IOT Based Smart Industry Monitoring and Alerting System

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***Abstract* — With the advanced computer innovation and automation, the industries across the world have undergone a major revolution. This led to the increased living standards of the commoner and contributed to the country's economic growth. IoT has transformed itself to suit various fields, namely home automation, smart devices, and significantly contributing to the healthcare sector. IoT provides a perfect solution for cost reduction over to 1/10th of the conventional systems. IoT also effectively increases the productivity and efficiency of any industry, thus contributing to its development. Unlike Traditional Systems, we have used IoT technology to make a Smart Industry Monitoring and Alerting System and perform data analytics on sensor readings using cloud service successively. This will detect any leakage of harmful gases, and thus reports the details of the leakage effectively. This model's vision is to develop a system that automatically senses and alerts the corresponding officials, thus stopping gas leakages in those permeable areas. Throughout this paper, our prototype's technological advantages – "IoT Based Smart Industry Monitoring and Alerting System" are being explored.**

Keywords* — *Air pollution, IOT, Sensors, Monitoring systems, Web-Server Based Applications, Internet, Big Data, Cloud, Wireless technology, Gas emission Sensing, Industrial applications.

I. INTRODUCTION

The idea of Industrial IoT received high response with the advent of automation. IoT has end up the maximum preferred region of studies because it targets to boom productiveness and performance. The quantity of automobiles and industrial machines has elevated to peak fold in these twenty years. This adversely resulted in the surroundings through the boom in air pollution water pollution respectively, which led to a dangerous effect on people's healthful lives [1],[3]. This has elevated the dwelling requirements of the commoner and contributed to the country's monetary growth[4]. IoT has converted itself to healthy numerous fields, particularly domestic automation, sensible buildings, clever cities, and appreciably contributing to fitness tracking [6],[10]. The advanced prototype can document the readings, which may be analysed [5]. Potential factors may be identified, and corresponding sensors may be hooked up to screen and document the records [2],[7]. IoT targets at growing the productiveness and performance of any industry, however environmental duty ought to be the top element of concern [8]. The large records may be despatched to Google Cloud, which allows tracking through legal employees across the globe. Hence, we initiate moves and actions to prevent these problems through properly designed alerting systems. Thus, by saving precious lives of many [9].

II. METHODOLOGY

The main focus of any enterprise is to have maximum productiveness with assured employee protection and environmental sustainability. A device

for real-time tracking of harmful gases and temperature proposed in this model with the aid of using correctly deploying shrewd sensors at extraordinary commercial ground points. The different sensors locate the extent of fuel line emission, leakage if any through gases, humidity levels, boiler temperature, etc., and passes a notification to the ground supervisor and the government TNPCB through the medium of Google Cloud respectively. A prototype primarily based totally on IoT Based Smart Industry Monitoring and Alerting System is being proposed to successfully supervise and regulate and elevate alarms in detecting gases and gasoline leakage above the secure restriction can assist keep away from accidents. Thus regulating the officials from overruling the resources and to ensure transparency in the industries.

2.1 System Architecture

The block diagram given below contains NODEMCU Unit, Arduino UNO, gas sensors, temperature and humidity sensor, power units, and a DC Motor. Sensors are connected to GPIO Pin of Arduino UNO. NODEMCU connected to UART Port of Arduino UNO, which collects the sensor values from Arduino UNO and sends them to the cloud. The Sensor Values are updated to two server rooms (Factory Server and TNPCB Government Server) and are constantly stored in cloud database using Firebase. If Processor receives abnormal values, a notification will be released in form of buzzer. TNPCB will send the warning message to respective factory official in their respective application developed for mobile. The obtained data is being sent to the cloud which helps tracking with the aid of using legal employees in TNPCB. Initiating preventive movements with the aid of using relay in case of any abnormalities determined withinside the acquired data.Thus, by regulating their actions successively.

2.2 Modules in the development

I. Implementing Sensor Integration and Calibration

- In this system, NODEMCU serves as a median internet connector for information accessing through cloud interface. The sensors are calibrated successively and attached to the GPIO Pins of Arduino UNO.

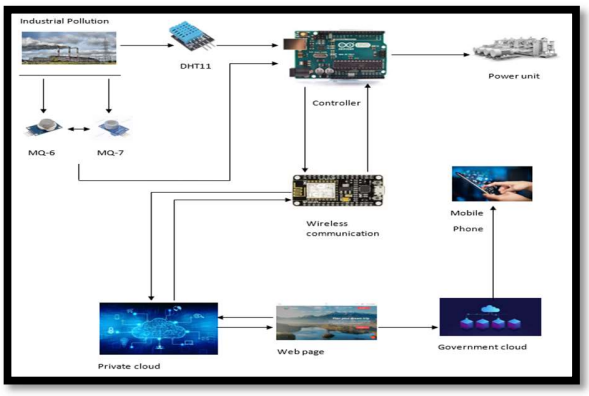

Fig. 1 – System Architecture Diagram

- All Sensors are successively wired to PCB board and are connected directly component's window as explained in the architecture illustration.

- Then we integrate and calibrate the three sensors that detect gases and temperature and humidity respectively with Arduino UNO before the information is detected and passed to the controller module.

II. Integration of Data between both servers (Private Cloud and Government) with sensors

- In this system, we integrate the data between both the servers i.e Public and Private Cloud through google firebase respectively with Arduino UNO before the information is detected and passed to the controller module.

- Both the clouds are synced successively and are connected directly in real-time.

III. Real Time Data Interpretation and Live Action of Power Outage Relay

Processor getting abnormal values from sensors it will activate buzzer sound reflected from both Government's and Organization's cloud server.

The two-step process happening at this juncture are:

- TNPCB would send one warning message to factory's authoritative pollution level manager.
- In case the company doesn't make any pollution controlling process, the power supply of the Factory unit is disrupted and the license will be cancelled by TNPCB.

III. SYSTEM IMPLEMENTATION

3.1 Sensor Integration and Arrangement

In the prevailing scenario, monitoring of emissions consisting of gases produced withinside the ecosystem could be very important. Right from home domestic equipment's consisting of air conditioners to electric powered chimneys, it is essential to monitor the gases. Gas sensors (MQ-6 and MQ-7) are critical a part of this system.

DHT11 – provision's a temperature & humidity sensing detail with a digitally - calibrated sign output. With the assist of this unique acquisition approach and temperature-humidity sensing technology, thereby guarantees good reliableness.

The Gas-sensor module includes a metal exoskeleton beneath which a sensing detail is housed. This tool is subjected to modern-day via connecting leads.

3.2 Reading Calibration using Arduino Uno

Sensors are a key aspect of the fault detection machine due to the fact they offer all of the statistics the machine will ought to deal with, even though in a few instances statistics coming from manufacturing control structures may be useful.

3.3 Factory and TNPCB Cloud Architecture

The Firebase Realtime Database is a cloud-primarily based totally database that allows to save and sync in real-time. Firebase gives backend services, easy-to-use SDKs, and ready-made UI libraries to authenticate customers to the app.

Firebase Cloud Service gives a dependable hyperlink among the server and gadgets that lets in to supply and get hold of messages and notifications on iOS, Android, and the internet successively at equal time. This statistic data is connected to the TNPCB Server at real-time.

3.4 Webpage and Mobile Application Development

Website is designed using PHP. The Mainframe of the pages is architected using HTML, CSS, SaSS and JS.

It consists of three webpages:

1.Home page

2.Login page

3.Registration page.

Every factory registers an account for its organisation. Once logged in, there would be a page for smart-meter which would showcase the value of gas, temperature, humidity and the status (whether it is a within or exceeding the permissible limit).

Mobile application is completely handled by the Organisation and used to have a check on the gas, temperature and humidity and to keep a check on its status. It is coded using java. There are two pages designed for login/registration and the other, once logged in shows the pollution status of the factory.

3.5 Warning Message Generation and Live Action Relay

The Webpage has three options under warning action

1. Sending the Email if the pollution level had exceeded

2. Switching off the power if the pollution level has still not been controlled even on receiving the e-mail and switching it on again after prior action taken by TNPCB, both ON and OFF button in the smart meter webpage are connected to the firebase. Firebase sends the corresponding Radio wave frequency to transmit the data to NODEMCU, which in-turn activates the relay to cause power outage at the factory end.

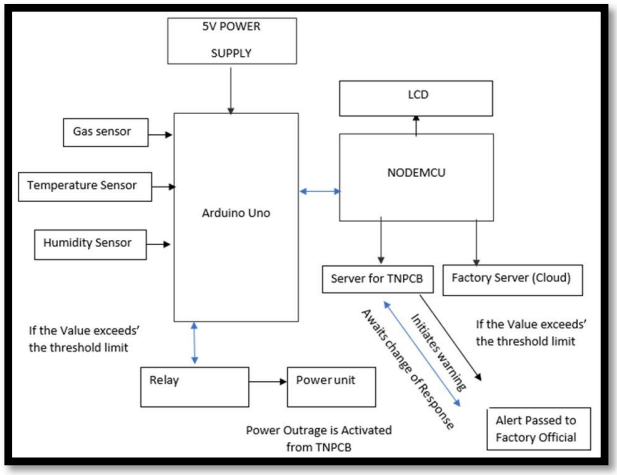

Fig. 2 – Working Flow Diagram of Module

IV. RESULTS AND OBSERVATIONS

Results Obtained

- The Prototype of Module – "IoT Based Smart Industry Monitoring and Alerting System" is successfully designed

- Both the Clouds are synced successively and are connected directly in real-time which are used to monitor, locate and successively alert gas leaks of a complex factory thus, controlling the pollution.

- The Sensor Values are updated to two server rooms (Factory Server and TNPCB Government Server) and are constantly stored in cloud database using Firebase.

- Able to monitor and identify the changes.

- This IOT based Smart Industry Monitoring system gives real-time monitoring.

- Detects Temperature, humidity, level of leaked harmful gases from industrial premises successfully

Challenges Addressed

- Need an internet connection to access from anywhere in the world without cannot access | Wifi has limited range Speed of the most wireless network

- Range affected by varies medium and slower than the cable.

The Working Images of the Developed Prototype Model are as follows:

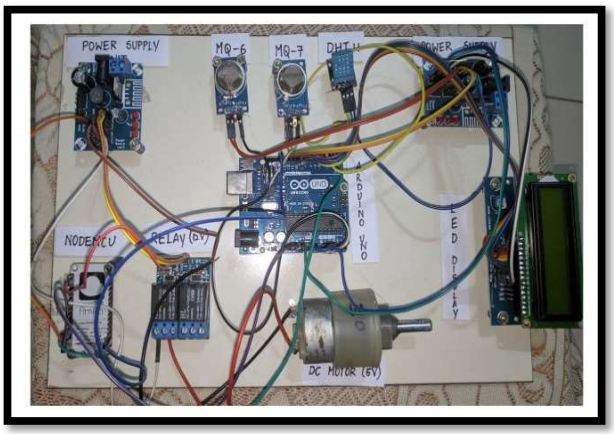

Fig. 3– Description of Various Sensors and other components in the prototype

Fig- 4 Readings Observed in the Model

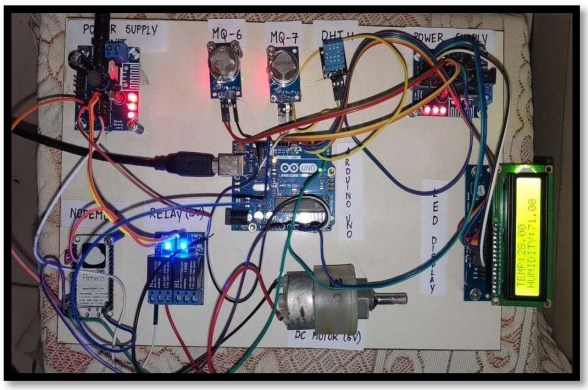

Fig. 5 - Module When Completely Powered ON

Fig. 6– APK Working Screenshots and Readings

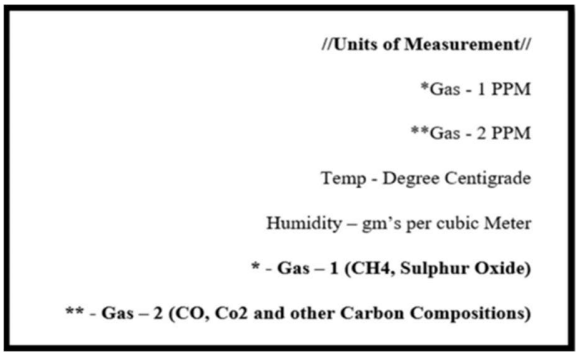

Fig. 7– Units of Measurement of Various Parameters

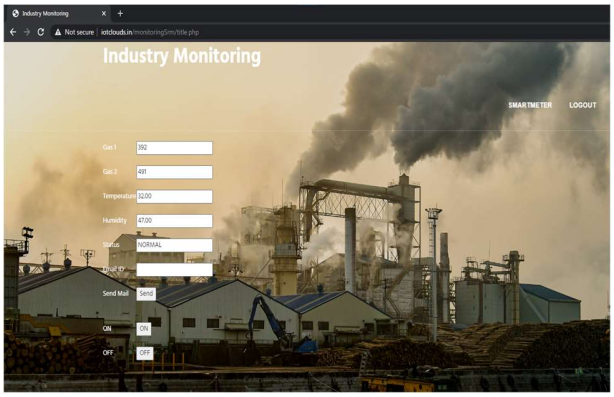

Fig. 8 –Webpage for the Government End

V. CONCLUSION AND FUTURE WORK

This prototype of IOT Based Smart Industry Monitoring System is a wonderful step closer to a healthful livelihood. With the assist of this tool now no longer handiest the industries can display the quantity of pollutants however even the authorities can take part withinside the system of controlling pollutants and make certain secure surroundings. This automated version, as soon as set up is able to constantly monitor the pollutants stage and analyses the detected information. The maximum highlighting function of this tool is that the output is represented in real-time and handy on clever telephones or even from the webpage. The tool itself may be very green and does now no longer damage the surroundings in any way. Moreover, it's far primarily based totally on one of the current technologies and additionally cheaper compared to different technology evolved thus far and may be set up efficiently.

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