IoT based Environment Pollution Monitoring System

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Abstract— In today's world where population and industrialization has expanded exponentially, pollution is a major crisis faced by the mankind and necessary measures should be taken to control it fast. Currently our population neglects this fact and there is less awareness regarding the pollution threshold values set by the government. To tackle this problem the system explored is an IOT kit, with effective utilization of various sensors, recording the values of different types of pollutants in the environment and display the statistics on a website which can be accessed by all users for free. The system we are proposing is an advanced solution for monitoring the environmental pollution at particular place and makes the information accessible to every individual.

Keywords—Wireless sensor network, Arduino, MQ135 Gas sensor, CZE-15E sound sensor, ph sensor, pollution, real time monitoring.

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I.   INTRODUCTION

Basically, pollution affects humans and our environment directly or indirectly. Previously, the environmental pollution was not a critical problem but due to urbanization and industrialization the pollution in the environment has hiked suddenly and it should be controlled as soon as possible.

To tackle this problem, environmental pollution monitoring system is an exemplary approach by which we can observe and study the condition of environment. The sensor in the system tracks the effects and level of the pollution. The measured parameters are sent to server and displayed on the website for public in an organized way for proper understanding. Initially, most systems consisted of only one sensor capable of monitoring only one parameters and such systems were only confined to monitor either air, water or sound pollutants. Also, due to limited number of fixed monitoring sites and restrictions like size, cost and data resolution made them complex to assess the effectiveness of pollution abatement strategy.

Our main aim is to implement an environmental pollution monitoring system which enables to monitor the parameters of pollution in air, water and noise and record this data to server. It will provide data in organized way to public and help spread awareness in this fight with pollutions. Reduction in pollution is very essential for a better future.

II.   LITERATURE REVIEW

NihalKularatna and B.H.Sudantha [1] presented environmental air pollution monitoring system in 2008 consisting of multiple sensors and a microcontroller to control them. Also graphical interface was provided on their personal computer to show graphical data.

Octavian A.Postolache, J.M.Dias and P.M.B Silva Girao [2] presented Smart sensor network for air quality monitoring. It was designed to monitor both indoor and outdoor environment. Sensors were remotely controlled by a central unit and were installed in different rooms. Sensors also measured the concentration of temperature and humidity in the surrounding for accuracy. Communication between sensors, central unit and server were done using Wi-Fi.

Y.J.Jung and Y.K.Lee [3] implemented air pollution monitoring system using Geo-sensor network in 2008. In this paper model and concept of flexible sampling interval change was introduced to increases the battery lifetime. It monitored level of pollutions in areas and displayed the data accordingly.

III.   PROPOSED SYSTEM

The main aim is to make a kit which will be installed in the required location for monitoring. The kit will basically include Arduino, on which all the sensors will configured and Wi-Fi module for data transfer. Collect the respective pollution readings after certain time interval. All the readings recorded by the kit will be transferred to the main station (server) by Wi-Fi module.

Readings from all the kits will be recorded and saved into the database at the server end. Visualization of collected data from the different location is done using statistical and user-friendly methods such as tables and line graphs. A website will to spread the pollution data collected by all the sensors, different colors will be allotted for different ranges of pollution meaningfully to give an idea about the level of pollution.

Generation of reports are done per week on a regular interval and also real-time notifications are sent by

appropriate authorities when the pollution level exceeds the normal range threshold value.

A. *Hardware Specification*

In hardware specification, the components for the proposed system are sensors, Arduino, Wi-Fi module. Three types of sensors are used for monitoring the different types of pollution. The Wi-Fi module is used to send the data collected by the different sensors to the main server.

Due to low cost, easy interface, compactness and ability to connect to various devices, Arduino UNO was selected as a main controller. The board features 14 Digital pins and 6 Analog pins. It operates at 5V with input voltage ranging from 8-20V.Arduino has Static Random Access Memory of size 2KB along with flash memory of size 32 KB which makes it quite swift and efficient. ATmega328 is an MCU belonging from the AVR family; Arduino is a it 8-bit device hence its internal registers and data-bus architecture can handle 8 data signals parallel simultaneously.

The Wi-Fi Module is a system on chip in which TCP/IP protocol stack is integrated such that can give any microcontroller access to any available Wi-Fi network. The Wi-Fi Module is used for hosting an application or it can offload all functions of Wi-Fi networking from any other application processor. AT commands are used to program the Wi-Fi Module.A program in AT commands is written to connect the Wi-Fi Module to the Arduino device. The Wi-Fi Module is extremely cost effective.

Three different sensors are used in our kit. For monitoring the air pollution, the MQ-135 gas

sensor is used.In clean air MQ-135 Module sensor has less conductivity. The conductivity of theMQ-135 gas sensor is higher along with the gas concentration in the surrounding environment rises. Convert change of conductivity to correspond output signal of gas concentration. MQ135 gas sensor is highly sensitive to Ammonia(NH_3), Sulphide(S_2) and Benzene(C_6H_6). MQ-135 also senses the smoke and other hazardous gases in the surrounding. It enhances the system's ability to monitor pollution to a minute level.

CZN-15E is second sensor. It is a Mic based Sound Sensor Module which is used for Sound pollution monitoring. The CZN-15E is used to detect the sound intensities in the surrounding. CZN-15E has an adjustable potentiometer. It can be used to adjust the trigger level at which we want the sound to be detected. It gives output regarding the sound intensity in the surrounding.

B. *Software Specifications*

The microcontroller required a program to operate and execute the process associated with the proposed design. Arduino programming is used to program the proposed system. Arduino IDE provides the required environment for running of program. Different types of codes are used for different types of sensors in the Arduino IDE.

HTML is used to create website to display the monitored data from the sensors. CSS combined with HTML is used to make that website graphically interfaced and easy to understand to a layman.PHP is used to retrieve data from the kit and then is used to store monitored data into database. SQL is used to create and maintain that database. PHP is also used to send data to the website for displaying.
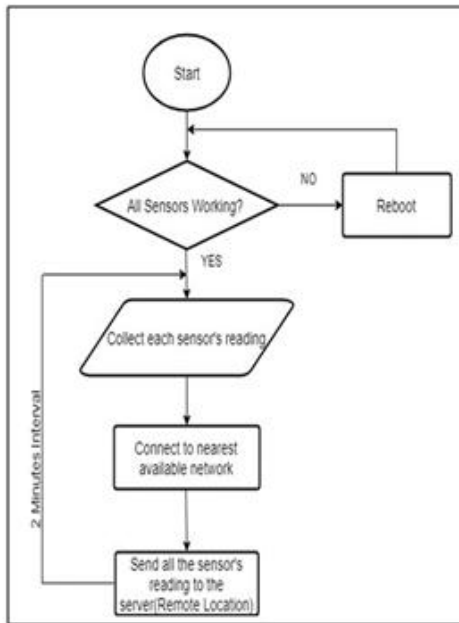
C. *Implementation Flow*

Figure 1 illustrates the implementation flow of the system. After every 2 minutes interval the working of the sensors is checked or else they are rebooted. The data collected by all the sensors is sent to the server via the Wi Fi module. At the server proper analysis of the readings is done to understand the amount of pollutants in the respective areas .Once all the data is analyzed it is displayed on a website to make it available to the common people, to make the aware of the pollution around them. This process is repeated after every 2 minute interval. If anytime the pollution threshold value is crossed a warning is displayed on the website to make people aware of the polluted area.

IV.   IMPLEMENTATION DETAILS

In our system three sensors (mq135 gas sensor, CZN-15E sound sensor, water sensor) and Wi-Fi module are connected to Arduino UNO microcontroller. The three sensors monitor the pollution values in the environment, gather the reading and the values are then displayed on the serial monitor of Arduino IDE. From there the data is then send to the server with the help of PHP to the server. Arduino IDE necessary for implementation is workable on variety of Operating system like windows and Linux.

The website where data for the public will be shown was created using HTML and CSS. Website will be fetching continuous data from the server in regular intervals and displaying the data to the public. Database was created and managed by SQL and it stored all the data monitored by the sensors.

Figure 1: Implementation flow of the proposed system

V. RESULTS

The Arduino collects data from the different sensors. The sensors located in different places collect pollution details in the surrounding of the kit. These sensor readings are send to the server with the help of Wifi-Module. These readings are displayed on a website. If the values obtained by the sensors are in normal range then they are displayed in green color on the website. If the sensor readings exceed the threshold value set by the government then all those values are displayed in red on the website. Weekly charts and graphs are plotted and displayed on the website showing the pollution levels at different periods of the week.

In a certain area if the pollution level is beyond the threshold value continuously then an alert message is displayed on the website, in order to make people aware of highly polluted areas. This way the common people will know about the pollution levels and their surroundings.
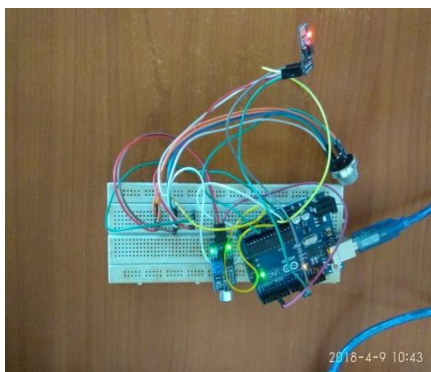
Figure 2: The proposed system
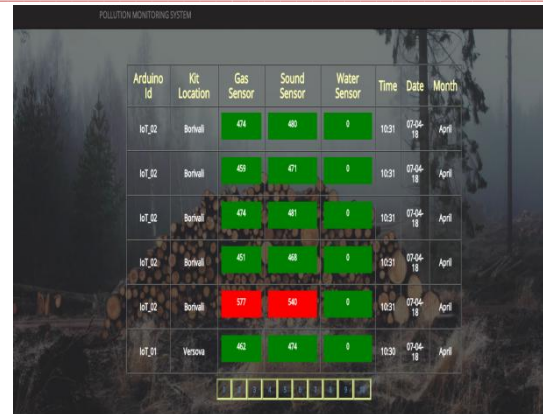
Figure 3: Website displaying pollution details

VI. CONCLUSION

The pollution monitoring system is solution to contribute to avoid the biggest threat. This monitoring system makes people aware about the highly-polluted areas in their surroundings. It supports the new technology and effectively supports the healthy life concept. People can view the weekly statistics of the pollution in their surroundings. This will help them be aware about when the pollution around their surrounding is highest and can try to avoid it.

So, it becomes very reliable and efficient for the Municipal officials along with the Civilians to monitor environment. Letting civilians also involved in this process adds an extra value to it. As civilians are now equally aware and curious about their environment, this concept of IOT is beneficial for the welfare of the society as well as it is implemented using the latest technology with a lowimplementation cost.

VII. REFERENCES

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