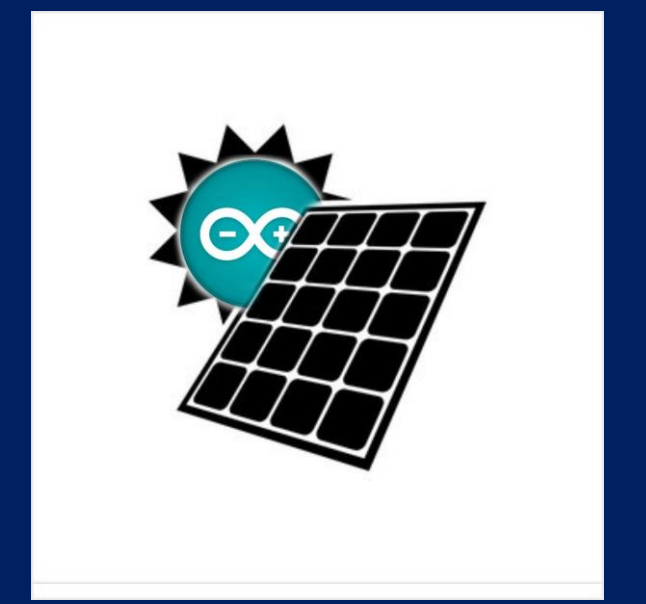




Fully Solar Powered Living

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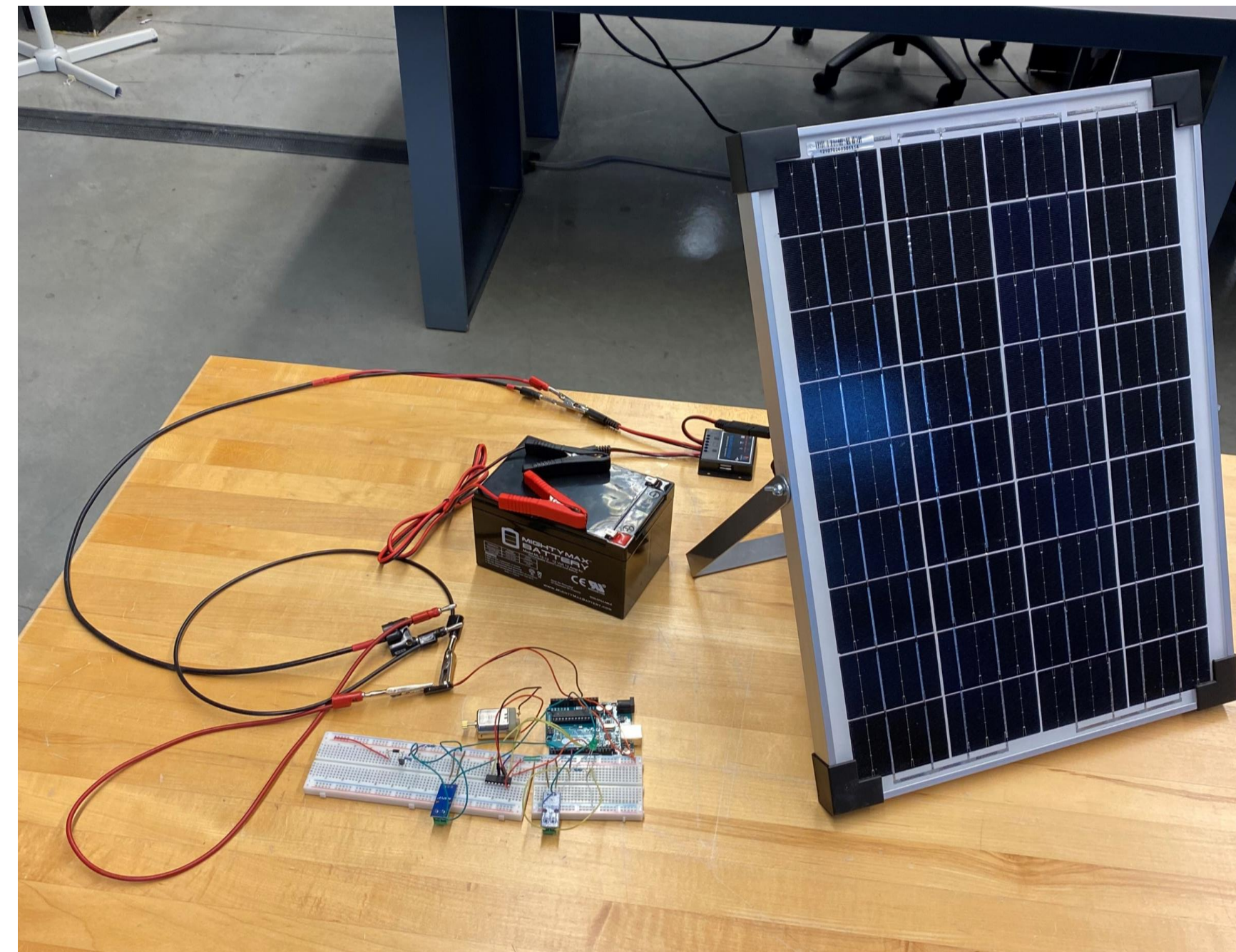
Introduction

With solar energy being on the industry rise for the past couple of decades, our group decided to take on the challenge of harnessing and utilizing the sun's energy on a smaller scale array to energize an Arduino Uno circuit.

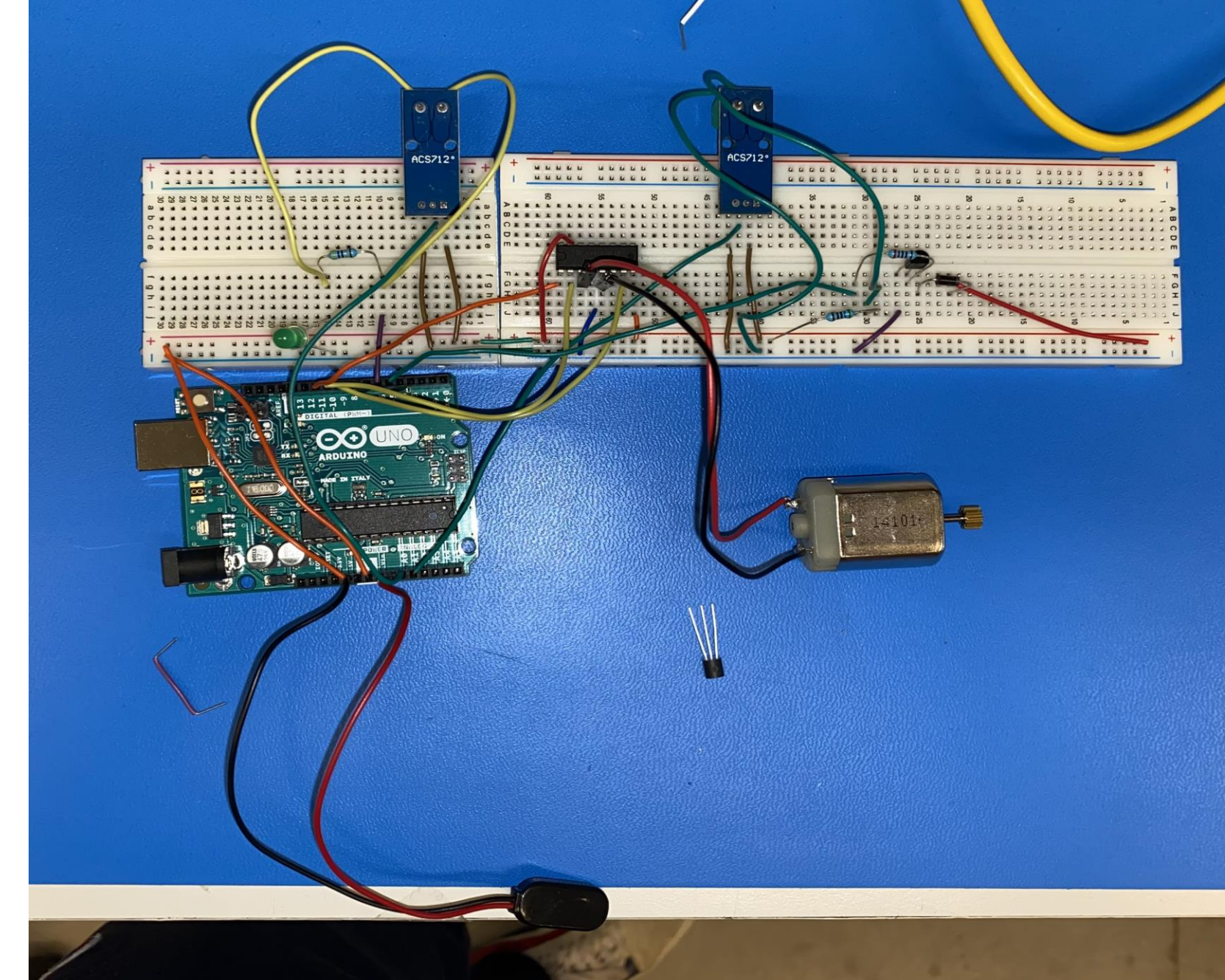
This project challenges the students to design a system that can perform various functions using the Arduino Uno. These functions include the handling of simultaneous loads, current consumption measurements, and managing the loads based on current consumption data.

Project Hardware

Final Combined Hardware



Smart Switching Circuit Prototype



Concept and Potential Uses

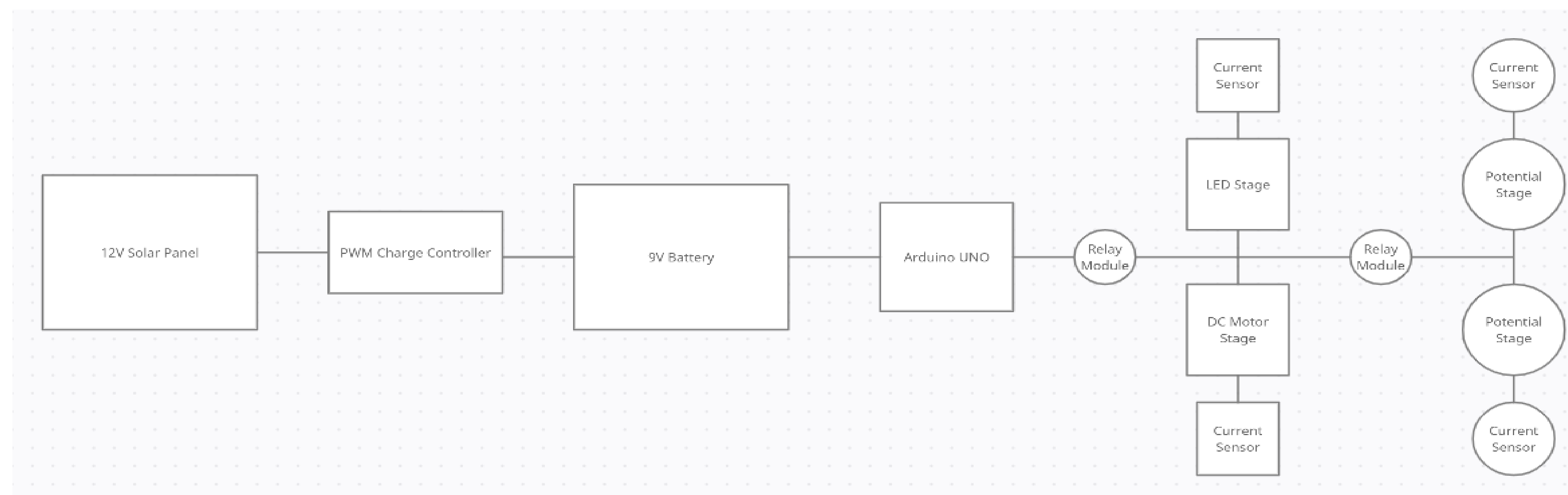
- Current Sensors:**
- Used in the project to measure the LED stage current consumption, input current, DC motor stage current consumption
 - Improved smart switching circuit prototype can provide a homeowner with better information about their home's receptacle and appliance loads
- Solar Power and Sustainability:**
- Efficient control of solar power will make it more feasible for structures to be powered with renewable energy
 - Improved smart switching circuit prototype can improve solar power use in homes
- Automation:**
- Switching off appliances automatically when taking too much power allows safety as a circuit breaker
 - Switching off appliances automatically allows the redirection of power for better efficiency
 - Improved smart switching circuit prototype can provide automation to controlling household loads

Methodology

- Coding:**
- Measure current consumption
 - Prioritize in order of lights, HVAC, and current consumption
 - Automatically switch individual priorities
- Hardware:**
- Connecting loads, battery, and solar panel to the centralized Arduino unit
- Testing:**
- Charging the 12V battery using the solar panel and provided PWM charge controller
 - Current measurement of the LED stage and DC motor stage
 - Application of smart switching circuit without the relay module

Block Diagram

Block Diagram of the Ideal System



Conclusions

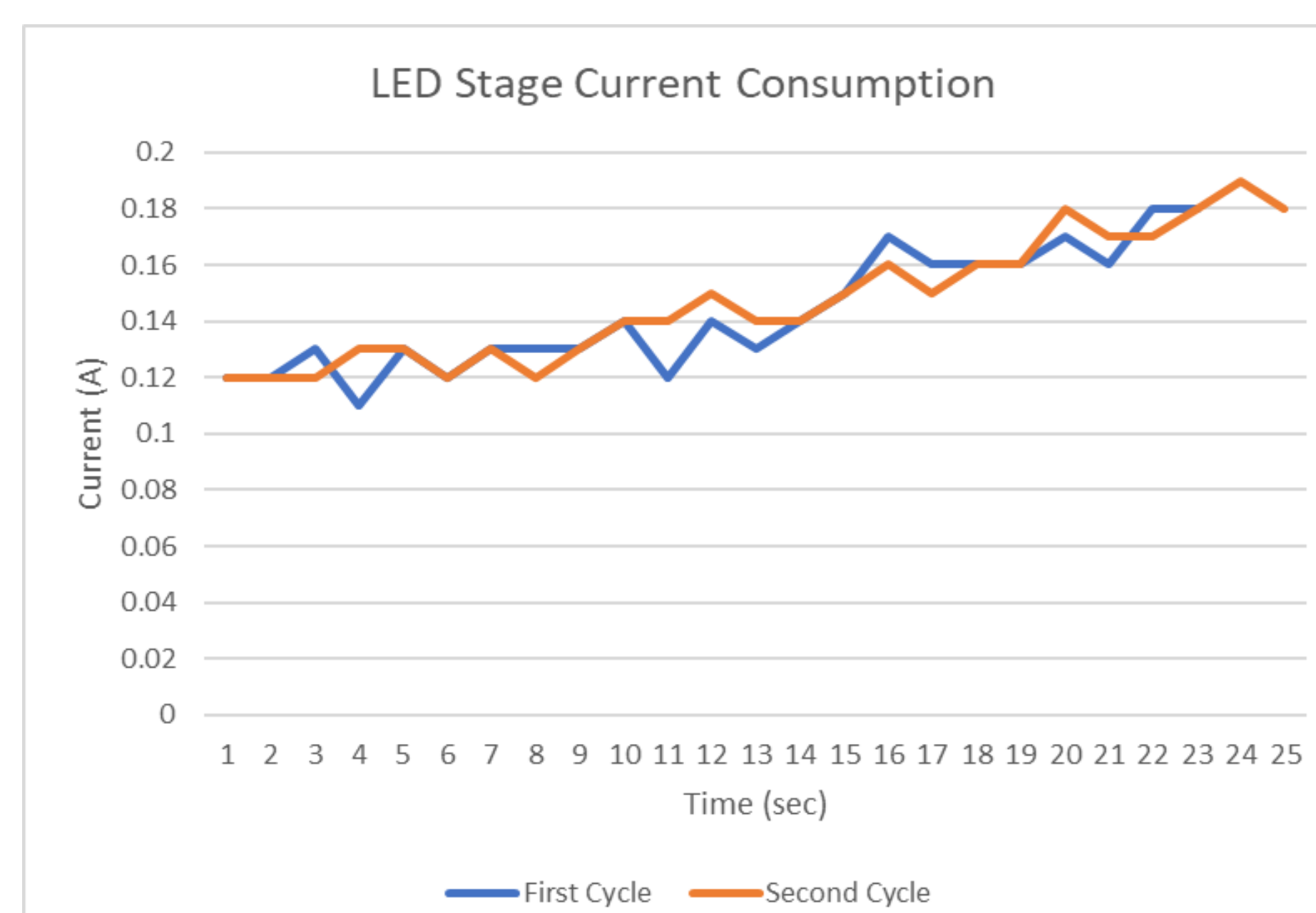
- Results:**
- Solar panel charged the 12V battery during clear days
 - Current sensor successfully printed an output to the Arduino Serial Monitor
 - Smart switching prototype turned off the DC motor based on declared current consumption for the LED stage
- Next Steps:**
- A second Arduino Uno for more processing power
 - A swivel for the solar panel and coding with photoresistors to follow the sunlight
 - Larger variety of loads
 - Smaller battery for low voltage design prototype
 - Add relays to prevent excess current draw, as well as control load stage states more effectively
 - Implementation of household receptacle loads

Data

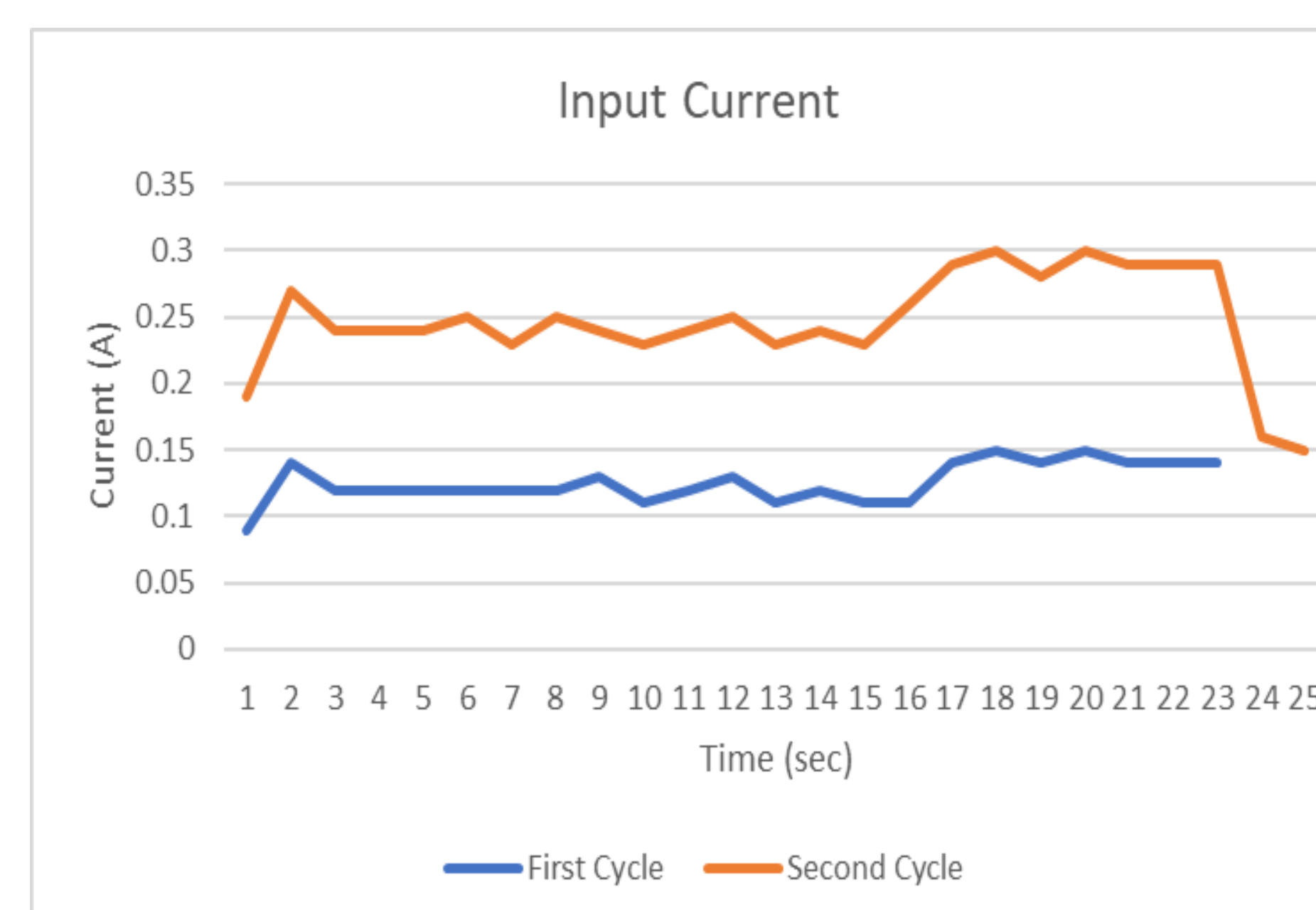
- LED Stage Current Consumption:**
- A program that increases the amount the brightness the LED over 25 seconds.
 - The increase in current consumption corresponds to the increase in LED brightness over time.
- DC Motor Stage:**
- To conserve power, the DC motor is turned off when the LED consumes $>.16$ A.
- Input Current:**
- Input current measurement to see when the DC motor is turned on and off
 - Increase in available current when the DC motor is turned off
- Block Diagram:**
- Square and rectangle blocks denote parts used in the prototype
 - Circle blocks denote theoretical blocks that could be added to an improved future design

Data from Testing Phase

LED Stage Current Consumption



Input Current



Acknowledgements

The group would like to thank Professor Wayne Smith for being the advisor throughout this process. The professor would also thank Marek Sosnowski from NJIT for the initial project idea.

References

- A few senior project ideas-s10-MS (njit.edu)
- Marek Sosnowski
- Energy.gov/solar-photovoltaic-cell-research-directions
- Electronics.stackexchange.com
- Create.arduino.cc
- Previous courses: Electromagnetism, Electronic Design, Intro to Scientific Programming, Junior Laboratory, Applications of Integrated Circuits