

Thermal Comfort-Based Automatic Speed Control of a Fan: A Sensor-Based Approach for Adaptive Indoor Airflow Control

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Abstract

This paper presents a sensor-based method for automatic fan-speed estimation using thermal comfort parameters. The proposed system combines environmental and occupant-related measurements to estimate the airflow requirement and assess thermal comfort. A DHT22 sensor is used for room temperature and relative humidity, an LM35 is used for body temperature measurement, and a pulse sensor is used to obtain heart-rate information. A NodeMCU is used to obtain ambient-temperature information and communicate it to an Arduino UNO, which performs data acquisition and processing. The required air velocity is estimated from ambient temperature and relative humidity, and the corresponding fan speed is obtained using the fan-law relationship. Predicted Mean Vote (PMV) and Predicted Percentage of Dissatisfied (PPD) are then calculated from the environmental and personal parameters. The supplied prototype reports an operating condition of 33 °C ambient temperature, 40.70% relative humidity, 1.21 m/s calculated air velocity, 157 rpm required speed and PMV of 2.8. These values demonstrate the intended relationship between sensed thermal conditions and fan-speed estimation. Further repeated experiments, calibration and energy measurements are recommended before final publication.

Keywords

Thermal comfort, PMV, PPD, DHT22, NodeMCU, Arduino UNO, fan speed control, IoT, air velocity.