Dwight Look College of ENGINEERING
TEXAS A&M UNIVERSITY

Team 34: Portable High Energy Experiment (PHEE) DAQ

Bi-Weekly Update 5

Team Members: Ethan Barnes
John Sabra
Sang Hoon Chung

Sponsor: Michelle Chatter
Sandia National Laboratories

TA: Logan Smith

Project Summary

Sandia National Laboratories

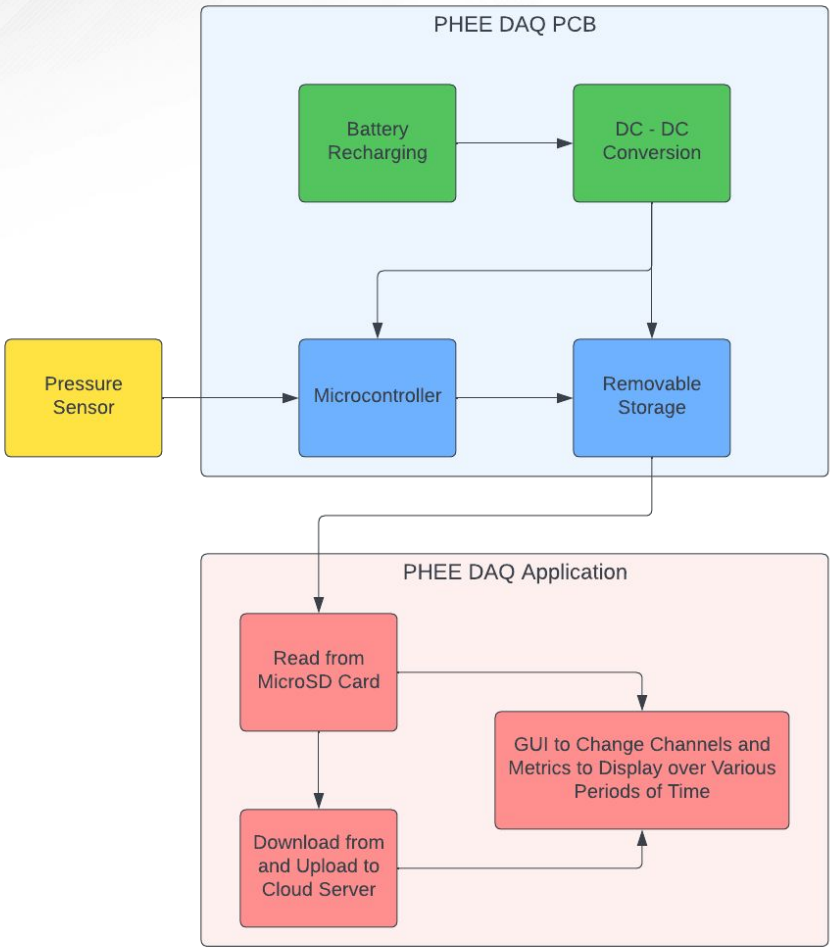
Problem statement:

- The United States military possesses about 5500 nuclear weapons in its stockpile
- The security of these weapons and equipment is paramount when they are transported for storage and testing
- Sandia is interested in detecting explosive-type events in sensitive areas
  - Exact application for DAQ system may not be disclosed

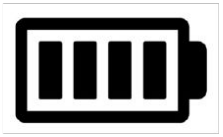
The Portable High Energy DAQ System will:

- Protect government equipment by detecting and identifying explosives within a 100 ft range
  - Utilizes accelerometer and pressure sensor to classify if an explosive event occurred
- Write output to removable storage device
  - User will be able to refer to and perform analysis on past data

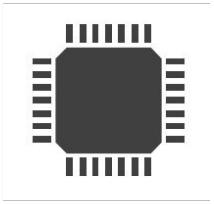
System Overview



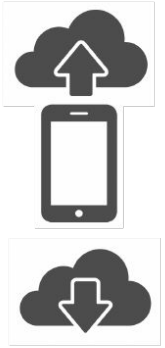
Johnny Sabra



Ethan Barnes



Sang Hoon Chung



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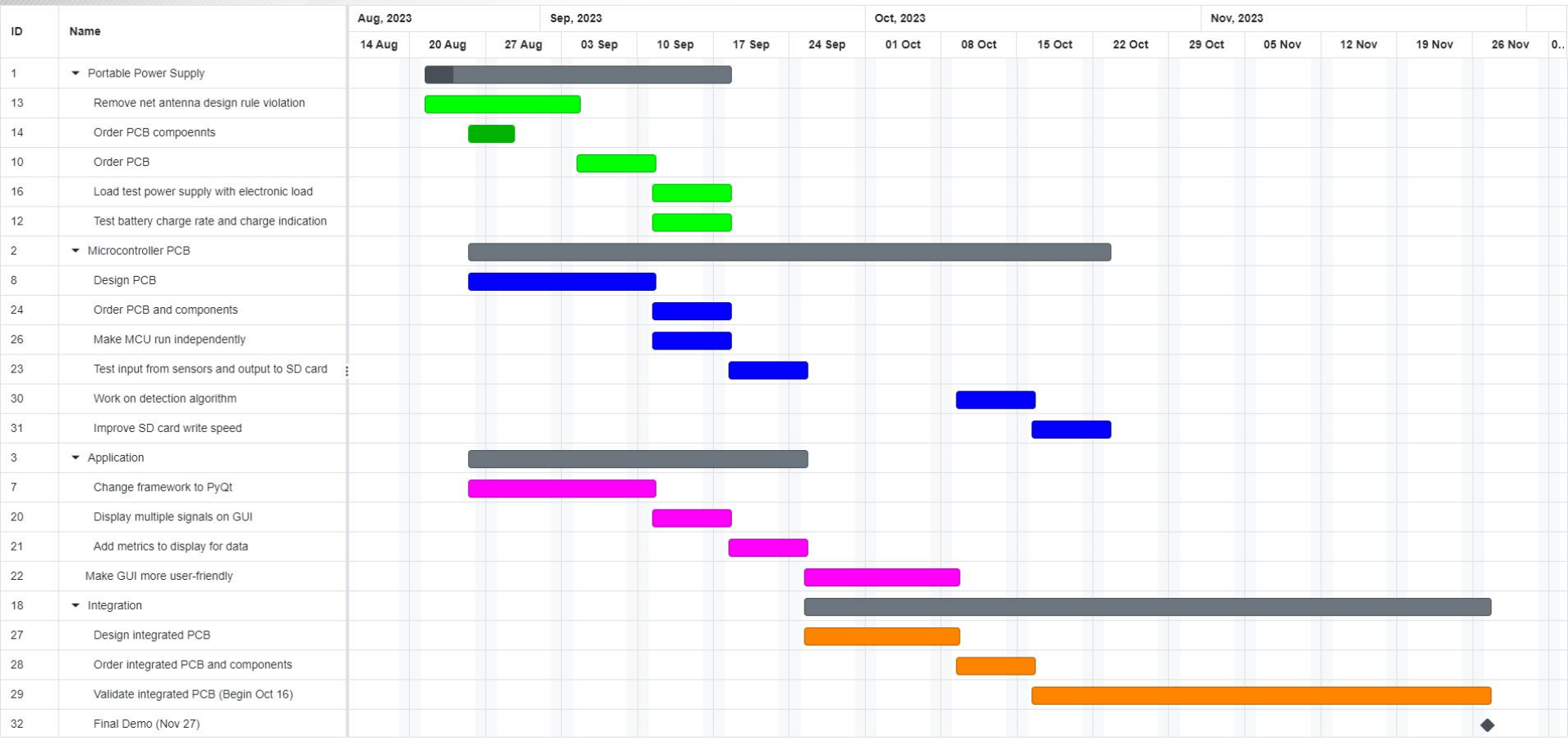
Team: PHEE DAQ (Sandia)

	9/10	9/24	10/8	10/22	11/5
Johnny	PCB Ordered	Power supply PCB validated	Charging feature validated	Integrated PCB design complete	Integrated PCB is functional
	Zero design violations in Altium	Regulates 3.3 V under 40mA load and 5 V under 120 mA load (estimated load current of MCU)	Can charge a 3-cell lipo battery at 1C rate		
Ethan	PCB design complete	MCU runs independently	PCB is functional	Zero design violations in Altium	Can be powered with 3.3V source and can read from sensors and write to SD card at more than 2 kHz Integrated PCB is portable with power supply regulating battery voltage to 3.3 and 5V under load
	Zero design violations in Altium	Program will start and stop from GPIO outside of debug mode	Powered with 3.3 V source, can write to SD card at ~2 kHz Pressure sensors test pending		
Sang Hoon	Change Framework to PyQt and Design multiple signals on GUI	Add more metrics to display for data	Make GUI more user-friendly	Finalizing the program and adopting the software	Validate and test communication between subsystems
	Check the application shows whole sensors data	Add more metrics and check availability of the result Display via the application at next column	Ask opinions to other people about the design of GUI	Check the software works when we download the software itself as .exe file	Application can read data from SD card in desired format (time, explosion, pressure, acceleration)

Execution


ID
Name
Aug, 2023
Sep, 2023
Oct, 2023
Nov, 2023
14 Aug
20 Aug
27 Aug
03 Sep
10 Sep
17 Sep
24 Sep
01 Oct
08 Oct
15 Oct
22 Oct
29 Oct
05 Nov
12 Nov
19 Nov
26 Nov
1 Portable Power Supply
13 Remove net antenna design rule violation
14 Order PCB compoennts
10 Order PCB
16 Load test power supply with electronic load
12 Test battery charge rate and charge indication
2 Microcontroller PCB
8 Design PCB
24 Order PCB and components
26 Make MCU run independently
23 Test input from sensors and output to SD card
30 Work on detection algorithm
31 Improve SD card write speed
3 Application
7 Change framework to PyQt
20 Display multiple signals on GUI
21 Add metrics to display for data
22 Make GUI more user-friendly
18 Integration
27 Design integrated PCB
28 Order integrated PCB and components
29 Validate integrated PCB (Begin Oct 16)
32 Final Demo (Nov 27)

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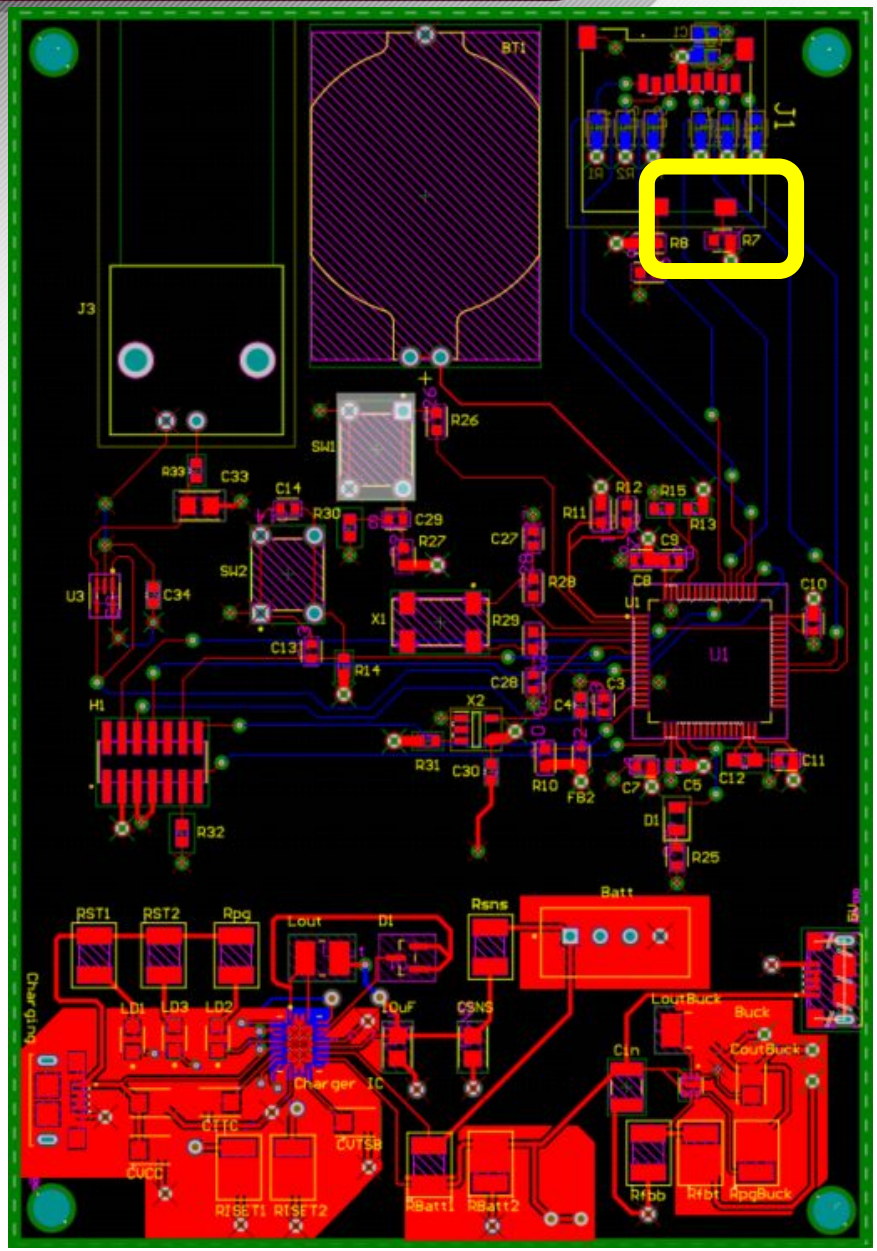
PHEE DAQ System

Johnny Sabra & Ethan Barnes

Accomplishments since the last presentation <20> hrs	Ongoing progress/problems and plans until the next presentation
• Power supply tested with range of input voltages when expected is 5V • SD card footprint corrected • Integrated PCB ordered and arriving Friday 10/27	• MCU cannot detect SD card • Data cannot be written to SD card - footprint error where pad is shorted to SD socket casing • Integrated PCB must be soldered and validated

Input Voltage (V)	**3.7 V**	**4.5 V**
Output Voltage (V)	3.289	3.311



- Integrated PCB
  - SD card reader footprint corrected by moving SDIO_CD pad 40 mil to the right to provide more clearance for the case
- Polygons added for better heat dissipation
- Power ground outputs corrected at the output of battery charger
- Arriving this Friday 10/27

Port 0 ×

```
SD card mounted successfully...
ERROR: no 1 in creating file *adc_data.csv*
ERROR: no 1 in creating file *adc_data.csv*
Time wasted making saving buffer data and creating new buffer file: 1
ERROR: no 1 in creating file *adc_data.csv*
Time wasted making saving buffer data and creating new buffer file: 0
ERROR: no 1 in creating file *adc_data.csv*
Time wasted making saving buffer data and creating new buffer file: 0
```

SD card mounts correctly, but files cannot be created due to FatFs FR_DISK_ERR

When code is run on the NUCLEO development board, files can be created and values are written to files as expected

BATCH_0.CSV

File Edit View

```
batch,time,explosion,audio,pressure,acceleration,delta_audio
0,0,0,256,57,405,d = 0
0,0,1,765,126,508,d = 509
0,0,1,1069,194,521,d = 304
0,0,1,1203,268,522,d = 134
0,0,1,861,369,593,d = 0
0,0,1,270,515,621,d = 0
0,0,0,0,447,653,d = 0
0,0,1,0,505,0,d = 0
0,0,1,0,562,0,d = 0
0,0,1,880,0,337,d = 880
0,0,1,1204,0,314,d = 324
0,0,0,1079,0,300,d = 0
0,0,0,746,0,275,d = 0
0,0,0,245,0,254,d = 0
0,0,0,0,0,236,d = 0
0,0,0,0,0,0,d = 0
0,0,0,0,0,0,d = 0
0,0,0,0,0,0,d = 0
0,0,1,0,0,100,d = 0
0,0,1,0,0,148,d = 0
0,0,1,559,0,69,d = 559
0,0,1,1061,0,0,d = 502
0,0,1,1251,0,0,d = 190
0,0,0,1091,0,0,d = 0
```

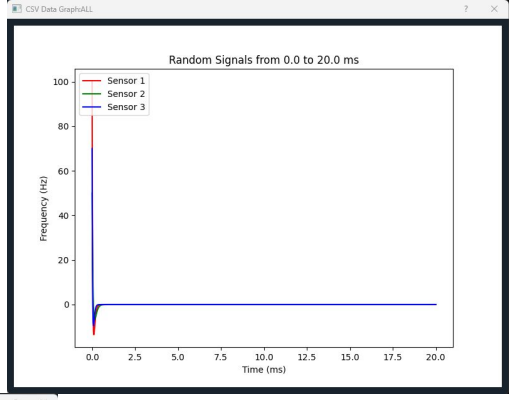
Ln 1, Col 1 100% Windows (CRLF)

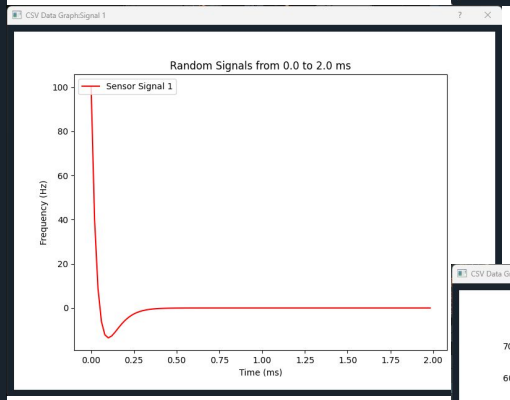
Application

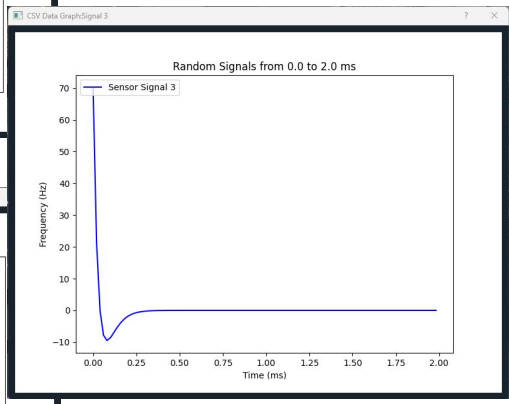
Sang Hoon Chung

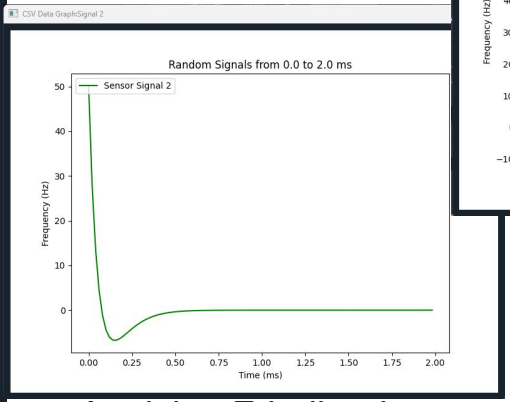
Accomplishments since the last presentation <9> hrs	Ongoing progress/problems and plans until the next presentation
• Simulate the app with the Friedlander waveform which is similar to the blast wave • Check the software recognize the SD card or external Drive	• Validate and test communication between subsystems. • Keep communicate with sponsor and fix any changes.

How the app for GUI works









Applying Friedlander waveform CSV file to analyze the signal with the application.

Thank you!

Questions?