A SURVEY ON MOBILE AIR POLLUTION MONITORING SYSTEM USING IOT

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ABSTRACT

Internet of things (IOT) is a worldwide system of "Smart Devices" which senses and connects with their surrounding and interacts with users. And other systems. Air pollution is one of the major concerns of our era all over the globe. The level of pollution is increasing day by day, and this is due to increase in amount of gases like carbon dioxide, smoke, alcohol, benzene, NH3 and NO2, some of the main causes for air pollution are increasing population , increased vehicle use, industrialization and urbanization these all factor ends up affecting wellbeing and health of population causing various harmful diseases.

In order to analyses we are developing an IOT Based mobile pollution Monitoring System which we can take with us to different locations as it is able to move easily and will monitor the Air Quality over an internet server. Existing monitoring systems have inferior precision, low sensitivity, and need laboratory analysis. Therefore, improved monitoring systems are needed. To overcome the issues of existing systems, we have used machine learning and analyzing. It will show the accurate reading of air quality in PPM on the LCD and also as on webpage in order that we will monitor it very easily. In this IOT project, you can monitor the pollution level from anywhere using your computer or mobile device. The system uses MQ2, MQ135 and MQ7,MQ9 sensor for monitoring Air Quality. It measures their amount exactly and finds out harmful gases.

Keywords: *IOT, sensors, Population, Mobile, Smart Device, Pollution, Air Quality, Monitoring, Arduino*

INTRODUCTION

The IOT (Internet of Things) one of the most dynamic and exciting developments in information and communications technology is the advent of the Internet of Things, it is a collection of embedded devices which are interconnected together with some network and they collect, share and process the aggregated information to execute some jobs over it. The most common devices in IoT are sensors which sense the data and give the data to some processing device to process the data or to save it to the cloud. In today's world everything needs to be smart and movable or mobile. Smart houses, smart infrastructures, smart transportation and smart devices are realizable due to advancement of IoT. The concept of IOT was put forward as early as 1999 by Professor Ashton at the American Auto-ID center of MIT. In 2005, ITU gave it the corresponding definition. IOT has become the hot-spot question for scientific research technology personal, because people realized that it has immeasurable potential, such as intelligent power network, intelligent traffic, intelligent logistics, intelligent building, GPS navigation, industrial monitoring, modern agriculture, public security, environmental management,

remote medical treatment and digital urban management, digital home, digital battlefield and so on. People expect IOT to bring a lot of convenience in the vision. The expansion application of IOT and controllability of information has become a pair of contradiction.

Air is one of the essential elements of man's surroundings. The earth's atmosphere is full of air which contains gases such as Nitrogen, Oxygen, Carbon Monoxide and traces of some rare elements. Humans need an atmosphere of air that is free from contaminants. This is very crucial for human life and health. Any change in the natural composition of air may cause grave harm to life forms on earth. Air pollution is the presence of one or more contaminants in the atmosphere such as gases in a quantity that can harm humans, animals and plant. Air pollutants are measured in Parts per Million (ppm) or ug/m3. Primary pollutants are released directly into the atmosphere. Secondary pollutants are produced .

when the primary pollutant reacts with other atmospheric chemicals. Air quality affects public health. The effect of air pollution ranges from difficulty in breathing, coughing, aggravation of asthma and emphysema. Polluted air can also impair visibility. Air pollution is accountable for the death of 7 million persons worldwide each year or one in eight premature deaths yearly. Almost 570,000 children under the age of five die every year from respiratory infection linked to indoor/outdoor pollution and second-hand smoke. Children exposed to air pollution have an elevated risk of developing chronic respiratory problems such as asthma. In the monitoring of air pollution, several researchers worldwide have developed models to monitor many of the pollution gases such as Sulphur Dioxide (SO2), Carbon Monoxide (CO), Carbon Dioxide (CO2), Nitrogen Oxides (NO) etc. This paper focuses on the design and implementation of a smart air pollutant monitoring system. It discusses how the level of pollutants in the air can be monitored using a gas sensor, Arduino microcontroller and a Wi-Fi module. The main objective of this project is to design a smart mobile air pollution monitoring system that can monitor, analyze, log data about air quality to a remote server, keep the data up to date over the internet and notify the user when to air quality in the surrounding is not suitable for good health.

EASE OF USE

1. IOT Based Air Pollution Monitoring System monitors the Air Quality over a webserver using internet and will trigger an alarm when the air quality goes down beyond a certain level
2. means when there are amount of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3, NOx and LPG.
3.The system will show the air quality in PPM on the LCD and as well as on webpage so that it can be monitored very easily. Temperature and Humidity is detected and monitored in the system.
4. LPG gas is detected using MQ9 sensor and MQ135 sensor is used for monitoring Air Quality as it detects most harmful gases and can measure their amount accurately.

RELATED WORK

The systems is a need in current age of development as the countries try to grow though industry the increase of using vehicles and other industries increases. Even though a person sees this as normal issue the chain of reactions that come through is quite devastating. The smog and the greenhouse effect are leading problems of this. Also the long term effect to the health of people living in these areas have to be considered. According to WHO" More than 80% of people living in urban areas that monitor air pollution is exposed to air quality levels that exceed WHO limits". The levels of small and fine particulate matter (PM) have increased dramatically over the decade this could have been controlled if a proper monitoring system was established with high analytical capabilities. There are many variables that affect to the air pollution and these pollutants can come in all three forms of matter solid, liquid and gas. These pollutants can be categorized into three major sections by considering the way of the formation of these substances.

- *Primary pollutants.* Usually produced from a process such as vehicle gas exhaustion, volcanic eruption etc. These include the gases and substances such as Carbon Dioxide, Sulfur Oxides, Nitrogen Oxides, Carbon Monoxide, Volatile Organic Compounds (VOC), Particulates, Persistent free radicals, Toxic Metals, Chlorofluorocarbons, Ammonia, Odors, Radio Active Pollutants, etc.

- *Secondary Pollutants.* Created by interactions of the primary pollutants such as Smog, Ground level Ozone, Peroxyacetyl nitrate etc.

- *Minor Air Pollutants.* These include minor hazardous air pollutants and persistent organic pollutants etc.

According to the Gradient newspaper the risks in the cities around the globe increases dramatically and new kinds of pollutants are found in many cities so to cater these problems an IOT module which supports attaching modules to the device and an analyzing system based on machine learning is introduced.

The System Generally comprised with four Main parts,

- The microcontroller with module connection slots
- The wireless communication device through Wi-Fi module
- The data classifying and storing server
- The machine learning and graphing software

This module comprises with Arduino board which has the capability to cater attaching several modules into the board hear the relevant sensors can be attached and the necessary codes are given in a header so that when communicating with the Wi-Fi module no hassle have to be done. The Arduino has the help for many modules available in the market but the problem is that the Arduino board does not have any powering module in this research we have used another separate powering module to the device in order to supply the power according to the necessary requirements of the modules.

The low cost ESP8266 Wi-Fi module was used in this system as the communication module. This Module was able to connect to the Wi-Fi access points in city and send data to the centralized server. In the Arduino code there is a header to send all the data according to the users wish so the code was wrapped and could be easily used with any given number of modules.

The Server was written in Python where the data was sent to the Python Server Socket the socket then created a thread and stored the sent data. This server is also can be customized by the code and new parameters could be added into the database and the database also could be expanded. The data was sent by the individual Wi-Fi modules get sorted by the server and stored in the database for the further use.

The machine learning software does the prediction of the air pollution levels using the supervised learning. This was done using python and tensor flow machine learning.

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package to create the graph of the prediction of a given location. The linear regression was used mostly in stock price prediction, and therefore, it was also used in this project to plot the graph and predict the air pollution factors. Further, it was used to give an output based on WHO limits on air pollution. The liner regression is a statistic based machine learning algorithm and the air pollution concentration change was assumed to be linear when they change. It was the best fit line of the plotted graph and the line could be used to predict the values.

FIGURES AND TABLES

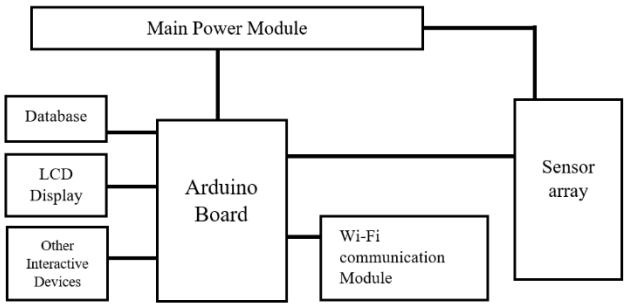

Fig.1. IOT System Block Diagram

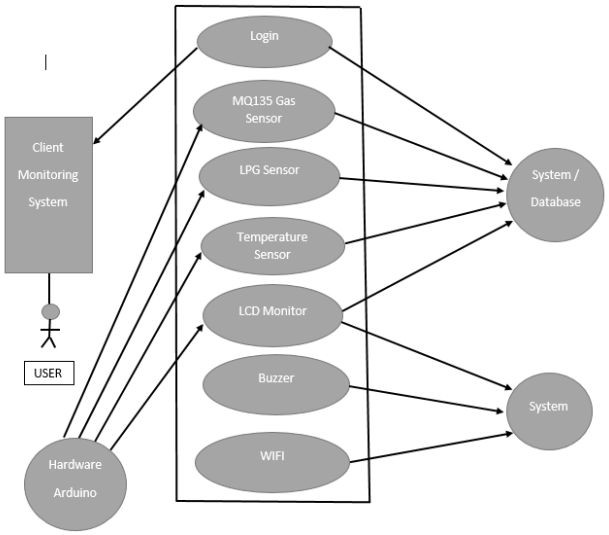

Fig.2. Use-Case Diagram

EQUATIONS

Mathematical Analysis of Proposed Model

The level concentration of pollutants in the air is measured in parts per million (ppm) or percentage. Conversion factors include the following:

1 ppm = 1.145 mg/m3

1 mg/m3 = 0.873 ppm

1% = 1/100

1 ppm = 1/1000000

1 ppm = 0.0001%

Table 1 shows PPM to percentage conversion.

Parts per million (ppm)	**Percent (%)**
0	0
5	0.0005
50	0.005
500	0.05
1000	0.1

Table.1. PPM to Percentage Conversion.

Applications:

- Used to monitor air quality changes in the atmosphere in the surrounding where the module is installed.

- This module can give an alert through the buzzer to the user to that user gets to know that the air quality in the surrounding is not suitable for good health.
- The data gathered through the module can be saved in the database for further processing and generating reports according to the air quality changes occurred in the particular time period.
- The gathered information can be used to study the atmospheric changes and take actions regarding the air quality changes occurring in the surrounding
- Controlling air pollution is the second thing to do but the first thing is to monitor the changes in the quality of the air and this module is designed to monitor the changes in the air quality and provide accurate readings to the user.

The data gathered and stored can be used to generate useful measures for future use and for developing more advanced air pollution monitoring and controlling devices.

CONCLUSION

The system is a complete low cost solution to monitor the environment pollution as the sensor devices are low cost to buy and easy to setup in a given environment. The server is very flexible and many parameters could be easily added or removed according to the users need. The state of art machine algorithm is used to predict the air pollution and this helps an organization or government to do better planning of cities or places.
The air of the environment is a monitor with the help of the system by using Arduino microcontroller, IoT.

Technology has introduced a system which improves the quality of air. Internet of Things is the technology which amplifies the monitoring process and various side of the environment such as air quality monitoring issue introduced in this paper. Here, we use two types of sensor which are MQ135 gas sensor gives the senses of different type of dangerous/harmful gases and another sensor can be used MQ2/MQ7./MQ9 Arduino is the main component of this project and the entire process is controlled by Arduino UNO. Wi-Fi module is the hardware which connects the whole process to the internet and LCD is used for the visual Output. It is good to attempt because when we use this system everywhere because life is very important than luxurious life like we use costly cars and harmful electronic gadgets. We have to do something by which data is always available to users and then people feel how much air is polluted. Then they avoid such polluted things which are very necessary now a days. This module also processes the data obtained from the sensor and shows the accurate readings and the buzzer warns the user when the air quality in the surrounding is not suitable.

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