International journal of basic and applied research
www.pragatipublication.com
ISSN 2249-3352 (P) 2278-0505 (E)
Cosmos Impact Factor-5.86

OXYGEN LEAKAGE DETECTION

[1]Sunkari Pradeep,[2]G. Vaishnavi,[3]K. Tejaswini,[4]G. Deepa
[1]Associate Professor,[234]Students
Department Of CSE
Malla Reddy Engineering College For Women

ABSTRACT

Systems that have gas leaks expose consumers and infrastructure to risk; these leaks might be caused by aging foundations or environmental factors. In hospitals and companies that employ a variety of gases, such as nitrogen and mono oxide, even minute concentrations in the air may be harmful, and it can be quite challenging to identify these tiny amounts of gas from the outset. Numerous systems that were created in the past but were not implemented correctly have been produced. In this study, a portable gas leak detection system has been created. The gas sensor (MQ-2) is utilized to detect leaks in their early stages. A sensing circuit is used by the sensor and transmission module to detect changes in the gas level. When the gas concentration reaches a certain threshold, the device will sound an alert and SMS the receiving module with a message. The suggested approach works well in homes, hospitals, and businesses.

Keywords: Arduino; MQ-2; Alarm; Gases; Detection;

I. INTRODUCTION

A cutting-edge initiative called the Oxygen Gas Pipeline Monitoring System for Hospitals is positioned to completely transform the healthcare system by guaranteeing a safe and smooth oxygen delivery to medical institutions. The implementation of a state-of-the-art monitoring system that emphasizes patient safety while simultaneously improving operational efficiency is the project's main objective. Human error may occur during manual inspections used in traditional oxygen pipeline monitoring systems in healthcare settings, which might cause delays in recognizing serious concerns. The Oxygen Gas Pipeline Monitoring System aims to combine cutting-edge technology to provide a reliable and automated solution in response to these difficulties.

The need of ongoing monitoring is essential to the endeavor. Modern sensors and monitoring tools will be included into the system to provide real-time input on the condition of the oxygen supply network. This real-time component is critical, particularly in hospital settings where oxygen supply disruptions may have dangerous repercussions. The system's clever algorithms are essential for early defect detection since they quickly spot abnormalities or problems in the network of oxygen pipelines. Early detection is essential to patient safety and not only an issue of efficiency, protecting vital spaces like operating rooms, intensive care units, and emergency departments from compromise.

The project's dedication to remote accessibility is one of its main characteristics. Healthcare workers and facility administrators may now verify the condition of the oxygen pipeline from anywhere by integrating remote monitoring capabilities. This degree of accessibility facilitates prompt decision-making and enables a proactive approach to any potential problems. The system's dedication to a comprehensive and integrated approach to healthcare facility management is shown by its smooth integration with the current hospital infrastructure, which includes compatibility with building management systems and electronic health records.

One of the non-negotiable aspects of the Oxygen Gas Pipeline Monitoring System is safety compliance. A major focus of the project is to fulfill or exceed industry standards and laws pertaining to medical gas delivery systems. Ensuring the safety of patients, healthcare professionals, and hospital personnel is contingent upon this dedication. Hospitals demonstrate their commitment to using technology to improve healthcare delivery by using the Oxygen Gas Pipeline Monitoring System, which also increases the safety and dependability of their oxygen supply infrastructure.

The Oxygen Gas Pipeline Monitoring System is a paradigm change in the administration of healthcare infrastructure. For hospitals looking to improve their oxygen delivery systems, its combination of remote accessibility, early defect detection, real-time monitoring, and a strong adherence to safety standards puts it as a holistic solution. This initiative demonstrates a commitment to patient safety, technical innovation, and the general effectiveness of healthcare institutions.

1.1: Problem Statement:

The healthcare sector relies heavily on a consistent and reliable supply of medical gases, particularly oxygen, to meet the needs of patients undergoing various medical procedures and life-support interventions. However, the current methods of monitoring and managing oxygen gas pipelines within hospital settings are outdated and prone to inefficiencies, posing potential risks to patient safety and operational continuity. The existing manual monitoring systems are susceptible to human error, leading to delays in identifying faults or anomalies in the oxygen supply network. These delays can have severe consequences, especially in critical areas such as operating rooms and intensive care units, where uninterrupted oxygen supply is paramount.

The lack of a real-time monitoring system exacerbates the challenges associated with the current infrastructure. Hospitals often face difficulties in promptly detecting faults or disruptions in the oxygen pipeline network, resulting in potential compromises to patient care. Furthermore, the absence of remote accessibility hampers the ability of healthcare professionals and facility managers to respond swiftly to emerging issues, leading to an increased risk of operational disruptions and compromised patient safety.

In addition, the disjointed nature of the existing systems often hinders seamless integration with hospital infrastructure, including building management systems and electronic health records. This lack of integration not only poses challenges in terms of data accessibility and interoperability but also adds complexity to overall facility management.

Moreover, compliance with safety standards and regulations governing medical gas supply systems is paramount in healthcare facilities. The absence of a dedicated system designed to meet or exceed these standards leaves hospitals vulnerable to potential safety breaches, putting patients, healthcare providers, and hospital staff at risk.

International journal of basic and applied research
www.pragatipublication.com
ISSN 2249-3352 (P) 2278-0505 (E)
Cosmos Impact Factor-5.86

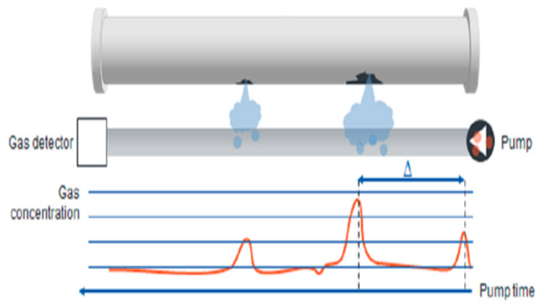

Figure 1.1: Gas monitoring

The current state of oxygen gas pipeline monitoring in hospitals is characterized by manual processes, delayed fault detection, lack of real-time monitoring, insufficient remote accessibility, and inadequate integration with existing infrastructure. These deficiencies underscore the need for a comprehensive Oxygen Gas Pipeline Monitoring System to address these challenges and ensure a safer, more efficient, and technologically advanced approach to managing oxygen supply within healthcare facilities.

1.2: Problem Scope:

The problem scope for the Oxygen Gas Pipeline Monitoring System in hospitals encompasses various challenges and deficiencies in the existing infrastructure for managing and monitoring oxygen supply. The scope of the problem is delineated by the limitations in current systems, hindering operational efficiency, patient safety, and overall healthcare facility management.

Manual Monitoring and Human Error:

- The reliance on manual checks for monitoring oxygen pipelines introduces a significant risk of human error.
- Manual monitoring is time-consuming and may lead to delays in identifying faults or anomalies.

Delayed Fault Detection:

- The lack of a real-time monitoring system contributes to delayed detection of faults in the oxygen supply network.
- Delays in identifying issues pose a substantial risk to critical areas like operating rooms and intensive care units.

Lack of Remote Accessibility:

- The absence of remote monitoring capabilities limits the ability of healthcare professionals and facility managers to access real-time data from different locations.
- Remote inaccessibility hampers quick decision-making and proactive response to emerging issues.

Integration Challenges:

- The current systems often lack seamless integration with hospital infrastructure, including building management systems and electronic health records.
- Lack of integration complicates data accessibility, interoperability, and overall facility management.

Safety and Compliance Concerns:

- Compliance with safety standards and regulations governing medical gas supply systems is a critical concern.
- The absence of a dedicated system designed to meet or exceed these standards leaves hospitals vulnerable to safety breaches.

Operational Disruptions:

- Inefficient monitoring and delayed fault detection contribute to the

International journal of basic and applied research
www.pragatipublication.com
ISSN 2249-3352 (P) 2278-0505 (E)
Cosmos Impact Factor-5.86

potential for operational disruptions in oxygen supply.

- Operational disruptions pose a direct threat to patient care, especially in critical medical procedures and life-support interventions.

Complex Facility Management:

- The disjointed nature of existing systems adds complexity to overall facility management.
- Lack of integration with other hospital systems complicates data flow and decision-making processes.

Risk to Patient Safety:

- The cumulative impact of manual monitoring, delayed fault detection, and operational disruptions poses a direct risk to patient safety.
- Uninterrupted and reliable oxygen supply is essential for patient well-being, and any compromise in this regard could lead to adverse outcomes.

Addressing these challenges within the defined problem scope requires the development and implementation of a comprehensive Oxygen Gas Pipeline Monitoring System that integrates advanced technologies, real-time monitoring capabilities, remote accessibility, and strict adherence to safety standards. This system aims to enhance the efficiency and safety of oxygen supply in hospitals, ultimately contributing to improved patient care and overall healthcare facility management.

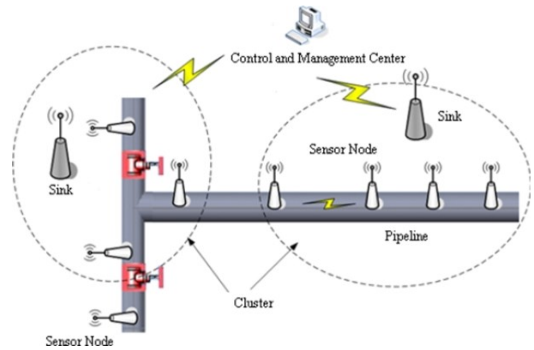

Figure 1.2: Technologies used for monitoring the Gas

1.3: Advantages of using Oxygen Gas pipeline monitoring system for hospital

The implementation of an Oxygen Gas Pipeline Monitoring System in hospitals offers numerous advantages, significantly enhancing the efficiency, safety, and overall management of oxygen supply within healthcare facilities. Some key advantages include:

Real-time Monitoring:

- Enables continuous and real-time monitoring of the oxygen supply network.
- Promptly detects any anomalies, ensuring a timely response to potential issues.

Early Fault Detection:

- Utilizes intelligent algorithms to detect faults and anomalies in the oxygen pipeline network at an early stage.
- Minimizes the risk of operational disruptions and ensures uninterrupted oxygen supply to critical areas.

Enhanced Patient Safety:

- Reduces the risk of oxygen supply interruptions, enhancing patient safety during medical procedures, surgeries, and life-support interventions.

- Contributes to a more reliable and consistent oxygen supply in critical healthcare settings.

Remote Accessibility:

- Facilitates remote monitoring of the oxygen supply system from various locations.
- Enables healthcare professionals and facility managers to respond swiftly to emerging issues, even when not physically present on-site.

Improved Operational Efficiency:

- Streamlines the monitoring and management of oxygen pipelines, reducing the need for manual checks.
- Enhances operational efficiency by providing real-time data and enabling proactive decision-making.

1.4 Proposed Solution:

The proposed solution for optimizing the Oxygen Gas Pipeline Monitoring System in hospitals involves the strategic integration of Internet of Things (IoT) technologies. By leveraging IoT, the system transforms into a smart, interconnected infrastructure, providing real-time monitoring, remote accessibility, and advanced analytics capabilities. Key components include a network of IoT-enabled sensors strategically placed throughout the oxygen pipeline network, wirelessly transmitting data to a centralized monitoring system. This system, empowered by edge computing, processes and analyzes the data, offering immediate insights into the oxygen supply infrastructure. A user-friendly dashboard, accessible remotely via web interfaces or mobile applications, empowers healthcare professionals and facility managers to monitor the system, receive alerts, and take swift corrective actions. Machine learning algorithms contribute to predictive analytics, foreseeing potential issues and enabling proactive maintenance. The solution prioritizes seamless integration with existing hospital infrastructure, ensuring interoperability and data exchange. With robust security measures, scalability, and a focus on energy efficiency, the proposed IoT-based solution aims to enhance patient safety, operational efficiency, and overall healthcare facility management.

1.5 Aim and Objectives

Aim:

The primary aim of deploying an Oxygen Gas Pipeline Monitoring System in hospitals is to ensure a dependable and secure supply of oxygen, aligning with the critical healthcare requirements of patients. This system is designed to enhance patient safety by guaranteeing an uninterrupted and reliable oxygen supply to crucial medical areas like operating rooms and intensive care units. By introducing real-time monitoring, the system enables the prompt detection of anomalies and faults, facilitating immediate corrective actions to prevent potential disruptions. Operational efficiency is improved through streamlined monitoring processes, reducing the dependence on manual checks and promoting proactive decision-making based on real-time data. The inclusion of remote accessibility empowers healthcare professionals and facility managers to monitor the oxygen supply system remotely, ensuring quick responses and interventions even when physically distant. Moreover, the system aims for early fault detection using intelligent algorithms, minimizing the risk of operational disruptions by addressing issues before they escalate. Seamless integration with existing hospital infrastructure, compliance with safety standards, cost efficiency, and support for

International journal of basic and applied research
www.pragatipublication.com
ISSN 2249-3352 (P) 2278-0505 (E)
Cosmos Impact Factor-5.86

environmental sustainability further underscore the holistic aims of this monitoring system, contributing to advancements in patient care and overall healthcare facility management.

Objectives:

The objectives of implementing an Oxygen Gas Pipeline Monitoring System in hospitals are multifaceted, focusing on ensuring patient safety, operational efficiency, and the overall improvement of healthcare facility management. The specific goals include:

Continuous Patient Safety:

- Ensure an uninterrupted and reliable supply of oxygen to critical healthcare areas, minimizing the risk of disruptions during medical procedures and life-support interventions.

Real-time Monitoring:

- Implement a continuous and real-time monitoring system for the oxygen supply network to promptly detect anomalies and faults.

Swift Intervention through Early Fault Detection:

- Utilize intelligent algorithms to achieve early fault detection, enabling immediate corrective actions and minimizing the risk of operational disruptions.

Operational Efficiency Enhancement:

- Streamline the monitoring and management of oxygen pipelines to reduce reliance on manual checks and improve overall operational efficiency.

Remote Accessibility:

- Enable healthcare professionals and facility managers to monitor the oxygen supply system remotely, facilitating quick responses and interventions regardless of physical location.

Integration with Hospital Infrastructure:

- Seamlessly integrate the monitoring system with existing hospital infrastructure, including building management systems and electronic health records, to enhance data accessibility and interoperability.

Adherence to Safety Standards:

- Ensure strict adherence to safety standards and regulations governing medical gas supply systems, mitigating the risk of safety breaches and maintaining a secure oxygen supply environment.

Cost Efficiency:

- Reduce operational costs associated with manual monitoring, emergency interventions, and downtime, optimizing resource utilization and contributing to long-term financial sustainability.

Data-driven Decision Making:

- Facilitate data logging and analysis, supporting data-driven decision-making for the optimization of the oxygen supply infrastructure.

Proactive Maintenance:

- Implement predictive maintenance strategies by identifying potential issues before they escalate, reducing the need for reactive and costly repairs.

Emergency Preparedness:

- Strengthen emergency response capabilities by providing real-time information during critical situations, ensuring swift and effective responses to

International journal of basic and applied research
www.pragatipublication.com
ISSN 2249-3352 (P) 2278-0505 (E)
Cosmos Impact Factor-5.86

unforeseen circumstances and emergencies.

Environmental Sustainability:

- Contribute to environmental sustainability by optimizing oxygen usage, minimizing waste, and supporting eco-friendly practices in healthcare infrastructure management.

By achieving these objectives, the Oxygen Gas Pipeline Monitoring System aims to create a comprehensive, technologically advanced solution that enhances patient safety, improves operational efficiency, and contributes to the overall advancement of healthcare facility management.

II. LITERATURE SURVEY

The utilization of an Oxygen Gas Pipeline Monitoring System in hospitals, coupled with an Internet of Things (IoT) framework, has garnered significant attention in the literature. Researchers have been actively exploring ways to enhance the efficiency and safety of medical gas supply through continuous monitoring using IoT-enabled sensors. These sensors play a crucial role in acquiring real-time data on various parameters such as pressure, flow rates, and oxygen levels, contributing to a proactive approach in maintaining a stable and reliable oxygen supply within healthcare facilities.

In the realm of sensor technology, the literature suggests a diverse range of sensors being employed in IoT-based systems for monitoring medical gas supply. The focus lies on assessing the accuracy, reliability, and real-time capabilities of these sensors, thereby influencing the overall effectiveness of the monitoring system. Different types of sensors, including pressure sensors, flow sensors, and gas concentration sensors, are explored in the literature to understand their suitability for specific monitoring applications.

Communication protocols play a pivotal role in establishing reliable connections between IoT-enabled sensors and central monitoring systems. The literature extensively covers various communication protocols, with wireless technologies such as Wi-Fi, Bluetooth Low Energy (BLE), and Low Power Wide Area Network (LPWAN) being prominent choices. Evaluating the strengths and weaknesses of these protocols is crucial in ensuring seamless and robust data transmission, especially in the context of critical healthcare infrastructure.

Addressing security and privacy concerns is paramount in the development of IoT systems for medical gas monitoring. The literature survey delves into the implementation of robust security measures to safeguard sensitive healthcare data. Encryption techniques, authentication protocols, and secure data transmission mechanisms are explored to establish a secure framework for handling the information generated by the monitoring system.

Integration with existing hospital infrastructure is a key consideration, as highlighted in the literature. Compatibility with Building Management Systems (BMS) and Electronic Health Records (EHR) is emphasized to ensure a cohesive and interconnected healthcare environment. Understanding how IoT-based solutions seamlessly integrate with these existing systems contributes to the overall success and adoption of the monitoring technology in hospital settings.

Case studies and real-world implementations provide valuable insights into the practical challenges and lessons learned from deploying IoT-based oxygen gas pipeline monitoring systems in hospitals. Analyzing these cases offers a deeper understanding of the system's performance, its impact on hospital operations, and potential areas for optimization.

Recent trends in the literature showcase a shift towards advancements in edge computing for faster data processing. Additionally, the incorporation of artificial intelligence (AI) for advanced analytics is gaining prominence, enabling more sophisticated data interpretation and decision-making. The exploration of 5G technology as a means to improve connectivity further emphasizes the commitment to staying at the forefront of technological innovation in the healthcare sector.

The comprehensive literature survey reveals a concerted effort to develop sophisticated and technologically advanced solutions for monitoring oxygen gas pipelines in hospitals. The exploration of IoT-enabled sensors, communication protocols, data security, integration with hospital infrastructure, and real-world case studies provides a holistic view of the current state of research in this domain. The continuous evolution of these technologies reflects the ongoing commitment to revolutionize healthcare monitoring systems and enhance patient safety.

III. BLOCK DIAGRAM

The methodology for implementing an Oxygen Gas Pipeline Monitoring System in hospitals, employing an Internet of Things (IoT) framework, follows a systematic and comprehensive approach tailored to the unique demands of medical gas supply. Initiating the process with a meticulous needs assessment, collaboration with healthcare professionals helps identify critical requirements and operational challenges related to oxygen supply in healthcare facilities. The subsequent step involves clearly defining both functional and technical prerequisites for the system, encompassing aspects such as real-time monitoring, remote accessibility, integration with existing infrastructure, and strict adherence to safety standards.

Following this, the selection of suitable IoT-enabled sensors becomes crucial, with considerations including accuracy, reliability, and power consumption. Communication protocols, such as Wi-Fi or Bluetooth Low Energy, are then chosen to facilitate seamless and secure data transmission between the sensors and the central monitoring system. The development of the centralized monitoring system includes the incorporation of edge computing for local data processing, thereby reducing latency and ensuring timely access to critical information.

User interface design is emphasized to create an intuitive platform accessible through web applications or mobile devices. This interface incorporates features for real-time monitoring, immediate alerts, and insightful visualization of historical data. The implementation process places significant emphasis on security, encompassing robust measures like encryption, authentication, and access controls to protect sensitive healthcare data. Integration with existing hospital infrastructure, including Building Management Systems (BMS) and Electronic Health Records (EHR), is meticulously addressed to ensure interoperability and cohesive data exchange.

Subsequent steps involve rigorous testing of the entire system, encompassing sensor functionality, data transmission, and the performance of the central monitoring system. Validation occurs in controlled environments before deployment, and training programs are conducted for healthcare professionals and

International journal of basic and applied research
www.pragatipublication.com
ISSN 2249-3352 (P) 2278-0505 (E)
Cosmos Impact Factor-5.86

facility managers to ensure effective system utilization. Deployment itself is undertaken in a phased approach, commencing with critical areas, and is followed by continuous monitoring post-implementation.

A proactive maintenance schedule is established to address regular updates, patches, and sensor calibration, ensuring the sustained performance of the system. The methodology also emphasizes the incorporation of data analytics and machine learning algorithms, contributing to predictive maintenance, fault prediction, and optimization of the oxygen supply infrastructure over time. Continuous evaluation and adaptation of the system form integral aspects of this methodology, ensuring that the Oxygen Gas Pipeline Monitoring System remains effective, efficient, and aligned with evolving healthcare needs.

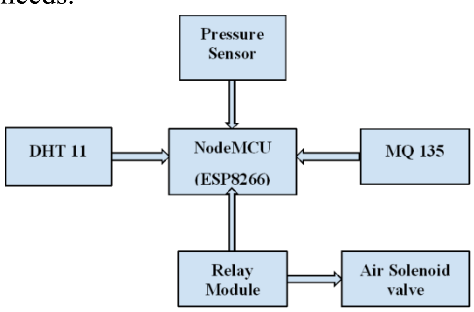

Figure .1: Block Diagram of the Oxygen gas Pipeline Monitoring

IV. HARDWARE COMPONENTS

4.1 NodeMCU (ESP8266)

The NodeMCU ESP8266 is a powerful and versatile platform designed for Internet of Things (IoT) development. The ESP8266 is a cost-effective Wi-Fi microchip known for its capability to enable wireless communication in IoT applications. NodeMCU, on the other hand, is an open-source firmware and development kit that simplifies the process of prototyping and programming the ESP8266. With built-in Wi-Fi connectivity, the NodeMCU ESP8266 allows devices to connect to the internet wirelessly, making it suitable for a wide range of IoT projects. One notable feature is its support for the Lua scripting language, providing a high-level programming environment for developers. Additionally, it is compatible with the Arduino IDE, allowing those familiar with Arduino to use the NodeMCU platform. Equipped with General Purpose Input/Output (GPIO) pins, the ESP8266 facilitates interfacing with various electronic components, making it ideal for applications such as home automation and sensor networks. The NodeMCU ESP8266 has garnered significant community support, resulting in an extensive collection of libraries and documentation, making it a popular choice for rapid IoT prototyping and development.

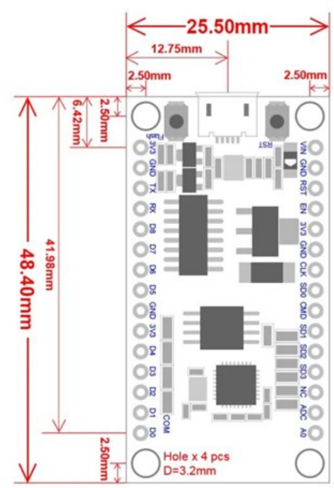

Figure .2 NodeMCU 2D View

4.2 MQ-135 Gas sensor:

The **MQ-135 Gas sensor** can detect gases like Ammonia (NH_3), sulfur (S), Benzene (C_6H_6), CO_2, and other harmful gases and smoke. Similar to other MQ series gas sensors, this sensor also has a digital and analog output pin. When the level of these gases go beyond a

International journal of basic and applied research
www.pragatipublication.com
ISSN 2249-3352 (P) 2278-0505 (E)
Cosmos Impact Factor-5.86

threshold limit in the air the digital pin goes high. This threshold value can be set by using the on-board potentiometer. The analog output pin, outputs an analog voltage which can be used to approximate the level of these gases in the atmosphere.

The MQ135 air quality sensor module operates at 5V and consumes around 150mA. It requires some preheating before it could actually give accurate results.

Details of MQ135 Sensor

The MQ135 is one of the popular gas sensors from the MQ series of sensors that are commonly used in air quality control equipment. It operates from 2.5V to 5.0V and can provide both digital and analog output. The pinouts and important components on an MQ135 Module is marked below

Note that all MQ sensors have to be powered up for a pre-heat duration for the sensor to warm up before it can start working. This preheat time is normally between 30 seconds to a couple of minutes. When you power up the module the power LED will turn on, leaving the module in this state till the pre-heat duration is completed.

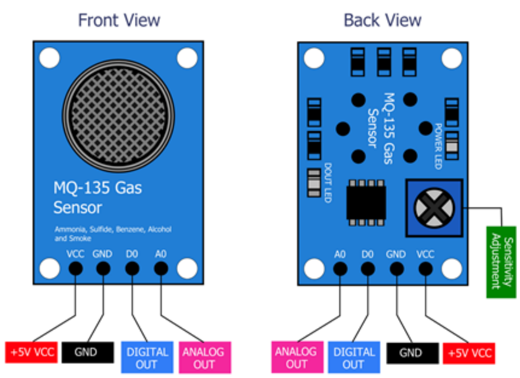

Figure 3: MQ135 Gas Sensor

4.3 Temperature and Humidity Sensor:

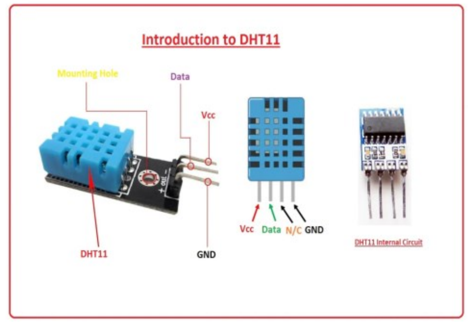

Figure .4 DHT 11 sensor

Temperature and Humidity Sensor

A temperature sensor is a device that measures the temperature of its surroundings or a specific object and converts that temperature into an electrical signal. Temperature sensors are used in a wide range of applications, including industrial processes, environmental monitoring, consumer electronics, medical devices, and more.

4.4 Pressure Sensor (BMP180)

What is Atmospheric Pressure and BMP 180 Atmospheric Pressure Sensor? BMP 180 atmospheric pressure sensor is a type of sensor which is mainly used for measuring atmospheric pressure or biometric pressure. If we talk about pressure, then pressure is a force that affects per unit area .The unit, which is commonly used for pressure is pound per square inch means when one pound force presses one square inch area then this pressure is called one psi. The SI unit of pressure is newton per square meter which is called one pascal (Pa). There are so many situations when we measure the pressure but here we are only interested in atmospheric pressure. Atmospheric pressure is basically the force, whose effect exists on all the surrounding things. Means, the weight of gases in the atmosphere creates the atmospheric pressure.

International journal of basic and applied research
www.pragatipublication.com
ISSN 2249-3352 (P) 2278-0505 (E)
Cosmos Impact Factor-5.86

For measuring the pressure of these gases atmospheric pressure sensors are used. It is a high precision low cost sensing solution and especially designed for consumer applications such as weather forecast, sports devices ,GPS, computer peripherals, indoor navigation, hobby projects and vertical velocity indicator etc. It can also be used as an altimeter because pressure is changed with altitude. It is easy to use and easy to solder on a printed circuit board(PCB) as well as it has a small size and consumes less power. If it is used as a temperature sensor then it is a perfect sensor. It is easily available on the market or online shop. A simple BMP 180 atmospheric pressure sensor

Figure .5 : **Pressure Sensor (BMP180)**

4.5 Relay Module:

Figure .6: Relay Module

A relay sensor, also known as a relay switch or simply a relay, is an electrical component that functions as an electromagnetic switch. It operates by using a small control signal to activate a larger load or circuit. Relays are commonly used in various applications to control high-power devices or circuits using low-power signals. They are widely used in automation, industrial control systems, automotive systems, and more.

4.6 Air Solenoid Valve

A solenoid valve is an electrically controlled valve used to allow or prevent the flow of media through it. The basic principle of operation is a plunger that moves up and down based on the magnetic field generated from the electrical solenoid. This plunger either opens or closes an orifice that the media flows through. There are different circuit functions, designs, and construction material allowing them to be selected and designed for specific applications. They can be remotely and automatically controlled, making them ideal for a wide variety of industries from water treatment, automotive, and food processing applications.

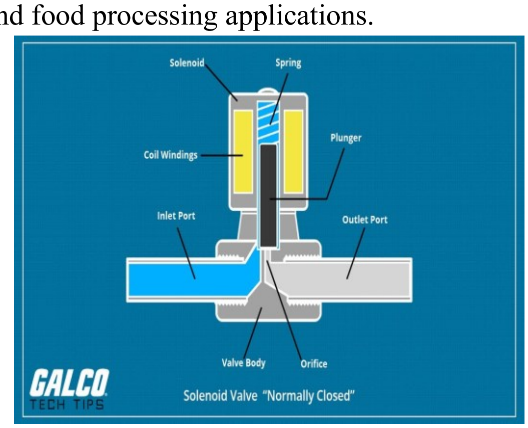

Figure 7: Solenoid Valve

V. CONCLUSION

The goal of this study is to develop a low-cost gas detection system that contributes to a decrease in incidences. Our study's objective was to lower the percentage of unintentional fatalities brought on by dangerous gas leaks at the workplace. It was successful to design and build the gas leak monitoring system with an Arduino board and a MQ-2 sensor. Numerous projects are designed to detect gasses, but this one has a lot of advantages of its own, such being lightweight and portable, making it easy to carry and install anyplace. The method we suggested has produced encouraging outcomes. Therefore, we want to incorporate a temperature sensor to our suggested prototype in the future.

As technology advances, those who come into direct or indirect contact with gases on a daily basis may find it easier to get these early gas detection devices. This gadget may be used not only in hospitals but also in homes, businesses, automobiles with gas kits, gas stations, etc., and provide long-term benefits. This sensor will be used in higher industrial regions because of its longer sensory range and increased accuracy.

REFERENCES

1. Shimizu, Y.; Egashira, M. “Basic aspects and challenges of semiconductor gas sensors.” MRS Bull. 1999.
2. Batzias, F., Siontorou, C., Spanidis, P.-M., “Designing a reliable leak bio-detection system for natural gas pipelines.” Journal of Hazardous Materials 186 (1), 2011.
3. Brodetsky, I., Savic, M.,“Leak monitoring system for gas pipelines. In: Acoustics, Speech, and Signal Processing,” ICASSP-93. IEEE International Conference on. Vol. 3, 2004.
4. Salma, Aya Bani, et al. “Methane and Carbon Monoxide Gas Detection System Based on Semiconductor Sensor - IEEE Conference Publication.” Methane and Carbon Monoxide Gas Detection System Based on Semiconductor Sensor - IEEE Conference Publication, IEEE, 23 Feb. 2005.
5. Emil Cordos, et al. “Methane and Carbon Monoxide Gas Detection System Based on Semiconductor Sensor.” Methane and Carbon Monoxide Gas Detection System Based on Semiconductor Sensor, IEEE, 11 Dec. 2006.
6. Prasasnth Krishnan, and David Jackson. “Multifunctional Gas Detection Based Temperature Compensation and Data Fusion.” Multifunctional Gas Detection Based Temperature Compensation and Data Fusion - IEEE Conference Publication, IEEE, 23 May 2016.
7. Zhou Bin, et al. “The Simulation and Analysis of Gas Detection System in Infrared Absorption Spectrum Based on LabVIEW.” The Simulation and Analysis of Gas Detection System in Infrared Absorption Spectrum Based on LabVIEW - IEEE Conference Publication, IEEE, 7 Jan. 2016.

8. Sahil Adsul, et al. "Development of Leakage Detection System." Development of Leakage Detection System - IEEE Conference Publication, IEEE, 5 Aug. 2017,
9. Sulzer, Philipp; Hartungen, Eugen; "Fire Protection Guide to Hazardous Materials", 13th edition, National Fire Protection Association (NFPA) One Battery Park, Quincy, MA 0226, 2002.
10. Shinde S.,Patil S.B, Patil A.J. "Development of Movable Gas Tanker Leakage Detection Using Wireless Sensor Network Based on Embedded System". International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-