



Therm-Alert: Solar Battery Charger with Thermal Imaging

Hotspot Detector

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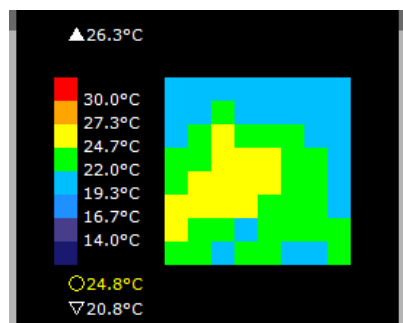
MAKE WAVES.

Abstract

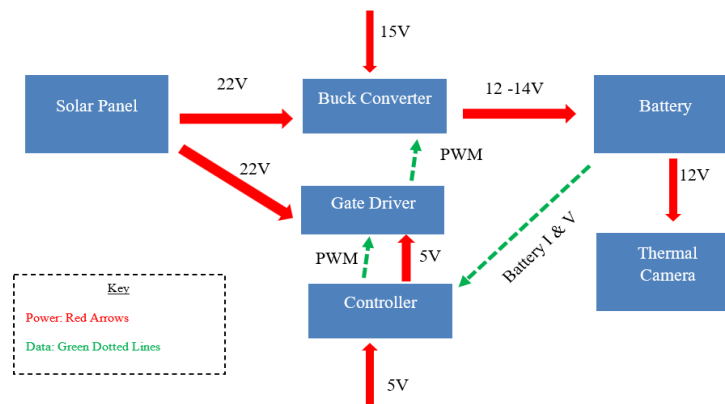
The project is a solar battery charging circuit that uses a 50W solar panel to charge a 12v battery. The charging is achieved using a buck converter circuit controlled by an Arduino Uno. The battery is then used to periodically power a thermal imaging camera that detects hotspots resulting from soiling on the solar panel. Hotspots are a common issue on solar panels and cause degradation of the panels over time. Hotspot detection is critical for increasing the lifespan of a solar panel.

Background

- Solar panels operate optimally in direct sunlight
- Shading and soiling of photovoltaic panels is a natural occurrence but can cause current to build up in the shaded/soiled area.
- This build up of current causes the panel to heat up and over time this damages the panel.
- Thermal cameras are used to detect these hotspots early to prevent damage and address the issue.
- Most thermal cameras are handheld and only provide data periodically thus a fixed camera would allow for continuous data on the soiling/shading conditions of the panel.



The thermal imaging camera shows the temperature variation across the solar panel.

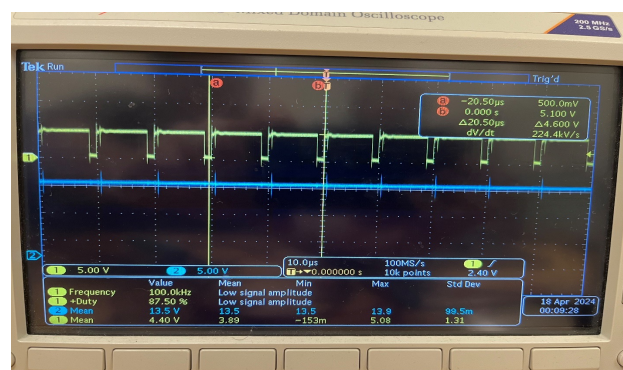


Power & Data Flow Diagram

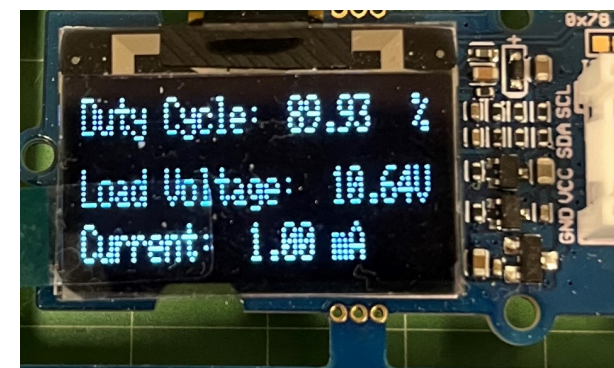
Methods and Materials

- The solar panel provides approximately 20 volts at the input of the circuit.
- The buck converter uses current control to modify the pulse width modulation signal into the buck converter that in turn regulates the current into the battery and charges it in a safe and optimal manner.
- The 12-volt 12 Ah lead acid battery is charged by the solar panel. When it is done charging the battery powers the thermal imaging camera.
- The thermal imaging camera is used to detect hotspots on the solar panel which prompts the observer to clean the panel.

Results



The output voltage in blue and the duty cycle in yellow. The duty cycle determines the output voltage relative to the input voltage.



The OLED display presents the output voltage and duty cycle measured in the circuit.

References

- [1] B. Sandeep, D. S. Reddy, A. R and R. Mahalakshmi, "Monitoring of PV Modules and Hotspot Detection using TensorFlow," 2022 International Conference on Electronics and Renewable Systems (ICEARS), Tuticorin, India, 2022, pp. 155-160, doi: 10.1109/ICEARS53579.2022.9752346.

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