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# Air Pollution Monitoring System Using IOT And Artificial intelligence

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**Abstract:** Good quality of air is required to maintain good health conditions among the living environment. Hazardous gases and air pollution can be detected in surrounding areas. Parameter like IAQI is measured from the proposed system gives an efficient way of detection of air quality. Proposed system has ESP8266 for connecting with IOT platform to pass the information regarding the pollutants to the personnel. Self care is improved by the way of detecting the pollutants of the environment.
Keywords: Air pollution, IOT, Monitoring system, Air quality, Gas sensors.

## Introduction

Respiratory problems are very common among many people due to air pollution and toxic substance of air. Carbon monoxide, Carbon dioxide, Sulfur dioxide, Nitrogen dioxide, Lead are certain air pollutants commonly known as Criteria pollutants. Microbes, moulds, Animal skins, pets, insects are common among the biological pollutants. Air pollution is a major drawback of the current environment and it is a hindrance for public health. Air pollution causes many adverse health effects in human beings, other organisms, for environment, variations in climatic conditions and changes in life cycle of everything. Harmful gases in the air is the reason for all the effects mentioned above by which the entire world suffers a lot. IOT and artificial intelligence based systems will be much helpful for the monitoring of environment. Algorithms like ANN, CNN, KNN, SVM, Random Forest are pre dominantly used for the environment monitoring. The monitored data or measured data is connected with Think Speak. The environment data obtained can be monitored from anywhere. Here Indoor Air Quality Check (IAQC) is considered for making a smart home with pollution free or pollution less. Air quality based on pollutants level which has the parameters like Carbon dioxide, Nitrogendioxide, Sulfur dioxide etc . Temperature
also has reverse effect on environment. Various sensor nodes integrated along with IAQC monitoring will have a better effect on air quality. This paper gives the comparison of various methods involved and better effect based on the proposed technique. Modified Navie bayes algorithm is proposed here to analyze and give the data. The proposed system has a microcontroller ESP8266 and various sensor nodes for measurement of various parameters. DHT22 is a humidity and temperature sensor for measuring the temperature and humidity of the environment. The data measured from DHT22 is interfaced with the controller. MQ2 is a gas sensor used here. MQ2 is sensitive to LPG, Hydrogen, and propane.
The key concept of this paper is to give the emergency alert when the air quality is not acceptable by people are in industry as well as home locations. The paper ordered follows covers Air Quality monitoring system for its existing method. Section III covers the given method and argument of the tests achieved to show the performance of the various blocks of the AMS. Section IV has the conclusion of proposed method.

## Air quality monitoring system

Certain methods like AQ prediction based models gives the pollutants concentration based on the average data of the various methods. The result was obtained based on the mean values. Statistical methods and ML based methods for analyzing the air quality are discussed further. As mentioned by S.Ali in [1] low cost devices are used to measure the various concentration s of gases like CO, $NO_2$ . LORAWAN is used here for transmission of sensor data. It gives good prediction of data based on the sensor values. The Mean Absolute Percentage error of the technique is about 38.89% based on artificial neural network calculation. J.Huang et al [2] has proposed a system in which the vehicular data is taken and level of pollutants concentration is checked for the surrounding environment. About 500 vehicle data are compared and it is being analyzed for air quality streams based on IOT cloud platform. Carlos Santos [3] proposed a system in which in which the transmission time between sensor nodes and power consumption of sensor nodes are taken the issues faced is analyzed. The

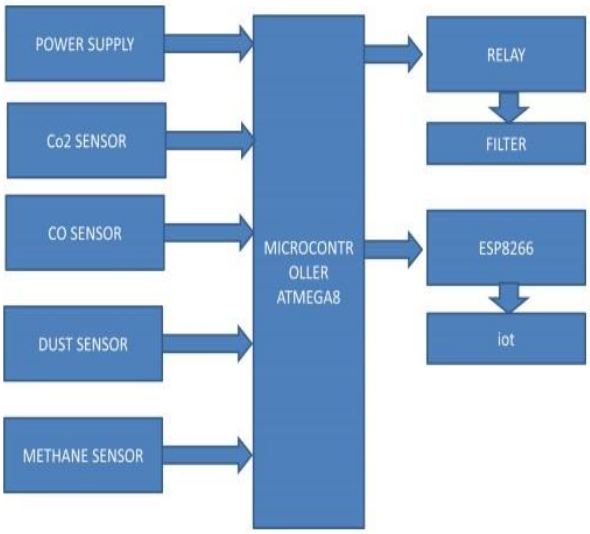
event based sensing gives suitable power consumption reduction. Here 50% of the battery power can be saved. Kan zheng et al [4] has proposed a system in which the Low power wide area technology LPWA is used. Due to small area coverage this LPWA technique is preferred. This LPWA can provide about 20kn for rural and 5km for urban area for air quality monitoring. LPWA has less maintenance and deployment costs which is based on IOT. Liang Zhao et al [5] has proposed a system where Indoor Air Quality Detector is used for measuring the parameters like like temperature, pressure, $CO_2$ etc. This Indoor air quality detector is integrated along wit the GPRS, LORA, WIFI etc from wired to wireless and then for cloud transmission. Here an office surrounding is considered for the measurement and monitoring. Shifeng Fang et al [6] proposed a system in which a integrated system is given where Internet of things is combined with many things like Cloud computing, Remote sensing information, data from GPS, GIS from multiple sensors. This technique gives the future for various environment monitoring techniques. Mario Molinara et al [7] has given a thin layered Multi layer perception along eith the CNN and LSTM for confirming the MLP data. About 75% accuracy is obtained for IOT based air quality monitoring. An Sensiplus API used for getting the sensor data, Preprocessing is done using a EMA filtering and normalization and then classified using MLP, CNN, LSTM. Baowei Wang [8] has proposed a double layer Recurrent neural network. This network is a superior model of LSTM. It has three layers 1. Application layer, 2. Network layer, 3. Perceptron layer. The third layers gets the sensor data. Second layer is to transfer information from perceptron layer to internet to reach the application layer. Application layer is for real time monitoring of data and for early warning of measured data. Ahmad F. Subahi et al [9] proposed a system for very high temperature environment where Petri Nets is used to monitor the environment for countries like Saudi Arabia. Energy efficient system for handling the IOT data has been developed for monitoring crop growth rate , etc. his systems measures temperature, energy consumption and the data are represented graphically.

Saba Ameer et al [10] has given comparison between different techniques involved. Quadruple layers involved are as follows correspondingly for collection of data, Air pollutants data are gathered from different sources with numerous preprocessing and filtration of data. Next the collected data are transferred or communicated to the layers with communication technologies. The real time data can be processed with this layers; computing methods like FOG is much helpful in reduction of latency. The collected data are stored and analyzed with prediction analysis and pattern analysis. The actual devices are connected with this final application layer to get data in the form of charts and reports along with statistics. Decision tree algorithm, Random forest algorithm, Regression based algorithms are used here for classification. Mean Absolute Error MAE and Root Mean Square Error RMSE are estimated for cities of Beijing, Shanghai, Shenyang, Guangzhou, and Chengdu. Decision Tree Regression is simple to implement. Random Forest regression lowers the fitting problem like overfitting.

E.Gambi et al [11] has given a paper which exhibits the plausibility of the acknowledgment of day by day life exercises in AAL, helped out through a framework based on the characterization cycle of the information produced by a bunch of monetary gas sensors. The model considers acknowledgment of 4 distinct situations: ordinary circumstance, feast readiness, smoke presence, cleaning. A k-NN AI calculation is applied to continuous dataset to anticipate current circumstance on the premise of recorded information (classificatory information). Framework exactness is over 96%, in this way permitting to distinguish with high accuracy every one of the thought about exercises, including a potential hazardous circumstance. The proposed framework is flexible and, subsequent to having appropriately prepared the classifier, it tends to be applied to any climate, on account of the joined utilization of air sensors also, AI calculations. Future work ought to improve framework capacity to distinguish a similar action regardless of whether it is performed in an alternate manner or in an alternate room, however this infers the utilization of a bigger preparing set. A further exertion should be possible to attempt to foresee at least two circumstances that are acted in something similar room simultaneously. Action acknowledgment should ensure individuals protection by plan, by utilizing verification and secure correspondence between sensors, IoT stage and end client gadget.

In the conventional method, more number of sensors is incorporated in the room or industry area which monitors the air quality level. In this method pollution/toxic levels are increases the system automatically will provide the emergency alarm. This method is not suitable for all regions and there is no remedial action undertaken by the system by itself.

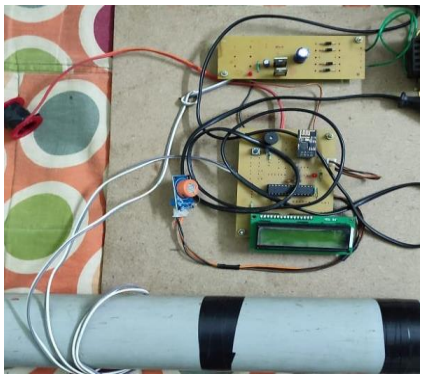
**Proposed method**




**Block Diagram of the Proposed Method**

In this method, System is monitoring the carbon dioxide, dust and Methane gases. If these sensors crossing the threshold level human will face the central nervous system damage and respiratory deterioration in humans and other breathing creatures and also these gases will create heart damages and etc. In this technology world, air monitoring plays a vital role in the industrial sector as well as home. Developed model system uses the Sensors to detect the gas level of the environment. Sensed signals from the sensors are fed into the microcontroller and for the each gas, threshold levels are fixed and sensed data are stored in the cloud. When the gas level crossing the threshold level, the alarm will provide to the concern person to alert the employees. Gas sensors play a role which detects the gas level in the atmosphere. The sensor generates a corresponding potential difference based on the gas concentration by adjusting the resistance of the material within the sensor, which can be calculated as output voltage. The form and concentration of the gas can be calculated using this voltage value. By finding this voltage value, system can monitor and estimate gas level in the environment. If Methane levels above a certain threshold will reduce the amount of oxygen available for breathing. Mood swings, slurred speech, vision disturbances, memory loss, nausea, vomiting, facial flushing, and headaches are all possible side effects. Changes in breathing and heart rate, as well as balance issues, numbness, and unconsciousness, can occur in serious cases. For methane, 50,000ppm ie.5% of mixing in air is dangerous level and it makes very immediate effect to life and death. The level of gas in the air is sensed by the sensors; Alert can send in case of any abnormality when sensed value are crossed the threshold level.

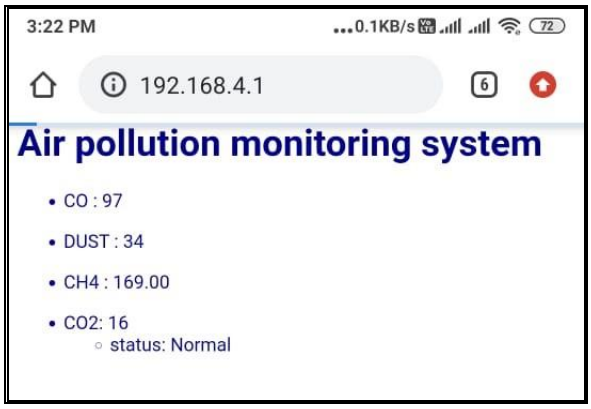
The system continuously monitors the environment using the gas sensors and sensed value fed into the microcontroller.ESP8266 can fetch data and loaded into the Internet of things. In case of any abnormality find in the location, Alert message will reach the person through the module. The prototype module monitors the carbon monoxide, Methane Sensor and Dust of the location.



**Prototype Module**

**Results and conclusion**

We developed, installed, and tested a low-cost, high-fidelity air quality monitoring system. For the each moment, System will gather the data and it will be transmit through Wi-Fi and notification will reach the staff while the threshold level is exceeded. The system will fulfill a significant humanitarian need by tracking the quality of air that kids breathe near schools and playgrounds, in factories or high-traffic areas where emissions are not adaptable level and impact a large number of human, in developing countries and in places where air quality is poor and poses a health risk by alerting people to Unhealthy levels of these sensed pollutants. This prototype can implement in hospitals and research lab air concentration control by adding the additional gas sensors.




**Results of Air pollution Report**

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