The Solar Monitor

SDSU ECE: Team 4

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Sponsored by HiTech EdVentures

Project Overview

The Solar Monitoring System (SMS) helps to create a friendlier interface between the user and a solar panel. In doing so, it takes the data collected daily to track overall power optimization of the PV system under various weather conditions. The collected data recorded from the system will be uploaded to the SMS hosted website. Therefore, the user can remotely monitor the system and view the ambient temperature, light, input and output power.

The SMS will have a voltage control knob to allow the user to change the inverter to various load conditions. The SMS algorithm will process the efficiency and display it on the LCD screen, which allows the user to view the systems parameters. When the SMS senses the efficiency drop below a certain threshold, an indication on the LCD will prompt the user to adjust the voltage control knob accordingly to meet the load requirements.

Team

Travis Blake

Converter Specialist

Annie Vu

Team Leader

Daniel Baltazar

Circuitry Designer

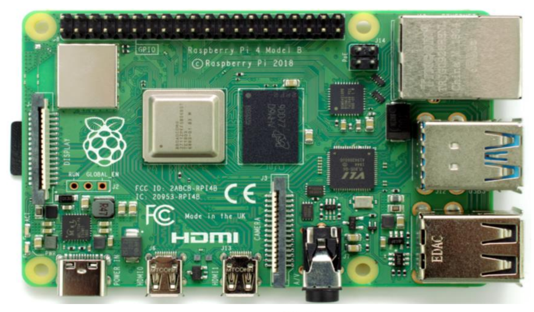
Ryan Dial

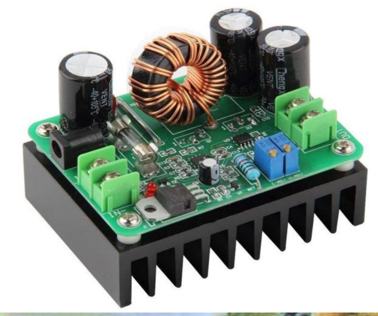
Circuitry Software Developer

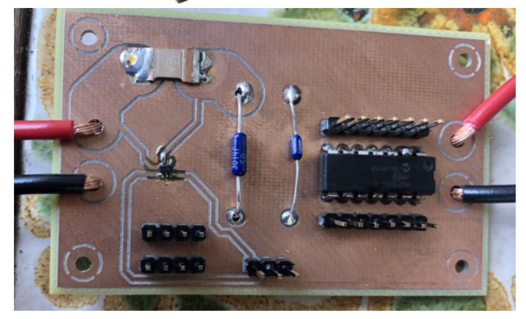
Keelan Gloria

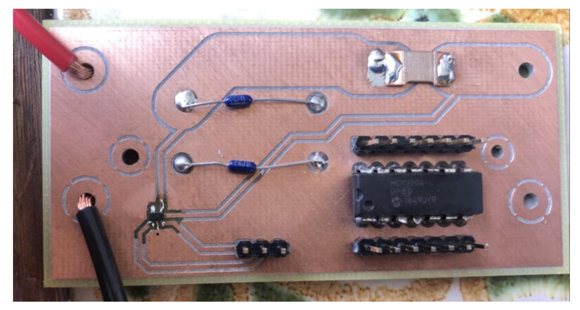
Web Server Developer

Hardware









Raspberry Pi

The Pi hosts our web server as well as sends all the current, voltage, temperature, and irradiance information to our web server and to the Energy Management System. Additionally, the Pi also sends the current, voltage, power, and efficiency to an LCD screen for the user to observe.

Boost Converter

The DC-DC Boost Converter boosts the nominal 12 V value from the solar panel to a usable 10 to 48 V for the Energy Management System. This off the shelf converter offers an impressive maximum power rating of 600 W as well as up to 95% efficiency.

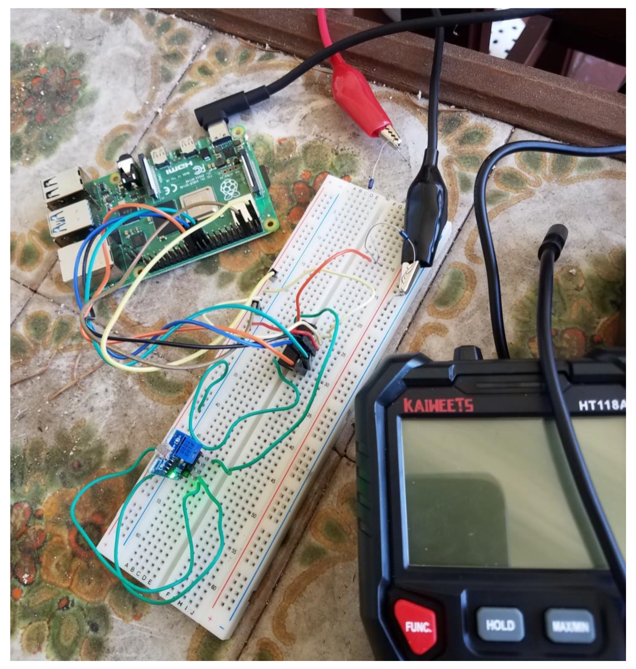
Input Sensing PCB

The Input Sensing PCB senses input voltage and current, as well as the temperature and irradiance. The voltage is sensed using voltage division to step down the sensed voltage to a readable 5 volts for the Pi. Current is sensed using a shunt resistor and current amplifier. Temperature and irradiance are sensed using a temperature module and irradiance module.

Output Sensing PCB

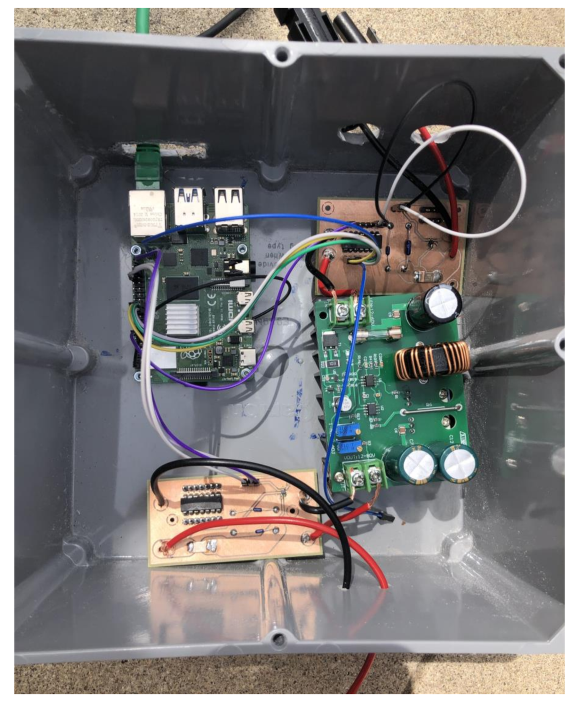
The Output Sensing PCB senses the voltage and current at the output of our system. It uses the same voltage division technique to step down to a readable 5 V for the Pi. Additionally, the same current sensing technique is used as the input.

Prototyping

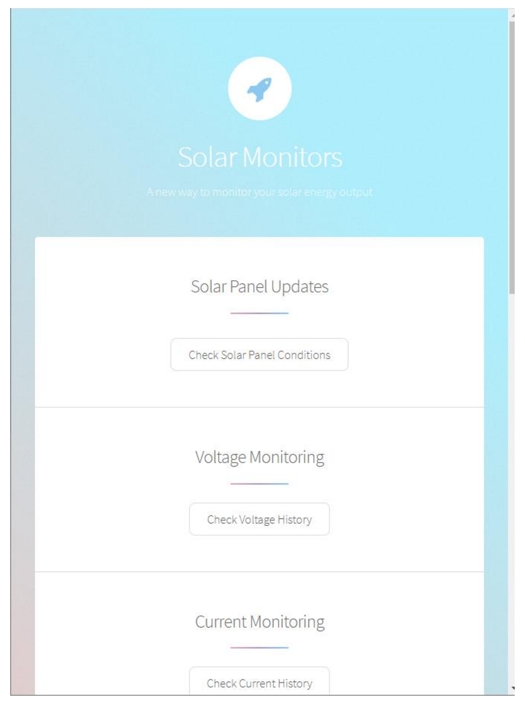


The primary tests and validations that were administered dealt with constructing circuits to sense current, voltage, temperature, and irradiance and then accurately observe this information on the Pi. Two of our many test and circuit prototypes can be seen above. Additionally, on the software side, there were many stages of coding updates needed to accurately read the sensed data and send it to our webserver.

Final Product



The final design for the solar monitor is an 8" x 8" x 4" weatherproof enclosure. Two 14 AWG MC4 connectors are found on the left-hand side of the enclosure to connect the system to a 100 W to 180 W solar panel. Two more 14 AWG connectors and CAT5 cable are connected to the right-hand side to output data transfer to the energy management system. On top of the enclosure, we have a clear window for our irradiance sensor, two mechanical potentiometers to control the voltage and current of the solar monitor, and an LCD screen to display the controls for maximum power output. Inside the enclosure, you will find 2 PCBs connected to our Raspberry Pi. The PCBs contain our input sensing and output sensing circuits.



Users can manually control the output voltage by adjusting a knob on the system; the voltage, current, power and efficiency is then displayed on an LCD screen. Furthermore, users will be able to access past and recent data of the system through a webpage.

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