

PHYSIOSHOE

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Project Summary

For our senior design project, we are creating a shoe that performs gait analysis at the feet of a patient and provides critical data for physical therapists. We apply our knowledge in electrical engineering to help geriatric patients in physical therapy. We have contacted Physical Therapists and electronics professionals that we believe can better assist us moving in the right direction. With this project we expect to develop a cheaper solution to gait analysis that can be used in the health care community.

The PhysioShoe will be a cost effective, portable, and easy to use gait analysis system that offers real-time data capturing. This tool will be mainly used by physical therapists to help their patients get rehabilitated. We will be analyzing the basic parameters of the foot used in gait analysis such as pressure contour, step length, and foot angle. Our team is a group of experienced individuals who are highly motivated to create PhysioShoe to help the people of our community.

Problem and Need

The problem that we are trying to address is that currently gait analysis is costly and is proprietary, so access to such technologies are very limited. Many physical therapists cannot afford such high tech equipment, so there is a need to have an inexpensive alternative that would be more widely available. We want to bring costs low and modern technology to the current practice of physical therapists. Currently, many physical therapists are using old methods or old technologies to perform gait analysis and we would provide a more efficient way to complete the process or at least provide extra context to help them tailor their therapy sessions.

Significance

Healthcare professionals, mainly physical therapists using outdated practices or that don't have access to current gait analysis equipment would benefit directly from our project. Most practices today use decade old technology or simply don't require such large and complex systems. So, we want to provide the option of using inexpensive yet simple to use modern technology.

Goal

Gait analysis is for measuring body mechanics used in clinical evaluation of movement disorders. Today there are some clinics that service the middle to low-income population, but these clinics are not able to take advantage of modern options for their analysis. In other clinics, gait analysis is very expensive and the setup is complicated. These clinics have various methods of gait analysis, including placing electrodes on the body and cameras in the lab that monitor patients closely. Additionally, devices on the current market are proprietary. Our project offers more affordable gait analysis and real-time data for better examination. This product is intended to perform basic analysis that shows a pressure contour of the foot and calculates parameters including step length, stride length, cadence, speed, and foot angle.

Customer/User Analysis

Our intended customers are physical therapists and they will be using this project as an aide for their examinations. Typically work in hospital or clinical settings where a room is required for examinations. There are many types of gait data that may make the scope of our project overwhelming so we narrowed it down to the most necessary and feasible tasks to complete. They will attach a insole-like pressure sensor into a shoe that will be worn by the patient. A separate device will be strapped around the patient's

ankle that will gather data. Data will transmit wirelessly to a smartphone where it will be viewed and analyzed.

Deliverables

Our final deliverable is a small box containing the essential electronic components. The box will strap around a patient's ankle and will face toward the opposite leg that it's placed on. In the overview diagram below we lay it all out. Inside is a microcontroller, battery, Bluetooth, and gyroscope. Our insole is a pressure sensor with pressure points laid out in a grid and will be placed inside a shoe.

Terminal Objective

Our approach was to get a working prototype as fast as possible and then improve the system from there. Therefore, for the fall semester, we obtained our first prototype. This shoe prototype displayed a pressure contour and the foot angle based on measurements from the sensors and sent data to a computer via Bluetooth. We refine the prototype by adding a distance sensor and finish designing the power circuit with accompany with a chargeable battery. We then focused on integrating the final code and developing a phone application.

Overview Diagram

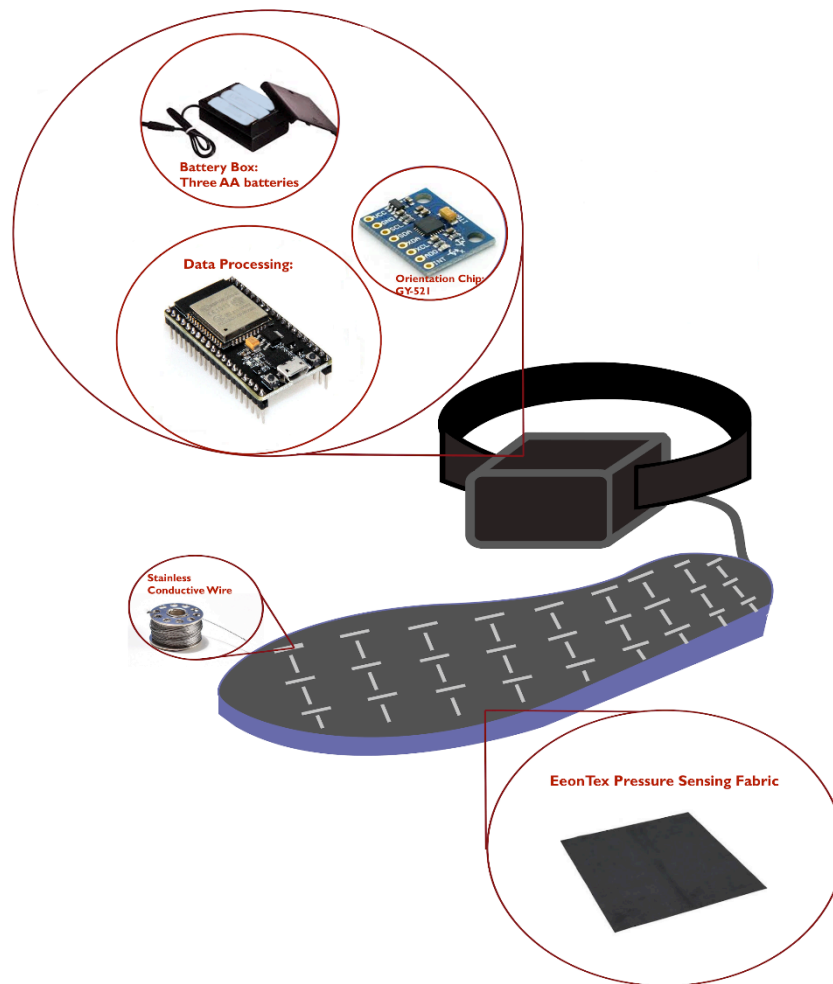


Fig 0. The black box houses all the internal electronic components used to gather and process data. The pressure sensor insole is composed of a fabric material and lined with conductive wiring to create variable resistive points at each intersection.