2016

MOTIL™ Monitoring and Tracking Integrated in Life

Dylan Anthony
Florida Institute of Technology

Kristopher Bloom
Florida Institute of Technology

Paige Carlton
Florida Institute of Technology

Jessica Cushman
Florida Institute of Technology

Juston Dias
Florida Institute of Technology

See next page for additional authors

Authors

Dylan Anthony, Kristopher Bloom, Paige Carlton, Jessica Cushman, Juston Dias, and Karley Herschelman

MOTIL™ Monitoring and Tracking Integrated in Life

Dylan Anthony, Kristopher Bloom, Paige Carlton, Jessica Cushman, Juston Dias, Karley Herschelman
Faculty Advisors: Dr. Kunal Mitra, Department of Biomedical Engineering; Dr. Eraldo Ribiero, Department of Computer Science;
Dr. Ken Gibbs and Dr. Barry Grossman, Department of Electrical and Computer Engineering
Florida Institute of Technology

Motivation

- An estimated 70% of the population does not walk with correct pronation
- Pronation is the method of distributing weight across the plantar surface of the foot
- This leads to severe pain and joint damage over time

Project Features

- Measures the pronation of the user's gait through analysis of pressure distribution
- Pronation Algorithm uses a set of pressure values sampled at 50 samples/second communicated via Bluetooth
- Detects a fall when the phone's accelerometer receives a sudden motion in addition to a low pressure reported by all sensors
- Sensor placement following anatomical mapping for optimal sensitivity and accuracy

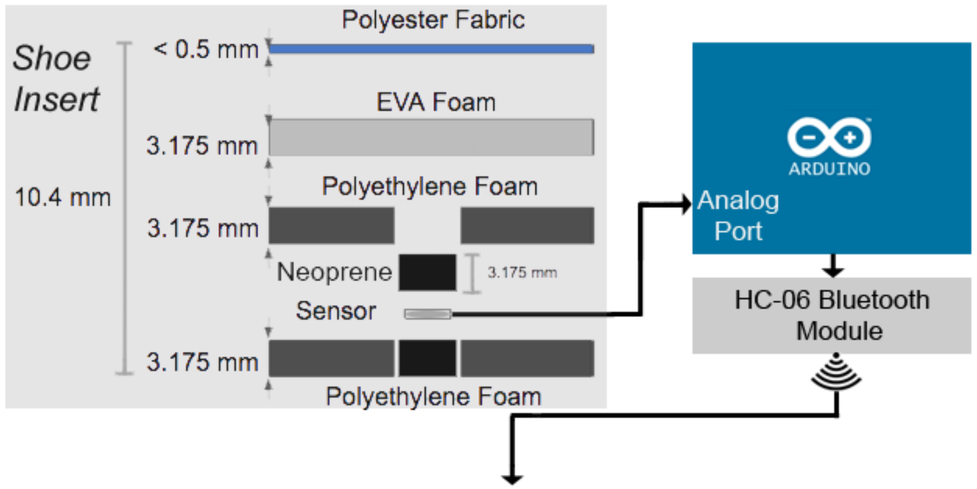
Design Specifications

- 10 Force Sensitive Resistors
- Ethylene-vinyl acetate (EVA) foam
- Polyethylene foam
- 2 Arduino Uno microcontrollers
- 2 HC-06 Bluetooth modules
- 2 LiPO Batteries

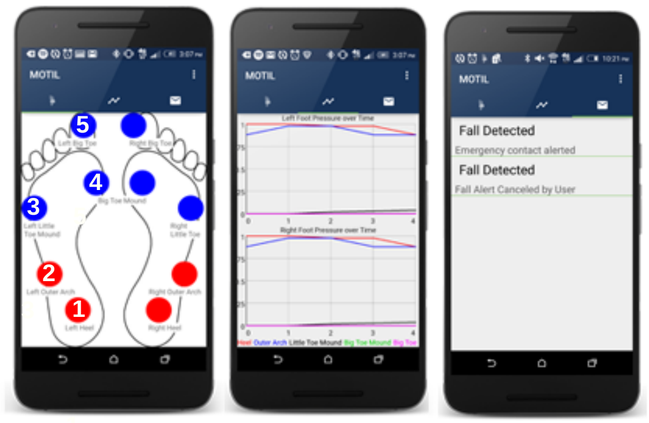
Future Improvements

- Custom printed circuit with Bluetooth included to remove bulky ankle attachments
- Machine learning algorithm to prevent multiple notifications

Data Gathering



Data Processing



Data Analysis

NOVEL™ ENGINEERING

Pronation Algorithm

- During each step the sum of the pressure of each sensor is found

$$\{\sum_{heel}^{toe} Pressure_{Sensor\ 1}, \ldots, \sum_{heel}^{toe} Pressure_{Sensor\ 5}\}$$

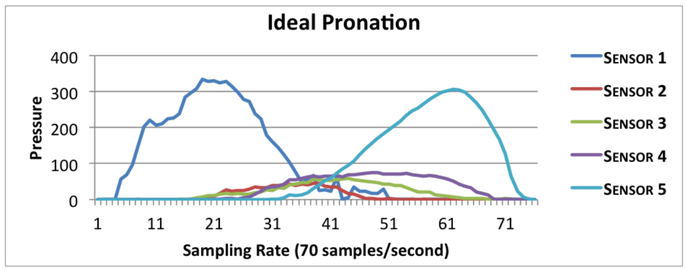
- The sum is used to find the percent of total pressure for each sensor

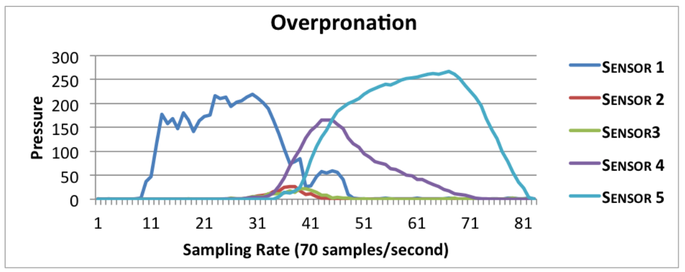
$$\{\frac{\sum_{heel}^{toe} Pressure_{Sensor\ 1}}{\sum Pressure}, \ldots, \frac{\sum_{heel}^{toe} Pressure_{Sensor\ 5}}{\sum Pressure}\}$$

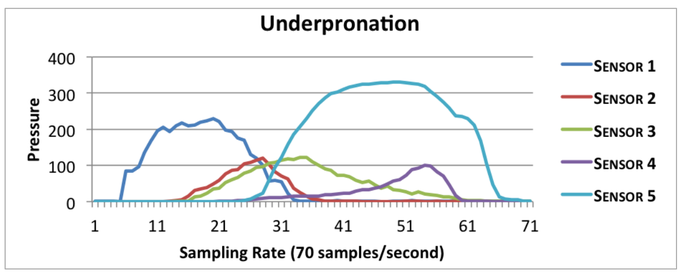
- Determination of incorrect pronation is made using these percentages:

	Central	Medial	Lateral
Ideal	Sensor 1 = 62%	Sensor 4 + 5 = 26%	Sensor 2 + 3 = 12%
Over	N/A	Sensor 4 + 5 ≥ 36%	N/A
Under	N/A	N/A	Sensor 2 + 3 ≥ 22%

- The same incorrect pronation must occur 10 times in a row for the user to be notified







NORTHROP GRUMMAN
Engineering & Science Student Design Showcase
at Florida Institute of Technology