

ABSTRAK

PEMBUATAN DAN EVALUASI KINERJA SISTEM PENGUKUR TINGGI DAN BERAT BADAN BERBASIS IDENTIFIKASI SIDIK JARI DENGAN PENYIMPANAN DATA HISTORIS OTOMATIS

Muhammad Aulia Haykal

(2026: xii + 79 Halaman, 43 Gambar, 5 Tabel, 6 Lampiran)

Pemantauan tinggi dan berat badan merupakan komponen krusial dalam deteksi dini masalah gizi seperti stunting. Berdasarkan Survei Status Gizi Indonesia (SSGI) 2022, prevalensi stunting balita di Indonesia masih berada di angka 21,6%. Di Posyandu Mawar 7, proses pengukuran masih dilakukan secara manual, yang rentan terhadap kesalahan pencatatan dan kehilangan data historis. Penelitian ini bertujuan merancang dan mengevaluasi kinerja sistem pengukur tinggi dan berat badan otomatis yang terintegrasi dengan identifikasi sidik jari dan penyimpanan data historis, sebagai penyempurnaan dari prototipe program MBKM sebelumnya. Sistem dirancang menggunakan arsitektur dual-mikrokontroler: Arduino Uno mengendalikan sensor Time-of-Flight VL53L0X untuk tinggi badan dan load cell dengan modul HX711 untuk berat badan, sedangkan ESP32 menangani identifikasi biometrik menggunakan sensor sidik jari R307 serta penyimpanan data ke modul microSD dalam format CSV. Struktur mekanik dievaluasi melalui simulasi Finite Element Analysis (FEA) dengan variasi beban 200 N, 400 N, dan 700 N. Pengujian akurasi dilakukan terhadap 15 responden menggunakan analisis Paired Sample T-Test. Hasil simulasi FEA menunjukkan desain rangka baru dengan besi hollow 30×30 mm dan penambahan penyangga vertikal jauh lebih unggul. Pada beban 700 N, tegangan Von Mises turun dari 128,082 MPa menjadi 63,306 MPa, *displacement* berkurang dari 0,558 mm menjadi 0,144 mm, dan *safety factor* meningkat dari 1,61 menjadi 3,26. Pengujian akurasi menunjukkan rata-rata selisih tinggi badan sebesar 0,67% dan berat badan sebesar 0,90%. Uji Paired Sample T-Test menghasilkan nilai $p = 0,135$ ($> 0,05$), yang berarti tidak terdapat perbedaan signifikan antara pengukuran manual dan otomatis. Fitur identifikasi sidik jari dan penyimpanan historis otomatis berjalan sesuai rancangan. Sistem yang dikembangkan terbukti memiliki akurasi setara alat manual standar posyandu, struktur mekanik yang lebih stabil, serta mampu mengatasi permasalahan pencatatan manual di Posyandu Mawar 7.

Kata Kunci: identifikasi sidik jari, load cell, penyimpanan data historis, sensor Time-of-Flight, sistem antropometri otomatis.

ABSTRACT

DEVELOPMENT AND PERFORMANCE EVALUATION OF A HEIGHT AND WEIGHT MEASURING SYSTEM BASED ON FINGERPRINT IDENTIFICATION WITH AUTOMATIC HISTORICAL DATA STORAGE

Muhammad Aulia Haykal

(2026: xii + 79 pp., 43 Figures, 5 Tables, 6 Attachments)

Height and weight monitoring is a crucial component in the early detection of nutritional problems such as stunting. According to the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in children under five in Indonesia remains at 21.6%. At Posyandu Mawar 7, the measurement process is still carried out manually, which is prone to recording selisih and loss of historical data. This study aims to development and evaluate the performance of an automated height and weight measurement system integrated with fingerprint identification and historical data storage, as an improvement on the previous MBKM program prototype. The system was developed using a dual-microcontroller architecture: an Arduino Uno controls a VL53L0X Time-of-Flight sensor for height and a load cell with an HX711 module for weight. An ESP32 handles biometric identification using an R307 fingerprint sensor and stores data to a microSD module in CSV format. The mechanical structure was evaluated through Finite Element Analysis (FEA) simulations with varying loads of 200 N, 400 N, and 700 N. Accuracy testing was conducted on 15 respondents using a Paired Sample T-Test. FEA simulation results showed a significantly superior new frame design using 30x30 mm hollow steel and additional vertical supports. At a load of 700 N, the Von Mises *stress* decreased from 128.082 MPa to 63.306 MPa, the *displacement* decreased from 0.558 mm to 0.144 mm, and the *safety factor* increased from 1.61 to 3.26. Accuracy testing showed an average selisih of 0.67% for height and 0.90% for weight. A paired sample t-test *yielded* a p-value of 0.135 (>0.05), indicating no significant difference between manual and automatic measurements. The fingerprint identification and automatic historical storage features performed as developed. The developed system proved to have accuracy equivalent to standard manual Posyandu tools, a more stable mechanical structure, and was able to address manual recording issues at Posyandu Mawar 7.

Keywords : automated anthropometric system, fingerprint identification, historical data storage, load cell, Time-of-Flight sensor.