

ABSTRACT

This research designed and implemented an infrared light emitter as part of an automatic vehicle recognition system for parking areas. The system consists of an infrared transmitter and TSOP1738 receiver connected to an Arduino Uno microcontroller to automatically detect vehicles. A servo motor is used to control the parking barrier based on detection results, and an ESP8266 module is employed to transmit data in real time to a MySQL server. The system is also equipped with an LCD display to provide parking status information.

The test results show that the system is capable of recognizing registered vehicle IDs with 100% detection accuracy, while consistently rejecting unregistered IDs. The optimal infrared transmission range reaches 2 meters in daylight and 5 meters at night. The average barrier opening time after ID validation is 344.27 ms, with a standard deviation of 16.38 ms, while the infrared signal reception latency on the Arduino is 358.60 ms. Communication between the ESP8266 and the database is very fast, with an average latency of 3.60 ms and a maximum of 15 ms. Parking slot status is displayed in real time and accurately via the LCD. Ultrasonic sensors reliably detect slot conditions based on distance changes: 1–5 cm for occupied slots and more than 5 cm for vacant slots, with accurate and consistent performance.

Keywords: Arduino Uno, ESP8266, infrared, TSOP sensor, automatic parking system.