**Live Air Quality Monitoring App Using IOT**

**A Project Work Synopsis**

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# Abstract

This study presents the development of a comprehensive air quality monitoring application employing Internet of Things (IoT) technology. With increasing concerns over deteriorating air quality and its impact on human health, there is a growing need for real-time monitoring solutions that provide accurate and accessible data. Leveraging IoT devices, such as sensors and data communication modules, the proposed application collects real-time air quality data from various locations. The collected data is then processed and visualized through an intuitive mobile app interface. Users can access up-to-date information on pollutants such as particulate matter (PM2.5 and PM10), volatile organic compounds (VOCs), carbon monoxide (CO), and nitrogen dioxide (NO2) in their vicinity. The integration of IoT technology with air quality monitoring demonstrates a practical and impactful solution to address environmental health concerns in today's urban landscapes.

Keywords: ***Air quality monitoring, IoT, Internet of Things, Real-time data, pollutants, particulate matter, carbon dioxide, nitrogen dioxide, mobile app, sensors, data visualization, personalized alerts.***

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# 1. INTRODUCTION

## 1.1 Problem Definition

Air pollution is one of the biggest challenges that the world is facing today as it has got adverse effects on human health like lung cancer, respiratory and heart diseases. There is a need to constantly measure, analyse and monitor the air quality on a real-time basis so that appropriate measures can be taken whenever needed. For this, we have proposed a model that uses the concept of the Internet of Things to let the user know about the concentration of harmful gases present around him and thus letting the user know the quality of air. The parameters that are monitored here are PM2.5, Carbon monoxide (CO), Carbon dioxide (CO2), temperature, and humidity. The values of these parameters are further displayed on a Flutter Application. If the concentration of Carbon dioxide exceeds a certain threshold, the user is notified.

## 1.2 Problem Overview

Air pollution poses a significant global challenge, impacting human health with conditions such as lung cancer and respiratory diseases. Addressing this concern requires continuous real-time monitoring of air quality. To meet this need, an Internet of Things (IoT)-based model is proposed. It informs users about the concentrations of harmful gases like PM2.5, CO, and CO2, as well as temperature and humidity in their vicinity.

## 1.3 Hardware Specification

* ESP-32
* DHT 11 Sensor.
* MQ 7 Sensor.
* MQ 11 Sensor.
* Computer/PC.

## 1.4 Software Specification

* Flutter/Dart.
* Arduino IDE.
* Google Firebase.
* Android Studio.

# 2. LITERATURE SURVEY

## 2.1 Existing System

In this wide growing society, the air quality monitoring system is still at a low point. Although there are many ways to check the air quality levels, these often lack the ability to give accurate , real-time, and not so precise location accuracy.

## 2.2 Proposed System

In today's rapidly urbanizing world, the quality of air we breathe has become a critical concern for public health and environmental sustainability. To address this issue, we propose the development of a "Live Air Quality Monitoring App Using IoT." This app aims to provide real-time and accurate information about air quality to users, empowering them to make informed decisions regarding their outdoor activities and health protection.

## 2.3 Literature Review Summary (Minimum 7 articles should refer)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year and**  **Citation** | **Article/ Author** | **Tools/ Software** | **Technique** | **Source** | **Evaluation Parameter** |
| 2019 | Ramik Rawal. | * ATMega328P. * ESP-01. | Thingspeak IOT | Research India Publication. | Historical Data Analysis. |
| 2017 | Kumar S.  Jasuja A. | * Raspberry Pi. * Arduino Uno. * Node MCU. | IBM Watson. | Semantic Scholar | Hardware circuitry. |
| 2018 | Kennedy Okokpujie.  Etinosa Noma-Osaghae. | * Arduino Uno. * ESP 8266. * MQ 135 Sensor. | ThingSpeak IOT | Core | Bar Graph Comparison. |
| 2020 | Kumar A.  Kumari M. | * Node MCU. * ESP 8266. * Sensors. | ThingSpeak. | IEEE. | Cloud integration |
| 2019 | Harsh Gupta.  Vinay Anand. | * Rasbery pi. * ADC. * SDS021. | Android App. | Research Gate. | Outdoor Testing. |
| 2021 | Shreya Mahetaliya.  Dipansh Makwanan. | * ADC. * Node MCU. * Sensors. | Thing Speak | Amazon Web Services. | Graph testing. |
| 2020 | Liu x.  Ahn KH. | * GP261010AU0F. * PMS1003. * SDS011. | Experimental Chamber. | AAQ research. | Sensor Testing. |

# 3. PROBLEM FORMULATION

Air pollution has emerged as a significant global health concern, adversely impacting both human health and the environment. As urbanization and industrialization continue to grow, the need for accurate and real-time air quality monitoring becomes increasingly critical. Current air quality monitoring systems often lack accessibility and granularity, leaving individuals uninformed about the air they are breathing. Additionally, the lack of localized data limits the ability of policymakers to implement targeted interventions. Traditional monitoring systems, while effective, are often constrained by their fixed installation locations and high costs. The limitations of these systems make it challenging to provide citizens with timely and relevant air quality information that influences their daily decisions. This problem is compounded by the lack of user-friendly interfaces that effectively communicate air quality data to the general public. In response to these challenges, we propose the development of a "Live Air Quality Monitoring App Using IoT." This app seeks to address the shortcomings of existing systems by leveraging the power of the Internet of Things (IoT) to create a comprehensive and user-centric solution. By integrating IoT devices with a mobile application, the proposed system aims to deliver accurate, real-time air quality data directly to users' fingertips, enabling them to make informed decisions about outdoor activities and personal health protection.

# 4. OBJECTIVES

* **Design and Build Hardware Setup:** Create a robust hardware setup that includes DHT11 sensors for monitoring temperature and humidity, along with additional sensors for air quality measurements (e.g., PM2.5, PM10, CO2, VOCs)
* **Connectivity and IoT Integration:** Establish a secure and efficient connection between the sensor hardware and the IoT platform, enabling continuous data transmission to a cloud-based server
* **Cloud Infrastructure:** Set up a cloud-based infrastructure to store and manage the collected data, ensuring scalability and data integrity. Utilize services like AWS, Google Cloud, or Azure.
* **Mobile Application Development:** Develop a cross-platform Flutter mobile application for users to access air quality information on their smartphones. Ensure compatibility with both Android and iOS devices
* **Alerting System:** Design an alerting system within the mobile app that notifies users when air quality levels reach predefined thresholds. Alerts can be in the form of push notifications or in-app messages

# 5. METHODOLOGY

Our IoT-based air quality monitoring system represents a remarkable fusion of precision, user-friendliness, and cost-effectiveness. This cutting-edge system orchestrates a seamless synergy of various sensors, including the DHT11 and MQ7, all meticulously linked to the high-performance ESP32 microcontroller. To ensure real-time data dissemination, the ESP32 is seamlessly integrated with the Internet, equipped to transmit the invaluable real-time air quality data to a centralized repository. In this case, we have harnessed the robust capabilities of Google Firebase as our central server, forming the backbone of our data management infrastructure. To crown this sophisticated setup, a user-centric, and effortlessly navigable application has been meticulously crafted. This mobile application effortlessly interfaces with our central server, Firebase, allowing users the privilege of accessing and monitoring live air quality parameters from virtually anywhere on the globe, setting new benchmarks in convenience and accessibility for air quality monitoring solutions.

# 6.EXPERIMENTAL SETUP

The experimental setup for the "Live Air Quality Monitoring App Using IoT" involves a combination of hardware components, software systems, and data communication protocols to create a functional and reliable air quality monitoring system. The setup is designed to demonstrate the feasibility and effectiveness of the proposed solution.

Hardware Components:

* Microcontrollers: IoT devices are powered by microcontrollers (e.g., Arduino, Raspberry Pi) to collect and process data from various sensors.
* Wireless Connectivity: Wi-Fi and cellular modules ensure smooth data transmission from IoT devices to the central server.

Software Systems:

* Central Server: The central server receives and processes air quality data from IoT devices, using algorithms to ensure accuracy and reliability.
* Mobile Application: Our user-friendly mobile app (Android, iOS) interfaces with the server, displaying real-time air quality data. Users access trends, alerts, and educational content.

Data Communication:

* Device-to-Server: IoT devices use robust protocols like MQTT or HTTP to transmit data to the central server.
* App-to-Server: The app communicates with the server via API calls, displaying up-to-date air quality information seamlessly.

Deployment and Testing:

IoT devices are deployed indoors and outdoors for testing system performance. Rigorous testing assesses accuracy, reliability, and responsiveness by comparing collected data to established monitoring stations.

# 7.CONCLUSION

In summation, the "Live Air Quality Monitoring App Using IoT" represents a dynamic response to the escalating concern of air pollution in urban landscapes. By seamlessly integrating state-of-the-art IoT devices, a sophisticated central server, and a user-centric mobile application, the system presents a comprehensive solution that transcends conventional monitoring methods.

The amalgamation of IoT devices equipped with diverse air quality sensors, microcontrollers, and wireless connectivity underscores the system's capacity to gather real-time data from varied locations.

The user-friendly mobile application serves as the interface between users and the system, bridging the gap between technical data and practical decision-making. Through intuitive real-time, personalized alerts the application empowers users to make informed choices regarding outdoor activities, health precautions, and environmental awareness. Ultimately, the "Live Air Quality Monitoring App Using IoT" holds immense promise as a tool to not only raise public awareness but also enable proactive steps toward healthier, more sustainable urban living.

## 8. TENTATIVE CHAPTER PLAN FOR THE PROPOSED WORK

**CHAPTER 1: INTRODUCTION**

* Introduce air pollution's impact on health and environment.
* Highlight IoT's role in real-time air quality monitoring.
* Present the project's scope and "Live Air Quality Monitoring App Using IoT."

**CHAPTER 2: LITERATURE REVIEW**

* Introduce air pollution's impact on health and environment.
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**CHAPTER 3: OBJECTIVE**

* Introduce air pollution's impact on health and environment.
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**CHAPTER 4: METHODOLOGIES**

* Introduce air pollution's impact on health and environment.
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**CHAPTER 5: EXPERIMENTAL SETUP**

* Introduce air pollution's impact on health and environment.
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**CHAPTER 6: CONCLUSION AND FUTURE SCOPE**

* Introduce air pollution's impact on health and environment.
* Highlight IoT's role in real-time air quality monitoring.
* Present the project's scope and "Live Air Quality Monitoring App Using IoT."

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