ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785
(ISRA), Journal Impact Factor: 2.114

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

ENERGY EFFICIENT ROUTING PROTOCOL FOR AIR QUALITY MONITORING SYSTEM USING ENHANCED LEACH IN WIRELESS SENSOR NETWORKS

Parminder Kaur*, Er. Rajbhupinder Kaur
*Student ,Computer Engg., Yadvindra College of Engineering, Punjabi University Patiala,Patiala
Asst. Prof ,Computer Engg., Yadvindra College of Engineering, Punjabi University Patiala,Patiala

ABSTRACT
Air pollution monitoring is though old but very useful concept in day to day life. Air pollution monitoring start from traditional way to the most sophisticated computer has been used to monitor the air quality, however the fresh air is necessary for all human being, for that various technology has been used and some of this technology is really useful in order to provide a real time air quality data. Aim of this paper is to highlight some technology which is used for air pollution monitoring and how effective of these technologies are and identify the important research in this important area.

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

INTRODUCTION
Wireless Sensor Network (WSN)
Wireless Sensor Network (WSN) has been rapidly developed during recent years. Starting from military to industrial controls and its advantages include the liability, simplicity, and low cost. The (WSNs) are a kind of self-configuring networks which consist of large numbers of low-cost, low-power, multi-functional wireless sensors nodes. These wireless sensor nodes, which are small in size, are capable of sensing and reacting to specific physical or environmental conditions, such as temperature, sound, pressure, speed, humidity, and so on. These sensor nodes have the wireless communication ability in short distances and pass their data through the network to their desired locations. In a WSN, the position of wireless sensor nodes need not to be pre-determined, this is because; a wireless sensor node may join in or leave the network very quickly and unpredictably. WSN provides a bridge between the real physical and virtual worlds. It has the ability to observe the places where it is difficult to fix the wired system and at terrestrial environments at a fine resolution over large scales. Its characteristics give the WSN a wide range of applications, such as industrial automation, agricultural monitoring, air pollution monitoring, health care, security systems, etc.

Air Quality Monitoring System
Air quality is important. Personal exposure to air pollutants is strongly related to the health and productivity of individuals. For example, long-term exposure to ozone (O_3), volatile organic compound (VOC), and particulate matter (PM) can cause chronic diseases, various cancers, and thus increased human mortality. Moreover, even some typically harmless and naturally existing gases, such as CO_2, can cause sick building syndrome and significantly reduce productivity if in high concentration. Thus, the demand for better air quality and tighter environmental regulation is increasing significantly worldwide. Sometimes, they can even cause social tension and unrest [2]. In response to a growing need for better air quality monitoring, mobile sensing applications are increasingly popular. The fast development of smart phones and sensor technology makes many such applications possible, e.g., mobile noise pollution sensing networks [4] and mobile personalized air quality sensor networks [5]. Compact, light, and energy-efficient sensors are now becoming available at prices that permit widespread use by non-scientists (and scientists). In the future, individuals will carry multiple unobtrusive sensors with them, within or networked with their smart phones, forming dense and interconnected sensor networks. Mobile sensing applications will soon become mainstream.

Mobile sensing systems have many advantages over conventional systems composed of a few accurate, low-drift, stationary, and expensive sensing stations. For example, in the personal air quality sensing applications, many pollutants have non uniform spatial distributions [66]. As a result, personal exposure is poorly estimated by using sparsely distributed stationary sensors. If each participant in a sensing system were to carry a sensor, we would be able to better understand human exposure and provide more relevant information to users.

The problem of air pollution is accelerated in magnitude with increasing urbanization. Thus polluted atmosphere has become as a part of urban life. Urbanization, industrialization and economic growth resulted in a profound deterioration of urban air quality (Wahid, 2006). As modernization and enhanced industrial activities led to the increased use of fossil fuels and their derivatives, particularly in developing countries leading to the emission of particulate as well as gaseous pollutants into the atmosphere. In urban areas the transportation sector causes the most pollution, producing CO, Pb and NO2. Industry, power plants and the burning of solid waste also add to the pollution load. Cities and urban areas therefore contain the bulk of people that are most vulnerable to the immediate effects of air pollution. This fact received international recognition when in 1992, the United Nations Conference on Environment and Development (UNCED) made specific recommendations in its Agenda 21 (UN, 1992) with regards to addressing air pollution in cities. One key recommendation was," the establishment of appropriate air quality management capabilities in large cities and the establishment of adequate environmental monitoring capabilities or surveillance of environmental quality and the health status of populations". Rapid economic growth through urbanization is causing serious air pollution related problems in many areas worldwide. The WHO has estimated that 1.4 billion urban residents in developing countries breathe air in which pollutant concentrations exceed WHO air quality guidelines (UNEP/WHO, 1992). Urban air pollution episodes are associated with sudden incidences of high concentrations of pollutants, which are generally governed by local meteorology, emissions and dispersion conditions (Mayer, 1999). The major source groups responsible for urban air pollution are primarily motor traffic and industries. Over a number of years, legislation and control have led to marked decrease in the air pollution impacts of industries in many countries. However, there has also been a substantial increase in urban air pollution.

However, before mobile air quality sensor networks can be used in real-world applications, there are still many challenges to overcome. Those challenges include, but not limited to, sensor drift, cross sensitivity, and sensor noise.

Sensor Drift: Drift is the gradual deviation of a sensor's readings from the ground truth value. It is affected by many factors that change the sensing surface and thus change the sensor function that translates the analog sensor inputs into pollutant concentrations. Wireless sensors are generally more susceptible to drift than stationary sensors due to trade-offs made for compactness and economy. Our deployment data has shown that even within a short period of time, such as several months, the drift can be significant enough to make the sensor useless. This problem is amplified because it is difficult to frequently calibrate mobile sensors, especially when they are carried by non-specialists. Thus, for sensor drift, the main challenge is, "how to model the drift and compensate for its error in real-world applications?"

Cross Sensitivity: Cross sensitivity refers to the sensor responding to gases in the air other than the targeting pollutant. The low-cost sensors typically have poor selectivity, i.e., their readings can be influenced by multiple pollutants, or even humidity. In real-world applications, the types of pollutant gases in the air are usually unknown and unpredictable, which cause additional uncertainties to the measurement.

Sensor Noise: The readings reported by the metal oxide sensors usually contain a significant amount of noises. They can be caused by random environment and electrical noises, cross sensitivity, and drift. The sensor error caused by random noises and cross sensitivity can be detected and compensated for using a Bayesian network based approach by exploiting the correlation between sensors. However, the abnormal readings caused by sensor drift can not be corrected by a basic Bayesian belief network directly. Thus, the main challenge is, "How to differentiate and remove the sensor noise caused by drift and re-calibrate the drifted sensor?"

LITEATURE SERVEY

S. Mansour et al. (2014) this paper proposes a simple Wireless Sensor Network (WSN)-based air quality monitoring system (WSNAQMS) for industrial and urban areas. The proposed framework comprises a set of gas sensors (ozone, CO, and NO2) that are deployed on stacks and infrastructure of a Zigbee WSN and a central server to support both short-term real-time incident management and a long-term strategic planning. This architecture would use open-hardware open-software gas sensing capable motes made by Libelium. These motes use the ZigBee communication protocol and provide a real-time low cost monitoring system through the use of low cost, low data rate, and low power wireless communication technology. The proposed monitoring system can be transferred to or shared by other applications. We also introduce a simple but efficient clustering protocol dubbed hereafter "Clustering Protocol for Air Sensor network" (CPAS) for the proposed WSN-AQMS framework. CPAS proves to be efficient in terms of network energy consumption, network lifetime, and the rate at which data is communicated.

R. A. Roseline et al. (2013) Pollution has been aggravated by developments that typically occur as countries become industrialized: growing cities, increasing traffic, rapid economic development and industrialization, and higher levels of energy consumption. The high influx of population to urban areas, increase in consumption patterns and unplanned urban and industrial development has led to the problem of air pollution. Air pollution has significant influence on the concentration of constituents in the atmosphere leading to effects like global warming and acid rains. To avoid such adverse imbalances in the nature, an air pollution monitoring system is utmost important. Wireless Sensor Networks is excellent technologies that can sense, measure, and gather information from the real world and, based on some local decision process transmit the sensed data to the user. These networks allow the physical environment to be measured at high resolutions, and greatly increase the quality and quantity of real-world data and information for applications like pollution monitoring. In this paper, a survey on pollution sensors and pollution monitoring systems using Wireless sensor Networks is presented.

S. A. Mishra et al. (2011) this paper presents Wireless sensor network system used to monitor and control the air quality in Nagpur city, India. Environmental air pollution monitoring system that measures, RSPM (Reparable Suspended Particulate Matter), NO2, and SO2 are proposed. The traditional air quality monitoring system, controlled by the Pollution Control Department, is extremely expensive. Analytical measuring equipment is costly, time and power consuming, and can seldom be used for air quality reporting in real time. Wireless Sensor Networks are a new and very challenging research field for embedded system design automation, as their design must enforce stringent constraints in terms of power and cost. Wireless Sensor Network is a fast evolving technology having a number of potential applications in various domains of daily-life, such as structural and environmental monitoring, medicine, military surveillance, condition based maintenance etc. A WSN is composed of a large number of sensor nodes that are usually deployed either inside a region of interest or very close to it. WSN nodes are low-power embedded devices consisting of processing and storage components (a processor connected to a RAM and/or flash memory) combined with wireless RF transceiver and some sensors/actuators. The proposed system makes use of an Air Quality Index (AQI) which is presently in use. Several sensor nodes, which measures pollutants information, were uniformly deployed in the networks to create sensing phenomena. The simulation results consist of the scenario generated and x and y co-ordinates of the nodes from the gateway by using Network Simulator (NS-2.33). For better power management we used low power strategies and hierarchical routing protocol in wireless air pollution system and caused the motes to sleep during idle time.

Kavi K. Khedo et al. (2010) proposed an innovative system named Wireless Sensor Network Air Pollution Monitoring System (WAPMS) to monitor air pollution in Mauritius through the use of wireless sensors deployed in huge numbers around the island. In order to improve the efficiency of WAPMS, they designed and implemented a data aggregation algorithm named Recursive Converging Quartiles (RCQ). The algorithm is used to merge data to eliminate duplicates, filter out invalid readings and summarize them into a simpler form which significantly reduce the amount of data to be transmitted to the sink and thus saving energy.

EXISTING ALGORITHMS

Recursive Converging Quartiles (RCQ) Algorithm

The strategy to deploy the WSN for our system is as follows:

- System first partition our region of interest into several smaller areas for better management of huge amount of data that will be collected from the system and for better coordination of the various components involved
- System deploy one cluster head in each area; these will form cluster with the nodes in their respective areas, collect data from them, perform aggregation and send these back to the sink.
- System, then, randomly deploy the sensor nodes in the different areas. These will sense the data, send them to the cluster head in their respective area through multihop routing.
- System use multiple sinks that will collect aggregated from the cluster heads and transmits them to the gateway. Each sink will be allocated a set of cluster heads.
- The gateway will collect results from the sinks and relay them to the database and eventually to our application.

Computerized Tomography Technique

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

ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785
(ISRA), Journal Impact Factor: 2.114

Online GPRS Sensors Array

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 an interfaced with the Google map to provide a real time pollutants level as well as the location in large metropolitan area.

CONCLUSION AND FUTURE SCOPE

In this paper, we have discussed various techniques of Air quality monitoring in WSNs. As various techniques have been proposed to monitor the quality of air in WSNs there are various limitations that exist in these technique which includes energy loss, monitoring of large networks etc. These problems are required to be resolved in future.

REFERENCES

1. Samer Mansour, Nidal Nasser, Lutful Karim, Asmaa Ali, "Wireless Sensor Network-based Air Quality Monitoring System",International Conference on Computing, Networking and Communications, Wireless Ad Hoc and Sensor Networks(IEEE), 2014, pp.545-550.
2. R.A.Roseline, Dr.M.Devapriya, Dr.P.Sumathi, "Pollution Monitoring using Sensors and Wireless Sensor Networks: A Survey", International Journal of Application or Innovation in Engineering & Management (IJAIEM), vol.2, issue7, July 2013, pp.119-124.
3. Jenn-Long Liu and Chinya V. Ravishankar, "LEACH-GA: Genetic Algorithm-Based Energy-Efficient Adaptive Clustering Protocol for Wireless Sensor Networks", International Journal of Machine Learning and Computing, Vol.1, No. 1, April 2011
4. Sonal A. Mishra ,Dhanashree S. Tijare and Dr. G. M. Asutkar, "Design of Energy Aware Air pollution Monitoring System using WSN ", International Journal of Advances in Engineering & Technology, Vol.1 ,Issue 2, May 2011,pp.107-116.
5. Kavi K. Khedo, Rajiv Perseedoss and Avinash Mungur, "A Wireless Sensor Network Air Pollution Monitoring System", International Journal of Wireless & Mobile Networks (IJWMN), vol. 2, May 2010,pp.31-45.
6. Robin North, Mark Richards, Jeremy Cohen, Neil Hoose, John Hassard and John Polak, "A mobile environmental sensing system to manage transportation and urban air quality", IEEE, 2008, pp.1994-1997.
7. Wendi B.Heinzelman, Anantha P.Chandrakasan and Hari Balakrishnan, "An Application-Specific Protocol Architecture for Wireless Micro sensor Networks", IEEE Transactions on Wireless Communications, vol. 1, Oct.2002, pp.660-670.