

AN OPEN SOURCE NEUROPROSTHETIC HAND POWERED BY INDUCTION COUPLING

Introduction

A Neuroprosthetic is a brain-computer interface that replaces a missing biological function and eases the life of its user; the foundation of rehabilitation medicine.

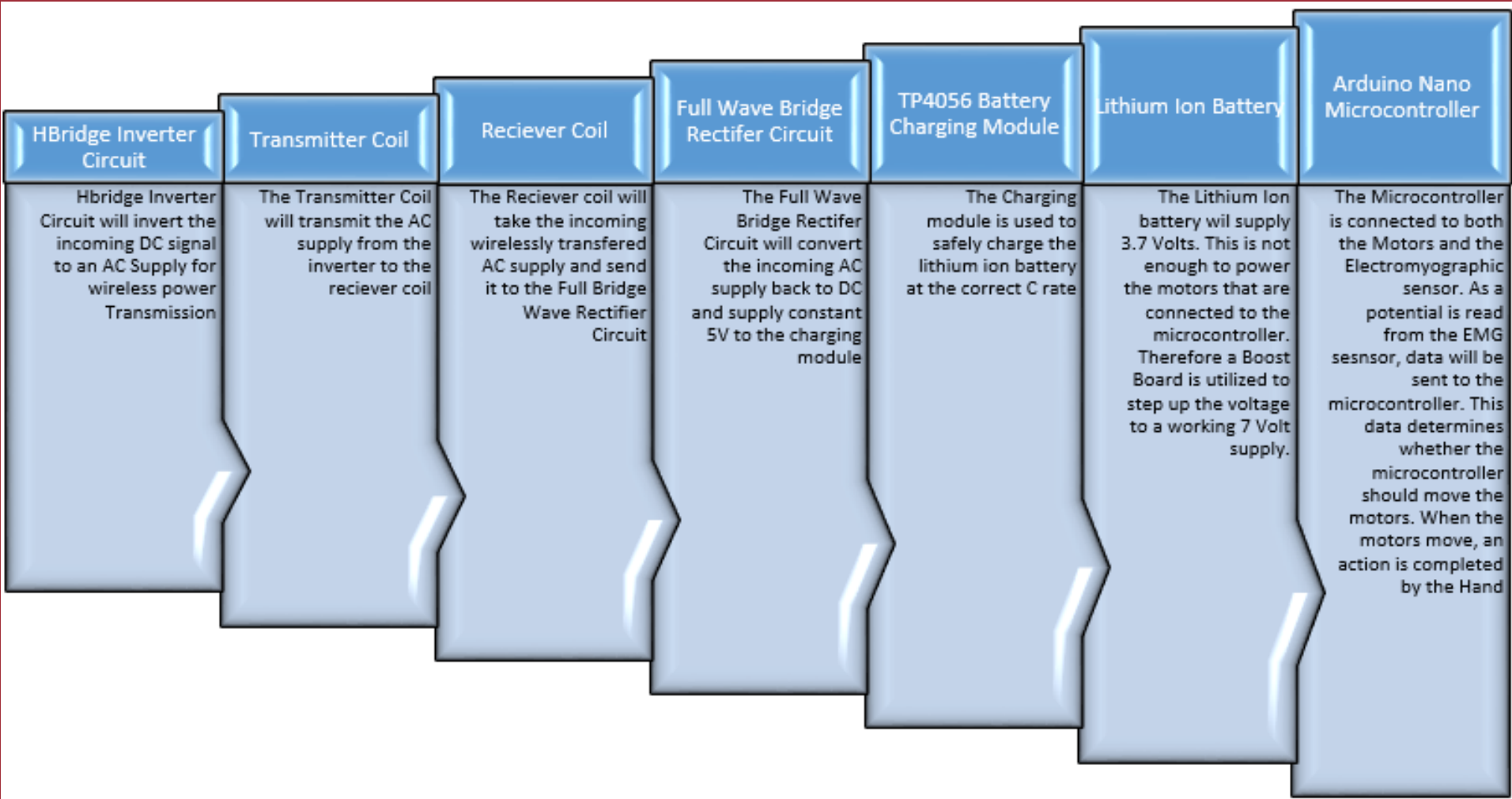
Hypothesis

The hypothesis to this dissertation is that utilizing electromyography for the mind muscle connection, and induction coupling to wirelessly charge the battery, will further enhance the users prosthetic experience.

Objective

- 3D Print a prosthetic hand
- Implement Electromyography for movement of prosthetic
- Enable induction coupling for wireless power transfer to charge the onboard battery of the prosthetic

Methodology



Design

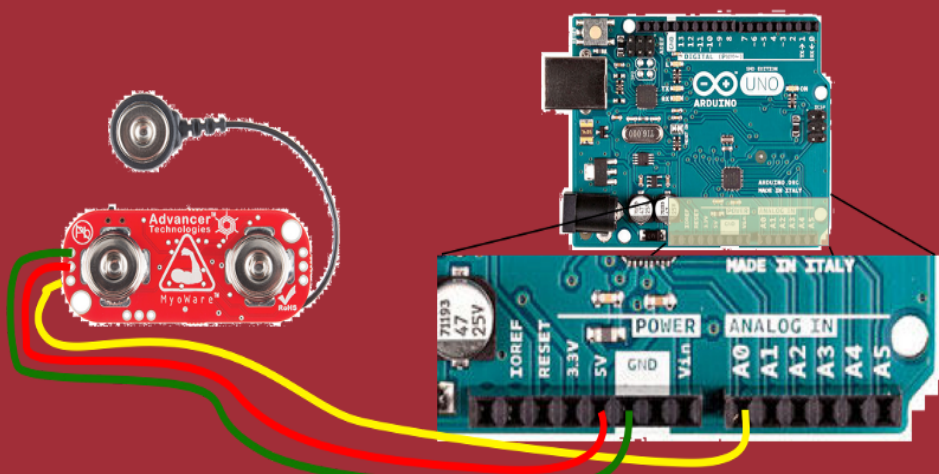


Figure 1. Myoware Control Setup

The electromyographic sensor determines the potential difference at the point of connection and sends that information to the microcontroller

The full wave bridge rectifier passes the incoming AC voltage through fast switching diodes and a transistor for a stable DC output

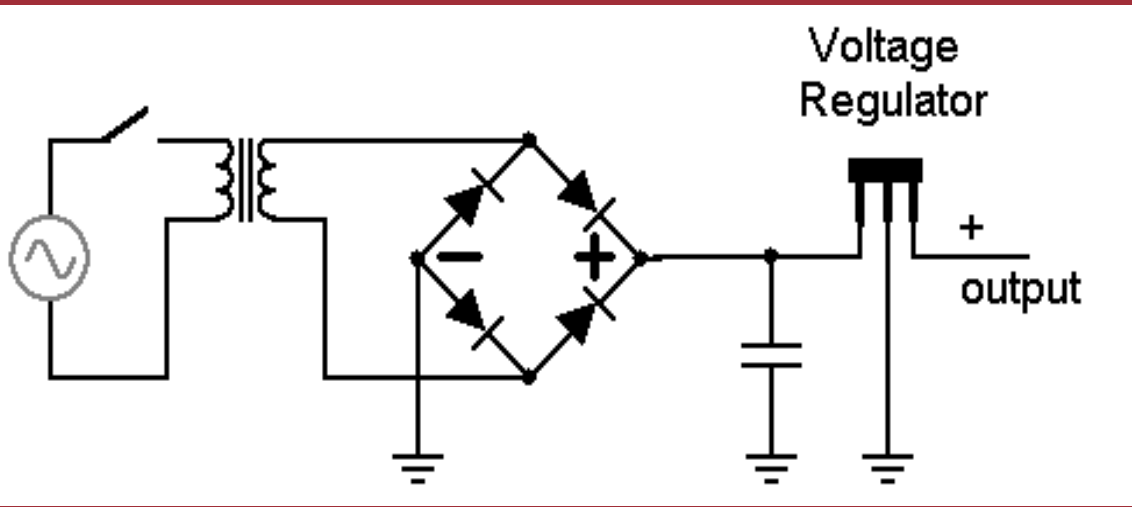


Figure 2. Full Wave Bridge Rectifier

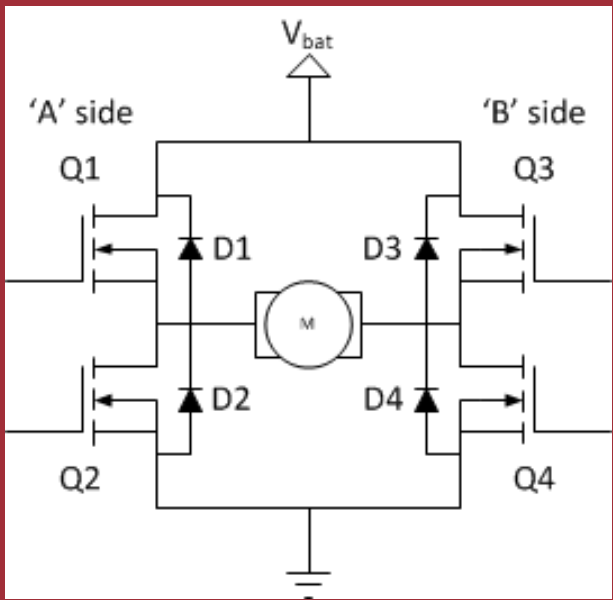


Figure 3. H-Bridge Inverter

The transistors in the Hbridge inverter switch between on and off states creating a sinusoidal DC output sent to the rectifier

An open source prosthetic hand was 3D printed and then assembled to include an EMG sensor, transmission and rectification kit.



Figure 4. 3D Printed Prosthetic Pieces

Results

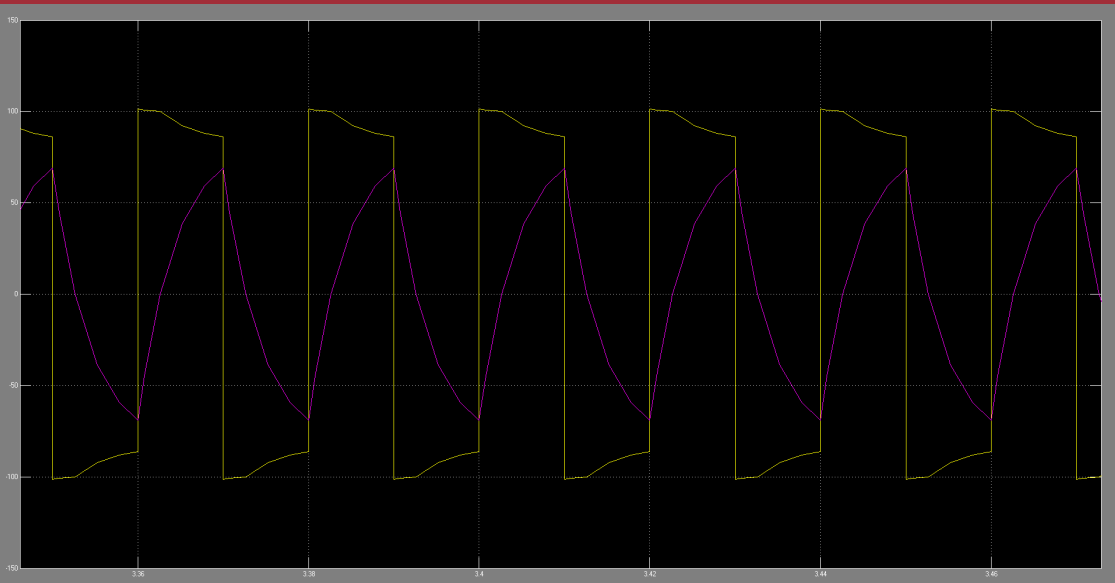


Figure 5. MATLAB simulation of H-Bridge Inverter displaying sinusoidal voltage signal

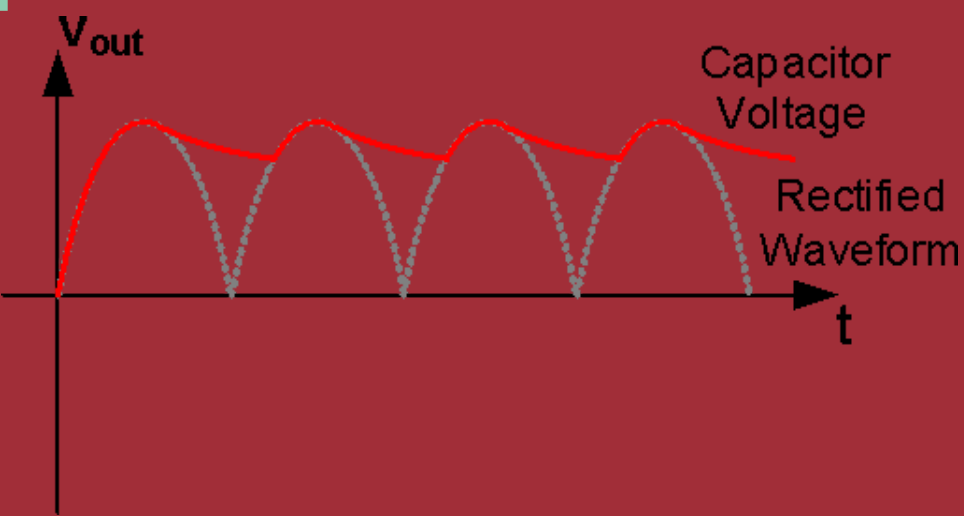


Figure 6. Rectified DC output of incoming AC voltage



Figure 7. Complete assembled neuroprosthetic

Conclusion

As the primary objective of rehabilitation therapy is to ease the life of its user, adding the neural functionality to a prosthetic with the use of EMG sensors in addition with the induction coupling wireless charging ability, further enhances the users' prosthetic experience, as was hypothesized. It has now been seen with this alpha design, that a low-cost open source neuroprosthetic hand with induction coupling is a feasible working design that may be implemented by people in the future.