Wearable Measurement Device for Walking Studies

Haley Hoppe\textsuperscript{1}, Nathan Moser\textsuperscript{3}, Nathan Tom\textsuperscript{3}
Dr. Mohammad Moghimi\textsuperscript{2}
Dr. Chris Hill
\textsuperscript{1}Biomedical Engineering, \textsuperscript{2}Electrical Engineering, and \textsuperscript{3}Mechanical Engineering

Abstract

This project created a wearable device that measures the knee joint angle of a participant during various types of walking gaits. This angular data is displayed and analyzed to provide the subject with real-time feedback on the accuracy of the motion when compared to a preset target. Feedback effectiveness is also analyzed by recording brain activity of the participant through an EEG system.

Introduction

Many degenerative diseases require relearning of a proper walking gait to return to normal functions. By studying the most effective method of reinforcement learning, better patient outcomes can be expected during rehabilitation. The client's goal was to use the device to collect data to better understand the benefits of reinforcement learning.

Methods and Materials

Two inertial measurement units were integrated into sensor housings; these sensors were read by an Arduino and relayed to a PC for data analysis and feedback generation. The system was attached to the subject via velcro straps.

Results

Real-time angle data is passed to the feedback system and displayed with a performance score to the user: A short walking exercise is shown below.

Discussion

IMU sensors with data fusion algorithms were required to obtain an acceptable level of accuracy for angular orientation. The real-time analysis of angle data is processed in MATLAB and displayed in a GUI. The system will be used for lab studies in the NIU department of Kinesiology.

Conclusion

This system provides measurements of walking mechanics for studying the gate of rehabilitation clients. The result is a tool that can be used to assist in reinforcement learning studies to produce long lasting improvement of the walking gait.

Acknowledgements

Team 33 would like to thank:

- Dr Moghimi for his mentorship
- Dr. Hill for his input and positive feedback
- NIU College of Engineering for funding