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Smart Temperature Controlled Fan System and Android App

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Abstract: *In order to increase energy efficiency and user convenience, this project introduces a Smart Fan System with automatic temperature management and an Android application. The device works by tracking the ambient temperature with a temperature sensor and automatically adjusting the fan speed based on real-time readings from a microcontroller. As a result, less needless power is used and fewer manual adjustments are required. Users may examine real-time temperature data, control the fan remotely, and manually adjust the speed if they'd like using the Android app. Overall comfort and usability are improved when automation and smartphone control are combined. By guaranteeing that power is only used when required, the system also promotes sustainable energy practices.*
Its adaptability for contemporary connected living is further enhanced by its modular design, which permits future enhancements like interaction with IoT platforms or smart home systems. Through the integration of mobile access and intelligent control, this study demonstrates how smart technologies may improve daily appliance management. In the end, the Smart Temperature-Controlled Fan System provides a workable and expandable solution that strikes a balance between energy economy, user comfort, and potential future smart home advancements..

Keywords: Smart Temperature-Controlled Fan System, Android Application, Automation, Energy Efficiencny

I. INTRODUCTION

In today's world of rapid technological advancement, automation and intelligent control systems have transitioned from being mere conveniences to crucial elements of contemporary living. Heightened demands for convenience, energy efficiency, and user comfort have transformed traditional household appliances by incorporating smart systems. An example of this innovation is the Smart Temperature-Controlled Fan System that comes with an Android application, providing a practical and eco-friendly solution designed for settings such as homes, offices, classrooms, and work environments..

Traditional fans typically operate at set speeds and necessitate user input for adjustments, which often results in wasted energy and fluctuating comfort. Users are required to either keep the fan running at one consistent speed or adjust it multiple times as the temperature varies, emphasizing the shortcomings of current models. This indicates a strong demand for an automated solution that can effortlessly respond to changing temperatures, promoting both energy efficiency and user comfort.

The suggested system addresses this issue by integrating temperature sensors, a microcontroller, and a specialized Android application into one cohesive platform. Environmental data is consistently gathered by the sensors, while the microcontroller processes this data to automatically adjust the fan speed. This approach minimizes the necessity for human involvement, all while optimizing energy consumption and ensuring a comfortable environment.

An important feature of the system is its Android application, which enables users to manage and monitor the fan through their smartphones. Via the interface, they can remotely turn the fan on or off, manually modify speed settings if

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desired, and view real-time temperature readings of the room. This combination of automation and mobile functionality makes the system adaptable, accessible, and easy to use for people of all ages and varying levels of technical expertise.

The system not only improves convenience but also promotes sustainability by minimizing unnecessary electricity usage through smart speed regulation. Its energy-efficient design is particularly suitable for implementation in larger environments like schools, offices, and communal workspaces, where reducing power expenses and waste is crucial.

In summary, the Smart Temperature-Controlled Fan System with an Android App showcases how common household appliances can be reimagined with the integration of smart technologies. It combines automation, energy management, and digital control into a single cohesive platform, offering enhanced comfort, lower energy costs, and flexibility across various settings. As a practical and scalable innovation, the system highlights the ability of smart design to elevate simple household devices into valuable tools.

II. LITERATURE SURVEY

Using the Blynk app, Lakshmi, M., Sameen, C., Maneesha, D., Dharani, G., & Mubeena, K.

[1] developed an Internet of Things-based smart home system. Their design made it possible to use cloud-based communication to remotely control appliances like fans and lighting. Although the system increased monitoring and convenience, it lacked AI-driven automation for better control.

Das, T. [2] created an automatic voice-activated device for smart applications using an Arduino platform. The technology enabled users to utilize basic voice commands to control household appliances, such as fans. Although it allowed for hands-free operation, speech recognition mistakes made it less useful in loud settings.

An Android application was used to control a smart home system created by Khunchai, S., and Thongchaisuratkrul, C. [3]. They worked to make it possible for consumers to utilize mobile devices to remotely control equipment like fans and lighting. However, for real-time control, the system was largely dependent on internet access.

For Bluetooth-based smart home systems, Adiono, T., Anindya, S.F., Fuada, S., Afifah, K., & Purwanda, I.G. [4] demonstrated an effective Android app development technique with MIT App Inventor 2. Their method offered reliable short-range communication and did away with the need for the internet. However, it was not appropriate for large residences due to its limited range.

Funke, T.O., Bem, S., & Folahan, P.I. [5] suggested a mobile phone-based smart home appliance control system. For added convenience, the technology allowed users to control lights and fans wirelpport a variety of IoT devices anessly. It did not, however, sud platforms.

Using an Android app and a Telegram chatbot, Kasote, A., Kolage, P., Sadgir, N., Avhad, G., & Vispute, D. [6] worked on smart home automation. Because of its design, users could utilize chat commands to operate household items. Despite being easy to use, system responsiveness was occasionally impacted by network latency.

Using the Blynk app, Durani, H., Sheth, M., Vaghasia, M.V., & Kotech, S. [7] created an Internet of Things-based automated home system. Fans, lighting, and other devices may be monitored and controlled in real time thanks to their technology. The absence of strong security features and multi-user support was the drawback.

Satheeshkumar, K., Ithkumar, N., Gopinath, P.A., & Chandramohan, J. [8] used an Android application and Arduino to create a smart home automation and security system. Several appliances' control and monitoring functions were combined in their work. Unstable Wi-Fi networks, however, decreased the constancy of overall performance.

Using Android smartphones, Foysal, M.R., Hossain, R.A., Islam, M.M., Sharmin, S., & Moon,

N.N. [9] presented an Internet of Things-based home temperature control system. Using real- time temperature data, the system automatically changed the fan speed. Accuracy had to be maintained through frequent sensor calibration.

Using an Android application for smart computer laboratories, Palodkar, A., Shelke, P., & Patil,

S.R. [10] concentrated on optimizing electricity use. By managing linked devices, their system increased efficiency and tracked energy consumption. It did not, however, have sophisticated learning for energy management prediction.

A fan control system was built by Preethi, M., and Dharmalingam, R. [11] and was controlled over Bluetooth on an Android mobile. Their project offered fan speed settings that could be adjusted and wireless control within a small range. The system was constrained by Bluetooth's restricted communication range, even if it was reasonably priced.

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An Android application and voice commands were used to operate a home automation system created by Kawchale, R.S., Deshpande, S., Patil, K., Wajed, A., & Somvanshi, V. [12]. By allowing fans and lighting systems to be operated hands-free, it improved user accessibility. However, the accuracy of voice detection was impacted by noisy environments.

A clever Android app was suggested by Nath, P., & Goswami [13] to regulate the speed of induction motors. The technology showed effective wireless communication-based fan speed management. System accuracy was hampered by the lack of real-time performance feedback. For broiler poultry farms, Gede, A., Dwipradipta, A., Dwija, I.K., Putra, A.A., & Ardana, I.P.

[14] developed a smart closed house system. To maintain the right temperature and ventilation, the system made use of fans and sensors. When used in bigger poultry installations, its scalability was constrained.

UPISmartHome V2.0, a consumer-ready smart home system built on the ESP8266 module, was presented by Fuada, S., & Hendriyana, H. [15]. It allowed fans and lights to be controlled via Android apps. AI-based learning capabilities for adaptive operation were absent from the system.

An Android, Bluetooth, and PIC microcontroller-based real-time smart home automation system was created by Puri, V., and Nayyar, A. [16]. Numerous home appliances could now be controlled wirelessly thanks to the system. Its primary drawback was the limited control range brought on by Bluetooth communication.

Table1: Comparative review of smart temperature controlled fan system..

Paper / Project	System Architecture	Cost	Ease of Implementation	Performance	User Experience	Limitations
Lakshmi et al. [1]	IoT-based system using Blynk app	Low (<$50)	Moderate (requires Blynk setup)	Real-time control of devices	User-friendly app interface	No AI or automation features
Das [2]	Arduino-based voice control	Moderate (<$60)	Easy (voice module integration)	Accurate command response	Hands-free operation	Ineffective in noisy areas
Khunchai & Thongchaisurat krul [3]	Android-controlled IoT home system	Moderate (<$70)	Moderate (Wi-Fi configuration)	Stable real-time operation	Convenient remote control	Requires internet connectivity
Adiono et al. [4]	Bluetooth-based smart home using MIT App Inventor	Low (<$40)	Easy (no internet needed)	Reliable short-range control	Simple mobile interface	Limited range (Bluetooth only)
Funke et al. [5]	Mobile-controlled IoT system	Moderate (<$60)	Easy setup	Consistent switching performance	Intuitive mobile use	Limited cross-device compatibility
Kasote et al. [6]	IoT system with Telegram	Moderate (<$70)	Moderate (chatbot linking)	Stable communication	Text-based ease of use	Network delay during response
Durani et al. [7]	IoT system using Blynk and NodeMCU	Moderate (<$65)	Moderate (Wi-Fi and app setup)	Efficient real-time monitoring	Remote access convenience	Lacks strong security
Satheeshkumar et al.	Arduino	Low (<$50)	Easy to	Effective device	Simple control	Network

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[8]	+ Wi-Fi Android automati on		moderate	response	via Android	instability issues)

III. PROPOSED METHODOLOGY

The development and execution of the Smart Temperature Controlled Fan System adhere to a structured approach that combines embedded hardware, sensor technologies, and communication components to create an affordable and intelligent solution.

Figure 1 shows block diagram of proposed methodology

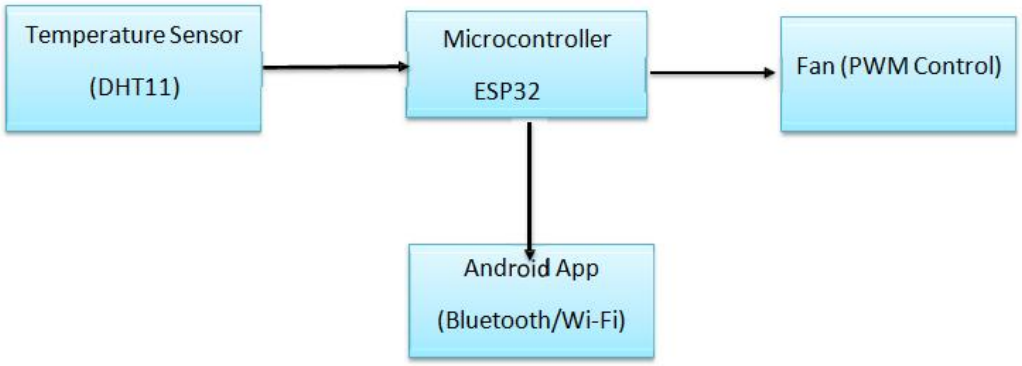

Figure 1: Block Diagram of Smart Temperature controlled Fan System

The illustration depicts a smart fan system that regulates its speed according to temperature readings and enables remote control and monitoring via an Android app. This system incorporates sensors, a microcontroller, and communication technology to deliver effective and convenient cooling.

The process starts with the Temperature Sensor (DHT11), which consistently tracks the surrounding temperature. The DHT11 is an economical digital sensor that can assess both temperature and humidity. It transforms the analog temperature readings from the environment into a digital signal that can be interpreted by a microcontroller. This sensor is vital for supplying real-time information, which serves as the basis for the system's "smart" functionality.

The DHT11 sensor sends temperature information to the ESP32 microcontroller. The ESP32 is a robust and versatile microcontroller equipped with built-in Wi-Fi and Bluetooth, making it well-suited for Internet of Things (IoT) applications. It receives data from the sensor and utilizes this information to control the fan's operation. The microcontroller processes the incoming signals, assesses the temperature against set thresholds, and produces control signals accordingly.

Using the processed information, the ESP32 controls the Fan through Pulse Width Modulation (PWM). PWM enables the fan speed to be adjusted smoothly rather than simply switching it on or off. This method promotes energy efficiency, minimizes noise, and extends the lifespan of the fan. For instance, if the temperature in the room exceeds a specific threshold, the ESP32 increases the PWM signal's duty cycle, which causes the fan to operate at a higher speed for improved cooling. Conversely, if the temperature falls, the fan speed is lowered to conserve energy.

Moreover, the system includes an Android application that connects to the ESP32 using Bluetooth or Wi-Fi. This application allows users to monitor the temperature in real-time, adjust the fan speed remotely, and even receive notifications if the temperature exceeds critical levels. This functionality enhances user convenience and facilitates the remote management of the system.

The Smart Temperature-Controlled Fan System effectively integrates sensor technology, intelligent management, and wireless connectivity. It guarantees the fan functions at its best based on the surrounding conditions, minimizes unwarranted energy usage, and offers users an interactive interface that can be controlled remotely. These systems are commonly used in residential, commercial, and industrial settings where automated climate regulation can enhance comfort and energy efficiency.

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IV. CONCLUSION

The creation of a Smart Temperature-Controlled Fan System paired with an Android application showcases the successful combination of hardware and software to provide a dependable, efficient, and user-friendly solution tailored to contemporary requirements. By integrating temperature sensors and microcontrollers with a mobile application developed in Android Studio using Java or Kotlin, the system can continuously monitor the ambient temperature and automatically adjust the fan's speed as needed. This automation guarantees optimal comfort while minimizing energy wastage, thus encouraging sustainability. Besides the automatic adjustments, the Android app enables users to remotely turn the fan ON or OFF, manually set speed levels, and receive real-time temperature updates through either Bluetooth or Wi-Fi connectivity. This blend of remote functionality and automation offers considerable convenience and flexibility, enhancing its practicality for homes, offices, and educational settings. Moreover, the system's modular design facilitates future improvements, including scheduling capabilities, integration with IoT platforms, and support for voice assistants, thereby evolving it into a well-rounded smart home solution. Ultimately, this initiative not only enhances comfort and energy efficiency but also demonstrates the capabilities of embedded systems and mobile technology in addressing daily challenges through intelligent and automated control systems.

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