IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

HARMFUL GAS DETECTION AND MONITORING SYSTEM IN INDUSTRIES USING IOT

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Abstract: Harmful gas leakage accidents are the main reason for workers death in industries which work mainly using chemicals. Gas leakage can be easily detected and controlled by using latest trends in information technology by applying internet of things. This project intended to avoid industrial accidents and to monitor harmful gases and to intimate alert message to safety control board of industry using Arduino Uno R3 and internet of things. Ardunio Uno R3 board is used as central microcontroller which is connected with sensor. Such as temperature, gas sensor, alcohol sensor which can continuously monitor respective environmental parameters. Hence this device may be used as multi gases detection apparatus more over the rate of response is high. An alarm is produced instantly if the level of the gases goes above the normal level means indication through the internet specific receiver section. Data received by sensor is stored in internet which can be used for further processing and it can be analyzed for improving safety regulations. This model can be future extended for providing better living environment for people in and around industries with a pollution controlled environment.

Key Words- Ardunio Uno R3, gas sensor, radiation sensor, Wi-Fi module, internet of things.

I. INTRODUCTION

These days harmful gases leakage is the main reason for industrial accidents and deaths of workers in industries. Pollutants released by industries in to atmosphere is also a cause for the environmental pollution and such the reason greatly effects humans and animals health by minimizing the levels of oxygen and increasing the levels of harmful gases like ammonia, carbon monoxide, nitrogen trifluoride, sulfur hexafluoride etc,, .These gases are mainly the reason for increasing the no of pollutants in atmosphere. These environmental pollutants are mainly released by industries working with chemicals. Industries management only have a eye on profits and consider environmental safety as least priority which in turn affects the atmosphere and industrial workers health who are living in and around industries as the level of harmful gases are high around industrial areas compared to normal living places. it is observed that about a 1.1 billion of human population respiration is done through unhealthy air and recorded 7 million deaths occur globally.

Gas leakage and detection of gas leakages and harmful gases in and around industries and can be effectively handled by using sensors and automation using IoT . Here we developed a basic model for detection of harmful gases and measurement of harmful gases on a self-calibrated ppm scale and notifying the workers of industry by sms in case any gas leakage is occurred in any sector of the industry.MQ-6 Semiconductor Sensor for Combustible Gas detection is a Sensitive Gas sensor. The sensitive material of this MQ-6 gas sensor is SnO2, which works with lower conductivity in clean air. When the target combustible gas exist, the sensors conductivity is higher along with the gas concentration rising. As the conductivity increases the current in the circuit of the sensor increases which results in lower sensor resistance. This change is used to correspond the output signal of gas concentration. MQ-6 gas sensor has high sensitivity to Methane, Propane and Butane and could be used to detect both Methane and Propane. The sensor could be used to detect different combustible gas especially Methane, it is with low cost and suitable for different application. According to the value received if that is above threshold, microcontroller will turn on LED and Buzzer and message is start viewing on the 16x2 LCD display. Once few milliseconds delay, it conjointly sends the information over the internet for throwing gas out. This information that is send over the server created on the internet and a Smartphone application can be used to notify. The data on the server is displayed at a webpage for user.

II. REVIEW OF RELATED LITERATURE

A. Gas leakage Detectors

Traditional Gas leakage detection approaches fall under two categories:1) fixed instrumentation and 2) mobile sensing [2]. In fixed instrumentation, sensors are appended in regions of associated with leakage (valves, compressors, and so on). These instruments normally require consistent power source and generate alerts in light of their inspected information. These cautions can be visual or capable of being heard, or can nourish specifically in a plant administration. Mobile sensor is generally a hand-held device. The specialist needs to place this at the presumed leakage source and assess the readings. Estimated reports are transferred progressively either through a remote association or by coordinate correspondence between the specialist and other plant representatives. Both these strategies have their favorable circumstances and detriments, but regularly, a hybrid arrangement of fixed and portable sensors is executed [2]. Specifically, a fixed sensor can persistently screen a region, rather than a laborer who tests a similar district for a couple of moments. As our proposed solution is static, we are interested in fixed sensors. A number of wireless safety devices for gas leakage detection are proposed [4]. It is designed for household safety applications. Most of them include the detection and transmission module, and the receiving module which detects the change of gas concentration using a special sensing circuit, checks if a change in concentration of gas(es) has exceeded a certain predetermined threshold and activates an audiovisual alarm and sends a signal to the receiver module which acts as a mobile alarm device to allow the mobility within the house premises [5].

B. Internet of Things

The Internet of things is the internetworking of physical devices like vehicles, buildings, electronic or any general appliances and other connected devices embedded with sensors, network connectivity, actuators etc. which lets these devices to exchange data among themselves and perform any action as per requirement. It enables sensing and control from remote location. Hence, it creates a platform for integration of physical world with the network infrastructure leading to improved accuracy and efficiency with minimizing the time needed to carry out the process manually. The economic benefits also huge and is penetrating into global market share. The connectivity goes beyond the machine-to-machine communications hence leads to not only connection of servers or hosts but also the devices leading to automation in almost every field.

The application of IOT encompasses almost every field. Few of them are listed as: Smart Home, Smart Logistics, Smart City, Wearable, Smart Supply chain, Smart farming, Intelligent Transportation System

Each device in the network is identified by a unique address because of embedded computing system and can operate in that network infrastructure with the help of existing protocols and domains. As per the estimates by the experts, IOT will comprise of approximately 50 billion devices as part of some network infrastructure.

With the expansion of network and increase in the number of devices being automated, there will be large amount of data generation from distinctive locations which needs quick processing and analysis to act upon it as per the scenario. IOT can be extended for application in manufacturing for process control and asset management. Intelligent Manufacturing will not only increase the throughput but will also optimize the real time production and supply chain. Lesser the human intervention and greater the automation will result into better accuracy and efficiency. IOT term is often encountered in manufacturing industries which have incorporated IOT in production and manufacturing process. It can be picture as industrial subset of IOT. It is estimated that the industries will be able to improve productivity by creating new business models and exploit analytics for faster data processing. As per the most recent estimate, the potential growth by implementing IOT will generate huge amount of revenue approximately 12 trillion by 2030.. There is a need to control as well redirect the data flow for the huge amount of data generated. Hence, it may pose a need for new routing algorithms and data mining capabilities to coordinate among the interconnected devices

The most important aspect to keep in mind while connecting things is the limited memory capability in-built in these devices or things. Hence, they must be loaded with lightweight operating system and use light-weight protocols which should be able to fulfill the demands made by interconnectivity. Connecting devices to the network and the data generated raises security concern for the limited capability IOT devices. The security issues from technical point of view are similar to that of traditional servers but due to constraints posed by the limited capability, it is difficult to install firewall or anti malware systems to protect these devices from unauthorized access. Recently in 2016, a distributed denial-of service attack by IOT connected devices took place which was powered by Mirai malware and it ended up taking down not only major websites but also few DNS providers. Hence, the security concerns need to be resolved for safe and secure coordination and control between devices.

III. WORKING PRINCIPLE

The existing system used zigbee module transmitting and receiving information data bit rate is 250 kilo bits per second [6]. This system is mainly used Wi-Fi module transmitting and receiving information data bit rate is 54 mega bits per second. Wi-Fi module using getting information very quickly to reach desired designation or location peoples or related government officers.

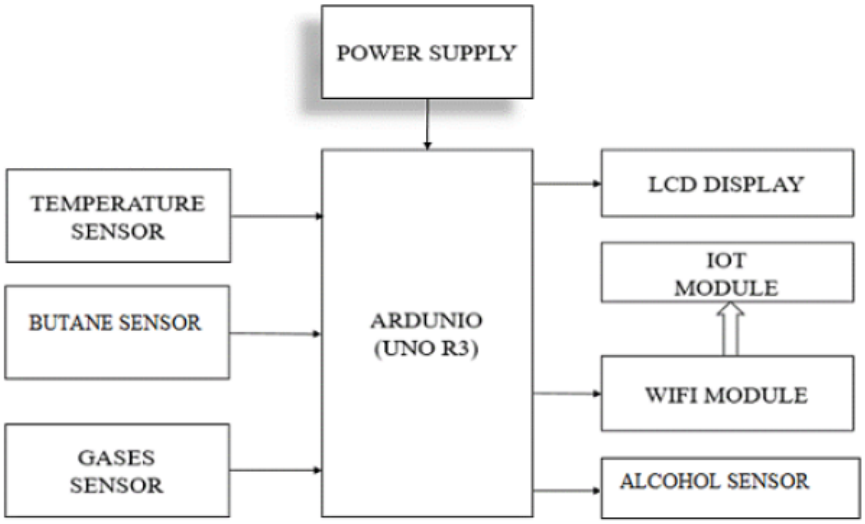

FIGURE 1: Block Diagram of Harmful gas detection and monitoring system In industries using IOT

- ***Hardware used***

MQ2 Sensor

MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide.MQ2 gas sensor is also known as chemiresistor. It contains a sensing material whose resistance changes when it comes in contact with the gas. This change in the value of resistance is used for the detection of gas.

MQ7 Sensor

This is a Carbon Monoxide (CO) sensor which can be easily utilized, appropriate in detecting cabon particles gas radiation noticeable focusing all around. This MQ-7 sensor has a range of 20 to 2000 PPM for detecting carbon particles gas radiation .This sensor is having high affectability with quick reaction time.

MQ135

MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benzene steam, also sensitive to smoke and other harmful gases. Sensor SnO2 has the lower conductivity in the clear air which is used by Mq135 gas sensor as gas sensing material. The conductivity of this gas sensor increases as the concentration of gas that polluting the atmosphere increases.

Linear Monolithic 35 Sensors

LM35 is a temperature measuring device having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade (Celsius). It does not require any external calibration circuitry. The sensitivity of LM35 is 10 mV/degree Celsius. As temperature increases, output voltage also increases. It is a 3-terminal sensor used to measure surrounding temperature ranging from -55 °C to 150 °C. LM35 gives temperature output which is more precise than thermistor output.

Wi-Fi Module

ESP8266-Based Serial Wi-Fi Shield for Arduino is planned and created by Shenzhen Doctors of Intelligence &Technology (SZDOIT). At long last Cloud Server will apply information mining on informational indexes. It likewise mail or SMS Technician and send points of interest to the Owner (mail or SMS). We can interface any number of clients on cloud server so it underpins multi client framework attributes. Here we can utilize just a single cloud server yet we can associate many quantities of users to it by means of pc, or any android gadgets.

LCD Display

The LCD (Liquid Color Displays) for Arduino gives a straightforward correspondence between the client and the electronic framework in a simple and justifiable dialect. For any microcontroller, perusing and composing the characters to the LCD is the need errand, and among of microcontrollers, Arduino is the best. Arduino is an extraordinary stage for prototyping to interface the LCD shows, actuators, sensors, and so forth. Contingent upon your necessities and prerequisites.

Alarm

The caution or signal utilizing this framework primary reason is demonstrated to ready working individuals and staying individuals moved wellbeing place spare the general population life and condition.

Power Supply

6 to 20 volts power supply should be given to turn on the board. On the off chance that provided with under 7V, in any case, a 5volts stick will supply under with five volts and the board might be unsteady. On the off chance of utilizing more than that of 12V, the voltage controller unit may get overheated and can harm the board. The range prescribed is 7 to 12 volts. I've discovered that utilizing 9V functions admirably. You can essentially interface the + end of your battery to Arduino VIN and the conclusion to Arduino ground.

Arduino UNO

Arduino UNO is a microcontroller board based on the ATmega328P. The Arduino Uno R3 pin diagram is shown below. It comprises 14-digit I/O pins. From these pins, 6-pins can be utilized like PWM outputs. This board includes 14 digital input/output pins, Analog inputs-6, a USB connection, quartz crystal-16 MHz, a power jack, a USB connection, resonator-16Mhz, a power jack, an ICSP header an RST button.

- ***Software Used***

Arduino IDE Software

The Arduino Integrated Development Environment (or) Arduino Software (IDE) contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. By using this software and Embedded C program we debugged the program to the Arduino UNO. The Arduino Software (IDE) uses the concept of a sketchbook: a standard place to store your programs (or sketches). The sketches in your sketchbook can be opened from the File > Sketchbook menu or from the Open button on the toolbar. The first time you run the Arduino software, it will automatically create a directory for your sketchbook. You can view or change the location of the sketchbook location from with the Preferences dialog.

Thingspeak Software

ThingSpeak is an IOT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. Features of ThingSpeak include real-time data collection, data processing, visualizations, apps, and plugins. At the heart of ThingSpeak is a ThingSpeak Channel. A channel is where you send your data to be stored. Each channel includes 8 fields for any type of data, 3 location fields, and 1 status field. We Used Thingspeak software to store the Sensed values.

ALGORITHM

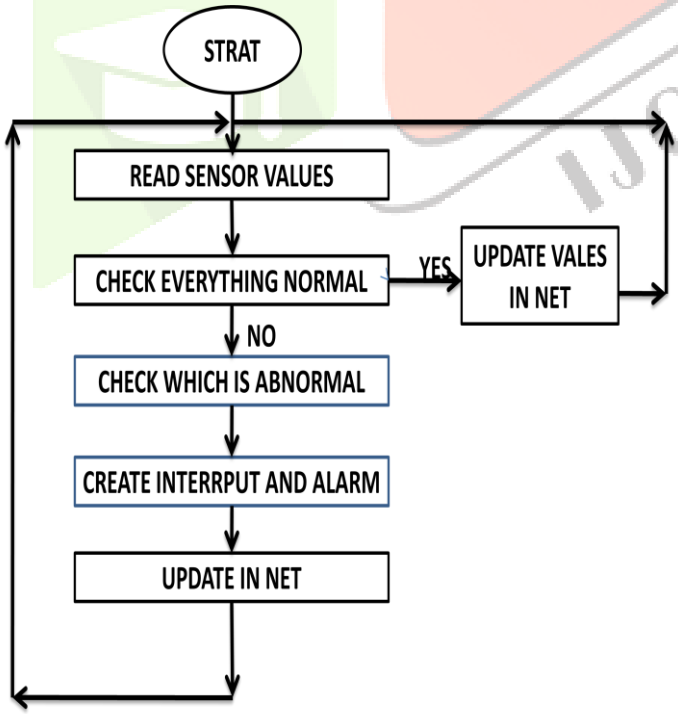

FIGURE 2 ALGORITHM OF SYSTEM

Sensors continuously monitors the gases in the surrounding and posts in to the server for storing and usage of data futurly. While continuously monitoring if any gas level exceed the range to that of normal range in air the alert will be enhanced and a SMS notification will be posted to safety control board of organization and even to the workers mobile station only if required. In figure 5 it carries the syntax of parameter (maximum permissible value) = value detected at the moment. If value detected at that particular moment is greater than that of maximum permissible value an SMS has sent by imitating the GMS module through commands programmed in micro controller.

IV. PROPOSED ALGORITHM

Step 1: Initialization.

Step 2: Connect power supply.

Step 3: Sensors will sense the gas levels.

Step 4: Sensed value is updated to Arduino.

Step 5: Where it checks the sensed gas levels are Normal or Abnormal.

Step 6: If the sensed gas levels are more than fixed threshold value then it make buzzer sound.

Step 7: The gas levels are stored in cloud through the Wifi & IOT module.

Step 8: When we need to see the past gas levels then we can visit Cloud platform and where we can get the values.

Step 9: Repeat the same process.

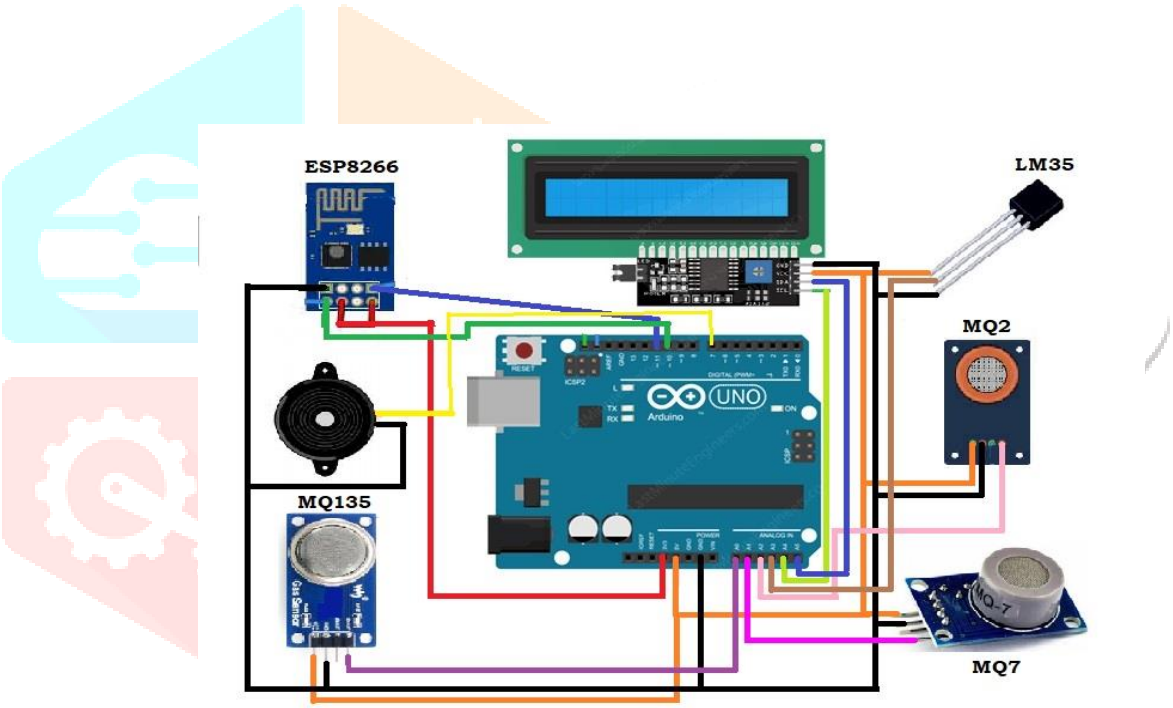

FIGURE 3 SIMULATION LAYOUT

The Arduino UNO is the main heart of this project. MQ2,MQ7,MQ135,LM35 , buzzer, ESP8266 Wifi module, 16x2 LCD display are connected to the arduino. Each gas sensor analog pins are connected to the arduino analog inputs. LM35 temperature sensor output pin is connected to the arduino. VCC and ground pins of all sensors are connected to the 5V & ground pins of arduino respectively. I2C module is connected between LCD display and arduino, I2C module converts the series input to the parallel output.

Gas sensors and temperature sensor continuously sense the gas & temperature levels, if the sensed gas levels is normal then it will updated to the cloud by the use of IOT module. The sensed values are displays in LCD display. While the sensed gas levels are abnormal then the buzzer sounds, then it is updated in cloud. Like this the temperature is also sensed by sensor, if it abnormal then the buzzer sounds and the data stored in cloud for future use.

V. RESULT AND DISCUSSION

Display has been reenacted by utilizing by Proteus Software to screen the noxious gas and radiation location utilizing distinctive sensors. The adjustment in, carbon monoxide, smelling salts, radiation, methane will be recognized by separate sensors and can be resolved. Figure 4 shows the prototype for the system design. Fig5 shows the values of gases that are continuously detected by the sensors having a temperature sensor is a added minimum requirement besides gas sensor.

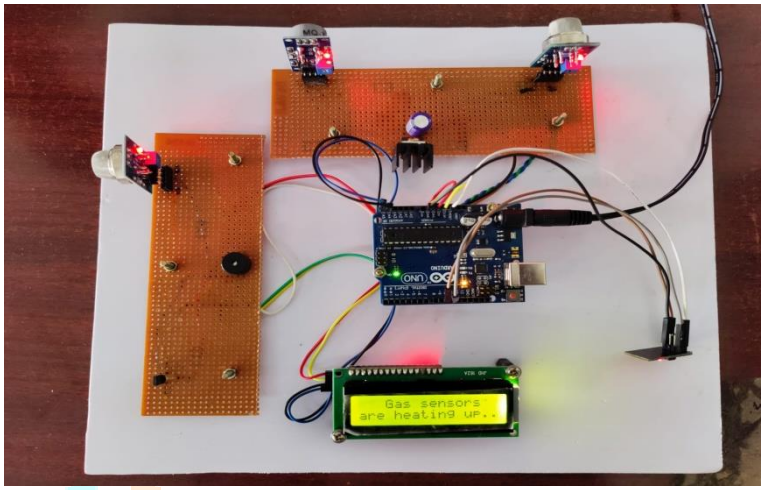

Figure 4 Complete experimental setup

FIGURE 5 GRAPHICAL REPRESENTATION OF DIFFERENT GASES

VI. CONCLUSION AND FUTURE SCOPE

In this project work a clever framework for toxic gas and radiation discovery checking cautioning has been created to defeat the drawback looked in more established techniques by utilizing Wi-Fi module and web of things. Consequently the utilization of serial correspondence makes the framework with Arduino controller and IOT. The IOT door associate remote sensor connects with the web, guarantee the operation of the gas and alcohol observing framework. It utilized just constrained sensor. Created application additionally utilized for checking gas and radiation in android portable. The main Limitation of our project is In order for a leak to be detected, the GAS itself must either be in close proximity to the detector or within a pre-defined area. Unfortunately outdoor environmental conditions such as changing wind directions and quick dispersion of the gas cloud from a leaking outdoor installation often cause gas detection to fail simply because the gas never reaches the detector. In future we can implement the GSM module to get the alert message in industry. From this the workers can go outside when the alert message came to their Phones.

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