


CS486C – Senior Capstone Design in Computer Science

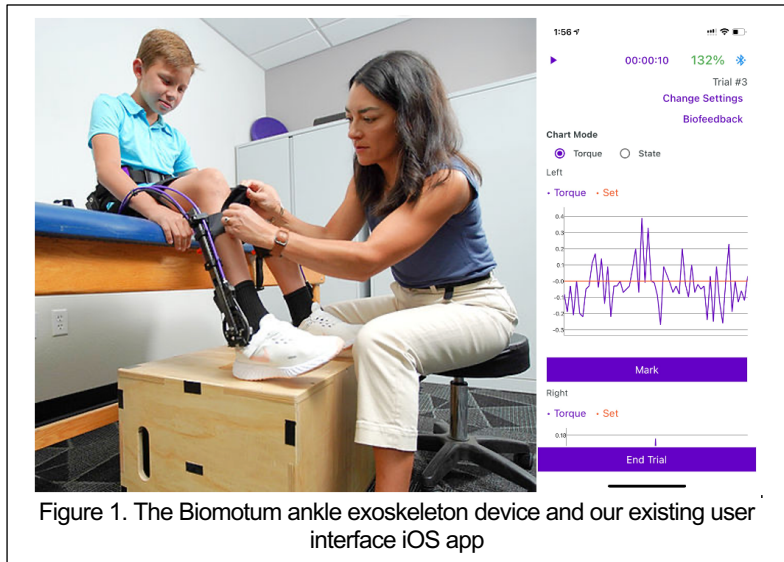
Project Description

Project Title: Gamified Walking Training App	
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Project Overview:

Do you want a capstone project with tangible outcomes that can improve people’s lives? There are over 7.5M individuals in the United States who have difficulty walking and engaging in physical activity. These patients may have acute or chronic conditions that impair their mobility. Our focus is on assisting children with cerebral palsy, the most common cause of pediatric disability worldwide. Help us change the trajectory of their lifelong disability that incurs a financial burden of over \$1 Million per affected child.

The current approaches for treating these individuals include physical therapy (PT) and prescription of passive leg braces. While physical therapy can be effective, it can be difficult to get enough PT to lead to improved mobility. Biomotum is working to help solve mobility and rehabilitation challenges through exoskeleton technology with remote therapy delivery capabilities to increase the amount and effectiveness of clinical care.



Biomotum needs your help. Biomotum, Inc. is an NAU spin-off assistive technology company with a long-term business objective to provide rehabilitation professionals and patients intelligent products that increase independence and mobility. We developed connected wearable robotic devices to be used in rehabilitation. We need your help developing an iOS application to help deliver remote, gamified gait (walking) rehabilitation training! We have a functional, but very basic iOS app that controls the device (enter patient details, sets up a session, calibrates the device, sends torque control commands) and streams sensor data (number of steps, battery data, torque set points, etc.) to an AWS database.

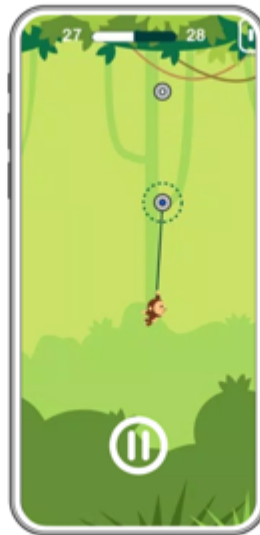
The Problem. What we need. We need your help creating a game for patients to “play” when walking with their exoskeleton. Example game concepts and descriptions are shown in Figure 2. We also need your help creating a visually-interesting patient portal (example in Fig. 3), and personalized training coach (built using ChatGPT)



Keep the Balloon in the Air

Hit pre defined power/angle of rotation targets to blow air at the ball to keep it in the air. The more you miss your goals, the lower the balloon gets, and eventually hits the floor and pops!

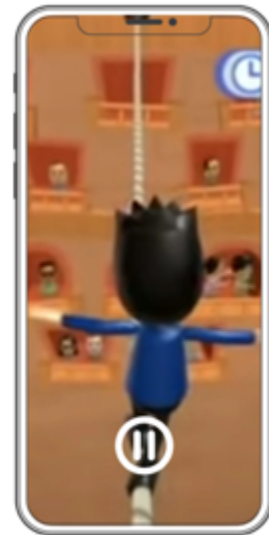
Audio Only (headphones)
Use altitude indicator sounds to communicate to the user the rise and fall of the balloon. Can include ambient sounds to enhance the gaming environment.



Monkey Rope Swing

Consistently keep hitting your pre defined power/angle of rotation targets to keep the monkey swinging, every set number of successful steps the monkey will advance to the next swing, miss your targets and the monkey will slow and eventually falls off the rope!

Audio Only (headphones)
Higher sounds for successful steps, lower for missing your goal. Happy monkey sounds for a move to the next swing.



Tightrope

Designed to assist in maintaining symmetry in both legs. If you consistently hit your L and R leg targets, you will walk forwards to the end of the rope. If you miss, the rope walker will tip off balance either right or left.

Audio Only (headphones)
Positive sounds for accuracy, with lower sounds when you start to head off balance. We can use the spacial audio features of the headphones to indicate which side is off target. Ambient sounds come from the crowd when you get too close to falling off.

Figure 2.



Walking



Dashboard

Today's Date

Date

Last Walk

Last 7 Days

Trend (total)

Figure 3.

Minimum Viable Product – We need a functional iOS app to deliver gamified gait training:

- A basic iOS game controlled using sensor data from the exoskeleton sent via Bluetooth
- Display high-level training analytics, including a training summary and weekly summary
- Ability to track training progress over time

Stretch Goal:

- Integration of ChatGPT to provide personalized training motivation and recommendations.

What if you are successful in this capstone project? You will create a valuable tool used by researchers and clinicians advancing the treatment of neurological disorders. You will gain insight into creating an interactive and easy to use mobile application game controlled by a wearable robotic device, and utilization of ChatGPT.

Do you want a capstone project that gives you experience in a hot CS industry? Telerehab/Telemedicine, including remote monitoring and control of wearable assistive devices, is going to transform medicine in the coming years. This project would give you valuable experience to join this exciting and well-paying CS field.

Knowledge, skills, and expertise required for this project:

- Algorithm development
- GUI design and usability
- Flutter and Dart or Xcode

Equipment Requirements:

- Software/tools freely available online

Software and other Deliverables:

- Creative yet intuitive GUI design
- The functioning basic iOS game for gait training
- Proper code commenting/documentation
- A report detailing the design and implementation of the product in a complete, clear and professional manner.
- Complete professionally-documented codebase, delivered both as a repository in GitHub or BitBucket.