



# Wearable system for monitoring posture and human movements

## Advisors:

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## 1. Background

Monitoring human movement is essential for promoting health and efficiency in both daily life and work environments. For students, the long hours spent sitting in front of a computer often result in poor posture, discomfort, and even chronic issues such as lower back pain. Similarly, in organizational and industrial contexts, precise monitoring of human movements is critical to evaluate workers' health and optimize production efficiency.

Traditional methods for ergonomic assessment (direct observation or video analysis) are limited because they are subjective, time-consuming, and lack accuracy. **ErgoSuit/ SmartPosture/ PostureTrack / MotionSuit** addresses this challenge by proposing the development of a wearable suit equipped with sensors capable of detecting and recording human body movements in real-time. The collected data will be processed into metrics and displayed on a user-friendly dashboard.

A similar project has already been initiated only for the upper body, capable of detecting the angular movement between arms and main body, heart rate and body temperature.



Figure 1- Prototype of the Ergonomic Suit

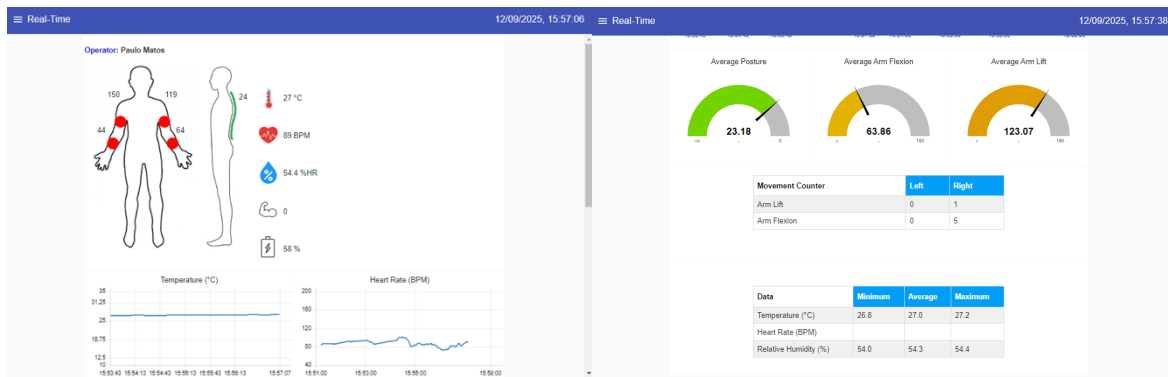


Figure 2- Example of the monitoring dashboard.

The project uses specific sensors such as:

- BNO055: an absolute orientation sensor for accurate position and movement tracking.

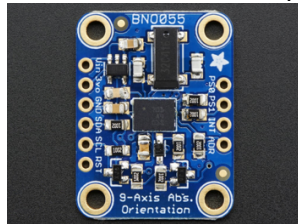


Figure 3 - Orientation sensor (BNO055).

- MLX90614: an infrared temperature sensor capable of measuring body or object temperature without direct contact.

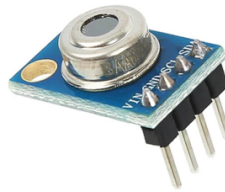


Figure 4 - Temperature sensor (MLX90614).

## 2. Project Objectives

The main objectives of this project are:

- Develop a wearable suit capable of accurately detect and record human body movements in real-time.
- Integrate motion, temperature, body heart frequency and EMG sensors to collect postural and physiological data.
- Process and visualize collected data through a user-friendly dashboard, providing metrics to monitor posture, movement patterns, and potential risk factors.
- Implement a web and/or mobile application to collect and analyse sensor data, providing user alerts whenever posture deviates to a potentially harmful risk level.



### 3. Key features

- Wearable suit prototype development
  - Create a new prototype using motion and temperature sensors.
  - Integrate heart rate technologies to monitor fatigue or strain.
  - Convert raw sensor data into angular measurements that reflect body movements and postural changes.
- Monitoring and reporting
  - Customizable dashboards for users.
  - Real-time ergonomics and posture metrics.
  - Long-term posture trend analysis to support the prevention of future musculoskeletal disorders
- Feedback system
  - Provide notifications and status updates (vibration, sound, or app notification) when risky postures are detected.

### 4. Technology stack

- Backend: Python (web frameworks like Django or FastAPI)
- Frontend: Next.js
- Sensors Data Manipulation: Python
- Message broker: MQTT Broker