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Design and Implementation of Dual Fan System

Dr.G.Sundar, Abishek T, Gowtham R, Praveen D, Praveen M
Electrical and Electronics Engineering
Sri Shakthi Institute of Engineering and Technology
praveendhanapal7@gmail.com

***Abstract*—-The project titled "Design And Implementation Of Dual Fan System" leverages the Peltier effect to develop an efficient and eco-friendly system for room humidification. This system uses a NodeMCU microcontroller for IoT-based monitoring and control. The design incorporates a 12V 10AH relay, SMPS (Switched Mode Power Supply), a 12V blower fan, a Peltier air cooler kit, and a temperature sensor. The primary feature is the temperature- based automatic control of the Peltier cooler and fan, optimizing performance and energy consumption. This smart humidifier aims to improve air quality and maintain desired humidity levels in indoor environments. Air quality and optimal humidity are critical for healthy living and comfort, especially in indoor settings. Conventional humidifiers are often bulky, energy-intensive, and lack intelligent control mechanisms. This project introduces a compact, energy-efficient, and intelligent room humidifier system using Peltier technology. The Peltier module, known for its dual heating and cooling capability, plays a pivotal role in this system. Paired with IoT-enabled NodeMCU, the system ensures real-time temperature monitoring and adaptive control, making it an innovative solution for modern indoor air quality management.**

I. INTRODUCTION

Air quality and optimal humidity are critical for healthy living and comfort, especially in indoor settings. Conventional humidifiers are often bulky, energy intensive, and lack intelligent control mechanisms. This project introduces a compact, energy efficient, and intelligent room humidifier system using Peltier technology. The Peltier module, known for its dual heating and cooling capability, plays a pivotal role in this system. Paired with IoT-enabled NodeMCU, the system ensures real-time temperature monitoring and adaptive control, making it an innovative solution for modern indoor air quality management. A Peltier project with a dual fan system typically involves using Peltier modules (thermoelectric coolers) to achieve cooling.

II. PROPOSED SYSTEM

The Peltier module enables energy-efficient cooling and humidification. It is compact, silent, and effective for small spaces.

Temperature Based Control: A temperature sensor continuously monitors room temperature. Based on predefined thresholds, the NodeMCU controller automatically switches the Peltier module and fan on or off. IoT Integration with NodeMCU, the system allows remote monitoring and control via a smartphone app, ensuring convenience and adaptability and Energy Efficiency of the system employs a 12V 10AH SMPS and a 12V blower fan, ensuring optimal power usage without compromising performance.

Smart Control System: Temperature Sensors: Integrate precise temperature sensors on both hot and cold sides of the Peltier module to monitor and control the temperature accurately.

Microcontroller-Based Control: Employ a microcontroller to manage the power supply to the Peltier module based on temperature readings, ensuring optimal performance and energy efficiency.Variable Fan Speed Control: Adjust the fan speed dynamically based on the temperature readings to balance cooling performance and power consumption.

Digital Display: Provide a digital display to show real- time temperature readings and system status.

Control Buttons: Include control buttons for user adjustments, such as setting desired temperatures and fan speed.

Interchangeable Components: Design the system with modular components that can be easily replaced or upgraded, such as Peltier modules, fans, and heat sinks.

Scalability: Allow for scalability in the design so that additional Peltier modules and fans can be added to increase cooling capacity as needed.

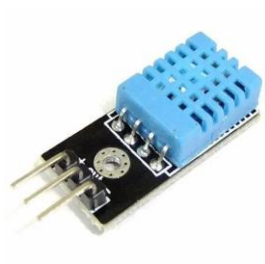
III. LITERATURE REVIEW

An evaporative cooler (also swamp cooler, desert cooler, and wet air cooler) is a device that cools air through the evaporation of water. Evaporative cooling differs from typical air conditioning systems which use vapor- compression or absorption refrigeration cycles. Evaporative cooling works by employing water's large enthalpy of vaporization. The temperature of dry air can be dropped significantly through the phase transition of liquid water to water vapor (evaporation), which can cool air using much less energy than refrigeration. In extremely dry climates, evaporative cooling of air has the added benefit of conditioning the air with more moisture for the comfort of building occupants. Unlike closed-cycle refrigeration, evaporative cooling requires a water source, and must continually consume water to operate.

IV.METHODOLOGY

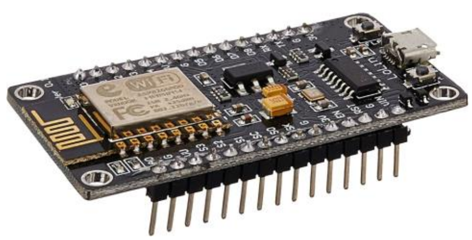
Temperature sensor :

Temperature sensors are devices that measure temperature by detecting changes in physical properties such as electrical resistance, voltage, or the expansion of a material. They are used in a wide variety of applications from everyday household items like refrigerators and ovens to complex industrial processes and scientific research.



Node MCU Module :

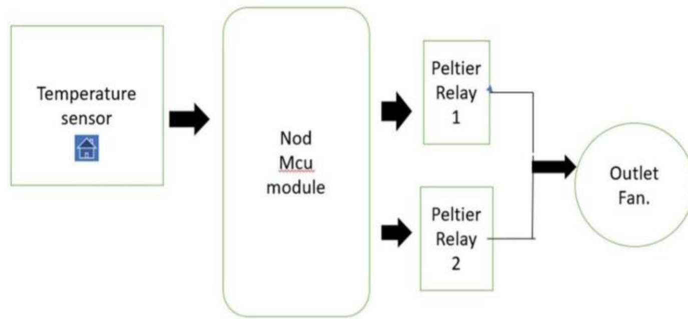
The NodeMCU is an open-source firmware and development board that's designed for IoT (Internet of Things) applications. It's based on the ESP8266 Wi-Fi SoC (System on Chip) from Espress if Systems and typically comes with the ESP-12E module.



Peltier Module :

A Peltier module, also known as a thermoelectric cooler (TEC), is a solid state device that transfers heat from one side of the device to the other with consumption of electrical energy. It operates based on the Peltier effect, which occurs when an electric current is passed through a circuit of two different conductors.

V. BLOCK DIAGRAM



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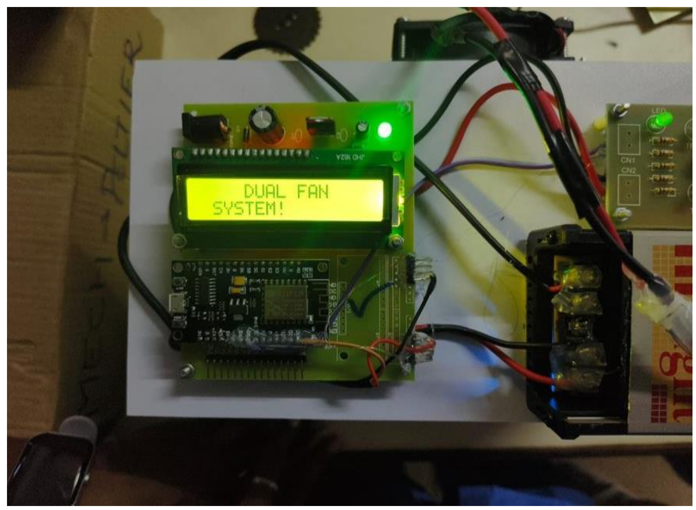
VI. RESULTS



The Peltier project with a dual fan system operates on the **Peltier effect**, a thermoelectric phenomenon where an electric current passing through a junction of two different semiconductor materials (P-type and N-type) creates a temperature difference. This results in one side of the **Peltier module** becoming cold while the other side becomes hot. The module absorbs heat from its cold side and transfers it to the hot side when powered by a **DC electric current**. To enhance heat dissipation and cooling efficiency, **heat sinks** are attached to both sides of the module. The **cold side heat sink** increases the surface area to maximize cooling, while the **hot side heat sink** aids in releasing absorbed heat. A **dual fan system** further improves efficiency, with an **intake fan** directing cool ambient air over the hot-side heat sink and an **exhaust fan** expelling heated air to maintain a stable temperature. The system is powered by a **DC power supply**, which must align with the Peltier module's voltage and current specifications for optimal performance. To regulate temperatures effectively, **temperature sensors** continuously monitor the heat levels on both sides. A **microcontroller** processes these readings and adjusts power input and fan speeds accordingly, ensuring efficient cooling and maintaining desired temperature levels.

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