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An Insight on Air Pollution Monitoring System

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Abstract: Air pollution monitoring has been carried out since lot many years but off late its has gained a lot of prominence. Initially monitoring was carried out in a traditional way and has adapted itself with the ever changing technological developments and has been able to create an awareness into the general public. This work tries to highlight the concept of Air pollution monitoring, its implementation and its effectiveness.

Keywords: Wireless sensor network, Air quality, pollution, real time monitoring.

I. INTRODUCTION

Monitoring need a systematic approach for observing and studying the condition of the parameter in contention. Air is one of the very basic and a very important parameter without which there is no existence and there is a need to breathe fresh air. With increased industrialization, urbanization and unplanned development air has taken a beating and is getting deteriorated with the every passing day. It has become very necessary to percolate the ill effects of pollution to the general public so that they are aware about it. Road traffic, industries are the major source of pollution with Carbon Monoxide, Sulphur dioxide and Nitrogen dioxide along with many other pollutants pose major risk to the humans. Therefore, air quality monitoring is needed in order to provide useful information about the pollution and can take appropriate measures to make themselves comfortable as and when required. The purpose of monitoring the air quality is to collect data analyze it and present it for authorities and the lay man to implement rules and regulations and to take suitable decisions respectively. The main mission of air quality monitoring network is to record the concentration of pollution and other parameter related to the pollution and deliver these information or data to the population to warn against the any danger.

II. NEED OF MONITORING

Clean air is a basic need of human being. Polluted air leads to lots of respiratory problems. Thus air pollution monitoring has become very important. 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. Lots of efforts will be needed to improve the quality of air in both outdoor and indoor environment. Monitoring of air has done manually and has moved to automatic control but still a lots of efforts are needed to be employed so that air pollution is tackled properly [2].

III. RELATED WORK

A. Techniques Used For Pollution Monitoring

In the early days of air pollution monitoring computerized tomography technique was put to use which would 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 [3]. Monitoring then shifted on using GPRS sensors array which has been designed, implemented and tested. This system unit that consists at a single chip of microcontroller and a pollution server which is a high end personal application server with a internet connectivity where the mobile data acquisition unit that collect the pollution level & pack it into a frame with GPS location, date and time. This frame is uploaded to the GPRS modem and transmitted to the pollution server via the public mobile network. A data base server which is attached to the pollution level which is used by the various client. Pollution server for storing the pollution level which is used by the various clients. Pollution server having a interfaced with the Google map to provide a real time pollutants level as well as the location in large metropolitan area [4]. And presently the system have upgraded to using Internet of Things.

B. *Wireless Sensor Network For Real Time Monitoring*

A distributed infrastructure contains wireless sensor network and grid computing technology for air pollution monitoring as well as mining. However, the two layer network architecture and peer to peer e-science grid architecture and distributed data mining algorithms are used in order to collect the data and tiny operating system is used to examine the operation and performance of the wireless sensor network [5]. Wireless sensor network have been extremely effective in monitoring and when being integrated with desired sensors is capable of providing real time pollution monitoring. The various gases like CO₂, NO₂ are calibrated by using a appropriate calibration technologies and these pre calibrated sensors are integrated with the wireless sensor using a multi hop data aggregation algorithm. An effective middle ware along with a suitable web interface is used to display pollution data in the form of charts and number. It is also available on the internet. Apart from various gases the wireless sensor can be used to measure and relay the values of temperature and humidity too. The air quality monitoring system combines with the virtual instrument technology & frequency hopping communication technology to achieve the wireless data transmission. By using a spectrum hole detection specimens that adjust a carrier frequency according to the result & made a full use of available radio spectrum with this specimen there is no signal interference during the wireless transmission process & the system can receive the real time information effectively and the gas concentration can show clearly and easy to read by the non professional staff also [7]. The air quality monitoring station which were being conventionally used to monitor the quality of air were expensive with a low resolution data sensing but with progress in the technological development the WSN got much better and gave a fast and more accurate result. The WSN were integrated with front end disseminating softwares like Lab view etc. The advantages of these wireless sensor network is that it is easy to set up, inexpensive and also provide a real time data[8]. The system in which several monitoring station communicate wirelessly with the backend server using machine to machine communication & each station equipped with the metro logical sensor and gaseous sensor for data logging and wireless communication capabilities. The backend server collects the real time data from station and converts it in to the information which is used by the user through the web portals and mobile application [9]. The small scale of wireless sensor station to communicate with the backend server and provide their measurement in a real time however the collected data are process and analyse in order to provide these data in different format to the end user [10].

C. *Centralized Monitoring*

With different sensors being deployed at different areas and each sensor node being required to relay the data to a central node ensures that quality data is being received and processed. Collected data are uploaded to the cloud dataset so that it can be analyze or viewed for future use. All these uploaded data are managed in database management system over the centralize database with this available information the user can search the record as per their requirement.

D. *Pollution Level Mapped On Google Map*

One major objective of monitoring is to display the collected information in a user friendly format. Normally front end software such as visual basic or lab view etc are used to disseminate the received information to the end user. A web page is also used to display the real time data. Only the authorized user can access the website which is easily available to the public when the permission is granted. Website allows displaying the different level of pollution in different area over the Google map. With the help of internet connectivity it is possible to display the different level of pollution at different area on the Google map [11].

E. *Types Of Sensor*

Lots of sensors are available which are able to sense a particular pollutant or a parameter. These sensor can be Temperature sensor, Humidity sensor, Rain sensor, Gas Sensor or various gas sensors like CO₂ sensor, NO₂ sensor, SO₂ sensor etc. Wireless sensor network built a node where each node is connected to one sensor. With the additional sensors may help to enhance the network and monitoring the additional pollutants. Sensors help in collecting the information and forward it with the help of the microcontroller and the internet to the central server. Air quality measurement can process and presented in a real time to the end user in a friendly format to spread environmental awareness among the population and allow taking appropriate precaution when it is needed.

IV. CONCLUSION

Monitoring air pollution using Wireless sensor network has marked advantages over the traditional environment. Wireless sensor network has its own advantage such as low cost, easy to setup and provide a real time pollutant data. Monitoring stations collect and analyze the data and disseminate the data in public domain. As individual monitoring is not feasible the WSN help by relaying the data on to the central server where the data is processed to be displayed for the end users. With data about pollutants available to the user on the web at the comfort of their office of homes, it saves a lot of efforts. The end user is armed with information about the

pollution level and can take judicious decisions as per his need and requirements. Accurate reading of pollution level is important in order to provide a guidance for the people who suffer from the asthmatic problem with this information they may help to choose the alternate healthy route.

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