

## Team 19043 Subsystem Build and Test Pre-Read

<b>Project Title:</b>	Personal Data Collection System for Essential Tremor Evaluation II
<b>Project Number:</b>	19043
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## **Team Vision**

Our team wanted to get a bit ahead of the curve in this phase of the project. Due to this, we decided to focus on not only subsystem build, but also integration into one cohesive system. This was done by gradually expanding with each subsystem. Eventually, we wanted to create a fully functional electrical and software system based on our design. We were able to reach this goal and can demonstrate our ability to communicate wireless data transmission. We are also able to demonstrate proper operations of one MyoMuscle sensor and both IMU sensors. This shows both the system level and subsystem level design of our electrical and software systems operate as we intended. We had a setback in housing fabrication as we decided to redesign our Arduino Housing to allow for a more modular device.

## **Instructions for Preliminary Testing**

1. Verify that the system is turned off, plug the Arduino programming header into the computer
2. Upload the Arduino program to the Arduino Mega
3. Attach the MyoMuscle sensor to a desired muscle group
4. Unplug the programming header, and power the device via the battery
5. Open the C++ Code and run the KST plot software
6. Move the device to verify each of the six IMU signals and proceed to flex accordingly
7. Over the course of data acquisition verify real time data capture
8. Ensure that operation remains the same at an adequate distance away
9. Open the .csv file and verify the frequency of capture is greater than 40 Hz

## **Test Plan**

We edited our testing criteria to report numerically backed criteria that was less subjective and more concrete. This can be seen in our 'Device Test Rev. 2'.

Our test plan for this phase utilized the breadboarded equivalent of our Wiring Diagram. We input both translational and rotational x, y, and z data to our IMU pair. We also wanted to verify that the output was consistent with that of our wired data transmission. We also input flexion muscle data to verify that our MyoMuscle was able to verify EMG data. Our muscular response was done on a healthy arm and was just used for preliminary verification.

[Device Test Rev. 2](#)

## Subsystem Fabrication

### Electrical:

- The electrical system was fabricated on a breadboard. The first subsystem constructed was the Power Subsystem which can power the Arduino as expected. As it stands, the power monitor is not yet calibrated, but does function at full power.
- The next electrical subsystem created was the EMG DAQ subsystem.
- Then, the Motional DAQ subsystem was created via breadboard.
- The final electrical system component was the communication subsystem which was also integrated into the breadboard design.

### Software:

- The Arduino software was adapted from the previous group's Arduino software. This was updated to use Bluetooth communication, and to use the new ports selected for EMG data lines.
- The GUI was created from scratch to be used to set-up for data acquisition, store data, and to call upon the KST Plot application.
- The KST Plot application is used to display the data received by the device in real time.

### Physical:

- Our first housing print was scaled at approximately 1/25th scale as we drew our design on an inch basis and the 3D printers operate on a millimeter basis.
- Our second housing print was at an insufficient resolution, and settings were therefore edited on the printing profile.
- We are holding off on housing fabrication as we are in the process of redesigning our Arduino Housing.

## Test Results

Preliminary testing of the Breadboard device resulted in a data rate of 100 Hz, which exceeds our 40 Hz minimum limit. We were also able to verify that the MyoMuscle sensors detected Flexion, which is one of the muscle activations we are to monitor. Data acquisition tests were carried out to verify IMU response, through movement in the x, y, and z direction while stored inside the box that we use to protect our prototype. The power system has an implemented kill switch that supplies battery power when on and nothing when powered off. This then goes into a switching regulator which regulates to 5 V DC. This signal is input to the Vin Arduino pin, and the Arduino supplies the desired 5 V to each of the DAQ components and to the Bluetooth communicator. We have also verified wireless communication works from 15 feet.

### **Subsystem Integration**

The electrical system was fabricated on a breadboard. The first subsystem constructed was the Power Subsystem. This was used to power the EMG DAQ subsystem, which was verified by the power monitor LED. The Motional DAQ subsystem was also integrated onto the breadboard but was not verified as working. The final electrical system component was the communication subsystem which was also integrated into the breadboard design and displayed that it could use the power subsystem to power itself. The Arduino software was then programmed via the USB programming header. The GUI was then used to set-up for data acquisition and to call upon the KST Plot application. The KST Plot application was then used to verify the signal connections of each of the IMU and the MyoMuscle sensors in real time. This also verified that our power subsystem could supply enough power for each component in our design. Our Bluetooth communicator was also proven to work in our system.

### **Risk Assessment**

We have continued risk tracking. As time goes on, we are seeing a negative trend in our perceived risk. The corresponding excel file can be found at [Risk Tracking](#).