

REVIEW PAPER ON SMART AIR QUALITY MONITORING AND FILTERING SYSTEM

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ABSTRACT

The word pollution is defined as the mixing of any additional particles in the pure substrate of anything present in the environment. In this view, Air pollution is defined as the alteration in the air quality which is present in the environment. Air pollution is a serious concern for all living beings i.e. Humans as well as animals living on this earth. Air pollution needs to be monitor especially for those who are suffering from Air-borne disease like Cholera, Asthma, Lung cancer, etc. Fresh air is basic necessity for all living beings so to monitor the pollutants present in this many technologies evolved to monitor the air pollutant particles.

KEYWORDS — Air Quality Monitoring System, Arduino, Air Pollutants, Environment Safety, PM 2.5 detection, Air Filter, Temperature, Humidity, Sensors, Monitoring.

I. Introduction

Air, being the essential need it should be pure as crystal so in view of this we continuously monitor it's quality and found which particles are polluted it. This is been impossible to survive on the earth had we not had such a supportive environment. However, with the surge in the urbanization over the last few years we have seen a steady decline in the quality of the environment around us. The human race has done a lot of damages to this world. Our surroundings have suffered the curse of pollution, exploitation of resources, and many other things. Now, it is our duty to take some important measures and save environment for future generations. Air quality parameters, which we need to monitor is having impact in our air quality have short-term results.

This system will help us to detect the parameters of air quality monitor. Many sensors are used for different purposes some of them are being used in

The system to know the best result of the whole condition of the air. Some important gases which is most responsible for air pollution are CO₂, CO, LPG, etc. these gases are detected by this system. Buzzer is also added to indicate the pollution level in the environment.

II. Objective of the Study and Proposal

- To combine advanced detection technologies to produce an air quality sensing system with advanced capabilities to provide low cost comprehensive monitoring.
- To monitor the quality of air and analyse of pollutants condition with sensors and control plane operations. The above problem is monitored by using sensors, we are able to track their carbon status and other pollutants to keep an analysis of our daily air quality.

III. Need of Monitoring

Clean air is vital need for every human being. Polluted air causes many health problems and several damages. Therefore to make a suitable step ahead for controlling the pollution rate in the air, it is necessary to monitor the air quality which may help us to make a right decision at right time. There are various causes of increasing the pollution such as smoke automobile exhaust, chemical discharge from industries, radioactive substance etc. These are main reason of decreasing the quality of air. The main gases which directly affect the human health are Carbon Monoxide (CO), hydrogen sulphide, sulphur dioxide (SO₂), Nitrogen dioxide (NO₂) and the main contribution of these gases are traffic related pollutant emission. Huge efforts are required to improve the quality of air in both outdoor and indoor environment.

IV. Related Work

Previously the air pollution monitoring is done via computerized tomography technique which generate a two dimensional map of pollutant concentration. It provides a many advantages over the differential absorption method. In this system there is a single laser source located at the centre of the area. This laser beam is rotated and directed towards the circumference of the circle. There is a cylindrical mirror so that incident laser beam is reflected in a fan beam over angle across the circle. The beam from the mirrors is the circular region and strikes a set of detectors lie in same plane parallel to the ground. This technique focus on lower transmitted laser energy increasing the range and ability to monitor the area that contains several pollutant sources.

GIS based system is formed, executed and endeavored to screen the air contamination of any region. It contains a microcontroller, gas sensors, flexible unit, a transient support and a server with web arrange which accumulates data from different regions close by compose information at certain period of a day. The data for particular territory are touched base at the midpoint of in a close time and space.

Remembering the ultimate objective to screen nature of air, a Wireless sensor organize (WSN) based new framework is proposed which relies upon data securing and transmission. The parameters of the earth to be watched are picked as temperature, sogginess, volume of CO, volume of CO₂, area of spillage of any gas - smoke, alcohol, LPG.

V. Pollutants Affecting Environment

There are many particles and pollutants present in the environment which result in the air pollution. It would have been not possible to survive on the earth had we not had such a supportive environment. However, with the surge in the urbanization over the last few years we have seen a steady decline in the quality of the environment around us. In the cities, industries are growing on a large scale for contributing in the development of this world. These industries cause many substances and particles which is harmful for the environment. The hazardous substances spread out in the environment includes Air pollutants, Water pollutants and Soil pollutants. The air pollutants includes: Carbon Monoxide, Carbon Dioxide, Sulphur Dioxide, LPG gases, etc.

VI. Types of Air Pollution

On the basis of the source from where these pollutants spread in the air, Air pollution is categorized in two categories:

6.1 Indoor Air Pollution

Indoor Air pollution is a complex mixture of pollutants migrating indoors from outdoor air and pollutants generated by indoor sources. PM 2.5 Sensor, MQ 135 Sensor, DHT 11 Temperature & Humidity Sensor. This pollution detecting device keeps the environmental undesired particles under surveillance. The monitoring unit of setup will get continuous update about the air quality status so that they aware about the unhealthy air about their child and other people. This will create some fear to the persons those continuously evolving the smoke and other type of pollutants in the air. As like well-known proverb "Environmental pollution is not only humanity's treason to humanity but also a treason to all other living creatures on earth!"

6.2 Outdoor Air Pollution

Another category in which air pollution is categorized is Outdoor Air Pollution in this pollutants which are spreading from the external sources like industries, factories, Vehicles, etc. are to be considered. In this type of pollution we generally considered large size pollutant particles which is measured in microns like PM 10 particles. The common sources which causes outdoor air pollution are emissions caused by combustion processes from motor vehicles, solid fuel burning and industry.

5 major outdoor air pollutants:

- Ozone (O₃)
- Nitrogen Oxides (NO_x)
- Carbon Monoxide (CO)
- Sulphur Dioxide (SO₂)
- Particulate Matter (PM₁₀ and PM_{2.5})

VII. Air Quality Index

Air Quality index is an index issued by government regularities which depicts about which quality of air is good for a healthy living life. It also tells about at which level air pollution is harmful for human health. The table drawn below shows the various categories and air quality level:

Air Quality Index	Health Concern
0-50	Good
51-100	Moderate
101-150	Unhealthy for Sensitive groups
151-200	Unhealthy
201-250	Hazardous

VIII. Basic Block Diagram

The basic block diagram of the system is shown in the Figure 1. This block diagram uses Arduino integrated with individual gas sensors like carbon monoxide, ammonia along with particulate matter, humidity, and smoke which measures the concentration of each gas separately.

Arduino is connected to various sensors and other components. Arduino collects data from the sensors and GPS connected to it and then performs predefined set of logics on it. This gives a required output to the monitoring station in form of a Air Quality Index.

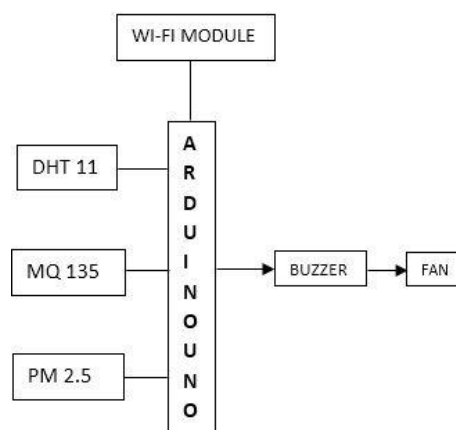


Figure 1: Basic Block Diagram of the system

IX. Development of Sensing Device

The designing of the sensing device plays a major role to spread the awareness about the polluted air which we intake on regular basis i.e. it should be a 'Real Time Monitoring System'. For 'Human Health', first concern is the compact size of the device, and secondly about how and where to install in the house or any other place.

9.1 Size of the Device

To fix the size of the device, survey of local houses is done. The size of air quality monitoring system which is installed by government is very large in respect of this we are developing this device which is portable and easy to carry anywhere to monitor that place air quality as well as temperature and humidity. And we also surveyed about the air quality of all the areas in our city. For references, the device weight is approximately 300 – 500 gms, and it's size is very small and compact.

X. Things in View for Development of the Device

It's helpful to understand what features are most vital and play important role in Air Quality Monitoring and Filtering device.

10.1 Ease of Use

It's important to make sure that the monitoring device is comfortable and easy for your use.

10.2 Battery Life

The best-case scenario is a monitoring device with few days battery backup. The more high-maintenance a filtering unit is (requiring daily charging), the more likely you are to attach this device at any place, it is showing the best results.

10.3 Sensors

Gas sensors like MQ135 are used along with particulate matter sensor PMS5003 and DHT 11 humidity sensor. The gas sensors MQ135 measure the concentration of overall Air quality. PMS5003 is PM_{2.5} sensor used to measure particulate matter, which is the mixture of liquid and solid particles with diameter of 2.5 micrometers or smaller than that floating in air.

Basic features which is considerable in a sensing device:

10.4 Range

Whether you simply want to monitor the quality of the air present in your nearby surrounding or detect the particulate matter like PM 2.5 and PM 10, you need a sensor that will work for the detection of suspended particles which you require.

10.5 Alerts and Alarm

In this device we are using a buzzer which works after the air quality is reached to the worst condition as per the Air Quality Index.

10.6 Real-Time Analysis

When you want to know whether the quality of air in your surrounding is good or not then check it on this device. If monitoring your nearby area air in real time is healthy or not, make sure you put your device in an open area.

XI. Conclusion

The smart way to monitor environment and air being a low cost but efficient and embedded system is presented. In the proposed architecture functions of different sensors and their working procedure were discussed. How they work, their functionality, their optimal uses and their data taking procedures and comparison with standard base data's are also discussed here. This air quality monitoring system was tested for monitoring the gas levels on different parts of the city. It also sent the sensor parameters to the data server. This device is having many sensors which helps in the detection of various air pollutants present in the environment.

XII. Rewards of the Study

The rewards of this device is to shown the improved human health, increased productivity and reduced health costs and a healthier and more productive environment. The use of Air filters can reduce the air pollution to considerable amount.

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