The University of Texas at TYLER

HEC 6: The Solars

Electrical & Mechanical Engineering

Marine Solar Charger

Team Members: Dana Bekmaganova, Prakash Jha, Kieran Kapila, Rudy Marban, Hicham Matraka
Sponsor: Austin Canoe & Kayak
Advisor: Aws Al-Shalash

Abstract

When fishermen go on extended fishing or recreational trips, they use 12VDC batteries to charge various loads such as: fish finders, LED lights and cellular devices. The main objective for the team is to provide an alternative source of power in the form of a solar battery charger for kayakers who need to recharge their 12VDC batteries. The design incorporates many different features, including an automated solar tracking system that helps optimize the time to charge the battery, a custom charge controller and a universal mount that can be used on different kayaks.

Design Requirements

- Solar panel to charge a marine battery
- "Sit on top" kayak
- Portable
- Lightweight (30 lb. max)
- Ability to monitor the charging status
- IP65 Standard

System Overview

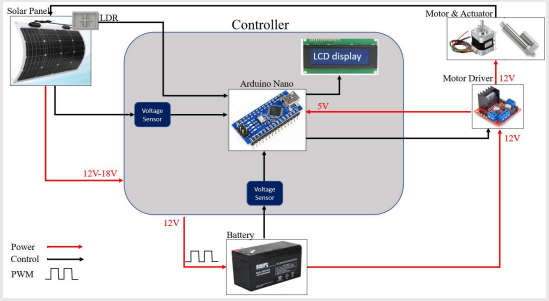

Figure 1: Power Flow Diagram

The heart of the controller is an Arduino Nano. The microcontroller senses voltages of both the battery and solar panel, then decides how to charge the battery based on the proper charging cycles. The tracker receives readings from four photoresistors mounted on the lid and rotates the box left/right and lid up/down until it finds the optimal position facing the sun.

Component Breakdown

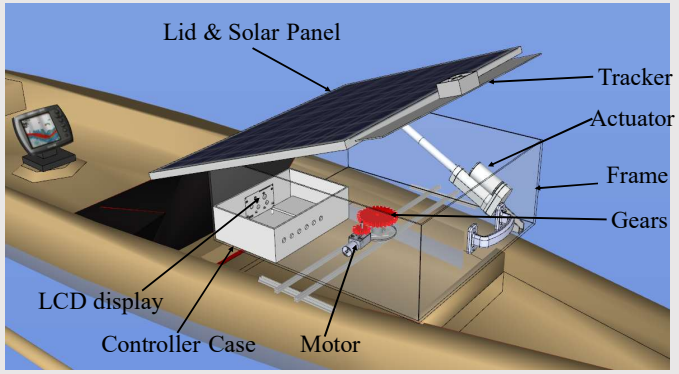

Figure 2: Model of System

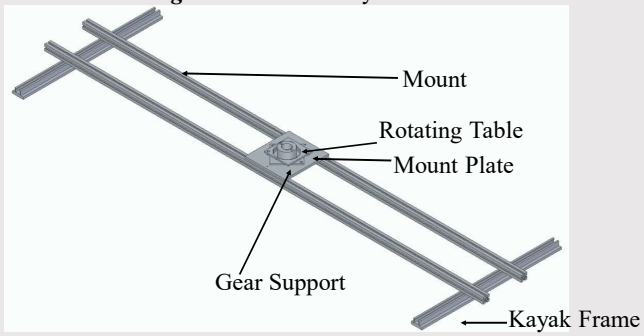

Figure 3: Mounting System Breakdown

Figure 4: Custom Controller

Figure 2 is the model of full system including all the electrical components. *Figure 3* is the breakdown of the mounting system that will be attached to the kayak. *Figure 4* illustrates custom-made PCB that integrates solar charge controller and solar tracker.

Experimental Analysis

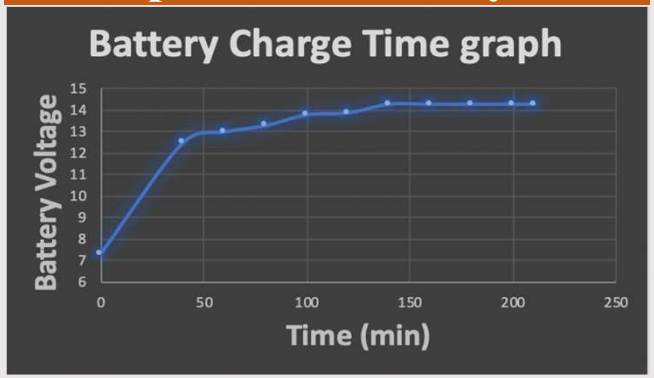

Figure 5: Charge time

- The figure above shows the results of the battery testing. The 12V lead acid battery was charged by a 50W Solar Panel using the custom charge controller. The total charge time was 220 min under ideal solar conditions.
- Tests were done on the motor and the actuator to verify the results obtained from the calculations. The torque required by the system i.e. 3.037 lbf*ft was provided by the motor. The force required to lift the lid of the box (3.87 lbf) was provided by the actuator.
- IP testing was done to fulfill the design requirement of IP65 rating.

Conclusion

After combining the mechanical and electrical components to form the full system, tests were conducted to verify that it was functional and met all the design requirements. A 3D model of the system was made using CAD software and was subjected to different stresses. The data was generated to estimate the durability of the system. As a result, the final prototype proved to be fully functional, light weight and portable system. In addition, the acknowledgement of precision, detail, and specification in our prototype were noted to be the most beneficial factors to take into consideration.