Dwight Look College of
ENGINEERING
TEXAS A&M UNIVERSITY

Team 60: Solar Lighting System
Bi-Weekly Update 1

Josh George, Jeb Malek, Lyric Haylow
Sponsor: Dr. Wonhyeok Jang
TA: Rhett Guthrie

Project Summary

- 85% of the world's energy comes from nonrenewable sources, sources that will eventually be depleted.
- A need for clean, renewable sources becomes more apparent than ever.
- Our home indoor and outdoor lighting system is the first step towards this, using **solar power.**

Project/Subsystem Overview

For our project, we will design a home lighting system that operates a variety of lights throughout both an inside foyer and an outside patio. The separate parts for the system to be considered are the battery, power conversion and regulation, mobile application functionality, BT microcontroller, and motion and light sensors for automated switching.

Major Project Changes for 404

- We lost a team member in 403, and they were in charge of the microcontroller. We'll use an Arduino to replace them.
  - Jeb will power and implement hardware of Arduino to project.
  - Josh will code Arduino for lighting system.
- We dropped the flood light from the patio portion of the project. Deemed unnecessary addition after discussion between TAs and Sponsor. Now simply 2 lights on inside, one on outside.
- Potential extra board for measuring battery percentage.

Project Timeline

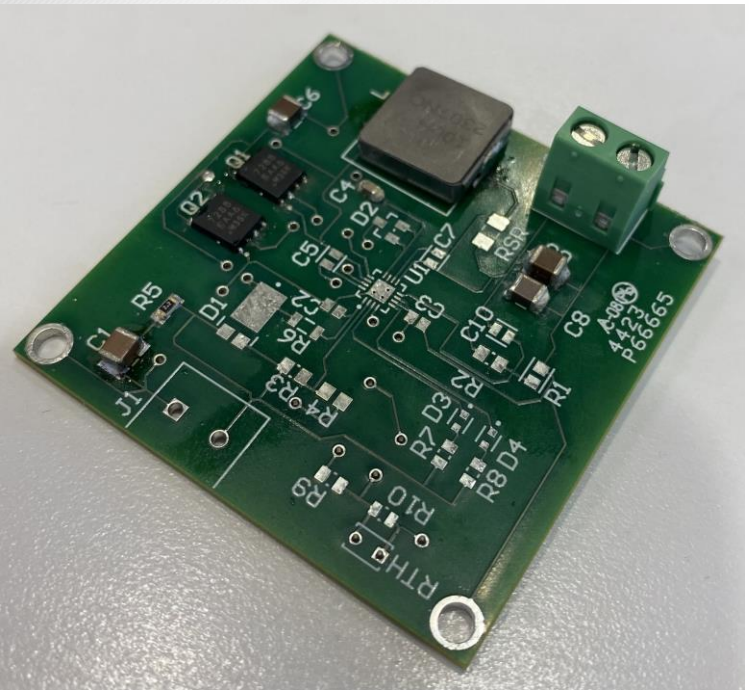
- Jeb
  - PCB soldered and beginning testing
- Josh
  - App interface and settings developed.
  - Specifics for settings need to be adjusted.
  - Bluetooth needs to be implemented
- Lyric
  - Solar Charge Controller design made.
  - Design for PCB being finalized and parts already ordered.
  - 3D print for microcontroller enclosure in process of being made.

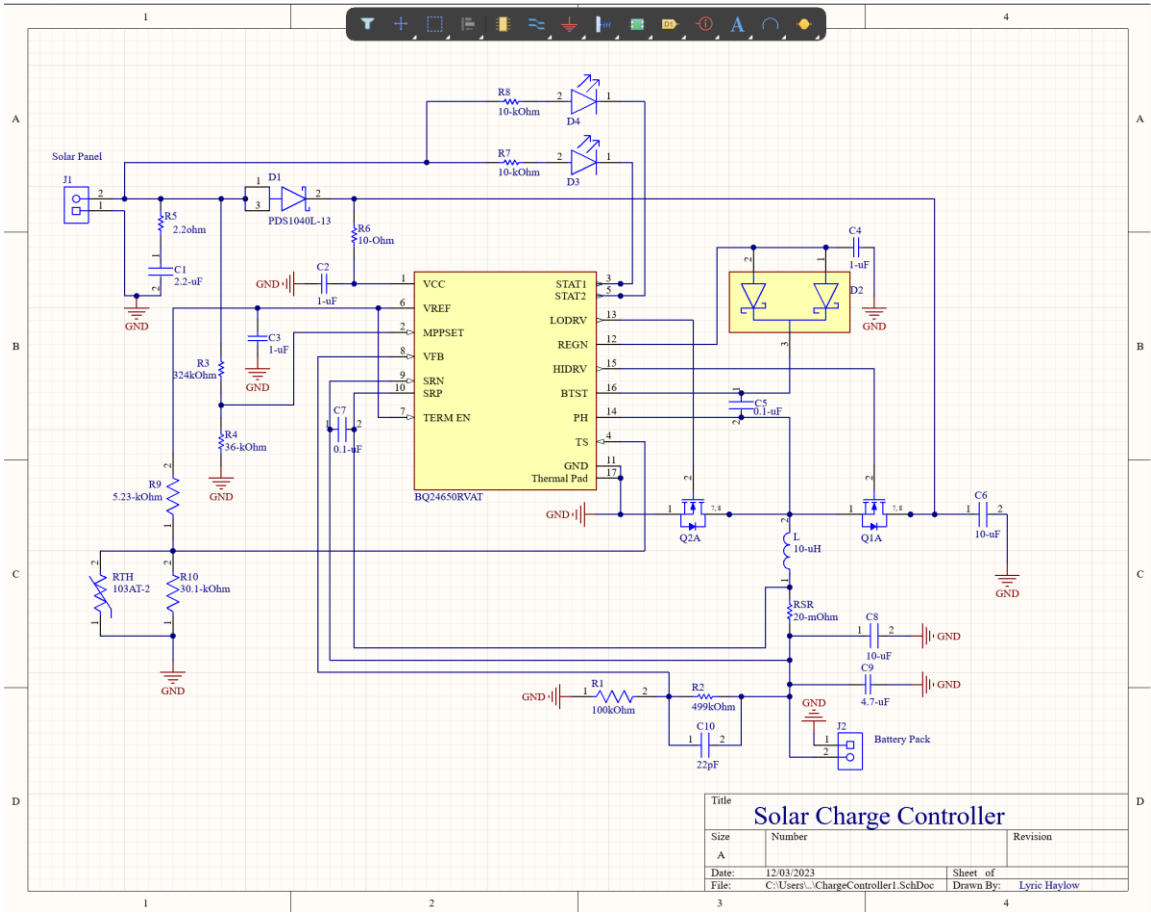
Solar Charge Controller

Lyric Haylow

Accomplishments since 403 — 22 hrs of effort	Ongoing progress/problems and plans until the next presentation
- Previous design analyzed and checked by Prof Lusher, full report available. - Parts for new board ordered, expected in less than a week.	- Design and order new board within next 2 days - Decide on action to take for battery reading portion, whether order or make. - Begin soldering new board, to be at least %50 complete by next presentation.

Solar Charge Controller





Inverter Subsystem

Jeb Malek

Accomplishments since 403 60 hrs of effort	Ongoing progress/problems and plans until the next presentation
PCB Order Arrival All Parts Ordered/ Final Shipment In-Progress	Finish Board Assembly this week dsPIC in-circuit programming Begin Testing & Validation soon as MCU ICSP Programming Complete

- Found multiple design flaws: Transformers / 0.1 uF Filter Capacitors Footpring issue , Part Order change orders
- Discussed EMI Filter need , planned revision (PCB schematic updated)
- Planning a 3D Print of Inverter Enclosure

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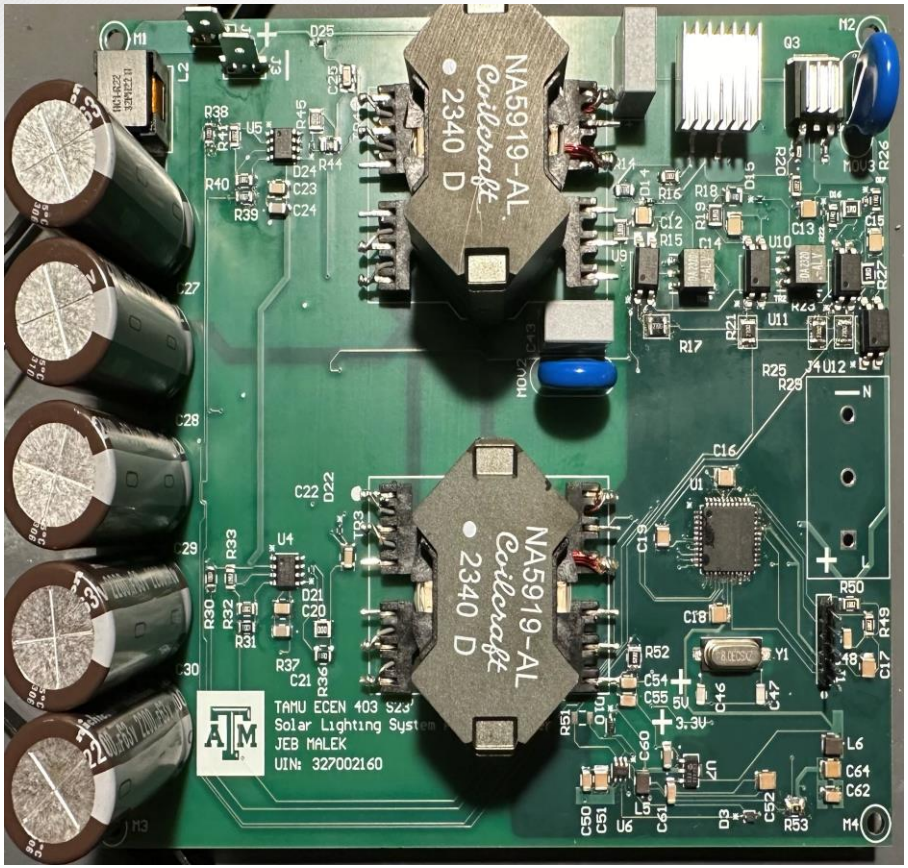
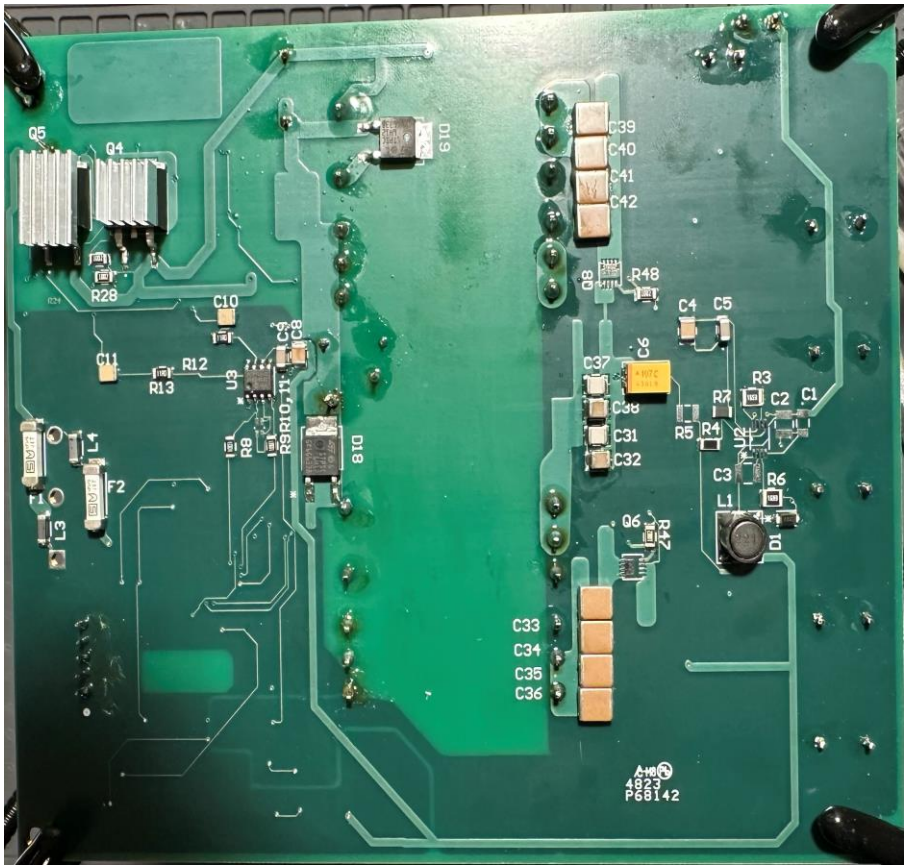
Inverter Subsytem

Jeb Malek





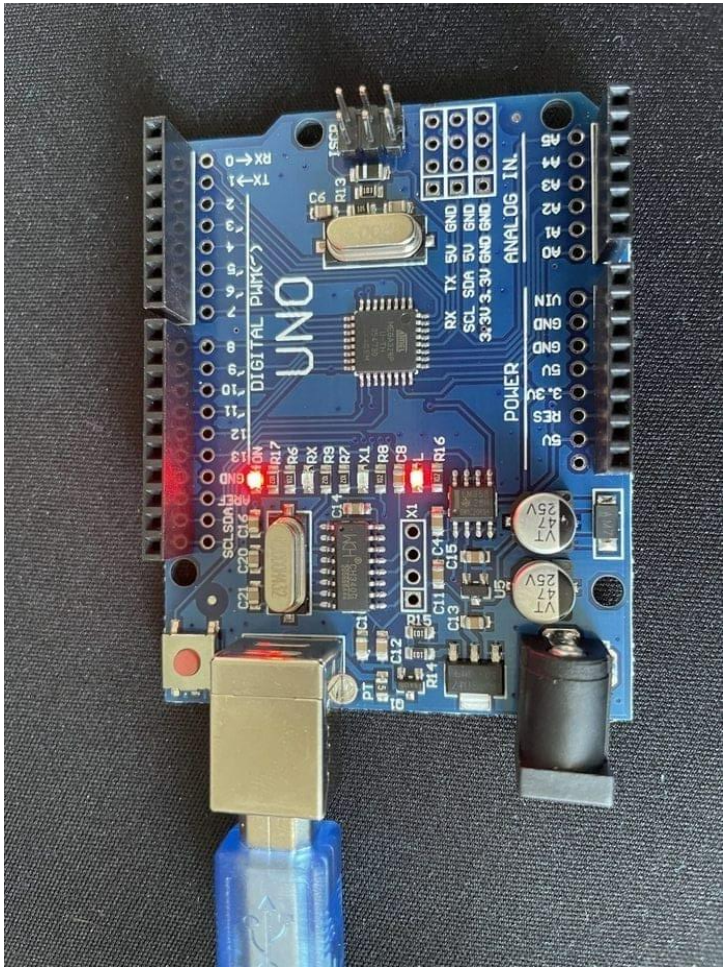
Mobile Application

Josh George

Accomplishments since 403 10 hrs of effort	Ongoing progress/problems and plans until the next presentation
-Added Bluetooth widget to landing page -Researched implementation of Bluetooth connection to Arduino Uno R3 -Added code to enable and display Bluetooth connections	-Work out errors with Bluetooth connectivity -Still unable to connect to Arduino board

Mobile Application

Josh George



Parts Ordering Status

- Full Part Shipment for Inverter expected : Week of 2/5
- Parts for new Charge Controller PCB ordered as of 1/29, expected in a week.
- Final Parts for preliminary version Inverter
- Sensors need to be ordered.
- Lights and sockets need to be ordered. Specific parts identified, verifying whether they are good currently.

Execution & Plan

TASK	21-Jan-24	28-Jan-24	4-Feb-24	11-Feb-24	18-Feb-24	25-Feb-24	3-Mar-24	10-Mar-24	17-Mar-24
Application									
Bluetooth Widget									
Bluetooth Screen									
Working Connection to Arduino									
Data input to MCU									
Data output to MCU									
Battery Preferences									
Complete Interface									
Solar Charge Controller (SCM)									
Solar Panel Testing									
Order Parts									
MK2 PCB Designing & Ordering									
Soldering Solar-PCB-Battery									
Solar-to-MPPT Testing and Verification									
Design 3D print enclosure									
Implement System									
Test Battery Charging over time									

Execution Plan

	21-Jan-24	28-Jan-24	4-Feb-24	11-Feb-24	18-Feb-24	25-Feb-24	3-Mar-24	10-Mar-24	17-Mar-24	24-Mar-24	31-Mar-24	7-Apr-24	14-Apr-24
Power Inverter													
Load Measurements, Operating Conditions													
Topology Selection for DC/AC Inverter													
Pulse Width Modulation Switching Part Select													
PWM Pure Sine Wave Schematic Verification													
Inverter PCB Design													
Inverter PCB Soldering													
MCU Programming													
Battery Input Verification													
Transformer/Voltage Verification													
Power Regulation Verification/System Integration													
Switching Verification													
Full Load Support Testing													
Full Load Solar Light System Demo													

Validation

App Requirements				
3.2.5.1	App Connection to phone Via USB	Android studio establishes a connection with Android phone when connected via micro USB	Beginner code in android studio	
3.2.5.2	App Connection to phone Via APK F	Android studio establishes a connection with the Android phone when the app is downloaded on the phon	Beginner code in android studio, uploaded through Bluetooth	
3.2.5.3	Establish Bluetooth Connection witl	Able to connect to a bluetooth capable device and detect the serial number	Work with microcontroller Bluetooth package to connect to android studio	
3.2.5.4	Bluetooth Communication via App	App displays screen with good connection.	Make sure code runs successfully on Android device	
3.2.5.5	Main Screen	App is able to display a home screen	Code home screen in Android studio, make sure it runs, debug errors.	
3.2.5.6	Data from Charge Controllor	App is able to connect to charge controller and accurately display readings.	Understand how charge controller connects to MCU, adapt code accordingly.	
Solar Panel Battery Charge				
3.2.1.1	Solar Panel Mount	Stays in space mounted for several days time	Verifying Hardware is properly mounted	
3.2.1.2	MPPT Functionality	MPPT is working as expected within the IC	Set higher voltage than MPPT, check whether IC brings voltage down to set MPPT voltage level.	
3.2.1.3	Charge Controller Verification	Voltage levels are modulated along with Current Levels	Steadily increasing current will be applied to charge controller, to point of max expected	
3.2.1.4	Overvoltage Solar Panel Protection	Supply voltage levels do not exceed IC limits	Sending a increasingly higher voltage through the charge controller, eventually checking it functions as predicted	
3.2.1.5	Overcurrent Battery Protection	Charging current levels do not exceed expected input values	When charging battery, consistently measuring charging current upon increasing supply voltage using DC power supply	
3.2.1.6	PWM EMI Interference	Interference does not significantly alter design guidelines	Use a Broadband RF meter if one available, if not then the Oscilloscope to identify interference points.	
3.2.1.7	Battery Charging to Capacity	Battery stops being charged once it has a full charge	Feeback voltage will be applied back to IC as shown in documentation	
3.2.1.8	State of Charge (SOC)	Measurement for current State of Charge coincides with expected values	Measure the voltage with a multimeter and convert measured voltage to approximate power percentage expected	
3.2.1.9	Depth of Discharge (DOD)	Measurement for current State of Charge coincides with expected values after discharge	Measure the voltage with a multimeter and convert measured voltage to approximate power percentage expected	
Power Inverter Characteristics				
3.2.2.3	PWM EMI Interference	Amplitude modulation ration falls in desired values for correct switching frequency EMI	In a unipolar switching topology the pulse width modulated signal should be a desired value to obtain suit	
3.2.2.5	Output Voltage	Inverter will supply a steady 120 VAC RMS value	With an attached load a benchmark of current drawing configurations to satisify stable pure sine wave voltage of 120 RMS	
3.2.2.6	Output Frequency	Inverter will supply a steady output sinusoid at a frequency of 60 Hz	Proper inverted sine waves shall operate at normal operating constraint of 60 Hz	
3.2.2.7	DC/DC Conversion	Inverter will supply 3.3 V / 1 A USB-C regulated output	Attaching E-Load to Inverter USB-C Receptacle provides 3.3 V load at varying currents	
3.2.2.8	Output Stability	Output Voltage Ripple demonstrates acceptable output harmonic components below certain THD	Measurement with Oscilloscope and E-Load with charging and discharging states can cause voltage flucuation	
3.2.2.9	Varying Loads	Inverter will supply light loads of varying configurations	Measurement with Oscilloscope and E-Load with benchmark loads attached while charging, discharging, in all modes of operati	

Thank you , 404 Classmates