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IOT-BASED TEMPERATURE-CONTROLLED FAN SPEED SYSTEM FOR LAUNDRY ROOM

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Abstract— The growing demand for energy-efficient and intelligent temperature control systems has led to advancements in various sectors, including laundry facilities. This project presents an innovative solution that integrates a temperature-controlled fan system with Internet of Things (IoT) monitoring, specifically designed for laundry rooms. The system employs an ESP8266 module microcontroller, a DS18B20 temperature sensor, a 16x2 LCD display, and an IRF540N MOSFET to regulate a 12V DC fan. Powered by a 12V DC adapter and controlled by a 7805 Voltage Regulator IC, the system ensures precise fan speed control based on temperature fluctuations.

System, Temperature Sensing	Unlike traditional laundry room temperature control systems, which often require manual intervention and result in energy inefficiency, this system operates autonomously, adjusting fan speed in real-time to optimize energy use. The IoT functionality further enhances usability by allowing remote monitoring and control through an online platform, making it an ideal solution for laundry facilities. The methodology involves creating a simple IoT interface, programming the microcontroller for temperature sensing and fan control, and designing an electronic circuit tailored for the laundry room environment. Rigorous testing validates the system's effectiveness, and comprehensive documentation is provided to support the development and management of the project. This solution addresses the unique temperature control needs of modern laundry facilities.

I. Introduction

Home laundry setups play a vital role in maintaining cleanliness and personal hygiene, making them an essential component of modern households. Within these domestic environments, efficient drying processes are crucial for managing laundry effectively [1]. Temperature control and monitoring significantly influence drying times, energy consumption, and overall laundry quality [2, 3]. However, traditional temperature control in home laundry systems often relies on manual adjustments, which can be cumbersome, inconsistent, and inefficient. Manual fan control typically involves periodic checks and adjustments based on user experience [4].

This approach has inherent limitations, such as delays in responding to changing conditions, which can result in suboptimal drying performance and unnecessary energy consumption. Ensuring consistent and efficient drying temperatures in home laundry setups remains a persistent challenge under manual control systems. Automated temperature-based fan speed control and monitoring systems offer a promising solution to these challenges [5]. These systems can continuously monitor temperature levels and dynamically adjust fan speeds to maintain optimal drying conditions. Such automation is particularly beneficial for household applications, where laundry is a frequent activity, and energy efficiency is critical for reducing operational costs.

The integration of Internet of Things (IoT) technology further enhances these systems by enabling remote monitoring and control. IoT-enabled devices provide users with real-time temperature data and the ability to make adjustments from anywhere, offering added convenience and efficiency [6, 7]. This feature is particularly valuable in scenarios where users may be away from home, ensuring seamless operation and energy savings. The "Iot-based temperature-controlled fan speed system for laundry room" project addresses these specific challenges within home laundry environments [8]. By combining automated temperature regulation with IoT capabilities, the project aims to enhance drying efficiency, reduce energy consumption, and enable remote monitoring. Through an innovative integration of hardware, software, and IoT technologies, this project seeks to provide a comprehensive solution tailored to the unique requirements of home laundry systems.

The proposed system represents a significant advancement in home laundry operations. By leveraging automation and IoT, the project aspires to transform traditional practices into efficient, user-friendly, and energy-saving solutions, ultimately contributing to the evolution of smart household technologies [9].

II. Methodology

Figure 1 shows the flowchart of the complete system. Begin with the temperature sensor read the current temperature and send the data to ESP8266 where it will be analyzed for specific range of temperature. If the current temperature exceeds 29°C (threshold value) the system will send the signal to the fan and LCD to turn ON. Or else, the system will keep repeating measuring the current temperature.

Once the fan and LCD are turned ON, a notification will be sent to the user via IOT to complete the system. In this system DC motor fan is used because of its simplicity. PWM speed-controlled technique has been adapted in this project whereby varying the duty cycle, DC fan will be accurately being controlled. Figure 2 illustrates the circuit diagram of the project. The main components are Arduino, LCD display, 12V DC fan and power supply The simulation circuit diagram assembled using EasyEDA software and Thinkercad software. Arduino has been coded to fulfil the setting requirement.

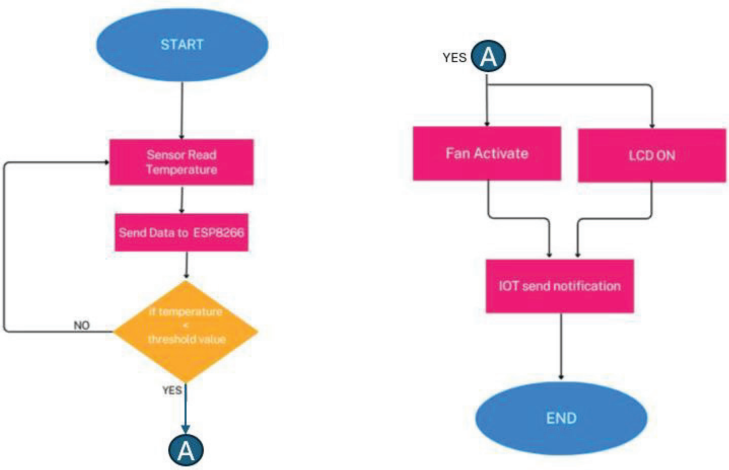
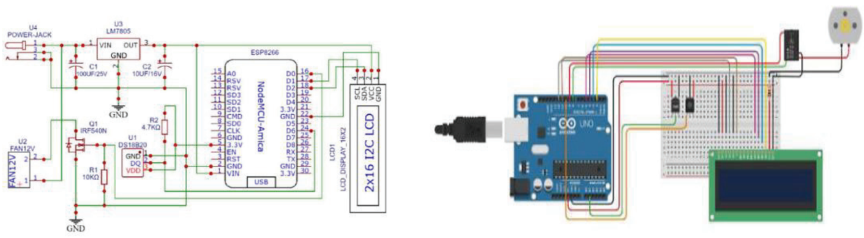


Figure 1: Flowchart for the complete system

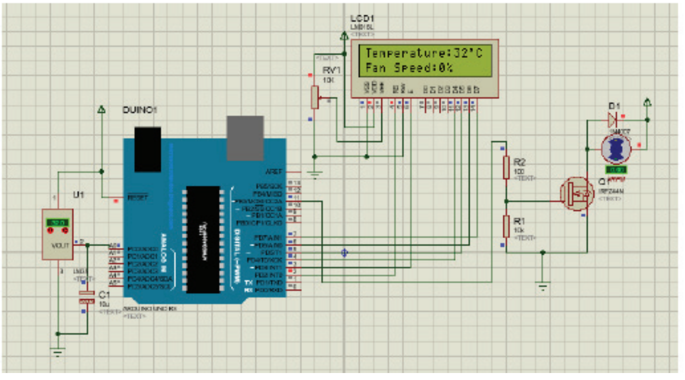


(a) using EasyEDA (b) using Thinkercad

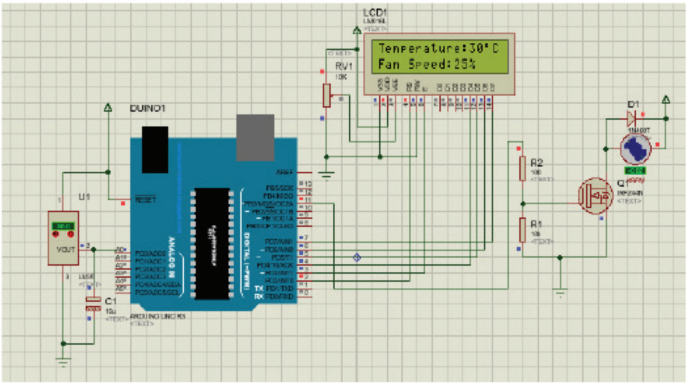
Figure 2: Circuit Diagram of the Project

III. Results and Discussion

Figure 3 shows the simulation results of the project when the temperature changes. Figure 4 shows the results of hardware implementation.



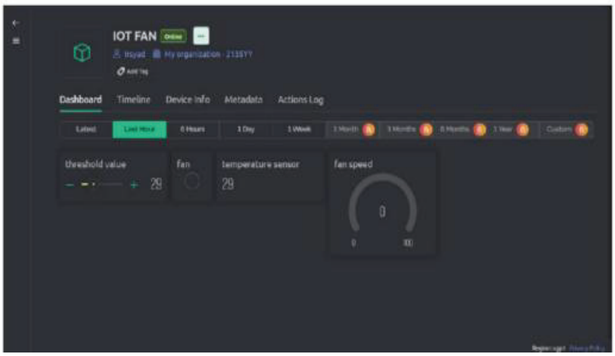
(a)



(b)

Figure 3: (a) Simulation result, the outside temperature higher than ambient, motor OFF, (b) outside temperature lower than ambient, motor ON

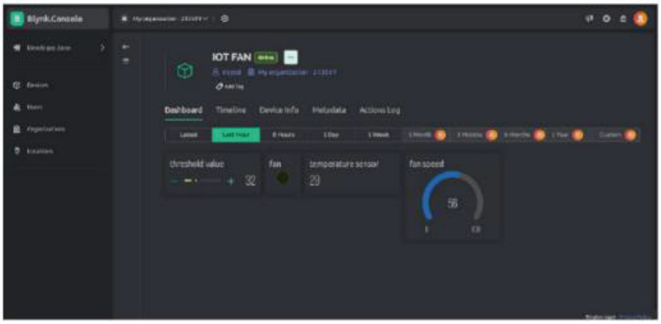
(a)



(b)

Figure 4: Result of hardware implementation during off-state condition. (a) LCD temperature higher than 29°C, motor OFF, (b) IOT sent the notification to user

(a)



(b)

Figure 5: Result of hardware implementation during on-state condition. (a) LCD temperature lower 29°C, motor ON, (b) IOT sent the notification to user

Table 1 shows the comparison result power consumption of the system with and without the controller. For both conditions, temperature varies, the measurement of the voltage and current were performed. From these parameters value, the power consumption for both states is determined. Power consumption has been reduced to almost 30% with implementation of the system controller.

Table 1: Comparison Result Power Consumption of the System with and without the Controller

Without Controller		With Controller	
Voltage (V)	4.89 V	Voltage (V)	4.9 V
Current (A)	2.3 m	Current (A)	1.6 mA
Power (W)	11.2 mW	Power (W)	7.81 mW

IV. Conclusion and Recommendations

The IoT Temperature-Based Fan Speed Control and Monitoring Device significantly improved energy efficiency and fan speed regulation in home laundry settings. By integrating the DS18B20 temperature sensor, IRF540N MOSFET, and ESP8266 microcontroller, the system enabled precise temperature monitoring, dynamic fan speed adjustments, and remote control via Wi-Fi, reducing energy consumption by an estimated 30%. While external factors like humidity and sensor placement and reliance on Wi-Fi posed limitations, the project demonstrated effective power optimization and enhanced user convenience.

Future enhancements could focus on sensor placement, calibration, and alternative connectivity options to ensure consistent performance and broader applicability in diverse conditions. In addition, future enhancements could optimize DS18B20 sensor placement, refine calibration, and consider factors like humidity and airflow to improve accuracy and responsiveness. Adding backup systems or alternative connectivity would ensure reliability during Wi-Fi disruptions. Data logging integration could enable trend analysis, optimize settings, and enhance system accuracy, reliability, and adaptability.

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