



Enhanced High Precision Air Quality and Pollution Monitoring System

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ABSTRACT

In this study, carbon monoxide (CO) and air quality (Qa) were measured using MQ135 and MQ7 sensors, respectively. Measuring air quality is a crucial step in raising awareness among the public about the need to ensure the health of future generations. Therefore, in order to secure a healthy lifestyle and a brighter future, pollution management is now required. In this study, an efficient Internet of Things implementation is used to track environmental atmospheric conditions, such as air pollution. This study provides a conceptual architecture for a modular, cost-effective, and adaptable air monitoring system. The system continuously transmits this data while using air sensors to detect the presence of dangerous chemicals and compounds in the air. However, since everyone needs access to clean air, a variety of technologies have been used to monitor air quality, some of which are very helpful in providing real-time air quality data. Air pollution monitoring methods have ranged from traditional methods to the most advanced computers. The purpose of this study is to highlight certain air pollution monitoring technology.

KEYWORDS – Air quality, Environmental monitoring, Wireless Communication, Calibration, Real-time data processing, Air pollution control

1. INTRODUCTION

The main issue facing all countries, developed or developing, is air pollution. The release of gases frequently causes lung cancer, eye discomfort, and breathing problems in both humans and animals. Mild allergic reactions near the throat, eyes, and nose, as well as more serious issues including bronchitis, heart diseases, pneumonia, lung, and worsened asthma, are some other detrimental effects brought on by pollution. These are the issues that typically arise when an industry fails to implement appropriate measures to minimize gases in accordance with legal requirements. Particularly in urban regions of emerging countries, where industrialization and an increase in the number of cars lead to the this issue.

^[5]The proposed effort is a step in the right direction for monitoring pollution levels in the vicinity of manufacturing enterprises in an effective, dependable, and accurate manner in order to address.

^[3]The primary goal of the IOT Air Pollution Monitoring System is to track pollution levels, which are a significant problem nowadays. For a better future and everyone's health, it is important to monitor and control air quality. The Internet of Things (IOT) is growing in popularity day by day due to its adaptability and inexpensive cost.

It employs an LCD (liquid crystal display) for output. Rapid technological advancement made the construction of small, inexpensive sensors both technically and financially possible. The factors that may have an impact on both human health and the health of the natural system are given special consideration. Discharge of several gaseous pollutants, health issues have been escalating more quickly.

2. EXISTING SYSTEM

^[1]There is currently no system in place to keep track of air pollution. The residents of that area will be impacted by the pollution. Because the amount of pollution is not effectively monitored and cannot be known, it also has an impact on ozone. ^[4]GSM mobile devices do not support this application. The current system makes it difficult for the populace to observe the level of pollution that is present in the area with ease and comfort. Due to its lack of composition, the specific place cannot be discovered and cannot be used very frequently in society. There is no precise indication of the level of contamination that has taken place in the International Journal of Pure and Applied Mathematics Special Issue 936. This is not practical and is not relevant to all members of the community.

3. PROPOSED SYSTEM

^[3]We're going to build an IOT-based air pollution monitoring system for this project, and we'll use the internet to monitor the air quality. When the air quality drops below a certain point that is, when there are enough dangerous gases like CO₂, smoke, alcohol, benzene, and NH₃—an alarm will go off. On the LCD and on the website, the air quality will be displayed in PPM so that we can readily monitor it.

4. COMPONENTS SPECIFICATION

A module is a software component or part of a program that contain one or more routines. One or more independently developed modules make up a program. This project consists of two main modules they are,

- Hardware
- Software

4.1 HARDWARE SPECIFICATION

- Arduino UNO
- DHT11
- MQ-7
- MQ-135
- MQ-2
- LCD 16*2
- ESP 8266-01
- Buzzer
- LED blub
- Connectors and Wires

4.1.1 Arduino UNO:-

The ATmega328P micro controller chip serves as the foundation for the well-known Arduino Uno micro controller board. It was created by Arduino.cc and made available as an open-source building block for electronic applications in 2010. The Arduino Uno board contains 6 analogue inputs, a 16 MHz quartz crystal, 14 digital input/output pins, a USB port, a power jack, an ICSP header, and a reset button. The Arduino software, a free, open-source development environment that works with Windows, Mac OS X, and Linux, can be used to code it.



4.1.2 DHT11:

A basic, extremely affordable digital temperature and humidity sensor is the DHT11. It measures the air around it using a capacitive humidity sensor and a thermistor, and it spits out a digital signal on the data pin. Although it's quite straightforward to operate, data collection requires precise timing. A straightforward, incredibly affordable digital temperature and humidity sensor is the DHT-11. It measures the humidity in the air using a thermistor and a capacitive humidity sensor, and it outputs a digital signal on the data pin. This sensor is employed in a number of applications, including the measurement of temperature and humidity levels in HVAC systems.



4.1.3 MQ2 GAS SENSOR

The MQ2 Gas Sensor is 5V. Any PPM concentrations within that limit can be detected with accuracy by the sensor. The MQ-2 is a smoke and combustible gas sensor from Wines. It can detect flammable gas in a range of 300 - 1000ppm. Its most common use is domestic gas leakage alarms and detectors with a high sensitivity to propane and smoke.

The MQ2 gas sensor can easily detect smoke, liquefied natural gas (LNG), butane, propane, methane, alcohol, and hydrogen in the air the maximum output voltage.



4.1.4 MQ-135 SENSOR

The MQ-135 Gas sensors are used in air quality control equipment and are suitable for detecting or measuring of NH₃, NO_x, Alcohol, Benzene, Smoke, CO₂. The MQ-135 sensor module comes with a Digital Pin which makes this sensor to operate even without a micro controller. The MQ 135 sensor can be implemented to detect smoke, benzene, vapors, and other hazardous gases. It can detect various harmful gases. It can be used for air quality monitoring, noxious gas detection, home air pollution detection, industrial pollution detection, portable air pollution detection, etc.



4.1.5 MQ-7 SENSOR

It is mainly used to detect Carbon Monoxide. This sensor contains a sensing element, mainly aluminum-oxide based ceramic, coated with Tin dioxide, enclosed in a stainless-steel mesh. The MQ-7 sensor has a small heating element present which is needed to preheat the sensor to get it in the working window. It can detect carbon monoxide gas in the range of 20 PPM to 2000 PPM in the air.



4.1.6 WIFI Module (ESP8266)

The ESP8266 is a low-cost Wi-Fi chip with an integrated MCU (micro controller unit) and a complete TCP/IP stack. Our system can connect to Wi-Fi or the internet thanks to its 3.3V operation. To send and receive data through Wi-Fi, Wi-Fi micro controllers or Wi-Fi modules are utilized. They can also respond to commands transmitted via Wi-Fi. For device-to-device communication, Wi-Fi modules are employed. The Internet of Things is where they are most often employed. A self-contained SOC with an integrated TCP/IP protocol stack, the ESP8266 Wi-Fi Module allows any micro controller to access your Wi-Fi network. The ESP8266 is capable of offloading all Wi-Fi networking tasks from another application processor or hosting an application.



4.1.7 LCD (Liquid Crystal Display)

This is a basic (16x2) 16 character by 2 line display. Black text on Green background. It is used to indicate the Air and Humidity in PPM. Thus, this is all about LCD 16x2 datasheet, which includes what is a 16X2 LCD, pin configuration, working principle, and its applications. The main advantages of this LCD device include power consumption is less and low cost. The main disadvantages of this LCD device include it occupies a large area, slow devices and also lifespan of these devices will be reduced due to direct current. So these LCD's use AC supply with less than 500Hz frequency.



4.1.8 LED (RED)

A semiconductor light source called a light-emitting diode (LED) produces light when current passes through it. Recombining electrons and electron holes in the semiconductor results in the release of energy in the form of photons. The energy needed for electrons to bridge the semiconductor's band gap determines the colour of the light, which corresponds to the energy of the photons. By layering light-emitting devices or additional semiconductors on top of each other, white light can be produced. In comparison to incandescent light sources, LEDs have a number of advantages, such as lower power consumption, a longer lifespan, increased physical durability, a smaller size, and quicker switching.



4.1.9 BUZZER

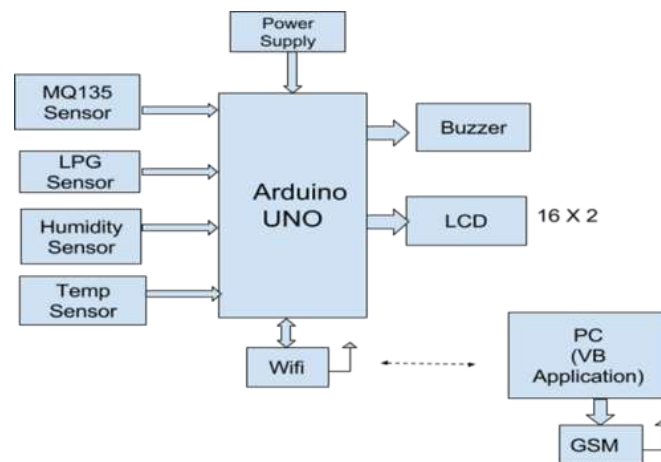
A Buzzer or beeper is an audio signaling device. Whenever the air pollution goes above the threshold level the Buzzer starts beeping indicating Danger. Buzzer is also known as Piezo Speakers (buzzers). You want to generate sound in our project you can use this simple magnetic buzzer. This is the same buzzer we have used in our development boards. This one generates a continuous beep usually when supplied with power but you can generate any tone as you wish by interfacing it with a micro controller with proper coding.



4.2 SOFTWARE SPECIFICATION

- Arduino Uno
- Thing-speak cloud
- Embedded C

5. DATA FLOW DIAGRAM



6. FEATURES

- Sensors are easily available.
- Simple, compact, easy to handle
- Sensors have long life and less cost.
- Quality of air can be checked indoor as well as outdoor.
- Detecting a wide range of physical parameters including temperature, humidity and carbon dioxide.

7. APPLICATIONS:

- Indoor air quality monitoring.
- Industrial perimeter monitoring.
- Roadside pollution monitoring

8. CONCLUSION

The Proposed System proposes an effective implementation for Internet of Things this used for monitoring atmospheric conditions of environment like air pollution. This paper presents a conceptual architecture for a versatile, flexible and cost efficient for monitoring the air quality of a particular site. System proposes an air quality monitoring system that allows us to monitor and check live air quality in an area through IOT.

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