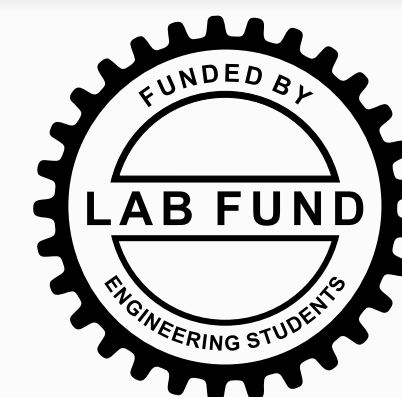


Flexibrace for Chondromalacia Patella Rehabilitation

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Problem Statement

- Chondromalacia Patella is the wearing of the cartilage on the underside of the patella; the cartilage degrades, weakening its ability for shock absorption.
- Flexing the knee over 60° can be extremely painful with this condition and braces available are very bulky and uncomfortable to wear.
- The vastus medialis has been shown to activate before its counterpart causing a pulling of the patella towards the medial condyle resulting in the wearing of the cartilage.
- To solve the problem, a device needs to be designed that allows for improved patient mobility while also alerting them when they are in danger of re-injury or pain.

Objectives

The main objective is to develop a device that reduces furtherment or re-injury of Chondromalacia Patella by measuring knee movement and muscle activity, to allow for more specific treatment. Other objectives include:

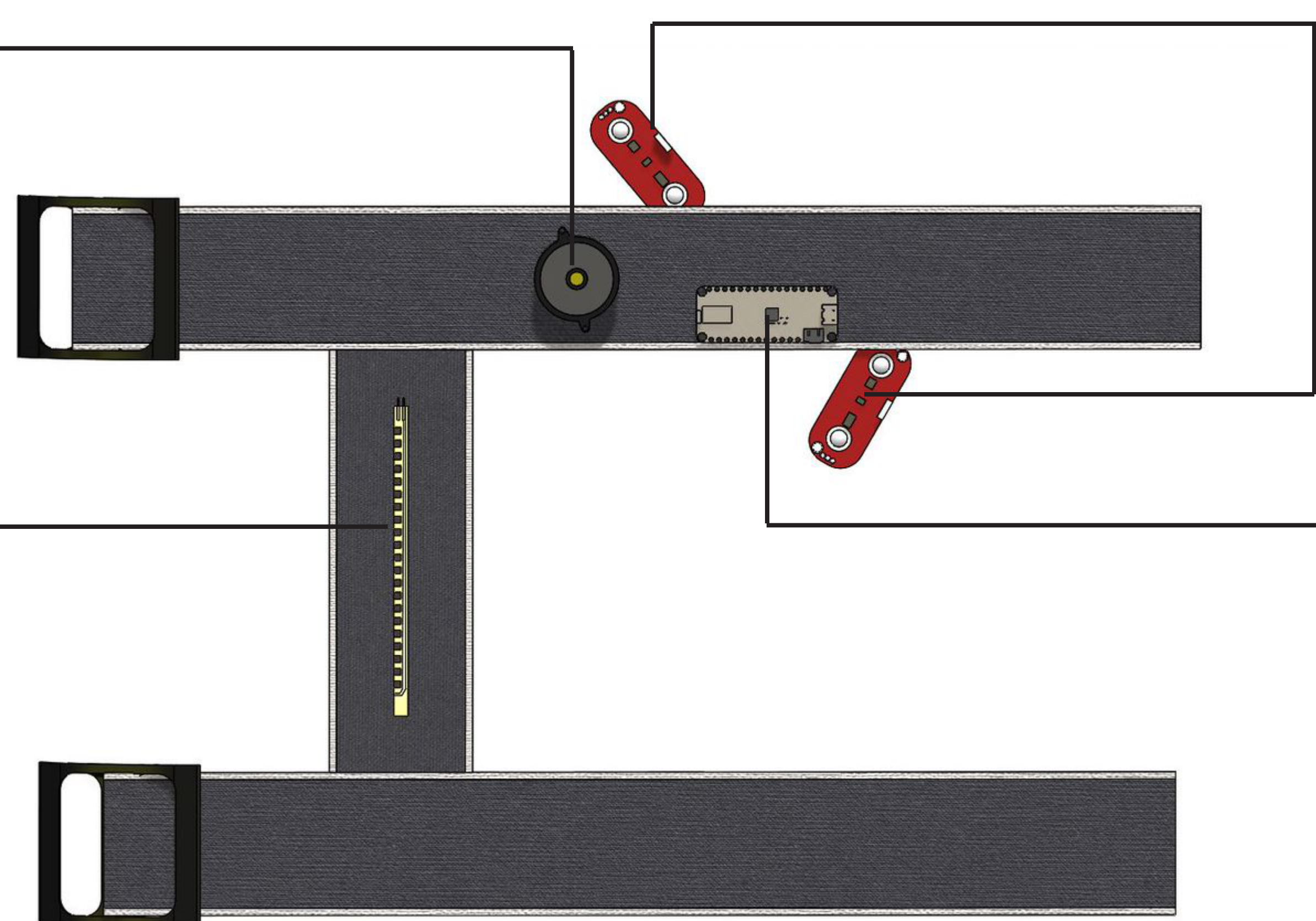
- Design and build a safe and user friendly monitoring system for knee motion.
- Aid individuals with Chondromalacia Patella during activities of daily living.
- Provide monitoring of the patient's daily activities to physiotherapists in efforts to aid in the rehabilitation process.

Design Solution

The **buzzer** will sound to notify the user when the knee angle exceeds 60° flexion, and the activation ratio between the vastus medialis and vastus lateralis is outside the range of 0.8 - 1.2.

A **flex sensor** runs along the back of the knee to measure knee angle during movement.

A **one-piece** design with **simple buckles** maximizes ease of use and allows the user to adjust the band size at their own discretion

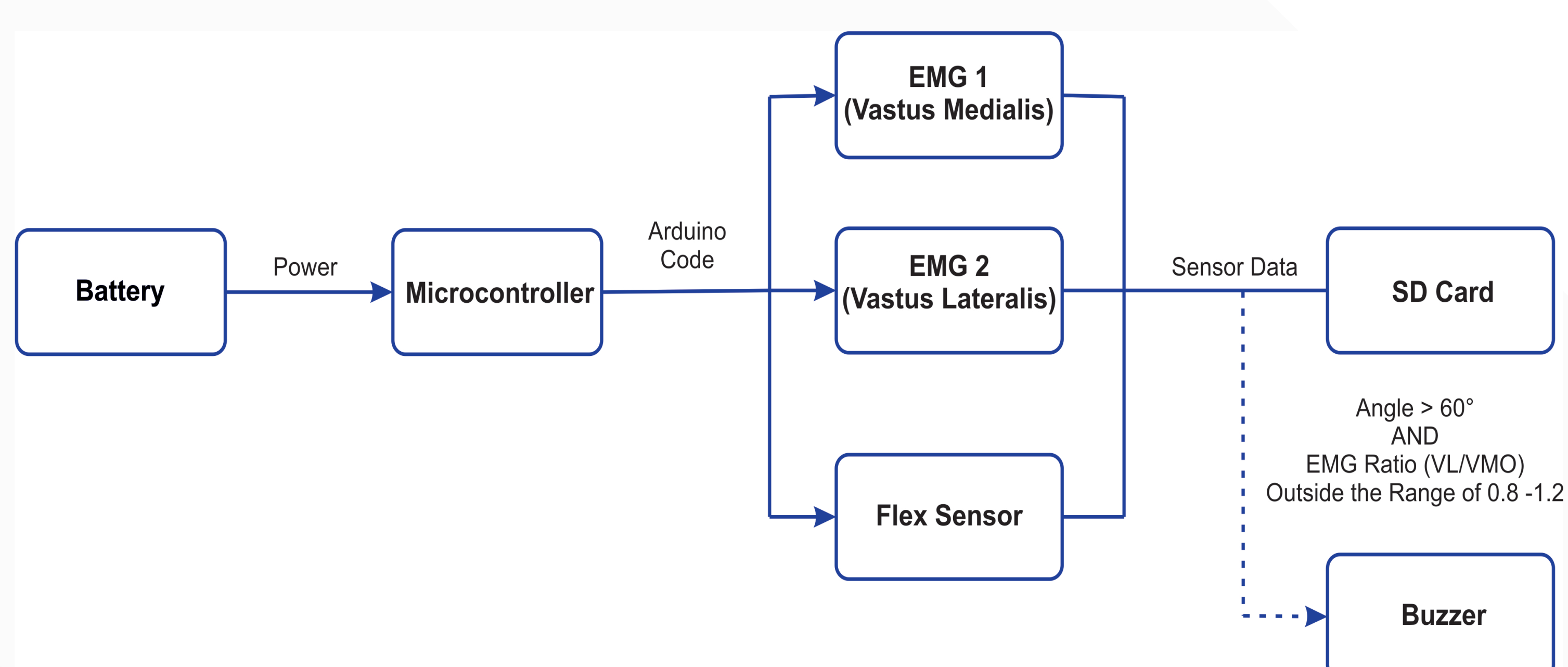


EMGs are placed on the vastus medialis and vastus lateralis to measure muscle activity to determine the ratio of activation.

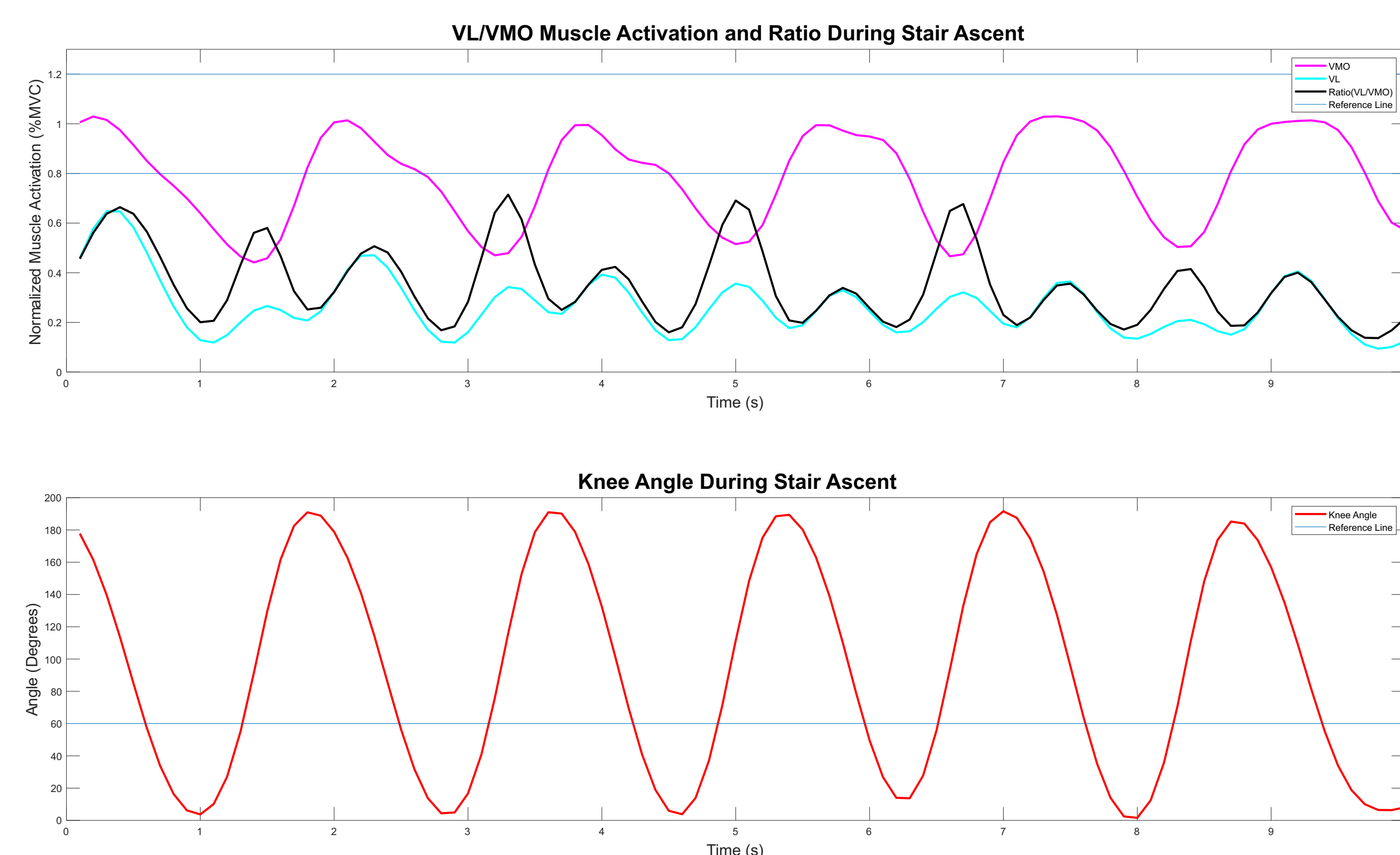
The **microcontroller** is housed in the top band and is responsible for programming the sensors and storing the data collected on an SD card.

A detachable, **merino wool band** is placed between the skin and the main band containing the electronic components, which can be removed and washed.

System Architecture



Results



Conclusion

- Patients are notified by sound when their knee is at an angle greater than 60° in conjunction with an abnormal ratio of vastus lateralis and vastus medialis activation.
- Device collects accurate and repeatable data that can be communicated to physiotherapists and the user to assist in rehabilitation efforts.

Future Works

- Replace the flex sensor with a more compliant sensor, such as the Bendlabs One-Axis Bend Sensor.
- Create a bluetooth version of the device to streamline the process of conveying information to the physiotherapist, and to provide more feedback to the patient.
- Adapt a different type of feedback mechanism such as vibration for a less bothersome notification to others.

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