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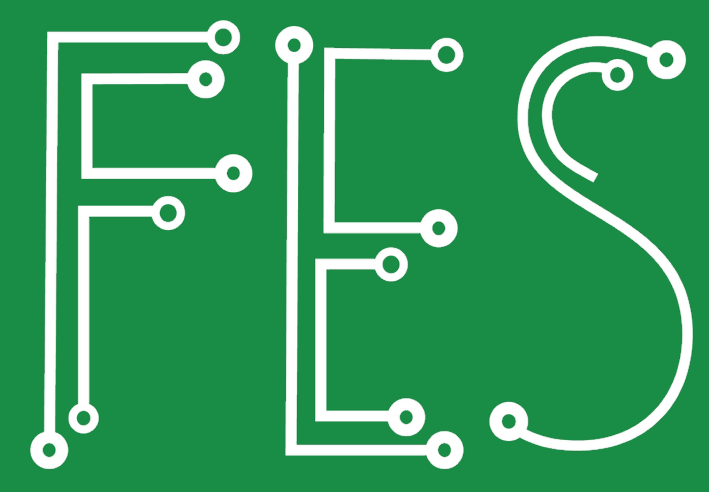
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# A Modular Functional Electrical Stimulation (FES) System for Gait Assistance in Pediatric Cerebral Palsy

Wyatt Bingaman and Andrew Clancy

## Introduction

We believe the creation of a low-cost functional electrical stimulation device will improve the quality of life and the happiness of many children otherwise unable to walk.

## Clinical Partner

Our clinical partner is Cure Ethiopia. We have not been in steady contact with them because of political instability in the region but plan to work with them as the situation changes.

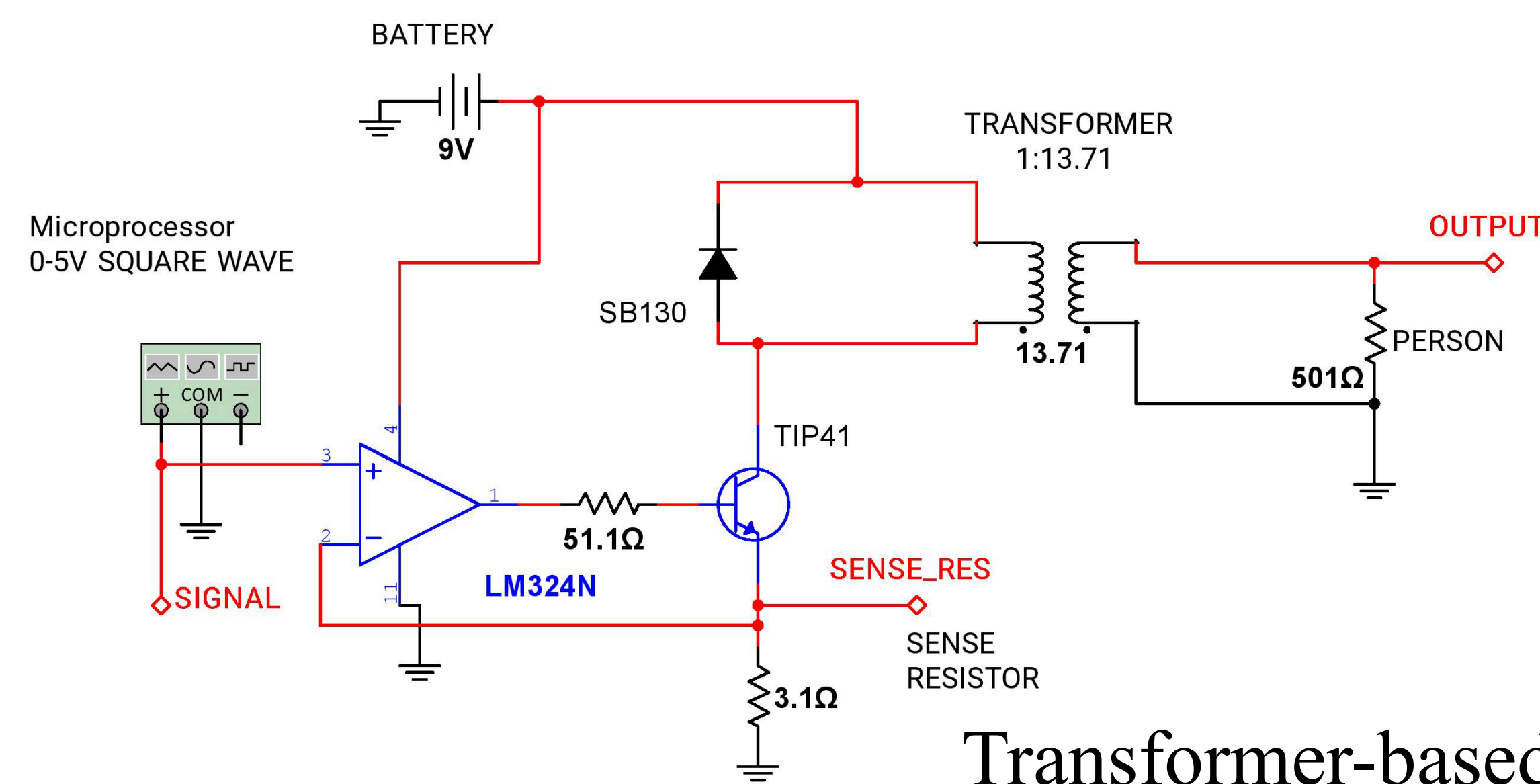


## Acknowledgements

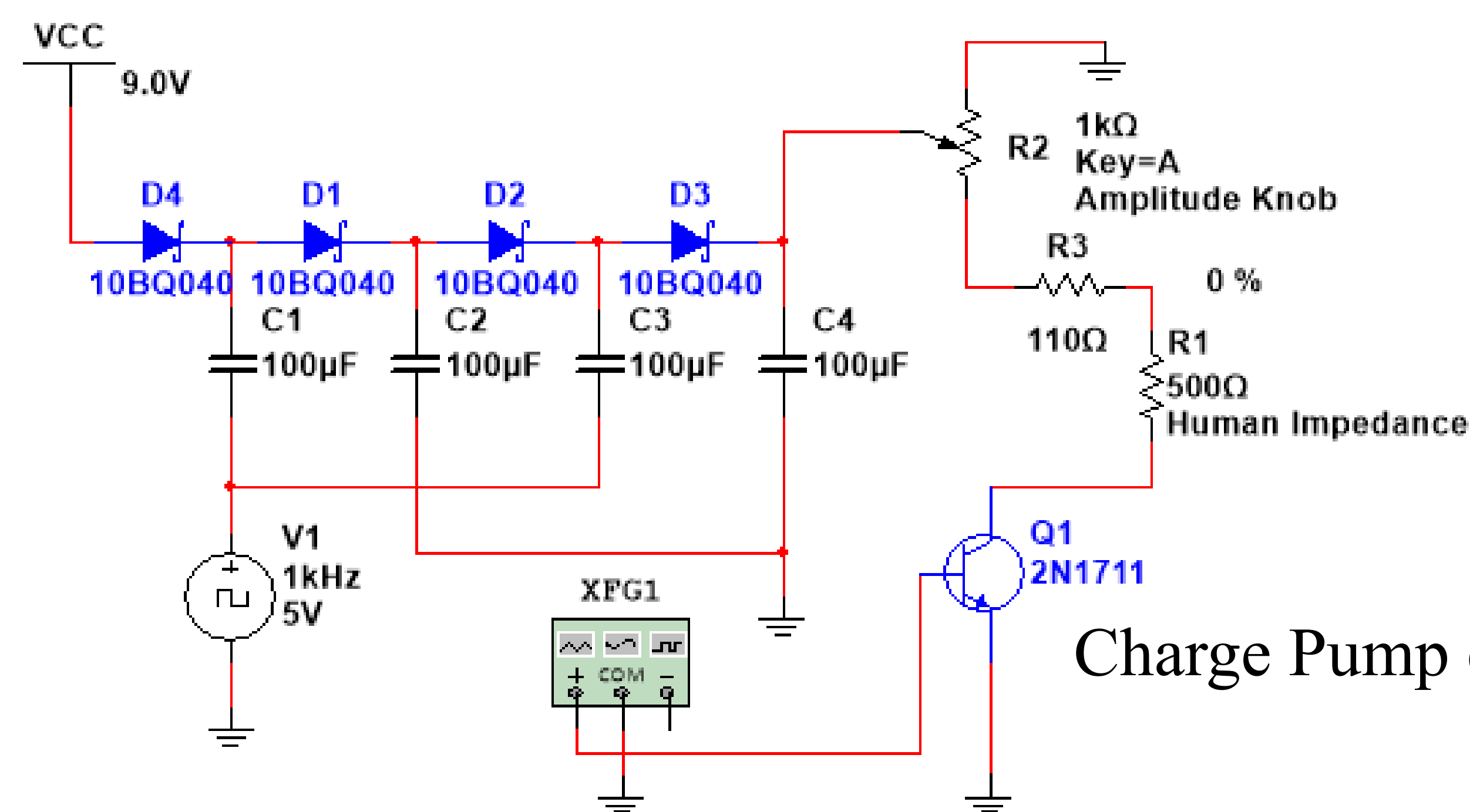
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Dr. Randy Fish – Panelist  
Dr. Richard Gardner – Panelist

## Circuit Design

This is what our circuits look like. We have a transformer-based circuit (below) and a charge pump circuit (above) that we are developing. Each circuit is supplied by a 9V voltage source and is designed to send a pulse to the user. These circuits are to be controlled by the sensor we are also designing for our product.



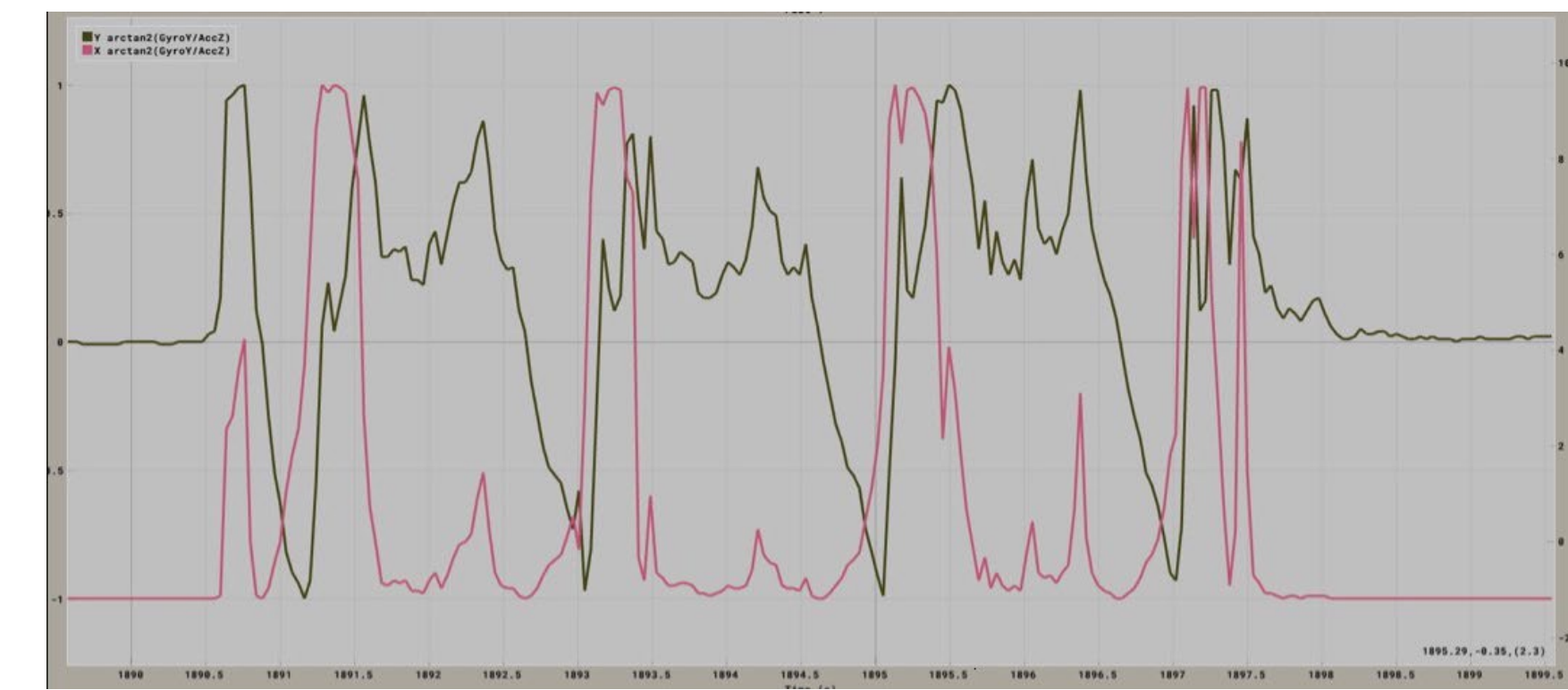
Transformer-based circuit



Charge Pump circuit

## Sensor Design

Using signals from the gyroscope and accelerometer in a BNO055 Absolute Orientation Sensor attached below the knee of the user, we can identify trends in the sensor data as the user walks. Shown below is a graph of the two signals as the user walks. The sensor data will be used to stimulate the user's leg at the correct time.



## Electrode Design

Electrode pads are used to provide an interface between an electrical circuit and the human body. The electrode has many applications in the biomedical field and is the location of electron transfer both for sensing and stimulating different parts of the body. Hydrogel electrodes and conductive fabric electrodes are two types of electrodes used for FES.



## Conclusions

The FES team is currently working on a cost-effective FES device prototype. Both circuit designs are being prototyped on breadboards and the sensor and electrodes are also in the prototyping phase. Since the team is not in direct contact with CURE Ethiopia, our goal of being cost-effective and increasing the quality of life have remained the same.

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