

ABSTRAK

IMPLEMENTASI RADIO FREQUENCY IDENTIFICATION UNTUK TRACKING DAN PENGELOLAAN ALAT LABORATORIUM SECARA REAL-TIME

(2026: XV + 101 HALAMAN + 63 GAMBAR + 15 TABEL + 9 LAMPIRAN)

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Penelitian ini bertujuan untuk mengimplementasikan sistem pengelolaan dan tracking alat laboratorium secara real-time menggunakan teknologi Radio Frequency Identification (RFID) dan Bluetooth Low Energy (BLE). Sistem yang dikembangkan menggunakan ESP32 sebagai pengendali utama, modul RFID RC522 sebagai media identifikasi pengguna, serta perangkat BLE yang dipasang pada alat laboratorium untuk mendukung proses pelacakan lokasi. Data hasil peminjaman, pengembalian, dan lokasi alat dikirim ke database Google Sheets dan ditampilkan pada website monitoring yang dikembangkan menggunakan Google Apps Script. Hasil pengujian menunjukkan bahwa sistem mampu melakukan identifikasi pengguna melalui RFID, menyimpan data transaksi secara otomatis, serta memantau lokasi alat laboratorium berdasarkan sinyal BLE yang diterima oleh gateway. Implementasi sistem ini diharapkan dapat meningkatkan efektivitas pengelolaan alat laboratorium, mempermudah proses pencarian alat, serta mendukung monitoring inventaris secara real-time.

Kata Kunci: RFID, Bluetooth Low Energy (BLE), ESP32, Tracking Alat Laboratorium, Pengelolaan Inventaris, Real-Time, Internet of Things (IoT).

ABSTRACT

IMPLEMENTATION OF RADIO FREQUENCY IDENTIFICATION FOR REAL-TIME LABORATORY EQUIPMENT TRACKING AND MANAGEMENT (2026: XV + 101 PAGES + 63 FIGURES + 15 TABLES + 9 APPENDICES)

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This study aims to implement a real-time laboratory equipment management and tracking system using Radio Frequency Identification (RFID) and Bluetooth Low Energy (BLE) technologies. The developed system utilizes an ESP32 as the main controller, an RFID RC522 module for user identification, and BLE devices attached to laboratory equipment to support the tracking process. Borrowing, returning, and equipment location data are sent to a Google Sheets database and displayed on a monitoring website developed using Google Apps Script. The testing results show that the system is capable of identifying users through RFID, automatically storing transaction data, and monitoring laboratory equipment locations based on BLE signals received by the gateway. The implementation of this system is expected to improve the effectiveness of laboratory equipment management, simplify the process of locating equipment, and support real-time inventory monitoring.

Keywords: *RFID, Bluetooth Low Energy (BLE), ESP32, Laboratory Equipment Tracking, Inventory Management, Real-Time, Internet of Things (IoT).*