

Industrial Noise Level & Gas Leakage Monitoring and Controlling System

Mrunal P. Patil.

Dept. of E&TC Engineering
Keystone School of Engineering

Pune, India.

Mrunalpatil220402@gmail.com

Vaibhavi S. Jaisawal

Dept. of E&TC Engineering
Keystone School of Engineering

Pune, India.

Vaibhavijaisawal23@gmail.com

Aniket S. Pathak

Dept. of E&TC Engineering
Keystone School of Engineering

Pune, India.

Pathakaniket607@gmail.com

Prof. Sheetal Waghchaware

Dept. of E&TC Engineering
Keystone School of Engineering

Pune, India.

sheetalwaghchaware@gmail.com

Abstract – In today's world, with the rapid increase in demand of people for gas cylinders in households, restaurants, and hospitals. Industries are also increasing. Excessive gas leakage can lead to accidents, and excessive intake of gases like nitrogen, CO₂, and hydrogen can lead to health issues for employees. To ensure the healthy and safe living of employees in industries, it is essential to monitor these issues and provide solutions to overcome them. The smart sensor network, which can combine electronic, wireless communication & and computer science is an emerging field of research, that can contribute to monitoring and controlling. The proposed system's major goal is to keep track of noise level & and gas leakage. The system contains a sound sensor (microphone) and, an MQ-2 gas sensor for collecting data. The system uses Raspberry Pi 3 Model A+ as a computer because it is easy to set up, easy to use & and it is low-priced. ThingSpeak, a cloud platform, is used as a server and visualization tool for the system, which has a free hosting plan.

Keywords – Noise level, Gas leakage, IOT, Raspberry Pi, sensors, ThingSpeak,

I. INTRODUCTION

In today's world, gas refilling industries and chemical industries play a crucial role in meeting the demand for various gases used across a wide range of applications in different sectors like healthcare, the food and beverage industry, energy production, etc. These gas refilling industries face many challenges regarding gas leaks that can cause many accidents in industries[1]. High noise levels of heavy machinery and processes due to some fault in equipment can affect production. Every year about 8+ accidents take place in industries due to gas leakage. There are pervasive effects on employees Due to excessive exhalation of gas. According to the WHO report employees

in industries face health issues like headaches, fatigue, eye itches, redness, rash, etc. To avoid these types of activities

“industrial noise level & gas leakage monitoring and controlling system has been proposed in this research work. With this device, it is expected that the number of future accidents can be reduced and will not cause major losses[2].

The system continuously monitors the external parameters to take necessary actions in addition to that, an alert message is sent to an authorized person. These things can be done by using the Internet of Things[3]. The Internet of Things and its application have become an important part of today's human lifestyle. It has become an important tool in every field [4]. Data monitored from the IoT sensors are constantly transmitted to the Raspberry Pi [5]. The proposed system additionally contains a DHT sensor for monitoring temperature and humidity. Thingspeak, a cloud platform stores and visualizes the data collected by the sensor network[5].

The rest of the paper is organized as follows. In section II existing methods for monitoring gas leakage and noise level are overviewed. In section III proposed methodology is explained in detail. Section IV consists of experimental results. In section V conclusion of the proposed work is explained and future work of this work is also discussed..

II. RELATED WORK

There exists a vast literature survey on Industrial noise levels & and gas leakage monitoring and control systems. The proposed system is IoT-based. Therefore the connection between human-computer things is explained by technology[4]. Danis Eridani, Adian Fatchur Rochinm, and



Alvin Zulham proposed a Noise monitoring and alerting system. This research was only suitable for the library. This research is focused on the development of classification and monitoring of the unwanted noise in the library by using a microcontroller[6]. Noise detection in enclosed areas, this research work makes use of Arduino nano, battery, LCD panel, and c programming to program controller. The objective is to only monitor the noise level[8]. The system is capable of detecting different sounds like falling objects, horns, cell phones, etc. Nisha Pedsangi, Priyanka Phapale, and Poorvi Pimpalkar proposed a sound level monitoring system using multiple controllers for monitoring sound pollution. Where measured data is shown on the SPL meter[13]. gas leakage detector makes use of an MQ gas sensor to collect data. The system alerts the people using the buzzer[15]. The system is suitable for a household that monitors gas and gives alert messages using GSM[2]. Amit Datta, Abhir Ahmed, Sabbir Hassan, and Kuasba Bosu proposed a combined system for air quality and noise level monitoring. The system is implemented using multiple sensors to collect and determine environment status[4]. Gas leakage detector with the automatic gas booking system. It automatically sends notifications to gas agencies using the Internet of Things [9].

III. METHODOLOGY

Fig.1 represents the block diagram of the proposed model. The system contains three input & and three output devices. Data is collected by a sensor from the environment. The collected data is sent to Raspberry Pi 3 model A+. Python programming language is used to program Raspberry Pi. They process the data. data is sent to Thingspeak, a cloud platform to store and visualize data.

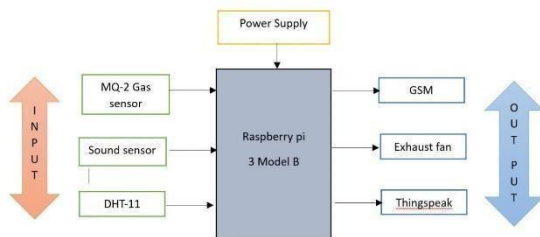


Fig.1 Block Diagram

A) Noise level & Gas Leakage

Industries like gas refilling face challenges like gas leakage and noise problems. Gas leakage can lead to various problems in industries like hazardous accidents that can affect the life of workers as we hear many accidents in industries due to gas leakage. More than 5 accidents take place every year in India. To prevent such accidents in

industries “industrial noise level & gas leakage monitoring and controlling system” is implemented. The system uses two types of sensors. For noise level monitoring, a sound microphone sensor is used and for gas leakage detection MQ-3 gas sensor is used.. There is a wide range of MQ gas sensors like MQ-1, MQ-2, MQ-3, and so on. They differ by the capability of sensing gas like each sensor can sense specific gas. We have designed this system for gas refilling industries so we have used MQ-3 which can detect alcohol, ethanol, and smoke. In industries sometimes gas leakage or excessive noise from machines can occur, which means gas leakage can cause accidents and excessive noise from machinery can lead to machinery equipment faults that may affect the production of industries. The sensor is interfaced with Raspberry Pi 3 model A+ using GPIO pins of Raspberry Pi. The sound sensor measures the intensity of sound in decibels (dB). MQ-3 gas sensor and sound microphone sensor collect data from the environment and send it to Raspberry Pi 3 model A+. it processes the data. The controller checks the gas concentration and enables the exhaust fan to turn on. The data are directly sent to a cloud platform for visualization and storage.

Sound range in decibels (dB)	level
Below 50 dB	Faint & Moderate
Below 100 dB and above 50 dB	Very Loud
Above 100 dB	Painful

Fig 2. Decibel scale

B) Temperature & Humidity

Gas and chemical industries face the problem of high temperatures. As there is a need to keep check on temperature, it can also affect the employees working in industries. To address this problem Noise level & and gas leakage monitoring and controlling system consists of an additional sensor called the DHT-11 sensor. DHT-11 sensor has various features like cost-effective, accuracy range of +2°C of temperature and +- 5°C of Humidity. DHT-11 sensor acts as an input device in the system. It is connected to a controller i.e. Raspberry Pi 3 Model A+, This sensor collects data from the environment and sends it to Raspberry Pi. It processes the data and sends it to cloud-based ThingSpeak software. Very firstly setting of the software is done like registration, details of the project entering the fields which we want to visualize. In this software, the data is stored and visualized in the form of a graph

IV. EXPERIMENTAL RESULT

A). Control System:

In the Proposed system Controlling is done in two stages, one is by reducing the concentration of gas in compact area and the other by sending an alert message to authorized person, so that he can take further actions. As the gas gets detected by the MQ-3 gas sensor, Data will be automatically send to Raspberry Pi 3 Model A+ where it processes the data. Raspberry Pi is programmed by using python programming language. In program we have used if-else condition i.e. When there is excessive gas leakage, Raspberry Pi automatically switches on the exhaust fan through relay where relay acts as a switch. Same as when there is no gas leakage, the exhaust fan will not get on. As we know adverse effects of excessive gas concentration on live employees. Exhaust fan sucks the gas away from the premises due to which health issues and big accidents are controlled. Collected data is sent to the Cloud platform, ThingSpeak. Its function is to display and store data. It provides the login page used by the admin and dashboard page to see graph data displayed in the form of a line graph.



Fig 3. Gas level

Fig 3. shows the line graph of gas levels collected by the sensor. Dates are considered on x-axis and gas levels in percentage are considered on the y-axis.



Fig 4. Sound levels

The system contains a microphone sound sensor, that monitors the noise level in industries. The controller directly sends the data to ThingSpeak for storage and visualization. Fig 4. shows data visualization for sound level. On the xaxis dates are taken and on the y-axis sound levels are taken. The graph contains data for the day.

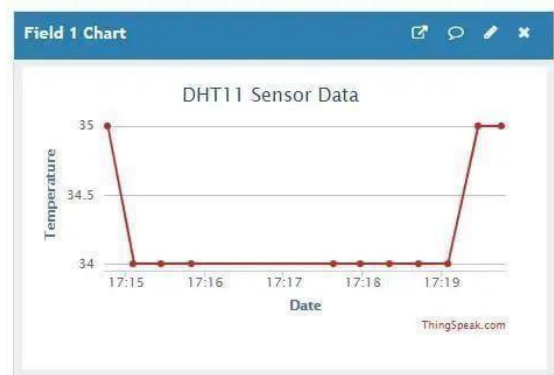


Fig 5. Temperature in °C on ThinkSpeak

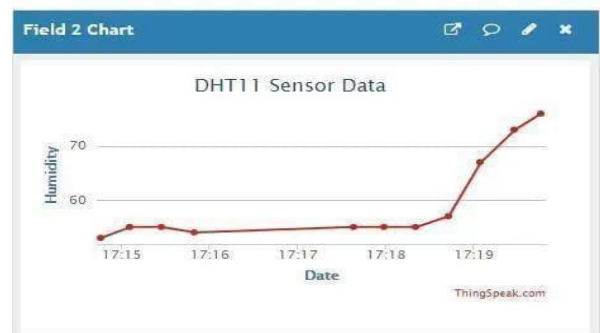


Fig 6. Humidity in % on ThingSpeak

Additionally, we have added a DHT-11 sensor for monitoring the temperature and humidity. This sensor

monitors the temperature of the environment to keep track of temperature & humidity in the industry.

Fig 5. shows the line graph for temperature, measured by the sensor. On the X-axis dates are taken and on the y-axis temperature is taken. We see temperature variations every day. In the same way, fig 6. shows the line graph for humidity, where on the x-axis dates are considered and on the y-axis humidity in percentage is taken. the graph shows different humidity percentages every day. B). Alert Notification:

As the gas is detected by the MQ-3 gas sensor an alert message to an authorized person is sent using the GSM module. GSM module is nothing but a global system for mobile communication. A website called Fast2SMS is an online service platform, that provides API for sending SMS. As we log in to Fast2SMS, we will be assigned an API authorization key which we need to include in the Python code.

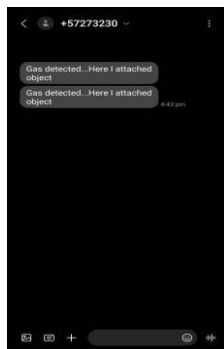


Fig 7. Alert Notification

The contact number of the authorized person is mentioned in the Python code to send an alert message. We can also add multiple contact numbers but, to reduce time complexity we have only added one contact number. The prototype of the projected system is shown in Figure 5.

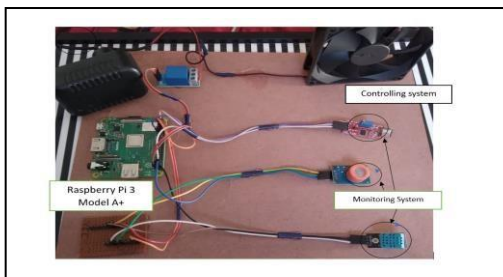


Fig 8. Prototype.

V. CONCLUSION AND FUTURE WORK

The common issue of gas and chemical industries is addressed in this paper in an easy and efficient manner. The system continuously monitors gas leakage, noise level, temperature and humidity. When excessive gas leakage in a compact area takes place, controller automatically turns on the exhaust fan due to which excessive gas concentration is controlled. The data is displayed visually and stored through a Thingspeak environment. A warning alert message is sent to the authorized person to take further action. Gas refilling industries, chemical industries, and several other organizations may benefit from this system. The costfriendliness, efficiency, low power, fast data transfer, and user-friendliness are the major benefits of this model. Future work can be done with different power sources, batteries, substations, and solar power can be used.

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