

ABSTRAK

Perubahan temperatur mesin pada berbagai kondisi pengoperasian sepeda motor menyebabkan kebutuhan pendinginan yang berbeda, sehingga diperlukan sistem pengendalian kipas radiator yang dapat menyesuaikan kerja kipas berdasarkan temperatur *coolant*. Penelitian ini bertujuan merancang sistem pengendalian kipas radiator berbasis logika fuzzy dan menganalisis pengaruhnya terhadap kestabilan temperatur mesin. Metode penelitian dilakukan melalui perancangan dan implementasi sistem menggunakan ESP32, sensor NTC 3950 50 k Ω , ADS1115, MOSFET, dan modul step-down Mini 560. Sistem menggunakan temperatur 95°C sebagai *setpoint* dan PWM sebagai keluaran untuk mengatur kecepatan kipas. Perangkat yang di uji meliputi sensor NTC dengan termometer, temperatur *coolant* terhadap PWM, serta kinerja sistem pada kecepatan konstan 80 km/jam, *full throttle acceleration run*, *idle*, lalu lintas padat, dan penurunan temperatur. Hasil pengujian menunjukkan rata-rata selisih sensor NTC sebesar 0,26°C dengan *error* 0,37%. Sistem mampu menyesuaikan PWM dan mempertahankan temperatur *coolant* di sekitar *setpoint* 95°C. Pada pengujian penurunan temperatur, suhu turun dari 103,3°C menuju 95°C dengan *fall time* 240 detik dan *settling time* 150 detik. Hasil tersebut menunjukkan bahwa sistem berbasis logika fuzzy mampu memberikan respons adaptif dan membantu menjaga kestabilan temperatur *coolant*.

Kata kunci: Sistem Pendingin Radiator, Logika Fuzzy, Sensor NTC, Temperatur *Coolant*, PWM, Sepeda Motor.



ABSTRACT

Changes in engine temperature under various motorcycle operating conditions result in different cooling requirements, necessitating a radiator fan control system that can adjust fan operation based on coolant temperature. This study aims to design a radiator fan control system based on fuzzy logic and analyze its effect on engine temperature stability. The research method involved the design and implementation of a system using an ESP32, a 50 k Ω NTC 3950 sensor, ADS1115, MOSFET, and a Mini 560 step-down module. The system uses a temperature of 95°C as the setpoint, with PWM as the output for controlling fan speed. The tested devices and system performance included comparison of the NTC sensor with a thermometer, coolant temperature against PWM, and system performance at a constant speed of 80 km/h, full throttle acceleration run, idle, heavy traffic, and temperature reduction conditions. The test results showed an average difference of 0.26°C between the NTC sensor and the thermometer, with an error of 0.37%. The system was able to adjust the PWM and maintain the coolant temperature around the 95°C setpoint. In the temperature reduction test, the temperature decreased from 103.3°C to 95°C with a fall time of 240 seconds and a settling time of 150 seconds. These results indicate that the fuzzy logic-based system provides an adaptive response and helps maintain coolant temperature stability.

Keywords: Radiator Cooling System, Logika fuzzy, NTC Sensor, Coolant Temperature, PWM, Motorcycle.

