Project Proposal

***Project teams:***

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***Project title:***

Mind-controlled robot using EEG signals

***Project description:***

In this project, we want to use the MUSE 2 brain sensing headband to develop a proof of concept for a mind-controlled robot. To do so, will capture the EEG signals coming from the brain, analyze the signal frequency domain and compositions. Then, we will train a machine learning classifier model by collecting our own EEG dataset. We will store and monitor signals resulting from imagining two basic tasks: moving froward and backwards (wheelchair control) or opening and closing a hand (robotic arm control), record the difference between the signals and train our machine learning classifier based on those differences. Finally, we will deploy our model on a robot and test it with multiple subjects.

***Project objectives:***

1. Successfully interfacing the EEG sensing device, filtering the signal, and extracting the useful frequency domain we need for our analysis.
2. Distinguishing brain signal difference between tasks executed, e.g., movement in open space, or grabbing objects, train a machine learning classifier based on the sample data.
3. Deploying the system all together (EEG, Classifier, Robot), the system should reproduce the task in the person’s mind in real time and transfer it to the physical robot.

***Project plan:***

10/15 to 10/31

In this period, we want to familiar with the applications and usage of EEG signals, how to interface the sensing device with a computer/phone and display the different type of outputs.

We will need to monitor the regular EEG signals, and then distinguish between the task we want to implement on a physical robot. A lot of work has been done using the MUSE 2, so we will use 3rd party software to get the quality signal we need to train our machine learning model. Bluemuse for example, provides a nice minimalistic and intuitive GUI for making an LSL connection with Muse 2.

11/01 to 11/20.

In this period, we collect and build our EEG to train a machine learning classifier like decision tree and neural network, and eventually, we will use this model to make the class prediction of the real-time EEG sample collected by the sensor. In this step, we prefer to use the machine learning libraries of Keras or TensorFlow to achieve this purpose. Meanwhile we will finalize the design of our application robot (moving robot or robotic arm).

11/21 to 12/14.

In this period, the full system will be connected, from capturing real time EEG signals to classifying the signals according to the task aimed and running it on a robot. We expect to make a lot of tests on multiple subjects and perform some debugging and optimization as the research on the same subject has shown that there it is still a very hard task to distinguish between EEG signals from different persons. We will keep records of our demos as a proof of concept. For the sake of saving time, a part of the demo may be recorded by camera and displayed in the classroom. Also, we need to prepare the final presentation and write the project report based on a real case application such as wheelchair control or neurological disease assistance.