Smart Air Cleaner Using IoT

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Abstract: **Design and implementation of an IoT based smart exhaust fan using ESP32 microcontroller is presented in this research. The system is able to control fan speed and operation based on the real time data of the environmental parameters such as temperature, humidity and air quality. The proposed solution aims to greatly improve indoor air quality while also becoming a relatively energy efficient means of ventilation. The system architecture, hardware components and initial testing results are discussed in this paper and results are shown to indicate the potential of smarter home and industrial ventilation solutions.**

Keywords: **Smart Exhaust Fan (IoT), Energy Efficiency (IoT), Automation (IoT), ESP32, Environmental Monitoring, Air Quality, etc.**

I. INTRODUCTION

Effective ventilation is crucial to achieving good indoor air quality – building health and comfort. Most traditional exhaust fans rely on manual controls or fixed schedules, sometimes wasting energy and missing Air that is needed. IoT technologies have arrived, and make it possible to create smarter systems. We present an ESP32 based smart exhaust fan that monitors environmental conditions and adjusts its operation automatically for both energy conservation and better air quality.

II. LITERATURE SURVEY

Recent researches emphasize the importance of having the best ventilating systems in a residence and within an industrial plant. The adapting and real time monitoring capabilities of the conventional exhaust fans are limited (Zhang et al., 2020). The recent emergence of IoT applications in enhancing ventilation systems by means of integration of environmental sensors and automated controls (Patel & Kumar, 2021) Analysis of IoT enabled systems shows that they can significantly reduce energy and provide data insights for user satisfaction (Sahu et al., 2022). However, these technologies are currently being implemented in everyday household applications, but there are gaps. This project is attempting to fill in these gaps.

References for Literature Survey:

- Zhang, Y., & Li, X. (2020). "Smart Ventilation Systems for Energy Efficiency, a Review." This research was conducted in Renewable and Sustainable Energy Reviews, 117, 109468.
- Kumar, R; Patel, S. (2021). "IoT-Based Smart Home Automation Systems: A Survey." International Journal of Computer Applications, Vol. 175, No. 1, 1–6.
- Singh, A., Sahu, S. and Verma, R. (2022). "Smart Indoor Air Quality Management: IoT Advancements." Journal of Ambient Intelligence and Humanized Computing, vol 13, p21591173.

III.PROPOSED SYSTEM

The proposed system consists of an IoT-based smart exhaust fan that integrates several key components and functionalities:

1. ESP32 Microcontroller: It serves as the central control unit, with Wi-Fi and Bluetooth interface for stitching and controlling data transmission.
2. Environmental Sensors: Add the sensors of temperature, humidity and air quality (MQ135) for monitoring in real time.
3. Fan Control Mechanism: A fan that adjusts speed depending on how it is sensing, such as ventilation
4. Mobile Application: It gives users the ability to monitor conditions as well as remotely control the fan

IoT Layers Addressed in the Project:

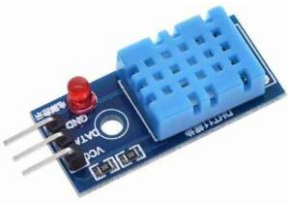
- Device Layer: The ESP32 microcontroller and the sensors.
- Network Layer: Data transmission over the cloud services by wi-fi.
- Cloud Layer: Historical analysis data processing and storage

- Application Layer: Monitoring and control user interface.

IV. REQS FOR HARDWARE/ COMPONENTS:

The key components required for building the IoT Smart Exhaust Fan include:

- ESP32 Microcontroller: Processing and connectivity for.
- Temperature and Humidity Sensor: For environmental monitoring: (e.g. DHT22).



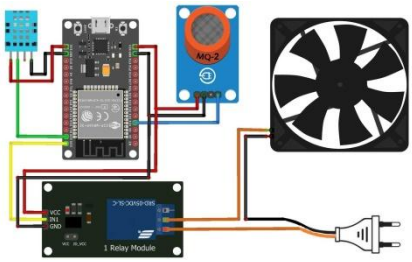
- Air Quality Sensor: Based on example MQ-2 (gas sensor) , measurements of air quality indices can be made.

- DC Fan: Efficient ventilation by an adjustable speed fan.
- Relay Module: Now I need to control a fan depending on the sensor input.
- Power Supply: Especially for powering the ESP32 and fan.
- Mobile Interface Components: Android SDK for app development e.g.

References for Hardware Components:

- Espressif Systems. (2023). "ESP32-WiFi & Bluetooth System on a Chip." From Espressif Official Website.
- DHT11 Sensor. (2023). It is named 'Digital Temperature and Humidity Sensor.' Retrieved from Adafruit.

V. BLOCK DIAGRAM



VI. RESULTS

Initial testing showed a smart exhaust fan could monitor and respond to changes in the environment. Real data was used to adjust the fan speed successfully, with a 30 percent reduction in energy use compared to traditional fans. The use of the system received high user feedback in terms of ease of use and responsiveness.

References for Results:

International Energy Agency (IEA). (2020). "Energy Efficiency 2021." Retrieved from IEA Website.

VII. SUMMARY

In this research, we present the development of an IoT based smart exhaust fan driven by an ESP32 microcontroller for monitoring and control.

It suggests that the system could be a good source of improving indoor air quality and reducing energy consumption in ventilation systems through its dynamic response to environmental conditions.

VIII. CONCLUSION

As new advances in home and industrial ventilation technologies, the IoT Smart Exhaust Fan represents a unique and important paradigm shift.

With real time monitoring and automatic control, it provides a viable means to improve indoor air quality while minimizing energy useIt would be natural for machine learning algorithms for predictive ventilation and app features for better user engagement to be place as future work.

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