Project Deliverable H: **Prototype III and Customer Feedback**
GNG 1103 – Engineering Design
Solar II

Introduction

Based on prototype 2, we are going to connect the real equipment(not the small replacement shown in previous prototype) according to the circuit that we drew before to test if our circuit can work on the real equipment and to get some values. In that case, we can calculate the efficiency of solar panels and battery and how long each of appliance can use in order to save the energy.

Why

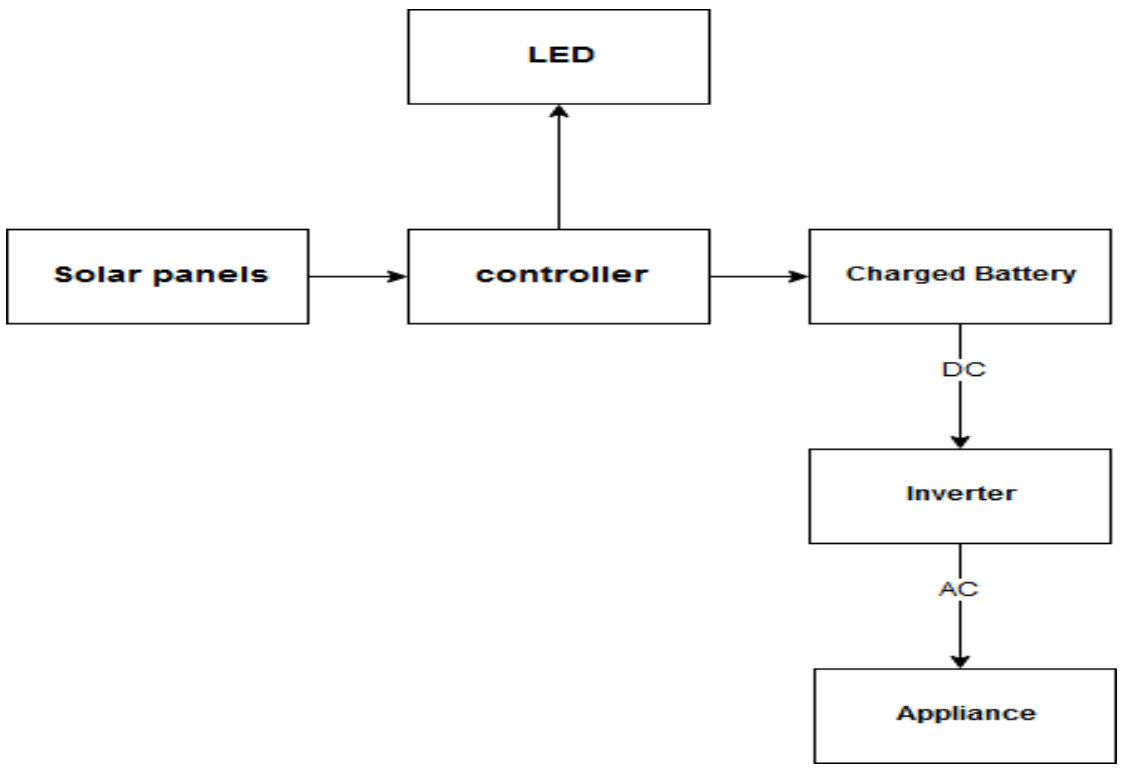
In order to make sure our designed circuit works, and collect data (battery efficiency, solar efficiency, and battery capacity). If some faults appear, we can solve them and find where our design has problems and mistakes as soon as possible. After we collect data, we can figure out if the battery is enough to support household appliances.

When

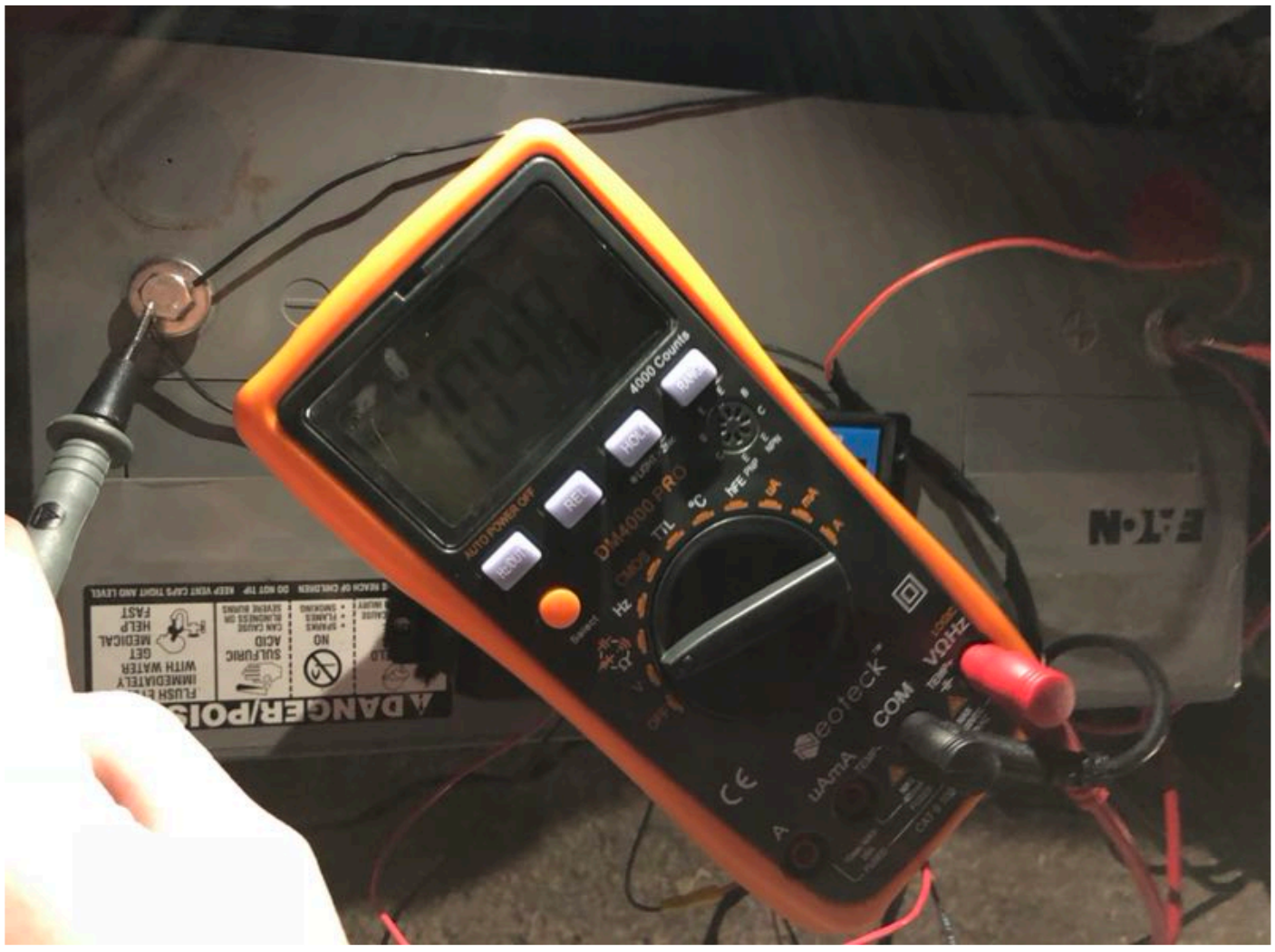
We connected all components and placed them outdoor. We needed to make sure the space we placed our prototype has enough sunlights. The solar panel absorbed sunlight from 7:00am to 5:30pm during three days.

How

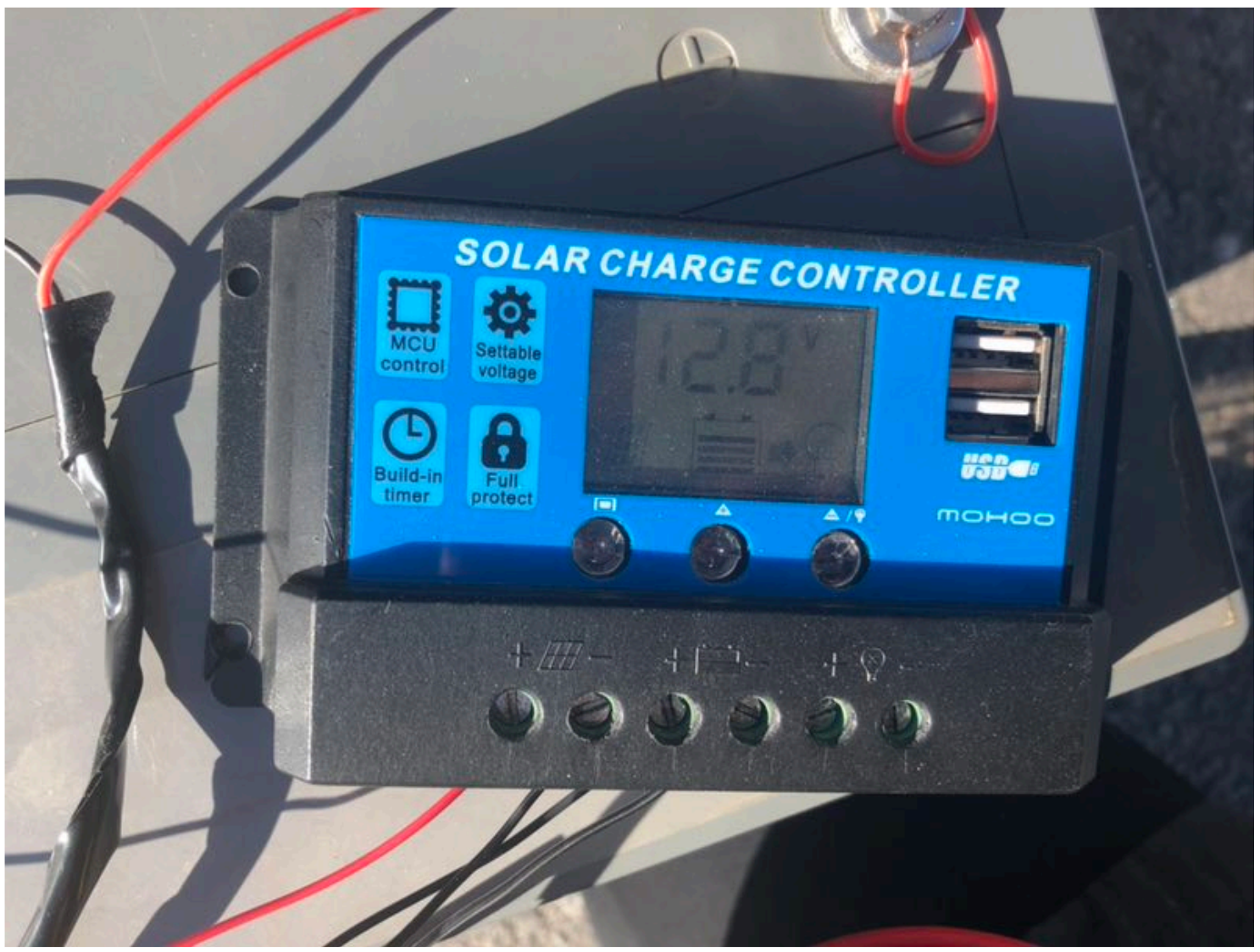
First, we are going to connect all the equipment according to our block diagram.



Then, we are going to move them outside and adjust them until all the equipment starts to work under the sun. After that, we will leave them outside for 2 to 3 days and we will record the values every 3 hours.




STUSSY
NEW YORK
LOS ANGELES
TOKYO
DANGER/POISON
SOLAR CHARGE CONTROLLER
10.4
ETN


SOLAR CHARGE CONTROLLER
MCU control
Settable voltage
Build-in timer
Full protect
12.8 V
MOHOO

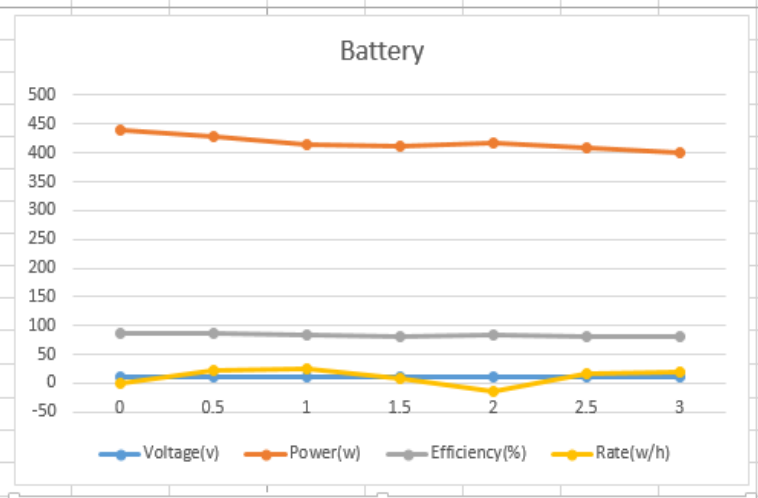
Test Plan

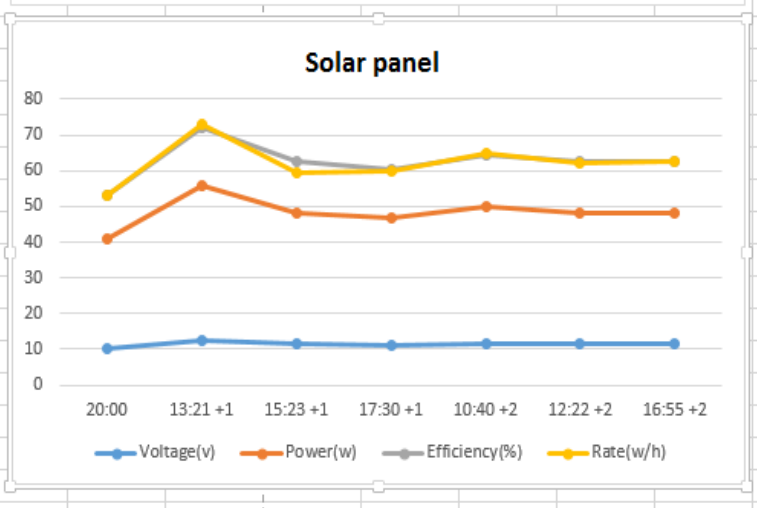
After charging the battery, we connected the battery, a charger controller, and a glue gun. If the glue gun work (emit heat), this means our prototype works.

Therefore, we can use the values that we got to calculate the efficiency of solar panels. Also, we can drain all the power that we got in the battery by using the glue gun to calculate the efficiency of the battery.

Result

		Battery			
	Voltage(v)	Time(h)	Power(w)	Efficiency(%)	Rate(w/h)
	11.24	0	438.672222	87.73444444	0
	11.1	0.5	427.8125	85.5625	21.27
	10.94	1	415.568056	83.11361111	24.48
	10.88	1.5	411.022222	82.20444444	9.1
	10.97	2	417.850347	83.57006944	-13.66
	10.86	2.5	409.5125	81.9025	16.56
	10.73	3	399.767014	79.95340278	19.6
		Solar			
	Voltage(v)	Time(h)	Power(w)	Efficiency(%)	Rate(w/h)
	10.4	20:00	30.7272727	11.81818182	0
	12.34	13:21 +1	43.2601136	16.63850524	0.716162338
	11.4	15:23 +1	36.9204545	14.20017483	-3.16982955
	11.2	17:30 +1	35.6363636	13.70629371	-0.64204545
	11.6	10:40 +2	38.2272727	14.7027972	0.152406417
	11.4	12:22 +2	36.9204545	14.20017483	-0.52272727
	11.4	16:55 +2	36.9204545	14.20017483	0





According to the values we got from our test, we made two tables about the specification of battery and solar panels.
We also calculate how much energy each appliance is needed and how long each of them can be used, and then we compare the total energy that the battery has with them to see if the energy we generate is enough.

Appliance	Power(w)	Time used(h)	Energy(wh)
LED	6	4	24
Air heater(winter)	500	1.5	750
Water heater(winter)	2500	0.083(5 min)	208.3

Total energy used	982.3 wh
Battery energy	1680 wh

So, it seems that all the energy from battery can support all the equipment.

Conclusion

It turned out that our project worked. All the equipment worked and the battery was charged. In the meanwhile, we got the values that we need. According to the calculation, all the appliance only can be used for at most 2 days if we only use the energy from solar panels, so we can’t use all the appliance at the same time.