

ABSTRACT

This study aims to design and develop a vehicle maximum speed limiting system based on the HC-SR04 sensor and ESP32 microcontroller. The system automatically deactivates the DC motor relay on a vehicle prototype when the speed exceeds the predetermined maximum limit and is integrated with the Internet of Things (IoT) for real-time monitoring. The research methodology includes hardware and software design, HC-SR04 sensor calibration, nRF24L01+ data communication testing, speed measurement on a conveyor-based platform with various dimmer angle settings, maximum speed limiting system testing, and IoT integration using Google Sheets. The results show that the sensor provides high accuracy, with a speed measurement error of only 0.7010%. The nRF24L01+ communication system successfully transmits data over distances of up to 100 m under line-of-sight conditions and remains reliable up to 30 m in the presence of obstacles. The speed limiting system operates according to the programmed logic, where the relay remains on when the vehicle speed is below the maximum limit and turns off when the speed exceeds the limit, thereby restricting the vehicle's movement. The IoT integration successfully displays and stores vehicle speed data and relay status in real time without data loss. Therefore, the proposed system is proven to be accurate and effective in limiting vehicle speed while supporting remote monitoring.

Keywords: *HC-SR04 sensor, speed, nRF24L01+ module, relay, Internet of Things*