



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 3, March 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com



Design and Development of Fire Safety & Alerting System

Mr. M. Shivaji¹, L. Rakesh Babu², D. Sravan Kishore³, B. Dhanush⁴, K. Nikhil Sai⁵

Assistant Professor, Department of ECE, Sri Vasavi Institute of Engineering & Technology, Nandamuru, A.P, India¹

U.G. Student, Department of ECE, Sri Vasavi Institute of Engineering & Technology, Nandamuru, A.P, India²

U.G. Student, Department of ECE, Sri Vasavi Institute of Engineering & Technology, Nandamuru, A.P, India³

U.G. Student, Department of ECE, Sri Vasavi Institute of Engineering & Technology, Nandamuru, A.P, India⁴

U.G. Student, Department of ECE, Sri Vasavi Institute of Engineering & Technology, Nandamuru, A.P, India⁵

ABSTRACT: These days, we read in our daily newspapers and social media about "Fire accidents occurring in industries as well as in gas firms." High temperatures and combustible gases in the environment are one cause of those fire mishaps. Also, it is important to keep an eye on the air quality at the workplace. This research focuses on a tool that can measure the industrial environment's air quality index and employee fire safety precautions. This is accomplished by connecting a gas sensor MQ135 for monitoring air quality, a DHT11 (humidity and temperature) sensor for measuring temperature, and an IR-based flame sensor for fire safety to a WIFI-enabled Raspberry Pi Microcontroller. The proposed device interacts with Thing talk cloud storage to acquire the data at what temperature and amount of combustible gases there is a potential to cause fire accidents.

KEYWORDS: Raspberry pi, DHT11 Sensor, MQ135 Gas Sensor, Flame Sensor, GSM, GPS, Exhaust Fan, Speakers, LCD display.

I.INTRODUCTION

In today's technologically advanced world, keeping an environment that is favourable, acceptable, and healthy for humans requires constant monitoring of air quality is crucial. This platform has consistently demonstrated that by being deployed in a range of disciplines, they may greatly contribute to the rapid resolution of difficulties faced in industries. Two key difficulties that come up in industries are the safety of the workers and the quality of the air along with fire safety. As a result, this paper proposes a solution to the problem. The earlier research on this subject that has been carefully examined is listed below. [1] outlines a system that interfaces an Arduino Uno with a Bluetooth module, a CCS811 multi-function sensor, and other components to identify and warn users of the presence of volatile organic chemicals. Liu Peng et al. [2] have presented a mobile module that utilises air quality monitoring sensors for MQ-7, DHT22, and Sharp PM2.5. A Raspberry Pi 3B microcontroller is used in [3] to get the required readings and output, which is then stored on a cloud server, via interacting with the DHT11, MQ135 gas sensor, and LM393 sound sensor. A system was developed by Gagan Parmar and associates. An air quality monitoring system in [7] is monitored along with temperature, humidity, and other environmental parameters with the help of data loggers, increasing its effectiveness for getting the desired results. A PIC microcontroller [8] can be used to build an air quality monitoring system that communicates with an internet access point, employs a variety of sensors to show the necessary readings on an LCD screen, and links to a mobile app via an internet server. Ravi Kishore Kodali et al. have created a system that uses an ESP8266 NodeMCU microcontroller, DHT, MQ2, and HC-04 sensors to monitor the environment and submit data to the Losant web platform [9]. There are [10] different industries that can use various smart gas sensors. The technology differs from other systems in that it may also be utilized for mobile sensing. [11–12] interfaces an Arduino UNO and an Arduino Nano with a Bluetooth module and a number of gas sensors to produce wireless sensor nodes. The data is therefore further examined, saved on cloud services, and dynamically shown on the mobile app. A system using an Arduino UNO as the main building block connected to a GSM and Bluetooth module has been demonstrated in [13]. It employs an Android app with a user-friendly Graphical User Interface to send commands through Bluetooth. In their study, Roman A. Lara-Cueva et al. describe the construction of a dynamic system that interfaces a gas sensor board with Zigbee and Wasp mote boards [14]. MATLAB is used as a software tool to obtain the data, which is then further examined for the CO₂ concentrations in the campus area. [15] describes a system where a Raspberry Pi is



connected to an Arduino UNO and a sensing unit made up of DHT, DSM501A PM, MQ135, and MQ9 sensors to manage data for measuring and analysing air quality using cloud computing. This system is more effective because it uses two separate controlling units that are connected to each other.

II.METHODOLOGY

We are going to design a hardware system that includes a fire alerting system as well as an air monitoring system as part of our system proposal. By calculating the temperature and Air Quality in ppm of the industrial locations We will use speakers to warn the staff that there is a potential of a fire disaster occurring right now, so stay vigilant. The main components of the project and the microcontroller used for this system implementation is the Raspberry Pi 3, DHT11 Sensor, MQ135 Gas Sensor, Flame Sensor, GSM, GPS, Exhaust Fan, Speakers and LCD display. We are connecting the MQ135 Gas Sensor, which is designed to find dangerous, toxic, and flammable gases that may be present in an industrial setting to the Raspberry Pias shown in fig.1 and fig.2.

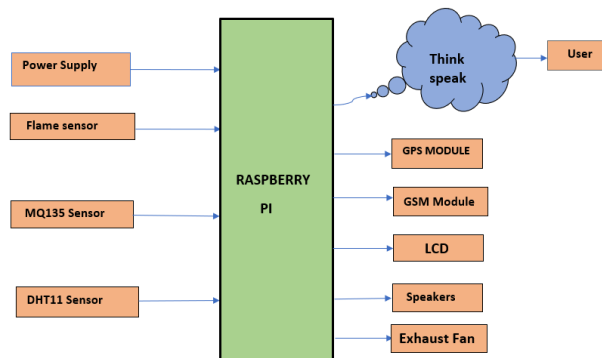


Fig.1 Block Diagram of Proposed System

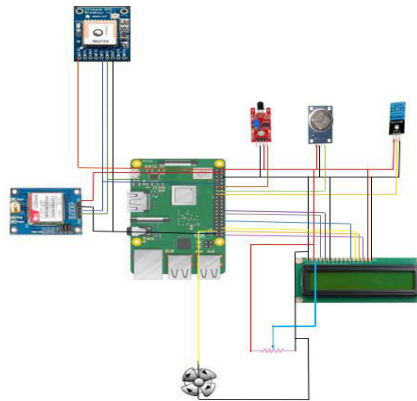


Fig.2 Circuit Diagram of Proposed System

If there is no chance to convey the dangerous gases through exhausted fans or ventilators, there is a chance that a fire accident will occur. DHT11 Sensor for updating the temperature in the surroundings. In the event of a fire accident, the fire diction sensor allows us to detect the incident and send a message by GSM and the location of the incident via GPS to the appropriate fire department. The entire procedure is recorded in the THINKSPEAK Server. The Flow chart shows how the proposed system is working and providing security to the employees in industries or gas companies as show in Fig.11.

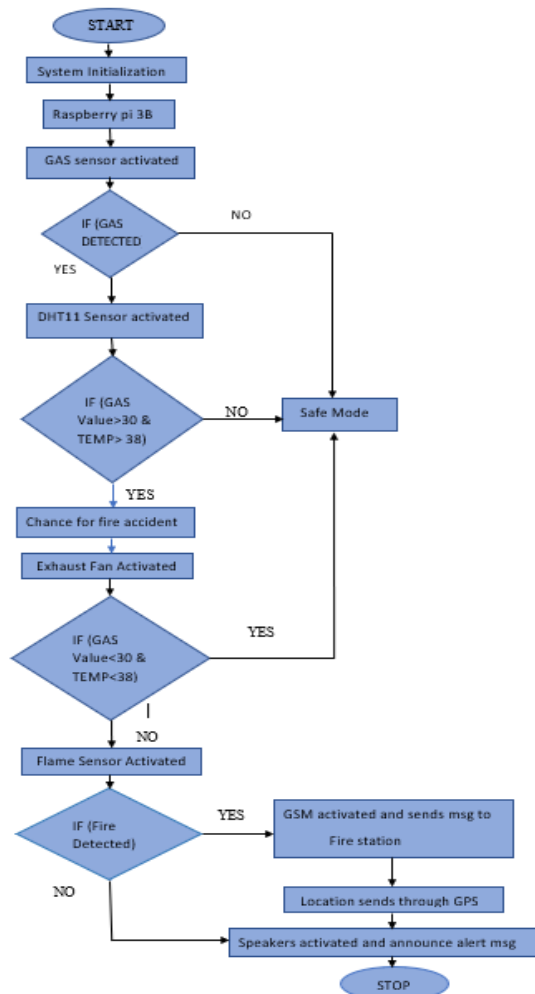


Fig.11. Flow Chart of Proposed System

III. HARDWARE REQUIREMENTS

RASPBERRY PI 3B:

As seen in Fig.3, Raspberry Pi is a line of miniature single-board computers (SBCs) created by the Raspberry Pi foundation. An SBC is a complete computer built on a single circuit board, with microprocessors, memory, input/output, and other characteristics necessary for a functional computer. A wide com system on chip (SOC) with an integrated ARM-compatible CPU and on-chip graphics processing unit is present in all variants (GPU). The foundation offers third-party Windows 10 IOT core, RISC OS, and specialised media centre distributions for download, in addition to the Raspbian (OS for Raspberry pi) based Linux distribution.

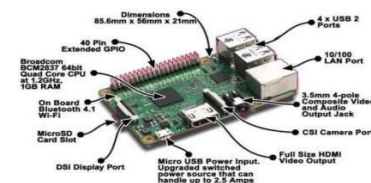


Fig.3 Raspberry Pi3B+

DHT11 SENSOR:

Temperature and humidity are measured using the DHT11. It operates via NTC. Negative temperature coefficient is referred to as NTC. Temperature and humidity are provided by the sensor as serial data. Interfacing with a

microcontroller is simple. This sensor measures temperatures between 0 and 50 degrees Celsius. The DHT11 sensor is depicted in Fig. 4 as such.

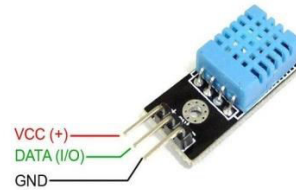


Fig.4 Temperature Sensor

GSM:

Global System for Mobile Communications, or GSM. Cellular network, that is. GSM networks function across four distinct frequency bands. The bands are either 900 MHz or 1800MHz. Because the 900 and 1800 MHz frequency channels were previously assigned, several nations use the 850 MHz and 1900 MHz frequencies. In some nations, where these frequencies were formerly used for first-generation systems, the more uncommon 400 and 450 MHz frequency bands are in use. In fig.5, the GSM is depicted as



Fig.5 Global System for Mobile Communication

GPS:

GPS is an abbreviation for "Global Positioning System." It relies on satellite communication to function. Today, GPS is widely utilized and is integrated into most smartphones. Anyone having a GPS receiver and a clear line of sight to at least four GPS satellites is free to use the system. It operates in the 3.2 to 5V supply range, allowing it to interface with both 3.3V and 5V microcontrollers. Fig.6 shows the G

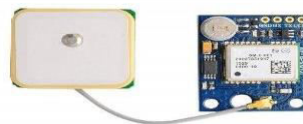


Fig. 6 Global Positioning System

MQ135 GAS SENSOR:

The MQ135 is a sensor for air quality that can identify a variety of gases, including NH₃, alcohol, Smoke, carbon dioxide, and benzene. So, they are perfect for workplaces, factories, or other commercial settings. The MQ135 gas sensor is extremely sensitive to harmful gases such as ammonia, sulphide, smoke, and others. It is appropriate for air quality monitoring applications because of its inexpensive cost and fig.7 displays it



Fig.7 MQ135 Gas Sensor

FLAME SENSOR:

This sensor—basically an infrared radiation-sensitive sensor—is used to find the presence of a fire source. The black LED installed on this module, which is a YG1006 NPN phototransistor, is included. In order to detect and respond to the incidence of a fire or flame, it has three pins: GND, VCC, and digital output pin. A flame sensor frequently reacts more quickly and accurately than a heat or smoke sensor because of the processes it employs to detect the flame. Flame sensors are frequently used to check whether furnaces are operating properly. These sensors are also utilised in ignition systems to obtain precise actions or, in the absence of such, to alert the operator, as seen in fig.8.

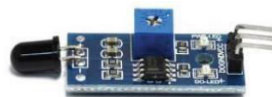


Fig.8 Flame Sensor

LCD DISPLAY:

The 4-bit mode and the 8-bit mode are the two operating modes for the LCD. In the 4 bit mode, we transfer the data one bit at a time, higher bit first, then lower bit. For those of you who don't know what a nibble is, it's a group of four bits made up of the lower four bits (D0-D3) of a byte and the top four bits (D4-D7) of a byte. We can convey data in 8 bits thanks to this. In contrast, since we employ all 8 data lines in the 8 bit mode, we may convey the 8-bit data in a single motion. Certainly, 8-bit mode is faster and more reliable than 4-bit mode, as you surely have figured by now and is in fig.9.

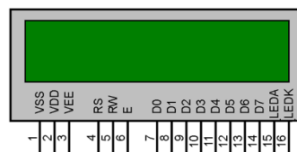


Fig.9. LCD Display

SPEAKERS:

One of the most popular output devices for computer systems is the speaker. While some speakers may be connected to any type of sound system, some are made expressly to function with computers. A device, like a computer or audio receiver, provides audio input to the speakers. This input could be digital or analogue in nature. The analogue electromagnetic waves are simply amplified into sound waves using analogue speakers. Since sound waves are created in analogue form, digital speakers must first transform the digital input into an analogue signal before producing sound waves. An example of a digital speaker is depicted in fig.10



Fig.10 speakers



EXHAUST FAN:

Exhaust fans support ventilation by removing impurities that, if inhaled, could be harmful or irritating. Minimises the chance of mildew, Mould and furniture or wall damage. As a result of their ventilation, they help to prevent things like asthma, allergies, and headaches. Also, it lessens the possibility of mildew, mould, and damage to walls or furnishings and it should be shown in fig.11



Fig.11 Exhaust Fan

IV.RESULT & CONCLUSION

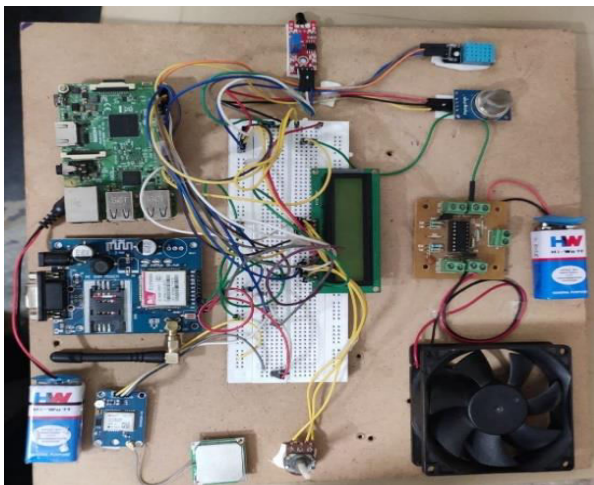


Fig.13 Hardware Without Power Supply

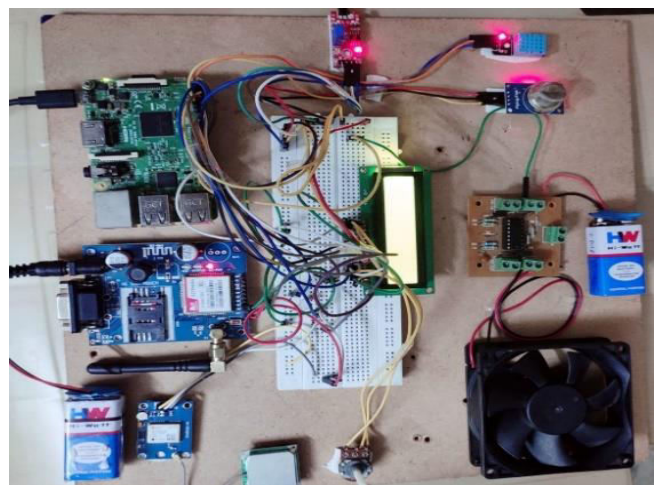


Fig.14 Hardware with Power Supply

```

Thonny - /home/pi/fire.py @ 264.33
fire.py
17 flame_sensor=3#Flame sensor pin
18 GPIO.setup(flame_sensor,GPIO.IN)#flame
19 gas_sensor_pin = 4#gaspin
20 dht11=2 #dht11 pin
21 GPIO.setup(2,GPIO.OUT)
22 GPIO.setup(gas_sensor_pin, GPIO.IN)
23 SERIAL_PORT = "/dev/ttyS0"
24 ser = serial.Serial(SERIAL_PORT,baudrate = 9600,timeout=5)
25 LCD_RS = 7
26 LCD_E = 8
27 LCD_D4 = 25

Shell
Gas Detected.....
Gas value: 8.818663121671662
humi: 65
temp: 30
Safe Mode..
b''
Sending message....
Text Mode Enabled...
Message_Sending
    
```

Fig.15 Industrial Area In Safe Mode

```

Thonny - /home/pi/fire.py @ 264.33
fire.py
17 flame_sensor=3#Flame sensor pin
18 GPIO.setup(flame_sensor,GPIO.IN)#flame
19 gas_sensor_pin = 4#gaspin
20 dht11=2 #dht11 pin
21 GPIO.setup(2,GPIO.OUT)
22 GPIO.setup(gas_sensor_pin, GPIO.IN)
23 SERIAL_PORT = "/dev/ttyS0"
24 ser = serial.Serial(SERIAL_PORT,baudrate = 9600,timeout=5)
25 LCD_RS = 7
26 LCD_E = 8
27 LCD_D4 = 25

Shell
Gas Detected.....
Gas value: 11.095179444356512
humi: 65
temp: 30
Chance For Fire Accident..
b''
Sending message....
Text Mode Enabled...
Message_Sending
    
```

Fig.16 Industrial Area in Danger Mode

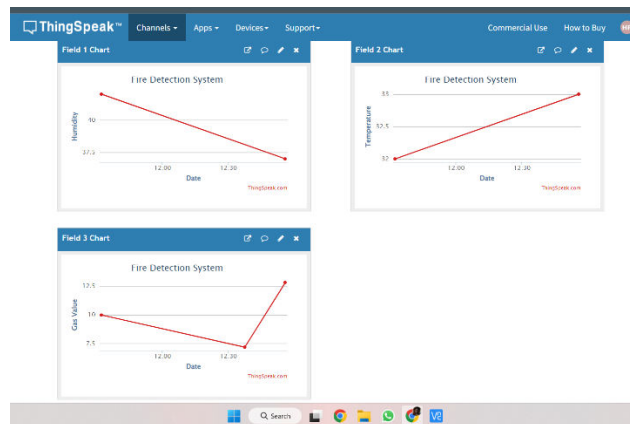


Fig.17 Data of Temperature & Humidity, Gas sensor.

The proposed gadget for monitoring air quality performed well. The readings from the MQ135 air quality sensor were displayed on the LCD display. A threshold value of 40 degrees Celsius was selected, and if it was surpassed, it would be notified by speakers. This technology not only provides air quality monitoring for worker health but also fire detection to safeguard workers from fire accidents. If a fire occurs, the flame sensor activates and notifies the microcontroller, which subsequently activates GSM to relay messages and location via GPS to a nearby fire station and the data of DHT11 and gas sensor will be stored in ThingSpeak. This prototype will also be useful in forests, industries, and factories, among other places.

REFERENCES

- [1] "Air Quality Arduino Based Monitoring System," 2nd International Conference on Computer Applications & Information Security, May 2019 Abdullah J. Alabdullah, Badr I. Farhat, and Slim Chtourou
- [2] A Movable Indoor Air Quality Monitoring System, 2nd International Conference on Cybernetics, Robotics and Control, July 2017, pp. 126–129. Liu Peng, Fu Danni, Jiang Shengqian, and Wang Mingjie.
- [3] A raspberry Pi controlled cloud-based air and sound pollution monitoring system with temperature and humidity sensing was developed by Arnab Kumar Saha, Sachet Sircar, Priyasha Chatterjee, Souvik Dutta, Anwesha Mitra, and Aishwarya Chatterjee and presented at the IEEE 8th Annual Computing and Communication Workshop and Conference on January 8–10, 2018, pp. 607–611.
- [4] "An IoT Based low cost Air Pollution Monitoring System" Proceedings of the International Conference on Recent Advances in Signal Processing and Embedded Systems, October 2017, pp. 524-528.
- [5] Haiming Zheng, "Design and application for environmental air quality automatic monitoring system", 9th International Conference on Electronic Measurement & Instrumentation, August 2009, pp.
- [6] Design of a smart indoor air quality monitoring wireless sensor network for assisted living, IEEE International Instrumentation and Measurement Technology Conference, May 2013, D.M.G. Preethi Chandra.
- [7] "A campus sustainability initiative: Indoor air quality monitoring in classrooms", XVIII AISEM Annual Conference, Feb. 2015, N. Marchetti, A. Cavazzini, L. Passti, M. Catani, C. Malagu, and V. Guidi.
- [8] "IoT Based Air Pollution Monitoring and Control System", International Conference on Inventive Research in Computer Applications, July 2018, pp. 1286–1288. S. Muthukumar, W. Sherine Mary, S. Jayanthi, R. Kiruthiga, and M. Mahalakshmi.
- [9] "MQTT Based Environment Monitoring In Industries for Employee Safety," 3rd International Conference on Applied and Theoretical Computing and Communication Technologies, December 2017, pp. 152-155. Ravi Kishore Kodali and Aditya Valdas.
- [10] Smart Sensors for Air Quality Monitoring by Jan Mitrovics, IEEE SENSORS, November 2016.
- [11] Real-Time Air Quality Monitoring by Sumanth Reddy Enigella, 10th International Conference on Knowledge and Smart Technology (KST), February 2018, pp. 182-185.



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.118



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details