A Survey on Environmental Hazard Monitoring

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Abstract— Industrial pollution is one of the major causes of pollution worldwide. It is a serious problem for the entire planet, especially in rapidly industrializing nations. Industrial pollution is the contamination of the environment by businesses, especially plants and factories that dump waste products into the air and water. Industrial waste is one of the major contributors to global pollution problem endangering people and the environment. Introducing an industrial pollution detection system that collects information about various industrial pollutants, analyses the data, alerts public, authorities and industries to take necessary actions. This system also performs a periodical analysis on the data to find out the pollutant which is most harmful in that industrial area and informs government agencies through which the industrial activities can be controlled.

Key words: Industrial Pollution, Industrial Pollution Detection System

I. INTRODUCTION

Pollution is the introduction of substances (solid, liquid, or gas) or any form of energy (such as heat, sound, or radioactivity) to the environment with a faster rate than it can be diffused, diluted, decomposed, recycled, or stored in some non-toxic form. Pollutants are the key components of pollution, generally waste materials of different forms. Pollution adversely affects our ecosystem and the balance in the environment. Modernization and development in our lives have led pollution reach its peak giving rise to global warming and human illness. The main kinds of pollution are air pollution, water pollution, and land pollution. Modern society also is responsible for specific types of pollutants, such as noise pollution, light pollution, and plastic pollution. Pollution of all kinds have negative effects on the environment and wildlife and impacts human health and well-being. So, a survey was done among different proposals and this survey paper includes survey among different methods for industrial pollution detection.

II. MOTIVATION

Industrial monitoring systems have several advantages that motivated the introduction of new methods every year with more and more advancements. Some of the advantages are:

A. Reducing Environmental Pollution

Many of the industries such as chemical, metalworking and pharmaceutical generate a large amount of hazardous waste. Industrial monitoring help to prevent the disposal of untreated residues in the soil, air or water, preventing wildlife and human contamination. Efficient industrial monitoring strategy includes the use of biodegradable compounds and can reduce the contaminants in industrial waste waters.

B. Preventing Occupational Diseases

Industrial monitoring can reduce workplace health hazards. For example, silicosis is an occupational disease that affects miners, has been controlled by Industrial monitoring that reduces the amount of silica dust in the air. In the chemical industry, the use of appropriate garments and gear avoids direct contact with heavy metals such as lead and thereby prevents poisoning.

C. Improving Public Image

People expect companies to operate in an environmentally responsible way. Industrial monitoring helps companies showcase that responsibility, building public trust and credibility. This helps in improving relations with regulatory agencies, such as the Environmental Protection Agency. Transparent environmental monitoring also helps companies build relations with socially responsible investors.

D. Resource Management

Farmers, foresters and fisher men, staying in the industrial area can plan their work based on the environmental conditions because of the industries. The severity of the natural hazards can be lowered if people are informed about the hazards earlier. Also farmers can know about soil fertility so that they can use required fertilizers to improve yield.

III. LITERATURE SURVEY

M. Ibrahim et al. propose a cost-effective standardized environmental monitoring device using the Raspberry-Pi (R-Pi) single-board computer [1]. The system is designed using Python Programming language and can be controlled and accessed remotely through an Internet of Things platform. Information about the surrounding environment is taken through sensors and uploads directly to the internet, where it can be accessed anytime and anywhere through internet. Experimental results exhibited that the system is able to accurately measure: temperature, humidity, light level and concentrations of the carbon monoxide, harmful air pollutant. The system also detects earthquakes through an assembled seismic sensor.

Shifeng Fang et al. suggested a novel IIS that combines Internet of Things (IoT), Cloud Computing, Geoinformatics [remote sensing (RS), geographical information system (GIS), and global positioning system (GPS)], and e-Science for environmental monitoring and management [2]. Multi-sensors and web services were used to assemble data and other information for the perception layer; both public networks and private networks were used to access and transport mass data and other information in the network layer. The key technologies and tools include real-time operational database (RODB), extraction–transformation–loading (ETL), on-line analytical processing (OLAP) and relational OLAP (ROLAP), naming, addressing, and profile server (NAPS), application gateway (AG),

application software for different platforms and tasks (APPs),IoT application infrastructure (IoT-AI), GIS and e-Science platforms and representational state transfer/Java database connectivity (RESTful/JDBC). In the middleware layer of the IIS application Program Interfaces (APIs) were implemented. The application layer provides storing, organizing, processing, and sharing of data and other information, as well as the functions of applications in environmental monitoring and management.

Dunfan Ye et al. propose a system for WSN based on environmental monitoring [3]. The system can monitor environmental parameters such as underground water level, barometric pressure, ambient temperature, atmospheric humidity, wind direction, wind speed and rainfall and provide various convenient services for end users. They can manage the data via a website from long-distance or applications in console terminal. An IRIS mote hardware platform is adopted and designed a data acquisition board, which mainly gathers seven environmental parameters such as barometric pressure, ambient temperature, atmospheric humidity, wind direction, wind speed, underground water level and rainfall. The system has made several achievements in: (1) this system is a practical environmental monitoring application where sensor nodes periodically sense their ambience and the information they got, which can be transmitted through multi-hop approach eventually to the research center for upper software analysis. (2) Packets from the gateway can be transmitted to all the users via the Internet which makes remote environmental monitoring feasible.

S. R. Mohana et al. developed a system to monitor the body's present condition and hence provide ways to improve it, if there are any ailments [4]. Presently the heart rate of a person is measured using equipment like stethoscope and electrodes which require the person to be present physically. In current scenario, people or public is realizing too late to receive serious medical care when things are non-invertible. On the other hand, access too many medical equipment is difficult and expensive. In order to overcome these drawbacks a system that remotely monitors the heart rate is required and to play music depending on the heart rate to accolade work out regimes.

Kulkarni, P.H. et al. suggested a framework for an Internet of Things (IoT) device as an automated industrial meter reader that uploads the collected numeral data to a cloud storage for centralized data processing [5]. The implementation of the device is done using Raspberry Pi as the platform. The device comes with a four-step process-Image Acquisition using Raspberry Pi camera module, Optical Character Recognition using feature extraction technique, Internet Upload Mechanism using Google Forms and Online Data Processing using Google Spreadsheet. The presented device can capture the image of the meter, recognize its reading and upload the data to a cloud storage for online processing. After the user manually presses the switch once to capture the image, all the subsequent stages are automated. The total time required by the hardware for the entire process from image acquisition to the uploading of the reading is up to 35 seconds.

The vital signs monitoring is very useful to detect medical diseases. A. Leone et al. present an open, flexible, wireless and portable platform for monitoring vital signs in the healthcare scenarios, both indoor and outdoor [6]. The platform is designed to overcome the limitations of well-known technologies for mobile architectures, such as the battery lifetime and the lack of the open source codes. To lessen these problems, the platform integrates the fast, easy-to-use, safe and low-power Near Field Communication protocol for data transmission in proximity, addressing the Internet of Things paradigm. The platform uses the Arduino NANO board and the related open source software libraries to make it possible to add new functionalities in a fast way. The first prototype of the platform has been personalized for human body temperature measurement by using the digital TMP100 temperature sensor. However, a real "ecosystem" of portable devices could be prototyped with low effort for the acquisition/transmission of other kind of clinical signs such as heart-rate, breath-rate, ECG.

Sudhir G. Nikhade et al. developed a wireless sensor network system using open-source hardware platforms, Raspberry Pi and zigbee [7]. The system is low-cost, less power consuming and more scalable both in terms of the type of sensors and the number of sensor nodes, which makes it well suited for a large number of applications related to environmental monitoring. Raspberry Pi is cheap, flexible, fully customizable and programmable small computer embedded linux board and can be used as WSN node and sensor node. Raspberry Pi acts as a base station which connects the sensor nodes via zigbee protocol in the wireless sensor network and collects sensors data from different sensors, and supply multi-clients services including data display. The client can communicate with the base station remotely via (website) Ethernet or command console.

M. Suresh et al. discussed an IoT Based Airport Parking System to implement Arduino environment as IoT application. Computers could manage and inventory objects and people in daily life easily if they were equipped with identifiers. Besides using RFID, the tagging of things can be accomplished through such technologies as near field communication, barcodes, QR codes and digital watermarking. A new method of using embedded technology to provide such application in which Arduino is used as an embedded controller to interface Ethernet shield with a PC/Laptop to provide IoT over Ethernet [8]. A user can utilize this parking service in the airport scenario provided by airport authority with user ID and password. A user who needs to check the vehicle in the parking lot, uses the ID and password to logon into the airport web link and view the status of the car in the parking lot using IoT.

M. A. Razzaque et al. outline a set of requirements for IoT middleware, and present a comprehensive review of the existing middleware solutions against those requirements [9]. The Internet of Things (IoT) visualizes a future in which digital and physical things or objects (e.g., smartphones, TVs, cars) can be connected by means of suitable information and communication technologies, to implement a range of applications and services. The IoT's characteristics, including an ultra-large scale network of things, device and network level heterogeneity, and large numbers of events generated spontaneously by these things, will make development of the variety applications and services a very challenging task. Middleware can ease development process by incorporating heterogeneous computing and communications devices, and

supporting interoperability within the diverse applications and services. Many proposals than have been introduced for IoT middleware mostly addressed wireless sensor networks (WSNs), a key component of IoT, but do not consider RF identification (RFID), machine-to machine (M2M) communications, and supervisory control and data acquiring (SCADA), other three core elements in the IoT vision.

The traditional marine environment monitoring system using an oceanographic research vessel is expensive and time-consuming and has a low resolution both in time and space. Wireless Sensor Networks (WSNs) have recently been considered as potentially promising alternatives for monitoring marine environments since they have a number of advantages such as unmanned operation, easy deployment, real-time monitoring, and relatively low cost. GuobaoXu et al. provide comprehensive review of the state-of-the-art technologies in the field of marine environment monitoring using wireless sensor networks [10]. It first describes application areas, a common architecture of WSN-based oceanographic monitoring systems, a general architecture of an oceanographic sensor node, sensing parameters and sensors, and wireless communication technologies. Then, it presents a detailed review of some related projects, systems, techniques, approaches and algorithms. It also discusses challenges and opportunities in the research, development, and deployment of wireless sensor networks for marine environment monitoring.

IV. Conclusion

Industrial pollution is the undesirable outcome when factories or other industrial plants emits harmful by-products and wastes into the environment such as emissions to air or water bodies (water pollution), deposition on landfills etc. (land pollution) or emission of toxic chemicals into the atmosphere (air pollution). The wide variety of pollutants enter the environment and disturb the natural eco-system. In this paper recent works in the field of industrial monitoring are discussed. Many researchers had contributed and are still working in this field. There are a number of problems in existing systems, some of them have been solved but still have possibilities of improvement. In all-purpose, different industrial monitoring approaches can be used to get effective results in different scenarios.

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