

ABSTRAK

PERANCANGAN SISTEM *MONITORING* DIABETES DAN KOLESTEROL BERBASIS IoT MENGGUNAKAN METODE *HYBRID LSTM-XGBOOST*

(2026: XIII + 146 halaman + 60 gambar + 19 tabel + 7 lampiran)

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Penyakit diabetes dan kolesterol merupakan penyakit metabolik yang memerlukan deteksi dini untuk mencegah komplikasi. Penelitian ini bertujuan merancang dan mengimplementasikan sistem monitoring diabetes dan kolesterol berbasis Internet of Things (IoT) menggunakan metode Hybrid Long Short-Term Memory (LSTM) dan Extreme Gradient Boosting (XGBoost). Sistem memanfaatkan sensor MAX30105 untuk memperoleh data photoplethysmography (PPG), detak jantung (BPM), dan kadar oksigen dalam darah (SpO₂), serta sensor MLX90614 untuk mengukur suhu tubuh. Data diproses oleh mikrokontroler ESP32, dikirim melalui protokol MQTT ke server, disimpan dalam database, dan ditampilkan pada website secara real time. Model Hybrid LSTM-XGBoost dikembangkan menggunakan dataset diabetes dan kolesterol dari Kaggle serta data sensor melalui tahapan preprocessing, SMOTE, ekstraksi fitur menggunakan LSTM, dan klasifikasi menggunakan XGBoost. Hasil pengujian menunjukkan rata-rata error pengukuran detak jantung sebesar 8,06%, suhu tubuh 0,73%, dan SpO₂ 1,64% dibandingkan alat standar. Model menghasilkan accuracy 75,66%, precision 20,95%, recall 67,18%, Specificity 76,45%, F1-score 31,94%, dan ROC-AUC 0,7904 pada prediksi diabetes, dengan rata-rata error prediksi diabetes dan kolesterol masing-masing sebesar 8,02% dan 6,78%. Hasil penelitian menunjukkan bahwa integrasi teknologi IoT dan metode hybrid LSTM-XGBoost mampu menyediakan sistem monitoring kesehatan real time serta mendukung prediksi awal diabetes dan kolesterol secara non-invasif.

Kata kunci: *Internet of Things (IoT), MAX30105, MLX90614, Hybrid LSTM-XGBoost, Diabetes, Kolesterol, Monitoring Kesehatan.*

ABSTRACT

DESIGN OF AN IOT-BASED DIABETES AND CHOLESTEROL MONITORING SYSTEM USING THE HYBRID LSTM-XGBOOST METHOD

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Diabetes and high cholesterol are metabolic conditions requiring early detection to prevent complications. This study aims to design and implement an Internet of Things (IoT)-based monitoring system for diabetes and cholesterol using a hybrid Long Short-Term Memory (LSTM) and Extreme Gradient Boosting (XGBoost) approach. The system utilizes a MAX30105 sensor to acquire photoplethysmography (PPG) data, heart rate (BPM), and blood oxygen levels (SpO₂), alongside an MLX90614 sensor for body temperature measurement. Data is processed by an ESP32 microcontroller, transmitted via the MQTT protocol to a server, stored in a database, and displayed on a website in real time. A hybrid LSTM-XGBoost model was developed using diabetes and cholesterol datasets from Kaggle and sensor data, involving stages such as preprocessing, SMOTE, feature extraction via LSTM, and classification using XGBoost. Test results indicate average measurement errors of 8.06% for heart rate, 0.73% for body temperature, and 1.64% for SpO₂ compared to standard devices. The model achieved an accuracy of 75.66%, precision of 20.95%, recall of 67.18%, specificity of 76.45%, F1-score of 31.94%, and ROC-AUC of 0.7904 for diabetes prediction, with average prediction errors of 8.02% for diabetes and 6.78% for cholesterol. The findings demonstrate that integrating IoT technology with the hybrid LSTM-XGBoost method enables a real-time health monitoring system and supports the non-invasive early prediction of diabetes and cholesterol.

Kata kunci: *Internet of Things (IoT), MAX30105, MLX90614, Hybrid LSTM-XGBoost, Diabetes, Cholesterol, Health Monitoring.*