

Development of a Low Cost Pyranometer

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Our Objective

Create a competitive prototype for Kilowatts for Humanity that is:

- Able to obtain accurate solar irradiance readings
- Simple to build and install
- An affordable alternative to commercial models



Background

Kilowatts for Humanity is a non-profit that provides renewable off grid electrification to developing countries.

- Rooftop solar stations bring first time access to electricity
- Provided services:
 - Refrigeration
 - Device charging
 - offline servers.



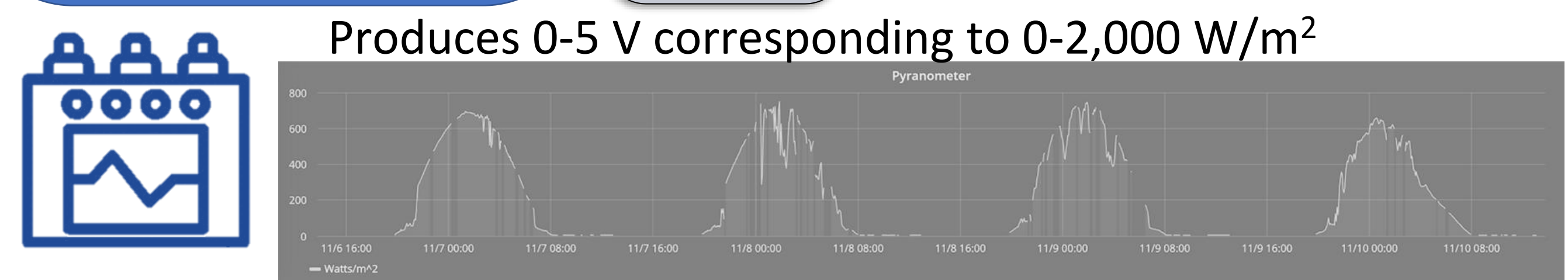
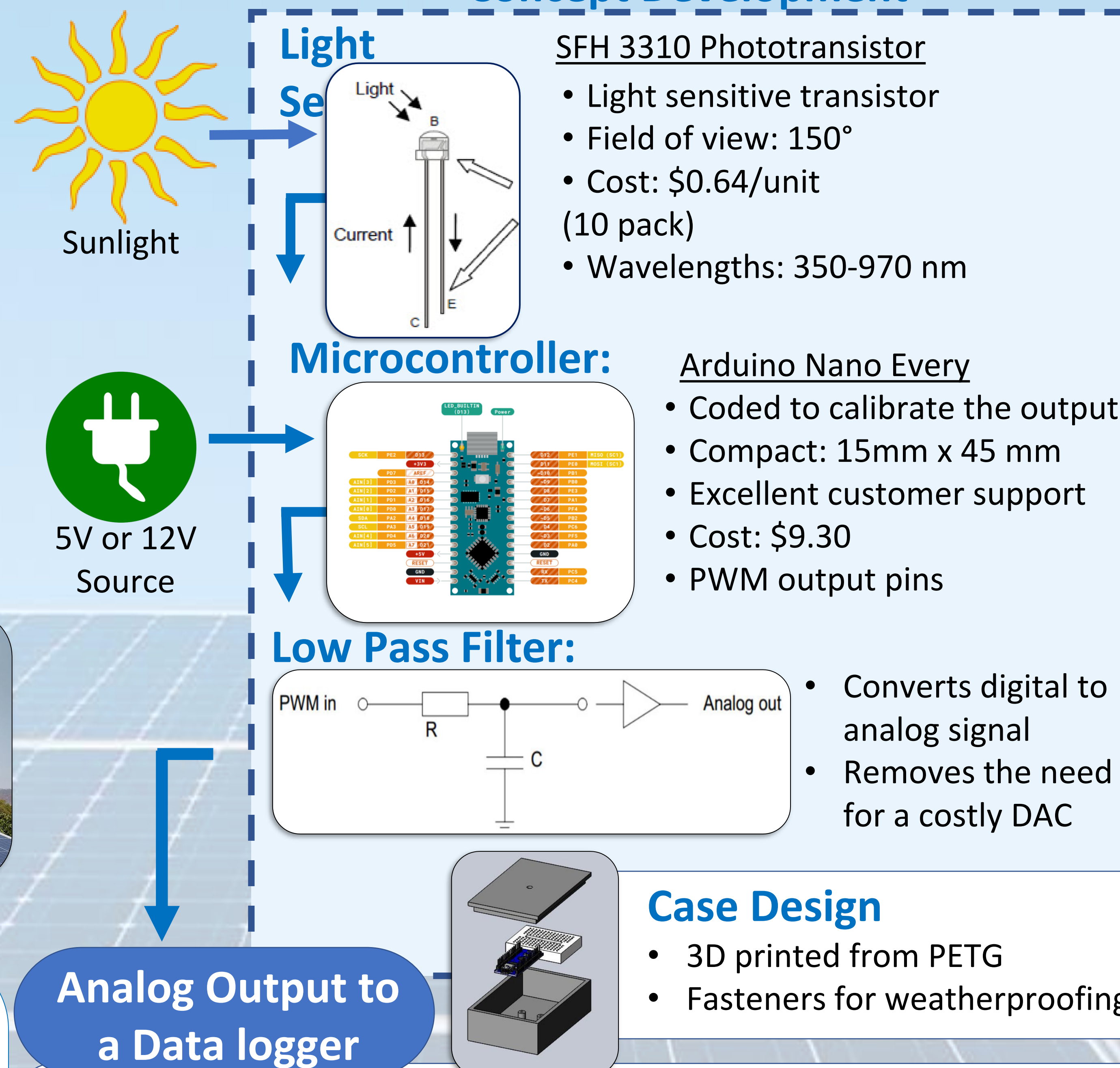
Value Proposition

Solar panels require continuous maintenance and monitoring. Pyranometers measure solar irradiance and are installed alongside solar panels to verify that they are absorbing light energy properly. Commercial pyranometers include extra features and are costly. This organization has asked us to look for a budget friendly alternative.

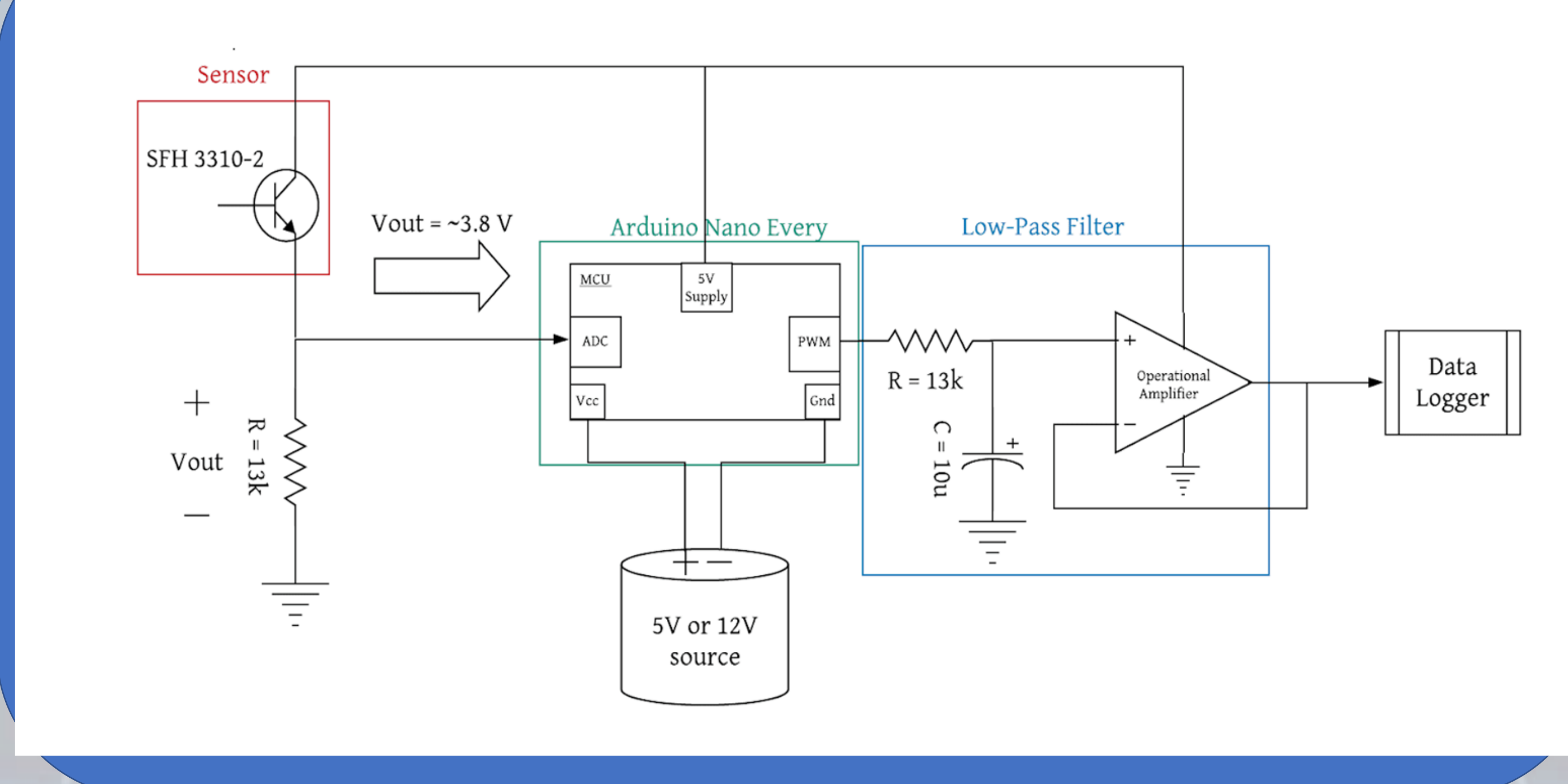
Requirements

- A prototype must cost between \$20-80
- The data from our device must be accurate. Compared to calibrated pyranometers, our results need to have less than 15% error.
- Our design needs to include clear directions so that KiloWatts for Humanity can reproduce our prototype.

Concept Development



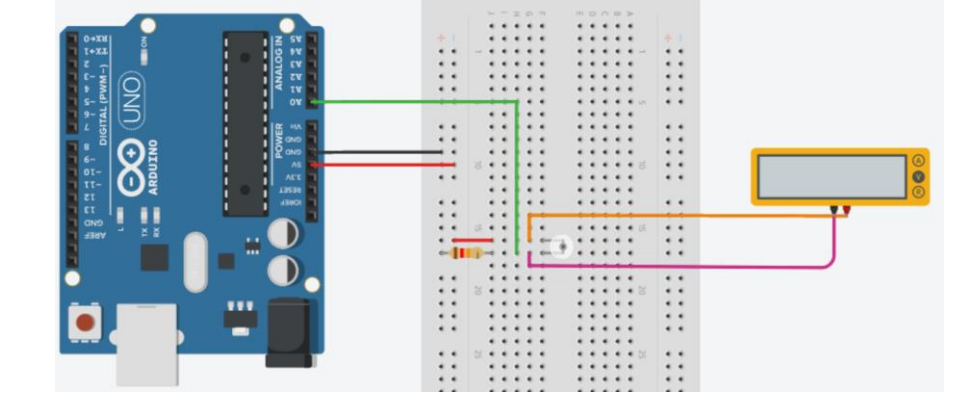
The Final Design



Validation

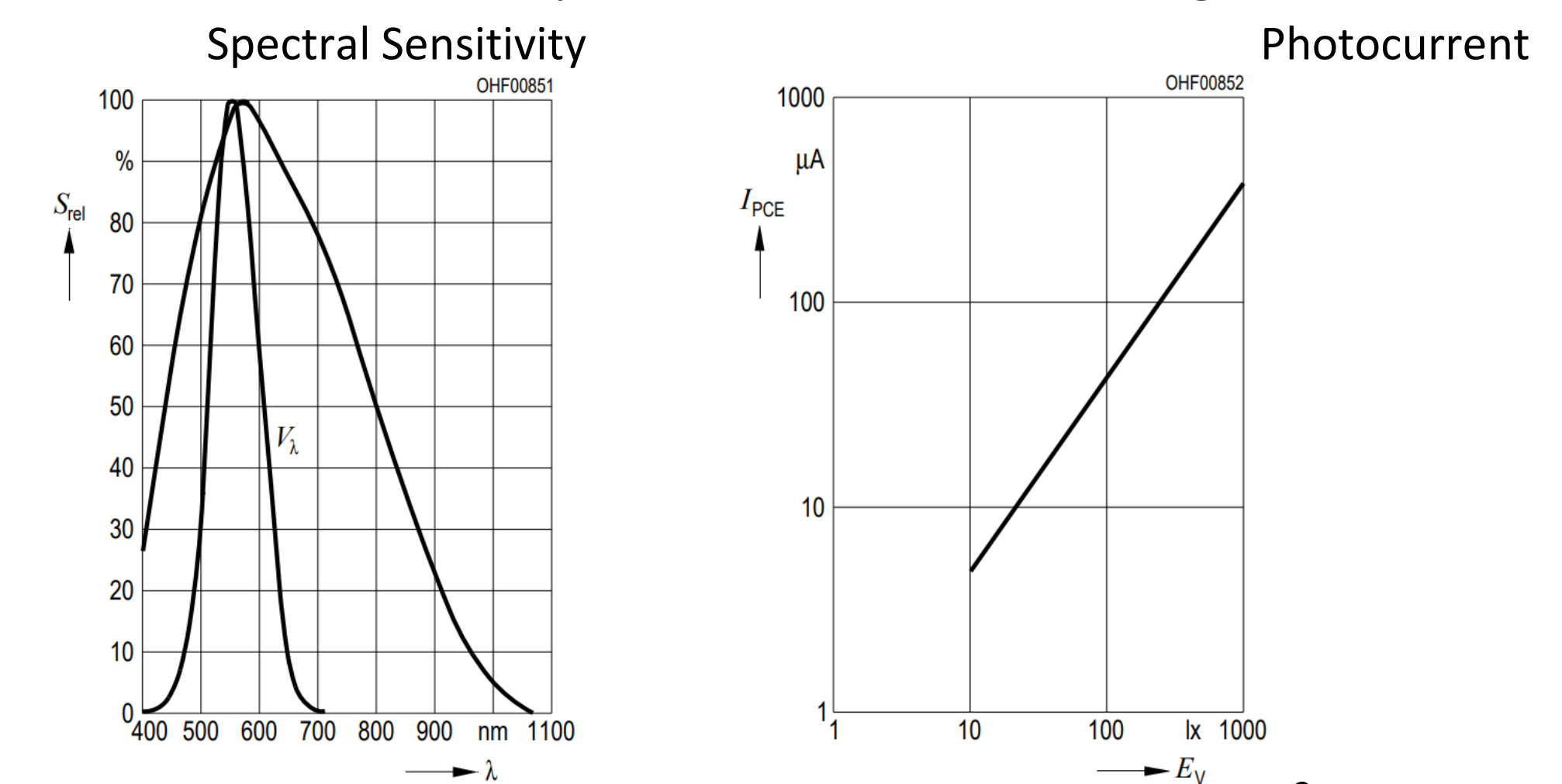
Virtual Testing:

- Tinker CAD simulations: Verifies circuit and Arduino compatibility and output range.



Physical Testing:

- Generation of IV curve: Adjustable solar lamp provides the current and voltage effect of the sensor when exposed to different wavelengths.



Results are used to calculate solar irradiance (W/m²)

- Prototype output verification and calibration:

Confirms 0-5V output and tests accuracy when compared to three calibrated pyranometers.



MP-100: Pyranometer Integral Sensor \$361.00



CMP10 Pyranometer Provided by the University of Idaho



SP-215-SS: AMPLIFIED 0-5 VOLT PYRANOMETER \$273.00

- Environmental chamber evaluation:

Performance data when exposed to environmental stress

Summary

- Based on the parts that were selected, each prototype costs \$25.
- Physical validation testing will begin next week.
- Once testing and prototype alterations have processed, we will start on an instruction manual.

Recommendations

- Convert 0-5V output to 0-20mA to avoid voltage drop
- Test a two-sensor system to widen viewing angle.