Second Progress Report

Our project is structured to enable three work streams to proceed in parallel –hardware build, grip recognition modelling, and user interaction schemes.

## Hardware Build

* ***Achieved***: A 3D printed case has been built to hold the circuit boards and all the sensors on the back of the galaxy note phone. A custom PCB was designed and assembled with the necessary components to extract the touch and pressure information from the 16 sensors and transmit it over Bluetooth Low Energy (LE) to the Phone for further processing. The Embedded firmware for communicating with the Analog to Digital Converters (ADC) on the circuit board along with simple filtering algorithms have been written and tested.
* ***Upcoming***: We will be improving the 3D printed case design and the placement of the sensors based on the initial pilot data that will be obtained. Additional or modified filtering schemes may be implemented to get more usable data from the hardware. Various dynamic ranges for the sensor values will be tested and the optimal range chosen based on the pilot data.

## Grip Recognition Modelling

* ***Achieved***: We were able to couple the machine learning library with the android prototype. We can now validate the accuracy of different machine learning algorithms using a training dataset. Currently, the training dataset is the accelerometer data collected from the device. However, once the pressure sensors are deployed in the mobile device, we will replace them with the pressure data and run the same algorithms.
* ***Upcoming***: We will apply the most accurate machine learning model on the pressure data. The data will be collected from the testing subjects and will represent different activities of the subjects on the phone. We will then use these models in real time to execute different user interactions depending on the identified patterns.

## User Interaction Schemes

* ***Achieved***: We tested the interaction of the Android application with a sample RFduino. The RFduino will be used to transmit the signals from each sensor to the application over Bluetooth LE. The Android application was designed so that the service that interacts with the RFduino provides a configurable, sliding window of sensor values that can be used for evaluation. We have defined 3 types of grips that we will attempt to accurately classify and perform an action – Regular Usage, Reaching for Top and No Grip.
* ***Upcoming***: We will integrate all 3 areas of work to ensure that it works in an end-to-end manner. After that we will design and test our implemented system against a user testing procedure that will provide objective performance measurements.