Robotic Foot Drop Assistance Device

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The goal of this project is to provide a soft engineered robotic solution to the problem of drop foot in patients. This is a condition where the person is unable to raise the foot from the ankle and thus has a profound negative effect on the patient’s gait. The designed device is an attachment for shoes that allows the patient to return to a normal gait or as mechanically possible.

Keywords— Soft, Wearable, foot-drop, Ankle, Rehabilitation, Tendon, Robotics, Plymouth University, Raspberry Pi

# Introduction

The purpose of the Robotic foot drop assistance device is to have a system mounted to the knee in order to provide support to the ankle. This system is required in the cases of certain muscle and nerve debilitating diseases and conditions such as Muscular dystrophy, Neuropathy (Diabetes related nerve damage) or even a stroke. [1] Foot-drop as a condition has many varying treatment methods varying from invasive procedures (such as Surgery), electrical nerve stimulation, Ankle-foot orthosis (to hold the foot in a normal position) and finally physiotherapy. [1]

The basis of this system is around a combination of both Ankle-foot orthosis and physiotherapy. This is due to the low cost of orthosis as well as the high value both physically and mentally of physiotherapy. In order to achieve this purpose, the device has two settings, one of which is an everyday support setting (with the system moving to support the patient’s foot) as well as a setting where an LED system instructs the patient through a rehabilitation program. The main benefit of this device based rehabilitation program is the difference in cost to Physiotherapist visits if the system is effective as it may reduce the number of visits required by and therefor the cost to the patient (Private Physiotherapy sessions can cost around £30 and courses are between 5-7 sessions). [2]

# Design Process

## Mounting the device to the leg

The initial design for this system was a gaiter-based design whereby the entire system acts as an extension of the shoe with the top of the gaiter held up by the protrusion of the calf muscle. This mounting method was soon ruled out for use however due to the force required to hold this system in place being too high for mounting at this point.

## Attaching the tendons to the foot

The method of attaching the tendons to the foot was designed around the principle that the device should be attachable to the patient’s foot without the need to remove the shoes that they are wearing. Keeping the patient in their own shoes was a key part in the design due to the comfort as well as increased sense of freedom this gives the user. A larger practical reason for making the system fit around the shoe is that it increases the level of adjustability that can be integrated into the system while reducing the cost of the said system.

## Selecting the microprocessor

## Motor selection

# Implementation

The designs from the design process stage were implemented in two different forms. With an MDF prototype of the system made in order to guarantee correct design measurements for a 3d printed version as well as allow for testing on calculated measurements at the time of production

## The 3d printing process

## The tendons

# Experiments

This

## The lifting wieght of the system

##### V. Conclusion

##### Acknowledgment

Thanks to Martin Stoelen for his guidance as well as the consistent feedback during review sessions along with all those people that commented on this project at those sessions along with him. Finally, thanks to Gordon who created wiringpi as his generated libraries as well as examples and literature on the subject have been incredibly useful in the setup of the raspberry pi board to servo interface.

# References

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