ABSTRAK

Postural imbalance akibat pronasi atau supinasi memengaruhi kestabilan berdiri dan berjalan, namun deteksinya masih bergantung pada observasi manual di lingkungan klinis. Penelitian ini merancang dan menguji prototipe *smart shoes* berbasis Internet of Things (IoT) untuk mendeteksi risiko *postural imbalance*. Prototipe mengintegrasikan empat sensor *Force Sensitive Resistor (FSR)* pada titik *heel*, navicular, metatarsal-1, dan metatarsal-5 untuk mengukur tekanan plantar, serta sensor IMU MPU6050 untuk sudut *pitch-roll*, yang diproses ESP32 dan dikirim ke AWS untuk ditampilkan pada dashboard Flutter. Data diklasifikasikan menggunakan *decision tree* berbasis CART. Hasil pengujian menunjukkan sensor FSR memiliki linearitas baik (Navicular = 3812,8 ADC/kg; R^2 = 0,991), sensor MPU6050 memiliki error rata-rata 4,51% (roll) dan 2,826% (pitch), serta model decision tree mencapai akurasi 99,26%.Pengujian *black box* dan usability juga menunjukkan sistem berfungsi baik dan mudah digunakan, sehingga prototipe layak digunakan untuk deteksi dini *postural imbalance* di luar lingkungan klinis.

Kata kunci: *smart shoes, postural imbalance, Internet of Things, Force Sensitive Resistor, decision tree*

ABSTRACT

Postural imbalance from pronation or supination affects standing and walking stability, yet its detection still relies on manual observation in clinical settings. This study designs and tests an Internet of Things (IoT)-based *smart shoes* prototype to detect *postural imbalance* risk. The prototype integrates four Force Sensitive Resistor (FSR) sensors at the *heel*, navicular, metatarsal-1, and metatarsal-5 points to measure plantar pressure, along with an MPU6050 IMU sensor for *pitch-roll* angles, processed via ESP32 and sent to AWS for display on a Flutter dashboard. Data is classified using a CART-based decision tree. Results show the FSR sensors have good linearity (Navicular = 3812.8 ADC/kg; $R^2 = 0.991$), the MPU6050 sensor has average errors of 4.51% (roll) and 2.826% (pitch), and the decision tree model achieves 99.26% accuracy. *Black box* and usability testing confirm the system functions well and is easy to use, making the prototype suitable for early detection of *postural imbalance* outside clinical settings.

Keywords: smart shoes, *postural imbalance*, Internet of Things, Force Sensitive Resistor, decision tree