## Project Introduction

- The vFit Gold is a wellness device made by Joylux Inc. with the intended application of alleviating symptoms commonly associated with menopause.
- Joylux asked our team of electrical and mechanical engineering students to implement an array of sensors to provide biofeedback to the consumer.
- Through a series of testing existing and added components, replicating them in a prototype form, and verifying the functionality of the device, we have successfully implemented Force Sensitive Resistors (FSR) to relay pelvic floor muscle strength to a smartphone application.

System Features

- An array of four FSRs are located near the tip of the device, allowing for accurate readings of pelvic floor muscle strength improvements after a series of therapy sessions.
- Bluetooth transmission allows for wireless data exchange from the device to a smartphone.
- Updated button logic allows for ease of use while reducing the number of components in the device, reducing weight and cost.

Design Concept

- Input data by FSR and temperature sensors through is received at 2 MHz and is decoded using the UART protocol through Arduino.
- The buttons controls the logic of the motor modes and LED session time.
- The received data is obtained and sent from the bluetooth module to the Joylux APP by Bluetooth 2.0 protocol at 3Mbps.
- The Joylux APP would record and show the data after each session finished. It would analyze the performance and improvement since the first usage.
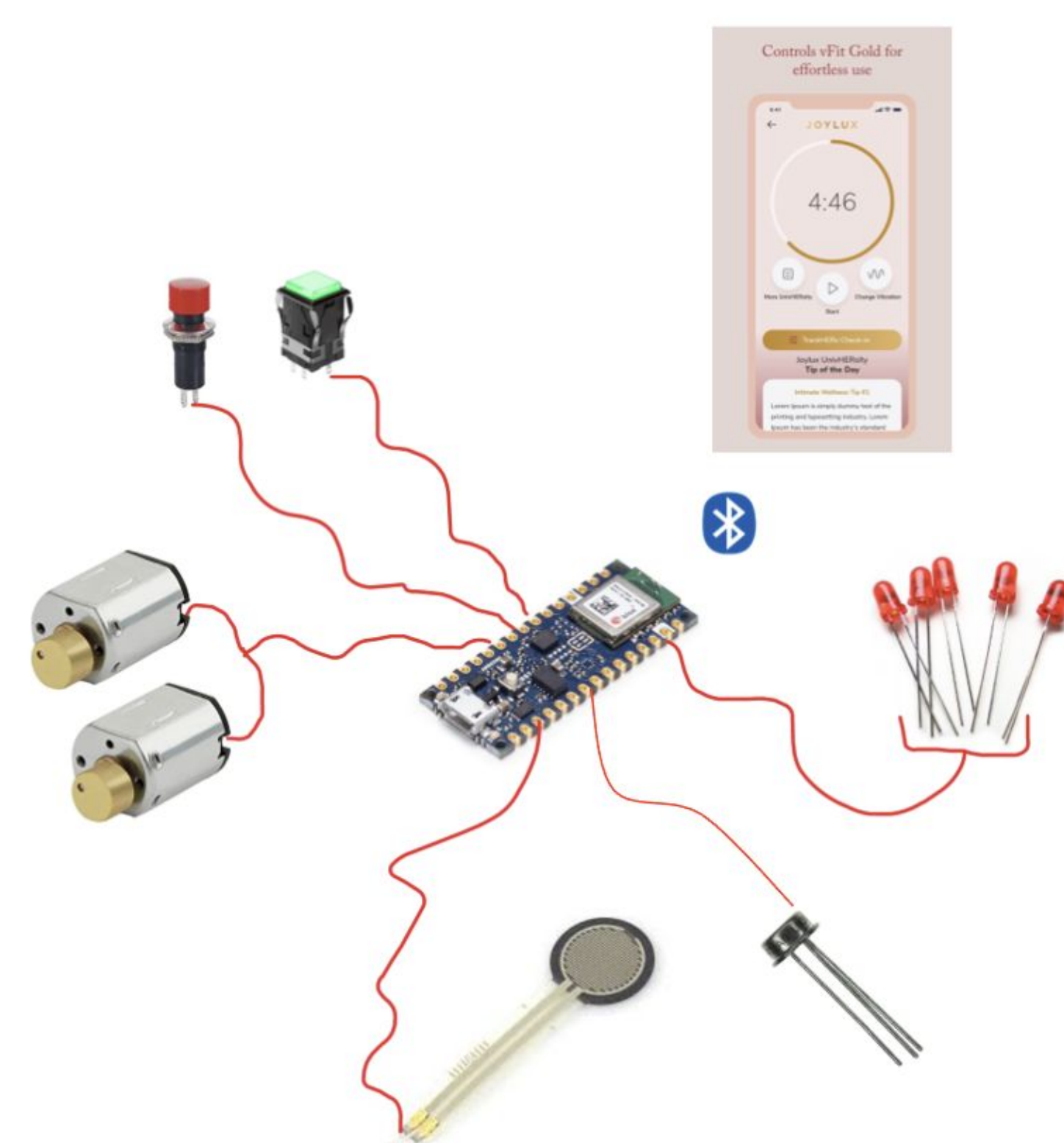
Calibration & Testing

- Replicating components in existing device was not challenging
- Implementation of the FSRs required some extensive research to construct the appropriate circuit and to ensure good results from the readouts
- All device functionality was replicated and the added sensor array proved effective in yielding accurate measurements
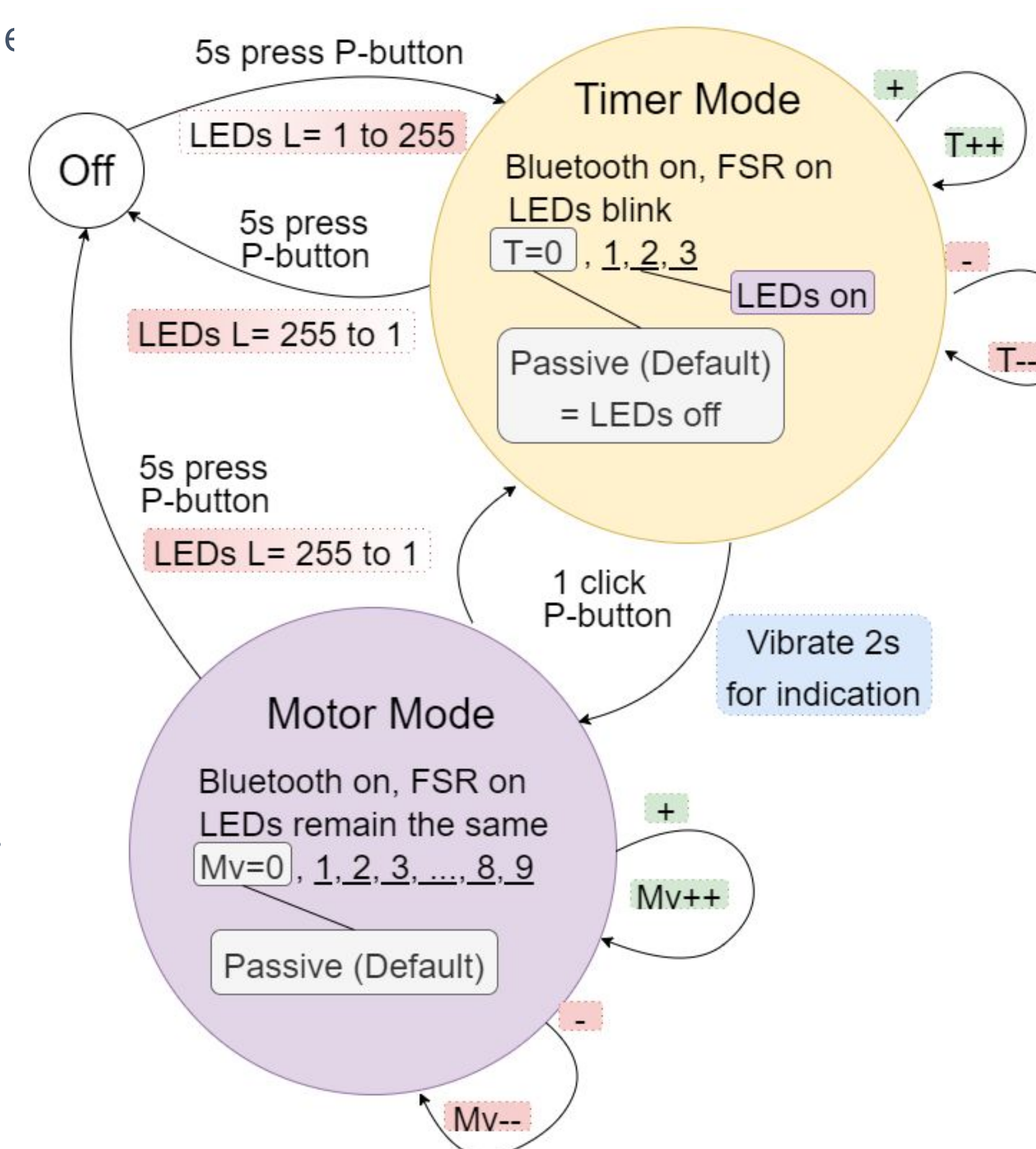
Hardware Design

- Used Solidworks to design prototype housings.
- Force Sensing Resistor (FSR) mounted to button slot for measurement.
- Vibration motor fitted in the forehead of the device.
- LEDs positioned in circular arrangement for therapy.
- Maintain IPX6 compliance with crystal silicone layer.
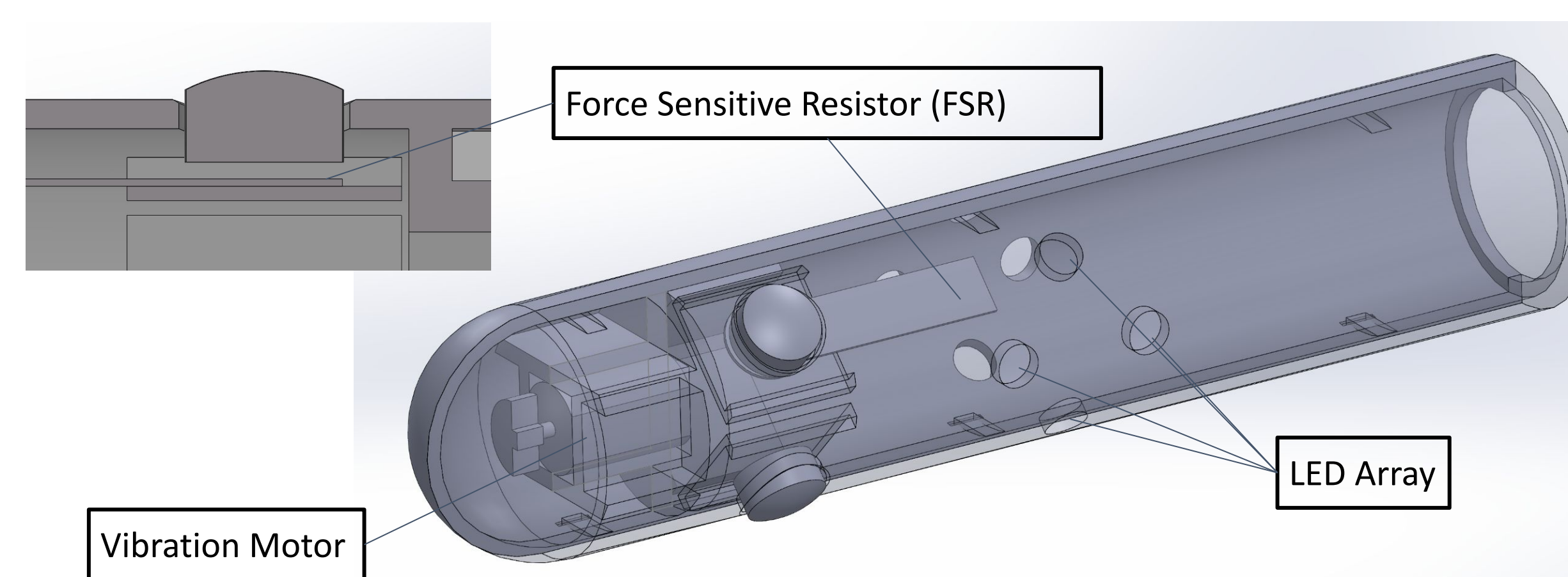
User Device Control

- One of our stretch goals in the vFit Value engineering project is to improve the user interface of the vFit gold.
- Redesign the function of buttons and eliminate the indicator LEDs.
- To start the device, 5-sec long press P-button with LEDs turning on.
- In Timer Mode, LEDs are off in passive mode. Choose different therapies with +/- buttons and LEDs.
- After clicking P-button, the therapy will start automatically. And the user can switch to Motor Mode.
- During the therapy, the vibration intensity is controlled by the +/- button.
- By implementing this new button logic, this device is more user-friendly for the elder in the future.

Software Design

- There are two parts for the Software Development in the project. The main goal is to program the microcontroller (Arduino Nano) to run all sets of sensors at one place. The second part is our stretch goal, to have an APP that can be used as a remote controller for the device and most importantly to show the user's pelvic pressure strength. Softwares used include Arduino IDE and Arduino Studio, programming languages used were C++ and Java.
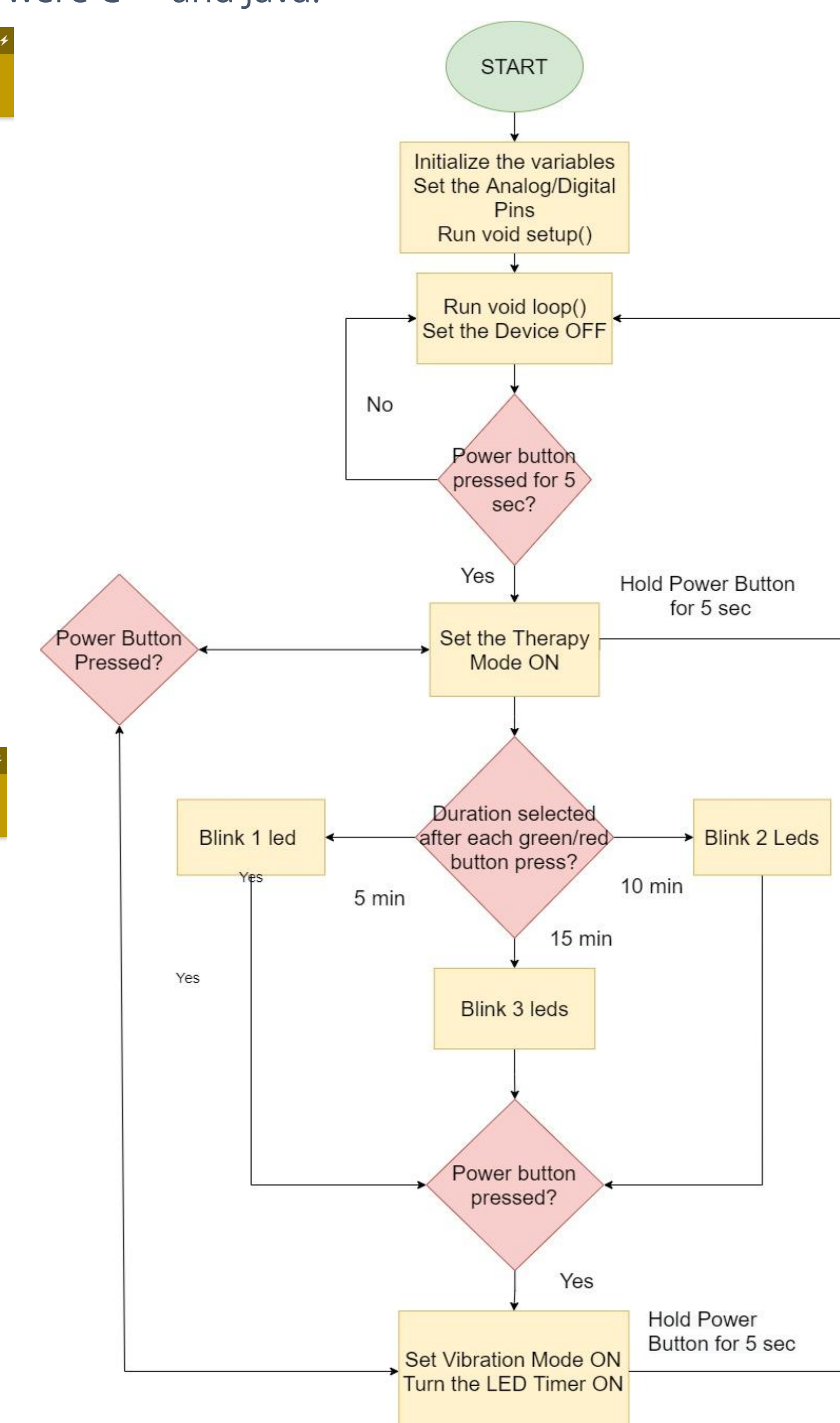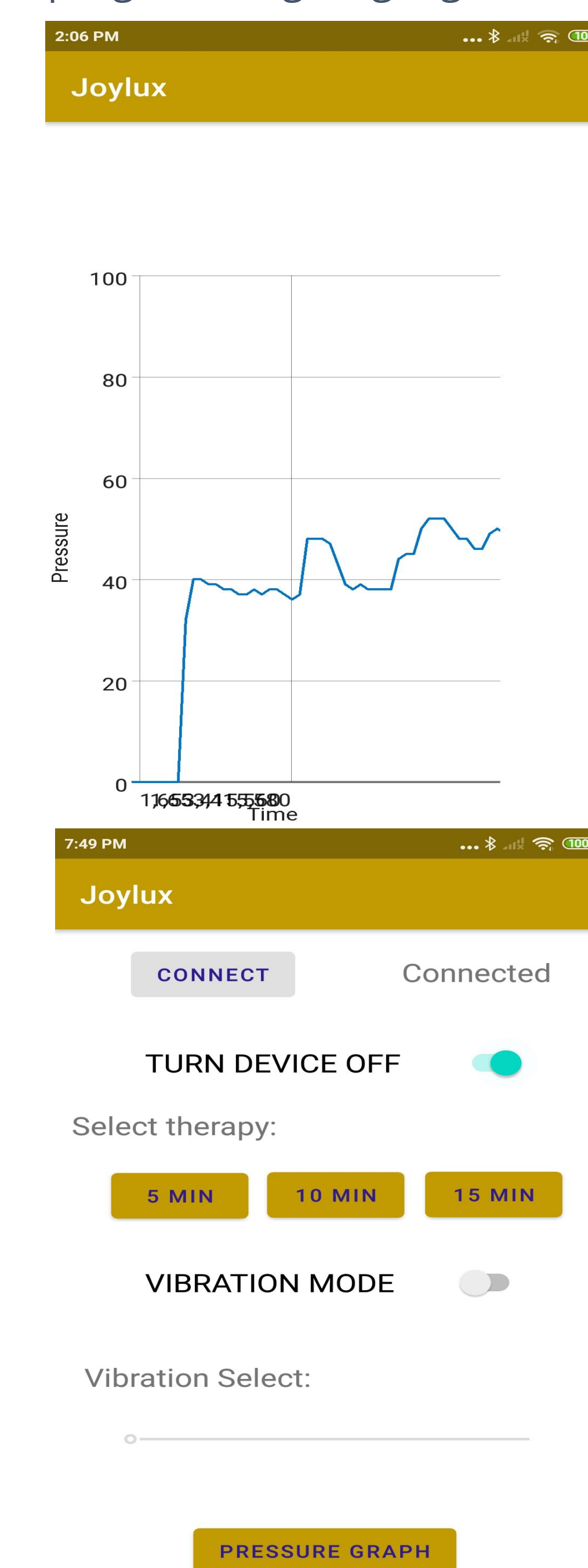
Future Work, References, and Acknowledgments

- Design and fabrication of an integrated PCB
- Investigation into cost reduction via parts redesign and materials sourcing
- Added usability from smartphone application for better user interface

Faculty: Kelly Ho, TA

References:
1. FSR Datasheet: https://cdn-learn.adafruit.com/downloads/pdf/force-sensitive-resistor-fsr.pdf
2. Joylux: https://joylux.com/