An IoT Based Approach to Minimize Air Pollution

Sandeep Gupta, Kailash Kumar, Aditya Tandon, Phong Thanh Nguyen, Lalbihari Barik

Abstract— In this paper we have used a new Digitalized approach to measure and control the pollution in the under developing country. We have use temperature sensor to sense temperature, Humidity sensor to sense humidity, Smoke sensor to collect data from the different gases (e.g. Carbon Di Oxide O2, Methane, Sulfur Dioxide etc.) and many more other sensors is used to collect data from dust and from atmosphere. Sensors are controlled by Microcontroller (MCU). Collected data is sent to the central server through access point. Data is stored being displayed on LCD/LED. Analysis of collected data is done to analyze the rise in the pollution, temperature and various parameters that causes the pollution. If it seems to be above danger level then alert signal is sent in the entire city and display the precaution that need to be furnished by the citizen. This will help to predict the weather and increase in pollution. Once the major cause of pollution is known then proper action can be taken to control the pollution. Every citizen will know about the pollution in their respective city so that they will be aware to it. This system will help to know about traffic on the different route in the city. If some the accident happens on the road, then this information will be distributed in the entire city and about the traffic on that route. It will help to find out the vehicles which releases more carbon dioxide (e.g. old Car, Bike, Bus etc.) after this type vehicle will be removed by the government authority which may leads to reduce in the pollution.

Index terms— Pollution,Pollutants, Sensor, Dust, Atmosphere, Internet of things, Tempareture, C ontroller, Access point, Server.

I.INTRODUCTION

Internet of Things (IoT) is a system that connect physical objects like sensors node which collects real time data and are accessible through the internet. The things can be person with heart monitor or an automobile with built-in-sensor. Objects are assigned an IP address and ability to collect data and transfer it to the server through a network. The Embedded technology in the objects helps them to it interact with external environment which helps them to take decisions. [1]

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Dr Sandeep Gupta, Assistant Professor, Department of Electrical Engineering, JECRC University, Jaipur

Dr Kailash Kumar, Assistant Professor, College of Computing and Informatics, Saudi Electronic University, Riyadh, Kingdom of Saudi Arabia

Aditya Tandon, Research Scholar, Amity University, Noida, UP

Dr Phong Thanh Nguyen, Director,Department of Project Management,Ho Chi Minh City Open University, Vietnam

Lalbihari Barik Asst. Prof., Department of Information Systems, Faculty of Computing and Information Technology in Rabigh, King Abdulaziz University, Kingdom of Saudi Arabia

II.EFFECT OF POLLUTION IN THE INTRODUCTION

Health effects of air pollution in developing nations has become an emerging issues worldwide. Various studies and research have been shown that how air pollution has an empact on health in develpoed countries like North America and Europe for many decades. But it has been found that research on effect on health in developing countries is less adavnced. A question is whether the model and method that has been found by conducting various research on air pollution in developed countries can be applied to developing countries to reduce air pollution. Through the various studies by considering this issue it has been examined that the factors that may leads to increased in human sensitivity or tolorance of air pollutants. There are also various factors in developing countries that may increase or decrease human sensitivity to air pollutants. Similar kind of response can be expected by indivduals in under developing countries that is same as those in developed countries in case of human sensitivity towards air pollution.[2,7,8]

The Current Exisiting Challenges At present, pollution is one of the sensitive problem for the whole world. Developing country has implemented some of the method to overcome or to reduce the pollution. But it's been a big problem for the under developing countries Due to lack of awareness, policies, technology and methodology to reduce the pollution causes the increase in the pollution in under developing countries. The rate of increasing in pollution is very high during nearly years. To overcome the effect of pollution and to reduce the pollution the efficient method and technology should be adopt in the context of under developing countries. [3]

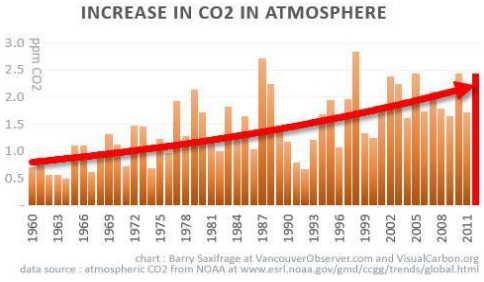

Figure 1. Increase in CO2 in Atmosphere.

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III.PROPOSED REMEDIAL MEASURES

Broadly there are 4 types of pollution.

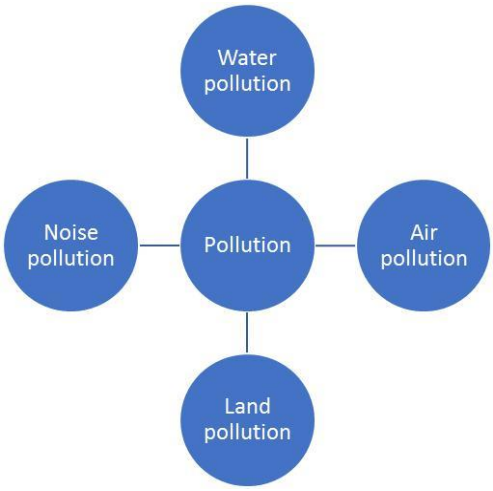

Figure 2. Types of Pollution

Water Pollution: - Pollutants are directly or indirectly being discharged in to the water bodies without using any appropriate method of removal the harmful compounds from the water which causes the contamination of the water bodies like River, Ocean, Lake, Groundwater etc. The various types of Water pollutions as water comes from different sources. [3]

- Surface water pollution
- Oxygen Depleting
- Microbiological
- Suspended Matter
- Chemical water pollution
- Oil Spillage

Air Pollution: - The effect of biological, physical or chemical alternation to the air in the atmosphere by introducing the harmful substances like gases, dust, smoke, Biological molecules etc. which causes the diseases, allergies or death of humans can be termed as Air pollution.[3]

Land Pollution: - The destruction of earth's land surface by introducing the deposition of solid or liquid waste materials on land. [3]

Noise Pollutions: - Enforcement of green laws, awareness in communities to take care of surroundings, introduction of technology that emits noise minimum.[3]

Measurement of various Pollutants: - Table shows the measuring of the pollutants by various method.

Pollutant	Sampling	Analysis
Sulphur dioxide	Passive diffusion tube 42 days (6 week) exposure Period	Colorimetric method, by external laboratory
Nitrogen dioxide	Passive diffusion tube 28 days (4 week) exposure Period	Colorimetric method, by external laboratory
Forlmalde hyde	GMD diffusion badge up To 3 day exposure period.	Liquid chromatography, by external laboratory.
Volatile organic compound s	Perkin Elmer diffusion tube 28 days (4 week) exposure.	Gas chromatography-mass spectrometry, by V&A Science laboratory

Table 1: - Depicting the Pollutant w.r.t. sampling and corresponding analysis. [5,6]

IV. TECHNOLOGY USED SO FAR

To clean-up the pollution present in the atmoshare varieties of methods, simple techniques and advanced engineering technologies are used. Different types of cantaminats like industrial chemicals , agricultral chemicals, metals and radionuclides are clean-up by using different simple and advanced techniques. Clean-up techniques is adopted with respect to the types of contaminants and to its site. Air pollution is generally clean-up at the time of its release because once they are release to the atomsphere it becomes dificult to capture and recover the cantaminats. [4]

Physical Removal: - The physical removal is a common techniquies and continued to be a removal techniqies to remove cantaminants from land and water pollution. In physical removal techniquies contaminants are not being eliminated but rather it is tranfer to specially designed container to contain the contamination for a long period of time.[4]

Conversion: - Conversion is the process of removal of pullutants by chemical reaction to change the contaminants into less toxic. Reactive chemical are introduced to the contaminated area which leads to the chemical reaction. Bioremediation is the biological system to clean-up the contamination.[4]

Contaminants: - When the technologies are not available or practically not possible to remove the contaminants then contaminants are taken as a final solution and wait until the availablity of the appropriate technologies.[4]

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V. PROPOSED METHODOLOGY

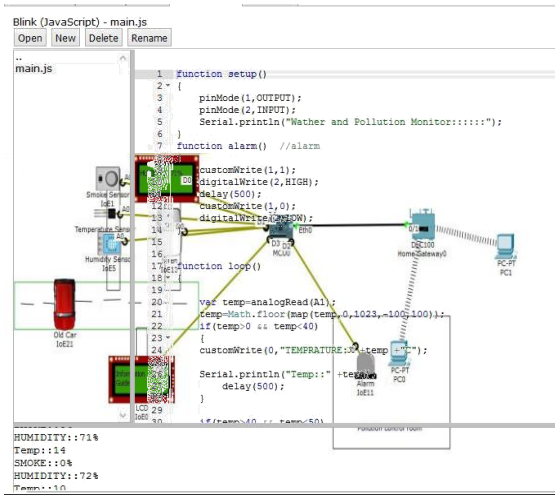

Figure 3: - Simulated Diagram of Working Model

As shown in figure 3 different sensors namely Temperature sensor, Humidity sensor, Smoke sensor is used to collect the data from the atmosphere. These sensors are controlled by microcontroller unit (MCU). The collected sensor data is sent to the server by access point (Gateway). Data is stored in central server and display the data on the LCD/LED screen present in the different location in the city. Analysis of data is done by experts or artificial intelligence. If the measurement goes above danger level then it invokes the alert function that ring the alarm and start red alert in the entire city. By analysis of the collected data, the increase or decrease in the pollution can be measured. The alert alarm makes citizen to be alert and precaution to avoid any effect is displayed on the information guide LCD/LED screen.

VI. WORKING PRINCIPAL

In this section, it has to be noted that more different sensors can be implemented for measurement of different types of pollutions like Dust sensor module, Digital sound level meter, pH meter & TDS meter, IR sensor etc. The main aim is to monitor the pollution and after analysis of the data, what can be done to control the pollution. A centralized control office (pollution control office figure 3) is monitoring the data coming from different sensors. A LCD/LED is placed on the street to display the temperature, smoke percentage, humidity present in the environment for public information. All devices are controlled by the central office. When temperature level, smoke level, humidity level goes above the danger level then street alarm as well as office alarm starts. When alarm starts then the proper precaution is displayed on the information guide LCD/LED (Fig. 4) to follow. All data will be saved central server. All devices can be access remotely.

Figure 4: - Data flow diagram of the working module

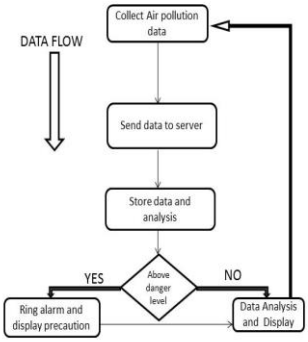

Figure 5: - Real time realization of data on packet tracer

VII. ALGORITHMS

a. Algorithm for Measuring Air pollution and pollution data analysis

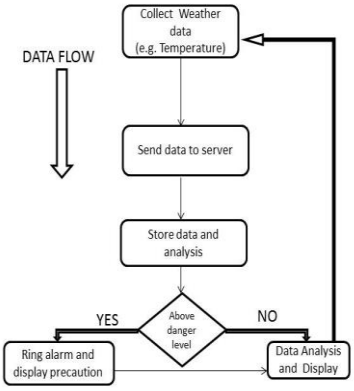

Figure 6:- Data Flow diagram to measure Air Pollution

Step-1: Measure the Dust, Gases, Biological molecules in the atmosphere using sensor e.g. Smoke sensor, humidity sensor etc.

Step-2: Send the collected data to the central server using access point and display on the LED/LCD.

Step-3: Store data in the central server and analysis of data by the experts (or by artificial Intelligence).

Step-4: If the air pollution is above danger level.

i. Ring the alarm and alert throughout the city and Display precautions to be taken by the citizen.

ii. Distribution of mask from automated mask centre for free in different location.

iii. Proper Action to be taken by the government authority to control and minimize air pollution.

Step-5: Else

i. Display the measured data on the LCD/LED.

ii. Data analysis

iii. Continue from Step-1

b. Algorithm for Measuring Temperature and data analysis: -

Step-1: Measure the temperature by using temperature sensors

Step-2: Send the collected data to the central server using access point and display on the LED/LCD.

Step-3: Store data in the central server and analysis of data by the experts (or by artificial Intelligence).

Step-3: If the air pollution is above danger level.

i. Ring the alarm and alert the entire city and Display precautions to be taken by the citizen.

ii. Loaction of A/c waiting rooms with chilled water for free is displayed.

iii. Proper action to be taken by the government authority to reduce effect of temperature to the human.

Step-4: Else

i. Display the measured data on the LCD/LED.

ii. Data analysis

iii. Cntinue from step-1

VIII. PROPOSED MODEL (VIRTUAL VIEW)

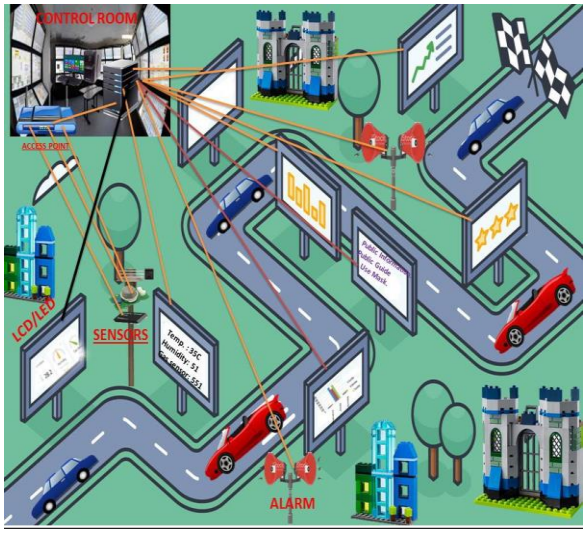

Figure 7: - Virtual View of the proposed model

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