Dwight Look College of ENGINEERING
TEXAS A&M UNIVERSITY

Team 16: Solar Power Battery
Bi-Weekly Update 5

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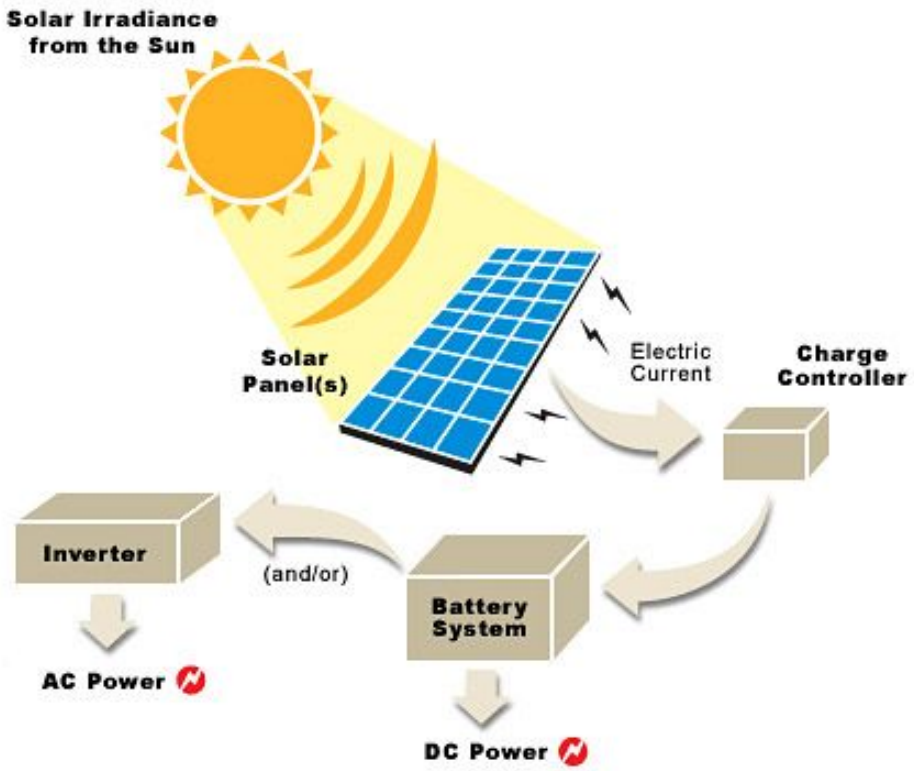
Project Summary

- Problem Statement:
  - Provide the user with an independent solar power generating system that can charge both AC and DC devices

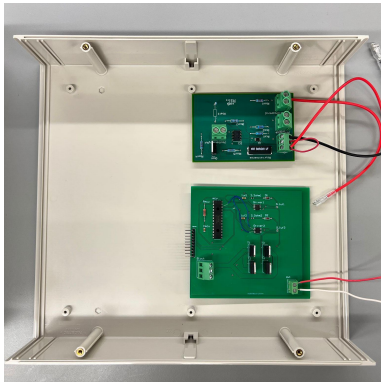
- Solution proposal:
  - Develop independent power grid using a solar panel that can charge the majority of items throughout the day and night. Both AC and DC power provided.



Integrated System Diagram

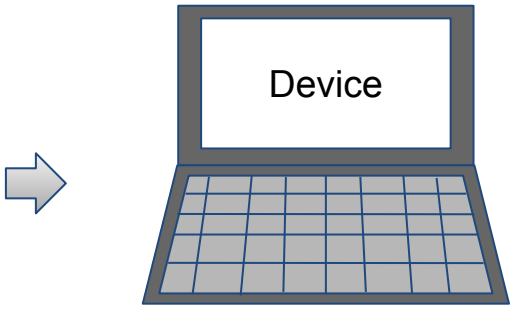
Solar Panel

Top level



Battery Sensor

DC-AC



Bottom level

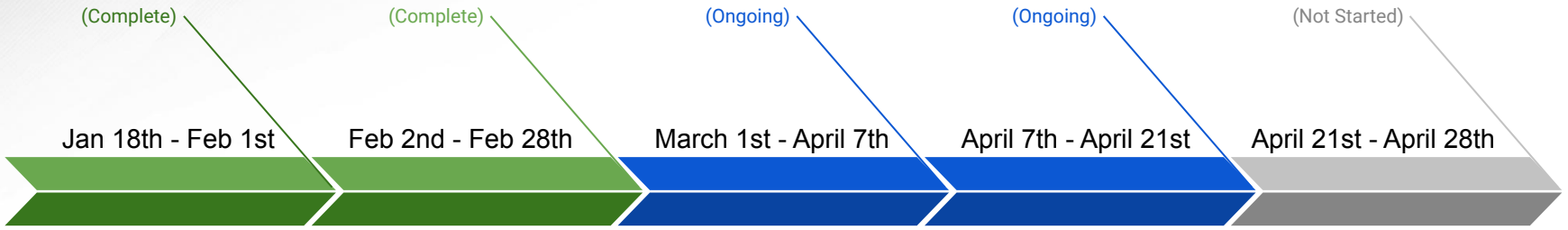
Microcontroller

Output ports

Battery

DC-DC

Project Timeline



Finalize Subsystems

Team members have finalized their designs and making finishing touches on subsystem

Validate Individual Subsystems

Team will finalize and validate individual subsystems

Integration Between Subsystems

ESP32 and Database is undergoing integration for bi-direction communication. Integration between DC-DC and ESP32.still ongoing

Validate System

Through power (Solar) test plans in place.

Final Demo

Team will demo the final completed system

MPPT

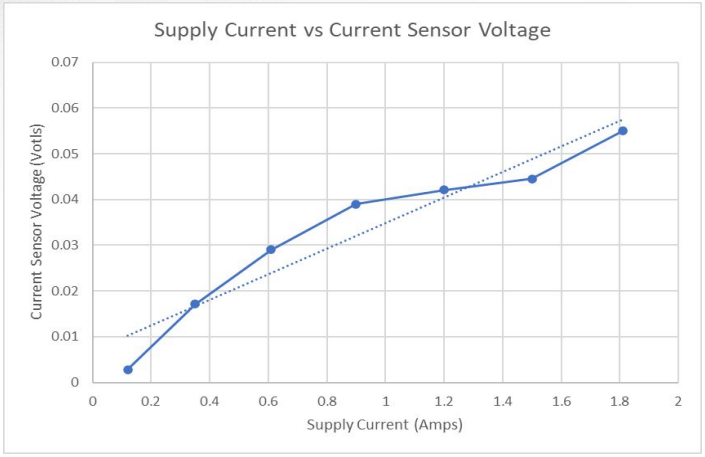
Accomplishments since last update 20 hrs of effort	Ongoing progress/problems and plans until the next presentation
• New voltage regulator working properly	• Adding a new ESP32 to the board today, after burning the old one • Validate all code to ESP32 PCB board and connection to switch/sensors • Integrate DC-DC converter board with ESP32, battery and battery switch/sensor boards together

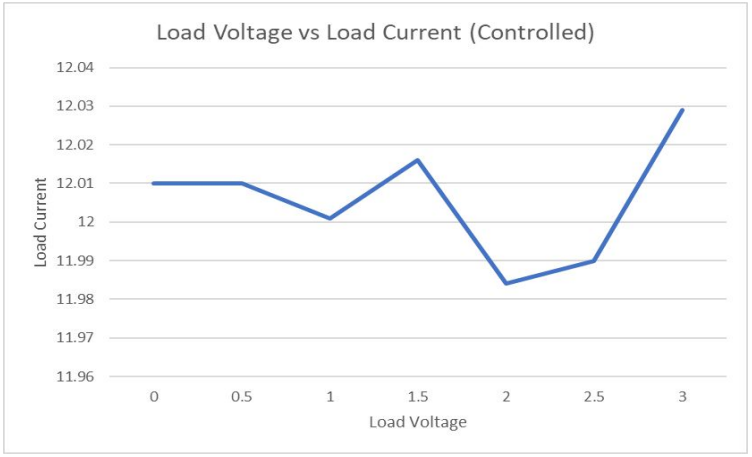
DC-DC Converter

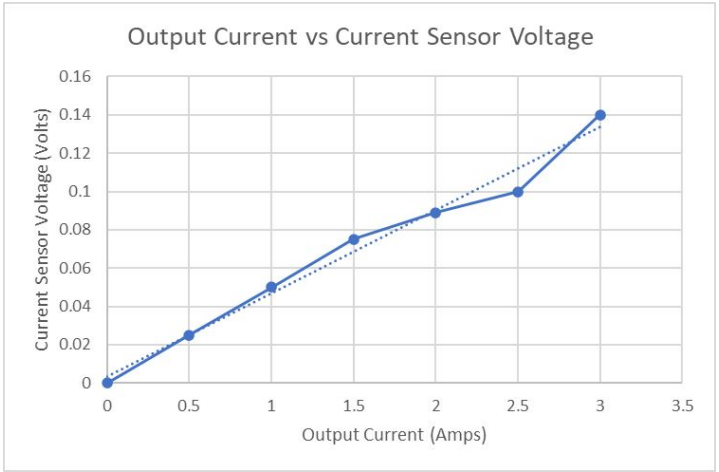
Tarik Dawson

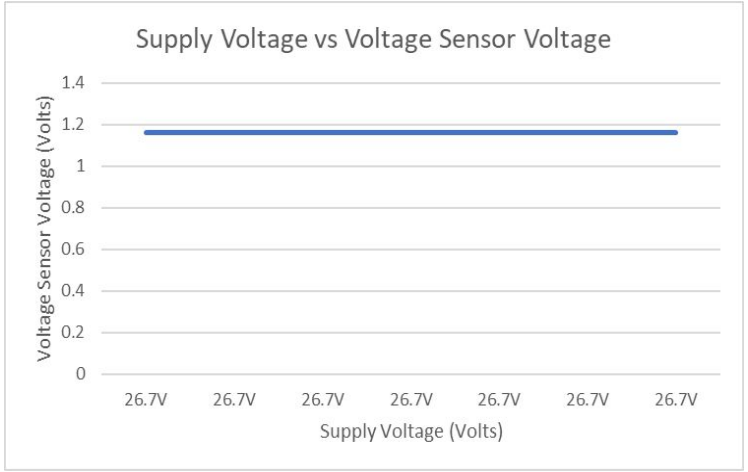
Accomplishments since last update 18 hrs of effort	Ongoing progress/problems and plans until the next presentation
• New board arrived, soldered and tested. Everything in working order. • Tests partially complete • Enclosure arrived and partially modified.	• Further modify enclosure to include other ports • Continue validation tests • Connect Solar Panel and conduct field test/through power solar test

DC-DC Converter









DC-AC Inverter

Accomplishments since last update 23 hrs of effort	Ongoing progress/problems and plans until the next presentation
• Resolved smoking MOSFET problem • Validated inverter operation and output without transformer connected • Touched up PCB design with minor changes	• Significant power loss when connected to transformer • Test inverter system with DC-DC Converter system

DC-AC Inverter

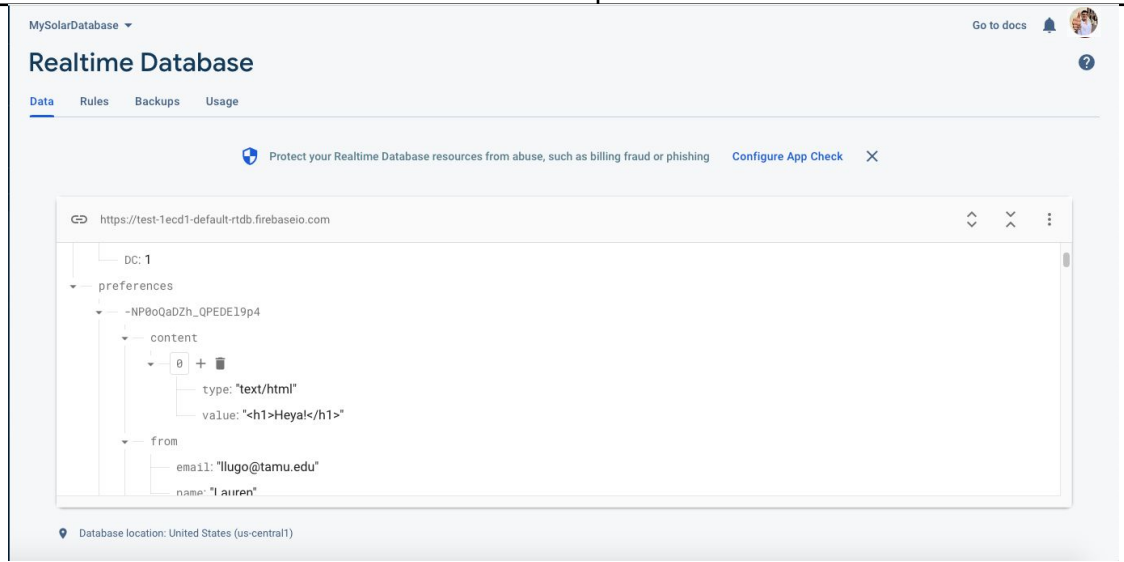
- Inverter produces AC output
  - Output waveform (without transformer) is as expected
    - Modified sine wave, expected amplitude and frequency
    - Vin = 12V, Vout = 10.96V

- Current problems:
  - Significant power loss when connected to transformer
    - Vin set at 12V, drops to 6.3V
    - Vout = 27.65V

- Plans:
  - Test with larger deadband gap in PWM wave
  - Test and validate with other subsystems

Website / Android Application

Accomplishments since last update 17 hrs of effort	Ongoing progress/problems and plans until the next presentation
• Replicated ESP32 environment / code on local laptop • Able to complete first testbench (sending data to backend database)	• Redesign code for final system integration • Validate ESP32 for consistency with large amounts of data being sent • (Website / App has already been validated - just needed backend data)



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Validation Plan

Test Name	Success Criteria	Methodology	Status	Responsible Engineers
Wifi Communication	ESP 32 sends voltage and current data over Wifi	Send different current and voltage values from the ESP32 to the Firebase App over wifi which will be plotted.	UNTESTED	Lauren Lugo, Nathan Gil
Max Power Point Tracking	ESP32 sends the appropriate voltage to the DC-DC Converter to optamize the power output	Under various voltage and currents the system will adjust to the correct the power output.	UNTESTED	Lauren Lugo, Tarik Dawson
Safety System Shut Down	System shut down when not enough power is supplied	When no power is supplied by the solar panel or the battery, the system disconnects all power supplies and	UNTESTED	Full Team
Switch Check	System will switch to battery power when the solar panel is not producing enough; system will open switch when solar panel is	Use multimeter to monitor output voltage to the various subsystems when changing the conditions of the solar panel (sunny,	UNTESTED	Lauren Lugo
Through Power (Solar)	Power flows from the solar panel all the way to both outputs under load	Take the whole system outside and use an ELoad/AC load to ensure power is flowing to the outputs	UNTESTED	Full Team
Through Power (Battery)	Power flows from battery all the way to both outputs under load	Use ELoad/AC load to to ensure power is flowing from the battery to the outputs	UNTESTED	Full Team
Full System Test (Solar)	System power AC and DC loads via Solar panel while providing data	Take the system outside and Load the outputs. Observe functionality and data provided	UNTESTED	Full Team
Full System Test (Battery)	System power AC and DC loads via battery while providing data	Load the outputs and observe functionality and data provided.	UNTESTED	Full Team

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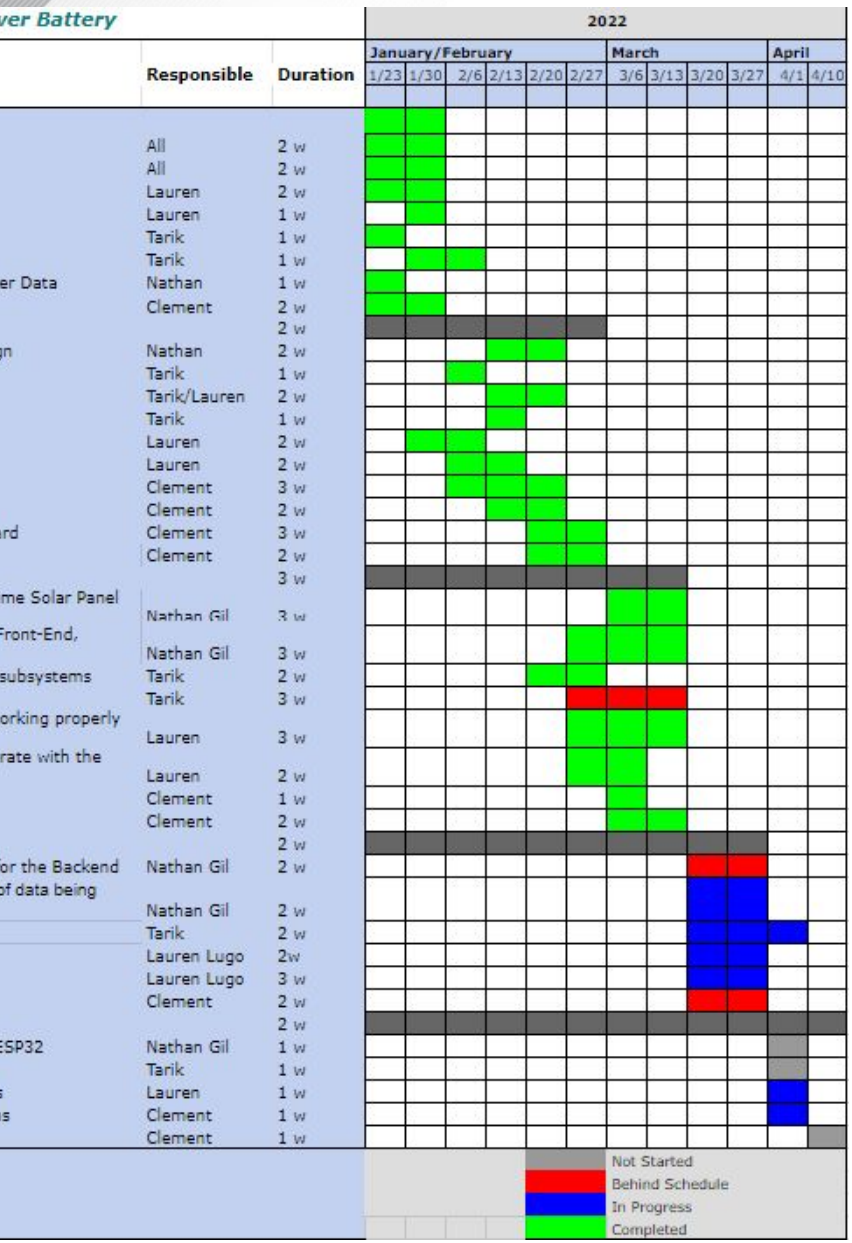
Execution Plan

Solar Power Battery

Deliverable/Task	Responsible	Duration
Status Update 1		
Discuss PCB Breakdown	All	2 w
Review Subsystems	All	2 w
Test all sensors and switches	Lauren	2 w
Connect to wifi	Lauren	1 w
Make PCB for Sensors and Switches	Tarik	1 w
Fix Feedback system	Tarik	1 w
Fix Firebase Backend by Organizing User Data	Nathan	1 w
Finalize inverter design	Clement	2 w
Status Update 2		2 w
Make Final Changes to Front-End Design	Nathan	2 w
Add Senors and Switch into PCB	Tarik	1 w
Order New PCB and Assemble	Tarik/Lauren	2 w
Validate Updated Subsystem	Tarik	1 w
Connect to Database	Lauren	2 w
Update sensor code	Lauren	2 w
Finalize MCU Code for PWM	Clement	3 w
Test H-bridge	Clement	2 w
Build and test full inverter on breadboard	Clement	3 w
Order PCB and all parts	Clement	2 w
Status Update 3		3 w
Create Design for Backend with Real Time Solar Panel Data	Nathan Gil	3 w
Three Way Communication (Backend, Front-End, ESP32)	Nathan Gil	3 w
Integrate DC-DC Converter with other subsystems	Tarik	2 w
Test Battery Charging with Lauren	Tarik	3 w
Check that switches and sensors are working properly on PCB	Lauren	3 w
Ensure that the other system are integrate with the switches and sensors	Lauren	2 w
Implement deadband gap in MCU	Clement	1 w
Solder and begin testing Inverter	Clement	2 w
Status Update 4		2 w
Testing, Validation of Real Time Data for the Backend	Nathan Gil	2 w
Optimization of Code for Front End (lot of data being processed)	Nathan Gil	2 w
Validate with the System	Tarik	2 w
Test and Validate ESP PCB	Lauren Lugo	2w
Test system in various light settings	Lauren Lugo	3 w
Debug and validate Inverter	Clement	2 w
Status Update 5		2 w
Last Fixes for the Backend, Frontend, ESP32	Nathan Gil	1 w
Final Debug for Demo	Tarik	1 w
Clean up code and run final diagnositcs	Lauren	1 w
Integrate inverter with othe subsystems	Clement	1 w
Final Checks/Debug for Demo	Clement	1 w
Annotations		



Thank You!

Questions?