A PROJECT REPORT

on

Air Quality Monitoring System

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by

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(BORRA UMESH CHANDRA)

ABSTRACT

This Project presents an air quality monitoring system using Node MCU. For all living things, the air is the foremost important aspect. Measuring air quality is vital in raising awareness about the importance of caring for future generations and living a healthier lifestyle. When people with health problems such as lung disease, nonfatal heart attacks, irregular heartbeat, and worsened asthma breathe in the bad air quality, it will affect more in their health. People have difficulty detecting poor air quality since they only perceive it after inhaling it. Carbon monoxide poisoning from fireplaces and cooking stoves can cause weariness, decreased vision, and chest pain.

This project aims to study the real-time monitoring of air by Node MCU and components and analyze the air quality at a specific place. The main component used are Node MCU, MQ7 carbon monoxide sensor, and MQ135 air quality sensor. An additional buzzer and LED are attached to the system to alert the user if the air quality is at a harmful level.

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CHAPTER-1: INTRODUCTION

1.1 Project Area

The selection of appropriate sensors for measuring different pollutants such as particulate matter, ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, etc. The process of collecting data from the sensors and storing it in a database or cloud-based platform for further analysis. By analyzing the data collected from the sensors to identify trends, patterns, and anomalies in air quality measurements.

Implementing an alert system that notifies stakeholders when air quality reaches unhealthy levels, enabling them to take necessary precautions. Overall, the project area of an Air Quality Monitoring System is interdisciplinary, combining aspects of sensor technology, data science, GIS, public health, and policy

1.2 Objective of the Project

The primary objective of an air quality monitoring system is to monitor the levels of pollutants and other harmful substances in the air. This information can be used to identify sources of pollution, track changes in air quality over time, and inform policy decisions aimed at reducing emissions and improving public health.

Air quality monitoring systems can provide early warning of potential health risks associated with poor air quality. For example, high levels of particulate matter or ozone can cause respiratory problems and other health issues, and early warning can help people take preventative measures to protect themselves.

1.3 Scope of the project

The scope of an air quality monitoring system, stakeholders can ensure that the project meets its objectives and provides valuable information to support decision-making related to air quality management.

CHAPTER-2: REQUIREMENT ANALYSIS

2.1 components required

2.1.1 MQ135 - MQ135 is a type of gas sensor that is commonly used to detect air quality, specifically the presence of harmful gases such as ammonia, carbon dioxide, benzene, and nitrogen oxides. The sensor works by detecting changes in the resistance of a tin dioxide (SnO2) sensing element when it comes into contact with these gases. The output voltage can be read using an analog-to-digital converter (ADC) and then processed by a microcontroller to determine the concentration of the gas in parts per million (ppm). The MQ135 sensor is widely used in air quality monitoring systems and indoor air quality applications.

2.1.2 MQ7- The role of the MQ-7 sensor in an air quality monitoring system is to provide accurate and reliable measurements of carbon monoxide gas levels in the air. This information is critical for ensuring the safety and health of individuals in the surrounding environment and for identifying potential sources of pollution. By detecting and measuring the concentration of carbon monoxide gas in the air, an air quality monitoring system can help to prevent the harmful effects of this toxic gas on human health and the environment.

2.1.3 NODE MCU-The NodeMCU is an open-source development board that is designed for building Internet of Things (IoT) projects. It is based

on the ESP8266 microcontroller and provides built-in WiFi connectivity, which makes it easy to connect to the Internet and other devices.

The NodeMCU can be used to control various sensors and actuators, as well as monitor data from these devices and also process data received from sensors and other devices, and perform data analytics or decision-making tasks based on that data.

2.2 software required

2.2.1 Aurdino IDE-The IDE allows developers to write and edit code for their projects based on micro controllers like Aurdino and Node MCU. It provides features such as syntax highlighting, auto-completion, and error checking to make the code development process more efficient and less error-prone. Once the code is written, the IDE compiles it into a binary file that can be uploaded to the micro controller.

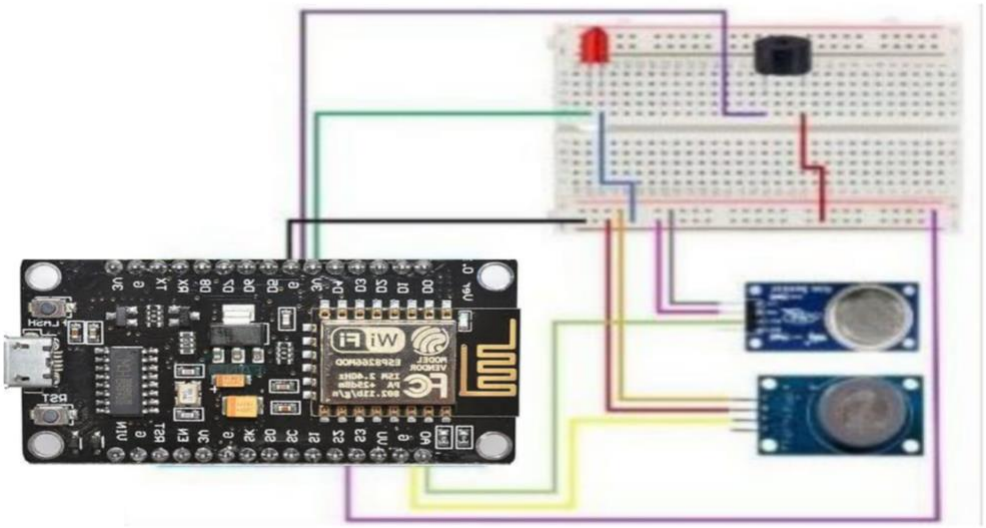
the Arduino IDE plays a crucial role in the development process of air quality monitoring system projects. It provides a user-friendly interface and powerful tools that help developers write, compile, and upload code to the Node MCU, as well as debug and test their projects more efficiently.

2.2.2 Blynk IOT- Blynk provides a wide range of connectivity options for IoT devices, including WiFi, Bluetooth, and cellular networks. This makes it easy to connect different types of devices to the platform and control them remotely. With Blynk, users can easily create custom mobile and web applications to control and monitor their IoT devices. The platform provides a drag-and-drop interface for designing app interfaces, and a library of pre-built widgets

Overall, Blynk simplifies the development and deployment of IoT applications by providing a user-friendly interface and a set of powerful tools. It enables users to quickly build custom mobile and web applications, connect IoT devices, and analyze data generated by those devices.

CHAPTER-3: PROJECT DESIGN

3.1 Circuit design



Node MCU acted as the microcontroller for this system. Since the MQ135 sensor and the MQ7 sensor are analog sensors, it is connected to the analog pin respectively. VDD pins from both sensors are linked to the microcontroller as the supply voltages. The red LED is connected to digital pin, and the buzzer is connected to digital pin. All GND pins are connected to the microcontroller's ground.

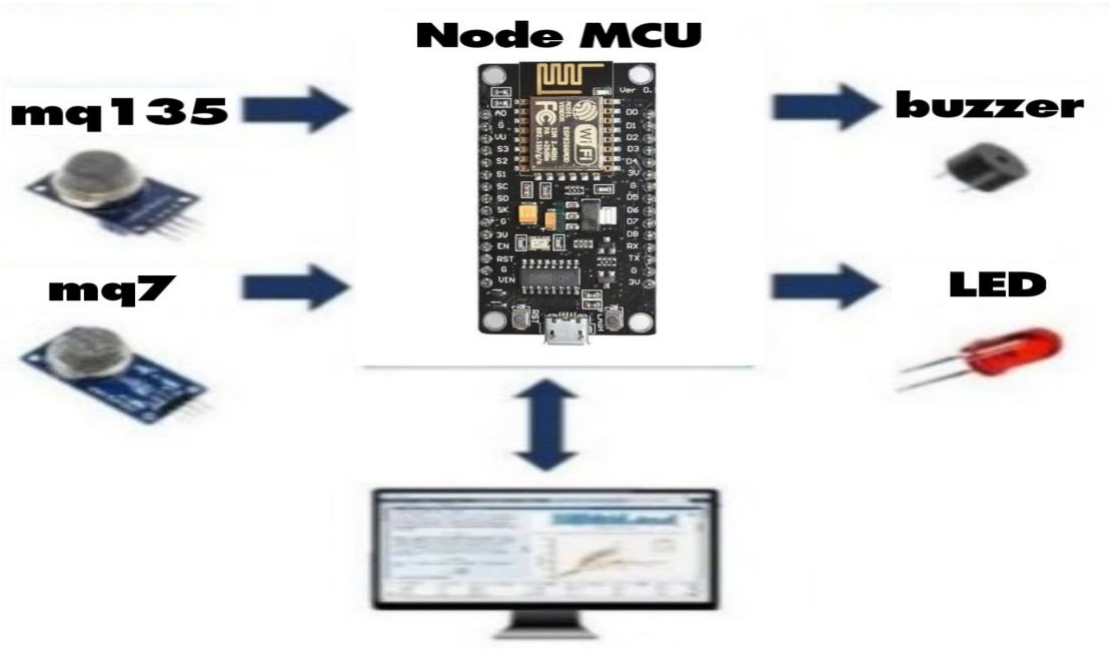
CHAPTER-4: WORKING

4.1 Methodology

The block diagram of the system has three parts: microcontroller, input and output. The inputs are the air quality MQ135 sensor and MQ7 sensor, interfaced with the microcontroller of this project. The microcontroller used is the Node MCU. The Node MCU connected to the output, a buzzer, and a red LED. Aurdino IDE and Blynk IOT is used as a medium to monitor the air quality CO level in the surrounding.

In general, the flow of the air quality monitoring system starts by programming the MQ135 and MQ7 to sense the air quality and the CO in the house surrounding every 5 minutes. The data from these sensors are displayed in Blynk IOT. When the data received is higher than the range set, the buzzer will turn on, and the LED will blink to alert people in the house.

4.2 Air monitoring system block diagram



CHAPTER-5: RESULTS AND DISCUSSION

5.1 Result

The NodeMCU can be programmed using the Arduino Integrated Development Environment (IDE). The code can be designed to read sensor data at regular intervals, store the data locally or transmit it wirelessly to a remote server, and display the data on mobile application.

Overall, an Air Quality Monitoring System using NodeMCU can be an effective and affordable way to monitor air quality in a particular environment, and it has the added benefit of being able to transmit data wirelessly for remote monitoring and analysis

5.2 Source code

```
#define BLYNK_PRINT Serial
#include <Blynk.h>
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

#define BLYNK_TEMPLATE_ID "TMPLJKmM0rwH"
#define BLYNK_TEMPLATE_NAME "Quickstart Template"
#define BLYNK_AUTH_TOKEN "s_odJwHTmekZgUYJOeXxMijWjWBGYIgs"

char auth[] = "s_odJwHTmekZgUYJOeXxMijWjWBGYIgs";
  // You should get Auth Token in the Blynk App.
char ssid[] = "abc";                          // Your WiFi credentials.
char pass[] = "123456789";

int buzzer = D2;
int smokeA0 = A0;
float RS_gas = 0;
float ratio = 0;
float sensorValue = 0;
float sensor_volt = 0;
float R0 = 7200.0;
```

```
// Your threshold value. You might need to change it.
int sensorThres = 600;

void setup() {
  pinMode(buzzer, OUTPUT);
  pinMode(smokeA0, INPUT);
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass);
}
void loop() {
  Blynk.run();

  int analogSensor = analogRead(smokeA0);
   sensorValue = analogRead(A0);
   sensor_volt = sensorValue/1024*5.0;
   RS_gas = (5.0-sensor_volt)/sensor_volt;
   ratio = RS_gas/R0; //Replace R0 with the value found using the sketch
above
   float x = 1538.46 * ratio;
   float ppm = pow(x,-1.709);
   Serial.print("PPM: ");
   Serial.println(ppm);
   Serial.print("Pin A0: ");
   Serial.println(analogSensor);
   Blynk.virtualWrite(V5, ppm);
   Blynk.virtualWrite(V6, analogSensor);
  // Checks if it has reached the threshold value
  if (analogSensor > sensorThres) {
    tone(buzzer, 100, 200);
  } else {
    noTone(buzzer);
  }
  delay(1000);
}
```

CHAPTER-6: IEEE standards

IEEE 1451 - Standard for a Smart Transducer Interface for Sensors and Actuators: This standard defines a smart transducer interface that enables plug-and-play interoperability between sensors, actuators, and other devices.

IEEE 802.11 - Wireless Local Area Networks (WLANs): This standard defines the specifications for wireless networking technology commonly known as Wi-Fi. By using this standard, an air quality monitoring system can connect to a wireless network and transmit data to a remote server or database.

IEEE 1588 - Precision Clock Synchronization Protocol for Networked Measurement and Control Systems: This standard defines a protocol for synchronizing the clocks of devices in a network. By adhering to this standard, an air quality monitoring system can ensure accurate time stamping of data, which is important for analyzing trends and detecting anomalies.

IEEE 11073 - Personal Health Device (PHD) Standards: This standard defines a set of protocols for interoperability between personal health devices and other systems, including air quality monitoring systems. By adhering to this standard, an air quality monitoring system can ensure compatibility with other health monitoring systems.

CHAPTER-7: CONCLUSION

In conclusion, an Air Quality Monitoring System using NodeMCU is a feasible solution for monitoring air quality in a particular environment. With the use of sensors and wireless communication capabilities, the system can collect and transmit real-time data to a cloud-based platform for remote monitoring and analysis. NodeMCU's open-source firmware and development kit allow for easy programming and customization of the system to meet specific requirements. As such, an Air Quality Monitoring System using NodeMCU can be an effective and affordable way to monitor air quality.

CHAPTER-8: COST REPORT

- NODE MCU 220rs
- MQ7 110rs
- MQ135 130rs
- JUMPERS 40rs
- BREADBOARD 65rs
- BUZZER 15rs
- LED LIGHT 02rs

TOTAL 582rs

CHAPTER-9: REFERENCES

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