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ENGINEERING
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Team 38: Fuel Cell Monitor
Bi-Weekly Update 4

Russell Wells
Rana Kortam
Sameer Osama
Jessica Odutola
Sponsor: John Lusher
TA: Dalton Cyr

Project Summary

- Problem statement: A single fuel cell is an easy power source to monitor, but to achieve any level of real usable power they must be connected in a stack. If only monitored as a whole, each cell would have to be tested individually to determine the issue. This causes longer down times and more technician wages to trouble shoot.
- The Fuel Cell Monitor System will give the operator real time voltages of both the individual cells and stack. The voltages will be monitorable from an android based mobile app. In case of over or under voltage, the app will notify the operator of not only the error but which cell has fallen or risen outside of expected ranges. Saving both time and money for repairs.

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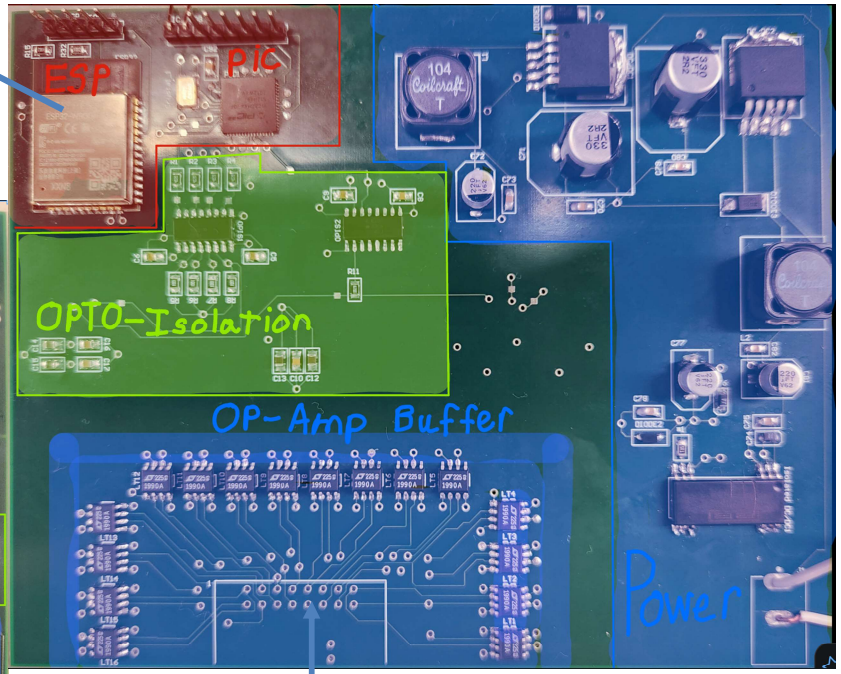
Fuel Cell Monitor Integrated System Diagram

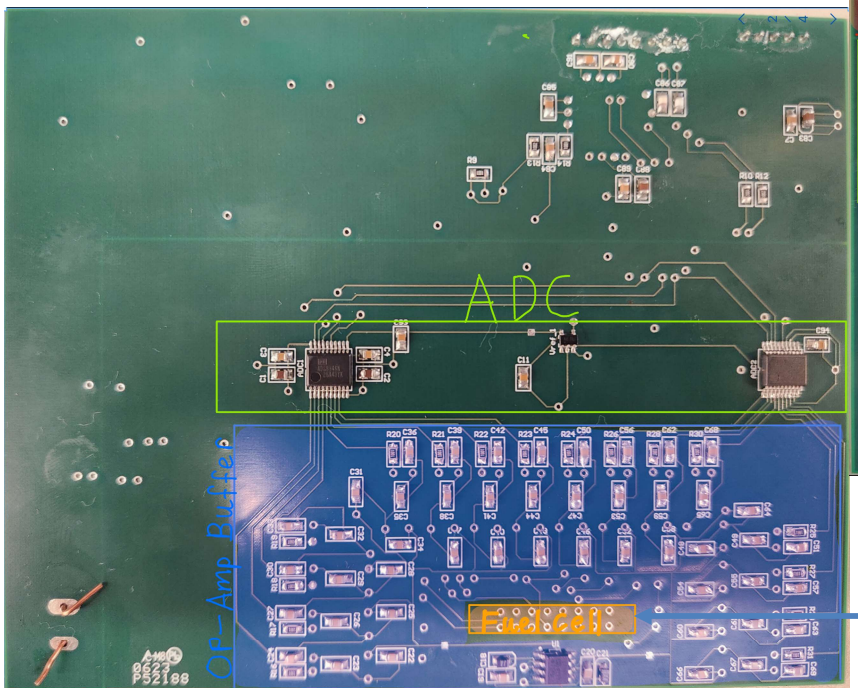
Sameer Osama
Russell Wells
Rana Kortam
Jessica Odutola

Fuel Cell Monitor Application

- Error Detection: No errors detected
- Individual Fuel Cells
- Historical Trends
- Check Status

Data Base



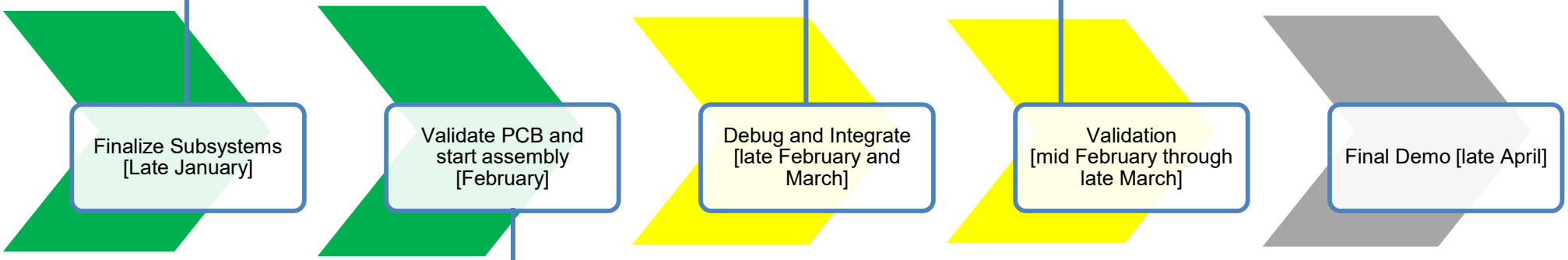


Fuel Cell Stack

Project Timeline

Power system issue resolved, Burnt out Op-Amp was the issues. SPI communication validated.

PIC is not manipulating chip select for each device. The ADC's do not recognize the data being transmitted to them.



Board is soldered and ESP/PIC32 have been successfully flashed.

Sameer Osama

Accomplishments since Update 3 8 hrs of effort	Ongoing progress/problems and plans until the next presentation
- Integrated power supply on PCB	- Ongoing: Testing current each component can handle (0A – 1A) while providing correct output voltages - Future: Testing negative voltages on buffer system

Sameer Osama

-DC/DC converters output correct voltages from 0A – 1A

-Isolated DC/DC converter max current it can handle is .15A while still outputting the voltage required.

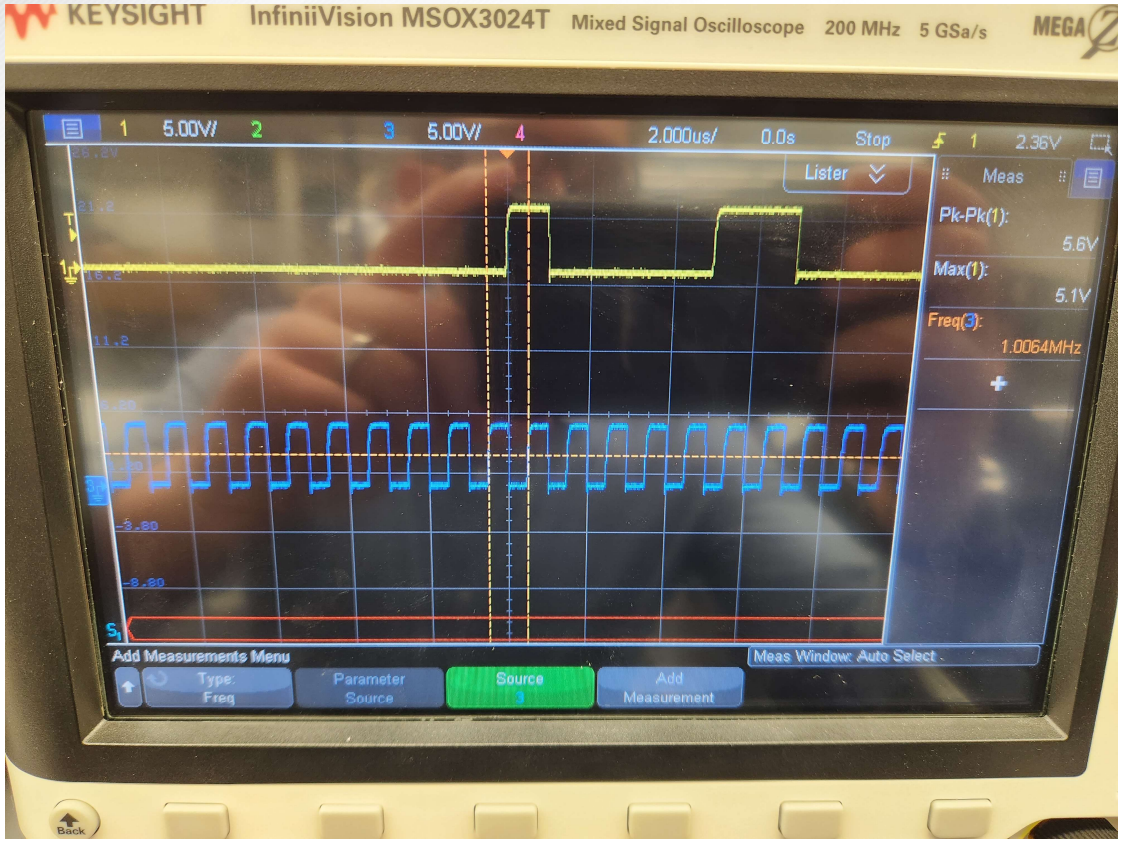
E-load measurements:

3.3V DC/DC		5V DC/DC		Isolated DC/DC	
No Load	Max Load	No Load	Max Load	No Load	Max Load
0A → 3.27V	1A → 3.2V	0A → 5V	1A → 4.9V	0A →5.28V	.15A →4.53V

Russ Wells

Accomplishments since Update 3 40 Hours Worked	Ongoing progress/problems and plans until the next presentation
N/A	Ongoing: -- Testing of SPI communication within the device -- Update PCB Design as needed.

Russ Wells



-- Opto-Isolators are capable of passing signals of up to 1MHz.

--SPI communication is necessary for further testing.

-- In Absence of working SPI communication. The PIC memory will be cleared and an Arduino will be used for testing and validating Internal Signal System and Buffer system.

Rana Kortam

Accomplishments since update 3 40 hrs of effort	Ongoing progress/problems and plans until the next presentation
Validated the SPI communication on Curiosity board	Ongoing: Integrating with ADC; Clock and digital in pin are working, however, both chip select pins are outputting low or high instead of high then low. Future: Complete Integration with ADC and Database

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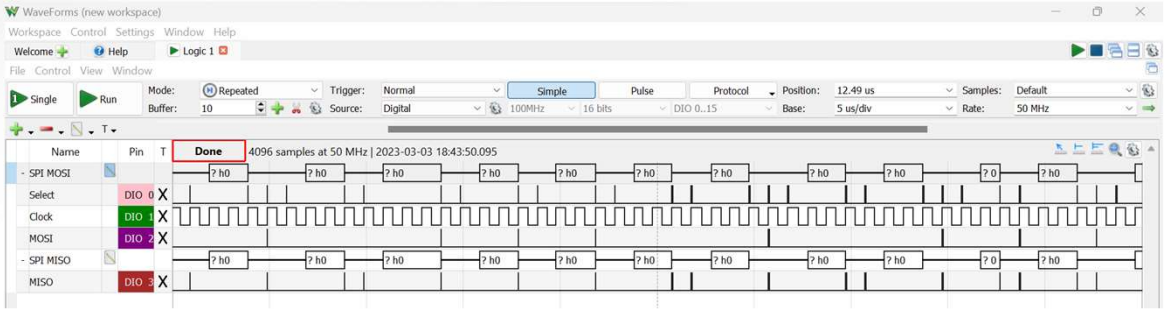
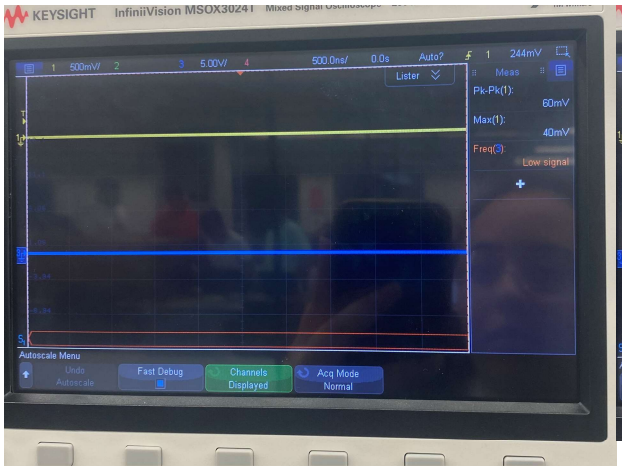
Rana Kortam

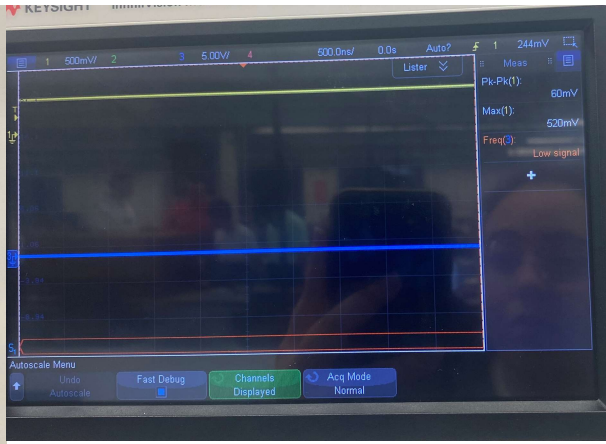
Oscilloscope of Curiosity board



Oscilloscope of clock and digital in

Oscilloscope of chip select

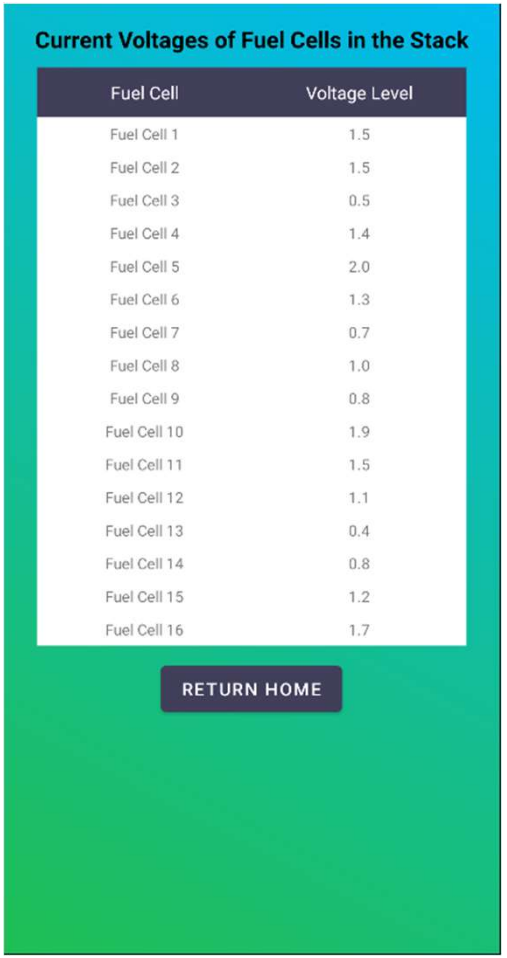




Jessica Odutola

Accomplishments since update 3 40 hrs of effort	Ongoing progress/problems and plans until the next presentation
N/A	- Ongoing: Integration with MCU; Testing and validating edge cases for App Subsystem - Future: Complete integration and validate integrated system

Jessica Odutola



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Execution Plan

	1/17/2023	1/24/2023	1/31/2023	2/7/2023	2/14/2023	2/21/2023	2/28/2023	3/7/2023	3/14/2023	3/21/2023	3/28/2023	4/4/2023	4/11/2023	4/18/2023	4/25/2023		DATE
TEAM DELIVERABLES																	
Solder and Test Power																	Completed
Solder and Test Signal Transfer																	In Progress
Solder and Test Micro Controllers																	Not Started
PCB/System redesign and order for Test Problems and Pactec Enclosure																	Behind Schedule
Full System Assembly and Testing																	
POWER SUBSYSTEM																	
Troubleshoot system																	
Order extra parts if need be																	
INTERNAL SIGNAL SUBSYSTEM																	
Integrated PCB Design																	
Order Integrated PCB																	
MICRO CONTROLLER SUBSYSTEM																	
SPI communication with ADC																	
Review SPI communication with Dr. Lusher																	
Integrate SPI with ADC																	
Order for Test Problems																	
APP SUBSYSTEM																	
App Reads Values from Database																	
Integration with Microcontroller																	
Full System Assembly and Testing																	

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Validation Plan

Paragraph #	Test Name	Success Criteria	Methodology	Status	Responsible Engineer(s)	Notes
3.1.1.1	Mass	Mass of the fuel cell monitor shall be less than or equal to 0.25 kilograms	meaure the fuel cell monitor with digital scale	Untested	Rana	
3.2.1.1	Read full voltage Range	Device is capable of measuring and passing voltages to the database from 0 to 4.096 V	Apply sustained negative voltage	Untested	Russell	
3.2.4.2	discontinuous cell	Device is capable of handling up to twice the maximum measurable voltage input without damage to system	Apply voltages at least 8.192 Volts across a single cell input and check functionality.	Untested	Sameer	
4.3.1	General Error Alerts	App is able to correctly indicate which fuel cell is Low/High and Alerts the User of the situation Via the App.	meaure the fuel cell monitor with digital scale	Untested	Jessica	
4.3.2	User Specified Error Markers	App is capable of succsefully charnging the criteria for alerts	Use the app the manipulate the fuel cell voltage range, apply a voltage outside of the range to one of the cells and monitor the app for the error alert.	Untested	Jessica	
5.1.1.1	Power Outage Restart	Device should power up, reboot, and continue operation after full power disconnect	Disconnect power source for 30 seconds (Allow capacitors to disipate) and reconnect power.	Untested	Rana	
5.1.1.1	System Loop Functionality	A voltage is applied to the fuel cell input, read by the device, reported to the database, and diplayed on the app.	Apply a voltage of 2.048 volts to the first cell input and ensure the data apperas in both the database and is displayed on the app.	Untested	Rana	

Thank you!
Any questions?