

EE / CprE / SE 491 – sdmay20-10

Power Scraping Module

Week 2 Report

9/20/2019 -10/5/2019

Client: Honeywell FM&T

Faculty Advisor: Gary Tuttle

Team Members/Role:

Jordan Fox — Chief Engineer

Xiangyu Cao — Design Engineer

Andesen Ande — Design Engineer

Ahmed Salem — Test Engineer

Ben Yoko — Test Engineer

Shahzaib Shahid — *Team Leader*

Weekly Summary

This week we received the project parameters and developed a block diagram of how we anticipate the power scraping module will work. During our meeting with our faculty advisor we discussed possible ways to achieve our objectives. In this meeting we detected some challenges for each possible design including converter AC-DC given our input constraints. The overall objective was to make a high level design and further investigated components of our system.

Past Week Accomplishments

Initially in the investigation and high level design stage we found it vital that all members participate in understanding the fundamental concepts of our project. All past week accomplishments were completed by every member.

Supercapacitor Investigation:

- They are electronic devices that are used to store electric charges.
- There are many names for Supercapacitor such as double-layer capacitors or ultracapacitors.
- Operation based on two mechanisms so that it can store energy. Those two mechanisms are double layer capacitor which is electrostatics and pseudocapacitance which is electrochemical. Therefore, it works as a combination of an ordinary battery and normal capacitor.

- Supercapacitors will be used to store charge in our system. Supercapacitors work for our application because of its low voltage limits and relatively high capacitance.

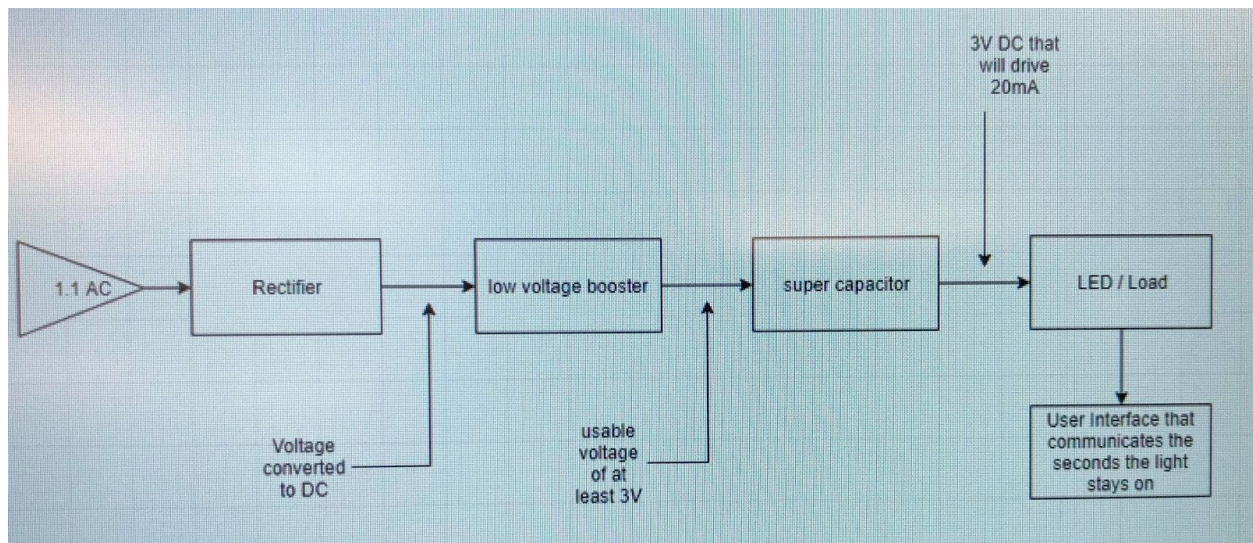
Boost Converter Investigation:

- We are investigating ways to boost a DC V with the use of a boost converter in order to reach the desired level of 3V.
- Is a DC-to-DC power converter that steps down current while stepping down voltage form primary inputs to its load or the output.
- It is a switched-mode power supply that contains a diode and transistor in one end and other ends include storage elements such as inductors and capacitors.

Rectifier Investigation

- In our system a rectifier circuit is required to convert the AC signal to a DC signal before it is amplified and stored. The problem with using traditional diodes is that voltage drop is significant when working with low voltages. An alternative for precision diodes is the use of an op-amp is not feasible with
- One alternative we are exploring is the schottkey diode. The reason being is the low forward voltage drop range of .15-.45 V. At the lower part of the voltage range this may be a viable solution for converting our initial voltage. The problem with this is the power efficiency will at best be 50%.
- We researched the bridge diode as a possible means to perform a full wave rectification. This option might have the highest power efficiency possible for us to attain. We will investigate whether a desired voltage level can be met.

High Level System Design



- For our initial design we have our first stage as a rectifier that will input a 1.1 V peak-to-peak signal and output a DC voltage. We have a couple leads with how this stage will be designed. We will consider the trade-offs as well as the rest of the design for the next phase of development. The second stage will consist of a low voltage DC to DC booster that will output a 3 V minimum. This stage may be a charge pump or boost converter. For our third stage we have a supercapacitor that will store 3+ V. This stage will be consistent in any design iteration given that it is a requirement. The fourth stage will consist of an LED to indicate charge as well as a load. Lastly, we intend to create a UI to monitor the time in seconds that the LED is turned on.

Individual Contributions

<u>Name</u>	<u>Hours this week</u>	<u>Hours Cumulative</u>
Jordan Fox	6.5	13
Xiangyu Cao	6.5	13
Andesen Ande	6.5	12.5
Ahmed Salem	6	13
Ben Yoko	6.5	12.5
Shahzaib Shahid	6.5	12.5

Keep in mind the times reported are estimates. Each member has done their part in understanding the fundamental concepts of our project and all designs have been a collective effort.

Plans for the upcoming week

1. Our first objective for the upcoming week is to meet with the client to discuss our high level design and any concerns.- All team members
2. Continued research on power efficient ways to rectify an AC signal while maintaining minimal loss in voltage- All team members
3. Begin to research parts on DigiKey that meet our design requirements and adjust design as needed. - All team members

