

ABSTRAK

Fuad Ramadhan Ariesty Setiawan. RANCANG BANGUN SISTEM KEAMANAN SEPEDA LISTRIK MENGGUNAKAN GPS (Neo-M8Q) DAN RFID DENGAN FITUR *GEO-FENCING*. Dibimbing oleh Sofitri Rahayu, S.Pd., M.Eng.

Peningkatan penggunaan sepeda listrik sebagai sarana transportasi menimbulkan permasalahan keamanan, seperti risiko pencurian dan penggunaan oleh pihak yang tidak berwenang. Oleh karena itu, penelitian ini bertujuan merancang dan mengimplementasikan sistem keamanan sepeda listrik menggunakan metode Geo-Fence yang dipadukan dengan autentikasi RFID serta fitur Auto Cut Off. Sistem dirancang menggunakan mikrokontroler ESP32 sebagai pengendali utama, modul GPS u-blox NEO-M8Q untuk memperoleh koordinat lokasi, modul SIMCom A7670C sebagai media komunikasi data melalui jaringan LTE, modul RFID MFRC522 sebagai autentikasi pengguna, relay sebagai pemutus arus kendaraan, serta buzzer sebagai indikator peringatan. Data lokasi dikirimkan ke aplikasi sehingga posisi kendaraan dapat dipantau secara real-time. Metode penelitian meliputi tahap perancangan perangkat keras, pengembangan perangkat lunak, integrasi sistem, serta pengujian terhadap setiap komponen dan fungsi sistem. Pengujian dilakukan pada modul GPS, modul SIMCom A7670C, RFID, aplikasi pemantauan, serta pengujian skenario sistem meliputi autentikasi RFID, kehilangan sinyal GPS, kehilangan koneksi internet, dan pengujian fitur Geo-Fence. Hasil penelitian menunjukkan bahwa sistem mampu melakukan autentikasi RFID dengan baik, memperoleh koordinat GPS secara real-time, serta mengirimkan data lokasi ke aplikasi melalui jaringan LTE. Ketika kendaraan keluar dari area Geo-Fence yang telah ditentukan, sistem secara otomatis mengaktifkan buzzer dan memutus aliran listrik kendaraan melalui relay (Auto Cut Off). Selain itu, ketika koneksi internet terputus, fungsi pemantauan pada aplikasi berhenti diperbarui, namun sistem keamanan tetap bekerja secara lokal pada ESP32. Berdasarkan hasil tersebut, sistem yang dirancang mampu meningkatkan keamanan sepeda listrik melalui autentikasi pengguna, pemantauan lokasi, serta pembatasan area operasional kendaraan.

Kata Kunci: ESP32, Geo-Fence, GPS u-blox NEO-M8Q, RFID, SIMCom A7670C, Auto Cut Off, Sepeda Listrik.

ABSTRACT

Fuad Ramadhan Ariesty Setiawan. DESIGN AND BUILD AN ELECTRIC BICYCLE SECURITY SYSTEM USING GPS (Neo-M8Q) AND RFID WITH GEO-FENCING FEATURES. Guided by Sofitri Rahayu, S.Pd., M.Eng.

The increase in the use of electric bicycles as a means of transportation poses security problems, such as the risk of theft and use by unauthorized parties. Therefore, this study aims to design and implement an electric bicycle security system using the Geo-Fence method combined with RFID authentication and Auto Cut Off features. The system is designed using the ESP32 microcontroller as the main controller, the NEO-M8Q u-blox GPS module to obtain location coordinates, the SIMCom A7670C module as a data communication medium through the LTE network, the RFID module MFRC522 as user authentication, relay as a vehicle circuit breaker, as well as a buzzer as a warning indicator. Location data is sent to the app so that the vehicle's position can be monitored in real-time. The research method includes the stage of hardware design, software development, system integration, and testing of each component and function of the system. Tests were carried out on GPS modules, SIMCom A7670C modules, RFID, monitoring applications, and system scenario testing including RFID authentication, GPS signal loss, internet connection loss, and Geo-Fence feature testing. The results showed that the system was able to perform RFID authentication well, obtain GPS coordinates in real-time, and send location data to the application via LTE network. When the vehicle exits the predetermined Geo-Fence area, the system automatically activates the buzzer and cuts off the vehicle's power through the relay (Auto Cut Off). In addition, when the internet connection is disconnected, the monitoring function on the application stops being updated, but the security system still works locally on the ESP32. Based on these results, the system is designed to improve the safety of electric bicycles through user authentication, location monitoring, and vehicle operational area restrictions.

Keywords: ESP32, Geo-Fence, GPS u-blox NEO-M8Q, RFID, SIMCom A7670C, Auto Cut Off, Electric Bike.