Solar Charger

Controls a 170W solar panel to charge a SLA battery, Li-ion batteries, and USB-C devices.

SYSTEM REQUIREMENTS

- Display current, voltage, and power characteristics during operation onto a screen.
- The system must use MC4 connectors, have a disconnect switch, and not have any exposed conductors.
- Charge lead acid battery with proper curve while displaying battery status to user.
- The system must be able to charge a Li-ion battery.
- Temperature of each battery in the system must be measured and displayed.
- The USB-C power delivery should be able to deliver up to 45 watts of continuous charge to any compliant device.
- Given enough power is available from the solar panel or lead acid battery, the secondary batteries and USB-C should be able to charge simultaneously.

LEAD ACID BATTERY CHARGING ALGORITHM

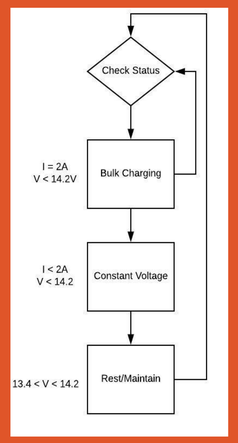

Figure 5: Flow chart of the system's SLA charging curve

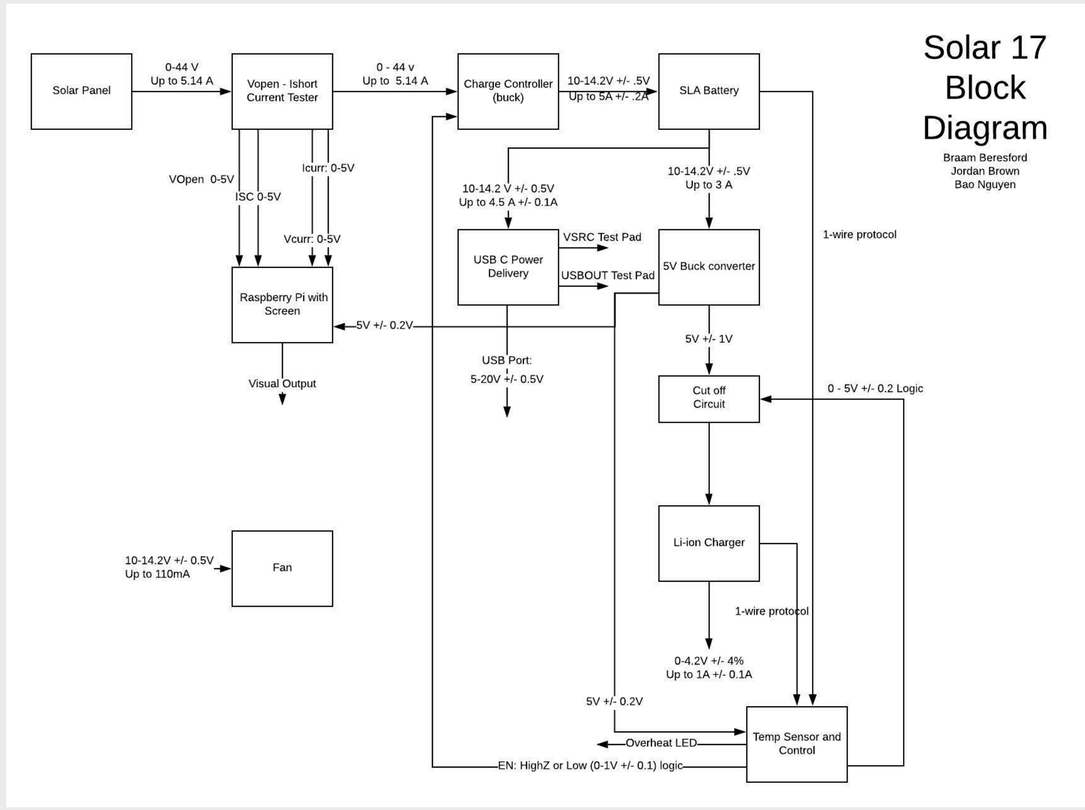

Figure 1: Block Diagram

Charge Controller

- The charge controller module is responsible for regulating the voltage and current to the SLA battery and external load.
- Sensed input and output voltage + current
- System state and sensor data will be process by an Arduino NANO and feedback voltage are controlled with an digital potentiometer.
- Add-on 4.2V 500mA Li-Ion Battery
- System and battery temperature monitoring

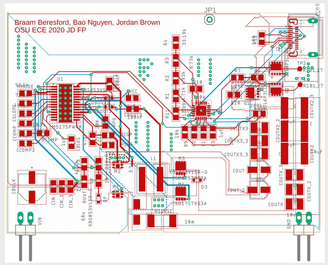

Figure 2: USB-C Charging Circuit

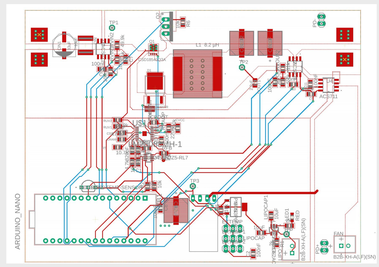

Figure 3: Charge Controller Circuit

USB-C Charge Regulator

- STUSB4500 IC negotiate charge voltage with USB-PD compatible devices by configure feedback loop for the Buck/Boost converter.
- USB-C compatible port with short circuit and over current protection.

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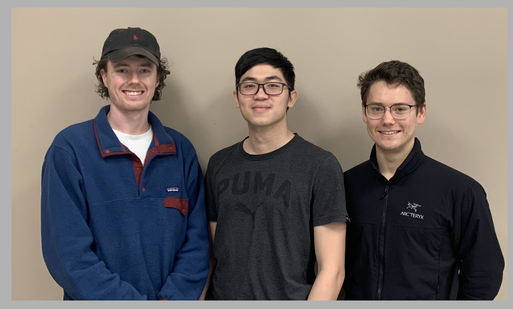
  USB-C PCB



CAD Drawings

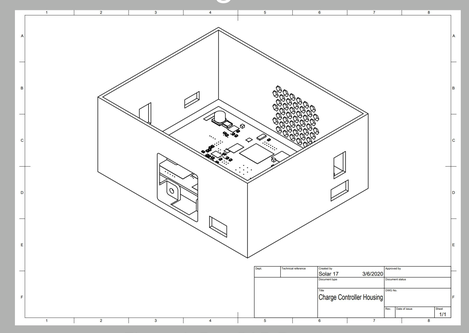


Figure 4: Box CAD Drawing

USB-PD

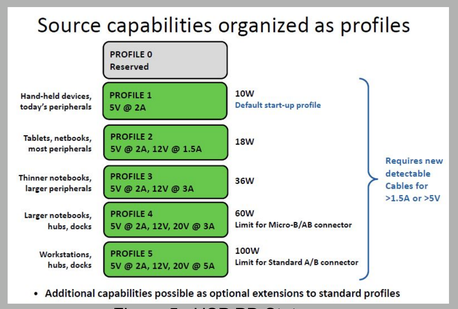


Figure 5: USP PD States

Future Developments:

- Mounting holes on PCB
- Reduced component cost
- Floating charge capability
- USB-C Power Delivery 3.0 at 100W
- Power cut off for battery

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