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A Review on Decision Support System for Air Quality Management

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Abstract — In the process of modernization, collecting data regarding air pollution has been a difficult task for citizens. The existence of a green and clean environment is very much essential for the better health of nature across the globe. Unfortunately, different kinds of pollutants are ruining and affecting the environment. This review paper mainly deals with “Air Pollution”, a very important and sensitive issue in countries, it causes great damage to human health and biological balance. The system will detect maximum air pollutants and will be highly responsive, accurate, available at low cost, less power consuming, and can be used to understand the behavior of air pollutants and the potential impact on the reduction of related health impacts. Nowadays, on mobile towers, a lot of sensors are been deployed. A lot of users use mobile for task distribution and data collecting. The IoT-based Air Pollution observing system includes MQ series sensors connected to a microcontroller outfitted with an ESP8266 WLAN for transferring data processed and given as an output by sensors, to the server. The framework works hard to control existing dangerous gases from ruining the natural clean and pure air. The investigation of air quality is possible by studying the air quality index (AQI).

In this paper, we have reviewed our system, aimed to deal with air pollution. The system serves and have all the factors for pollution monitoring. It measures and records the concentration of various harmful gases such as Carbon Monoxide, Carbon Dioxide, Smoke, Alcohol, Benzene. [3]

Environmental monitoring and studying are a systematic approach. A human needs clean air to inhale but due to increasing air polluting factors, its being tough. Transport sector makes a huge impact. An increase in the number of vehicles gives rise to increasing traffic-related pollutant emissions which is constituted by 97% of CO and 75% of NO₃. Therefore, to track the effect of pollution, it is necessary to track the level of pollution in urban, sub-urban or rural areas to acquire useful and important information about the level of pollution. Many health-related problems are also arisen due to the impurity of air. [4]

Keywords - IoT, Server, Expert System, Air Quality, Sensors, Decision Support System.

I. INTRODUCTION

Pollution is something relatable to an error found in a healthy system, here, the natural environment. The different kinds of pollution are found in air, water, and land. [1]

Air pollution is seen to be produced from both natural and artificial source. Generally human-made or artificial pollution is caused by pollutants from ignition, mining, construction, agriculture, warfare, and industrial area units or non- natural sources. A pollutant is a substance that causes adverse effects on the ecological community/system and imbalances it. Therefore, with context to air pollution there is an increasing demand of management of greenhouse gases. [2]

II. NEED OF MONITORING

Unblended air is essential along necessary for every human being to survive. Impure air tends to many health issues and fatal cases. To take any action ahead of controlling the pollution rate. It is necessary to first study and monitor the air quality. Which also definitely help us take right decision. Increase in pollution also has various causes. Ex: smoke, automobile exhaust, etc. There are many main reason and factors decreasing the quality of air. Carbon monoxide (CO), Nitrogen Dioxide (NO₂), Hydrogen Sulphide, Sulphur Dioxide (SO₂), are the gases that have a huge effect on human health are

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.To improve purity of air, huge efforts are needed. Automated as well as manual controls are available for monitoring of the environment. There are various improvements and modifications that can be made further in the instrument. [5]

III. LITERATURE REVIEW

The proper air pollution monitoring and the result obtained has their own importance in the selection of the pollutants. However, the traditional air pollution quality checking method demands a laboratory experiment that may lead to extra effort and time for the proper result. Therefore, it is supposed to be ineffective and inconvenient. There is a genuine need to overcome these issues with new techniques of air parameters measuring by different sensors and enhance the system with the clarity of decision-based on them.[6]

A. Zig-bee Primarily Based Wireless Pollution Observing System

Air pollution isn't solely natural medical matters impact making nations alike. The robust result of pollution on well-being is extraordinarily mind-blowing as there's a broad space of sources and their explicit influence dissent from each other. The artificial substances reason an assortment of masses, and natural medical issues increase air contamination impacts on human prosperity. To screen this contamination WSN framework is expressed. The framework contains a Unit of Mobile-DAQ and a set Internet-Enabled contamination observation System. The Mobile-DAQ unit incorporates a solitary chip microcontroller, pollution sensors, and GPS Device. The Mobile-DAQ unit assembles air toxins levels (CO, NO₂, and SO₂) and packs them throughout a casing with the GPS aperiend distribution, time, and date. The rationale is send to the Pollution-Server via a zag bee device. The pivotal-Server is interacted with Google Maps to indicate the world of apparatus. It will associate the information to the Pollution-Server to swing away the toxins and also be helpful for future utilization by a distinct user.

B. Pollution Monitoring System utilizing WSN in Visakhapatnam

The level of robotic work, practically in all types of segments are likewise incrementing since the technology is ascending. WSN are building the foundation in all sectors of life; from traffic control to natural checking and from homes to industrial facilities. To screen the satisfied pollution parameter outcomes with associate to the conditions, the pollution displaying system contains sensors.

It replays the three air contaminating gases including Carbon Dioxide, Carbon Monoxide, and Sulphur Oxide. These gases decide the level of pollution. Dissimilar, to caution the laborer in oil and gas mining sites to recognize the spillage, household activities like spilling gas in our homes, and so on can additionally apply the methodology. In urban communities this repetition creates awareness amongst them.

C. WSN Based on Air Contamination Monitoring System in Metropolitan Cities

The WSN based air impurity identifying framework depends on AVR ATmega-32 Microcontroller. ID3 calculations are used to assure the outcome, to differentiate the sensor compliments from various detectors as temperature, and dampness, MQ7, MQ5, particularity. To interact with the customer associates and customer along the server via web administrations, Bluetooth device is employed. The framework doesn't simply compute the present noticeable pollution only, rather in additionally will create a figure within the precise dirtied zone to stay far from future contamination.

This study however, applied the principle of Biometric Fingerprint system to develop an application specific to the workforce of higher Institutions of learning using the Federal Polytechnic, Ilaro as a case study in order to curb the manipulations of manual attendance system and encourage commitment, hard work and discipline for improve service delivery.

IV. BENEFITS OF MONITORING

This section focuses on the benefits of the decision support system for air quality management.

- i. Decision support systems for air quality management gives information support to provide the scientists, by combining various forms of information required.
- ii. A system can be of the simple form, such as software that shows the air quality index.
- iii. Implementing the system in countries or cities with advanced technology such as IoT can be reliable and provides real-time decisions. It also can be extensible to a global perspective.
- iv. The wireless sensors help to the generation of automatic air monitoring and management.
- v. Mobile technology can also be embedded in the system for acquiring its easy use and reliability.

V. SYSTEM WORK

The framework includes of four-module, and are controlled and monitored by the webpage.

Every module is connected with the Arduino UNO along with the GPRS module which is responsible to establish the communication between the module and the server. The only purpose is to achieve the best and efficient solution for quality decisions by combining the real-time sensor and the Internet of Things. The Arduino UNO is used because the programming environment and its language is easy to understand even for people who have not programmed before and it is the best choice to be considered.

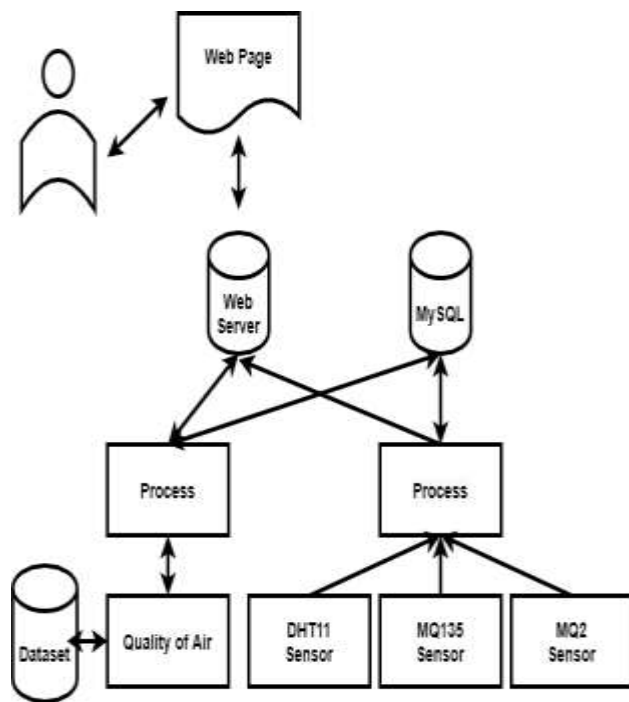


Fig. 1 Structure of System.

i. First Module

The first module is designed to take the number of readings from the air sample to achieve best result. The first module consists of the various sensors as follows:
Gas Sensor.

This sensor is used for used for detection of Liquified Petroleum Gas, i-butane, Hydrogen, alcohol, propane, smoke and methane in houses and industries. The sensitivity adjustment is essential because the resistance value of MQ2 sensor varies according to the various kinds of gases. A load resistance is calibrated with concentration gases.

Temperature & Humidity Sensor.

DHT11 sensor helps to measure temperature and humidity, and it comes with a factory calibrated and can be configure easily with Arduino board.
MQ135 Sensor.

Various types of gases like Ammonia, Alcohol, smoke, CO2 Benzene, and some other gases; can be detected with the help of this sensor. The yield from the sensor is a simple yield that can be associated with one of the simple to advanced port (ADC) accessible on the microcontroller board. It gives the output in form of voltage levels.

ii. Second Module

The second module focuses on establishing the communication of the Arduino UNO with the webserver. The GPRS/GSM sim 900A module is used to upload the sensor value to the webserver. This SIM900A module operates with the help of AT command which enables it to make an HTTP request to communicate and receive the response from the server.

iii. Third Module

The third module is the suitable air quality function algorithm to which the transfer of the input from the various sensors is analyzed and output is provided. The algorithm for the design system works as follows below:

- Calculate the average value of each air particle received as input.
- Know respective gases on the basis of outcomes given by MQ2 as value average value calculated on the basis of value in (a).
- Obtain respective gases on the basis of average values calculated in (a).
- Obtain respective gases by average value of humidity calculated in (a).

iv. Fourth Module

The fourth module comprises the database and the webserver. The database used here is the MySQL database which is used to store all the input data, dataset, and output. Dataset is nothing but the set of the related air index and their relative parameter. All the controlling and working is interfaced to the user via interactive and easy to use web pages.

v. Work Flow

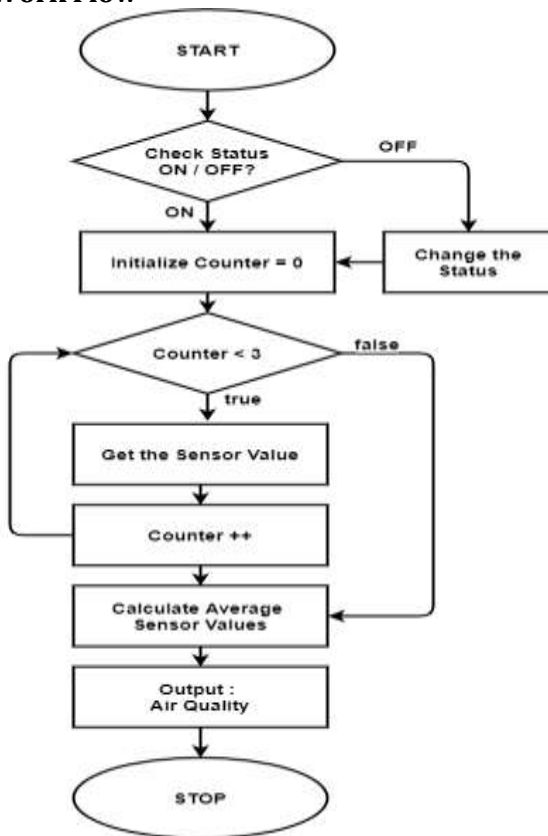


Fig. 2 Work Flow of DS System

VI. RESULT AND EXPERIMENTS

This section describes the result of the decision support system. Experimental setup for all modules consists of various sensors and modules after all the possible outcome result in the form of ppm (parts per million) will be as follows.

Table. 1 Polluted air with respective parameters.

Data Analysis for	Time (second)	Value (ppm)	Distance (meter)
Mosquito Coil	02	74 (Fresh Air)	0.5
	04	125 (Polluted Air)	0.3
Motorcycle Smoke	02	172 (Pollution Air)	3
	04	281 (Very Polluted Air)	2.3
Cigarettes	02	96 (Polluted Air)	3
	04	127 (Polluted Air)	2.5

VII. CONCLUSIONS

The decision support system in this report has been implemented to minimize the number of factors affecting the air quality index with the help of modern technology and various sensors.

This framework provides information of polluted air to study and monitor air pollution with real-time factors and sensor network and also has many benefits over the environment. However, this system can be more effective if the above scenario is compared with the actual air testing carried out by many different methods. Also, the decision support is properly matched with the prior knowledge and experiments. The system has its own many advantages such as easy setup, low cost, and provides a real-time pollutant data.

VIII. LIMITATIONS AND FUTURE SCOPE

This section describes the limitation and the future scope of the decision support system in regions using IoT as given below.

8.1 Limitations

Despite their views, soon decision support systems have contributed very small to solve practical problems in air index under real site conditions due to severe developed difficulties during their adoption and use. There are some of the limitations of using the decision support system with IoT as listed below.

- i. There are some more parameters of the air that play an important role calculated only with the experiment no sensor available for them to measure. The failure to adopt decision support systems may lose the tendency to overlook risk linked with management.
- ii. There can also be more limitations and inabilities of the system.

171

8.2 FUTURE SCOPE

In the future, this system can be improved with the implementation of the upcoming sensors or devices and forming the expert decision support to formulate a proper data set. The improvement in the decision support system and air testing with the help of the sensors surely leads to a decrease in air pollution levels. This system can also be compressed into one single device that can communicate with the remote server with the help of the Internet and operable on the battery. Also, the research can be concentrated on enhancing air check-up techniques with the help of mobile devices to monitor and control pollutant activities.

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The Originality of the work has been warranted by our
149 nd is not been published or in review elsewhere.

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