AIR QUALITY MONITORING AND ALERT SYSTEM

Submitted in partial fulfillment of the requirements for the award of Bachelor of Technology degree in BioMedical Engineering

BY

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INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **Preeti B (41240026), M.V Sri Harshitha (41240043), G. Shamitha (41240044)** Who carried out the project entitled **"AIR QUALITY MONITORING AND ALERT SYSTEM"** under our supervision from January 2023 to April 2023.

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DECLARATION

We **Preeti B (41240026), M.V Sri Harshitha (41240043), G. Shamitha (41240044)** hereby declare that the Project Report entitled **"AIR QUALITY MONITORING AND ALERT SYSTEM"** done by us under the guidance of **Dr.Grace Kanmani** at Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Bachelor of Technology degree in **BIOMEDICAL ENGINEERING.**

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ABSTRACT:

An air quality monitoring and alert system is a technological solution designed to measure and analyze the concentration of pollutants in the air. This system is equipped with sensors and data processing algorithms that provide real-time information on the air quality, which is then translated into alerts for public health and safety purposes. The system's primary objective is to improve air quality monitoring, reduce exposure to harmful air pollutants, and provide early warning systems for potential health hazards. This abstract highlights the importance of air quality monitoring and alert systems in modern society and their contribution to public health and environmental protection.

An air quality monitoring and alert system is designed to provide continuous monitoring of the air quality in a particular area and to alert users when the air quality falls below a certain threshold. The system typically consists of a network of sensors that measure various pollutants in the air, such as particulate matter, ozone, and carbon monoxide. These sensors send data to a central server where it is processed and analyzed in real-time. When the system detects that the air quality has reached an unhealthy level, it sends alerts to users via mobile app notifications or other means, so that they can take appropriate action to protect themselves. Such a system can help individuals and communities make informed decisions about their daily activities and help reduce exposure to harmful air pollutants.

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CHAPTER – 1

INTRODUCTION

In this project, we are going to make an Air Quality Monitoring and Alert System in which we will monitor the Air Quality over a webserver using internet and will trigger an alarm when the air quality goes beyond a certain level. when harmful gases are present in the air like CO2, smoke, alcohol, benzene and NH3. It will show the air quality in PPM on the LCD and as well as on webpage so that we can monitor it very easily.

Here, we basically use MQ 135 Sensor as the air quality sensor which is the best choice for monitoring Air Quality as it can detects most harmful gases and can measure their amount accurately. In this project, you can monitor the pollution level from anywhere using your computer or mobile. We can install this system anywhere and can also trigger some device when pollution goes beyond some level, like we can switch on the exhaust fan or can send alert SMS/mail to the user.

The MQ135 sensor can sense NH3, NOx, alcohol, Benzene, smoke, CO2 and some other gases, so it is perfect gas sensor for our Air Quality Monitoring Project. When we will connect it to Arduino then it will sense the gases, and we will get the Pollution level in PPM (parts per million).

MQ135 gas sensor gives the output in form of voltage levels, and we need to convert it into PPM., So for converting the output in PPM, here we have used a library for MQ135 sensor.

When the value will be less than 1000 PPM, then the LCD and webpage will display “Fresh Air”. Whenever the value will increase 1000 PPM, then the buzzer will start beeping and the LCD and webpage will display “Poor Air, Open Windows”. If it will increase 2000 then the buzzer will keep beeping and the LCD and webpage will display “Danger! Move to fresh Air”.

Figure 1.1 MQ 135 Air Quality Sensor

Figure 1.2 Arduino UNO

CHAPTER – 2

LITERATURE SURVEY

AUTHOR'S NAME	YEAR OF PUBLICATION	JOURNAL	ABSTRACT
JUNG-YOON KIM ETAL	2014	IEEE Sensors Journal (Volume:14, Issue:12)	This paper examines the issues, infrastructure information processing, and challenges of designing and implementing an integrated sensing system for real-time indoor air quality monitoring. The system aims to detect the level of seven gases, ozone, particulate matter, carbon monoxide (CO), nitrogen oxides, sulfur dioxide, volatile organic compound, and carbon dioxide, on a real-time basis and provides overall air quality alert timely.
BIKASH KUMAR MOHARANA ETAL	2020	2020 International Conference on communication and signal processing (ICCSP)	In this paper the proposed air quality monitoring device comprises of a Node MCU ESP32, a MQ-135 gas sensor and a DHT11temperature and humidity sensor module. As compared to other counterparts available, our proposed system gives an upper hand in terms of small

			size, efficient power usage and cost. The sensors record the data and send it to the Node MCU acting as the base station of the overall setup.
AMIZA AMIR ETAL	2020	Journal of physics conference series volume 1755 5th international conference on electronic design (ICED)2020 19 August 2020	This paper is about creating an IOT based alarm air quality monitoring system to detect the dust particle, pollutant gases, temperature and humidity in the surrounding. The objective of this research work is to develop an indoor and outdoor air quality monitoring system for different air quality parameters.
KHALEDBASHIR SHABAN ETAL	2016	IEEE Sensors journal (volume 16 april 2016)	The focus of this paper is on the monitoring system and its forecasting module. Three machine learning (ML) algorithms are investigated to build accurate forecasting models for one-step and multi-step ahead of concentrations of ground-level ozone, nitrogen dioxide, and sulfur dioxide. These ML algorithms are support vector machines, M5P model trees, and artificial neural networks (ANN).

OCTAVIAN A. POSTOLACHE ETAL	2009	IEEE Transactions on instrumentation and measurement	This paper presents a network for indoor and outdoor air quality monitoring. Each node is installed in a different room and includes tin dioxide sensor arrays connected to an acquisition and control system. The nodes are hardwired or wirelessly connected to a central monitoring unit. To increase the gas concentration measurement accuracy and to prevent false alarms.
AMLENDU PRABHAKAR ETAL	2012	IEEE Sensors journal	Colorimetry is a powerful sensing principle that detects a target analyte based on a reaction-induced colour change. This present work reports a combined microfluids channel via a complementary metal-oxide-semiconductor (CMOS) Imager. The change of the colour gradient provides continuous monitoring of the analyte concentration of over many years, and the principle and capability of the approach is demonstrated by theoretical simulation.

SILVIU.C. FOLEA ETAL	2015	IEEE Sensors Journal	This paper presents the development of a compact battery powered system that monitors the carbon dioxide level, temperature, relative humidity, absolute pressure, and intensity of light in indoor spaces, and that sends the measurement data using the existent wireless infrastructure based on the IEEE 802.11 b/g standards. The resulted device's characteristics and performance Experimental or materials and methods; algorithms used are comparable with the ones provided by recognized solutions, such as ZigBee-based sensor nodes. By combining Wi-Fi connectivity with ambient sensors, this solution can be used for remote gathering and further processing of measurement data.

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AIM:

The aim of this project is to develop a air quality monitoring and alert system that can monitor air quality level.

SCOPE OF THE PRESENT INVESTIGATION:

The scope of the investigation is to develop a iot based air quality monitoring make an IoT Based Air Pollution Monitoring System in which we will monitor the Air Quality over a webserver using internet and will trigger an alarm when the air quality goes beyond a certain level. When harmful gases are present in the air like CO2, smoke, alcohol, benzene and NH3. It will show the air quality in PPM on the LCD and as well as on webpage so that we can monitor it very easily.

CHAPTER – 4

EXPERIMENTAL OR MATERIALS AND METHODS; ALGORITHMS USED

Air quality monitoring and alert systems are designed to monitor and report the levels of air pollutants in the atmosphere. These systems use a combination of sensors, data analysis techniques, and communication technologies to provide real-time information about air quality in a particular area.

The primary goal of an air quality monitoring and alert system is to provide timely and accurate information to the public, which can be used to make informed decisions about outdoor activities, such as exercising, going to work or school, or simply spending time outside. The system can also be used to help government agencies and policymakers develop and implement strategies to reduce air pollution and improve public health.

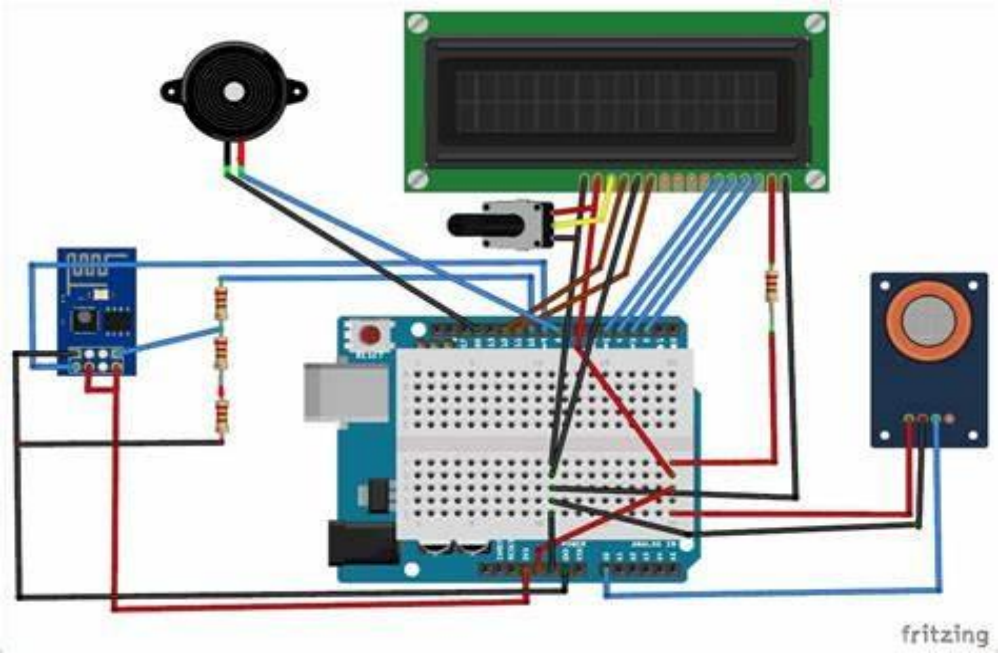

Fig: Circuit representation of the system

Air quality monitoring systems typically measure a range of pollutants, including particulate matter, ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide. The data collected from these sensors is often analyzed using sophisticated algorithms to generate a real-time air quality index (AQI), which is then used to provide alerts to the public.

These alerts can be sent through a variety of channels, including mobile apps, SMS messages, email, social media, or even local radio or TV broadcasts. Depending on the severity of the air pollution, these alerts can range from informational messages to warnings advising people to take specific actions, such as avoiding outdoor activities or wearing masks.

In summary, air quality monitoring and alert systems play a critical role in helping to protect public health by providing timely and accurate information about air pollution levels. By empowering individuals and communities with this information, we can all take steps to reduce our exposure to harmful pollutants and work towards a cleaner, healthier future.

COMPONENTS USED:

Air quality sensor - mq135
Arduino uno
16×2 lcd
Buzzer
Led
Bread board
Connecting wires
Potentiometer 1k(p103)
Current limiting resistor (220 ohm)

Block Diagram:

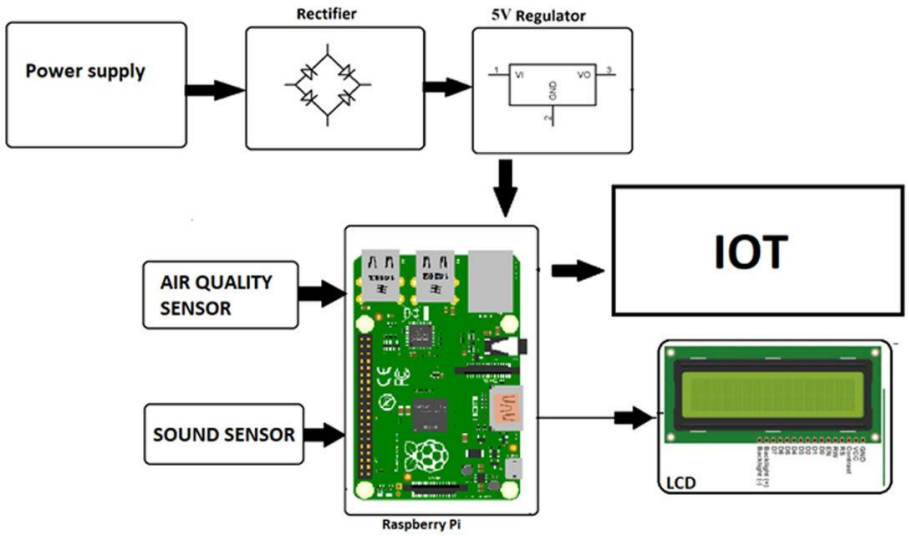

Figure: Block diagram of the system

Air quality monitoring and alert systems can be composed of various components, depending on the specific requirements and design of the system. Here are some common components used in these systems:

1. Air Quality Sensors: These are the primary components of an air quality monitoring system. They measure the concentration of various air pollutants, such as particulate matter, ozone, nitrogen dioxide, sulfur dioxide, carbon monoxide, and volatile organic compounds.

2. Data Acquisition System: This component collects data from the air quality sensors and stores it in a database. It may also perform data cleaning and calibration.

3. Data Analysis and Processing System: This component analyzes and processes the data from the sensors to calculate the air quality index (AQI) and other metrics. It can also generate alerts and reports based on the data.

4. Communication Infrastructure: This component provides connectivity between the various components of the system. It can use wired or wireless communication protocols, such as Ethernet, Wi-Fi, cellular networks, or satellite communication.

5. User Interface: This component provides a way for users to interact with the system, such as through a mobile app, a web dashboard, or an SMS-based system.

6. Alerting System: This component generates and sends alerts to users when air quality reaches a certain threshold. Alerts can be sent via SMS, email, mobile notifications, or other communication channels.

7. Power Supply: This component provides power to the sensors, data acquisition system, and other components of the system. It can use batteries, solar panels, or a power grid.

8. Maintenance and Calibration System: This component ensures that the sensors and other components are functioning properly and calibrated regularly to maintain the accuracy of the data.

In summary, an air quality monitoring and alert system typically includes air quality sensors, data acquisition and processing systems, communication infrastructure, user interfaces, alerting systems, power supply, and maintenance and calibration systems. These components work together to collect, analyze, and disseminate real-time air quality information and alerts to the public, promoting healthier living environments.

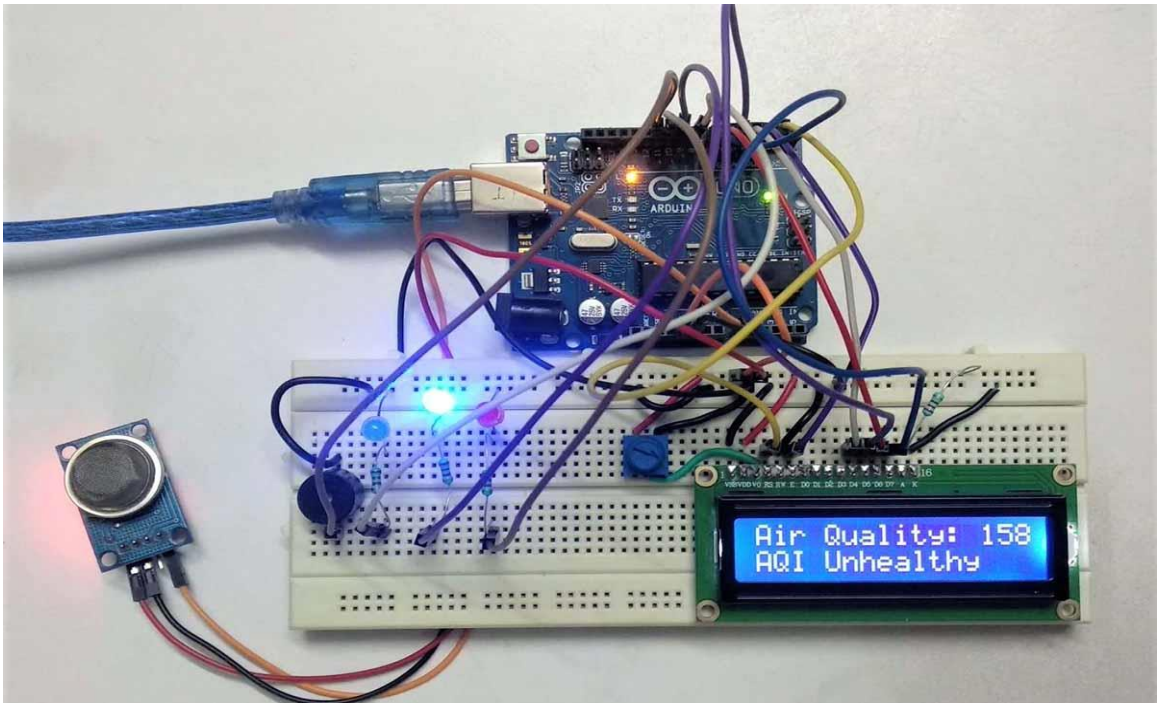

Figure: Air quality monitoring and alert system

The air quality alert system has several important uses, including:

1. Protecting Public Health: Air pollution can have serious impacts on public health, including respiratory problems, heart disease, and even premature death. By providing timely and accurate air quality alerts, the system can help people take steps to reduce their exposure to harmful pollutants and protect their health.

2. Informing Policy Decisions: Air quality monitoring and alert systems can provide valuable data for policymakers to make informed decisions about environmental regulations, transportation policies, and other measures to reduce air pollution and protect public health.

3. Promoting Sustainable Development: Air quality monitoring and alert systems can help identify areas with high levels of air pollution and promote sustainable development practices, such as building design, transportation planning, and land use policies that reduce emissions and improve air quality.

4. Supporting Climate Change Mitigation: Air quality monitoring and alert systems can provide data on greenhouse gas emissions and other pollutants that contribute to climate change. This information can be used to support efforts to reduce emissions and mitigate the impacts of climate change.

5. Enhancing Public Awareness: Air quality monitoring and alert systems can raise public awareness about the impact of air pollution on health and the environment. This can encourage individuals and communities to take actions to reduce their own emissions and support policies and practices that promote cleaner air.

Overall, the air quality alert system plays a critical role in protecting public health, promoting sustainable development, and mitigating the impacts of climate change. By providing real-time air quality information and alerts, the system empowers individuals, communities, and policymakers to make informed decisions that promote cleaner and healthier environments.

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RESULTS AND DISCUSSION, PERFORMANCE ANALYSIS

Air quality is a measure of how clean or polluted the air is. Air pollution is usually measured as Air Quality Index (AQI) in the PPM unit.

The sensors are most suitable for identifying hotspots at roadsides and near point sources. This sensor gets data that can be continuously monitored via different displays.

These are portable monitoring tools that can continuously monitor a range of pollutants.

Air Quality Index (AQI) Values	**Levels of Health Concern**	**Air Quality Index (AQI) Values**	**Qualitative name**
0 to 50	Good	0 to 25	Very low
51 to 100	Moderate	25 to 50	low
101 to 150	Unhealthy for Sensitive Groups	50 to 75	Medium
151 to 200	Unhealthy	75 to 100	high
201 to 300	Very Unhealthy	>100	Very high
301 to 500	Hazardous	>100	Very high

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SUMMARY AND CONCLUSIONS

In recent years the Air Pollution levels are increasing throughout the globe. Many diseases are caused due to long term exposure to pollutions like lung diseases, eye irritations and heart diseases. Now these pollutions are reached a level where even indoors and outdoors are not safe, so assessing and monitoring air pollutions levels is a priority in the world. Factors causing air pollution are the increase in usage of fossil fuels, industries, vehicle emissions which affects the human health also. For this situation and to tackle this, a technical way is required to monitor the air quality in real time. It is not possible to collect samples periodically and manually to test the pollution levels. so a solution that can be implemented in real time using Internet of things (IOT) will do the purpose. In this paper the work is focused to transfer information and for the systems to communicate using the internet network protocol.

The proposed system is an implementation of a real-time air quality monitoring system using Arduino microcontroller, IoT (Internet of Things) Technology and a sensor to check and improve quality of air around us. With the use of IoT, we implement a smart solution that helps to mitigate air pollution outdoors and to achieve a cleaner and safer environment. There are a variety of enhancements that could be made to this system to achieve greater accuracy in sensing and detection. The project can be used as a base for realizing a scheme to be implemented in other projects of greater level such as weather forecasting, temperature updates. The website used can also be extended into a mobile application. We can also use interface GPS module to monitor the pollution for each location easily. Similarly interface SD card can be added for storing data.

MQ135 sensor requires calibration to get a proper output. Hence, it might not be accurate in many cases. To avoid this, MICS-6814 sensor can be used in other models. However, MICS-6814 sensor is expensive.

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