Industry pollution control and monitoring using LabVIEW and the Internet of Things

Suchita B. Waghmare[1]

M.E. Student[1]

[1]Deogiri Institute of Engineering and Management Studies,

Aurangabad - 431005 (M.S.) India.

ABSTRACT

Environmental pollution is one of the most important factors which affect the health of living being and the ecosystem. It is a great challenge to control industrial pollution and to maintain the natural environment. The main objective of this paper is to design a productive and powerful system to control industrial pollution and monitoring reduce their adverse effect. In this system, data of temperature and humidity is collected from the sensor by using AT-mega 2560 Arduino board. The proposed methodology is to model a system that observes the pH level, co2 gas level released during the process and also the temperature of machinery if the level goes higher than industry standards. With the design of IoT, the signals can be effectively transferred and monitored remotely, and the action in these cases can still be made accurate and effective. Hence through this system, the pollution caused by the industry can be monitored and control effectively using LabVIEW and IoT.

Keywords: Pollution, LabVIEW, IoT, Arduino.

INTRODUCTION

Pollution can be effectively described as a change in the environment that is harmful. A general example is industries discharge of chlorine which may get added in the nearby water or rivers indirectly. On a large scale, industrial pollution is increased concerning the industrial revolution. Now a day any modern industry has the potential to produce some pollution, mostly this is in the structure of wastewater that has been used for washing machines and their components. This water from the industry may get added to the nearby water. Various industries that are responsible for pollution are of varied manufacturing industries such as paper pulp uses chlorine, while power generation using coal creates acid rain. The Ministry of environment, forest and climate change has put forth some rules regarding pollution monitoring and preventive action

against it. Therefore, all industries are restricted to keep the green zone in the industries and do plantation. Environmental law enforces industries to take more necessary action for emission that could harm the environment. This paper focuses on monitoring the pollution, for those parameters like CO_2, pH, temperature, and humidity are monitored on LabVIEW and also remotely with the help of the Internet of Things.

2. LITERATURE SURVEY

With the advancement of communication technology, network, and remote sensing technology, there has to be some way to go for air pollution monitoring through wireless technology. There are so many adverse effects that are there because of air pollution like breathing, coughing, respiratory system. In some industries like cement, pollution monitoring is monitored concerning emission through chimney only. Instead of that, wireless network technology is a good option for monitoring; swagarya et al. [1] has worked on the same path giving a brief idea about the use of a wireless sensor network in air pollution

In some cases related to air pollution, gases can be monitored such as carbon monoxide, carbon dioxide,. traditional monitoring systems are expensive Burla et al. [2] has proposed the work for monitoring air pollution through wireless sensor network, because of the increased number of the vehicles air pollution is getting increased on the similar approach Siva Shankar Chandrasekaran et al. [3] has worked to detect the level of Pollution and indicating it to the driver. Similar to the air pollution there is a problem with water pollution because of the increased industries; Prashant Salunke [4] has worked on water pollution monitoring based on the concept of the Internet of things. Divyata et al. [5] has worked on automobile pollution, headlight intensity control based on wireless sensor network.

A survey on pollution has verified that the pollution concentration recorded by fixed monitors may not reflect the values of the surrounding areas and therefore are inadequate for assessing population exposure. Julie Wallace et al. [9] have done work on mobile monitoring. some authors [10] have given an insight concerning the utilization of IoT in the various applications and the challenges that occurred.

Sensor networks consist of small, low-cost sensors, which collect and distribute environmental data among each other. Various applications shows work in a variety of fields such as indoor climate control, environmental monitoring, structural monitoring, medical diagnostics, surveillance, disaster management and emergency response, ambient air monitoring and gathering sensing information D. culler et al. [7]. In the last few year's economic growths of Mauritius is based on industrialization and tourism development, because of urbanization and an increased in vehicles air pollution has been increased in the last decades in Mauritius. Kavi K. Khedo et al. [8] proposed a wireless sensor network air pollution monitoring system (WAPMS) for Mauritius.

Yi-Bing Lin et al. [11] has proposed the work where they are specifying the range of values that can be pass on to the remote with the help of IoT. One of the major issues was Air pollution and sound pollution by finding it, and detecting is the main objective. To overcome these problems, gayatri k. [12] has worked on the monitoring of environmental disasters around the manufacturing industry.

Industrial quality monitoring is the gathering of data with different industries and at regular intervals to provide the data which may be used to define current conditions [16]. Many industries are approaching towards software approach for emission monitoring [17]. For accessing the data remotely, some authors have worked on pollution monitoring based on the Internet of Things [18]. In most industries nowadays, they are using a pollution monitoring system [13]. On similar concepts, A. Srinivasan [14] has worked on the remote monitoring of hazardous gas monitoring. The wireless sensor network is also used in the brief overview of solid-state gas sensors, which can be classified into semiconductor, capacitor, and solid-electrolyte type sensors, based on their sensing mechanisms [15]

3. SYSTEM DEVELOPMENT

Nowadays, it is important to monitor the industries for pollution control. Concerning industrialization, it has been observed that industrial pollution is one of the measures affecting human health and also the environment and thereby living being. In this work, real-time data is monitored using LabVIEW and also using the Internet of Things.

In order to monitor the real-time data, some sensors are utilized. Fig1. Shows the overall block diagram for the system which describes the different sensors and hardware used.
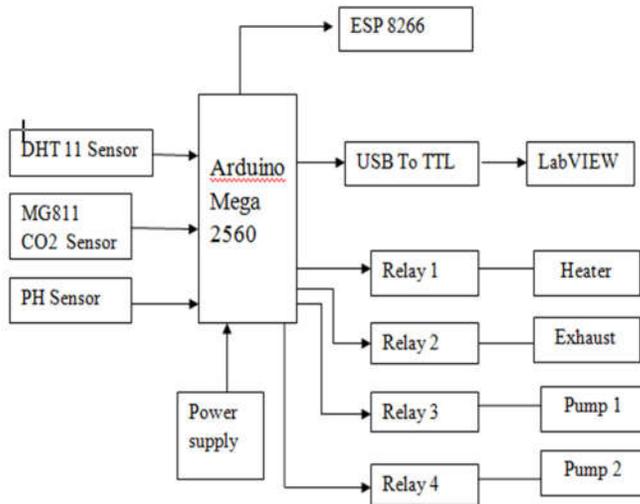

Fig. 1: Proposed Block Diagram

4. PERFORMANCE ANALYSIS

This system aims to monitor and control industrial pollution. For monitoring the pollution, LabVIEW software is used. Sensors like pH, Temperature and humidity and CO_2 are used for capturing live real-time data. Wi-Fi module is utilized to transfer the data on the internet. To monitor the remote data web page is created. Advantage of this system is user can monitor real-time data remotely at any time. The hardware setup is shown in Fig. 2(a,b).

Fig.2: a) Overall Hardware Setup b) Overall Running Hardware Setup

Input to the system is given by various sensors used and output is shown with the help of the WiFi module and USB to TTL respectively for the IoT web page and LabVIEW. The overall measurement is done as follows.

i) Temperature Detection:

If the temperature is below 18^0C, then heater (Bulb) is ON.

If the temperature is above 32^0C, then Exhaust is ON.

ii) Humidity Detection:

If the humidity is greater than 92, then Pump1 is ON.

iii) pH Value Detection:

If the pH value is less than 4, then Pump 2 is ON. To add some solution through that pump in the required solution for increasing the pH value.

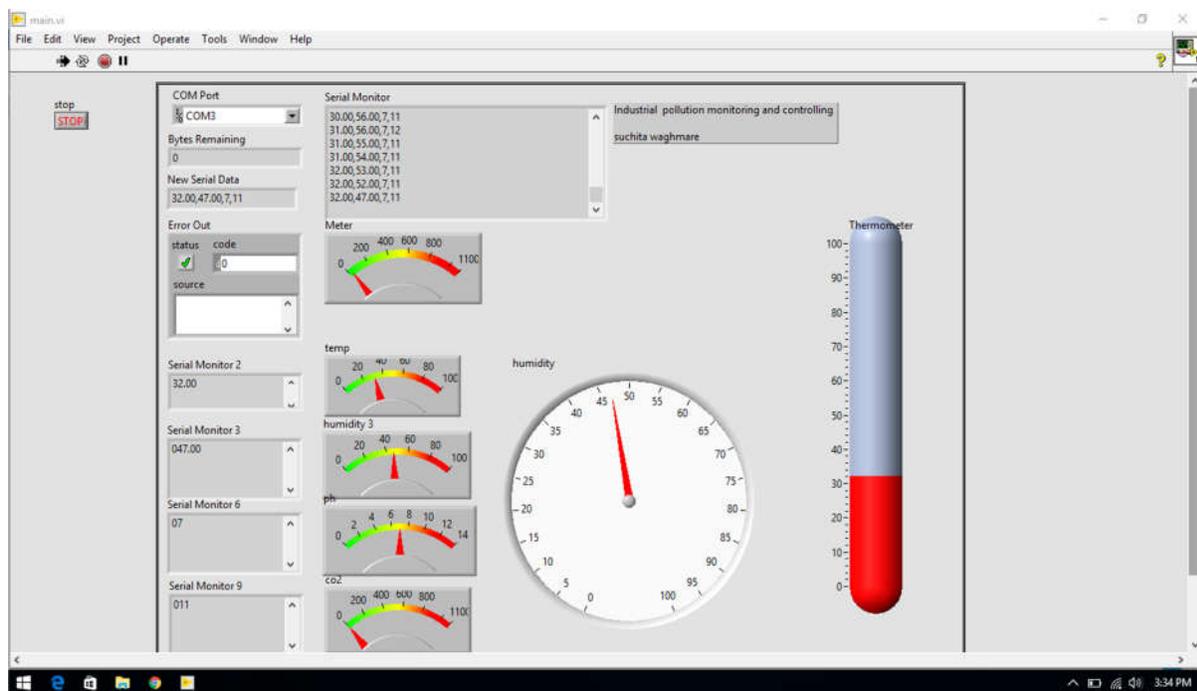### iv) CO₂ Detection:

CO_2 value is monitoring by using MG 811 CO_2 sensor.

Fig. 3: LabVIEW data for Temperature

Fig.3 shows data monitoring for temperature, similarly other parameters are monitored. Fig. 4 shows the data monitored remotely.

Fig. 4: Data captured and represented on the webpage.

5. CONCLUSION

The IoT concept can be applied to a wide range of application. IoT is useful in Industrial pollution monitoring and control. With this, it can also prevent any disastrous hazards in the industries and provides a keen control over environmental pollution. LabVIEW software-enabled straightforward applicability of using IoT with an easy graphical user interface platform for the designers and the users. More importantly, with the help of IoT concepts, monitoring the data is very easy with this method anytime and anywhere, so there is no restriction to be in the industry to monitor data physically.

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