

ASSESSMENT ON AIR QUALITY BY AIR POLLUTION MONITORING SYSTEM

Dr.V.Venkatesa Kumar M.E, Ph.D.¹, Sivasumitha .P²

Assistant Professor, Department of Computer Science, Anna University Regional Campus, Coimbatore.

Email Id: mail2venkatesa@gmail.com

P.G Scholar, Department of Computer Science, Anna University Regional Campus, Coimbatore.

Email ID:sivasumitha14@gmail.com, Contact no: 8344397442

ABSTRACT- One of the basic needs for human beings is fresh and clean air. Air pollution has become a major issue in the environment now-a-days. Air pollution are caused due to some of the toxic gases such as Carbon monoxide (CO), Sulphur dioxide (SO₂), Nitrogen dioxide (NO₂), Ammonia (NH₃) etc., Air monitoring is an important methodology to check whether the surrounded air is suitable for human beings to breath in or not. The Polluted air inhaled by the living organisms causes a serious issue in its health conditions. Majorly human beings are affected by the diseases like respiratory infections, cardio system diseases, lung diseases. The monitoring system which is put forwarded is based on the monitoring system using cloud which is used to evaluate the pollutant gases around the industrial area and thus make people aware on the concentration of clean air they breathe in. The sensing of toxic can be made by gas sensors. This survey helps in identifying the pollutants that are available around the atmosphere and monitoring methods for the toxic gases in the atmosphere.

Keywords – Toxic gases, Respiratory disorders, Gas Sensors, Industrial air quality monitoring, Cloud based monitoring system.

INTRODUCTION

The three basic needs of living organisms are food, water and air. The living organisms can be able to survive without water and food for about 3 to 5 days but not without air. Now-a-day's industries are rapidly growing in more number both in urban and in rural areas. Due to the effect of air pollution that is caused by the industries make a severe impact on change in climatic conditions depletion of ozone layer in the stratosphere. It also affects the fresh water sources which in turn affects the food production. The air pollution may also cause acid rain, globe warming. The air pollution may also cause changes in agriculture crops plantation etc. There are many organizations that provide the index value for air quality. Some of the organizations are World Health Organization (WHO), National Ambient Air Quality Standards (NAAQS), and Central Pollution Control Board (CPCB).

The causes of air pollution are mainly categorized as natural sources such as dust storm, forest fires, volcanoes, sea spray, plant pollen etc., and man-made sources such as domestic as well as industrial. The common air pollutants are Sulphur dioxide, carbon monoxide, nitrogen oxide, lead, Ammonia, Particulate Matter (PM).

Gregorio Andria et al., suggested that the assessment and forecasting variation for urban air pollution. Some modeling technics were used to validate the measured data and predict the toxic substances that are emitted in urban areas. Kalman filter and Kriging algorithms are used to improve the performance in examining them. Data filtering is done to estimate the analyzed quantity. The performance of the model is improved and the spatial relationship is identified in the monitoring network among the analyzed substances by Kriging technique [1].

Xiaofeng Liu et al., has put forward the monitoring system for air pollution near roadways. This system collects the quality of air near the roadways. Particulate matter sensors and exhaust gas sensors are used. Bluetooth is used as interface for the system and GPS as receiver. Aerosol sensor is put into operation to find the PM in the air while Figaro sensors are used to measure the quality of exhaust gases like CO₂, N₂, NO_x, CO and others. The downside of this system is the monitoring done for the whole day and the measured data are uploaded to the server through Bluetooth at the end of the day [2].

Nihal Kularatna et al., has explained the IEEE 1451 based environmental air pollution system for low cost requirement. Pollutants like CO, NO₂, SO₂, O₃ can be measured in this system with the help of semiconductor sensor. ADuc812 micro convertor is

used to implement the smart transducer interface module (STIM). The graphical user interface is provided with the help of Network Capable Application Processor. This system overcomes the short comes of analytical instruments. The gas sensors are used to measure the pollutant gases in the environment. The flaws of the system that there is no humidity sensor and temperature sensor to improve uncertainties, the STIM has no LCD display unit and memory and the clock rate of STIM works under 1000kb/s. The clock rate to be improved by receiving the direct PC clock rates [3].

Vijay Sivaraman et al., has put forward the Haze watch which is used to monitor the air pollution in the urban area of Sydney. Crowd-source fine-grained spatial measurement is made to calculate the level of pollutants in the air of urban areas. In this paper, the sensor node like Metal Oxide , Electrochemical sensors measure the pollutants and transmits to mobile phones , then the mobile phones uploads the measured values to the server by using 3G network. Server stores the collected data then GIS maps and profile were generated by it. User can view the level pollutants from their personal device [4].

SCRUTINIZING METHOD

The survey can be made in three scenarios.

- ❖ Sensing Method.
- ❖ Processing Techniques.
- ❖ Monitoring Method.

SENSING METHOD

The sensing can be carried out in various emission sources like large industrial centers, oil refinement industries, steel plants, cement industries. This process can also be analyzed in traffic roads, small industries. The sensing system consists of recording stations which can analyze both meteorological parameters as well as chemical substance that are contained in air. The recording station can embedded with chemical substances analyzes and several sensors to sense the meteorological parameters. These parameters are used in regular calibration and pre- processing the data which is acquired [1].

The recognizing method can to perform by using Smart bike. It can act as a mobile sensor node with additional sensors that can sense the particulate matter (PM) and the exhaust gas. In this the pollutants are categories as exhaust gases like CO₂, N₂, NO_x, CO, and some other gases and particulate matters. Optical aerosol sensor, Shinyei PPD42NS, is used to measure Particulate Matter (PM), which outputs a digital (Lo Pulse) in proportion to PM concentration. TGS 2201 (Figaro Sensor, Japan) is used to measure the exhaust gases [2].

The semiconductor gas sensors are used to sense the toxic of air that present in. It can measure the major pollutants like CO, NO₂, O₃ and SO₂. This sensors are get connected with Smart Transducer Interface Module (STIM). These sensors have improved range, low power consumption and longer life time compare to analytical instruments [3].

The sensing system 'Haze Watch' is aims to crowd-source fine-grained spatial measurements of air pollution and to engage users in managing their pollution exposure through their personalized tools like mobile phones. The concept of 'crowd-sourcing' is also called as 'participatory sensing'. In this crowd- sourcing , the users collects and contribute data related air pollution which is obtained from personal sensing units, and the greater spatial density of data thus collected from several users in turn gives each user more accurate estimates of their pollution exposure [4].

PROCESSING TECHNIQUES

The processing techniques of [1] use two methods. They are Kalman filter and Kriging techniques. Kalman filter is a recursive process that allows noisy data to be filtered and provides the estimate of the analyzed quantities. The Kalman filter is a very powerful tool which can controls the noisy systems. This filter gives best estimate of required parameters, even though the characteristics of the observed phenomena are unknown. To enhance performances of the model, consider the measured pollutant values in other stations of the monitoring network and to identify the spatial relationships between the analyzed substances, the Kriging technique has employed.

The Processing system of Bi-cycle borne consists of a single-chip processor, a micro GPS receiver, a particulate detector, an exhaust gas sensor, a micro SD card, and a Bluetooth modulus. When the user rent the public bicycle, the monitor starts to collect the air pollution over roadway, and store these data in the SD card. After the user returns the bicycle at the dock station, the collected data are uploaded to the data center through the Bluetooth interface [2].

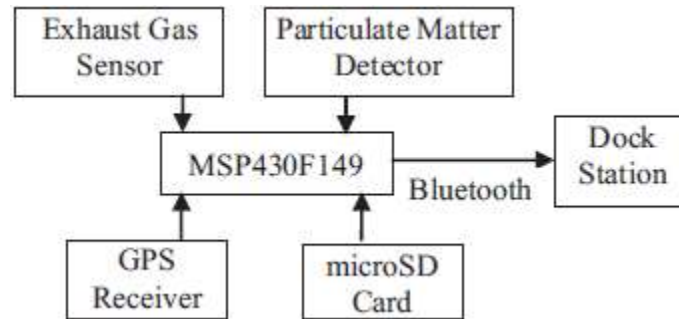


Figure 1: Processing Techniques of Bi-cycle Borne [3].

Micro Converter-ADuC812 is used for processing method in [3]. The sensing data from sensor array are in analog form. To process the sensed containment data of analog signal to digital form ADuC812 micro converter is employed. The ADuC812 is a completely integrated 12-bit data gathering system which provides high-performance self-calibrating multichannel ADC, dual DAC.

The sensor node measures the pollutants concentration and transmits to user mobile phones, and then the mobile phone uploads the measured values to the server by using 3G network. Server stores the collected data then GIS maps and profile were generated by it. The end user can view the level pollutants from their personal device [4].

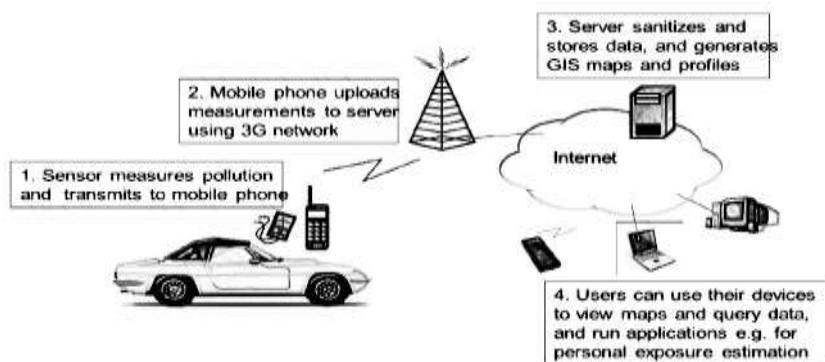


Figure 2: Processing Techniques of Haze Watch [4].

MONITORING METHOD

The monitoring strategy of [1] can provide the level of toxic gases that are present in traffic road can be analyzed from the monitoring stations. The monitoring has been done in hourly, daily, weekly and in yearly basis. From the monitoring station the level of carbon monoxide (CO), toluene and benzene can be determined. The unit of CO is noted as mg/m^3 whereas toluene and benzene were marking it as $\mu\text{g}/\text{m}^3$.

The air pollution monitoring system of [2] employees servers. In this model, the sensed data from near way road has been processed by uploading the gathered data throughout the day into the server. The monitoring can be made via the server of that particular organization.

Network Capable Application Processor (NACP) PC is connected to STIM through Transducer Independents Interface (TII). This NACP provides GUI and controlling power of STIM. The GUI is designed in Visual Basic 6.0 language. From the GUI of NACP PC the concentration of gases and current status of STIM [3].

The collected data from the sensor is uploading into the server using base station. The data processed in the server. The processed output of level of pollutants in the atmosphere can be viewed and monitored via the mobile application which is developed in android and in apple phones [4].

INDIA-AIR QUALITY INDEX (AQI)

The following table shows the air quality index of India.

AQI Category (Range)	PM ₁₀ (24hr)	PM _{2.5} (24hr)	NO ₂ (24hr)	O ₃ (8hr)	CO (8hr)	SO ₂ (24hr)	NH ₃ (24hr)	Pb (24hr)
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5-1.0
Moderately Polluted (101-200)	101-250	61-90	81-180	101-168	2.1-10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very Poor (301-400)	351-430	121-250	281-400	209-748	17-37	801-1600	1200-1800	3.1-3.5
Severe (401-500)	430+	250+	400+	748+	34+	1600+	1800+	3.5+

Table 1: AQI of India

Method Comparison

The following comparison affords the clear view about the assessment.

Attribute	Reference [1]	Reference [2]	Reference [3]	Reference [4]
Gases	CO, toluene, benzene	PM, CO ₂ , N ₂ , NO _x , CO	CO,NO,SO ₂ ,O ₃	Haze
Units	Mg/m ³ , µg/m ³	Mg/m ³ , µg/m ³	PPM, PPB	PPM, µg/m ³
Technique	Kalman filter & Kriging technique	Smart Transducer	-	Crowd Sourcing
Equipment	Sensors	Aerosol sensor & Figaro sensor.	Semiconductor sensor	Gas sensor
Monitoring	Fixed Station	Mobile Station	GUI Interface	Android application

Table 2: Method comparison from the reference paper

CONCLUSION

Air pollution is a main and most complex issue in terms of toxicology and health risk assessment. It is the introduction of Biological Molecules, particulates or other harmful materials into our atmosphere, which may cause damage to other living organisms or death to humans. It may come from natural sources or anthropogenic. Now days, it's mainly due to industries and traffics. Many different types of pollutants which may give rise to combined effects. The survived methods are used to identify and to monitor the toxic gases in the environment. It analyses the concentration of gases various gases and compared with the recommended mean value to monitor the level of pollution and condition of environment. This assessment gives the higher understating of varied technique that square measure used to sense and monitor the standard of air within the atmosphere and additionally provide sweetening for additional watching system.

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