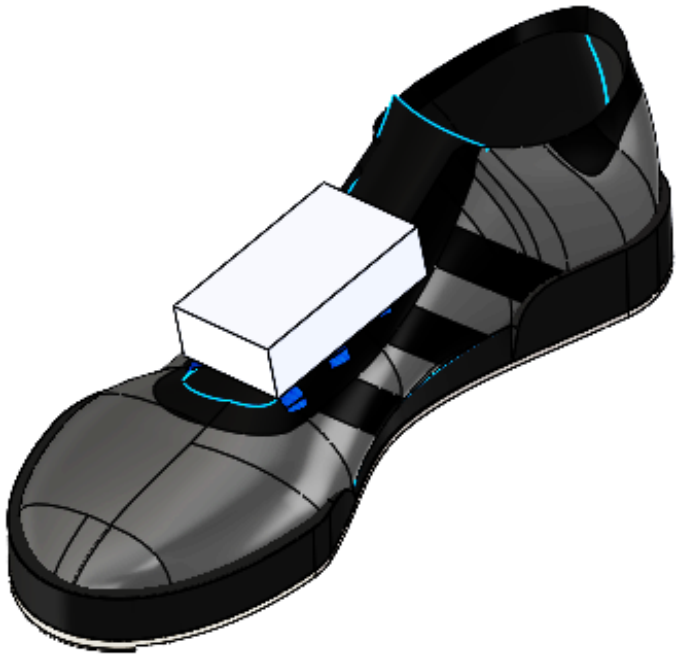


LivAbility Lab sponsored project:
Force and Position Monitoring System
Multidisciplinary Senior Design 1

Nick Petreikis

Team

- Nick Petreikis – Microelectronic Engineering
- Hrishikesh Moholkar – Computer Engineering
- John Lebrun – Electrical Engineering
- Matt Devic – Electrical Engineering
- Martine Bosch – Mechanical Engineering
- Patrick Mylott – Industrial Engineering

MSD I - Overview

MULTIDISCIPLINARY SENIOR DESIGN
The Kate Gleason COLLEGE OF ENGINEERING

- Project goal: Track position of a person in a room and determine force on their feet\assistive devices.
- Four Phases
  - Problem Definition
  - Systems Design
  - Preliminary Detailed Design
  - Detailed Design
- Semester Goal: Have all components ordered so that assembly may begin next semester.

LivAbility Lab - Overview

- Research Lab
  - Located in Rochester
  - Will be used to evaluate assistive devices
  - Designed to mimic a home

Force and Position Monitoring System

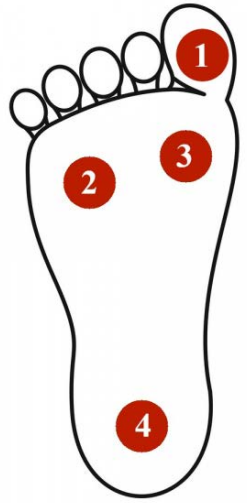
- The system will be attached to an individual using an assistive device.
- The individual will then navigate or perform tasks in the LivAbility lab for a predetermined amount of time.
- Following data collection researchers can determine the effectiveness of the device as well as proper usage of the device by the patient.

Problem Definition

- Needs
  - Determine force and position
  - Cannot impair user's movement
  - Rechargeable
  - Robust
- Wants
  - Simple user interface
  - Portable
  - Sustainable

$$F = m * a$$

Where:
F = Force
m = mass
a = acceleration

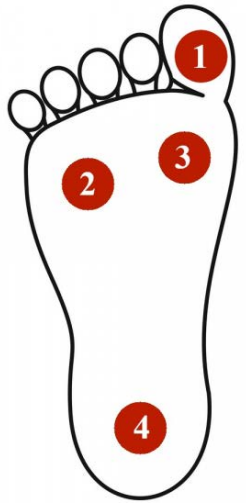


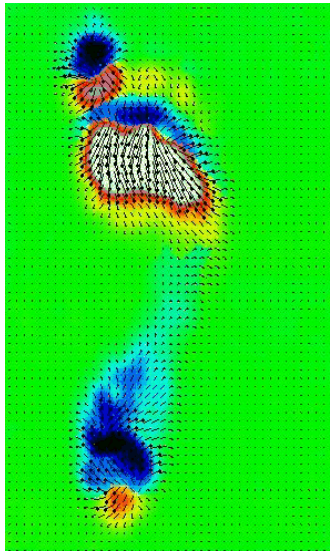
Ranked Customer Requirements

Requirement	Description
1	Safe for daily operation
2	No possibility of Electrostatic Discharge
3	Does not Impede Movement
4	Does not constrict blood flow
5	Low heat emissions
6	Accurately measures movement and force of individual
7	Force sensing subsystem will be battery powered and communicate wirelessly with a data logging system
8	Device is able to be secured and not easily dislodged from original position
9	Rechargable
10	Impact Resistance
11	Tolerable to wear for full day use
12	Real time wireless communication
13	On board data storage
14	Entire system can be deployed in an individual's home environment
15	Waterproof
16	Easy to clean
17	Low Battery Alert
18	Aesthetically Pleasing

Force Measurement

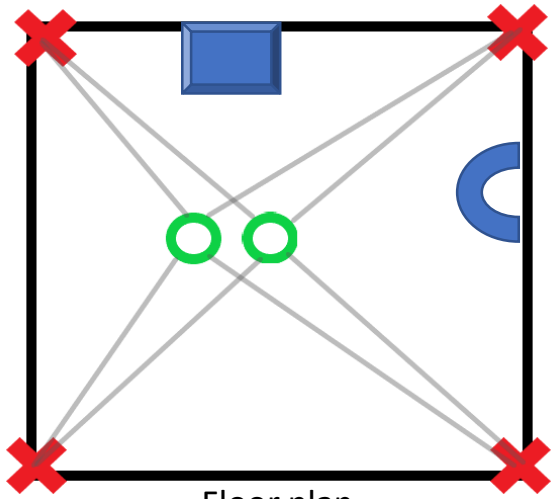
- Force measurement will be carried out utilizing Tekscan A301 force sensors.
- Desired output will show distribution of force across foot.



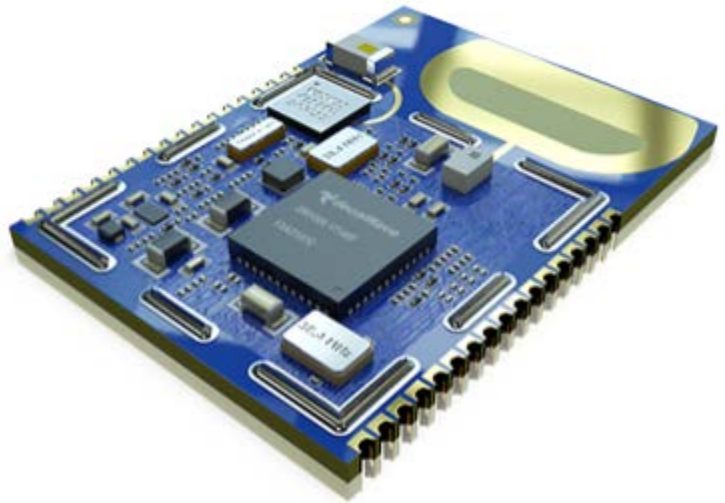


Location

- Location will be tracked by the Decawave MDEK1001 Dev Kit.
- The kit utilized a stationary beacon system to triangulate position.

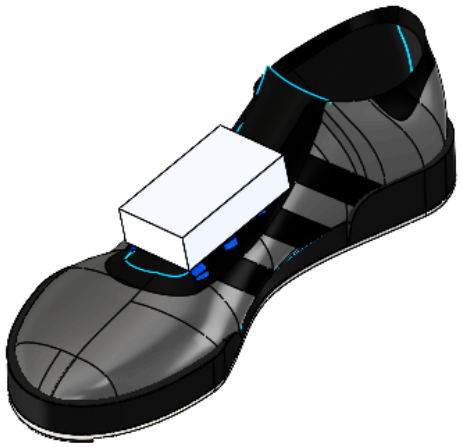


Floor plan



Attachment options

- Attachment will be to the shoe rather than ankle.
- The case will contain the MDEK sensor tag and Raspberry Pi 0W.



Gait Analysis

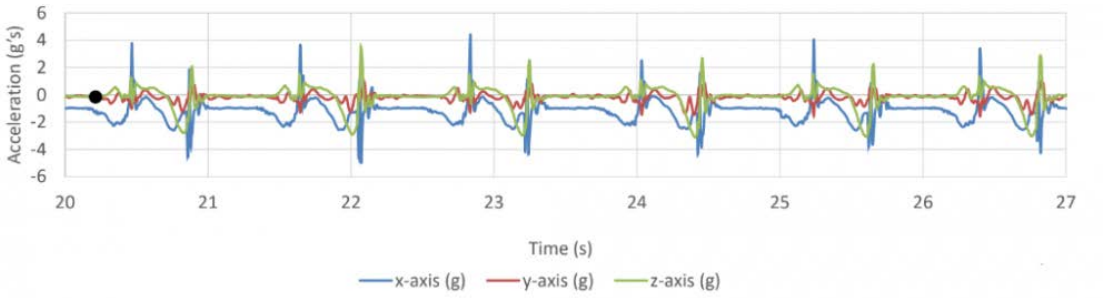
- Gait analysis, force, and position information provided by MBIENT MMR accelerometer.

MMR

9-axis IMU and Environmental Sensor

The MetaMotionR (MMR) is a wearable device that offers real-time and continuous monitoring of motion and environmental sensor data.

The MMR includes free and open source APIs and App software for sensor data acquisition and for in-depth analysis and visualization.



Brewer

Brewer

Current State – Semester 1

- Current state of the project is preliminary detailed design.
- Components have been selected and will continue to be evaluated.

Major Component	Status
A301 Force Sensor	Ordered
Raspberry Pi 0 W	Ordered
Decawave Dev Kit	Not Ordered
MMR IMU	Not Ordered
Battery	Not Ordered

- Minor components not yet ordered.

Future Plans

- For the next semester, all material will be assembled into a robust system.
- Testing goals:
  - Safety
  - Accuracy
  - Precision
- Desired end state is a portable system which satisfies engineering requirements.

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- Sponsership
  - Dr. Dan Phillips
  - LivAbility Lab
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  - Hrishikesh Moholkar – Computer Engineering
  - John Lebrun – Electrical Engineering
  - Matt Devic – Electrical Engineering
  - Martine Bosch – Mechanical Engineering
  - Patrick Mylott – Industrial Engineering
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  - Dr. Beato – Team Guide
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- Research
  - Owen Brewer