Solar-Powered Rover

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Engineering Analysis Technical Brief

I.A. System Description/Product Architecture

Table II-1: List of Sub-Systems

#	Name	Description of Sub-System Functionality
SS1	Solar Panel and Charge Controller	Provide solar power, voltage regulation, and power distribution to the rover.
SS2	The Cleaning System	The linear actuators run alongside the solar panel to cause the brush to move across the panel. There are additionally motors that will cause the brush to roll.

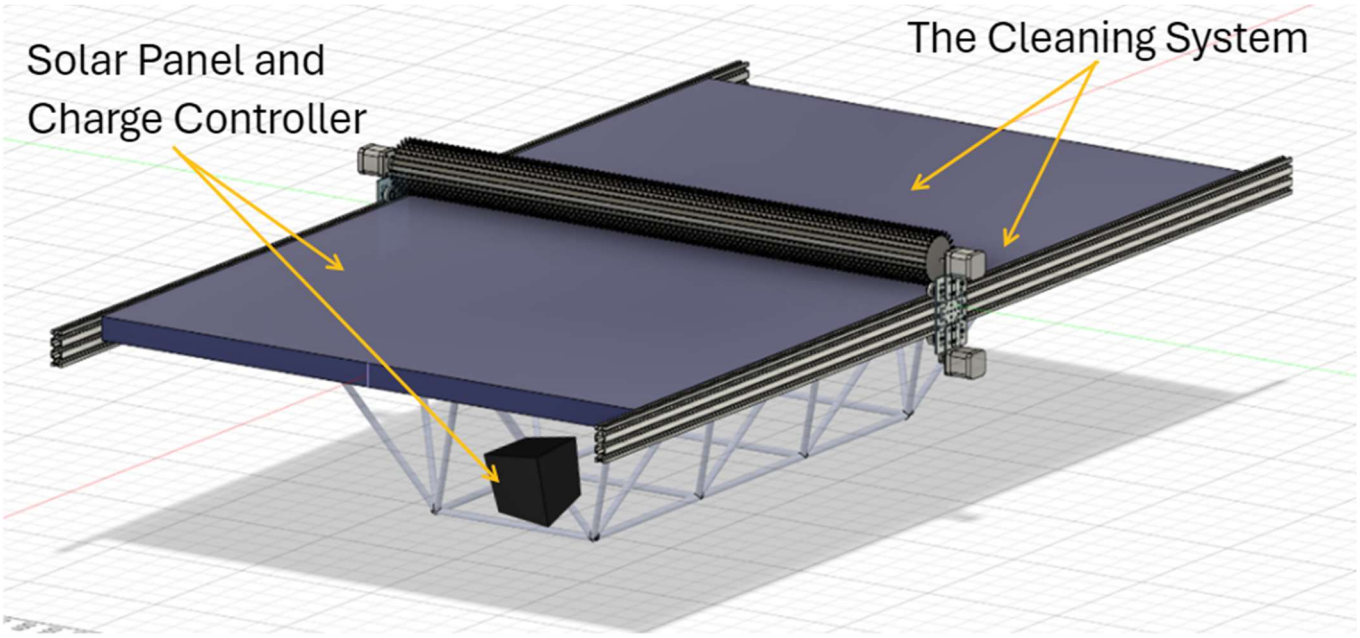

Figure 1: Fusion Drawing of Ideation

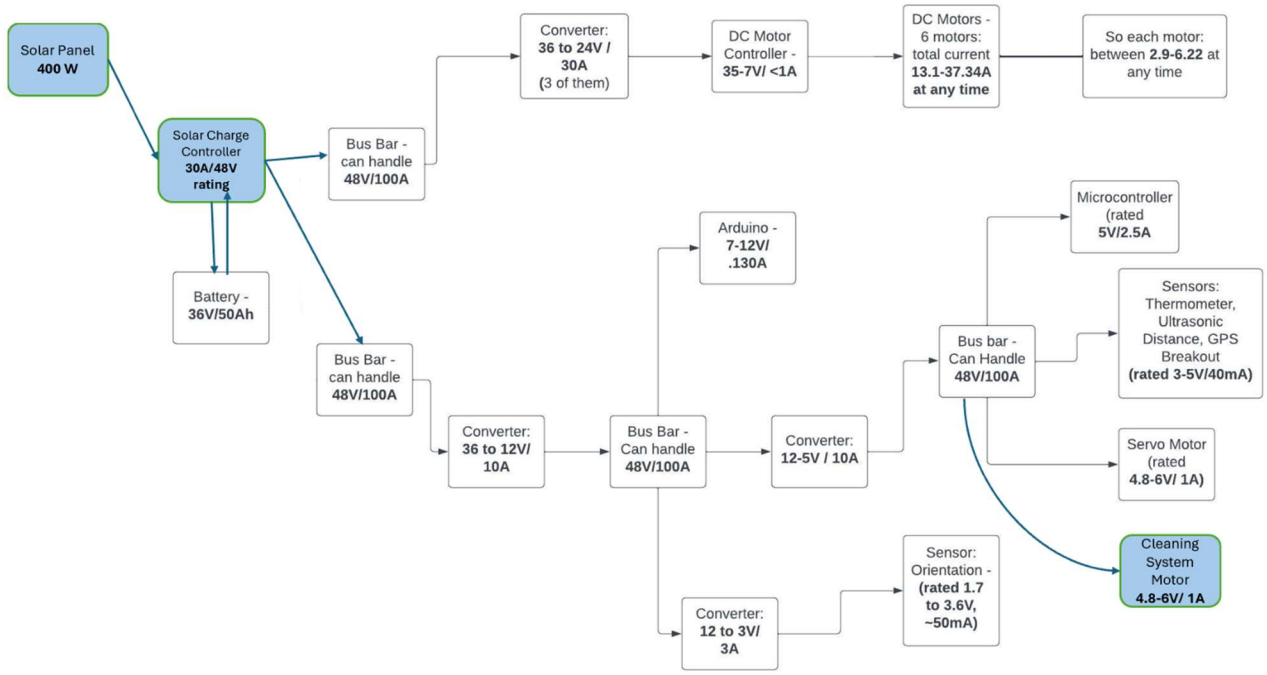

Figure 2: Electrical Flowchart

II. Engineering Analysis

II.A. Types of Engineering Analysis Needed for Sub-System SS#1

The following types of engineering analysis will need to be conducted for the solar panel and charge controller sub-system:

1. Load Analysis: The team will need to complete an analysis of the load to determine if the addition of the new solar power source is able to support the current load. We will also need to look at the charge controller pulling from both the battery and the solar panel, and its ability to do this effectively. To do this we will use the simulation software MATLAB Simulink to test these capabilities as well as stress test them to find the limitations in different situations.
2. Logic of Charge Controller: The charge controller works by taking the solar power generated to power the load and charge the battery. If the load requires more power, it will begin to pull from the battery. The controller has many features to account for all types of solar needs. It would be beneficial to analyze the programs to make sure that the correct setting for our specific project is selected.
3. State of Charge of Battery: The battery has Bluetooth capabilities, which allows the user to monitor its state of charge. This paired with the charge controller's ability to not overcharge the battery will overall extend the life of the battery and the rover. We will be

able to use Simulink to simulate this also to analyze the voltage and current entering and exiting the battery. We will also be able to compare this to the past team's charts to see the expected improvements.

II.B. Types of Engineering Analysis Needed for Sub-System SS#2

The following types of engineering analysis will need to be conducted for the cleaning system sub-system:

1. Sizing of the Motors: The team will need to select what top speed they would like the motors to run at and what acceleration rates will be necessary. Below is the speed profile of the motors responsible for the linear motion of the linear actuator. The motors responsible for the rotational motion of the brush will be analyzed once a brush is selected due to the need of the radius of the brush for calculations. Once this is completed, the team can determine the torque required for the motors. This will then allow us to be able to size the motor/wires and run a simulation on Simulink to test the effectiveness of the selection.

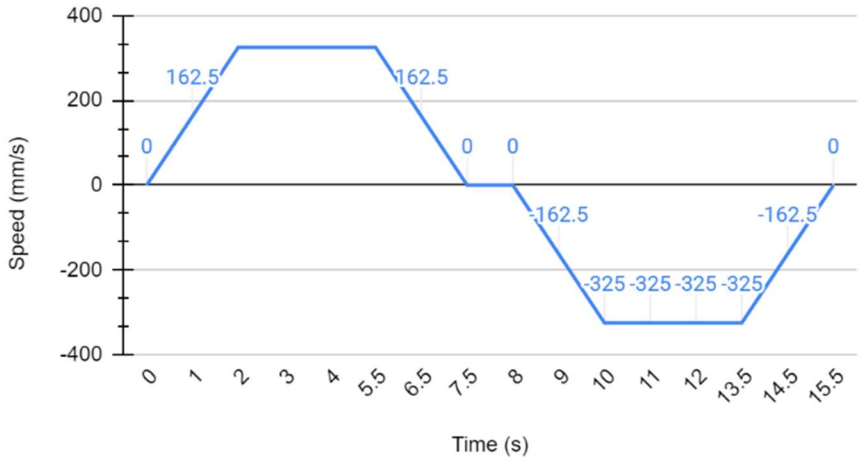

Figure 3: Speed Profile of the Linear Actuator Motors

2. Arduino Timer: The team will need to code an Arduino to act as a timer for the cleaning system to clean once a day. The flowchart is shown below for this concept.

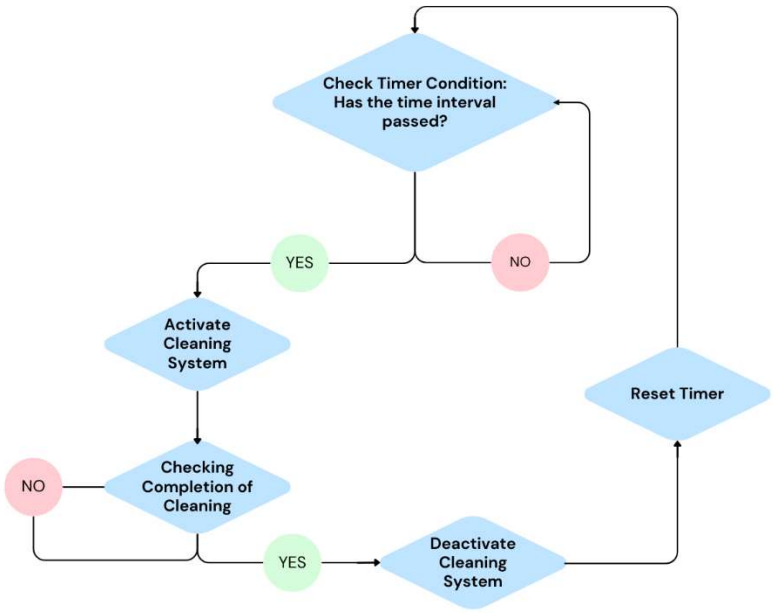

Figure 4: Timer Logic Flowchart