Internet of Things Based Pollution Tracking and Alerting System

S.Sanjay Kumar, P.Ramchandar Rao, Ch.Rajendra Prasad

Abstract*: Pollution is major issue in the present world. These include air, water, sound pollution, soil pollution etc. These pollutions lead to the adverse effects of the society that may lead to loss of living creatures. Industries contribute a large part of these pollutions. To reduce industry pollution there needs to be a continuous track of the industry emissions. It is merely difficult to measure pollution continuously at a place at a time. Due this majority of the industries are polluting the environment in various ways. To prevent industry pollution this system is proposed. The system regularly monitors the air, water, sound, soil around the industry and records the readings into the cloud storage and Internet of Things (IoT). If the recorded value exceeds minimum threshold level the notification is sent to the mail id of the concerned authority. The authority can also access these values continuously from the cloud by a secured login page. By this manipulation of data can be avoided.

Index Terms*: IoT, Pollution Tracking, Alerting System, NodeMCU, Turbidity Sensor.

I. INTRODUCTION

The major source of pollution in metropolitan cities of India is due to vehicles and industries. In the major cities of India every individual in the city having vehicle, these vehicles release different toxins into air. As a result, increase in environmental instabilities which will affect the human health in urban areas. Air pollutants from different vehicles result in the damage to the ozone layer of the earth surrounding surface and respiratory problem like asthma attacks for the people. Transportation is major cause for discharge carbon monoxide that contributes 72 percentage of overall pollution in the metropolitan cities of India. The technology advancements, specifically in Wireless Sensor Networks (WSNs) and embedded systems enhances the capabilities of monitoring environment in real time at diverse applications. IoT is a new trend in the technology which draws the attention of research in academia and industry. IoT concurrence things to communicate with one other, to share it on the web, to store and analyze, and to interact with users, thus creating smart, global and continuously connected environment.

II. RELATED WORK

In [1] article, the authors identified Internet of Things to increasing levels of social involvement of the objects composing of three stages. In I stage, in the social networks of humans the objects can post state information. In II stage, objects can interact with humans and other objects at the application layer in social networks. At III stage, a communication network is established by social interaction of objects. In [2] the authors proposed IoT based system to report the vehicular pollution in real-time applications by employing Arduino and RFID. The monitored values are send to sever, if pollution of particular vehicle limited value then information sent to vehicle owner. In [3] the authors present a system that monitors pollutant gases and temperature using city buses. They developed android web server to display real time pollutants and temperature on web and if these values are exceeding local limit corrective action taken by the concerned authority.

In [4] the authors introduced practical design of embedded Web server for monitoring the power network monitoring. The system employs LPC2148 and embedded TCP/IP Rabbit Core Module 5170. In [5] the authors presents a system that comprises of SmartBike devices for monitoring data, the end-user devices for detection of theft services and SmartBike central servers. In [6] authors presented a system which deploys economic air quality stations at different areas of the city. These sensors spread over the city and increase the accuracy of revealed air quality information. This system does not provide any service to users, but it constitutes a real and effective decision-making basis for emergency response that can be used to develop and provide new future services. In [7-9] papers authors presented air quality and environmental monitoring systems have been subject of widespread studies. In [10] the author proposed system which comprises of nine sensors placed in different points across the city for detection of air quality system using cloud to provide real time data.

. In [8] authors introduced dynamic adaptive a sensor based pedestrian crossing system at traffic junctions. In [9] the authors introduced power network monitoring using embedded Web server. The system employs LPC2148 and embedded TCP/IP Rabbit Core Module 5170. In [10] authors presented health should be given more importance in person's life. Health monitoring systems has been developed in these few years that can increase in providing better health.

III. PROPOSED WORK

In the literature different solutions proposed to this problem, but all of these involve complex circuitry and high-level knowledge required to operate these systems. But the proposed project does not require any profound knowledge of the hardware

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or software. By summarizing all the previous completed work, there are some drawbacks in them. To overcome those drawbacks, we are using an efficient way by employing Node MCU esp8266 and connecting them to cloud and retrieving the data to operator dashboard. There are no systems which exactly do the same work. But the present system easily tracks out the pollution and easily updates to open source cloud and then it automatically updates those same values to the operator dashboard. If the sensor values exceed threshold values, then there is an automatic alert generated on the operator dashboard. There is also a facility to track the location of the kit and so the place of pollution can be easily detected. By this kit the data can be digitalized, and the data can be easily delivered without delay. Data manipulation can also be avoided by employing this device.

The proposed IoT Based Pollution Tracking and Alerting System is shown in Fig. 1. The system consists of two major parts: (i) hardware implementation and (ii) software implementation.

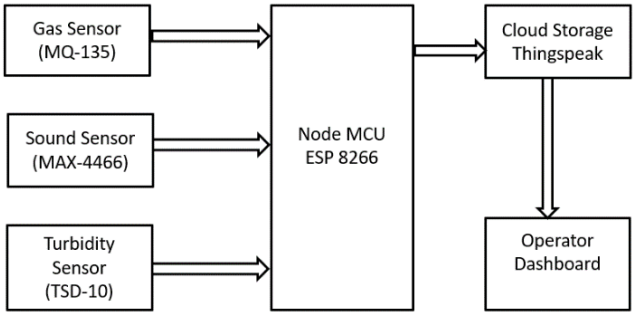

Fig. 1 Block diagram of the experimental setup of the proposed system

There are three different sensors in the block diagram they have similar operation but has different working principle. These three sensors are individually connected to the Nodemcu esp8266 and this block is directly connected to cloud storage and this cloud storage is connected to operator dash board. The sensor blocks record the values of pollution of various types they are air pollution, water pollution, sound pollution. If there is a raise of the values of pollution in air the gas sensor detects these values and gives it to Nodemcu. This block continuously updates values to the cloud and then retrieved to operator dashboard. If the recorded value exceeds the predefined threshold level, then the operator dashboard is notified with an alert. All the other sensors also operate in the same way as the gas senor

A. Hardware Description

Nodemcu esp8266: The block Nodemcu esp8266 in the block diagram is the heart of the project. It is a microcontroller board used to connect all the sensors. The power supply to the whole project is given through this block. The board is programmed with the source code in order to perform the operations of the project. The source code is stored in the on-chip memory available on the Nodemcu esp8266. This block can be considered as an interface between the programmer and the user. So, it is considered as the heart of the block diagram.

Gas sensor (MQ-135): This sensor block is used to sense the air quality and update the values to the Nodemcu esp8266. The power supply to this block is given from the Nodemcu esp8266 block. The sensed values from the sensor are monitored by Nodemcu esp8266 block using the programmer defined source code. The block is considered as a digital block as the input and outputs from the block are in analog format.

Sound sensor (MAX-4466): This sensor block is used to sense the sound level and update the values to the Nodemcu esp8266. The power supply to this block is given from the Nodemcu esp8266 block. The sensed values from the sensor are monitored by Nodemcu esp8266 block using the programmer defined source code. The block is considered as a digital block as the input and outputs from the block are in analog format.

Turbidity sensor (TSD-10): This sensor block is used to sense the water purity level and update the values to the Nodemcu esp8266. The power supply to this block is given from the Nodemcu esp8266 block. The sensed values from the sensor are monitored by Nodemcu esp8266 block using the programmer defined source code. The block is considered as a digital block as the input and outputs from the block are in analog format.

B. Software Implementations

The flowchart as shown in Fig. 2 describes the software implementation of the proposed system. This system monitors the sound, air and turbidity sensor values. Compared with threshold values of every sensor like, for sound <50dB and Turbidity <10µg/m2. If the sensors monitored values exceed the critical values (which is selected based on contamination of different pollutants), this triggers the operator dashboard.

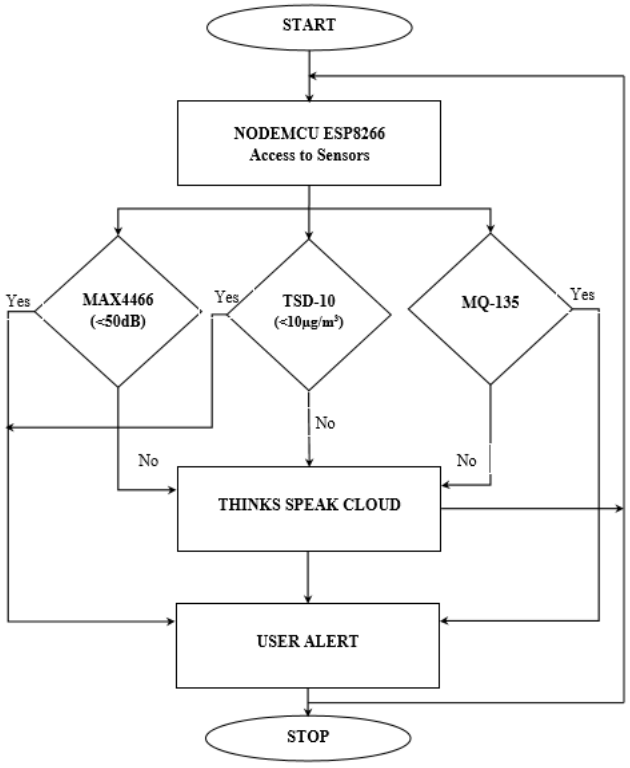

Fig. 2 Proposed system Flowchart

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IV. RESULTS

In fig. 3 schematic diagram, circuit connections are made and the whole setup is embedded into a small box to be resistant of all weather conditions. Now the whole setup is mounted in an industrial area to track various kinds of pollutions. The sensor records the values of pollution of various types they are air pollution, water pollution, sound pollution. If there is a raise of the values of pollution in air, water, sound the gas, turbidity, sound sensor detects these values respectively and gives it to NodeMCU.

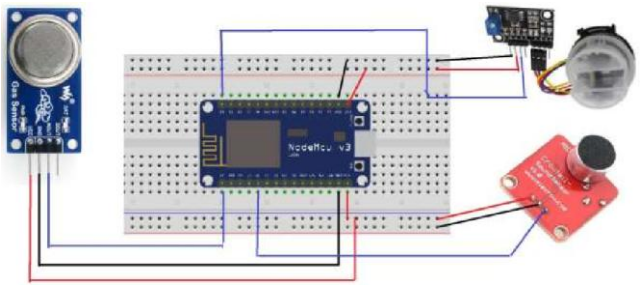

Fig. 3 Schematic diagram of proposed system

The Nodemcu continuously updates values to the cloud and then retrieved to operator dashboard. Fig. 4 shows the updated values of sound, air and turbidity sensor values and location of kit in cloud. If the recorded value exceeds the predefined threshold level, then the operator dashboard is notified with an alert and it is shown in Fig.5.

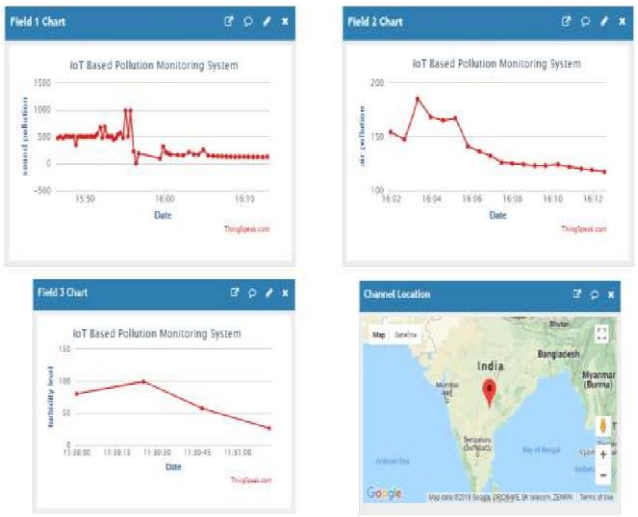

Fig. 4 Thingspeek channels showing sound, air and turbidity sensor values and location

V. CONCLUSION

The IoT based pollution tracking system can be used to track all kinds of pollutions very easily. It can be employed to reduce the man power in data collection and analysis. At the same time the system also helps us to reduce the pollution and can also be used take direct action on the people responsible for pollution. The system also has a data base of all the tracked pollution history which can be visualized at any movement of time. So, this paper can be considered as a multi-benefactor project for government, public and environment. The can further be developed as a pollution tracking and eradicating system by adding some extra hardware for purifying the pollutants in the detected areas. This step requires perfect analysis and awareness of all the other components.

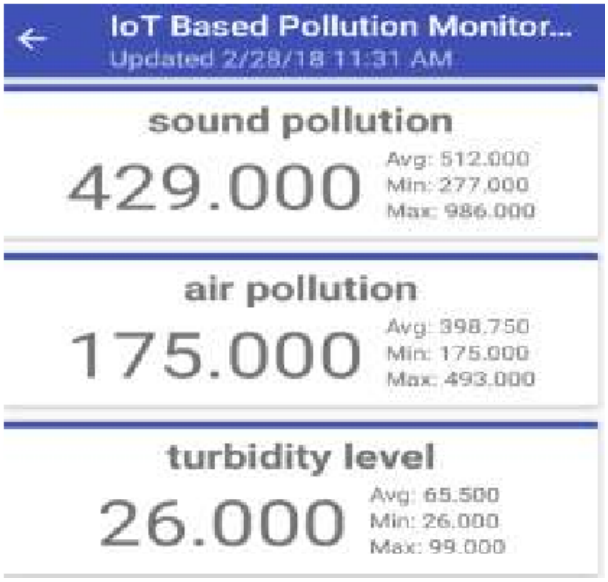

Fig. 5 Updated values of sound, air and turbidity sensor

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