

SMART AIR QUALITY MONITORING AND FILTERING SYSTEM

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ABSTRACT

Humans are growing on a fast pace, in respect of this they establishing many industries to step forward and achieving necessary things in our day-to-day life. With the great outputs these industries produce many type of pollutants or elements which are hazardous for our environment. These harmful pollutants is growing as a curse for our environment and pollute our environment. So, to deal with one of biggest problem of century i.e. Pollution, a continuous check is necessary which monitors the pollutants in our environment. By monitoring the pollutants, it is easy to reduce it and set an alarm which indicates about the quality of air present in our surrounding specially for those who is suffering from many air borne diseases like Cholera, Lung Cancer, Breathing problem, etc. caused by the environment.

KEYWORDS- Air Quality Monitoring System, Arduino, Air Pollutants, Environment Safety, GPS, GSM, GPRS, PM 2.5 detection, Air Filter, Temperature, Humidity, Sensors, Monitoring.

I. INTRODUCTION

Air pollution leads to be the biggest and most severe problem in our day-to-day life. Air pollution having many tiny and micro particles which enters in our nose and damages our breathing and lung capacity. Awareness of these pollutants is very important for every citizen in the society, especially for old age people which suffer from illness caused by exposure to polluted environment. Monitor of the pollutants in the air quality is necessary, particularly for those areas which is having industries. So, to reduce air pollutants by monitoring the pollutants is done by the support of its citizens who are well-informed about local and national air pollution problems. Air quality parameters, detected by the system is the root cause of many diseases. 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 by beep, when the Air pollutants detected by the system is reached to an alarming situation. The paper is organized as: the literature survey of the existing work in the area is carried out in section 2, working of the module is described in section 3 followed by description on development of sensing device in section 4, design of the system is presented in section 5 followed by results & discussion of the proposed work is considered in section 6. Finally the conclusion are drawn in the section 7, followed by future scope of work in section 8 of the paper.

II. LITERATURE SURVEY

A. Smart Air Quality Monitoring and Filtering System

This paper represents a system to monitor Air Quality in the environment to alarm about the quality of air during daily activities in Indoor and Outdoor environment. The system consists of two main units,

An Air quality Monitor, and a filtering unit. The air quality monitor unit is used to detect the air pollutants and particulate matters present in the environment. This information is shown on the screen unit which shows that the quality of the air is good or bad. If the quality of the air is not up to the mark then it issues an alert message accordingly. The prototype of this sensing device is tested to validate the system functionality. The results shown by this device is promising for daily air quality monitoring.

B. Problems due to Air pollution^[1]

Now-a-days the situation is gone worse because humans continuously using many sources which emit harmful gases in the environment. These gases evolve in the environment to make our environment unhealthy. In many cities the air quality level is reached to an alarming condition where it is difficult to survive. Air pollution acts as a slow poison and effects the human health. Due to air pollutants, many health diseases like Asthma, Pneumonia, Lung Cancer and Autism, etc. are to be found in Human beings. In a report published by World Health Organization (WHO) shows that 27% which is approximately equal to the 7 million death happens in a year due to the Air pollution.

C. Pollution Detecting Device^[2]

The focus of this device is to sense the unhealthy pollutants present in the environment which is not good for health. The device sense and measures the air pollutants parameters such as "PM 2.5", "PM 10", "METAHNE", "AMMONIA", "CARBON DIOXIDE" "TEMPERATURE", "HUMIDITY", "DUST", etc., to the detecting device. The device will reply back with a text containing the real time accurate temperature and humidity of the place and will also provide the surrounding gases data, so that the monitoring system can keep track if the pollutants level not suitable for the human health. The secondary measure implemented was using a Fan or a Filter and a buzzer present on the device which can be activated when the air quality reached to worst condition. With this pollution monitor we continuously surveillance the accurate status of the Air quality. Hence this project aims at providing information which is necessary for better human health with basic information like temperature and humidity in today's time. The drawback of this system is that the sensors is sensing only up to few meters.

D. Air Filtering System^[3]

Indoor air pollution is a complex mixture of pollutants migrating indoor from outside sources and pollutants generated by indoor sources. Some sensors are used in this device like PM 2.5 Sensor, MQ 135 Sensor, DHT 11 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!"

III. HOW THIS DEVICE WORKS?

Sensors from different devices continuously emit data in the environment about the working state of the system. Arduino provides a common platform to dumb their data in a common language for all components to synchronize with each other. Data fetched from various sensors is sent to Arduino platform securely. Arduino pins integrates the data from various sensors and perform analytics on it. All the information is extracted from data is to be considered for developing the results and observations. Finally result is shared with users for further recommendations. It is the simple process of taking Data from environment and then performing Logics on them. After performing Logics Output is shared with the user. The simple flow diagram of working of Sensor is shown in Figure 1.

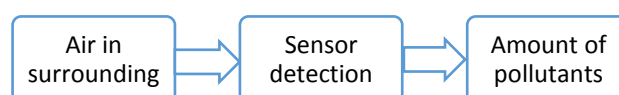


Figure. 1 Working of Device

3.1 Block Diagram

The basic block diagram of the system is shown in the Figure 2. The paper aims at designing an air pollution monitoring system which can be installed in a specific locality and to enhance the system from the previously developed systems beating the earlier disadvantages by developing an android app available for the public. This device uses Arduino integrated components with individual gas sensors like carbon monoxide, ammonia along with particulate matter, humidity, which measures the concentration of each gas separately. Arduino is connected to various sensors and other components. Arduino fetch 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.

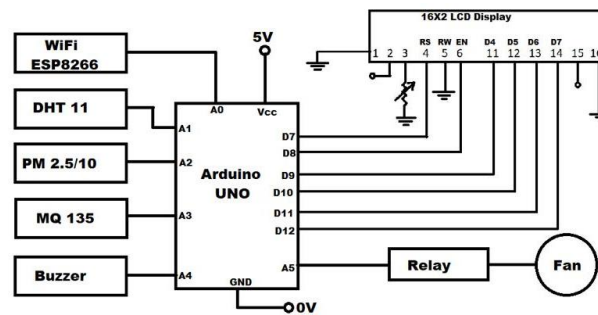


Figure. 2: Block diagram representation of module

IV. DEVELOPMENT OF SENSING DEVICE

The designing of the sensing device plays a major role to spread the awareness about the polluted air which living beings 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.

4.1 Size of the Device

To estimate the size of the device, survey of local houses is done. The air quality monitoring system which is installed by government is very huge 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 device 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.

4.2 How to use this Device?

To place on an appropriate position in the house, we should concern that it is place near the power supply. There are several designs of this Device such as permanent fixed and portable device, Vehicle mounted Type and Build-in Mock-Ups. To take pollutants quantity, this device will attach with the Ethernet cable for power supply. Then the device should be positioned in the open areas where all the gases is to be detected.

V. THINGS TO CONSIDER IN THE SYSTEM

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

a. Ease of Use

It's important to make sure that the monitoring device is compatible in detecting air pollutants and easy for your use.

b. 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.

c. Sensors

Gas sensor like MQ135 are used along with particulate matter sensor PMS5003 and DHT 11 humidity sensor. The gas sensor MQ135 measure the concentration of hazardous gases like ammonia, carbon

monoxide (CO), methane, smoke etc. PMS5003 is PM2.5 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.

Important features for a sensing device are as follows:

a. 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. Keep in mind this device is for the real time analysis and keep tracking the regular status of the air.

b. 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. Consider how often you want updates and how much flexibility you need for different circumstances.

c. Reset Button

If your device is not detecting all the gases or shows random data then press reset button to immediately let you keep the device in normal form.

d. Real-Time Analysis

When you wish to analyse 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.

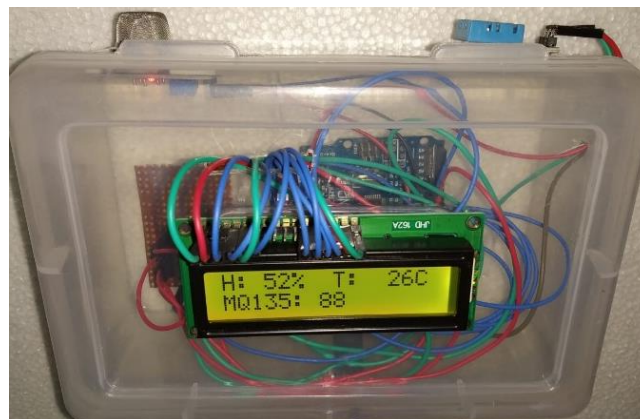


Fig. 3: Device Hardware Setup

VI. RESULT

This Air Quality Monitoring and Filtering System having different types of sensors and helps in detecting harmful gases present in the environment. DHT 11 helps in detecting Temperature and Humidity. MQ135 helps in showing Air Quality status and PM2.5/10 helps in detecting tiny particles present in the environment. This device helps in providing real time data about the pollutants present in our environment.

VII. CONCLUSION

In this paper we have reviewed the Smart Air Quality Monitoring and Filtering device. Firstly we have defined the various systems and devices available. Air Quality Monitoring device comprises of a GPS, GSM, Arduino or any other Microcontroller, Reset button and the Sensors to keep the track of particulate matters, humidity, temperature etc. There are some important things to be considered like the limited range of device and sensor, Battery life and the most important the cost.

VIII. FUTURE ASPECTS

Our work can demonstrate vast opportunities to work on the device, and also on the field using the device that we have worked with. This device is used any time efficiently in different locations of a city and then research with the achieved data for that particular area in that city. This device will be updated with additional sensors that can sense data from the existence of other gases such as CO₂ and H₂. These gases will provide the condition of the atmosphere and authority can take into further decisions accordingly. The sensors that we have been worked with can also be reset according to most recent time update. In future time, our device can be kept testing for checking whether the sensors still runs properly and give real time data. With the future plan programmer can add PHP programs to create additional tables to show amount of O₂ or H₂ and pie chart to show which color represents which particular gas and also diagram that can show relations with gas and time.

ACKNOWLEDGEMENT

With immense pleasure, we would like to express our deeper sense of gratitude to Dr. Rohit Garg (Director MIT Moradabad), Moradabad Institute of Technology, Moradabad for their strenuous guidance and giving us an opportunity to carry out our project work in the institute.

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