ABSTRAK

Perilaku sedentari akibat aktivitas belajar dalam posisi duduk yang berlangsung lama dapat meningkatkan risiko gangguan kesehatan, salah satunya *Low Back Pain* (LBP). Penelitian ini bertujuan mengembangkan sistem pemantauan aktivitas belajar mahasiswa berbasis *Internet of Things* (IoT) menggunakan *wearable sensor* serta menerapkan algoritma *Extreme Gradient Boosting* (XGBoost) untuk mengklasifikasikan aktivitas duduk dan berdiri secara *real-time*. Sistem menggunakan dua sensor MPU6050 dan satu sensor BME280 yang terhubung dengan mikrokontroler ESP8266 untuk mengirimkan data ke *server*. Data sensor diproses melalui tahapan *preprocessing*, ekstraksi fitur menggunakan metode *sliding window*, seleksi fitur menggunakan *feature importance*, dan klasifikasi menggunakan algoritma XGBoost. Hasil klasifikasi ditampilkan melalui *dashboard monitoring* yang dilengkapi fitur *sitting timer* dan pengingat *microbreak* menggunakan buzzer. Hasil evaluasi model menggunakan metode Leave-One-Subject-Out (LOSO) menghasilkan rata-rata akurasi sebesar 88,90%. Selain itu, evaluasi menggunakan confusion matrix dan classification report menunjukkan bahwa model mampu membedakan aktivitas duduk dan berdiri dengan performa yang baik. Pengujian sistem menunjukkan bahwa *dashboard* mampu menampilkan hasil klasifikasi dan data sensor secara *real-time*, serta buzzer berhasil memberikan peringatan ketika durasi duduk melebihi batas yang ditentukan. Hasil penelitian menunjukkan bahwa sistem yang dikembangkan mampu melakukan pemantauan aktivitas pengguna secara *real-time* dan mendukung upaya pengurangan perilaku sedentari selama aktivitas belajar.

Kata kunci: *Internet of Things*, XGBoost, *Wearable Sensor*, Aktivitas Sedentari, *Microbreak*.

ABSTRACT

Sedentary behavior resulting from prolonged sitting during learning activities may increase the risk of health problems, particularly Low Back Pain (LBP). This study aims to develop an Internet of Things (IoT)-based student learning activity monitoring system using wearable sensors and to implement the Extreme Gradient Boosting (XGBoost) algorithm to classify sitting and standing activities in real time. The proposed system utilizes two MPU6050 sensors and one BME280 sensor connected to an ESP8266 microcontroller to transmit sensor data to a server. The collected sensor data are processed through several stages, including preprocessing, feature extraction using the sliding window method, feature selection based on feature importance, and classification using the XGBoost algorithm. The classification results are displayed on a monitoring dashboard equipped with a sitting timer and a microbreak reminder using a buzzer. Model evaluation using the Leave-One-Subject-Out (LOSO) method achieved an average accuracy of 88.90%. Furthermore, the confusion matrix and classification report demonstrated that the proposed model was able to distinguish sitting and standing activities with good performance. System testing showed that the dashboard successfully displayed classification results and sensor data in real time, while the buzzer effectively provided reminders when the sitting duration exceeded the predefined threshold. The results indicate that the developed system is capable of monitoring users' activities in real time and supporting efforts to reduce sedentary behavior during learning activities.

Keywords: *Internet of Things, XGBoost, Wearable Sensor, Sedentary Behavior, Microbreak.*