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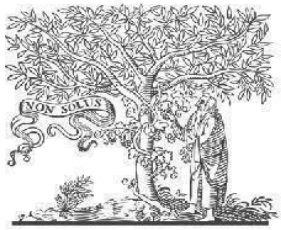

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Title: " IOT BASED POLLUTION MONITORING SYSTEM"

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IOT BASED POLLUTION MONITORING SYSTEM

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ABSTRACT- Air pollution, exacerbated by rapid urbanization and industrialization, poses a significant health risk in Europe. Both external and internal air pollution can lead to severe health issues. IoT technology offers an effective way to monitor and share real-time air quality data. Various IoT-based systems have been developed using micro-sensors to measure parameters such as CO_2, CO, PM10, NO_2, temperature, and humidity. These systems typically focus on outdoor air quality, utilizing sensors mounted on electric cars to collect data. The collected data is sent to a server and made accessible to users who subscribe to receive localized pollution updates. This system provides real-time, location-specific air quality monitoring. Additionally, it includes a secure data transmission protocol, ensuring protection against attacks and data interception, a feature lacking in many existing solutions. This secure, real-time approach improves public access to accurate air quality information while ensuring system-wide security and reliability.

1.INTRODUCTION

Air pollution, driven by rapid urbanization and industrialization, is a critical global health issue [1]. Many countries struggle with air quality levels exceeding recommended national limits, and some studies suggest that no exposure to pollutants is completely safe. Europe faces significant health impacts from poor air quality, which contributes to respiratory infections, cancers, heart disease, and strokes [2]. Outdoor air pollution is caused by emissions from vehicles, industries, and fossil fuel combustion, releasing pollutants like CO, O_3, NO_x, SO_2, and particulate matter (PM) [9].

According to the WHO, in 2019, ambient air pollution caused over 4.1 million deaths worldwide, including 500,000 in Europe and 36,000 in Poland [8]. Indoor air pollution is equally severe, affecting environments like buses, metros, offices, hospitals, and homes. Polluting fuels and devices used in households contribute to indoor pollutants such as NO_x, SO_2, O_3, CO, PM, and microorganisms. Household air pollution caused 3.2 million deaths globally and 150,000 in Europe in 2019 [3].

Given the severity of air pollution, real-time air quality monitoring systems are crucial [4]. The Internet of Things (IoT) offers an effective solution, enabling data collection from various sensors and converting it into actionable information. IoT-based systems can monitor air quality parameters like CO_2, CO, PM, NO_2, temperature, and humidity. Data collected by sensors, such as those mounted on electric vehicles, can be transmitted to servers and shared with users through subscriptions [5]. This provides localized, real-time updates on air quality. Additionally, secure data transmission protocols enhance system security, protecting against attacks and data interception [6].

Implementing IoT-based air quality

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monitoring systems helps address the urgent need for accurate, real-time information and promotes public awareness and health protection [7].

2.BLOCK DIAGRAM:

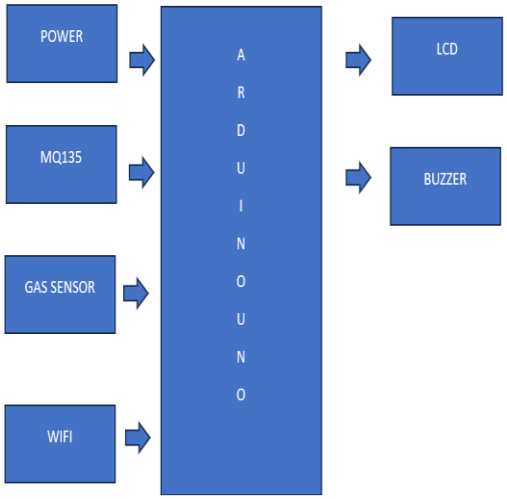

Fig 1: Block diagram of Proposed System

To build an IoT-based Pollution Monitoring System Using Arduino Uno, you'll need the following components:

Arduino Uno is a popular microcontroller board that's easy to use for embedded projects [10]. It serves as the brain of the system, controlling the sensors and lights.

Fig 2: Arduino SoC Module

GAS SENSOR is a device that detects and measures the presence of gases in the air. It converts gas concentrations into readable signals, ensuring safety by identifying harmful gases like carbon monoxide, methane, or smoke.

Fig 3: Gas Sensor

Gas sensors are widely used in industries, homes, and vehicles for monitoring and safety.

NODEMCU(WIFIMODULE)

Fig 4: Node MCU (WIFI-MODULE)

The Node MCU Wi-Fi module is an open-source IoT platform based on the ESP8266 chip. It enables wireless connectivity for devices, supporting Wi-Fi communication. With built-in GPIO pins, it facilitates integration with sensors and actuators. Node MCU is programmable using Lua or Arduino IDE, ideal for smart home and IoT projects.

MQ135:

Fig 5: MQ135 (Represents Gas Sensor)

The **MQ135** is a gas sensor used to detect air quality by measuring gases like ammonia, benzene, alcohol, smoke, and carbon dioxide. It operates on a metal oxide semiconductor (MOS) principle, providing analog output. Widely used in air purifiers and environmental monitoring systems for pollution detection and control.

LCD

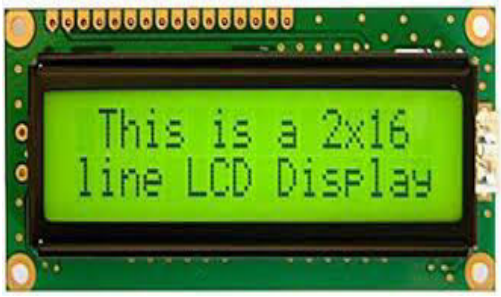

Fig 6: LCD Module

An **LCD (Liquid Crystal Display)** is a flat-panel display technology that uses liquid crystals to produce images. It is energy-efficient and widely used in televisions, computer monitors, smartphones, and digital clocks. LCDs offer clear, vibrant visuals and are thinner and lighter compared to traditional CRT displays.

BUZZER

Fig 7: Buzzer

A **buzzer** is an electronic device that produces sound, typically used as an alert or alarm. It operates on electrical signals, generating buzzing or beeping noises. Buzzers are found in appliances, alarms, vehicles, and games, providing audible notifications for warnings, reminders, or user feedback.

3.RESULT

Here's a concise and edited version of your document, staying within the 350-word limit The paper presents an IoT-based pollution monitoring system that measures and shares real-time air quality data to address growing environmental and health concerns caused by rapid

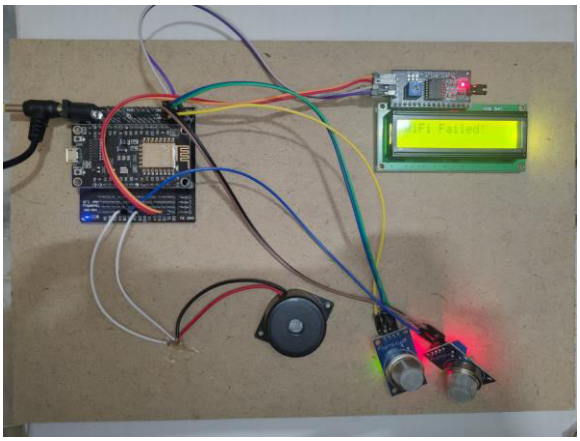

Fig 8: Implemented System of the Proposed Model

urbanization and industrialization. Air pollution, a major public health hazard, impacts both outdoor and indoor environments, emphasizing the need for accurate, scalable, and real-time monitoring solutions.

The proposed system uses a range of sensors—including CO_2, CO, PM10, NO_2, temperature, and humidity—mounted on an electric vehicle to collect localized pollution data while in motion. These sensors continuously gather data, which is transmitted securely to a central server using communication protocols like MQTT and Amelia. The system ensures data integrity and resilience against cyberattacks through secure data transmission protocols and automated security analysis. This enhances reliability compared to traditional pollution monitoring systems.

The paper highlights the critical role of IoT technology in addressing air quality issues. By leveraging IoT-based sensors and embedded systems, the solution enables real-time data sharing with end-users through subscription services. This data can be accessed via user applications or dashboards, offering actionable insights to stakeholders like government agencies, businesses, and individuals. Addressing both outdoor and indoor air pollution, the system contributes to improving public health and environmental safety.

The document further describes the hardware components used in the system, including microcontrollers (e.g., Arduino), various sensors, and communication modules for seamless connectivity. The integration of IoT, embedded systems, and secure communication protocols ensures efficient data collection, analysis, and sharing.

The IoT-based pollution monitoring system provides a scalable, cost-effective, and efficient solution for real-time air quality monitoring. It facilitates targeted interventions to mitigate pollution, contributing to smarter, healthier urban environments. By enabling localized data collection, the system empowers communities and policymakers to make informed decisions, ultimately addressing the global challenge of air pollution.

Fig 9: Displaying Data on LCD

addressing both outdoor and indoor air pollution, which significantly impacts global health. The document further delves into hardware components, including microcontrollers like Arduino, sensors, and communication modules. By integrating IoT and embedded systems, the monitoring solution provides actionable insights to mitigate air pollution, thereby contributing to public health and environmental safety.

4.CONCLUSION:

This article addresses the severe impact of outdoor air pollution on human health and proposes IoT-based air quality monitoring systems as a solution. These systems use micro-sensors to measure parameters like CO_2, CO, PM10, NO_2, temperature, and humidity in indoor and outdoor environments. The article highlights the importance of secure data transmission and introduces a protocol to protect against interception and attacks. The main limitation is the lack of fully autonomous vehicles, which restricts complete automation. Future advancements in vehicle autonomy and effective algorithms are needed to overcome this. Additionally, future work will focus on developing a user-friendly interface for multiple software platforms to enhance accessibility.

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