ABSTRAK

Tingginya angka pencurian sepeda motor mendorong perlunya sistem keamanan yang lebih modern dan andal. Penelitian ini bertujuan merancang dan menguji sistem keamanan sepeda motor berbasis modul ESP32 dengan teknologi Bluetooth Low Energy (BLE) yang memungkinkan kendaraan hanya dapat dinyalakan jika perangkat BLE milik pengguna terdeteksi. Sistem ini menggunakan modul ESP32 sebagai mikrokontroler utama, dengan dukungan relay NodeMCU, buzzer, dan LED sebagai indikator status. Perangkat BLE yang digunakan adalah iTag dan smartwatch.

Metodologi yang digunakan berupa eksperimen di laboratorium dengan tiga tahap pengujian, yaitu uji jangkauan, uji waktu respons (delay), dan uji pada kondisi nyata. Hasil pengujian menunjukkan bahwa sistem mampu mendeteksi perangkat BLE hingga pada jangkauan 5 meter dengan nilai RSSI sekitar -70 dBm, serta memiliki waktu respons 1–2 detik untuk mengaktifkan atau menonaktifkan sistem saat perangkat masuk atau keluar dari jangkauan. Sistem juga berhasil mencegah kendaraan dinyalakan apabila perangkat BLE tidak terdeteksi, sehingga mampu meningkatkan keamanan sepeda motor secara signifikan.

Sistem ini tidak hanya memberikan alternatif pengganti kunci konvensional, tetapi juga membuka peluang pengembangan lebih lanjut seperti integrasi GPS, notifikasi real-time, dan kontrol jarak jauh berbasis IoT.

Kata kunci: ESP32, sistem keamanan, sepeda motor, Bluetooth Low Energy, keyless, iTag, smartwatch.

ABSTRACT

The high rate of motorcycle theft highlights the need for a more modern and reliable security system. This study aims to design and evaluate a motorcycle security system based on the ESP32 module using Bluetooth Low Energy (BLE) technology, which allows the vehicle to start only when the user's registered BLE device is detected. The system utilizes the ESP32 as the main microcontroller, supported by a NodeMCU relay, buzzer, and LED as status indicators. The BLE devices used in this study are an iTag and a smartwatch.

The methodology involved laboratory-based experiments, consisting of three testing stages: range testing, response time (delay) testing, and real-condition implementation. The results showed that the system could detect BLE devices within a range of up to 5 meters with an RSSI value of approximately -70 dBm, and respond within 1–2 seconds when the device enters or leaves the detection range. The system also successfully prevented the motorcycle from starting when the BLE device was not detected, significantly enhancing vehicle security.

This system not only serves as an alternative to conventional keys but also offers potential for further development, such as GPS integration, real-time notifications, and remote control via IoT.

Keywords: ESP32, security system, motorcycle, Bluetooth Low Energy, keyless, iTag, smartwatch.