Monitoring System of Different Air Quality Parameter using Raspberry PI and Web Of Thing

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Received: February 06, 2019 Accepted: March 19, 2019

ABSTRACT: *In infrastructure and industrial plants the rapid growth creating environmental issues like pollution (Air, , climate change, malfunctioning and has greatly consequence for the requirement of an, operationally adaptable, efficient, cheap and smart monitoring systems. In this context where combination of many challenges of computer science, wireless communication and electronics; the Smart Sensor Networks are an emerging field of research. In this paper a solution to monitor the air and noise pollution levels in industrial environment or by using wireless embedded computing system a particular area of interest is proposed. The technology like Internet of Things (IoT) is included in the form of solution which is outcome of merged field of computer science and electronics. For monitoring the fluctuation of parameters like air pollution levels from their normal levels in this case the sensing devices are connected to the embedded computing system. For the requirement of continuous monitoring, controlling and behavior analysis this model is adaptable and distributive for any infrastructural environment. The working appearance of the proposed model is evaluated using prototype implementation, consisting of raspberry pi board, sensor devices For two or three parameters like humidity , dust and various gases levels the implementation is tested with respect to the normal behavior levels or given specifications which provide a monitoring over the pollution control to make the environment smart and ecofriendly. The basic mission of the Air Quality Planning and Standards is to preserve quality of air .The level of pollution in air can be measured by measuring the pollutants such as humidity level, temperature level, dust level, CO level, smoke level etc present in the air of that area. Here we propose an air quality pollution monitoring system that allows us to monitor and check live air quality in a particular areas through IoT. Wi-Fi module, temperature, humidity, gas, and dust sensors are interfaced with the raspberry pi*

Key Words*: Dust Sensor, Carbon Monoxide Sensor, Raspberry Pi,IOT,WiFi.*

I. Introduction

Nowadays, the Wireless Sensor Network (WSN) is considered to be an essential technology that is used in many fields and projects such as monitoring the water quality, engine emissions and air pollution and metrological. It is made of nodes, every node or more than one node is connected to one sensor. The WSN had many advantages which are sufficient data, temporal accuracy, flexibility, low power consumption, less implantation cost and so on [1]. The wireless sensor network can be an excellent device to observe air quality. It gathers air quality data automatically. Due to depending on industrial and fossil fuel in over the world, toxins and unhealthy gases and radiation that in many cases cannot be detected by smell or sight surround by humans. These gases and radiations have many potential dangers such as lung damage, skin damage, and even cancer and death, not to mention the possibility of explosive gas damage This paper presented an approach to prevent such dangers in a reliable and affordable way. Many hardware can be used to implement this work such as Raspberry Pi, IOT ,Dust sensor and so on. This project aims to prevent such dangers by using the Raspberry Pi because of its features and characteristics, which are:

1) Relatively low-cost.
2) Easy to program and understand.
3) Portable computer and pocket size device.
4) Many sensor nodes can be hooked up to it.

The study of focus on the detection of pollution level and controlling the emission of pollutants of a vehicle using the pollution control circuit. This circuit includes different sensors and devices such as smoke sensor for pollutant detector, LM35 temperature sensor for identifying the vehicle's temperature, semiconductor

sensor MQ-2 for smoke detection that ranges from 300ppm to 10000ppm and e that are all connected to the raspberry microcontroller. There is a pre-defined threshold value stated which will be used to compare it to the smoke sensor output. The microcontroller will initiate the timer circuit, turns on the alarm sensor result is more than the threshold value. The main goal of the this paper is to design and implement an adequate monitoring system through which the needed parameters are monitored and controlled remotely by using internet and the data collected from the sensors are stored in the cloud and on the web browser to project the estimated trend.

II. LITERATURE SURVEY

1. Industrial Air Pollution Monitoring and Analysis System:[1] The system existing before was based on microcontroller based toxic gas detecting and alerting system and the developing system will have a complete monitoring system which is IOT based. As monitoring is done continuously, we can release and share monitoring news at real time too. The positioning, analyzing and synchronous display can be done with the help of Web GIS. The controller makes out a decision plan with the database of inquiry rules, and traces the implementation of the program. This system could make real time remote monitor dynamically and accurately toward the monitor scope. It will help us to keep a working staff away from danger and a high security can be achieve and it will also help the Government authorities to monitor the harmful gases emission as "Global Warming" perspective too.

2. Smart Pollution Detection and Tracking System Embedded With AWS IOT Cloud: The main objective of this paper is to implement IOT to measure the pollution of public transports using MQ7 Arduino which is sensitive for Carbon Monoxide. Global Positioning System (GPS) is implemented in these arduino which would find the location of the transport vehicle.The amount of Carbon Monoxide emitted is sensed once in (say 20km) and also the locality of vehicle is used for finding the area which is polluted the most. These are then integrated to the Amazon Cloud IOT which is more securable and many services of AWS can be used along with it. This would enable a Simple Notification Service (SNS) to the mobile phone when the vehicle is causing higher level of pollutants. 3. Automated System for Air Pollution Detection and Control in Vehicles:

3The aim of the project is to monitor and control the pollutants in the vehicle by using the pollution control circuit. This pollution control circuit consists of various sensors like smoke sensor, temperature sensor and GSM, GPS kind of devices, and all of them are integrated and connected to a Controller. It is a real time work where a demo application has been made in which ARM 7 processor is used and a controller board is made where all these devices get integrated and work accordingly. The vehicle is controlled by this circuit. When a vehicle attains certain threshold pollution level then the engine gets automatically switched off and an SMS is generated and sent to the pre-defined number stored in the memory through the GSM module. The GPS module is used to locate the vehicle position where it is halted. This paper demonstrates an effective utilization of technology by which we save our environment by controlling the pollution of vehicles.By 2017, Rohani et al. used Arduino microcontroller with Open Platform Communications (OPC) in designing a monitoring system to control and monitor the CO2 emission in the industrial environment. System testing was performed in a lab under real-time CO2 emissions measurement, and system implementation indicated a successful application [10].

A real-time monitoring system for agriculture's weather was proposed by Susanto et al., which used parallel processing, Ardiuno, and Raspberry Pi. The system was faster and 50% efficient than the systems with single processor [11]. Furthermore, Mekki and Abdallah implemented a monitoring system for greenhouse controlling using Wireless Sensor Networks (WSN). Temperature, humidity, and soil parameters were controlled by the proposed system [12].

Abd Allah et al. presented a data logger system that can be used in applications of environmental monitoring. The system is universal, it is built using Arduino and LabView software, and can be used as a standalone device. It can monitor and record a massive amount of data [13].

Baharun et al. used the SICK sensor in conducting a study on measuring and analyzing the air quality inside the Meru Menora Tunnel. The study helped in controlling the ventilation fan system, which operates efficiently depending on the gases concentration level in the tunnel and thus eliminates the power consumption [14]. Montanaro et al. presented an air pollution monitoring system for the city, called SmartBike. The system exploited a network of bicycles to provide several services to citizens, such as bikes location detection, antitheft, traveled distance, and monitoring of air pollution [15].

III. PROPOSED METHODOLOGY

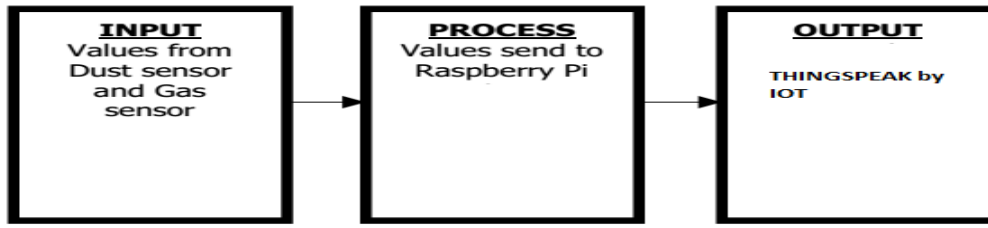

Figure 1 Framework of Proposed System

In Figure 1, the input detect values coming from the dust sensor and gas sensor. Dust sensor is responsible in detecting particulate matter and gas sensor is for detecting the Carbon Monoxide. The values will be sent to the Raspberry Pi which is the channel in sending the IoT-Based notification sent to residents of the community that registered in the monitoring system.

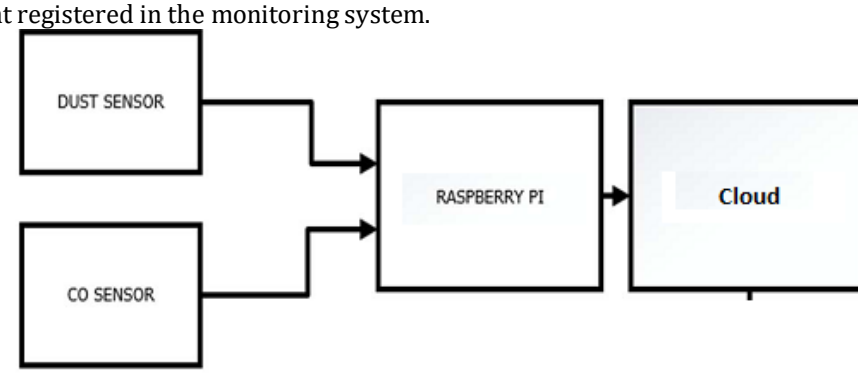

Figure 2 Block Diagram of Proposed System

Figure 2 shows the block diagram of the proposed system and it shows how the air pollution and particulate matter detector interconnected with different components of the system. Dust sensor and CO sensor are used in detecting the air pollution. The dust sensor used is SHARP GP2Y1010AU0F Compact Optical Dust Sensor which has an IRED (infrared emitting diode) as well as phototransistor. This dust sensor can detect very fine particles. The dust presence can be detected by the photometry of only one pulse. The carbon monoxide sensor used is MQ-7 Gas sensor. It detects by method of cycle high and low temperature. The sensor has good sensitivity to carbon monoxide in wide range. Its conductivity is much higher along with gas concentration. As dust sensor and carbon monoxide works together, the dust sensor, detects particulate matter and carbon monoxide can detect the gas or carbon monoxide concentration on the range of area. The sensors are connected to Raspberry Pi which channels in sending an email notification to the cloud server once detected values are on high level. A red light will turn ON upon detecting the high measurements

IV. Working

The parameters are then send to the microcontroller MQ-2 sensor is a gas sensorwhich can detect the presence of combustible gases such as butane, LPG, hydrogen & methane. In this project, it is used mainly for detecting household LPG. The ionized constituents are detected by the sensing element, which creates a potential difference thus giving output in the form of current. The concentration of the gas detected is then send to the raspberry pi. It has both the analog and the digital output but here we use the analog output which is connected to the analog pin of the microcontroller. DHT11 sensor is used for measuring humidity and temperature of the surroundings but, here I had used it for measuring only the humidity. The sensor provides fully calibrated digital outputs for the measurements of the parameters. It sends a data of 40 bits both for the temperature and humidity which also includes the checksum byte (bit error check). It operates at a voltage of +5v and gives the digital output connected to any of the digital pin of the microcontroller.

The MQ-135 gas sensor senses the gases like CO2, ammonia nitrogen, oxygen, alcohols, aromatic compounds, sulfide and smoke. The operating voltage of this gas sensor is from 2.5V to 5.0V. In the atmosphere we can find polluting gases, but the conductivity of gas sensor increases as the concentration of polluting gas increases. MQ-135 gas sensor can be implementation to detect the smoke, benzene, steam and other harmful gases. It has potential to detect different harmful gases. The MQ-135 gas sensor is low cost to

purchase. ESP8266 module is a Wi-Fi module, which the backbone of this project. Here it is used for connecting the microcontroller to an access point (Wi-Fi). This module has inbuilt set of Attention Commands which are required to configure the module. Firstly we flash the ESP8266 module using the software then using the Attention Commands it is set in the Wi-Fi mode and then it is connected to a mobile hotspot or a Wi-Fi, which finally connects our microcontroller to the WiFi. We create a channel (private) to view the changes in the parameters. The data is displayed graphically on the channel. One can get the access to the channel by getting the user ID and the data is transmitted to the channel by using the write API key provided by the channel, which enables our microcontroller to send the data. It requires a time of 15ms to update the data. Raspberry pi is one of the varieties of microcontroller based on , which takes input from the sensors and is connected to the Wi-Fi with the help of the Wi-Fi module which enable it to transmit data to the channel. The whole processing required is done by the processor in it.

Starting with this project, first of all we flash the memory of the Wi-Fi module (ESP8266) to avoid any garbage values in our readings, then moving on to the next step we use some AT commands to set the module in the Wi-Fi mode and search for the available access points and then connect to any of them. If the module gets connected, it is well and good otherwise go back to the basic AT Commands then retry to connect which connects our microcontroller to the Wi- Fi. Then the next step is for taking inputs from the respective sensors in the microcontroller, now after obtaining values from the sensors, we need to convert the 5 volt logic of to the 3.3 volt logic as the Wi-Fi module works in 3.3 volt logic, after doing that use the channel API key to transmit the data/ input from the sensor to the channel and display them graphically on the space provided by the channel and for more understanding the whole process has been depicted. In this the components used in the project are represented in the form of blocks and shows how we carried out our work.

First of all using all the 4 types of sensors collected data then this data is latched in the microcontroller, then after performing all the basic requirements required by the Wi-Fimodule, connect our microcontroller to the access pointand then finally we upload the data to the channel.

V. conclusion

The proposed system for the air quality monitoring with IoTBased Notification has been develop and tested. The system composed of two kinds of sensor particularly Dust sensor and the gas sensor. The study used Raspberry Pi, , MQ – 7 Toxic Gas Sensors, and Sharp GP2Y1010AU0F Optical Dust Sensors in the development of the proposed system. The integration of two sensors for each kind of sensor and average the readings of the sensor provides a stable reading. The proposed system provides a mechanism of sending sensor data wirelessly. on the system provides the IoT-Based notifications through information dissemination if the system exceeds a certain threshold and needs to inform the individuals whose emails have been included in the system.

VI. APPLICATIONS & USES

The above mentioned method will ease the process of water level management on a large scale. *We can solve many water related*issues by this method. By installing a central command center we are decreasing the manpower required at each and every dam. Since this is a fully automated project, any kind of human intervention has been avoided. So the possibility of faults has also decreased. In cases of emergency, the override capability will be given to an authorized personnel who can change the command if required. In places where there are issues of water distribution between two areas, this method helps in maintaining neutrality as the command is with the central command center and neither of the areas involved in the fight can give the command. During times of natural disasters like floods, this method will be very helpful as we don't need to have any human to control near the actual site of the dam. Any command required for the gate opening or gate closing can be given from remote center. This also reduces the response time as the water level data near command center is real time and the decisions are taken almost instantaneously. Since the data of water levels near all the dams throughout the country are at the same place, a quick decision on the routing of flood water can also be taken. This helps in decreasing the losses due to floods to a significant extent

References

1. Jadhav Aditya, "Industrial Air Pollution Monitoring and Analysis System", International Journal of Advanced Research in Computer Science and Software Engineering Volume 6, Issue 3, March 2016.
2. Marina Sruthi.M, "Smart Pollution Detection and Tracking System Embedded With AWS IOT Cloud, International Journal of Advanced Research in Computer Science and Software Engineering Volume 6, Issue 4, April 2016.

3. Anita kulkarni ,"Automated System for Air Pollution Detection and Control in Vehicles", International Journal of Advanced Research in Electrical ,Electronics and Instrumentation Engineering Vol. 3, Issue 9, September 2014.
4. Nihal Kularatna ,"An Environment Air Pollution Monitoring System", IEEE 1451 Standard for Low Cost Requirements IEEE Sensors Vol:8; pp:415422; Apr:2008.
5. Prakash Doraiswamy ," Measuring Air Pollution Inside And Outside of Diesel Truck Cabs", International Journal ofAdvanced Research in Electrical ,Electronics and Instrumentation Engineering Vol. 3, Issue 9, September 2014
6. Preethichandra, D. (6-9 May 2013). "Design of a Smart Indoor Air Quality Monitoring Wireless Sensor Network for Assisted Living." Paper presented at Instrumentation and Measurement Technology Conference (I2MTC), 2013 IEEE International. Minneapolis, MN. ISSN 1091- 5281. DOI 10.1109/I2MTC.2013.6555624. (pp. 1306 – 1310).
7. Ferdoush, Sheikh, and Xinrong Li. "Wireless Sensor Network System Design Using Raspberry Pi and Arduino for Environmental Monitoring Applications." Procedia Computer Science 34 (2014), 103-110. doi:10.1016/j.procs.2014.07.059.
8. Sonali, D., Venkatasubramanian, K. A (2016). "Raspberry-PI based IOT system for measuring the environmental parameters to monitor the pollution level using IBM Bluemix," Pakistan Journal of Biotechnology, 13, pp. 231-235.
9. Balasubramaniyan, C., Manivannan, D. (2016). "IoT enabled Air Quality Monitoring System (AQMS) using Raspberry Pi." Indian Journal of Science and Technology, 9 (39), art. no. 90414.Jadhav, Gaurav, Kunal Jadhav, and Kavita Nadlamani. "Environment Monitoring System using Raspberry-Pi." International Research Journal of Engineering and Technology (IRJET)3, no. 4 (April 2016).
10. Jadhav, Gaurav, Kunal Jadhav, and Kavita Nadlamani. "Environment Monitoring System using Raspberry-Pi." International Research Journal of Engineering and Technology (IRJET) 3, no. 4 (April 2016).
11. Rohani, Mohd F., Noor A. Ahmad, Shamsul Sahibuddin, and Salwani M. Daud. "OPC Protocol Application for Real-Time Carbon Monitoring System for Industrial Environment." International Journal of Electrical and Computer Engineering (IJECE) 7, no. 2 (April 2017), 1051. doi:10.11591/ijece.v7i2.pp1051-1059.
12. Susanto, Dwi, Kudang B. Seminar, Heru Sukoco, and Liyantono Liyantono. "Parallel Processing Implementation on Weather Monitoring System for Agriculture." Indonesian Journal of Electrical Engineering and Computer Science 6, no. 3 (June 2017), 682. doi:10.11591/ijeecs.v6.i3.pp682-687.
13. Mekki, Marwa, and Osman Abdallah. "Development of a Wireless Sensors Network for Greenhouse Monitoring and Control." Indonesian Journal of Electrical Engineering and Informatics (IJEEI) 5, no. 3 (September 2017), 270-274.
14. Abd Allah, Osman, Mohammed Abdalla, Suliman Abdalla, Amin Babiker, and Alaa Awad Allah. "Universal Data Logger System for Environmental Monitoring Applications." Indonesian Journal of Electrical Engineering and Informatics (IJEEI) 5, no. 2 (June 2017), 131-136.
15. Baharun, A. N., N. A. Murad, and N. N. Malik. "Harmful Gases Profiling in Meru Menora Tunnel using SICK Sensor." TELKOMNIKA (Telecommunication Computing Electronics and Control) 15, no. 2 (June 2017), 888-894. Montanaro, Teodoro, Fulvio Corno, Carmelo Migliore, and Pino Castrogiovanni. "SmartBike: an IoT Crowd Sensing Platform for Monitoring City Air Pollution." International Journal of Electrical and Computer Engineering (IJECE) 7, no. 6 (December 2017), 3602. doi:10.11591/ijece.v7i6.pp3602-3612