = 0.873 ppm

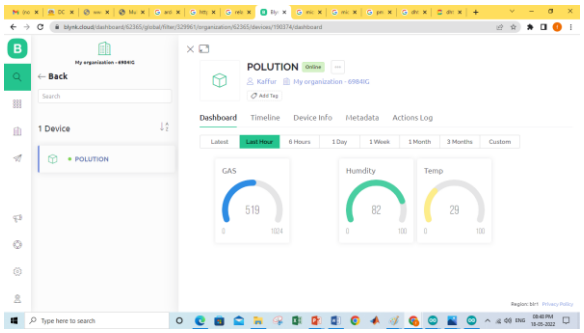
1% = 1/100 1 ppm= 1/1000000

1 ppm = 0.0001%

4. Results and Discussion

This paradigm holds up under scrutiny in the disciplines of contaminant observation, health monitoring, employment estimation, maintainability assessments and estimation-related fields. An information is subsequently stored in the database, where professionals can use it to make quick decisions. It also aids common people in considering the quantity of poisons in their general area and in implementing control measures. This is a strong framework that aids in initiatives due to the rising pollution as a result of an increase in businesses. This framework is inexpensive and helpful to the customer. This paradigm only examines five variables, therefore it can be expanded to take into account additional variables, notably those caused by projects that lead to pollution.





5. Conclusions

To guarantee high level of reliability of the measures collected by the sensors placed in this stations, a calibration method based on the best performance monitoring of the following machine learning techniques multiple linear regression, artificial neural networks, and random forest is presented. Taking into account the sample timestamp as a temporal heuristic at the system's input and assuming similarity in the daily environmental dynamics, a selection technique is created to select the ideal combination of sensors for the estimating models. The calibration and assessment sets were collected across two separate time periods of one and two months, respectively, in order to test the station under actual operating circumstances. An entire

procedure was carried out using reference data from a licensed. Since many toxins lack sensors to detect them and those that do exist are often expensive, developing sensors for various criteria may prove to be a difficult and challenging endeavour in the future. The model consumes too much energy, thus in the future we can use solar energy as an external source of energy, which would increase the stability of the framework. As a result, the suggested system model consists of the Arduino board below, which includes a microprocessor and various gas sensors. Specific to each type of gas, gas sensors are employed.

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