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ENGINEERING
TEXAS A&M UNIVERSITY

Team 61: Driver Drowsiness Detection
Bi-Weekly Update 5

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TA: Max Lesser

Project Summary

Problem:
Driving fatigue has been a major cause of accidents on the road. Truck drivers are at a greater risk of driver fatigue because of the long hours spent driving.

Solution:
Our Driver Drowsiness Detection System will use a machine learning (ML) algorithm and electroencephalogram (EEG) device to determine a driver’s level of fatigue and alert the driver to rest.

Project/Subsystem Overview

EEG

- Filter out unwanted frequencies.
- Take in brain waves in microvolts and amplify them to volts.
- Send data to MCU

MCU

- Receive incoming signals from EEG
- Send data to computer running ML algorithm

Dakota

Simulator

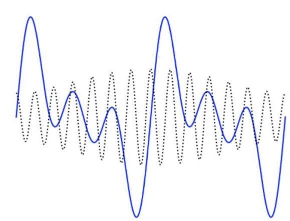
- Collect data
- Muse 2 EEG device

Signal Processor

- Perform live analysis of signals
- Process raw EEG signals

ML Algorithm

- Input processed EEG signals
- Output fatigue state of user



Team 2: Coady and Ali

Project Timeline

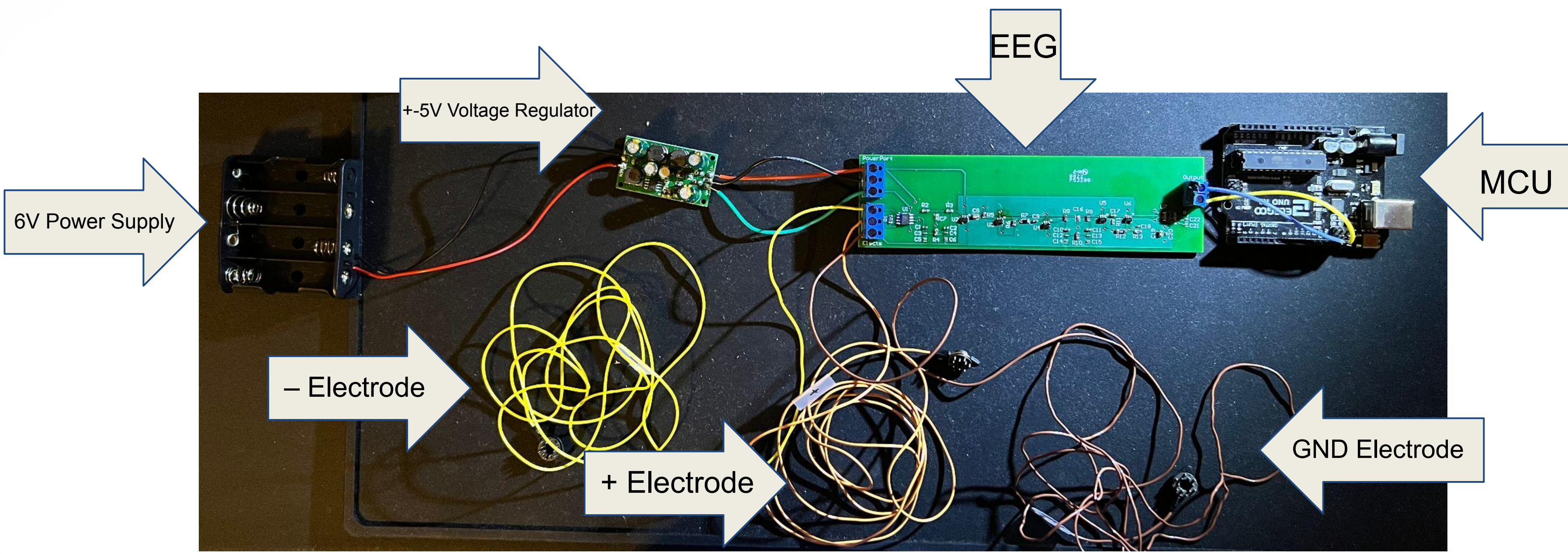
January	February	March	April
SP/ML Light Integration	SP/ML Live Analysis Full Integration	Model Refinements	System Verifications
EEG/MCU Interfacing	Classification Testing	Transition State Classification Testing	Final Presentations/Demo
	EEG PCB Complete	Live spectrum analyzer for EEG	

Dakota Mouton

Accomplishments since last update 12 hrs of effort	Ongoing progress/problems and plans until the next presentation
• I2C communication issue has been fixed and can view the logic on oscilloscope.	• Finishing live spectrum analyzer program for EEG. • EEG validations (started).

Dakota Mouton

- Finishing FFT live spectrum analyzer to see spikes for our target frequencies.
- Continuing validations.

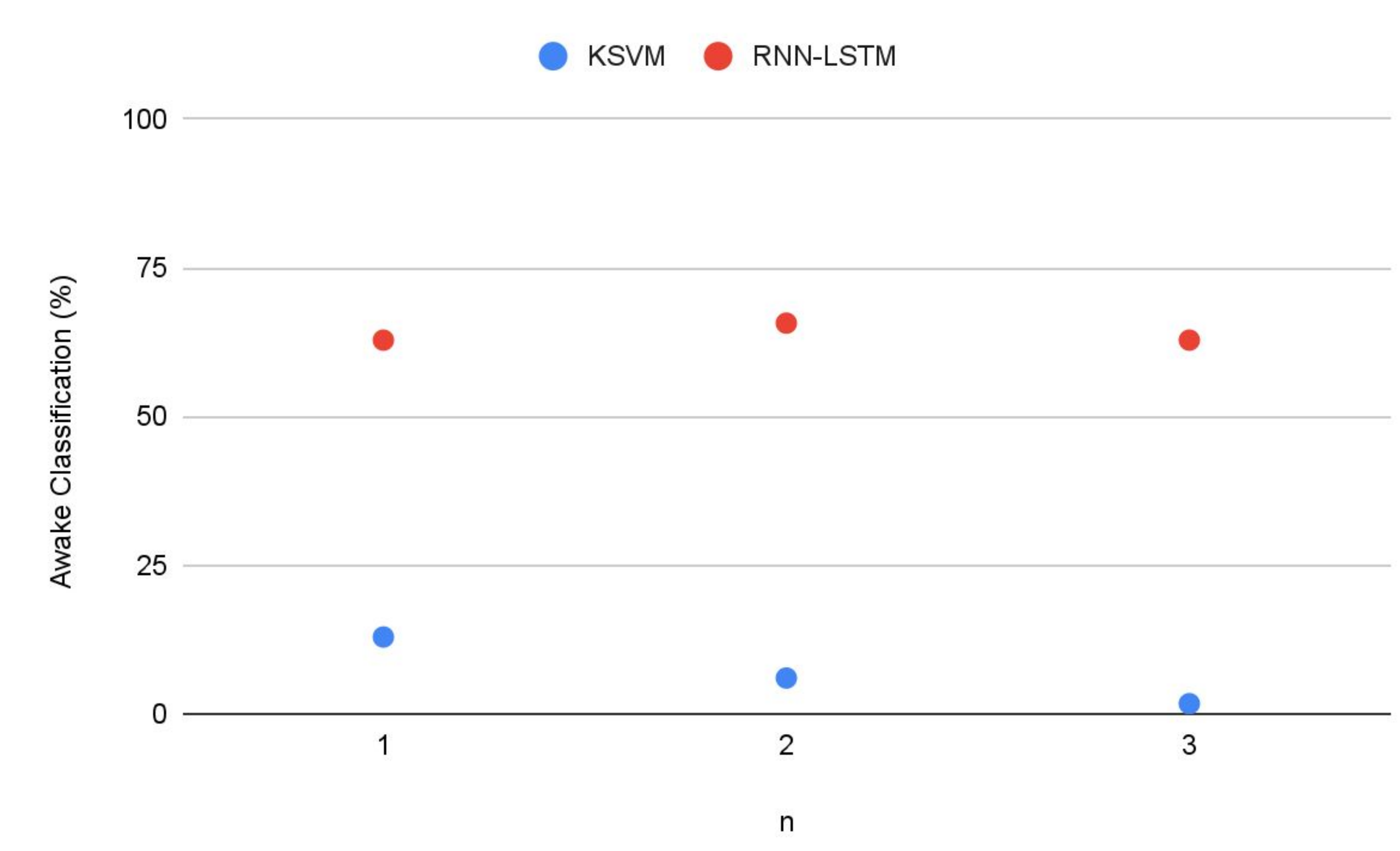


Coady Lewis

Accomplishments since last update 13 hrs of effort	Ongoing progress/problems and plans until the next presentation
-Modified live analysis to support 2D sequence input into the RNN. -Finished formatting input sequences and labels. -Tested RNN as a standalone model.	-More testing of RNN, R-CNN -Finalize live analysis configuration -Try to use recurrent models as a trim for the KSVM -Seek improvement, but prioritize performance on subjects that trained the model.

Coady Lewis

-Comparison of awake classification on awake datasets from Dakota.



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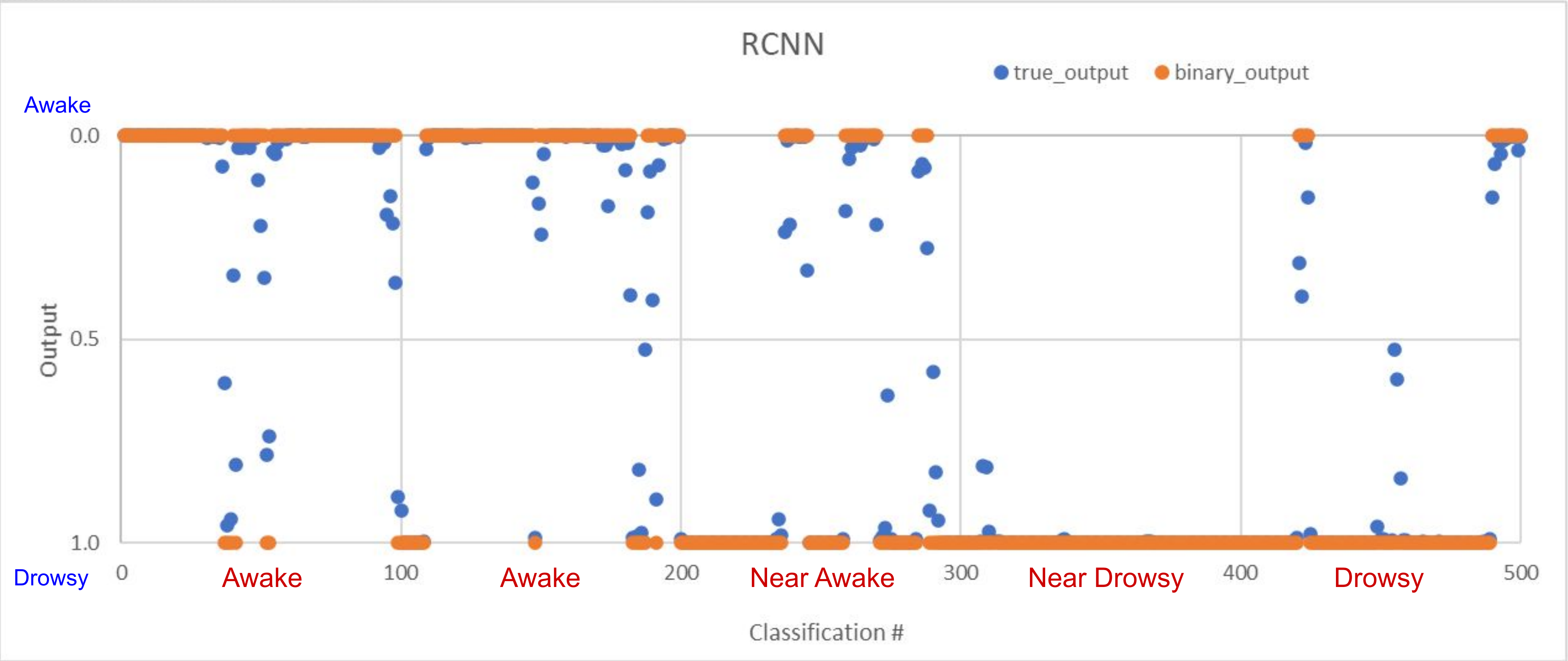
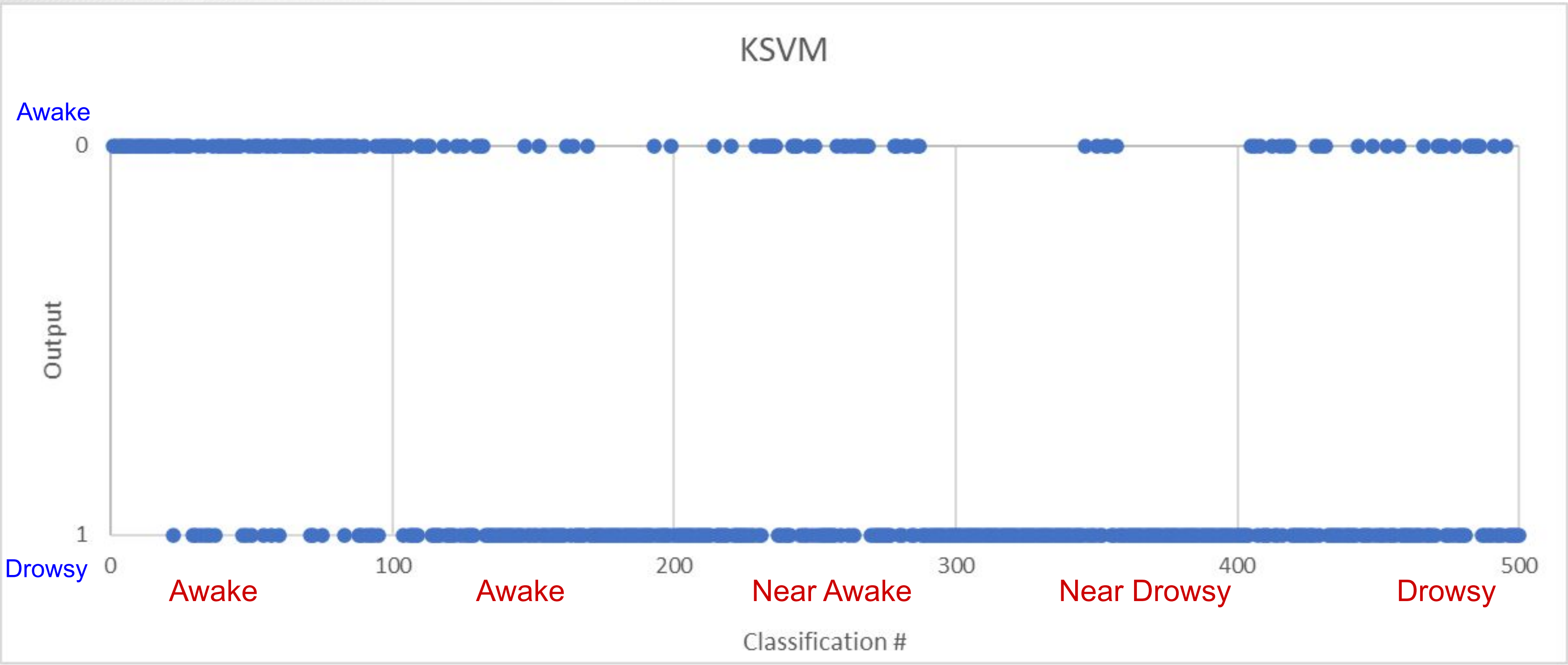
Ali Imran

Accomplishments since last update 15 hrs of effors	Ongoing progress/problems and plans until the next presentation
- Implemented RNN - Implemented RNN-CNN hybrid - Collected and tested “long session” data	- Continue to test the current models (KSVM, basic NN, RNN, RCNN)

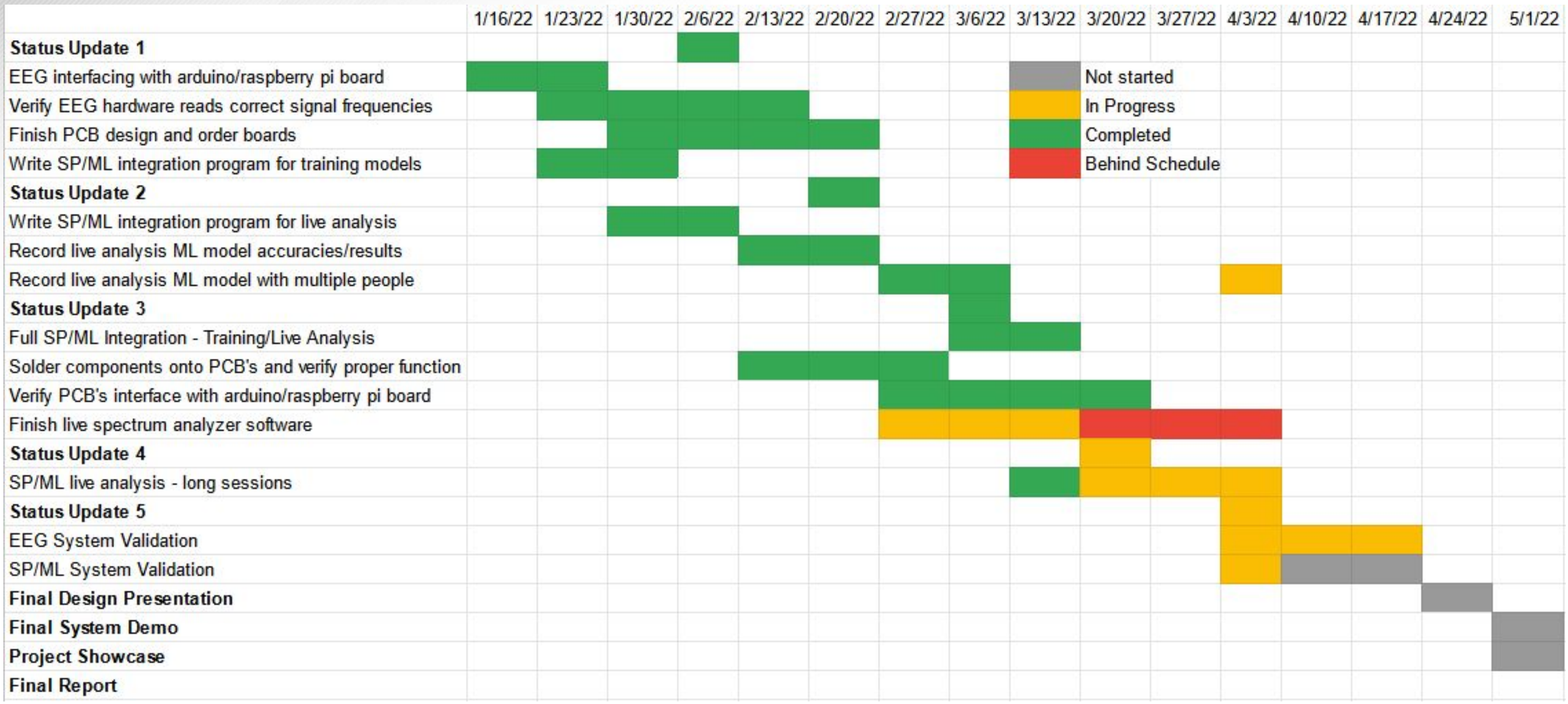
Ali Imran


RCNN
true_output
binary_output
Awake
0.0
0.5
1.0
Output
Drowsy
0
Awake
100
Awake
200
Near Awake
300
Near Drowsy
400
Drowsy
500
Classification #

Ali Imran


KSVM
Awake
Drowsy
0
1
Output
0
100
200
300
400
500
Awake
Awake
Near Awake
Near Drowsy
Drowsy
Classification #

Execution Timeline



Execution & Validation Plan

Driver Drowsiness Detection Validation Plan:
ML/SP - Machine Learning/Signal Processing

Test Name	Success Criteria	Methodology	Result	Owner
ML/SP Accuracy	> 90% success rate	Collect strongly labeled data (fully awake/drowsy) in real time of Coady/Ali and ensure classification accuracy is above 90% over 5-minute intervals	Exceeded on existing datasets (up to 97%)	Ali, Coady
ML/SP Performance	For 5 second chunk of data, output drowsiness state in < 5 seconds	Send a 5 second chunk of real-time data to ML/SP and ensure a classification is output within the next 5 seconds	Exceeded, smallest accurate classification interval at 2.5 seconds	Ali, Coady
ML/SP New Individual	For a new individual who hasn't had their data trained on the models, attain an accuracy of > 70%	Collect new individual's data in real-time and ensure classification accuracy is above 70% over 5-minute intervals	Currently very low accuracies	Ali, Coady
ML/SP Transition Detection	System is able to plot the point when someone goes from awake to drowsy	Collect data over a long session of Coady/Ali when going from an awake to drowsy state and plot the classification over time	For Ali's data, RCNN successfully classifies awake into drowsy, tends toward drowsy	Ali, Coady
EEG Filter Lower Limit	f=8-12 Hz	When we close our eyes for a short period of time there should be a spike on our FFT spectrum analyzer in the range of 8-12 Hz	Untested	Dakota
EEG Filter Upper Limit	f<=30 Hz	Our upper frequency range of fatigue is 30 Hz and want to test if power line interference (around 60 Hz) spikes which would cause noise and misreadings.	Untested	Dakota
EEG Amplifier Gain	G = 80+	Gain from Instrumentation amplifier close to 100 to properly amplify our signal voltages to a readable and manipulative level.	Untested	Dakota
Amplified Final Voltage Readings	0.148<V<0.81172 But V<1.3 V	Final voltage readings have amplified from millivolts to volts	Passed	Dakota
Amplified Final Voltage Readings (Min/Max)	Max Input: 10 Hz, 30uV Min Input: 1000 Hz, 20 uV	Final voltage readings have amplified from microvolts to volts (Max and Min Readings)	Untested	Dakota
System voltage input	6 V	Verifying components receive proper operating voltages to function correctly.	Regulated to +-5V	All
Peak Power Consumption	2 W	To be used to determine how long the device can last running off AA batteries and efficiency of the device.	Untested	All

Thanks for listening!
Questions?