



Capstone Design Project Abstract

Project Title: Accessible Gait Analysis Device for Runners and Cyclists

Sponsor: Onward Physical Therapy

Team Members: Angelina Stefan, Katherine Law, Samuel Rumph, Zachary Preikszas, Prabhjot Singh, Landry Cammarata

Faculty Mentor: Dr. Cheryl Gomillion and Dr. Eliza Banu

This project is conducted in collaboration with Onward Physical Therapy, a performance-based rehabilitation clinic focused on individualized patient care. Gait analysis is an essential tool used in clinical rehabilitation, yet many existing systems are expensive, nonportable, and inaccessible in everyday settings. Onward Physical Therapy previously used Runeasi, a belt-based gait analysis system, but it was expensive and produced inaccurate data with noticeable lag. Currently, Onward Physical Therapy relies on manual video analysis for patient monitoring and evaluation, using slow-motion playback to count cadence for individuals.

The device created through this work aims to deliver a low-cost, portable gait analysis device that utilizes a 6-degrees-of-freedom inertial measurement unit (IMU) mounted onto a 3D-printed shoe clip connected to any shoelace. This IMU captures translational and rotational data, which is manipulated to calculate key metrics such as cadence and step count for the user. To understand the data and make it readable, a minimum step interval algorithm detects the heel strikes with filters in place to prevent double counting, reduce noise, and eliminate drift. Python script was used to develop a user interface that reflects these exact metrics so that physical therapists can interpret and apply the key metrics to perform gait analysis. The housing system used to hold the microcontroller, and the IMU sensor is a 3D-printed CAD design made of PLA filament.

The device is designed to be lightweight, user-friendly, and transportable to any real-world environment. The system's performance has been evaluated by statistically comparing measurements to established portable gait devices, including Loadsol[®] insoles. This has been done across running and walking trials, ensuring that the device is a validated, low-cost upgrade over the previous solutions used by Onward Physical Therapy.

