ABSTRAK

PERANCANGAN DAN IMPLEMENTASI *FRAMEWORK* PREDIKSI CERDAS BERBASIS ARSITEKTUR *DEEP LEARNING* PADA *SMART FLOOR PIEZOELECTRIC*
(*2026: xlix + 80 Halaman + 38 Gambar + 23 Tabel + Daftar Pustaka + Lampiran*)

MUHAMMAD BILLY AKBAR
062240342216
JURUSAN TEKNIK ELEKTRO
PROGRAM STUDI SARJANA TERAPAN TEKNIK ELEKTRO
POLITEKNIK NEGERI SRIWIJAYA

Penelitian ini bertujuan merancang dan mengimplementasikan *framework* prediksi cerdas untuk memprediksi *output* energi *smart floor piezoelectric* melalui studi komparatif tiga arsitektur *deep learning*, yaitu *Multi-Layer Perceptron* (MLP), *Long Short-Term Memory* (LSTM), dan model *Hybrid* MLP-LSTM. Dataset diperoleh secara *real-time* menggunakan sistem akuisisi berbasis ESP32-S3 dan ADS1115 dari 12 subjek dengan rentang berat badan 42,4–100,9 kg melalui tiga jenis aktivitas, yaitu jalan, lari, dan lompat, menghasilkan total 10.336 sampel. Input model berupa berat badan subjek dan laju gerak (*Rate of Motion*), dengan *output* berupa tegangan (V), arus (μA), dan daya (μW). Tahap prapemrosesan meliputi deteksi *outlier* menggunakan metode *Interquartile Range* (IQR), normalisasi *Min-Max Scaling*, serta pembagian dataset dengan rasio 70:15:15. Hasil evaluasi menunjukkan bahwa model LSTM menghasilkan performa terbaik dengan nilai R^2 sebesar 0,824 (tegangan), 0,804 (arus), dan 0,833 (daya), serta nilai MAPE sebesar 10,778%, 11,233%, dan 23,800%. Model MLP memperoleh R^2 sebesar 0,681, 0,692, dan 0,746, sedangkan model *Hybrid* MLP-LSTM memperoleh R^2 sebesar 0,722, 0,702, dan 0,761. Penelitian ini membuktikan bahwa arsitektur LSTM paling sesuai untuk memprediksi *output smart floor piezoelectric* berbasis data deret waktu IoT dibandingkan MLP maupun *Hybrid* MLP-LSTM.

Kata Kunci : *deep learning, energy harvesting, Multi-Layer Perceptron, Long Short-Term Memory, smart floor piezoelectric*.

ABSTRACT

PREDICTION OF PIEZOELECTRIC SMART CARPET OUTPUT USING MACHINE LEARNING BASED ON MULTI-LAYER PERCEPTRON (MLP)
(2026: xlix + 80 Pages + 38 Figures + 23 Tables + References + Attachments)

MUHAMMAD BILLY AKBAR
062240342216
DIPLOMA OF APPLIED ELECTRICAL ENGINEERING
ELECTRICAL ENGINEERING DEPARTMENT
STATE POLYTECHNIC OF SRIWIJAYA

This research aims to design and implement an intelligent prediction framework for predicting piezoelectric smart floor energy output through a comparative study of three deep learning architectures: Multi-Layer Perceptron (MLP), Long Short-Term Memory (LSTM), and Hybrid MLP-LSTM. The dataset was collected in real-time using an ESP32-S3 and ADS1115-based acquisition system from 12 subjects with body weight ranging from 42.4 to 100.9 kg through three activity types walking, running, and jumping yielding a total of 10,336 samples. Model inputs consist of subject body weight and Rate of Motion, with outputs being voltage (V), current (μA), and power (μW). Preprocessing stages included outlier detection using the Interquartile Range (IQR) method, Min-Max Scaling normalization, and dataset splitting at a 70:15:15 ratio. Evaluation results show that the LSTM model achieved the best performance with R^2 values of 0.824 (voltage), 0.804 (current), and 0.833 (power), and MAPE values of 10.778%, 11.233%, and 23.800%. The MLP model obtained R^2 values of 0.681, 0.692, and 0.746, while the Hybrid MLP-LSTM model obtained 0.722, 0.702, and 0.761. This research demonstrates that the LSTM architecture is the most suitable model for predicting piezoelectric smart floor output from IoT time-series data compared to both MLP and Hybrid MLP-LSTM.

Keywords*: deep learning, energy harvesting, Multi-Layer Perceptron, Long Short-Term Memory, smart floor piezoelectric*