Dwight Look College of
ENGINEERING
TEXAS A&M UNIVERSITY

Team 4: Automatic Solar Lighting System Bi-Weekly Update 2

Atahan Bakanyildiz, Romi Gilat,
Cedar Maxwell, Nick Miller

Sponsor: Wohnyeok Jang
TA: Fahrettin Ay

What is the Automatic Solar Lighting System?

Problem:

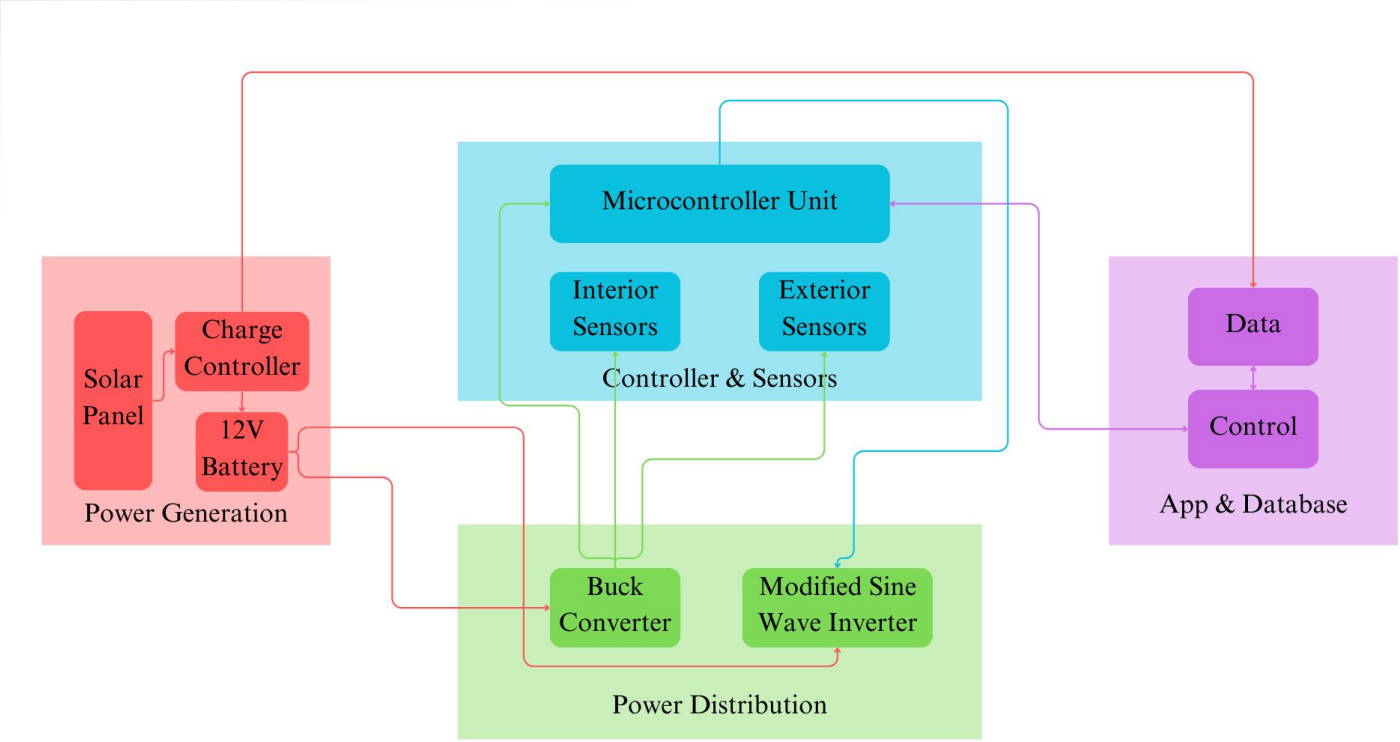
- Increasing grid demand and reliability issues make power outages more frequent.
- Integrating solar energy into homes ensures a dependable and independent power source.
- Solar power provides backup energy during outages, reduces electricity costs, and supports sustainability.

Solution:

- Solar panels provide up to a week of reliable power during emergencies.
- Motion-activated lighting for the foyer and patio ensures security and efficiency.
- Remote control via an app allows convenient access and management of the system.
- Enhances energy independence, cost savings, and sustainability for homeowners.

System Visual

Project/Subsystem Overview



Nick: Power Distribution

Romi: Controller & Sensors

Atahan: Power Generation

Cedar: App & Database

Project Timeline

Subsystems designed and completed testing (to complete by 2/20)	Integration of MCU and Power generation (to complete by 3/7)	Integration of MCU and Android App (completed 3/7)	Integration of MCU and power distribution (to complete by 3/7)	System Test (to complete by 3/21)	Validation (to complete by 3/21)	Demo and Report (to complete by 4/28)

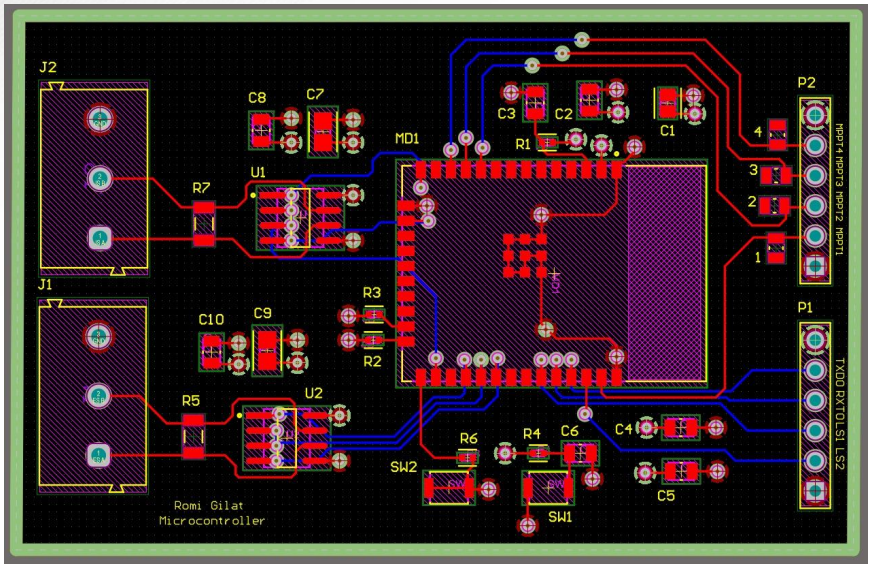
Controller & Sensors

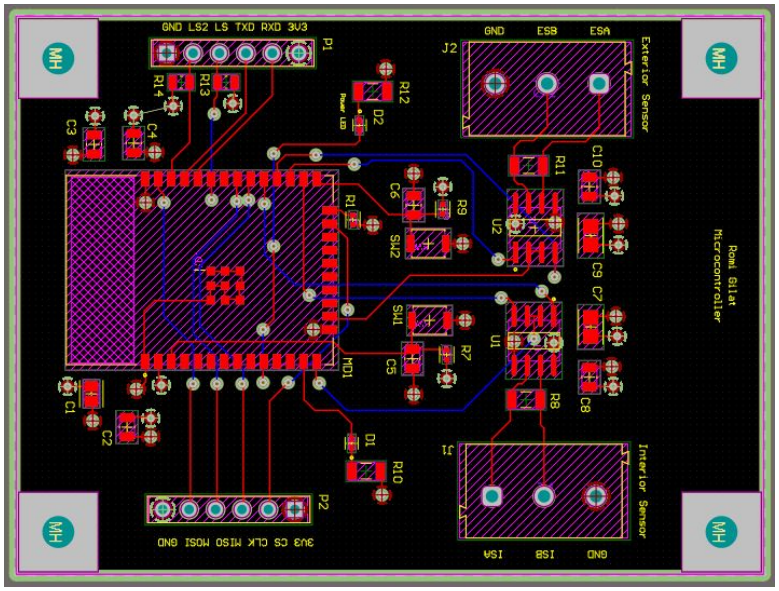
Romi Gilat

Accomplishments since last update 20 hrs of effort	Ongoing progress/problems and plans until the next presentation
PCB Design Complete: ● Completed MCU & Sensor design. ● Reordered PCB and components (estimated arrival Feb 14).	● Complete PCB. ● Test & Validate system. ● By next review will be integrate with App. ● By next review will be tested with power distribution.

Controller

Romi Gilat



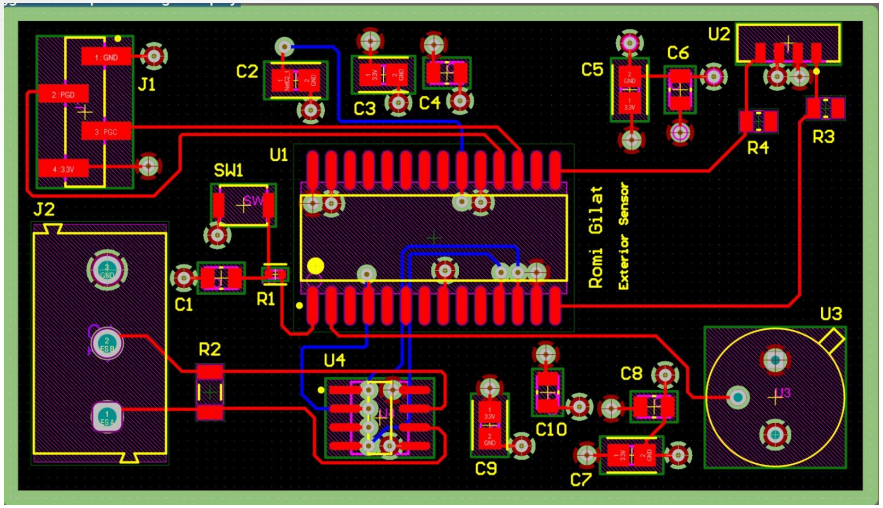


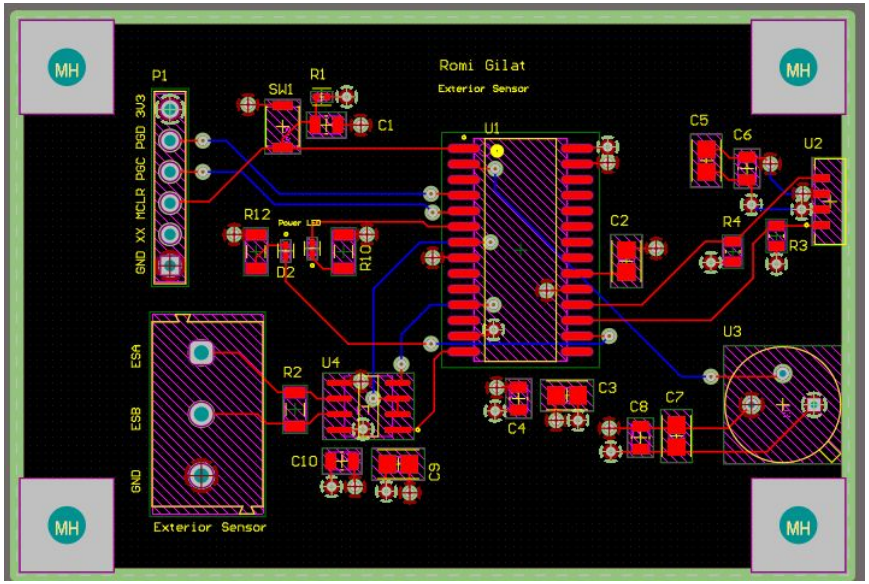
Design differences:

- Design Markings for easier pin location.
- Fixed rotation of wire connections.
- Added screw hole mounts.
- Added LEDs.

Sensors

Romi Gilat





Design differences:

- Design Markings for easier pin placement.
- Fixed rotation of wire connections.
- Added screw hole mounts.
- Added LEDs.
- Added MCLR pin.

Power Generation

Atahan Bakanyildiz

Accomplishments since last update 18 hrs of effort	Ongoing progress/problems and plans until the next presentation
• Completed charge controller pcb in preparation for integration with power distribution. • Completed power management PCB design for integration with MCU.	• Off-the-shelf version of power management integrated with MCU. • PCB for power management built and ready for integration with MCU.

Power Generation

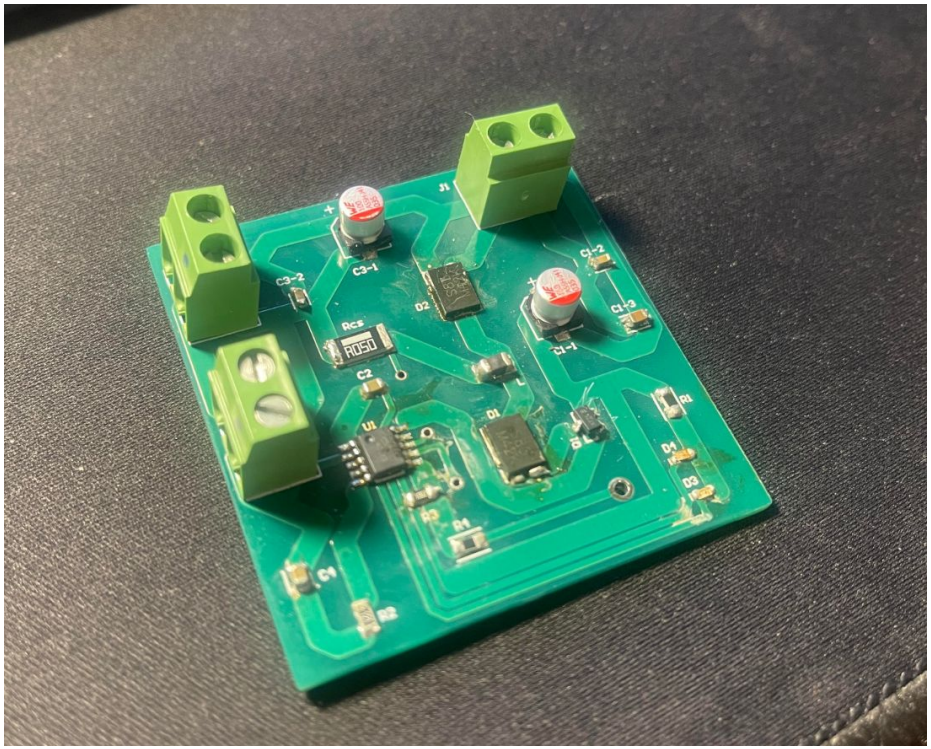
Charge Controller

Charge Controller:

- Fully Operational.
- 85% efficiency.
- MPPT Functionality.
- Overcharge protection.

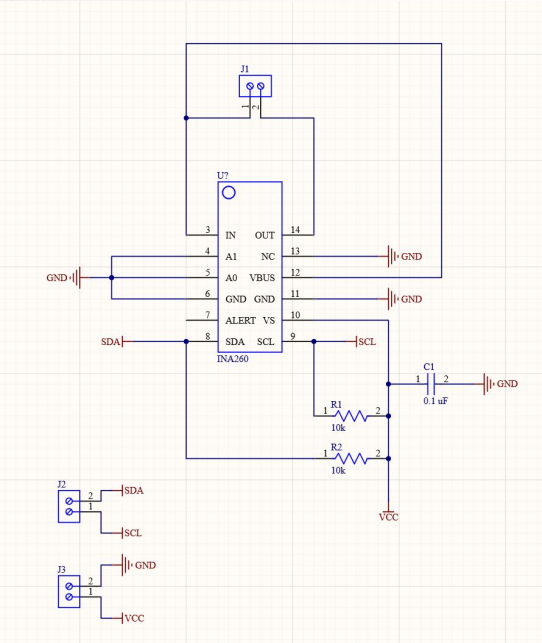
Integration:

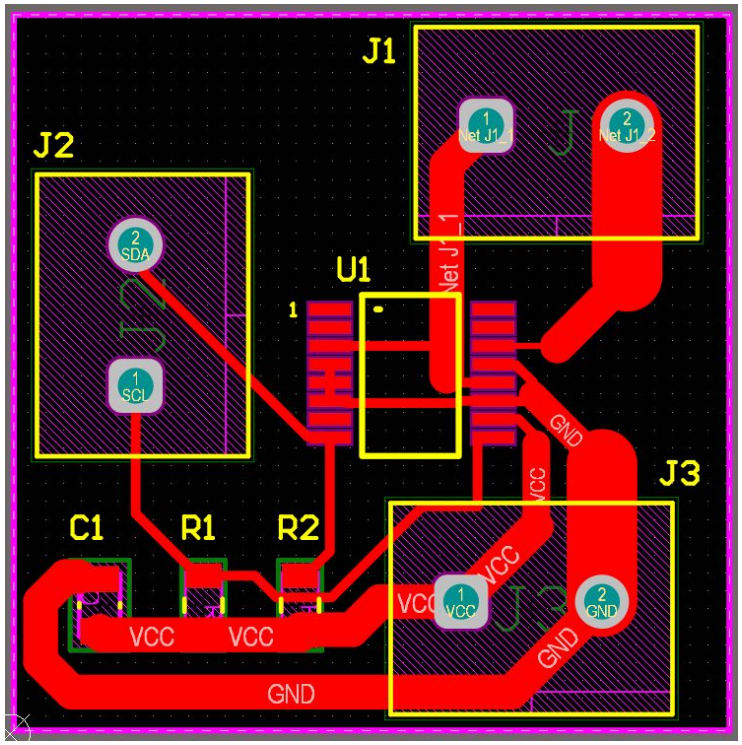
- Works fully with 12V battery.
- battery will be used by power distribution.

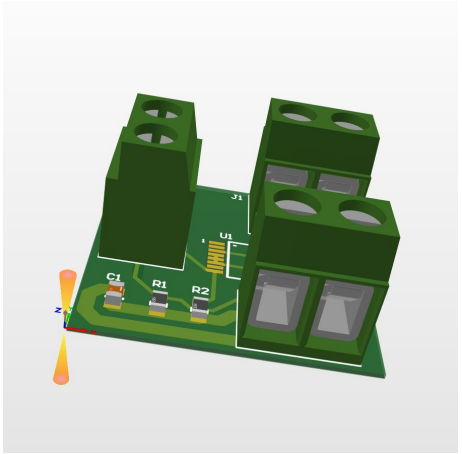


Power Generation

Power Monitor







Power Monitor Schematic & PCB Layouts - Needs to be built and integrated.

App & Database

Cedar Maxwell

Accomplishments since last update 12 hrs of effort	Ongoing progress/problems and plans until the next presentation
• ESP32 successfully transmitting data to Firebase.	• ESP32 to receive/synchronize data with Firebase – in progress. • Integrating new Firebase ESP32 code with existing MCU subsystem code – in progress. • Code to take future actual data from battery meter, etc.: in progress.

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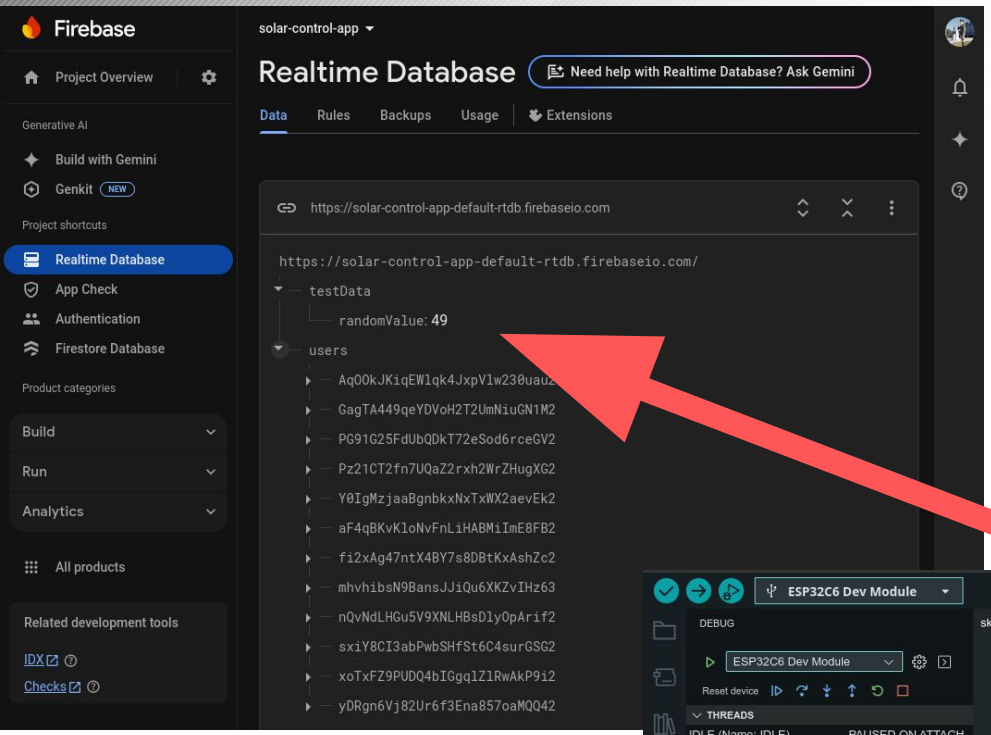
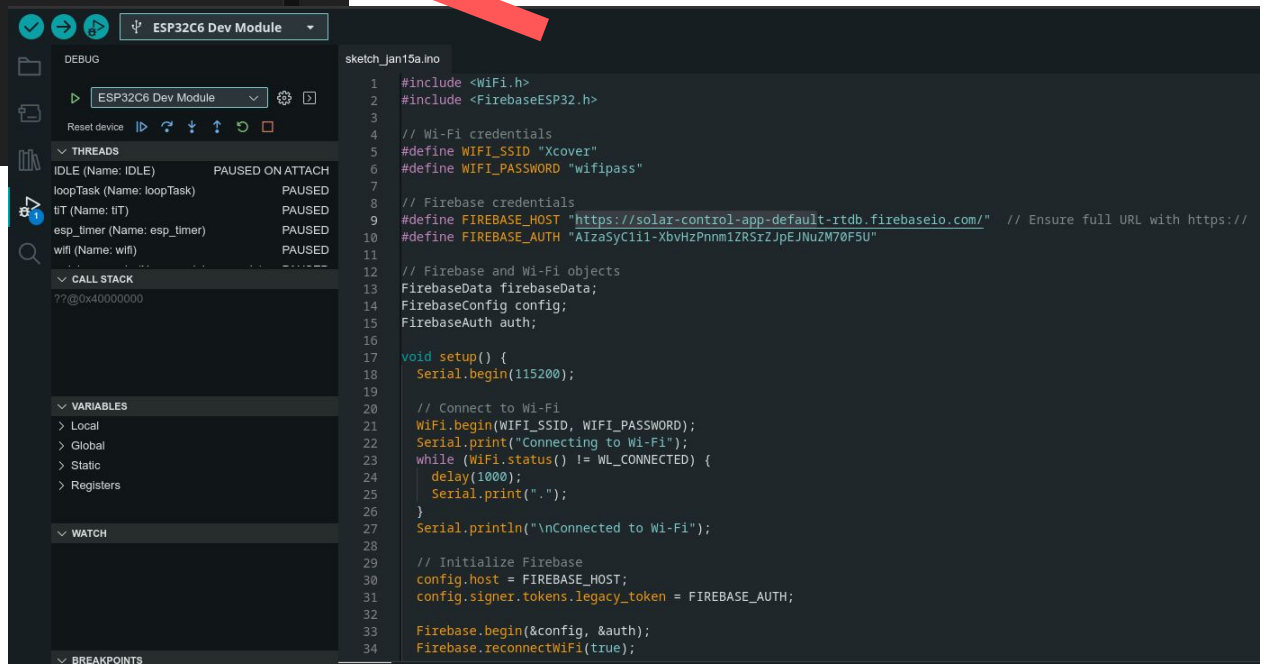
App & Database

Cedar Maxwell



Code loaded onto ESP32 below.

Uploading data to Firebase directly from ESP32.



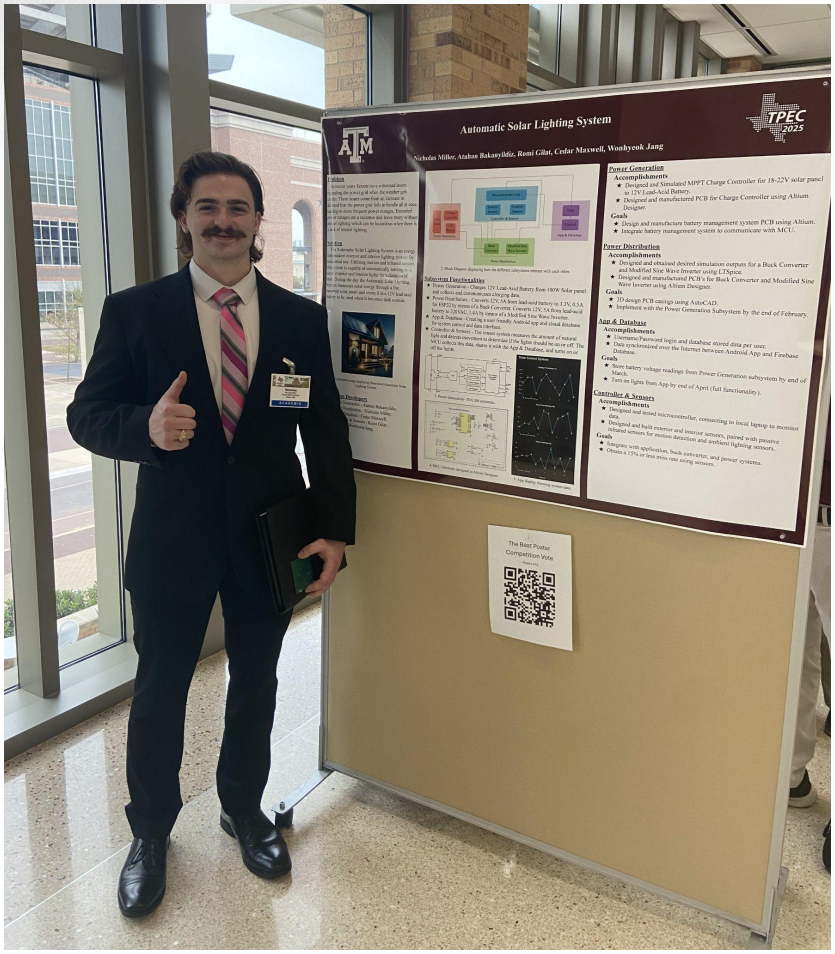
Power Distribution

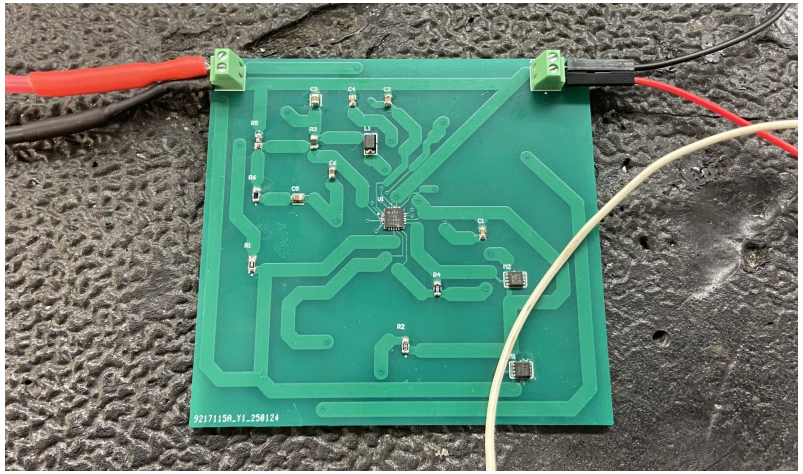
Nick Miller

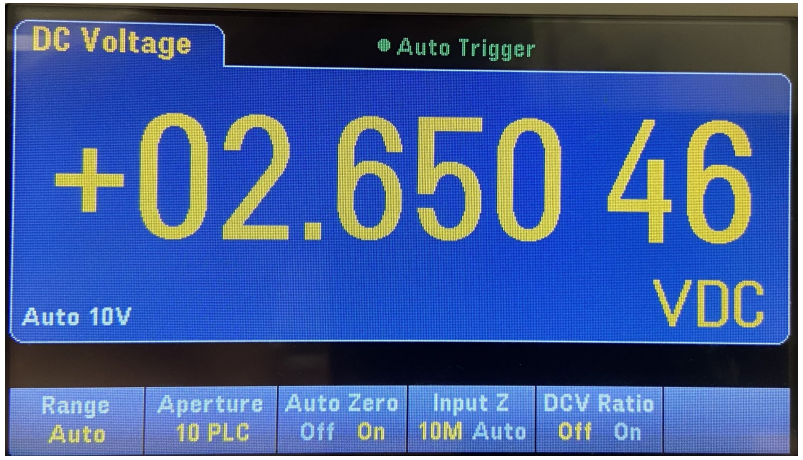
Accomplishments since last update 24 hrs of effort	Ongoing progress/problems and plans until the next presentation
• Attended and presented at the TPEC poster session. • Tested and validated the Buck Converter in preparation for integrating with the Power Generation subsystem.	• Continue testing and validating the Modified Sine Wave Inverter in preparation for integrating with the Power Generation subsystem. • By next review will integrate with Power Generation and will begin integration with Controller & Sensors.

Power Distribution

Nick Miller







Power Distribution

Nick Miller

Voltage In	Voltage Out
9V	2.649V
10V	2.649V
11V	2.649V
12V	2.650V
13V	2.650V
14V	2.651V

Table displaying input voltage and output voltage for designed Buck Converter.

Displays constant voltage of 2.65V, 0.65V less than intended voltage of 3.3V.

Execution Plan

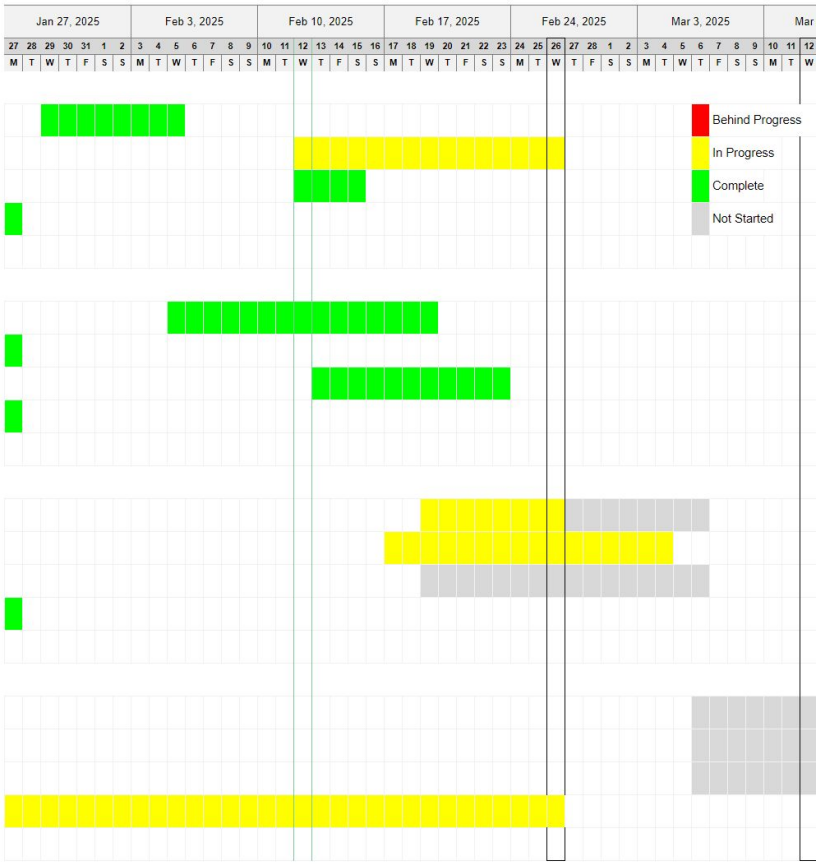
ASLS Schedule

VanArsdel, Ltd. Project lead

Project start: **Wed, 1/15/2025**

Display week: **3**

TASK	ASSIGNED TO	PROGRESS	START	END
Testing Subsystems				
Tested Subsystem	Romi Gilat	100%	1/15/25	1/22/25
Test Subsystem	Nick Miller	80%	1/29/25	2/12/25
Tested Subsystem	Atahan Bakanyildiz	80%	1/15/25	1/19/25
Tested App and Database	Cedar Maxwell	100%	1/13/25	1/13/25
Completion Progress	Team	90%	1/15/25	1/25/25
Subsystem Redesign				
PCB Redesign	Romi Gilat	100%	1/23/25	2/5/25
Circuit and PCB Redesign	Nick Miller	100%	1/13/25	1/13/25
PCB Design and Test	Atahan Bakanyildiz	40%	1/13/25	1/16/25
N/A	Cedar Maxwell	100%	1/13/25	1/13/25
Completion Progress	Team	85%	1/13/25	1/16/25
Subsystem validation				
Build, Test & Validate	Romi Gilat	15%	2/5/25	2/20/25
Build, Test & Validate	Nick Miller	75%	1/29/25	2/12/25
Build PCB and Validate	Atahan Bakanyildiz	0%	2/3/25	2/8/25
App Completed and Synced with Firebase	Cedar Maxwell	100%	1/13/25	1/13/25
Completion Progress	Team	48%	2/3/25	2/7/25
Subsystem Integration				
Integrate subsystems	Romi Gilat	0%	2/20/25	3/7/25
Integrate with MCU/Sensors	Nick Miller	0%	2/20/25	3/7/25
Integrate with MCU	Atahan Bakanyildiz	0%	3/8/25	3/11/25
Firebase Connected with MCU	Cedar Maxwell	75%	1/13/25	3/7/25
Completion Progress	Team	7%	2/27/25	3/4/25



Validation Plan

Standby Wake-Up Miss Rate	The maximum number of miss trigger incidents within the sensor's field of view will be 15% or less.	UNTESTED	Romi Gilat
False Positive Rate	Within the sensor system, the false positive rate will be less than 15% in case of small animals or critters walking within the range.	UNTESTED	Romi Gilat
Battery Operating Time	The operating time of the 12V Lead-Acid battery shall be between 10 and 20 hours.	UNTESTED	Nick Miller
Solar Charging Time	The solar charging time shall be between 4 and 6 hours.	SUCCESS	Atahan
System Area	The system area shall include the rooftop, foyer and exterior of a household.	SUCCESS	Atahan
Installation	The solar panel installation will be done up to National Electrical Code (NEC), International Building Code (IBC), and International Fire Code (IFC), along with the mounting of the system 45 degrees tilted offset from the ground level for optimal sunlight units.	UNTESTED	All
Mounting	The automatic solar lighting system includes **solar panels**, an **indoor sensor with integrated lights**, and an **outdoor sensor with lights**. The lightweight design eliminates the need for structural support, and the solar panels are roof-mounted for optimal sunlight exposure	UNTESTED	All
Inputs	The Automatic Solar Lighting System processes multiple inputs across subsystems. The **Power Generation** subsystem captures solar energy via photovoltaic panels, while the **Buck Converter/Inverter** adjusts DC voltage for the MCU and lighting. The app monitors light status and subsystem performance in real time.	Partial Success	Atahan, Nick, Romi

Validation Plan continued

Power Consumption	The system shall consume approximately 18 Watts, 9 Watts per light bulbs.	UNTESTED	Nick Miller
Input Voltage Level	The input voltage level shall be +10 VDC to +14 VDC.	SUCCESS	Nick Miller
External Commands	The Automatic Solar Lighting System shall document all external commands in the appropriate ICD.	UNTESTED	Cedar Maxwell
Data Output	The Automatic Solar Lighting System will output the status of the porch and foyer lights by means of the mobile application.	UNTESTED	Cedar Maxwell
Diagnostic Output	The MCU will transmit diagnostic data to the app for display.	UNTESTED	Cedar Maxwell, Romi Gilat
Connectors	The Automatic Solar Lighting System will use the American National Standard for Electrical Connectors ANSI C119.6-2011.	SUCCESS	All
Wiring	The Automatic Solar Lighting System will follow the guidelines set forth by the National Electrical Code regarding electrical wiring. The standard applications of electrical systems is in the article NFPA 70 (NEC).	UNTESTED	All
Altitude	The Automatic Solar Lighting System shall be able to operate efficiently at altitudes around 300 feet.	UNTESTED	Nick, Romi, Atahan
Thermal	The Automatic Solar Lighting System shall be able to operate efficiently at temperatures ranging from 0℃ to 70℃. The microcontroller unit will be located indoors, where the temperature is expected to range from 0°C to 70°C. The sensor system will be used both indoors and outdoors, and is rated for temperatures from -40°C to 85°C.	UNTESTED	Nick, Romi, Atahan
Humidity	The sensor unit will function up to 90% humidity for proper functioning.The sensors themselves need to be placed in a water proof, sealed container that will prevent the electronics from getting drenched.	UNTESTED	Nick, Romi, Atahan

Thank you!