

ABSTRAK

Laboratorium Teknik Elektro memerlukan sistem inventaris yang mampu mengelola data alat secara akurat sekaligus mendukung penentuan jadwal *preventive maintenance*. Pengelolaan inventaris yang masih dilakukan secara manual berpotensi menyebabkan ketidaksesuaian data, kesulitan pelacakan alat, serta keterlambatan pelaksanaan *maintenance*. Penelitian ini bertujuan merancang dan membangun sistem inventaris alat laboratorium berbasis *Near Field Communication* (NFC) Tag dengan metode *Forward Chaining* untuk menghasilkan rekomendasi *preventive maintenance* berdasarkan kondisi alat. Sistem dikembangkan menggunakan bahasa pemrograman Kotlin dengan *Jetpack Compose* pada platform Android, *Firebase Authentication* sebagai autentikasi pengguna, dan *Firebase Cloud Firestore* sebagai basis data. Setiap alat dilengkapi *NFC Tag* yang dipindai menggunakan smartphone Android untuk mengidentifikasi alat, mencatat riwayat penggunaan, dan memperbarui data inventaris secara otomatis. Selanjutnya, metode *Forward Chaining* melakukan proses inferensi berdasarkan parameter intensitas penggunaan, status *maintenance*, dan kondisi alat untuk menentukan tingkat risiko serta rekomendasi tindakan *preventive maintenance*. Pengujian sistem meliputi pengujian identifikasi NFC Tag, waktu respons, *Rule Validation* dan *Accuracy Evaluation*, *Black Box Testing*, serta *User Acceptance Test* (UAT). Hasil pengujian menunjukkan bahwa sistem mampu mengidentifikasi NFC Tag dengan tingkat keberhasilan 97% pada jarak pembacaan optimal 0–2 cm, memiliki rata-rata waktu respons 0,61 detik, menghasilkan akurasi inferensi 100%, memperoleh tingkat keberhasilan 100% pada *Black Box Testing*, serta memperoleh nilai 84,8% pada *User Acceptance Test* (UAT) dengan kategori sangat baik. Hasil tersebut menunjukkan bahwa sistem yang dikembangkan mampu meningkatkan efektivitas pengelolaan inventaris alat laboratorium sekaligus mendukung pengambilan keputusan *preventive maintenance* secara cepat, akurat, dan terstruktur.

Kata Kunci: Inventaris Laboratorium, *NFC Tag*, *Forward Chaining*, *Preventive Maintenance*, Android, *Firebase Cloud Firestore*.

ABSTRACT

The Electrical Engineering Laboratory requires an inventory system capable of managing laboratory equipment accurately while supporting preventive maintenance scheduling. Conventional inventory management often leads to inaccurate records, difficulties in tracking equipment, and delays in maintenance activities. This study aims to design and develop a laboratory equipment inventory system based on Near Field Communication (NFC) Tags integrated with the Forward Chaining method to generate preventive maintenance recommendations automatically. The system was developed as an Android application using Kotlin and Jetpack Compose, with Firebase Authentication for user authentication and Firebase Cloud Firestore as the database. Each laboratory instrument is equipped with an NFC Tag that can be scanned using an NFC-enabled Android smartphone to automatically identify equipment, record usage history, and update inventory data. Furthermore, the Forward Chaining method performs inference based on equipment usage intensity (cycle usage), maintenance status, and equipment condition to determine the risk level and recommend appropriate preventive maintenance actions. System evaluation included NFC Tag identification testing, reading distance testing, response time testing, Rule Validation and Accuracy Evaluation, Black Box Testing, and User Acceptance Testing (UAT). The results showed that the system achieved an NFC Tag identification accuracy of 97% with an optimal reading distance of 0–2 cm, an average response time of 0.61 seconds, 100% inference accuracy, 100% success rate in Black Box Testing, and a User Acceptance Test score of 84.8%, indicating a very good level of user acceptance. These results demonstrate that the proposed system effectively improves laboratory inventory management while assisting laboratory staff in making preventive maintenance decisions more quickly, accurately, and systematically.

Keywords: Laboratory Inventory, NFC Tag, Forward Chaining, Preventive Maintenance, Android, Firebase Cloud Firestore.