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MONITORING OF INDOOR AIR QUALITY VIA IOT

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Abstract

Humans can be adversely affected by exposure to air pollutants in ambient air. Hence, health-based standards and objectives for a number of pollutants in the air are set by each country. The detection and measurement of atmospheric content is becoming more and more relevant. Careful calculation preparation is important. The location of monitoring stations is one of the main factors affecting the data collection members. It is difficult to plan and set up a monitoring station and a large investment is involved. To track the pollution levels of different pollutants in Coimbatore region, an IoT-based real-time air pollution monitoring system is proposed. The geographic region is known as traffic, residential and industrial areas. This article proposes an IoT system that could be deployed at any location and store the measured value in a cloud database, perform pollution analysis, and display the pollution level at any given location.

Keywords: *Air, Human, Indoor, IoT, Quality.*

I. INTRODUCTION

Air pollution under the roof is a growing problem nowadays. As individuals spend 90% of their time indoors (schools, offices, institutions, commercial facilities), IAQ is the most influential factor for people's health, comfort and safety. The health concerns known as Sick Building Syndrome (SBS) and Construction Related Illness are caused by indoor air pollution (BRI). SBS symptoms do not match the pattern of any specific disease. It is very difficult to locate any particular source, and upon exiting the building, relief from these symptoms occurs. However, after leaving the house, symptoms associated with Building Induced Illness (BRI) are not alleviated. BRI is caused by microbial infection or specific exposure to contaminants that may cause allergies. Indoor air quality relies on a range of variables, including the concentration of different gaseous and particulate contaminants[1].

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Inadequate ventilation can increase indoor pollutant levels by not bringing in enough outdoor air to dilute emissions from indoor sources. Concentrations of certain contaminants can also be increased by high temperature and humidity levels. The key methods of maintaining good IAQ in most of the buildings are by using ventilation to dilute pollutants, indoor pollutant source control and air filtration. Cooking operations, cigarette smoke or some form of incomplete combustion are sources of carbon monoxide (CO) inside a home. It is an air pollutant that is colorless, odorless, tasteless, and therefore difficult to detect without sensory equipment. It decreases the blood's oxygen carrying capacity. This happens because CO binds to hemoglobin more readily than oxygen and contributes to the formation of carboxyhemoglobin (COHb), which leaves less hemoglobin available for oxygen transport across the body. The EPA (US Environmental Protection Agency) has set a primary 8-hour CO standard of 9 parts per million (ppm). Carbon dioxide (CO2) is a gas which is both colorless and odorless. At 330-400 ppm, it is a natural part of the atmosphere[2].

The concentration of indoor air offers a clear indicator of an air-conditioned building's air circulation rate. CO2-related SBS signs include headache, nausea, nose and respiratory tract inflammation, and eye burning. A complex mixture of extremely small particles of a variety of elements, including organic chemicals, smoke, soot, dust, salt, acid droplets, metals, and soil, is often called aerosol particulate matter[3]. Inhalable coarse particles, such as those found along roadways and dusty factories, are larger than 2.5 micrometers and smaller or equal to 10 micrometers in diameter. There are two types of particles. The fine particles are 2.5 micrometers in diameter and smaller, such as those present in smoke and haze. Particle sizes are directly related to their ability to cause health problems. Particles 10 micrometers in diameter or smaller will move through and penetrate the lungs through the throat and nose. These particles can damage the heart and lungs once inhaled and cause significant adverse health effects. PM10 may increase the number and severity of asthma attacks, cause or exacerbate bronchitis and other pulmonary diseases, and decrease the ability of the body to combat infections, especially among "sensitive populations" including infants, the elderly and those with asthma or bronchitis.

An accurate data measurement of indoor air quality is the most important factor for the platform. Smart-Air was thus developed to gather accurate and reliable data for monitoring the quality of indoor air. The device was designed to be easily adapted to an environment by using an expandable interface since the monitoring region is not constant. Thus, depending on the climate, different types of sensors may be mounted or modified. A Long-Term Evolution (LTE) modem is also installed on the system to directly transmit the detected data to the web server for air quality classification and visualization. For most IoT platforms, gateway or data loggers are installed to gather and transmit data wirelessly to the web server. However, in this study, a microcontroller was installed in the device to gather the data from the sensors and transmit it to the web server using the LTE modem, eliminating the need for a gateway and a data logger.

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The most important purpose of Smart-Air is to precisely detect air quality in the perception layer of the platform that is a primitive concept design of the device. This system has an expandable interface so that, according to monitoring specifications, multiple sensors can be mounted simultaneously or easily added. The Smart-Air system in the present study consists of a laser dust sensor, a sensor for volatile organic compounds (VOC), a sensor for carbon monoxide (CO), a sensor for carbon dioxide (CO2) and a temperature humidity sensor. In addition, in the center of the unit, an LED strip was mounted to visualize air quality using colors. As the air quality improves, the device's LED changes color and sends a warning message to the web server wirelessly via LTE. Thus, the LTE modem transmits and receives data by communicating with the web server for detailed monitoring and determination of air quality as the presentation layer of the platform[4].
Due to the growth of society and rising unclean emissions from factories and vehicles, air conditions continue to deteriorate every year. Although air is an important life resource, many individuals are indifferent to the severity of air pollution or have only recently recognized the problem. Air pollution is the most harmful and serious among different forms of pollutants, such as water, soil, heat, and noise, causing climate change and life-threatening diseases. 90 percent of the population now breathes toxic air, according to the World Health Organization (WHO), and air pollution is the cause of death for 7 million people every year. The health consequences of pollution, which causes stroke, lung cancer, and heart disease, are very severe[5]. In addition, air emissions have a detrimental effect on humans and the environment of the planet, as found in recent global air pollution problems such as ozone depletion. Thus, monitoring and control of air quality are primary issues of concern. There is 100 times more polluted indoor air than outdoor air. Many urban people spend 80 to 90 percent of their time indoors, so indoor air has a greater direct effect than outdoor air on human health. In addition, indoor contaminants are around 1000 times more likely to be transferred to the lungs, in comparison to atmospheric emissions, causing diseases such as sick construction syndrome, numerous chemical sensitivities, and dizziness. Control of indoor air quality is very crucial, as prudent precautionary measures may prevent exposure. In order to better control air quality, efficient and reliable monitoring of indoor air is therefore necessary.
Traffic congestion is severe in India’s cities and towns. Traffic congestion is caused for several reasons, some of which are: increase in number of vehicles per kilometer of available road, a lack of intra-city divided-lane highways and intra-city expressways networks, lack of inter-city expressways, traffic accidents and chaos from poor enforcement of traffic laws. The average traffic speed is affected by traffic congestion. Scientific studies show at low speeds that vehicles consume fuel inefficiently and pollute more per ride. For example, a study in the United States showed that for the same ride, if the traffic was congested, cars used more fuel and polluted more than if the traffic flowed freely. In terms of nitrogen dioxide emissions, a recent study has revealed that Coimbatore city leads other cities in Tamil Nadu. Nitrogen dioxide is a severe air pollutant because it leads to the development of photochemical smog,

which can have a significant health effect and, due to lack of visibility, can lead to traffic accidents[6]. The primary cause of NO2 is fossil fuel combustion. In the Thadagam area alone, there are over 200 brick kilns. Coimbatore has a large number of mills manufacturing textiles. Sulphate dioxide and sulphates typically emanate from poly-condensation in textile production, spinning the fibers and fur produced during the process of weaving and spinning. In the SIDCO Industrial Estate in Kurichi, Shulphur dioxide, Oxides of Nitrogen and Carbon monoxide are generated by the furnaces in foundries, heat treatment units, forging units. Pollution is also caused by the usage of fuel for boilers and vehicle transport in the cluster as well as in the surrounding area as specified in Final Action Plan Report 2010[3].

II. CONCLUSION & DISCUSSION

To monitor the content of air and to monitor the air pollution this sensor network system has a large number of advantages as compared to primitive or traditional monitoring systems. In primitive or the traditional monitoring systems the whole model design was very bulky and it was most of the times impossible to load the from one place to another and to examine the contents of the different harmful gases present in the atmosphere and hence due to this large size it was not possible to interface more devices and sensors with the system. But in today's modern monitoring systems it is easily possible to interface more sensors and devices with the proposed system as the size of the systems are small and they can be easily loaded from one place to another and the contents can be measured with them very easily.

III. REFERENCES

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