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Smart Industrial Pollution Monitoring and Controlling

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ABSTRACT: In today's world, the majority of emissions monitoring systems are used in industry. The industrial parameters pollute the natural and industrial ecosystems in a predictable pattern. To build a robust system that can measure industrial pollution and help to reduce it .To decrease the human interference in monitoring the industries to reduce the pollution and providing a healthy environment for the workers. To make the industrial pollution monitoring a wireless and contactless system Our project's main objective is to monitor the parameters that cause emissions and reduce their effects without affecting the natural or industrial environment. Initially, different sensors were used to sense different factors such as gas level, pH, z level, and noise, and the industrial emission parameters were continuously sensed from them. Our project is proposed that to reduce the human interference in monitoring the industries to reducepollution.Industrial pollution is reduced with the help of ESP8266 module and some types of sensors. The ESP8266 wifi module includes a TCP/IP protocol stack, allowing any microcontroller to connect to our wifinetwork .The Four sensor used are pH sensor, IR flame sensor, Gas sensor, Noise sensor. The pH sensor is used to determine the pH value of wastewater, the IR flame sensor are used to detect the fire. The Gas sensor is used to detect the concentration of gases, the Sound sensor is used to detect the intensity of sound produced by the machine in industry. ThingSpeak is a cloud-based IoT analytics that helps us to analyze real-time data streams. The data sensed by the sensor that are stored in the cloud can be visualized for further purpose and outside world interaction for information transfer.

KEYWORDS: Internet of Things,ESP8266 module, Gas Sensor, pH sensor, Sound sensor, IR Flame sensor.

I.INTRODUCTION

Control and track a range of operations that are focused on latest technical developments. These are becoming more common in order to satisfy human needs. The bulk of this technology is directed toward efficient monitoring and control of various activities. An effective environmental monitoring system is required to track and evaluate conditions in the event that specified levels of parameters are exceeded. When an object is fitted with sensor devices, the microcontroller and various software applications in the system become a self-defending, self-monitoring, and self-controlling environment, also known as a smart environment.An embedded system is a microcontroller-based, software-driven, reliable, real-time control system, autonomous, or human or network interactive, operating on diverse physical variables and in diverse environments and sold into a competitive and cost conscious market. A BSN (Body Sensor Network) is an autonomous network that links numerous medical sensors and implants located within and/or outside the human body, providing healthcare professionals and patients with versatile operation and cost-saving options. This project demonstrates the design and implementation of a smart health management system, as well as the use of cloud technology and communications standards .As a result, there is a growing need for industrial emissions emission monitoring and control systems. Environmental pollution has become one of the most important issues affecting all nations, whether industrialized or emerging. Environmental pollution is rapidly growing, especially in developed country metropolitan areas where industrial enterprise and an expanding range of vehicles result in the release of tonnes of pollutants into the environment. Internet of Things (IoT) describes an emerging trend where a large number of embedded devices (things) are connected to the Internet. These connected devices communicate with people and other things and often provide sensor data to cloud storage and cloud computing resources where the data is processed and analyzed to gain important insights. IoT solutions are built for many vertical applications such as environmental monitoring and control, health monitoring, vehicle fleet monitoring, industrial monitoring and control, and home automation. To create a reliable system that can quantify industrial pollution and assist in its reduction, as

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well as to minimize human intervention in monitoring industrial pollution in order to reduce pollution and provide a safe working atmosphere for workers. To develop a reliable system that continually assesses industrial pollution, alerts when there is a rise in emissions, and takes steps to reduce it. Wi-Fi is used for remote monitoring in this project and other smart home projects such as control and automation of heating, ventilation, and air conditioning, among other things. This project could also help with home and environment treatment because we could track the parameters from anywhere with Wi-Fi access. This enables authorities to monitor air pollution in various areas and take appropriate action to address the problem. The main goal of this project is to avoid the negative effects of pollution in the air so that a safe environment can be preserved through data collection in the IoT cloud.

II. EXISTING SYSTEM

Existing pollution monitoring devices necessitated manual data collection and analysis on a regular basis, necessitating a community of people to constantly track and record the data. A model that has been developed to monitor the changeability of boundary conditions such as air, noise, temperature, humidity, and weight. Existing pollution monitoring systems required manual monitoring of the system from time to time, which necessitated a group of employees to constantly track the data and log into the information. The IoT system's architecture and prototype were developed. Using Mobile Sensor Networks, an algorithm for estimating the source of air pollution. Since workers, in particular, have been placed in perilous circumstances as a result of industrialization, it is important to track and regulate the parameters that cause pollution in the industrial setting. Manual structures place pressure on people to be flawless in all aspects of their job at all times, despite the fact that no one is perfect. With manual processes, the level of operation is dependent on individuals, necessitating continual training for employees in order to keep them engaged and ensuring that they are following proper procedures. It's all too common to swap information by mistake, resulting in inconsistency in data entry or handwritten orders. Furthermore, the individual in charge of information logging could alter the data as directed by higher officials, making it unreliable.

III. PROPOSED SYSTEM

The Arduino microcontroller is integrated with ESP8266 Wi-Fi module and data transmission takes place.Each sensor is integrated with Arduino, the values are monitored in the an IoT with the help of Wi-Fi module and controlled with the help of the hardware component. The Gas sensor detect the concentration of gases in the industries when the sensor value exceeds certain threshold value, the buzzer is employed to alert the people.The Sound sensor is used to detect the intensity of sound of the working machine, when the machines produce a high noise then the machine is automatically stopped.The Flame sensor is used to detect the fire that occur in the industry and an alert intimation and location of the Industry will be sent to the nearby fire station.The pH sensor monitors the pH value of the water if the water is acidic a neutralizing agent is supplied.The data produced by each sensor is stored in ThingSpeak.ThingSpeak is an IoT analytic platform service that allows you to aggregate, visualize and analyse live data streams in the cloud.

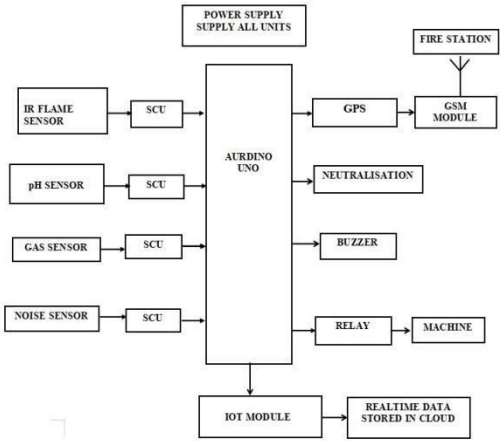

Fig.1.Block Diagram

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IV. HARDWARE COMPOENENTS

Hardware components are nothing but they are physical components which are implanted in the proposed system are

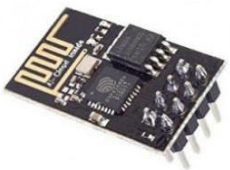
- Arduino UNO Micro-controller
- ESP8266 Wi-Fi module
- Gas sensor
- Sound sensor
- IR Flame sensor
- pH sensor
- Piezo Buzzer
- GSM Module
- GPS Module

ARDUINO UNO MICROCONTROLLER

Arduino is micro-controller which are destined to play an increasingly most important role in the revolution of various industries and that are influencing our daytoday life more strongly one can imagine. Arduino UNO micro-controller used is ATMEGA 328P. It is an 8-bit device which means that it can handle 8 parallel data signals by the data bus architecture and the internal registers. ATmega328P has three types of memory they are flash memory(32KB non-volatile memory),SRAM memory(2KB volatile memory),EEPROM(1KB non-volatile memory). The flash memory is used for sorting the application. Where you don't need to upload the application again whenever you unplug the Arduino from the power supply. SRAM memory is used for the storing the variables which are used by the application while it's running. EEPROM memory used to store data that will be available even after the board is powered up or powered down. The operating voltage about 1.8v to 5.5v.

ESP8266 WI-FI MODULE

The ESP8266 is a low-cost, user-friendly platform for connecting your projects to the internet. Since the module can act as both a hotspot and a station (connecting to Wi-Fi), it can quickly retrieve data and upload it to the internet, making the Internet of Things as simple as possible. It can also use APIs to fetch data from the internet, allowing your project to access any information available on the internet, making it smarter. Another appealing aspect of this module is that it can be programmed with the Arduino IDE, making it much more user-friendly.



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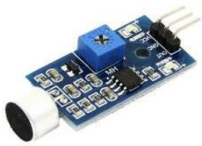
GAS SENSOR

Gases such as LPG, Alcohol, Propane, Hydrogen, CO, and even methane can be detected or analysed using the MQ-2 Gas Sensor. The module version of this sensor has a Digital Pin, which allows it to work without a microcontroller, which is useful when you only want to sense one gas. When measuring gas in ppm, the analogue pin must be used. The analogue pin is TTL powered and operates at 5V, making it compatible with most microcontrollers. With or without a microcontroller, this sensor can detect or quantify gases such as LPG, Alcohol, Propane, Hydrogen, CO, and even methane.

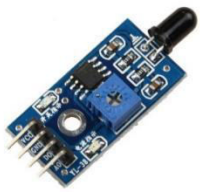
SOUND SENSOR

This sound sensor module is widely used to detect sound strength and offers a simple way to detect sound. The LM393 comparator IC detects when the sound has crossed a threshold value in this module, which is built on an electret microphone. A potentiometer on the monitor controls the sound frequency setpoint. An LED on the board illuminates when sound levels reach the setpoint, and the output is sent low.It uses a microphone to detect echo, which is then fed into an LM393 comparator IC. The computer is very easy to use and interface with Arduino, making it suitable for simple projects



IR FLAME SENSOR

A flame sensor is a device that detects the presence of a fire or some other bright light source. A Flame Sensor can be used in a variety of ways, but the one used in this project is an Infrared Radiation Sensitive Sensor.A flame sensor package with an integrated circuit that includes a flame sensor (IR receiver), resistor, capacitor, potentiometer, and comparator LM393. It can detect infrared light with a wavelength between 700 and 1000 nanometer. The light observed in the form of infrared light is converted into current shifts by the far-infrared flame probe. With a detection angle of 60 degrees, the onboard variable resistor can be used to adjust sensitivity.It uses a YG1006 sensor, which is a high-speed, high-sensitivity NPN silicon phototransistor. The sensor is sensitive to infrared radiation due to its black epoxy. A sensor can be an ideal addition to a firefighting robot because it can be used as a robot's eyes to identify the source of the fire. The Signal LED will light up when the sensor senses flame, and the D0 pin will go low.



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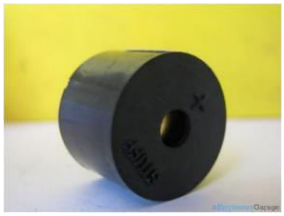
PH SENSOR

A pH metre is a precise instrument that monitors the movement of hydrogen ions in water-based suspensions and shows the acidity or alkalinity as pH. Since it calculates the difference in electrical potential between a pH electrode and a reference electrode, it's also known as a "potentiometric pH metre." The acidity or pH of the suspension is linked to the difference in electrical potential. This metre is used for testing, quality control, and other purposes. The pH Meter calculates the voltage of an electrochemical cell and determines the pH of a suspension using the Temperature Sensor.

PIEZO BUZZER

A piezo buzzer is a type of electronic system that produces sound. It can be used in a variety of applications, including car/truck reversing indicators, computers, and call bells, due to its light weight, easy construction, and low price. The inverse theory of piezo electricity, discovered by Jacques and Pierre Curie in 1880, is the basis for the Piezo buzzer. It's the phenomenon of certain materials producing electricity as mechanical strain is applied to them, and vice versa. These compounds are referred to as piezoelectric materials. Piezoelectric materials may be found in nature or manufactured. Piezoceramic is class of manmade material, which poses piezo electric effect and is widely used to make disc, the heart of piezo buzzer. When subjected to an alternating electric field they stretch or compress, in accordance with the frequency of the signal thereby producing sound.



GSM MODULE

SIM900A Modem is based on SIMCOM's Dual Band GSM modem. It runs at a 900MHz frequency. These two bands can be automatically searched by SIM900A. AT Commands may be used to adjust the frequency bands as well. Using the AT button, you can change the baud rate from 1200-115200. The SIM900A is a wireless module that is ultra-compact. The modem comes with an interface that helps you to connect your PC to a microcontroller that has an RS232 chip (MAX232). It can be used in M2M systems for SMS, speech, and data transferYou can use easy AT commands to make audio calls, send SMS, read SMS, answer incoming calls, and so on with this modem. This is a full GSM module in SMT format, made with a very powerful single-chip that allows for small dimensions.

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GPS MODULE

GPS modules contain tiny processors and antennas that directly receive data sent by satellites through dedicated RF frequencies. From there, it'll receive timestamp from each visible satellites, along with other pieces of data GPS is a system of 30+ navigation satellites circling Earth. We know where they are because they constantly send out signals. A GPS receiver in your phone listens for these signals. Once the receiver calculates its distance from four or more GPS satellites.

V. SOFTWARE REQUIREMENTS

The software used in the proposed system are

- Arduino IDE
- ThingSpeak

ARDUINO IDE

The Arduino Integrated Development Environment (IDE) is a cross-platform application that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards.

THINGSPEAK

ThingSpeak is a cloud-based IoT analytics tool that lets you compile, visualise, and interpret live data streams. ThingSpeak offers real-time visualisations of data sent to ThingSpeak by your computers. With the ability to run MATLAB code in ThingSpeak, you can analyse and process data as it arrives in real time. ThingSpeak is commonly used for IoT device prototyping and proof of concept that require analytics.

VI. OUTPUT

THINGSPEAK WEBPAGE RESULT

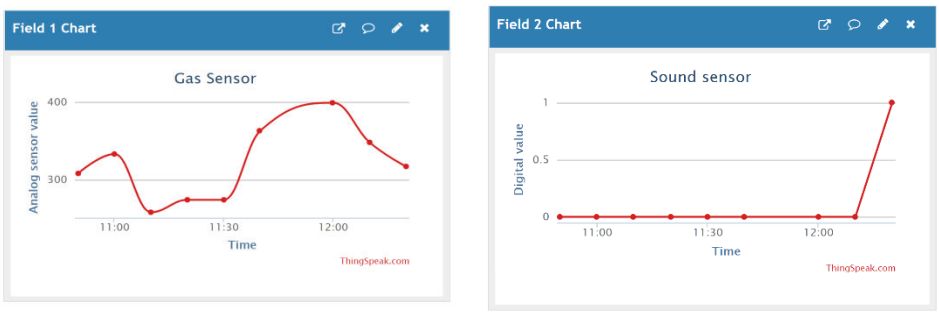

Fig. Shows Gas level and Sound level using ThingSpeak server.

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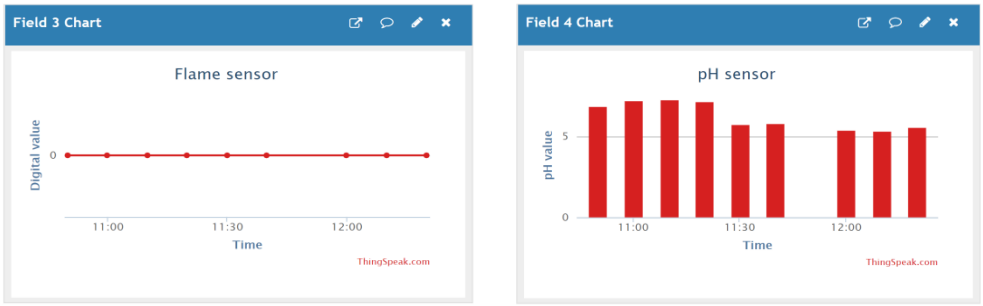

Fig. Shows Flame level and pH level using ThingSpeak Server.

VII. CONCLUSION

The most powerful technology IoT primarily based atmosphere observation pollution system was designed, implemented by mistreatment thingspeak environment. The gas, sound, flame and pH level are monitored terribly glorious through net. It's quite helpful as compared to manual observation and additionally it's reliable because it is not possible to watch continually the pollution parameter manually to examine the sensor measure and so we will recover the system in less time and faults before any unsure failures so leading to important price saving in addition as up system reliableness. The performance between accuracy and price is achieved by creating use of arduino, Wi-Fi module and applicable sensors resulting in a well grounded system. The attainment and robustious of the industrial pollution monitoring and control system can further be improved by implementing sensors for controlling pollution level thereby improving the industrial and natural environment. The thingspeak server contributes quick response rate and the diffusion of the critical situation can be made faster than the manual methods.

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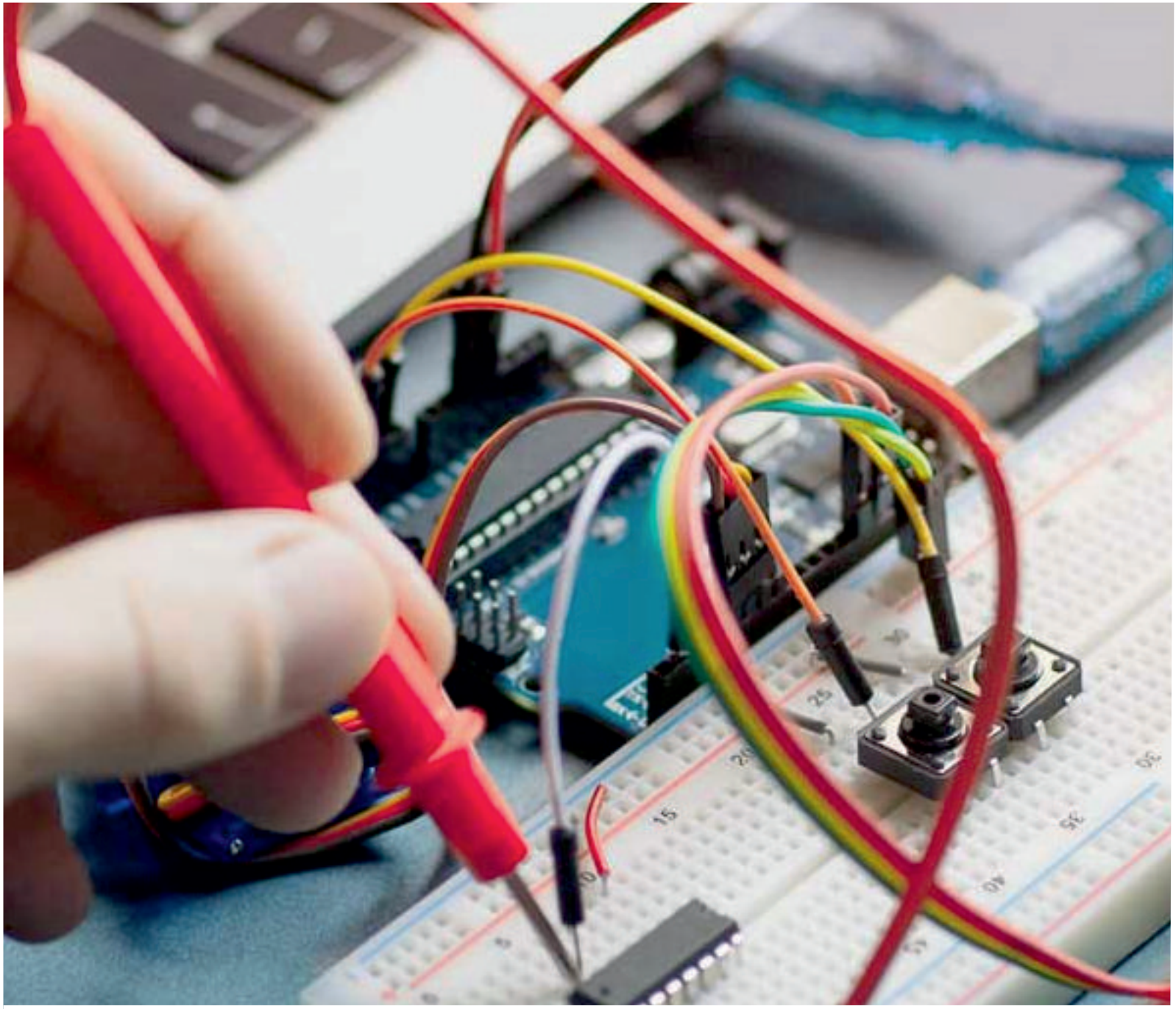

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