

INTISARI

Kendaraan bermesin diesel merupakan tulang punggung transportasi komersial dan logistik di Indonesia. Namun, kecelakaan lalu lintas yang masih tinggi menunjukkan belum optimalnya penerapan teknologi sebagai standar keselamatan transportasi. Penelitian ini bertujuan menghasilkan sistem pengendali batas kecepatan aman pada model kendaraan bermesin diesel menggunakan *Fuzzy Logic Controller* (FLC) dengan pengawasan berbasis IoT.

Sistem dirancang menggunakan mikrokontroler ESP32 yang mengendalikan bukaan model katup *throttle* melalui motor servo sebagai representasi mekanisme kontrol kecepatan kendaraan diesel. FLC menerima tiga masukan, yaitu rasio selisih kecepatan model kendaraan terhadap batas kecepatan yang ditetapkan, serta jarak model terhadap benda di sekitarnya yang diukur oleh sensor ultrasonik. Keluaran FLC berupa nilai bukaan katup yang kemudian dikonversi menjadi sudut motor servo dan nilai PWM untuk mengendalikan motor DC sebagai model kendaraan. Kecepatan model diukur menggunakan *encoder* kecepatan, sedangkan pemantauan dan konfigurasi sistem dilakukan secara real – time melalui platform IoT *Blynk*.

Hasil pengujian menunjukkan bahwa FLC mampu menghasilkan keputusan bukaan katup dengan rata – rata *error* 0,064% terhadap nilai acuan MATLAB. Sistem berhasil menjaga kecepatan model selalu dalam batas aman yang ditetapkan, sekaligus mempertimbangkan jarak terhadap benda sekitar. Sensor ultrasonik depan dan belakang menunjukkan rata – rata *error* masing – masing 3,82% dan 4,67%, sedangkan *encoder* kecepatan menunjukkan rata – rata *error* 0,8993%. Komunikasi data antara mikrokontroler dan platform *Blynk* berjalan secara real – time dengan baik.

Kata kunci: *fuzzy logic controller*, batas kecepatan, kendaraan diesel, IoT, motor servo

ABSTRACT

Diesel-engine vehicles are the backbone of commercial and logistics transportation in Indonesia. However, the persistently high rate of traffic accidents indicates that technology has not been optimally applied as a transportation safety standard. This research aims to develop a safe speed limit control system for a diesel engine vehicle model using a Fuzzy Logic Controller (FLC) with IoT-based monitoring.

The system was designed using an ESP32 microcontroller that regulates the opening of a throttle valve model via a servo motor, representing the speed control mechanism of a diesel vehicle. The FLC receives three inputs: the difference between the vehicle model's speed and the set speed limit, and the distance from the model to surrounding objects measured by ultrasonic sensors. The FLC output is a valve opening value, which is then converted into a servo motor angle and a PWM value to control the DC motor representing the vehicle model. Vehicle speed is measured using an encoder, while system monitoring and configuration are performed in real – time through the Blynk IoT platform.

Test results show that the FLC produced throttle valve opening decisions with an average error of 0.064% compared to MATLAB reference values. The system successfully maintained the vehicle model's speed within the defined safe limits while simultaneously considering the distance to surrounding objects. The front and rear ultrasonic sensors showed average errors of 3.82% and 4.67% respectively, while the speed encoder showed an average error of 0.8993%. Data communication between the microcontroller and the Blynk platform operated reliably in real – time.

Keywords: fuzzy logic controller, speed limit, diesel vehicle, IoT, servo motor

