Solar Airplane

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Project Objective

Solar Airplane seeks to create an RC solar airplane powered entirely by solar panels and battery power for the purpose of demonstrating the efficacy of solar panels on extending flight duration.

Requirements

- Shall, with fully charged battery, use solar panels to extend flight time by 15% as compared with unmodified plane's flight time
- Shall be stable in 20 mph side winds
- Shall not exceed altitude of 400 ft
- Shall integrate solar panels onto plane
- Shall be less than $700.00 for all combined expenses

Overall Success

We were successful in extending flight time from the addition of solar panels to the wings of the plane despite the increase drag and weight.

Electrical System Design Solution

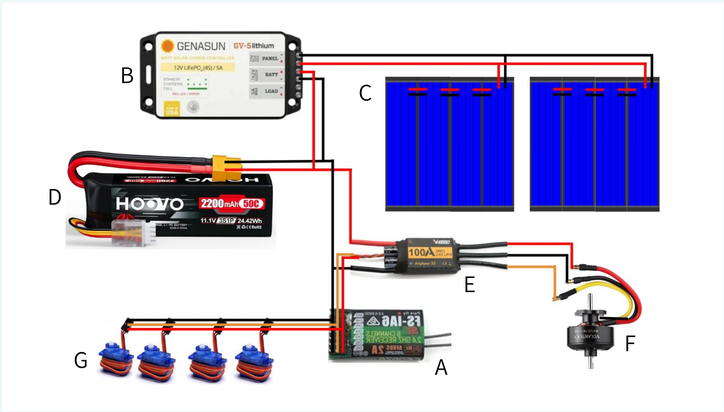

Figure 1: Wiring schematic implemented

Figure 1 Key:

A. FS-iA6 Receiver
B. Genasun MPPT GV-5-Li-12.5V (Solar Charge Controller)
C. 8 Jiang 2W6V Solar Panels
D. Hoovo 3S LiPo Battery
E. Electronic Speed Controller (ESC)
F. Motor
G. 4 Servo Motors

Key Design Analysis

The implementation of solar panels was dependent on several limiting factors:

Influencing Factors of Design

- Minimum and maximum solar panel voltage
  - MPPT input voltage range 12.5 V - 27 V absolute maximum

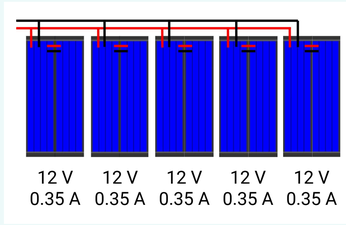

Figure 2: Initial solar array configuration considered

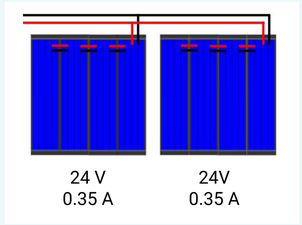

Figure 3: Final solar array configuration

- Weight distribution (center of gravity [CG] analysis)

Design	Center of gravity	Net weight
Plane kit	77.0 mm	3.13 lb
Plane kit + Battery + Solar circuit	59.8 mm	4.71 lb
Plane kit + Battery + GoPro	37.2 mm	4.17 lb

Figure 4: Center of gravity values from wing's leading edge

Figure 5: Fully assembled plane with solar panels

Hardware Performance

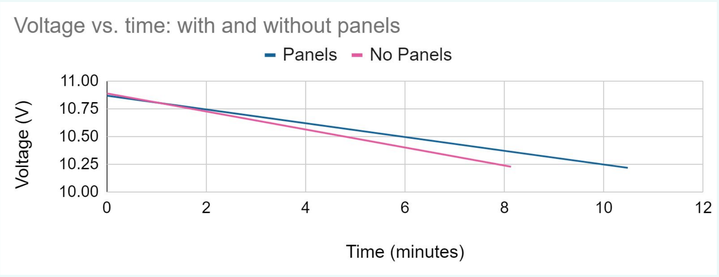

Figure 6: Averaged data for motor operation time and battery voltage showing a clear increase in time from the addition of solar panels

Contribution

The MAE 151A/B team has contributed to this project by establishing a viable proof of concept and discovering areas of improvement to reach higher increases in flight duration.

Future Recommendations

- Employ the use of an alternative solar charge controller so as to avoid issues with the voltage maximum being reached from the solar panels.
- Add an electronic speed controller capable of monitoring the motor speed, time of flight, and power draw to simplify the process of recording while improving accuracy

Societal Impact

The exploration of solar technology in mobile applications has the potential to cut down on a massive component of global CO_2 emissions. Any step toward increasing the use of solar power and away from fossil fuels will help improve humanity's relation with the environment.

References

Expert Domains Colin Sledge and Ryan Gurin, sunforgellc.com, faa.gov.

Acknowledgements

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