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Air Pollution Monitoring System using LabVIEW

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Abstract

Air pollution poses a significant threat to human health and the environment. To address this issue, the development of effective air pollution monitoring systems is crucial. This research paper presents an innovative approach to monitoring air pollution using the MyRIO platform, a programmable embedded system designed for real-time control and data acquisition. The proposed system integrates various sensors to measure key air pollutants and provides a reliable and accurate means of monitoring air quality in real-time. FPGA, and I/O capabilities, making it suitable for data acquisition and control applications. The proposed system integrates various sensors to measure key air pollutants, such as particulate matter, carbon monoxide, smoke, and Gas leakage like LPG. The acquired data is processed, analysed, and transmitted to a central server for visualisation and further analysis. The system provides an efficient and reliable solution for monitoring air pollution, aiding in decision-making processes, and facilitating effective pollution control measures. The system architecture, sensor selection, data acquisition, and analysis methods are discussed in detail, highlighting the potential of MyRIO-based solutions in air pollution monitoring.

Keywords: NI Labview, MyRIO, Monitoring, Air Pollution, MQ Sensors.

1. Introduction

Being healthy and having an eternal life for everyone is a constant concern in the current society. In actuality, the anxiety has increased over the last two years as a result of the Covid losses. People all throughout the world are beginning to consider their surroundings and selves. Air,

water, land, sky, and fire are nature's five basic elements. The air is the first of these five. Our ability to breathe is extremely important. The cleanliness of that air is crucial. Polluted air can actually cause illnesses including asthma, lung cancer, and emphysema. People's life were negatively impacted by these disorders. Due to its potential to produce greenhouse effects and contribute to global warming, air pollution also has a harmful impact on the ecosystem. The primary causes of air pollution are the burning of fuel, open fires, the release of gases from industrial facilities, and smoking. To make sure we are breathing the best possible air, it is crucial to assess the quality of the air we are breathing. In addition to having the same natural origins, some air pollutants also directly cause global warming. Reducing these pollutants, sometimes referred to as Short-Lived Climate Pollutants, would delay climate change and contribute to keeping global warming to 1.5C. You probably breathe filthy air even though you can't see it.

Utilising sensors, Arduino microcontrollers, and Global System for Mobile (GSM) modules are some of the current methods for remotely monitoring air quality. Additionally, some wireless systems use a wireless sensor that has been designed, installed, and tested as well as a GPRS sensor array for real-time monitoring. There is also a mobile system that monitors the Air Pollutant Index (API) utilising the Sharp GP2Y1010AU0F optical dust sensor, Arduino Uno, and Liquid Crystal Display Keypad Shield. A device created by Sevusu combines a smartphone and GPS to pinpoint locations and measure air pollution. Additionally, there are some older systems that make use of several sensor kinds, including the TGS2600, as well as a number of specially designed applications, like mobile sensing boxes and personal sensing gadgets. LabVIEW-based remote monitoring has been used in a number of applications in recent years.

LabVIEW and MyRIO can be used as a small-scale portable detection system where data can be seen remotely by the user. They can also be used to remotely monitor various physical characteristics. The logged data can then be automatically saved in Microsoft Excel for additional examination. Currently, we are working on a project where we will create a system based on MyRIO-LABVIEW that will allow us to remotely access the sir quality inside the buildings.

2. Methodology

Input is obtained from the MQ9, MQ7 AND MQ135 sensors which are energized with the help of the arduino UNO R3 and then feed that value to the myRIO, which is interfaced with the LabVIEW and controls the output devices like buzzer, LED. The sensor starts sensing the atmospheric air and the data is being loaded in the form of excel sheet which is later displayed in the front panel or commonly called a s GUI of the LabView(Fig.1)

The overall system block diagram(Fig.2) makes us to understand the overall methodology and the experimental progress of the proposed architecture in the form of flow chart(Fig.3)

Figure.1. LABView Front panel

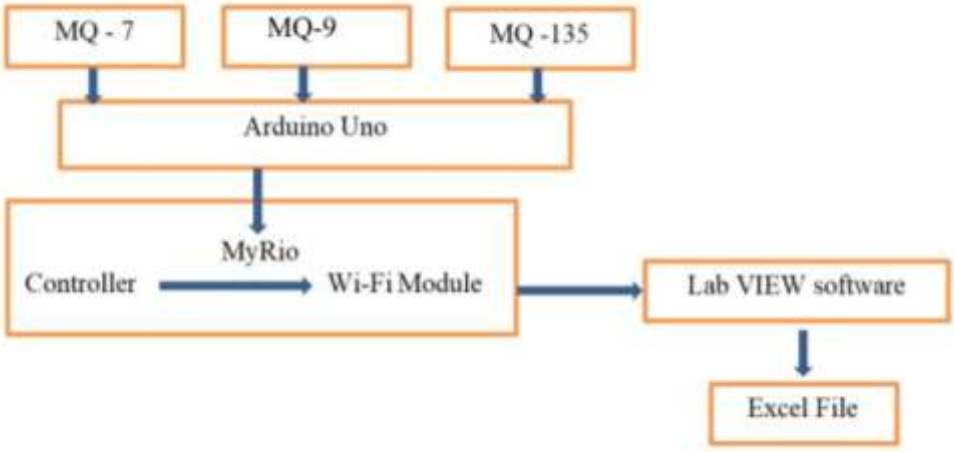

Figure.2. Overall system Block diagram

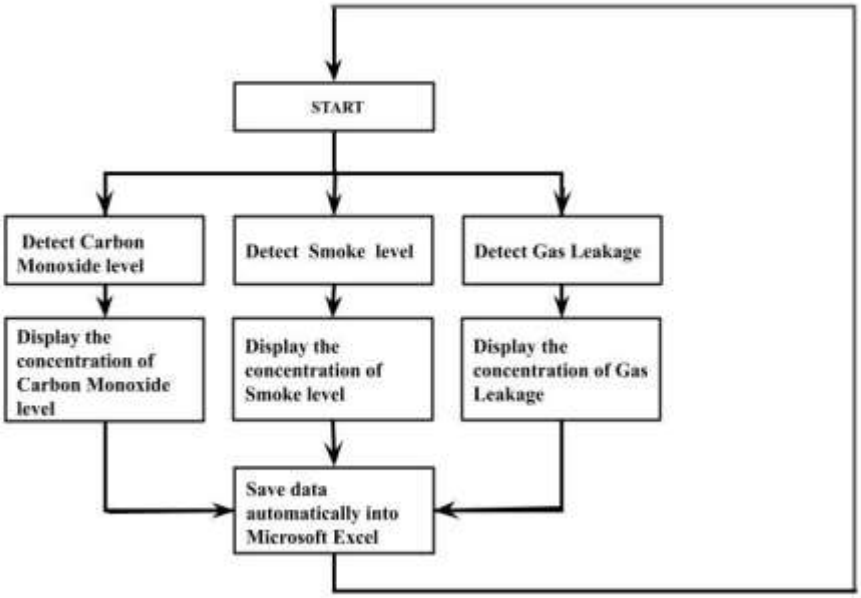

Figure.3. Flow chart for air quality monitoring system

3. Experimental Progress

The MQ-7, MQ-9, and MQ-135 sensors are part of the system. The MQ-7 gas sensor, which is designed particularly to detect CO gas, is employed by the system to detect the presence of Carbon Monoxide (CO) gas in the vicinity. The MQ-9 sensor is a gas leakage detector with great sensitivity to gas leaks as well as sensitivity to strong oxides like Cl2, NO2, and others.

Organic interfering gases cause it to react in the opposite way. It has benefits including a long lifespan, low cost, and a straightforward drive circuit in addition to having strong ozone sensitivity over a broad range. Similar to this, the MQ-135 sensor can be used to identify dangerous gases including smoke and benzene.It may identify a variety of dangerous gases. It can be utilised for a variety of purposes, including the detection of toxic gases, indoor air pollution, outdoor air pollution, industrial air pollution, portable air pollution, and more. The customised module that houses these sensors has its own circuitry. The Arduino Uno is then linked to the module. The sensor is turned on by the Arduino Uno's code, which causes it to produce parts per million (ppm) values of the gas. However, the MyRIO 1900 and Arduino Uno are connected via Universal Asynchronous Receiver/Transmitter (UART) so that LabVIEW software can access the data. The MyRIO's wireless module functions as a router so that the user computer can access it wirelessly and remotely. Through the LabVIEW Graphical User Interface (GUI), the user can remotely monitor the readings, and they are instantly stored into a Microsoft Excel spreadsheet.

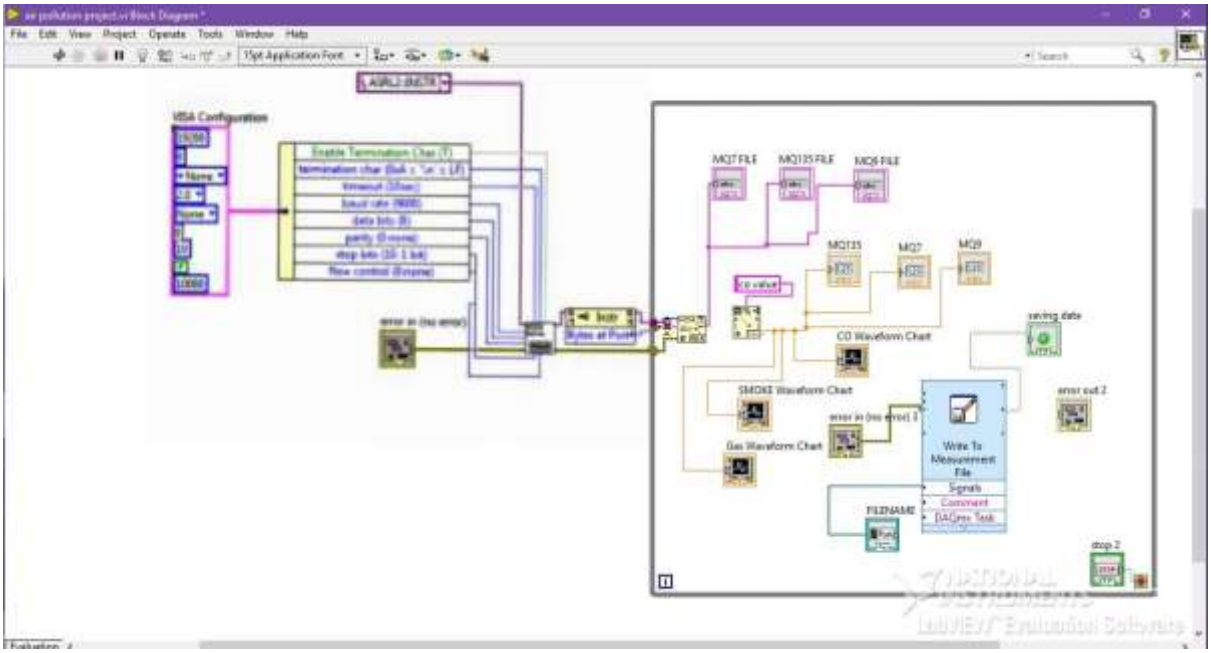

Figure.4. Labview Block Diagram

The LabVIEW environment is used to control this remote air quality monitoring device. In the LabVIEW block diagram window, the user can create the GUI functions. Here, a functional block diagram is used to construct LabVIEW GUI functionalities. The majority of the industry uses LabVIEW-based GUI (Fig. 4) for data visualisation and real-time monitoring.

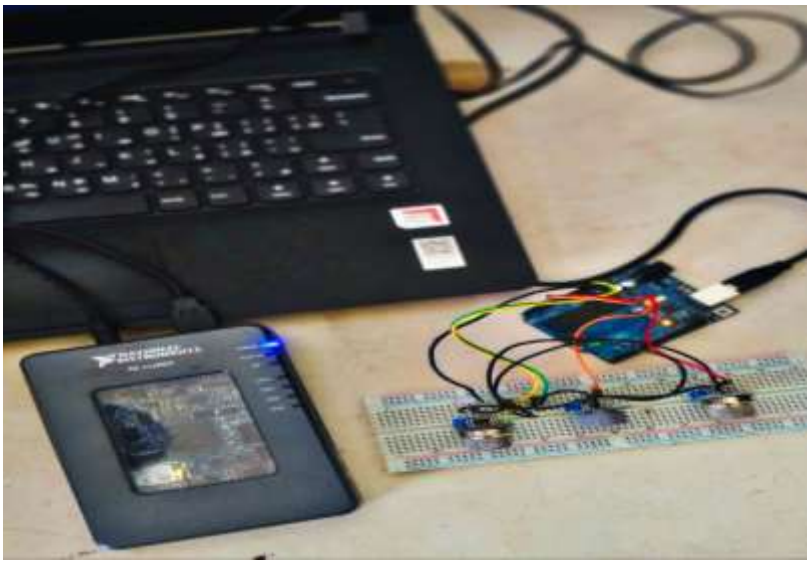

Figure.5. Experimental Hardware

4. Results and Discussion

There are several locations where gas emissions can be detected, therefore to test the proposed model's functionality, we went to a restaurant close to a traffic light. We received a prompt response when we used a MyRIO-based tool, and the outcomes were shown in the front panel as a graph (Fig. 1). The data is automatically recorded in the excel sheet, and each gas detection's separate graphs, such as the CO wave chart (Fig. 6), smoke wave chart (Fig. 7) and gas leakage wave chart (Fig. 8), are expressed graphically.

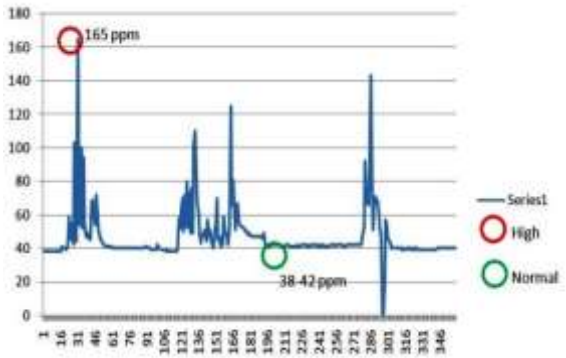

Figure.6. CO wave chart

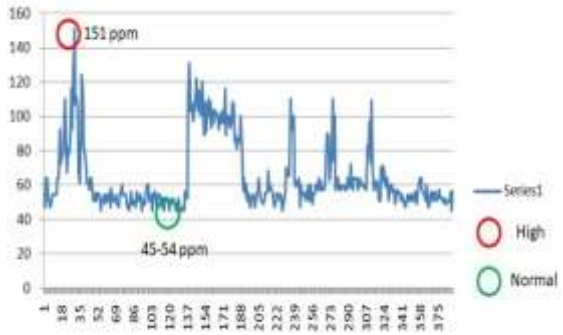

Figure.7. Gas Leakage wave chart

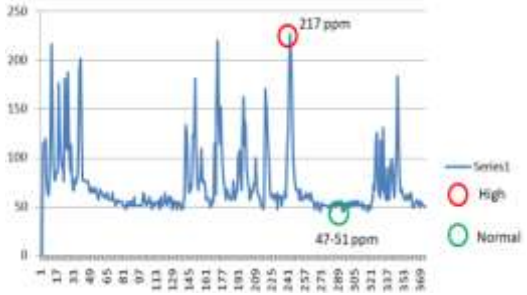

Figure.8. Smoke level wave chart

5. Conclusion

The MyRIO and LabVIEW-based air quality monitoring system might be regarded as a successful process. The device is fully functional and portable. The user's computer can be used to remotely access the Microsoft Excel file that has the data. This system can be used both at home and at the office. The relevant parties may resort to all of the acquired data in the future for additional actions. Several more types of gas sensors, such as MQ-7 for butane gas detection, MQ-135 for smoke detection, and MQ-9 for carbon dioxide detection, can be added to the current system to improve it. Why not put it into practice when technology is available to keep us safe and everyone content? This idea is what inspired this project.

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