AN ARTIFICIAL INTELLIGENT SYSTEM FOR INDUSTRIAL POLLUTION MONITORING AND CONTROLLING USING GRAPHICAL SYSTEM DESIGN

Mrs. Nethravathi H M[1], Mrs. Vidhya S G[2], Mr. Mahesh R[3], Mrs. KavyaShree N[4], Lakshmishree[5], Dr. Sharath Kumar A J[6]

Article History: Received: 12.03.2023 **Revised:** 27.04.2023 **Accepted:** 12.06.2023

Abstract

The Industrial Pollution Monitoring and Controlling System is a project that utilizes the NI myRIO and LabVIEW software to detect and control industrial pollution in real-time. The aim of this system is to provide a cost-effective and efficient solution to monitor air and water pollution levels in factories and industries, and to take immediate corrective measures to control pollution levels. The system utilizes sensors to measure the pollution levels and Transmits the data to the myRIO device. The data is then processed and analyzed by the LabVIEW software. Based on the analyzed data, the system sends signals to control devices such as valves, pumps, and fans to take corrective actions to control pollution levels. The system also provides a user-friendly interface for monitoring pollution levels and controlling the system parameters. The system can also generate alerts and notifications when pollution levels exceed safe levels. This system can be integrated with existing industrial control systems to provide an automated and comprehensive solution for pollution monitoring and control.

Keywords: LabVIEW, GSM, CO, CO2, pH, Temperature, Humidity, Flame.

[1]Assistant professor, Department of Electronics and Communication Engineering,BGS Institute of Technology (BGSIT), Mandya District, India.
[2]Assistant professor, Department: information science and engineering, BGS Institute of Technology (BGSIT), Mandya District, India.
[3]Assistant professor, Department Computer science & Engineering, BGS Institute of Technology (BGSIT), Mandya District, India.
[4]Assistant professor, Department Computer science & Engineering , BGS Institute of Technology (BGSIT), Mandya District, India.
[5]Department Computer science & Engineering, BGS Institute of Technology (BGSIT), Mandya District, India.
[6]Associate professor Department of Electronics and Communication Engineering, Vidyavardhaka College of Engineering, Mysuru. India.

DOI: 10.31838/ecb/2023.12.S3.480

1. INTRODUCTION

The aim of this paper is to present an overview of an Industrial Pollution Monitoring and Controlling System that utilizes the NI myRIO and LabVIEW software. The system is designed to detect and control industrial pollution levels in real-time, providing a cost-effective and efficient solution to monitor air and water pollution levels in factories and industries. The system's hardware components include sensors, a NI myRIO device, and control devices such as valves, pumps, and fans. The sensors are used to measure pollution levels and transmit the data to the myRIO device, where it is processed and analyzed using LabVIEW software. Based on the analyzed data, the system sends signals to control devices to take corrective actions to control pollution levels. The system also provides a user-friendly interface for monitoring pollution levels and controlling the system parameters. The system can generate alerts and notifications when pollution levels exceed safe levels. This system can be integrated with existing industrial control systems to provide an automated and comprehensive solution for pollution monitoring and control. NI myRIO is a powerful embedded system that is designed for real-time embedded applications. The myRIO device provides analog and digital input/output channels that can be used to interface with sensors and control devices. The device also has a built-in processor and FPGA that can be used to perform real-time signal processing and control tasks. LabVIEW is a graphical programming language that is widely used in the industry for developing control and monitoring systems. LabVIEW provides a user-friendly interface for designing and deploying control and monitoring systems. The software also provides tools for data acquisition, signal processing, and analysis, making it an ideal choice for developing industrial monitoring and control systems. The Industrial Pollution Monitoring and Controlling System utilizes LabVIEW software to process and Analyze the data obtained from the sensors. The system can be customized to suit the specific requirements of different factories and industries. The system can also be integrated with other monitoring and control systems to provide a comprehensive solution for pollution monitoring and Control.

2. LITERATURE REVIEW

A variety of studies from respected journals were examined in order to create this project, and each of its highlights are stated in brief . **The Paper [1]** serves as a template for tracking and managing industrial temperature fluctuations. The experimental examination of a temperature monitoring and control system is covered in this work. The usage of temperature monitor systems is crucial in the following sectors, including those that produce food, care for the sick, and medicines. The temperature is measured in this study using an LM35 temperature sensor. For system monitoring, this LM35 sensor is interfaced with myRIO. MyRIO is linked to a fan, buzzer, and LED. The LED will shine in accordance with the established limitations, for example, turning green when the temperature is within the limit and red when it is beyond the limit. The buzzer then starts to sound after being enabled. The fan is then turned on to lower the temperature. An application-based platform called LabVIEW is employed in this work to show the monitoring information. LabVIEW has an interface with the QuickStart cloud server. The LabVIEW's presented data is uploaded to the QuickStart server. This report also includes research on several sensor output ranges. A technique to monitor industrial pollution was proposed in **Paper [2].** This essay provides a thorough analysis of the procedure used by the pollution control board to monitor air quality. Monitoring the effluent gases generated by companies, such as carbon monoxide, carbon dioxide, etc., is the project's major goal. The information is gathered by this monitoring system, which then gives it to the pollution control board. When the concentration of the pollutants surpasses the standard limit, this information is transmitted through GSM to the pollution control authorities. LabVIEW software was used to create this system. Along with analysing two metrics, the suggested system also measures the effluents' temperature. Every sensor is in sync with the microcontroller. The Arduino UNO microcontroller was utilised in this study. The data gathered by the sensors is stored by this microcontroller. LabVIEW displays the parameters' saved data, and a GSM system is constructed for mobile communication. **Paper [3],** This article implements a remote sensor network based on ZigBee. This framework is a low-cost, sun-oriented air quality control system. This project's major goal is to connect the many sensors that are used to sense basic data. The sensor data is shown in LABVIEW by using the graphical user interface. Sensor hubs are used at various traffic signals in polluted metropolitan areas. The continuous collection and reporting of data on the many gases present in the climate. Gas concentrations including carbon monoxide, nitrogen dioxide, and methane are included in this data. Three different sensors, including the MQ7, MQ4, and MQ135, have been employed in the proposed system. To check for air pollution, these sensors were used. The 20 to 2000 ppm range of CO gas is detected by the MQ7 sensor. Propane, methane, and butane are more sensitive to the MQ4 sensor in this situation. The MQ135 gas sensor picked up on the benzene vapour, sulfidic and smelling salts. ZigBee, a standard module with a programming foundation, is used. The ZigBee module is connected to the PC through a sequential link. The VISA libraries, which provide sequential correspondence, are first installed on the computer. The data is sent to the sequential port and shown on the LCD. **Paper [4],** An IOT-based system for monitoring and managing pollution has been developed in this study. The system is equipped with a number of sensors that can detect industrial contaminants including smoke, radiation, and a temperature that is too high. When the sensors detect pollutants, they transmit a signal to the controller to which they are linked. A smoke sensor, a temperature sensor, and a radiation sensor are the sensors utilised in the project. Arduino is the controller utilised in this project. The control signal for the GSM module is generated by this Arduino controller. The MAX232 IC has provided the GSM with the control signal. When the pollution level exceeds the established limit, the GSM module will transmit brief signals to the control board. If the amount of smoke or radiation released is higher than 613 or 250, the controller or processor will transmit a notification through GSM. The measured data temperature is transmitted in the messages at the same time as the temperature reading. Here, the power supply of the relevant industries that exceeded the limit has been reduced thanks to the Internet of Things. The system is useful since it uses Arduino and IOT controllers. **Paper [5]** represents the system to keep an eye on and manage the factors that lead to pollution while minimising the impact on the environment or plants. Applications built on the LabVIEW platform are used to monitor and manage industrial pollution brought on by improper waste disposal. An Arduino UNO board, a DHT-11 sensor, a MQ135 sensor, and a pH sensor were used in the creation of this project. The temperature and humidity data are obtained via the DHT-111 sensor. The air quality emitted by industry is measured with MQ135 sensors. pH sensors display acid and base values based on a hardware compilation. An Arduino UNO board retrieves these parameters. LabVIEW-based programmes are used to monitor and regulate these parameters. Thing Speak, a platform for IoT analytics services, is introduced in this project. The observed values are updated to cloud data storage using this service platform, allowing for online monitoring of the readings. To improve dependability, an Android app was created. By using this monitoring method, we will be able to keep a close eye on environmental pollutants. **Paper [6]** proposes a wireless air monitoring device that provides thorough data on interior air pollution. to upload pollution concentration data to the internet. It uses a microcontroller that has several sophisticated functions. The microcontroller has built-in Wi-Fi connection, making it similar to an onboard Wi-Fi module like NodeMCU. The sensors that are attached to the controller MQ135 can distinguish between several harmful gases to determine the air quality. ThingSpeak, an open-source Internet of Things platform, is used in this study to store and retrieve data over the internet using the HTTP protocol. ThingSpeak uses the HTTP protocol to transmit and receive data. The IoT platform processes the data when it is supplied by the device via an HTTP request. This platform and the virtual server are in communication. **Paper [7],** The air pollution monitoring and detection system proposed in this study is an apparatus made up of numerous sensors, including gas sensors, temperature and humidity sensors, and dust sensors. Here, a cloud server, a mobile application, and a GSM module are all utilised. Using the information from the server and app, one can simply monitor the air pollution situation in this system. An alarm system will notify the competent authorities if the level of air pollutants exceeds the specified limit. The MQ-135 module is utilised in this system to sense and measure CO2 and ammonia among other gases. The CH4 concentration is measured using MQ-4. MQ-7 is employed to detect and quantify CO gas. The sensors HSL-20G and LM35 are used to monitor temperature and humidity. A dust sensor is used to determine how much dust is in the air. In this instance, a SIM800L module is utilised to transmit data to the server. The server gathers information from the GSM module and alerts when industry-related gas concentrations go over a certain level. **Paper [8],** This method of monitoring and managing industrial process pollution is used. The computerised system in place attempts to enhance the assessment of pollutants emitted during industrial activities. First, an issue caused by technology advancement has been investigated and analysed. The choice of measurement-related materials and equipment comes next. Thirdly, data analysis algorithms have been chosen. Finally, findings and tactics are derived utilising sensor measurement modules. The management's performance in supervising and regulating the industrial process is assessed using three criteria. The dispersal of contaminants is determined by the atmospheric meteorological conditions. Meteorological conditions and atmospheric wind speed are used to define the stability of the atmosphere. When the vertical dispersion of contaminants is less than 55 m4/s3, this model accurately predicts the present state of the atmosphere. This operation was created using a high-level programming language, and an artificial intelligence system gave particular attention to the operation's algorithm. The SCADA production system receives data from each subsystem. The SCADA system shows the data gathered from an environmental monitoring system close to the manufacturing base.

The creation of a low-cost real-time monitoring system is depicted in **Paper [9].** The system warns the employee and sends data on polluted places. The factors that this model examines include temperature, humidity, sound level, and air quality. The microcontroller PIC16F877A is utilised to gather the sensor data. The ESP8266 Wi-Fi module is used to upload the data or information gathered into the cloud. Using the MQTT protocol, a digital dashboard on a smartphone is operated. This warns the user via a web page and sends a strange notification. This report includes a thorough analysis of the permitted noise levels in various locations at specific times, as well as research of the effects of various air quality indices. When an industry fails to take action to minimise emissions within a given timeframe, the pollution control board shuts down the industrial electrical supply. The electrical supply may be cut off in accordance with government laws and regulations until the industry pays a fine for polluting the city.

Problem Statement

Industrial pollution is a significant environmental issue that poses risks to human health and ecosystems. The release of pollutants from industrial activities can have adverse effects on air, water, soil, and overall sustainability. It is crucial to develop efficient and reliable methods for monitoring and controlling industrial pollution to mitigate its impacts and ensure a clean and healthy environment. The current challenge lies in the need for advanced monitoring and control systems that can accurately detect and track pollutant emissions in real-time. Traditional monitoring methods often involve manual sampling and analysis, which are time-consuming, labor-intensive, and provide limited data points. Additionally, the lack of real-time data hampers timely decision-making and intervention to address pollution incidents promptly. To overcome these challenges, the use of advanced technologies such as MyRIO (My Reconfigurable Input/Output) and LabVIEW (Laboratory Virtual Instrument Engineering Workbench) can revolutionize industrial pollution monitoring and control. MyRIO is a compact and powerful embedded platform that integrates analog and digital I/O, real-time processing, and connectivity features. LabVIEW is a graphical programming environment that allows users to develop customized applications for data acquisition, analysis, and control. By leveraging the capabilities of MyRIO and LabVIEW, a comprehensive pollution monitoring and control system can be developed. The system can include sensors and actuators connected to MyRIO, which continuously measure pollutant levels in air, water, and soil. The collected data is then processed and analyzed in real-time using LabVIEW, providing instant insights into pollution levels, trends, and potential sources. The system can also incorporate wireless communication capabilities to transmit data to a central monitoring station or cloud-based platform. This enables remote monitoring and control, allowing environmental authorities and industrial operators to access pollution data from anywhere and take immediate actions when necessary. Moreover, LabVIEW's programming flexibility allows for the integration of machine learning algorithms and predictive analytics, enhancing the system's capabilities. By analyzing historical pollution data and identifying patterns, the system can provide early warnings of potential pollution incidents, enabling proactive measures to be taken. However, implementing such a system faces certain challenges. Firstly, there is a need for extensive collaboration between environmental scientists, engineers, software developers, and industrial stakeholders to ensure the system's accuracy, reliability, and compatibility with existing industrial processes. Secondly, cost considerations and scalability need to be addressed to make the system accessible to industries of all sizes. In closing, the issue of monitoring and managing industrial pollution with MyRIO and LabVIEW originates from the demand for a more effective, precise, and real-time strategy to address industrial pollution. It is feasible to get beyond the restrictions of conventional monitoring techniques and improve pollution control efforts by creating a complete system that combines the hardware capabilities of MyRIO with the LabVIEW programming environment. However, to properly deploy such a system, collaborative efforts, financial concerns, and scalability need to be addressed.

Objectives

- To create a sophisticated method for monitoring the essential elements of pollution-causing industrial wastes.
- To establish a management system for controlling important environmental elements.
- To analyse the viability of creating inexpensive smart pollution monitoring devices.

3. METHODOLOGY

The system architecture is made up of the general outline of the system's behaviour, structure, and viewpoints. System architecture describes the block diagram and flow of the system. A system that is set up to make it easier to analyse its constituent parts and behaviours is described and represented in a formal manner by an architecture description. In a system architecture, there may be components that work together to implement the overall system. myRIO is a versatile hardware platform developed by National Instruments (NI) specifically designed for embedded systems and educational applications. It combines a real-time processor, FPGA, and various I/O interfaces into a single compact device. With its powerful processing capabilities and flexible I/O options, myRIO provides an ideal platform for rapid prototyping, control systems development, and data acquisition tasks. It can be programmed using NI's LabVIEW graphical programming environment, allowing users to easily develop applications and implement custom control algorithms. With its compact size, portability, and extensive functionality, myRIO is widely used in fields such as robotics, automation, and industrial IoT applications.

Temperature sensor-Temperature sensors play a crucial role in industrial pollution monitoring and control by providing real-time data on temperature variations. This information helps ensure optimal operating conditions, preventing overheating or underheating of processes that can lead to pollution. Effective temperature management ensures efficient and environmentally responsible industrial operations.
Gas sensor- Gas sensors detect and measure the presence of harmful gases in the environment, enabling timely response to prevent or mitigate pollution incidents. Gas sensors provide accurate and reliable data on pollutant levels, allowing industrial facilities to implement appropriate measures such as adjusting process parameters or activating pollution control devices. By continuously monitoring gas emissions, these sensors help ensure compliance with environmental regulations and maintain a safe and sustainable industrial environment.

Air Quality sensor- Air quality sensors are essential in industrial pollution monitoring and control. They detect and measure pollutants present in the air, providing real-time data on air quality. These sensors enable industries to identify pollution sources, assess the effectiveness of pollution control measures, and implement timely interventions. By continuously monitoring air quality, they ensure compliance with environmental regulations, protect the health of workers and surrounding communities, and promote sustainable industrial practices. pH sensors – pH sensors measure liquid acidity/alkalinity, aiding in the early detection of pollution sources. These sensors enable optimization of treatment systems, adjustment of chemical processes, and compliance with environmental regulations. By maintaining proper pH levels, industries can ensure sustainable practices and prevent harm to ecosystems and water bodies. GSM module- GSM modules provide wireless connectivity, allowing remote data transmission and real-time monitoring. By sending pollution data to a central monitoring station or control centre, GSM modules enable prompt response to pollution incidents. They facilitate remote control and adjustment of pollution control measures, ensuring efficient and effective pollution management in industrial environments.

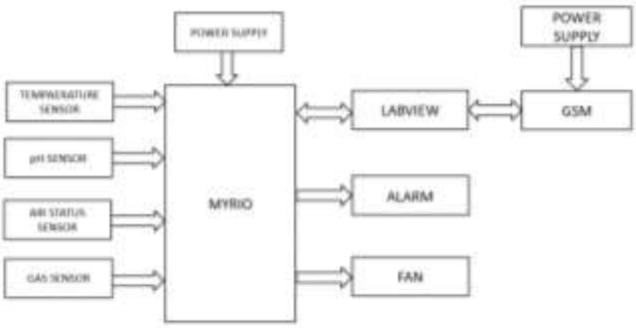

Figure 1: Functional Block Diagram

System Implementation
The system includes a temperature sensor, pH sensor, air quality sensor, gas sensor, and GSM module. The controller is myRIO. Installing sensors is the first step. The sensors have been put in place, and the myRIO controller will be collecting their values. Specific actions will be conducted with regard to the sensor if its value exceeds the defined limit.

In the Circuit Diagram, The GPIO pins are used for the external connections. The MQ135 Air Sensor is connected to the pin no. 11 of A port of the myRIO. The MQ2 Gas Sensor is connected to the pin no. 13 of A port of the myRIO device. The LM35, Temperature Sensor is connected to the pin no. 3 of B port of the myRIO. The pH Sensor which determines the pH value of the solution is connected to the pin no. 5 of the B port of the myRIO. The DC motor is connected to the pin no. 15 of Port A and the buzzer is connected to the pin no. 17 of Port A in the myRIO device.

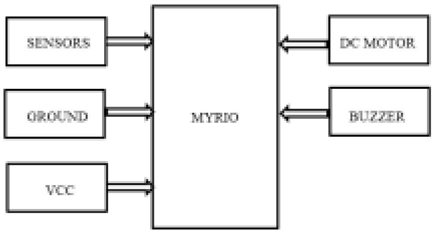

Figure 2: Circuit Diagram

Implementing an industrial pollution monitoring and control system using LabVIEW and myRIO involves utilizing the LabVIEW software and the myRIO hardware platform to develop the necessary functionalities. Here's a flowchart of the software implementation process:

a. Sensor Integration:

Connecting the pollution sensors (e.g., gas sensor, temperature sensor, pH sensor) to the myRIO device. Utilizing the appropriate interfaces and protocols supported by myRIO to interface with the sensors.

b. Data Acquisition and Processing:

Using LabVIEW to create a data acquisition system to continuously read sensor data from the myRIO inputs. Processing the acquired data using LabVIEW functions and algorithms to extract relevant information and calculate pollution levels or other desired parameters.

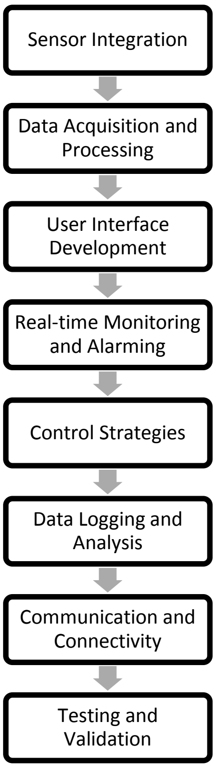

Fig 3 Flow chart

C.

User Interface Development

Designing a user-friendly graphical user interface (GUI) using LabVIEW's drag-and-drop interface design tools. Creating interactive displays, charts, and indicators to present real-time and historical pollution data. Includes controls to configure thresholds, set control parameters, and manage the system.

D. Real-time Monitoring and Alarming

Implementing real-time monitoring capabilities using LabVIEW's built-in functionality. Continuously monitoring pollution levels and comparing them against pre-defined thresholds. Raising alarms or trigger notifications such as SMS when pollution levels exceed the set limits. Ensuring that the alarm system is responsive and can effectively notify relevant personnel.

E. Control Strategies

Implementing control strategies based on the pollution levels to regulate the industrial processes. Using LabVIEW to send control signals to actuators, such as motors, to adjust process parameters and mitigate pollution. Design and implement closed-loop control algorithms, if required, to maintain pollution levels within acceptable limits.

F. Data Logging and Analysis

Using LabVIEW to store acquired pollution data in a database or log file for further analysis and historical tracking. Implementing data analysis algorithms to identify pollution trends, correlations, and patterns. Generating reports or visualizations to aid in decision-making and process optimization.

G. Communication and Connectivity

Integrate communication protocols, such as TCP/IP, Ethernet, or serial communication, to enable remote monitoring and control capabilities. Implement data transmission to a central server or cloud platform for data storage, analysis, and access from multiple locations.

H. Testing and Validation

Conducting thorough testing of the system to ensure its accuracy, reliability, and performance. Validating the system against known pollution scenarios and evaluating its effectiveness in monitoring and controlling pollution in an industrial setting.

Working

Industrial pollution monitoring and control systems play a crucial role in ensuring a safe and healthy environment by detecting and mitigating pollution in industrial settings. Let's explore the working of such a system using LabVIEW and myRIO.

Sensor Integration

- Air Quality Sensor: Measures the concentration of harmful gases, particulate matter, and other pollutants in the air.
- Temperature Sensor: Monitors the temperature in the industrial environment.
- Gas Sensor: Detects specific gases emitted from industrial processes.
- pH Sensor: Measures the acidity or alkalinity of liquid waste or effluents.

Hardware Setup

- Connect the sensors to the appropriate channels of the myRIO device.
- Ensure that the myRIO is powered and connected to the computer running LabVIEW.

LabVIEW Programming

- Launch LabVIEW and create new project.
- Add the myRIO device to the project and establish communication.
- Create LabVIEW VI (Virtual Instrument) to acquire data from the sensors.
- Configure the input/output channels for the sensors.
- Use LabVIEW's built-in functions and libraries to read sensor values periodically.

Data Processing and Analysis

- Receive sensor readings in the LabVIEW VI.
- Apply appropriate scaling and calibration to the raw sensor data.
- Implement algorithms and computations to convert sensor readings into meaningful units .
- Analyze the data to determine pollution levels and identify potential issues.

Alerting and Control

- Set threshold values for different pollutants and parameters.
- Compare the processed data against the thresholds.
- If pollution levels exceed the defined limits, trigger an alert mechanism.

Data Logging and Visualization

- Develop a user interface using LabVIEW to display real-time sensor values, pollution levels, and alerts.
- Create charts, graphs, or visual representations to present historical data and trends.

Control Actions

- Implement control mechanisms to regulate industrial processes or emission sources.
- Connect the myRIO to appropriate actuators or control devices to adjust parameters the sensor parameters.
- Integrate GSM Module to send real time notification to appropriate faculties if the air sensor parameter exceeds the threshold. Turn on the fan if temperature parameter exceeds the limit.

- The Buzzer is turned on if there is a gas leakage in the industry.
- By combining LabVIEW's powerful data acquisition and analysis capabilities with myRIO's flexible I/O capabilities, the system can continuously monitor industrial pollution, analyze the data, trigger alerts when necessary, and enable control actions to mitigate pollution levels and maintain a safe working environment.

4. RESULTS & DISCUSSION

MQ135 SENSOR

The MQ-135 air quality sensor can identify hazardous chemicals and smoke, including ammonia (NH3), sulfur (S), benzene (C6H6), and CO2. This sensor, similar to the others in the MQ series of gas sensors, has a pin for both digital and analog output. The digital pin turns high when the amount of these gases in the air exceeds a predetermined threshold. The on-board potentiometer can be used to adjust this threshold value. Hazardous gases in the environment can be found using the sensor's digital output pin.

Fig 4. Testing of MQ135 Sensor

The indicator LED D0 will turn on if gas is detected. A notification will be sent to the necessary faculties via the GSM module as soon as the polluted air is detected.

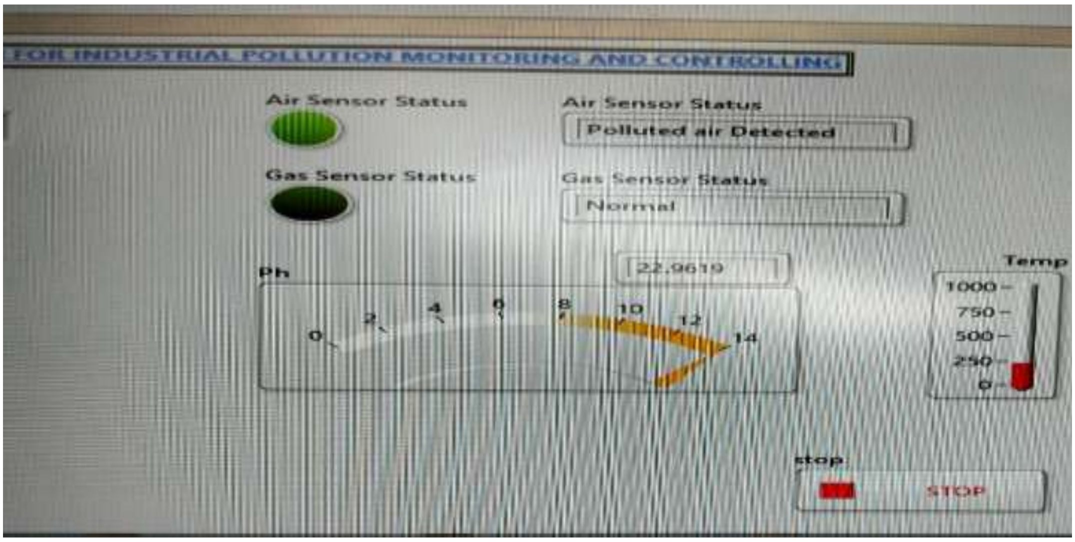

Fig 5 Output of the MQ135 sensor

MQ2 SENSOR:

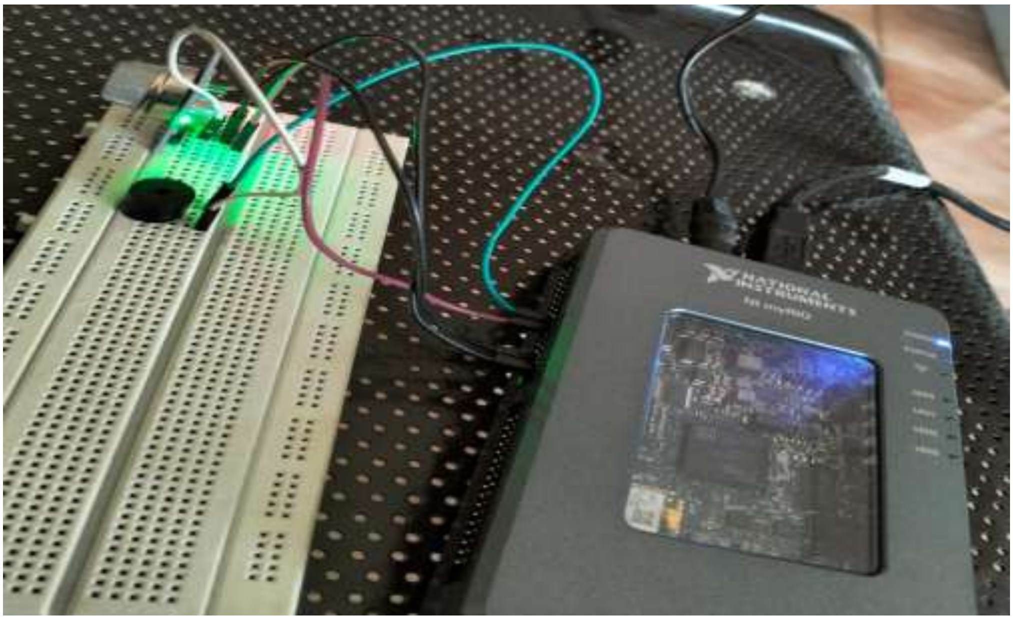

Fig 6 Testing of MQ2 Sensor and Buzzer

The MQ-2 gas sensor is another member of the MQ series of gas sensors, which can detect various combustible gases such as methane, propane, butane, alcohol, and smoke. The MQ-2 sensor also has a pin for both digital and analog output, and the digital pin goes high when the concentration of gas in the air exceeds a predefined threshold value, which can be adjusted using the on-board potentiometer. When the gas concentration exceeds the threshold, the indicator LED D0 will turn on. Therefore, the MQ-2 gas sensor can be used to detect the presence of flammable gases in the environment and trigger an alarm or take other safety measures accordingly.

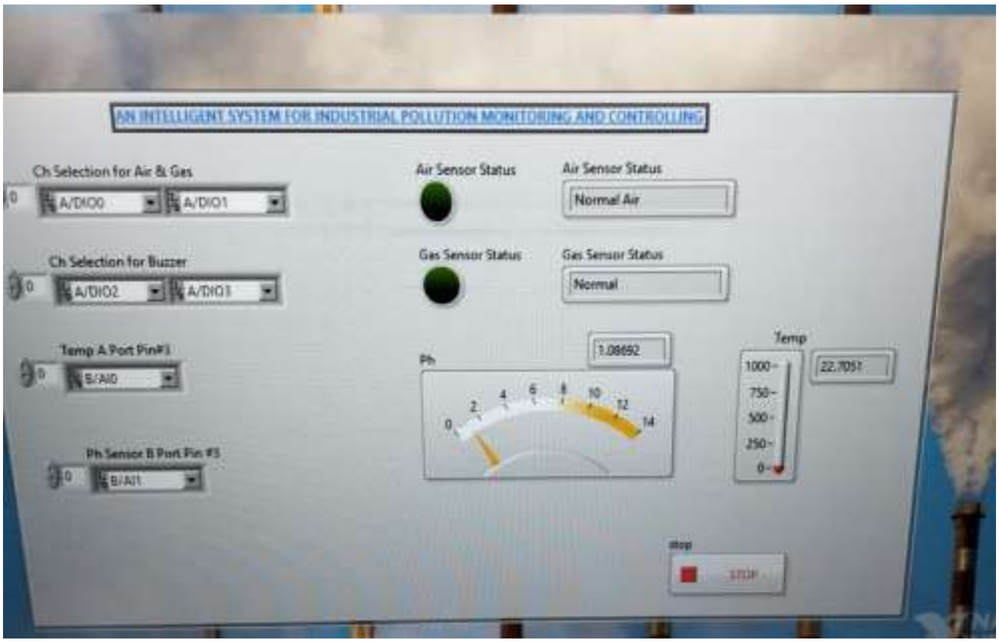

Fig 7 Output of MQ2 Sensor

TEMPERATURE SENSOR:

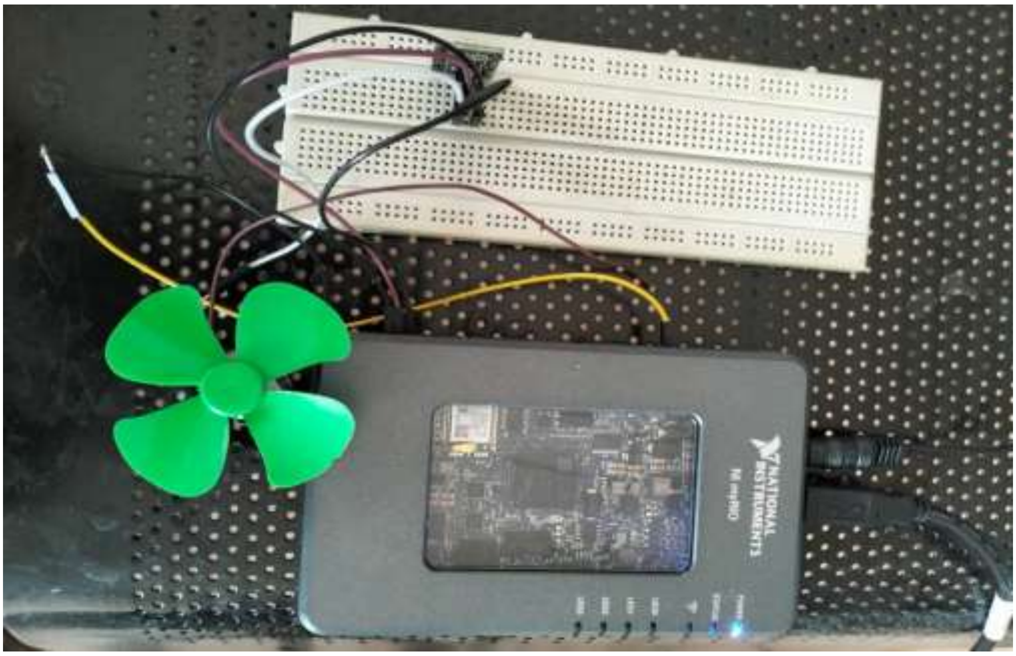

Fig 8 Testing of Temperature sensor and DC motor

The LM35 is a temperature sensor that can measure temperature accurately without requiring any external calibration or circuitry. It provides an analog output voltage that is proportional to the temperature it measures. The LM35 sensor is very easy to use, as it only requires power and ground connections, as well as a single output voltage that can be read using an analog-to-digital converter (ADC). It can be used in industrial settings to monitor temperature conditions, and if the temperature rises above a certain threshold, a fan can be turned on to cool the air.

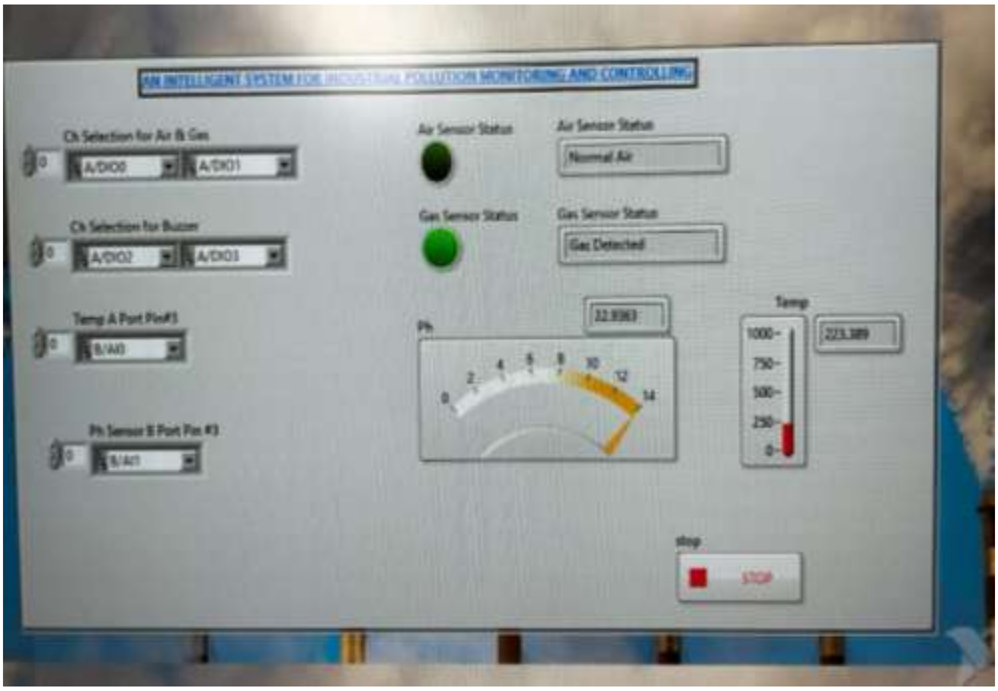

Fig 9 Output of the temperature sensor

PH SENSOR:

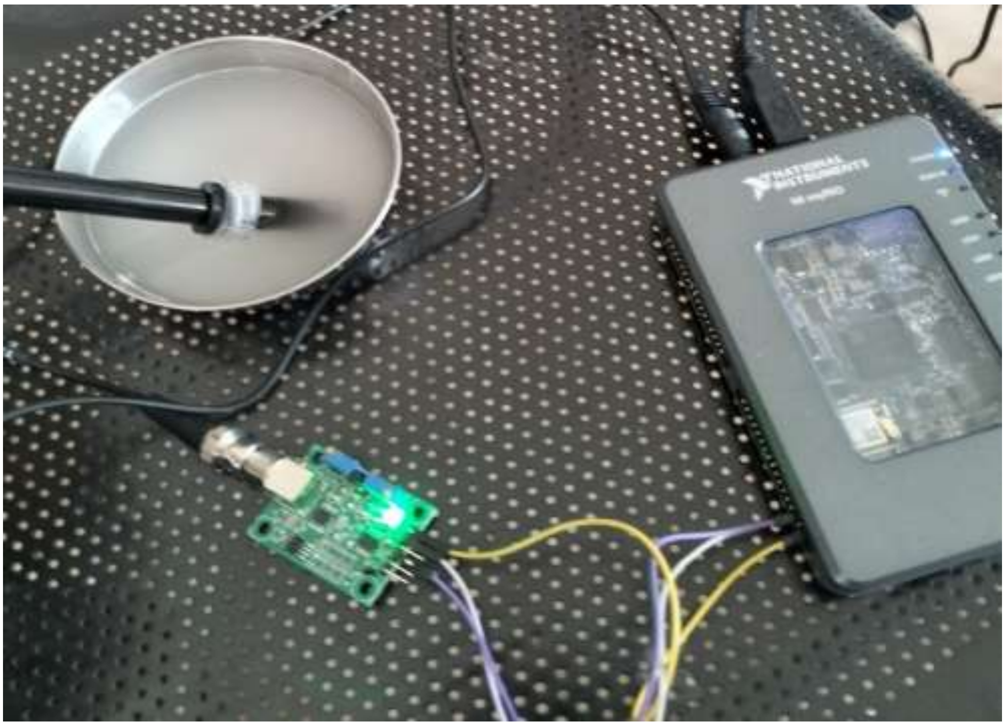

Fig 10 Testing of pH sensor

The pH sensor is an electronic device that measures the acidity or alkalinity of a liquid. It can be used to detect changes in the pH level of a solution, which can indicate the presence of certain substances or conditions. Like other sensors, pH sensors can have both digital and analog output pins. The digital pin can be set to turn high or low based on a predetermined pH threshold value, while the analog pin can provide a continuous voltage output proportional to the pH value of the solution.

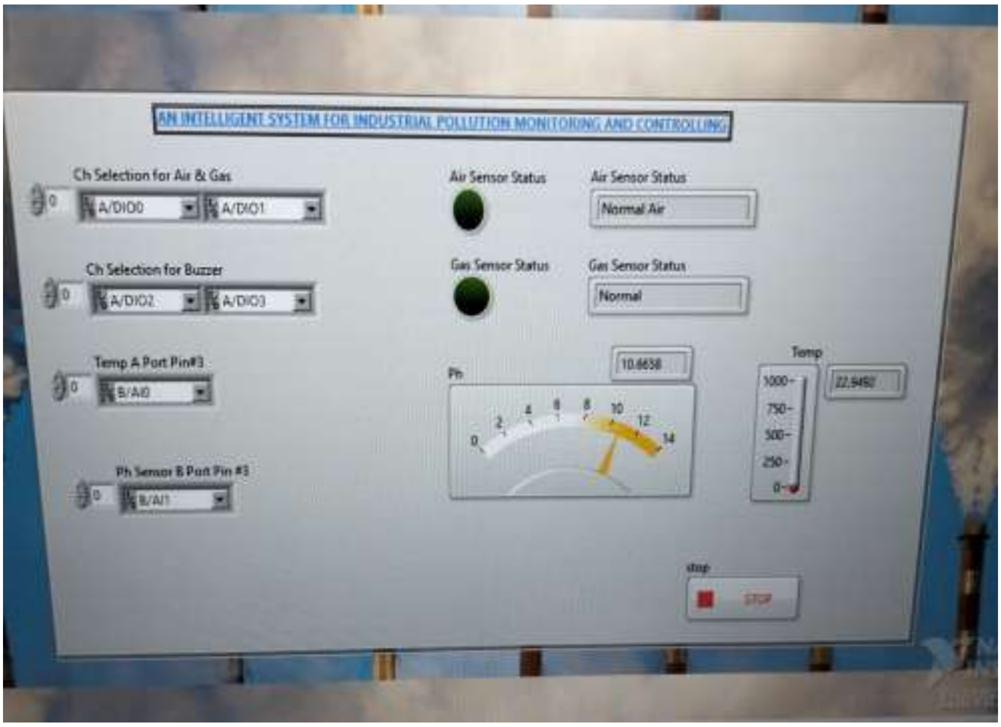

Fig 11 Output of pH sensor

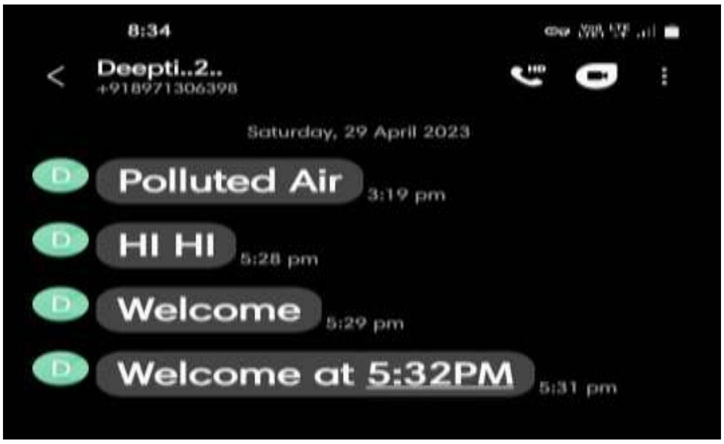

Fig 12 GSM notifications

LabVIEW and myRIO (my Reconfigurable Input/Output) are powerful tools that can be utilized to overcome some of the drawbacks mentioned in existing industrial pollution monitoring and controlling systems. Here's how they can help:

1. Comprehensive coverage: LabVIEW and myRIO allow for flexible and customizable programming, enabling the integration of multiple sensors and devices. This versatility allows for the creation of comprehensive monitoring systems that can accommodate various pollutants and industries.
2. Real-time monitoring: With LabVIEW and myRIO, you can develop real-time monitoring systems that continuously collect data from sensors and provide immediate feedback. These tools offer high-speed data acquisition capabilities, allowing for quick response and timely interventions when pollution incidents occur.
3. Advanced sensor technology: LabVIEW supports various data acquisition modules and provides an extensive library of drivers and APIs, enabling the integration of advanced sensor technology. This allows for accurate and precise monitoring of a wide range of pollutants, including the detection of low levels of contaminants.
4. Data interpretation and analysis: LabVIEW offers a comprehensive development environment for data processing, analysis, and visualization. It provides tools for efficient data interpretation, allowing you to analyze trends, patterns, and potential pollution sources. With the built-in graphical programming approach, LabVIEW simplifies the process of developing complex algorithms for data analysis.
5. Integration and interoperability: LabVIEW and myRIO facilitate seamless integration and interoperability among different systems. They support various communication protocols, enabling data sharing and collaboration between monitoring platforms. This integration enhances the overall understanding of pollution levels by leveraging data from multiple sources.
6. Regulatory compliance: LabVIEW and myRIO can be utilized to create systems that automate compliance monitoring and reporting. By implementing real-time monitoring and data logging capabilities, these tools enable industries to track and report their pollution levels accurately. This helps ensure compliance with regulations and encourages accountability.
7. Cost-effective solutions: LabVIEW and myRIO offer cost-effective solutions for industrial pollution monitoring and controlling. They provide a platform that combines hardware and software, reducing the need for expensive custom development. Additionally, LabVIEW's user-friendly graphical programming interface simplifies system development and maintenance, making it accessible even to users with limited programming experience.

By leveraging the capabilities of LabVIEW and myRIO, industries can develop robust, customizable, and cost-effective monitoring systems that address the drawbacks of existing industrial pollution monitoring and controlling systems. These tools enable real-time monitoring, advanced data analysis, and integration, paving the way for effective pollution management and control.

5. CONCLUSION

In conclusion, industrial pollution monitoring and controlling using LabVIEW and myRIO provides an effective and efficient solution to mitigate the detrimental effects of pollution on the environment and human health. This integrated system allows for real-time data acquisition, analysis, and control, enabling industries to monitor and regulate their pollution levels more accurately.

By leveraging the capabilities of LabVIEW and myRIO, industries can easily develop customized monitoring systems tailored to their specific pollution sources and requirements. The LabVIEW software platform offers a user-friendly interface for data visualization and analysis, facilitating the interpretation of complex pollution data. Additionally, myRIO's embedded hardware system provides a reliable and scalable solution for acquiring data from various sensors and actuators.

The real-time monitoring capabilities of this system allow industries to promptly identify pollution sources and deviations from permissible levels. By continuously monitoring key parameters such as air quality, water quality, and emissions, proactive measures can be taken to prevent and control pollution incidents. Moreover, the integration of myRIO allows for direct control of pollution mitigation processes, such as adjusting emission levels or activating pollution control systems.

The implementation of this monitoring and control system contributes to sustainable industrial practices by reducing pollution levels, minimizing environmental impact, and promoting regulatory compliance. By employing LabVIEW and myRIO, industries can optimize their pollution control strategies, improve operational efficiency, and ultimately protect the environment and the well-being of surrounding communities.

In conclusion, industrial pollution monitoring and controlling using LabVIEW and myRIO represent a significant step forward in achieving cleaner and more sustainable industrial processes. The combination of real-time data acquisition, analysis, and control capabilities provides industries with the necessary tools to mitigate pollution effectively and proactively, leading to a greener and healthier future for all.

Future Scope

To detect animal infiltration trends and increase the precision of alerts and warnings, machine learning and AI can be used to analyze data gathered by IoT sensors and cameras. Crop management practices can be optimized using real-time data by integrating IoT-based crop protection devices with precision agricultural methods. This may result in more effective and environmentally friendly agricultural methods. Crop management practices can be optimized using real-time data by integrating IoT-based crop protection devices with precision agricultural methods. This may result in more effective and environmentally friendly agricultural methods.

Farmer collaboration networks can be built using IoT-based crop protection systems to share data on animal activity and crop health. Informed decisions can be made by farmers as a result, which can also lessen the total effect of animal damage on crops. We can anticipate seeing sensors that are more precise and capable of detecting a larger variety of animal movement as sensor technology develops.

To automatically identify and react to animal intrusions, IoT-based crop protection systems can relate to autonomous systems, such as drones or robots.

The future holds promising advancements in industrial pollution monitoring and controlling through the integration of LabVIEW and myRIO. LabVIEW, a powerful graphical programming environment, combined with the versatile myRIO platform, can revolutionize the way we address industrial pollution challenges. In the coming years, we can expect enhanced real-time monitoring capabilities, allowing for the collection and analysis of extensive pollution data from various industrial sources. LabVIEW's intuitive programming interface and myRIO's embedded system capabilities enable the development of compact and cost-effective monitoring systems, making it feasible to deploy them widely across industries.

Furthermore, the integration of advanced sensors and Internet of Things (IoT) technologies will enable continuous data streaming and remote monitoring. This connectivity will facilitate proactive pollution control measures by providing immediate alerts and triggering automated responses to mitigate any potential environmental risks. Additionally, machine learning algorithms integrated into LabVIEW can help in identifying patterns, predicting pollution levels, and optimizing control strategies. This predictive capability will empower industries to implement preventive measures and adopt cleaner production processes, thereby reducing pollution at its source.

6. REFERENCES

1. "IoT-Based Temperature Monitoring and Controlling System by Using myRIO & LabVIEW" by M. S. Khan International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering Vol. 8, Issue 4, April 2020
2. "An Industrial Cloud-Based IoT System for Real-Time Monitoring and Controlling of Wastewater" by S. M. J. Mirzapour International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE) Vol. 3, Special Issue 13, March 2017
3. Industrial Air Pollution Monitoring System Using LABVIEW and ZIGBEE
4. Industrial pollution monitoring GUI system using internet, LabVIEW, and GSM July 2014, 2014 International Conference on Control,

Instrumentation, Communication and Computational Technologies (ICCICCT)

5. Patel, P., Sharma, A., & Pandya, H. (2022). LabVIEW-Based Pollution Monitoring and Control System for Industrial Applications. In 2022 International Conference on Computing, Power and Communication Technologies (GUCON) (pp. 1-6). IEEE.
6. Gupta, A., Kumar, R., & Kumar, P. (2022). IoT-Based Industrial Pollution Monitoring and Control System. In 2022 2nd International Conference on Computing Methodologies and Communication (ICCMC) (pp. 1-6). IEEE.
7. Bocaniala, C. D., Dumitru, V., & Bocaniala, C. (2021). IoT Monitoring and Control System for Environmental Parameters in a Manufacturing Environment. In 2021 IEEE 14th International Conference on Compatibility, Power Electronics and Power Engineering (CPE-POWERENG) (pp. 1-6). IEEE.
8. Raja, M., Anand, D., & Rajkumar, S. (2021). IoT-Based Environment Monitoring System for Industries. International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 7(3), 1-7.
9. Gera, V., & Kumar, V. (2021). LabVIEW-based IoT System for Pollution Monitoring and Controlling in Industries. In 2021 3rd International Conference on Inventive Computation Technologies (ICICT) (pp. 1-6). IEEE.
10. Sriram, M., Karthikeyan, S., Prakash, G. M., & Lakshmipriya, N. (2021). IoT-Based Real-Time Pollution Monitoring and Control System for Smart Industries. In 2021 IEEE International Conference on Electrical, Electronics, Signals, Communication and Optimization (EESCO) (pp. 1-6). IEEE.
11. "IoT-Based Temperature Monitoring and Controlling System by Using myRIO & LabVIEW" by M. S. Khan International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering Vol. 8, Issue 4, April 2020.
12. Chandrasekaran, S., Sundaram, S., & Sridharan, V. (2020). Internet of Things (IoT)-Based Industrial Environment Monitoring System for Sustainability. Journal of Cleaner Production, 256, 120411.
13. Jamil, F., Javaid, N., Ahmad, A., & Alrajeh, N. (2020). Design and Development of Industrial IoT-Based Monitoring System. International Journal of Advanced Computer Science and Applications, 11(5), 193-201.
14. Jayasankar, R., Elavarasan, E., & Chinnaraj, R. (2020). IoT Enabled Environmental Monitoring and Control System for Smart Manufacturing Industry. In 2020 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT) (pp. 1-6). IEEE.
15. Balakrishnan, B., Rengasamy, N., & Palanisamy, K. (2020). Real-Time Pollution Monitoring and Control System for Smart Industries using IoT. In 2020 International Conference on Smart Electronics and Communication (ICOSEC) (pp. 1-6). IEEE.
16. Parnami, R., & Sharma, S. K. (2020). Development of IoT-Based Pollution Monitoring System for Industrial Applications. In 2020 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT) (pp. 1-6). IEEE.
17. Patil, M. P., Bhosale, R. K., Jadhav, S. B., & Ghuge, S. N. (2020). LabVIEW Based Pollution Monitoring System for Smart Industries. In 2020 IEEE International Conference on System, Computation, Automation and Networking (ICSCAN) (pp. 1-5). IEEE.
18. Dilip R, Bhagirathi V. (2013) Image Processing Techniques for Coin Classification Using LabVIEW. OJAI 2013, 1(1): 13-17 Open Journal of Artificial Intelligence DOI:10.12966/ojai.08.03.2013 12.
19. Naveen Mukati, Neha Namdev, R. Dilip, N. Hemalatha, Viney Dhiman, Bharti Sahu, Healthcare Assistance to COVID-19 Patient using Internet of Things (IoT) Enabled Technologies, Materials Today: Proceedings,2021,https://doi.org/10.1016/j.matpr.2021.07.379. ISSN214-7853,
20. Mr. DILIP R, Dr. Ramesh K. B. (2020). Development of Graphical System for Patient Monitoring using Cloud Computing. International Journal of Advanced Science and Technology, 29(12s), 2353 - 2368.
21. Mr. Dilip R, Dr. Ramesh K B ."Design and Development of Silent Speech Recognition System for Monitoring of Devices", Volume 7, Issue VI, International Journal for Research in Applied Science and Engineering Technology (IJRASET) Page No: , ISSN : 2321-9653
22. R. Dilip, Y. D. Borole, S. Sumalatha and H. Nethravathi, "Speech Based Biomedical Devices Monitoring Using LabVIEW," 2021 9th International Conference on Cyber and IT Service Management (CITSM), 2021, pp. 1-7, doi: 10.1109/CITSM52892.2021.9588853.
23. Pandey, J.K. et al. (2023). Investigating Role of IoT in the Development of Smart Application for Security Enhancement. In: Sindhwani, N., Anand, R., Niranjana Murthy, M., ChanderVerma, D., Valentina, E.B. (eds) IoT Based Smart Applications. EAI/Springer Innovations in Communication and Computing. Springer, Cham. https://doi.org/10.1007/978-3-031-04524-0_13.

24. Dilip, R., Samanvita, N., Pramodhini, R., Vidhya, S.G., Telkar, B.S. (2022). Performance Analysis of Machine Learning Algorithms in Intrusion Detection and Classification. In: Balas, V.E., Sinha, G.R., Agarwal, B., Sharma, T.K., Dadheech, P., Mahrishi, M. (eds) Emerging Technologies in Computer Engineering: Cognitive Computing and Intelligent IoT. ICETCE 2022. Communications in Computer and Information Science, vol 1591. Springer, Cham. https://doi.org/10.1007/978-3-031-07012-9_25.