

ABSTRACT

This research aims to develop a TPMS prototype that supports wireless transmission of pressure and temperature readings using the ESP32-C3 microcontroller and MS5803-14BA sensor, leveraging the ESP-NOW protocol to conserve power. The system is designed to monitor vehicle tire conditions in real time, improve driving safety, and integrate with the IoT ecosystem. The prototype underwent three test scenarios: a static test on a gallon, a semi-dynamic test on a tire at rest, and a dynamic test on a moving vehicle. Test results show the system has an average pressure accuracy rate of $\pm 93.70\%$ and relatively stable performance under challenging environmental conditions. Compared to commercial TPMS systems, the prototype demonstrated high reliability in terms of accuracy, transmission stability, and energy efficiency. It was also able to deliver temperature and pressure data responsively through the monitoring dashboard. These results demonstrate the feasibility of the developed TPMS system as an economical, adaptive alternative that is ready for further development in real-world applications.

Keywords: ESP32-C3, ESP-NOW, Tire Pressure Monitoring System (TPMS), Vehicle safety monitoring, Wireless sensor network