Dwight Look College of ENGINEERING
TEXAS A&M UNIVERSITY

Team 61: Driver Drowsiness Detection
Bi-Weekly Update 3

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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

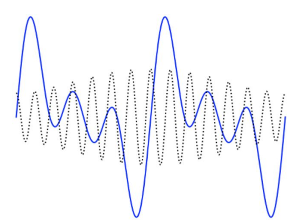
- Collect data
- Muse 2 EEG device

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

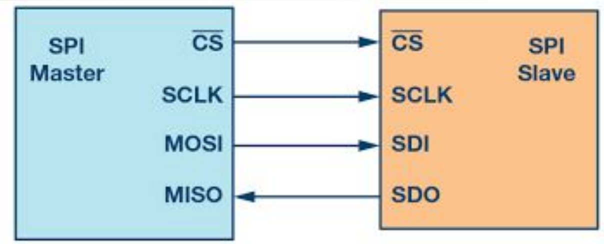
January	February	March	April
SP/ML Light Integration	SP/ML Live Analysis Full Integration	Model Refinements	System Verifications
EEG/MCU Interfacing	Classification Testing	Transition State Classification Testing	Integration of SP/ML & EEG (stretch goal)
	EEG PCB Complete	Live spectrum analyzer for EEG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

Dakota Mouton

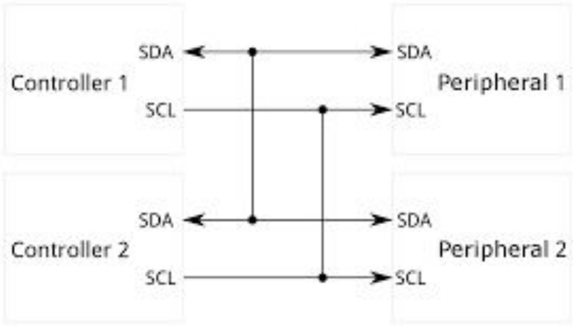
Accomplishments since last update 20 hrs of effort	Ongoing progress/problems and plans until the next presentation
• PCB has been ordered and should be here by end of week or beginning of next week.	• Finishing live spectrum analyzer program for EEG. • Fixing software to take in SPI and I2C serial communication for data input. • Soldering PCB and starting validations.

Dakota Mouton

Serial Peripheral Interface (SPI)



Inter-Integrated Circuit (I2C)



- Hardware verified and PCB ordered for final integration.
- Was using built-in ADC on arduino to analyze the analog signal from EEG for hardware verification but am now using the ADC from my circuit to communicate digital data to the arduino to then be processed.
- This involves using I2C and SPI serial communication between my circuit's ADC and the Arduino/raspberry pi.
- Trying to use I2C with breadboard prototype when the throughhole ADC uses SPI instead. Currently switching the program to take in that data protocol instead.
- The PCB SMD ADC does use I2C so the program will also be using that protocol to receive data.

Coady Lewis

Accomplishments since last update 7 hrs of effort	Ongoing progress/problems and plans until the next presentation
-More testing of live classification on totally new data. -Tried several existing parameter settings -Collected data in transition state	-Clean up code. -Try to make adjustments in frequency band limits and window size to improve live output. -Experiment with an average of the outputs.

Coady Lewis

-The model tends toward drowsy on the new datasets

-This is not necessarily bad, but awake accuracy still needs to be improved

-Ex: Two new 8 minute datasets, one drowsy and one awake

```
[1]
drowsy


Drowsy Fraction = 0.9142857142857143

Awake Fraction = 0.08571428571428572

Output Count = 70

Computation Time = 0.2593064308166504 s
```

```
[0]
awake


Drowsy Fraction = 0.24675324675324675

Awake Fraction = 0.7532467532467533

Output Count = 77

Computation Time = 0.23537015914916992 s
```

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Ali Imran

Accomplishments since last update 7 hrs of effort (19 total)	Ongoing progress/problems and plans until the next presentation
- Completed live analysis graph showing classification outputs in real time	- Collect more “grey area” data for testing then training - Test model on new person

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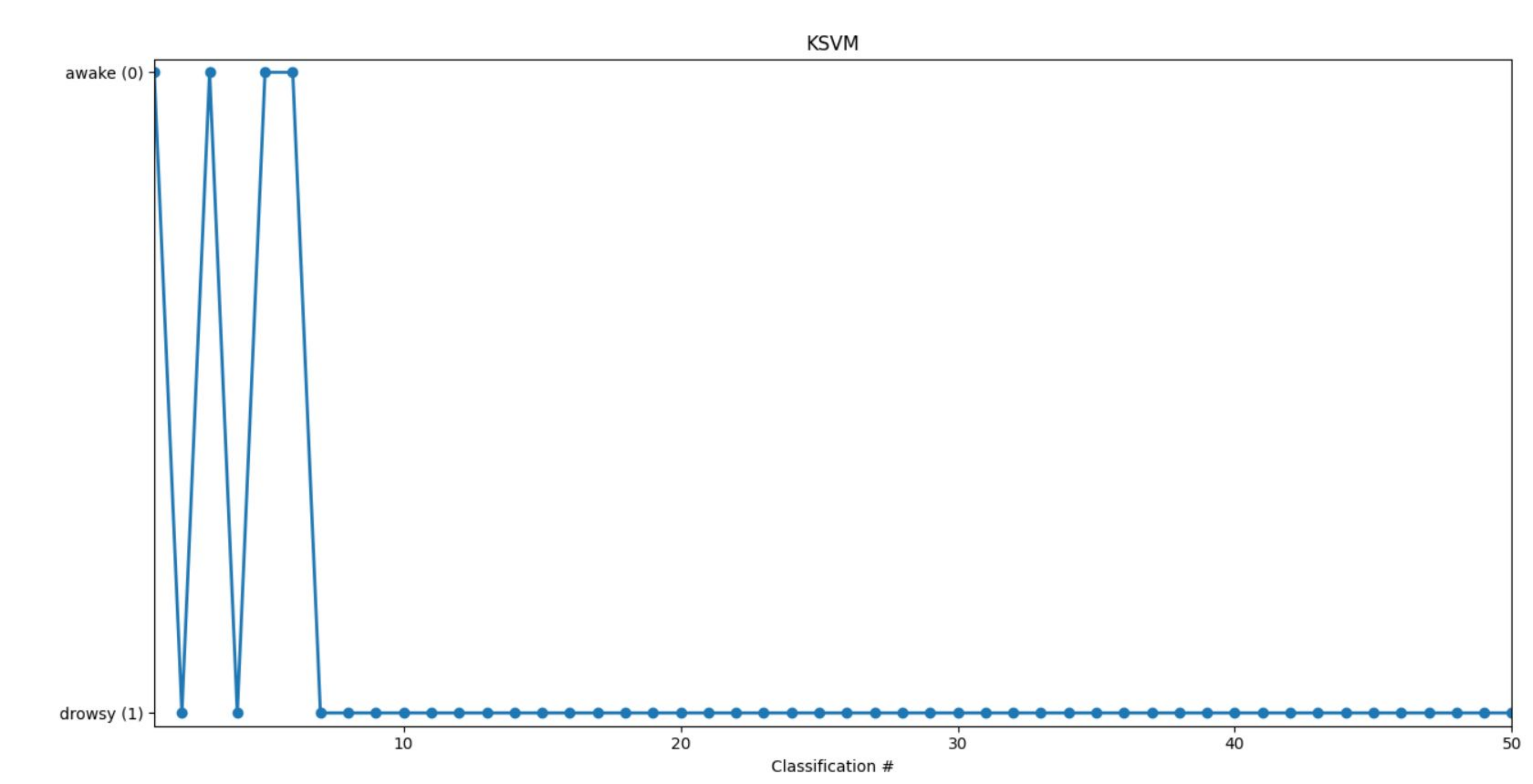
Ali Imran

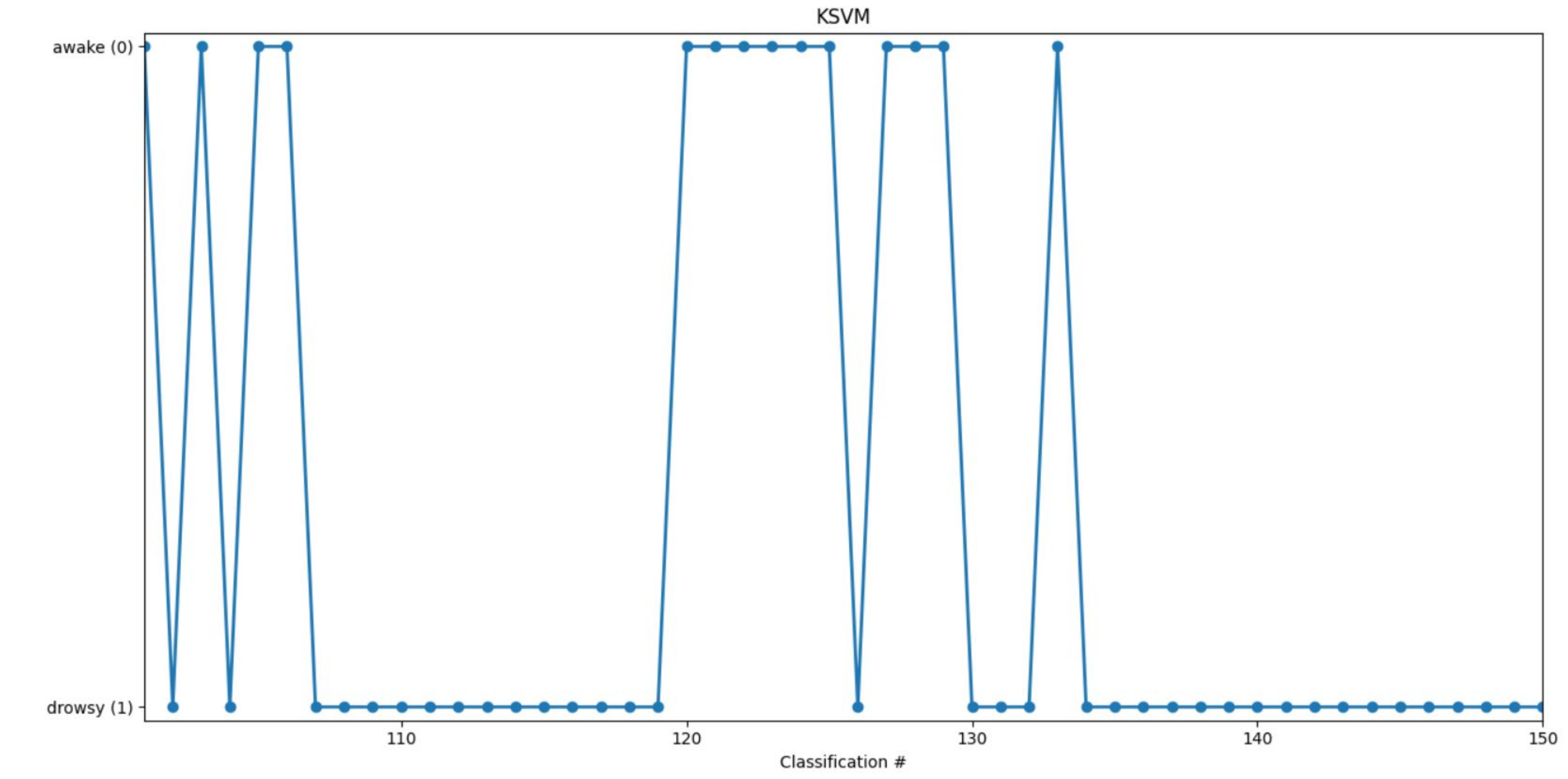


New drowsy data from Coady

Data: 1-50 (0 - 4.2 min)

Parameters: W=1280, A=100

Ali Imran

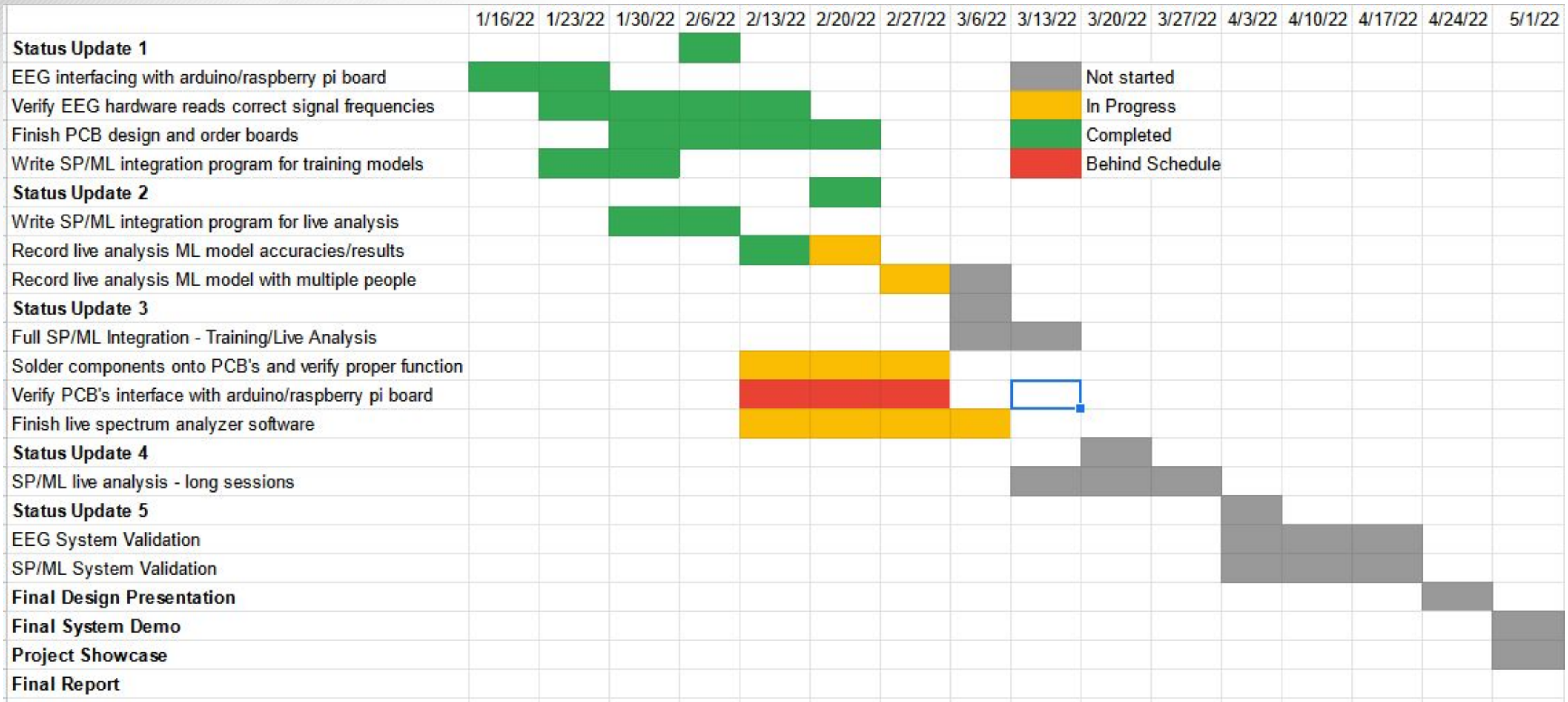


New drowsy data from Coady

Data: 101-150 (8.3 - 12.5 min)

Parameters: W=1280, A=100

Execution Timeline



Execution & Validation Plan

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

Task	Specification	Result	Owner
ML/SP Integrated System Accuracy	> 90% success rate	Exceeded on existing datasets (up to 97%)	Ali, Coady
ML/SP Integrated System Performance	For 30 second chunk of data, output drowsiness state in < 30 seconds	Exceeded, smallest accurate classification interval at 2.5 seconds	Ali, Coady
EEG Filters below 8 Hz	f>=8 Hz	Untested	Dakota
EEG Filters Above 30 Hz	f<=30 Hz	Untested	Dakota
Gain from Instrumentation Amplifier close to 100	G = 80+	Untested	Dakota
Final voltage readings have amplified from microvolts to volts	0.148<V<0.81172 But V<1 Input 15 Hz, 30uV	Untested	Dakota
Final voltage readings have amplified from microvolts to volts (Max and Min Readings)	Max Input: 10 Hz, 30uV Min Input: 1000 Hz, 20 uV	Untested	Dakota
System voltage input	6 V	Regulated to +-5V	All
Peak Power Consumption	2 W	Untested	All

Thanks for listening!
Questions?