# Solar-Powered Unmanned Aerial Vehicle



## Spring / Summer 2022 Recap

Sultan Hazawbar & Gabriel Martin

**Project Client:** David Willy
**Project Sponsor:** Gore
**Project Advisors:** Venkata Yaramasu, Ph. D &
Alexander Dahlmann, GTA
**Project Partners:** ME 486C Team

# Overview

**Goal: To construct a solar powered unmanned aerial vehicle (UAV) that will fly 1 ½ times the duration that a sole onboard battery would fly it for.**

Design Order

1) Research
2) Bylaws & Delegations
3) Requirements & Constraints
4) Individual Prototyping
5) Deliverables & Supporting Tasks
6) Component Selection
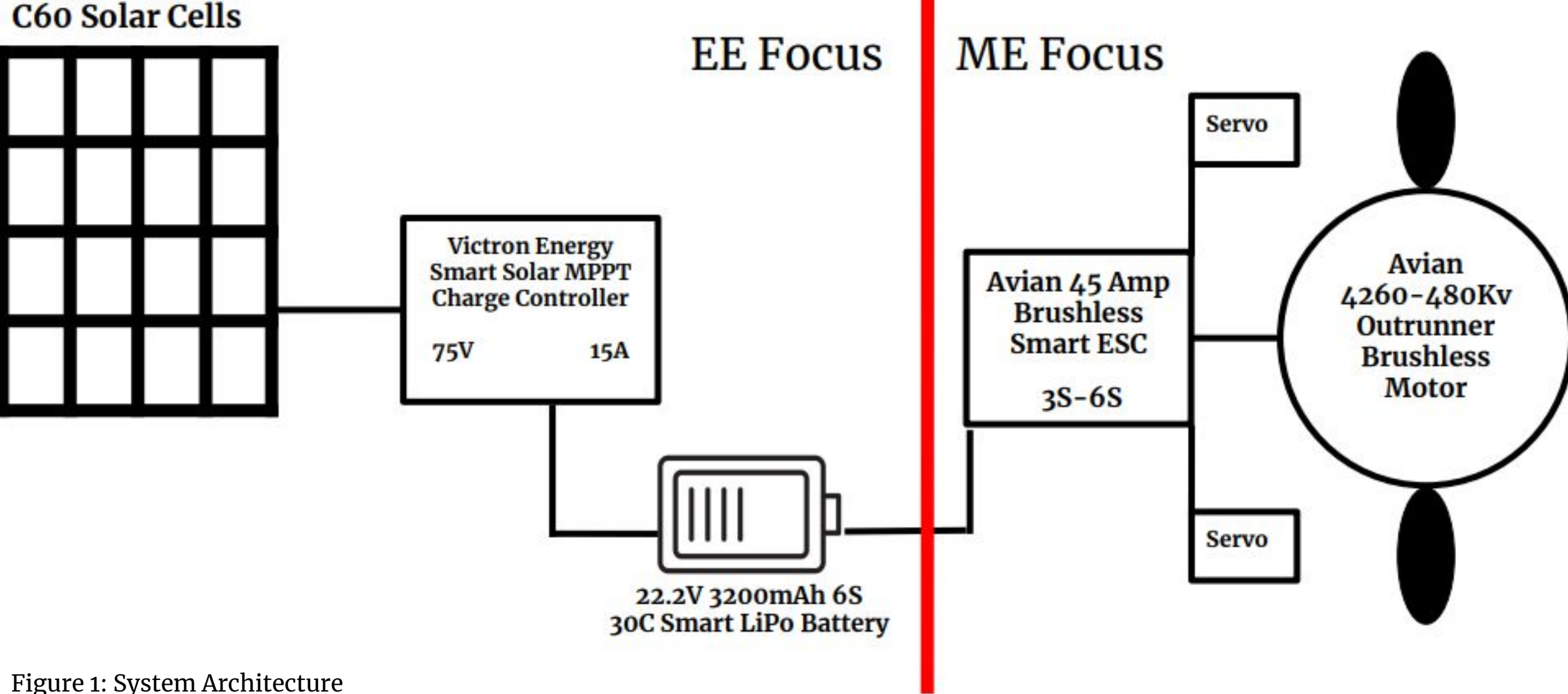7) Build Preparation & Summer Tasks

Figure 1: System Architecture

# Research

**Photovoltaics**
- Photovoltaic Energy
- Maximum Power Point Tracking
- Series & Parallel Configurations
- Types of Solar Technologies
- Standard Test Conditions

**Lithium Polymer Batteries**
- Charge & Discharge Characteristics
- Life Expectancy
- Weight Advantage

**Aerodynamics**
- Thrust
- Flight Techniques

**Brushless Motors**
- Electronic Speed Control
- Power Consumption

**Resources:**

- 2019 ME Capstone Solis Fur's Assembly Manual
- Photovoltaics: Design & Installation Manual
- Academic Articles & Publications
- Trusted Websites
- Our Client
- Project Advisors
- EE 404 Material
- Youtube

# Bylaws & Delegations

We established the standards and rules expected of our team members in regards to:

- Communication

- Work Ethic

- Responsibilities

- Project Execution

These are in writing and have been acknowledged by the members of our team.

# Requirements & Constraints

Acknowledging the requirements and constraints set by our client to develop the ideal product.

Requirements

- Flight Time
- Presentation & Performance
- Lightweight
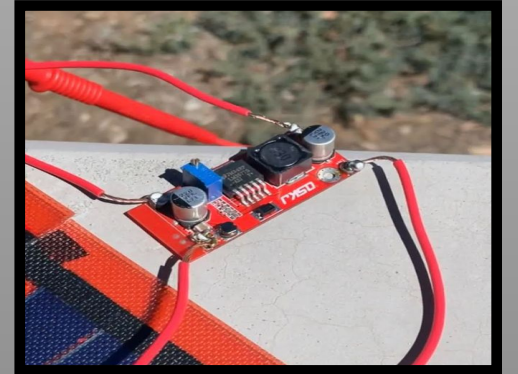- Use of MPPT Charge Controller

Constraints

- Budget
- Component Accessibility
- Time Frame

# Individual Prototyping

Each of us were tasked with prototyping a specific element of our project.

**Gabriel**



- Successfully soldered two thin film panels in series and in parallel.
- Soldered leads from the panels to a buck converter and got reads using a DMM.
- Adjusted the converter's potentiometer to get an IV & PV curve.

**Sultan**



- Successfully hooked up a solar panel to a small MPPT charge controller module.
- Connected controller to a LiPO battery.
- Received indication that battery was being charged via LED light feature from the charge controller.
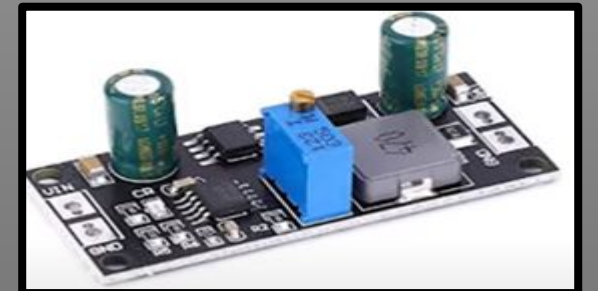
# Deliverables & Supporting Tasks

Aside from research and prototyping, our team had a number of deliverables and tasks to complete over spring.

- Website development and updates

- EE 476C assignments regarding professionalism and conflict management

- Informational sessions with our advisors and experts in our projects scope

- Client meetings

- Team meetings

- GTA meetings

- Presentations

- Final design document

# Component Selection
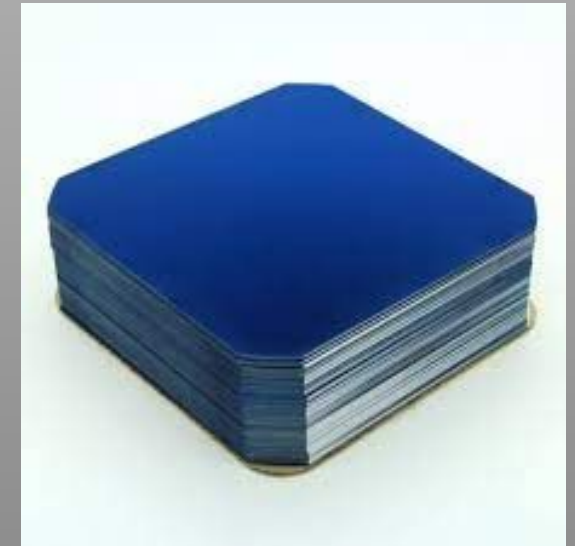
## Battery



Spektrum 2.2V 3200mAh 6S 30C Smart LiPo Battery

## Charge Controller



Victron Energy Smart Solar MPPT Charge Controller 75V 15A

## Panel



Sunpower C60 Monocrystalline Silicon Solar Cell

# Component Selection

## Battery Specifications

| Characteristic | Measurement |
|---|---|
| Nom.Voltage / Cell Count | 22.2 V  /  6 S |
| Battery Capacity | 3.2 Ah  /  71 Wh |
| Weight (g) | 484 |
| W x L x H (mm) | 42 x 142 x 38 |
| Maximum Continuous Discharge Rate | 30 C |

## Panel Specifications

| Characteristic | Measurement |
|---|---|
| Solar Cell | 22.2 V  /  6 S |
| Vpv, Ipv @ STC per Cell | .58 V  /  5.9 A |
| Weight per Cell (g) | 7 |
| W x L (mm) | 125 x 125 |
| Configuration | 24 units in series |
| Efficiency | 23% |

## Charge Controller Specifications

| Characteristic | Battery Voltage | Charging Current | Max Efficiency | W x L x H (mm) | Weight (g) | Special Function |
|---|---|---|---|---|---|---|
| Measurement | 12V/24V | 15 A | 98% | 113 x 100 x 40 | 500 | Programmable from mobile device |

# Build Preparation

1) Order materials by the end of this week:

   a) Panels

   b) Connectors

   c) Soldering Materials

   d) Charge Controller

   e) Various Other Small Things

2) Website Updates

3) Review ME team's progress

4) Move forward with initial prototyping ASAP

5) Research more into the functionality of our charge controller

# Questions ?