IOT BASED AIR QUALITY MONITORING SYSTEM

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ABSTRACT

Air pollution is one of environmental issues that cannot be ignored. In the pollutants are for a long time causes damages in human health. Traditional air quality monitoring methods, such as building air quality monitoring stations, are typically expensive. This project is suitable for air quality monitoring in real-time. Air quality monitoring is well known and established science which started back in the '80s. At that time, the technology was quite limited, and the solution used to quantify the air pollution complex and really expensive. Fortunately, nowadays, with the most recent and modern technologies, the solutions used for air quality monitoring are becoming not only more precise, but also faster at measuring. Devices are becoming smaller, and cost much more affordable than ever before. The presented device uses the Sam young "DSM501A" dust sensor which is one of the cheapest. This sensor is capable of detecting PM2.5 as well as PM10 particles.

KEYWORDS: Arduino, hazardous pollutants, DSM501A, Quality, AQI

1. INTRODUCTION

Air pollution is the most environmental problem and it causes a more damages and effects on human health, water banks and climate. The source of air pollution in all developed cities is due to vehicles and the another one is industries. The most use of vehicles are increase the toxins in the atmosphere. This is the cause of environmental pollution affecting the human health. It has also caused the other respiratory problems like asthma attacks and skin rashes. The air quality monitoring system is installed in a particular locality where there are monitor of air pollution to detect the constituent gases of air which may lead to harmful effects on human health and other living beings. This system uses Arduino and dust sensors to predict the level of various harmful gases like CO, NH3, particulate matter and smoke. Carbon Monoxide is given the highest preference, as it is a greenhouse gas and a major pollutant that is warming the earth. The pollution levels are displayed in LCD screen which helps the users in getting updates about the current air quality. Users are able to view the air quality level in numerical as well format. In addition, the Air Quality Index (AQI) for the current pollution level is determined and displayed in the application along with health effects. Thus, this application lets the users to take effective measures in advance to protect themselves from harmful effect.

2. LITERATURE SURVEY

The major cities are polluted by the vehicles. The vehicles are increase in the emission of loads of the toxins into environment. The commercial systems available in the market are devices that use the semi-conductor sensors at the smoke emission outlets of vehicles and this system detects the pollutant levels and also indicates this level to the owner of the vehicle with a meter. When the pollution level increases a particular threshold level, alarm will start ringing in the vehicle to indicate that the limit has been attained and the vehicle will automatically stop running after certain time [1] [6]. This type of individual usage system does not help the public to get into an awareness zone. Bharat stage emission standards are the emission standards set by the Indian Government to regulate air pollutants from internal combustion engines in motor vehicles. Also, over the years, several regulations have been made by the Government to regulate and reduce the emission from vehicles but in vain.

Also, other cost-effective measures were introduced to control the air pollution by calculating the levels of each and every pollutant [2][4]. Based on the observed values, the air quality index for that region is calculated and the values are made available through a web page.

The real time air pollution monitoring system was developed which measures the levels of almost all the pollutants with good accuracy [5]. Libelium wasp nodes are used for wireless communication and the data is displayed through a web interface both in chart and numerical format. But the usage of these libelium wasp

nodes have resulted in the production of expensive system for the public usage as it consumes more energy from the batteries [4][6].

Further a low-cost wireless monitoring system was developed to measure the levels of harmful gases based on a multilayer distributed model using Arduino platform. In addition, to achieve data transmission, a software component was built using C/C++ language. The data is collected and sent to a webpage to make the data available real time [1][7].

3. DESIGN OF THE SYSTEM

The chapter aims at designing an air pollution monitoring system which can be located at major polluted cities. Nowadays the recent modern technologies are used to develop the system for faster to measure the quality air in the environment. It 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. The collected data is display to the LCD (Liquid Crystal Display) screen. Then indicate the different quality rate in LED (Light Emitted Diode).
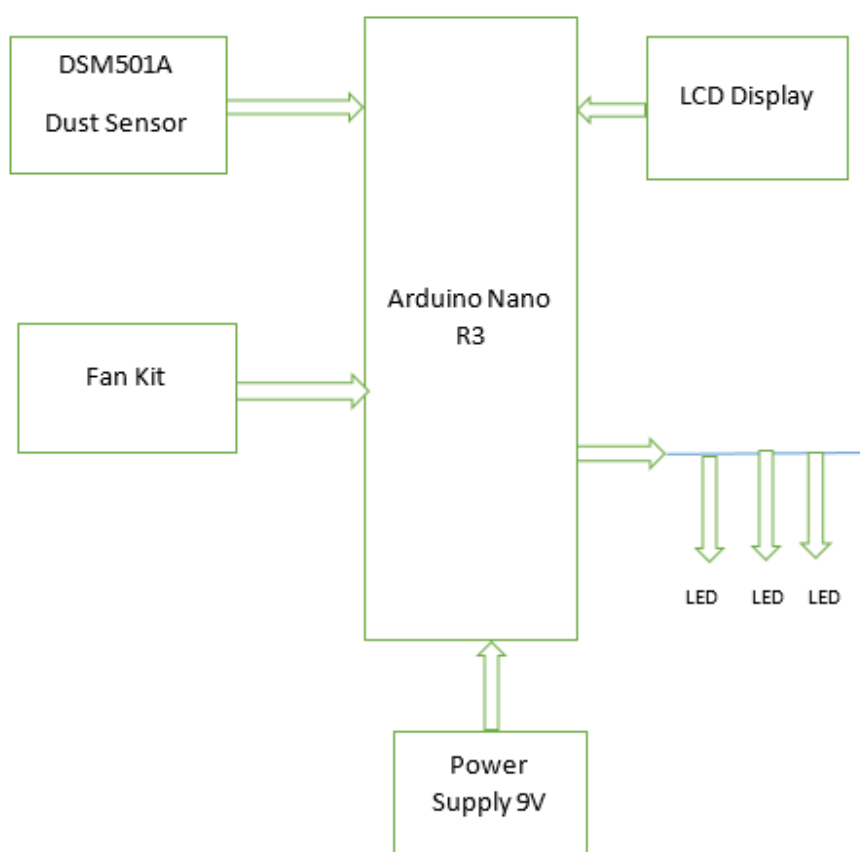

Fig 1: Architecture of Air Pollution Monitoring

The average concentration of each gas is analyzed using matlab. Then certain time control is assigned based on the standard level of each gas measured and the result can be viewed in LCD and lights. The architecture of air pollution monitoring is shown in Fig 1.

The concentration level of each gas can be viewed both as a graph and in numerical format. Based on these values the air quality index value is calculated and the nature of the air quality in that area is determined which is also displayed through the app. Along with this, the health effects for the corresponding air quality is displayed to create awareness among the public. The users will not get disturbed with irrelevant data as the values displayed are location specific and help them stay tuned to the current status of air pollution. The hardware setup system is shown in Fig 2.
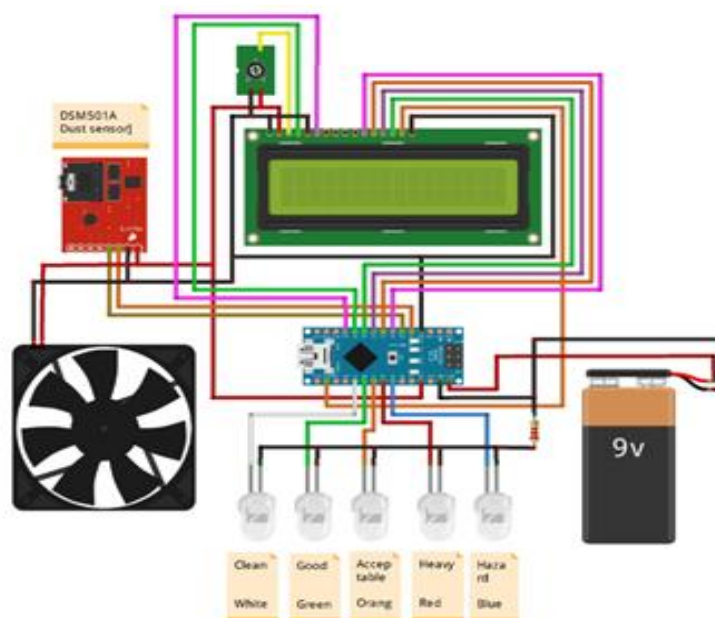
Fig 2: The Hardware Setup

4. SETUP OF THE HARDWARE SYSTEM

A. Arduino Nano board

Arduino is an advanced microcontroller which can work with various communication technologies and sensors. Due to its simplicity and availability of number of hardware extensions, the board can be used with at most efficiency.

B. Fan Kit

The fan kit is used to access the air in the environment and passed through the dust sensor.

C. Dust Sensor

The DSM501A 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. The concentration of various gases and particulate matter can be collected. The collected data is uploaded to cloud. The concentration of gases are obtained in microgram per meter cube and ppm (particles per million).

D. LCD display

The LCD display is used to shows the level of air molecules present in the environment and alert LED's with five different states:
- Clean
- Good
- Acceptable
- Heavy
- Hazard

5. RESULTS OF SYSTEM OPERATIONS

The concentration of both PM 10 and PM 2.5 can be monitored on the Arduino serial monitor. Depending on the degree of contamination (PM 10), an appropriate led of a certain color will be lit to allow a quick and easy reading of the result. It is very important to emphasize that by installing a fan that draws air out of the sensor outlet, significantly improve the characteristics in the area of unwanted peak values. The whole device is assembled in a plastic box for electrical installation.
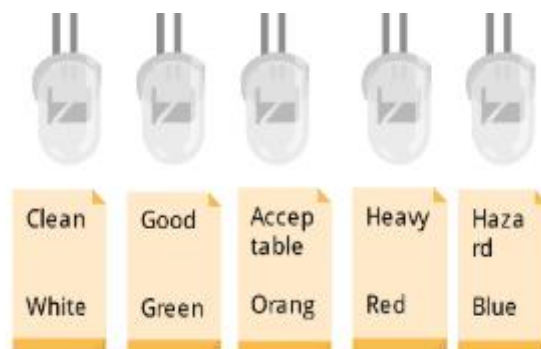
Fig 3: LED Output

The results are analyzed then viewed through LCD in a numeric format. Further the average level of pollution is calculated and analysis the time-controlled results are viewed through an LED as shown in Fig 3 and Fig 4.

Fig 4: LCD display for pollution level

6. CONCLUSION

The air quality monitoring system using a dust sensor senses the pollutant levels and uploads the data in cloud, this system is used by the public easy to access the pollution level in their area. This system is widely used to offices, factories, residential areas and education institutions, if the system is installed in their premises with there are many changes in our environment. In this system is most necessity of today world.

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