Portable Solar Powered Water Purifier (Spring 2024)

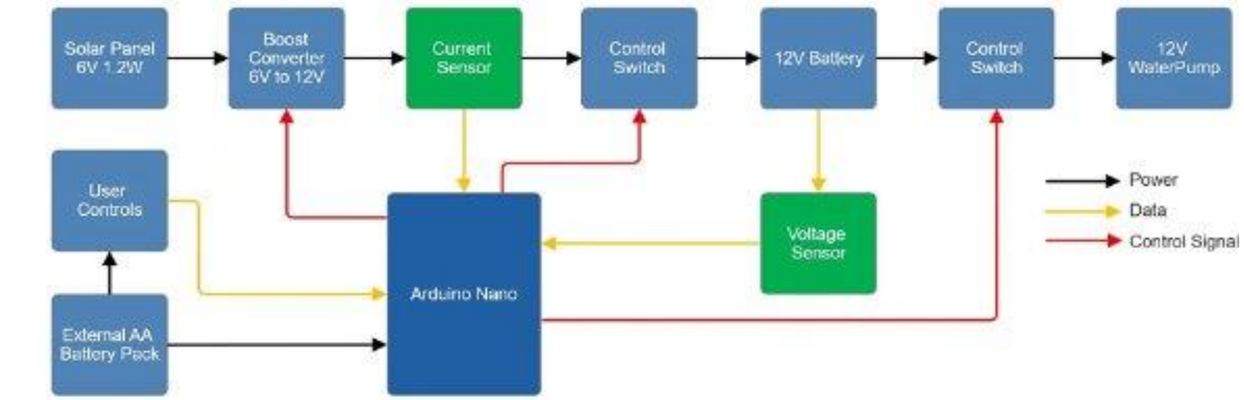
Alex Gervais | agervaisstudent@gmail.com

Abstract

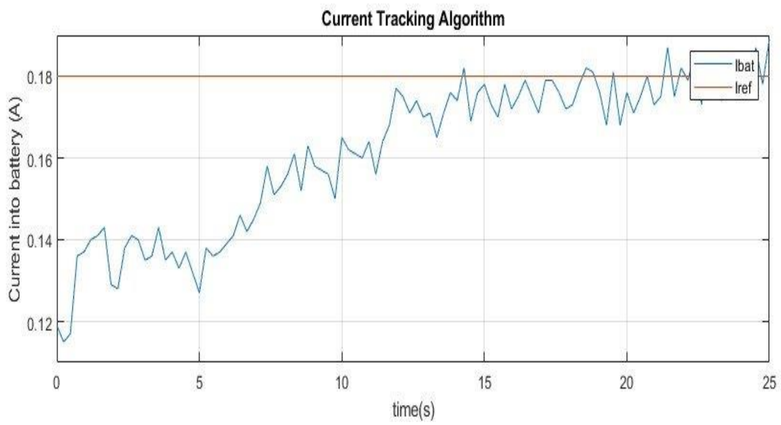
While hiking, it is very important to have a reliable way to obtain drinkable water. Even for shorter hikes, carrying enough water is not practical. There are currently a large variety of products to solve this problem, with a large range of prices and reliability. This project's objective is to build a fully functional water purifier system that balances price and reliability. While also being solely powered by a small set of solar panels that can be attached to the user's backpack.

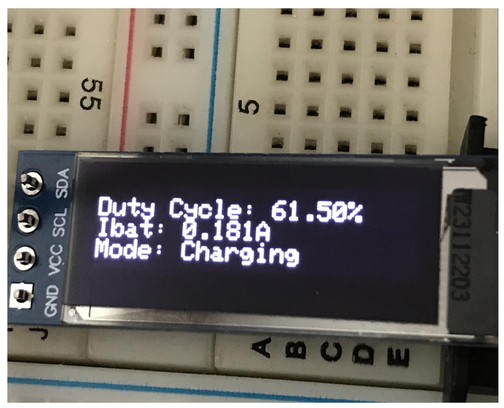
System Design

The entire system is controlled by an Arduino Nano [1] which regulates the constant current charging and monitoring of the battery, while also controlling the state of the system based on user controls.



The battery is charged by constantly measuring the current into the battery and changing the duty cycle of the boost converter to reach the desired current reference for the battery. This can be seen in the figure below.

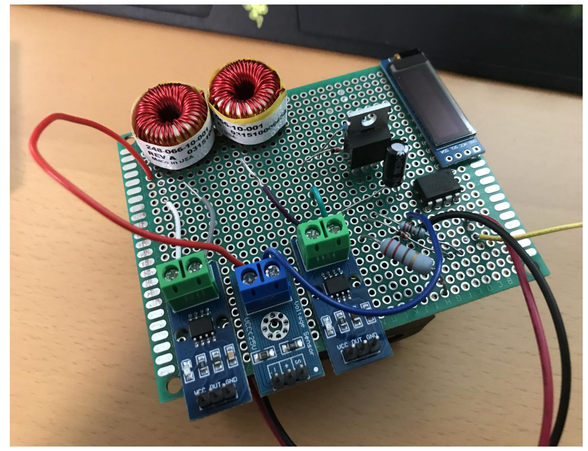




Features

Some the features of this project include:

- Battery charges while hiking and can be switched to be used to power the water pump
- Closed loop portable system
- Weighs less than 5 pounds to not affect other essential backpack equipment [2]
- OLED that displays important system information
- Arduino and gate driver powered by external AA battery pack



Future Direction

Here are some features I plan to continue to work on past my graduation:

- Waterproof case for battery charger
- Solar panel mounting to backpack
- Stable casing that doesn't break components when hiking
- Connecting multiple solar panels for quicker charging

Conclusions

Currently this project is not in a state that I would consider it safe to bring hiking, the housing of the system is not waterproof and could break easily while in a backpack. These are components that I will continue to work on past my graduation. But the battery charger and water pump function Properly and could even be used in different applications. Such applications include; a fish tank water filter, a solar powered water pump for a backyard fountain or some other motor with similar power usage.

References

[1]Arduino®Nano, https://docs.arduino.cc/resources/datasheets/A000005-datasheet.pdf
[2] "How much should your pack weigh: Rei Co-op," REI, https://www.rei.com/learn/expert-advice/backpackingweight.html#:~:text=Pack%20Weight%20for%20Backpacking%20and%20Hiking&text=A%20loaded%20backpacking%20pack%20should,percent%