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IOT BASED POLLUTION MONITORING SYSTEM USING RASPBERRY - PI

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Abstract

With the tremendous increase in the level of population and mechanisation pollution has increased many fold. This results in deterioration of individual health therby by directly affecting health of entire population. An IOT Based Air Pollution Monitoring System is proposed which will monitor the levelof pollution and Air Qualityover a web server using internet. Sensors can be deployed at various locations which can sense and collect the data. The big data can be uploaded on the Google cloud which facilitates monitoring from any part of the globe. The presence of harmful gases like CO2, Smoke, CO, Butane and LPG above a particular limit may turn fatal which can lead to severe accidents. This type of accidents can be prevented by implementing an effective pollution monitoring system. The

air quality can be displayed on the LCD and as well as on webpage which makes environment monitoring easy. An alarm can also be triggered when the air quality goes down beyond a certain level.

Key Words:IoT, Sensors, monitoring, pollution, web server, internet, big data, cloud.

1 INTRODUCTION

The main objective of IoT Pollution Monitoring System is that the Air pollution is a rising issue these days. It is compulsory to monitor air quality [1],[2] and keep it under control for a healthier future and healthy living for all. Internet of things (IoT) is gaining popularity day by day as it can transform life making it easier for human beings.

With the growth of population and with the increase in the automobiles and industries the atmospheric conditions are considerably deteriorating day by day. Risky effects of pollution include several allergic reactions causing irritation of the eyes, nose and infections of the throat.It can also lead to inflammation inside lungs paving way to problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma[6].These pollution related issues can be addressed by having an efficient monitoring system. Observing gives measurements of air pollutant concentrations, which can then be examined, interpreted and presented. Monitoring of environment by an intelligent system allows us to measure the extremity of air pollution which can be used to develop techniques to reduce it.

IoT when applied to industries are broadly defined under the category of Industrial IoT (IIoT). Environmental responsibility and worker safety goes in par with increasing the efficiency and productivity of any industry. This paper mainly focusses on pollution monitoring which can be mainly applied to industries. Industries such as petrochemical and gas industries employ thousands of workers who work 24 X 7. Due to the chemical reactions involved in the refining process, many types of gases are evolved. Some of these may turn fatal to human life if inhaled in excess of ppm [3], [4]. Leakage of like Butane, Methane, CO2, CO etc. should be monitored to avoid explosions and accidents.

An effective monitoring system will help to identify the presence of harmful gases if any. This can be realized by implementing sensors which can detect the various gases. The sensors will sense the data and send the data to the Google cloud server where the manager can monitor the data from any part of the globe[6]. An alarm can be initiated to alert the workers on the industrial floor if the level of the gas exceeds the threshold limit. Accordinglypreventive actions can be taken to stop the gas leakage problems and to save the workers lives from the harmful effect of toxic gases.

2 METHODOLOGY

Industrialization and urbanization has led to widespread problems relating to environment pollution of water, air and land [7]. Industrialization has also led to pollution in the above zones. The environmental responsibility and worker safety should be the prime motto of any industry along with productivity and efficiency [8]. This prototype (Fig.1) is for detecting those harmful toxic gases and shows the real time monitoring of the concentration of the gases in the industrial floor.

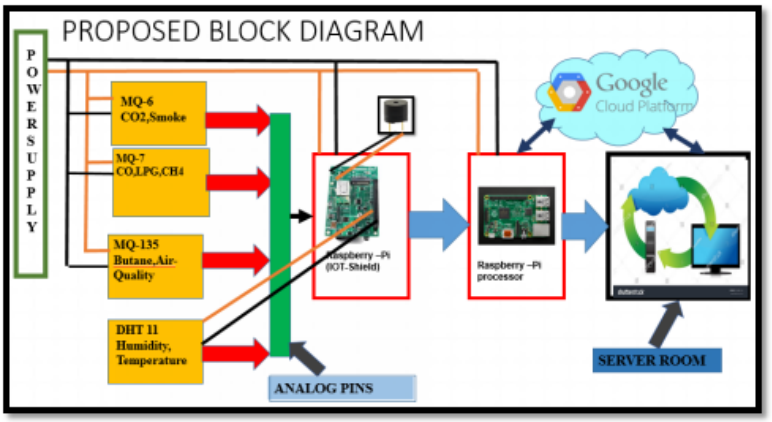

Figure 1 Hardware design shematic diagram

This concept uses three gas sensors namely: MQ-6,MQ-7,MQ-135 and also using the DHT11 (temperature and humidity)sensor.The

sensors can be embedded in caps, helmets or wrist watches which can be worn by workers. The introduction of flexible, light weight sensors can further boost-up the implementation [9],[10]. The idea can be realized by introducing[5]Raspberry-pi and IoT sheild .The idea of this paper is to sense the level of various gases in the industrial floor and upload these data to the Google spread sheet.Also it provides the warning alarm if the level of gases exceeds the allowable limit.

With IoTShield, device manufacturers, system integrators and IoT network operators can rapidly secure and manage devices, with no need for any security expertise, no costly development and testing resources and no change to the application code or device functionality[14][18].TheIoTShieldprovides solution to multiple layers of application-level security and is ideal for protection of gateways, industrial PCs and Linux-based edge devices[8]..IoT shield prevents damage to device operation and safeguards connected IoT network components. The API(application program interface) can be enabled which works as a medium between the Raspberry-Pi and the Googleserver. It also provides the permission to the sensor to write the readings on the Googlecloud web server by sharing the client email id from the (.json folder) which can be downloaded after enabling the API for google spread sheet.

MQ-6/7/135 GAS Sensors are one of the series of semiconductor Gas Sensor (Fig. 2)[15][16][17]that can be employed for detection of gases mainly employed for workshops and commercial buildings. These has many features such as: High sensitivity, Fast response, Wide detection range, Stable performance and long life, Simple drive circuit. Resistance values of these sensors differ with various-concentrations of gases. So, when using this components, sensitivity adjustment is very necessary.

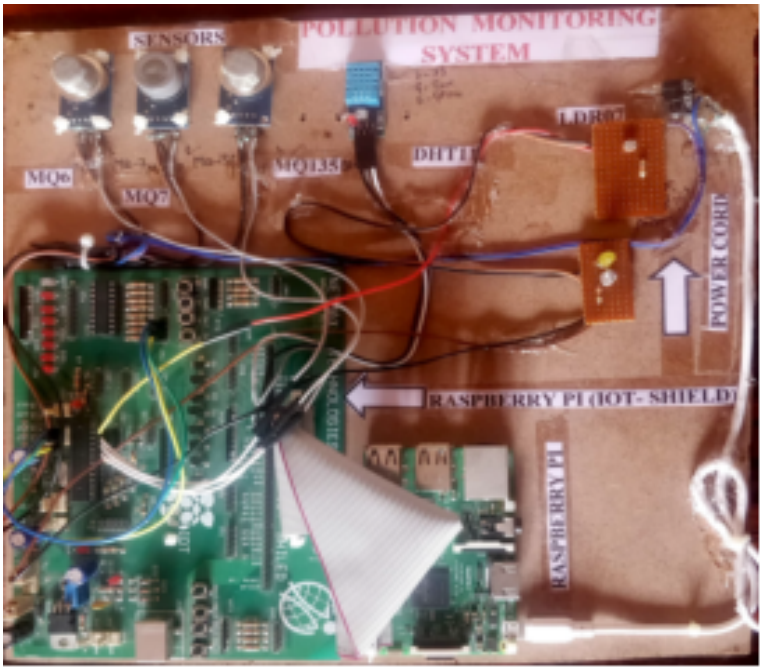

Figure 2 Physical view of the hardware setup

As an alternative solution for networking,intelligent routing algorithms which can maximize network life time and adjust transmission power can be considered [11]. Optimized load balancing [12] and mobile power banks [13] can improve the performance of multihop networks with respect to energy.

3 RESULTS AND DISCUSSION

The proposed design can be used to monitor a particular area of an industry and to measure the air quality. The presence of different toxic gases can be monitored. This paper mainly focuses on measuringgases likeCarbon Monoxide (CO) and Liquefied Petroleum Gas (LPG), Methane, Butane and Air quality. An experimental setup was developed to measure the gases. The sensor data obtained were collected and uploaded in the Google spread sheet (Fig. 3).

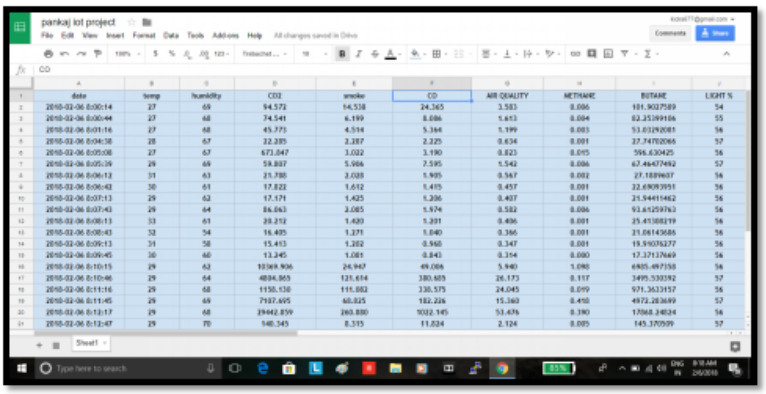

Figure 3 Google spread sheet (sample readings)

The variation in the concentration of various gases can be clearly studied from the Google spread sheet which can be accessed by authorized persons from any part of the globe (Fig.3). Plots can also be obtained to indicate the variations at different time periods (Fig. 4 5). Experiments were conducted under controlled conditions and can be used in any real time scenario.

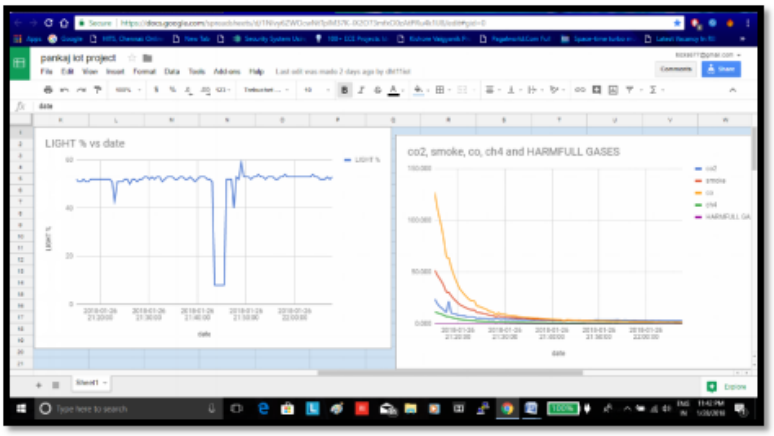

Figure 4 Variation in concentration of various gases.

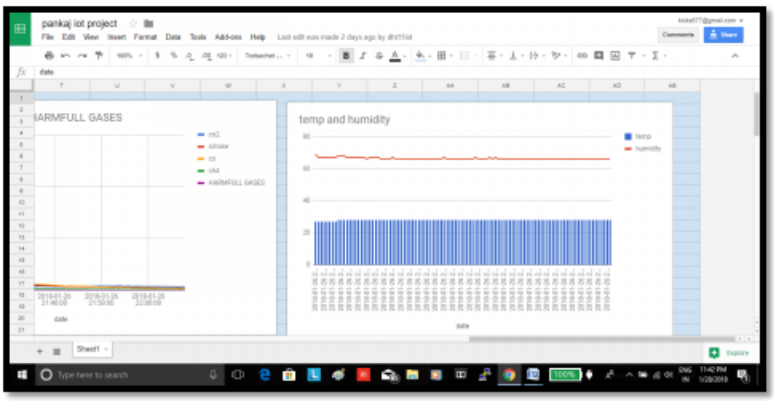

Figure 5 Temperature and Humidity

This mechanism provides a real-time information about the level of air pollution in different regions, as well as provide alerts in cases of drastic change in the quality of air. Based on these readings, such information can then be used by the authorities to take prompt actions such as evacuating people or sending emergency response team. The design can be enhanced by adding a wireless network card to the microcontroller circuitry for better and easier control of the sensors readings.

4 CONCLUSION

A system which can monitor the leakage of toxic gases and hence the level of pollution using Raspberry-Pi and IoT is proposed which can prevent fatal accidents. By the use of MQ135/6/7 gas sensors thepoisonous gases can be sensed and alert can be given to save the life of people. Raspberry-Pi serves as the heart of this module which controls the entire process. Wi-Fi module connects the whole process to internet and LCD is used for the visual Output. The use of wearable technology is also a mile stone which can ensure the safety of workers in the industrial floor. The air monitoring system can help in the innovation of new practices toovercome the problems of the highly-polluted areas,which is a major issue. It supports the new technology and effectively supports the healthy life concept.

This system has also features which enables people to monitor the amount of pollution on their mobile phones using the application.

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