

## EE/CprE/SE 492 GROUP PROGRESS REPORT #2

Group number: 01

Project title: Hybrid solar/battery for electronic derailleur

Client: Dr. Raj Raman

Advisor: Dr. Raj Raman

Team Members: Aydin Bashich, Elba Estarellas, Connor Davison, Mohamed Mohammad, Seth Pierre, Rachel Vallier, and Jack Waskow

- **Project Summary:** Our client requested a solar battery to charge an electronic derailleur. The derailleur is currently charged with a battery that is charged through a wall outlet. The benefit of having the solar battery is that the battery will never need to be taken off the derailleur to charge and, therefore, will hypothetically never die because the sun will be able to charge the battery since the bike is outside. For our project, we determined the components we needed to accomplish a set of criteria the client provided for our project. An example of one constraint is that the battery must have a run time of 10 hours.

- **Accomplishments**

Below is the breakdown of large tasks with subtasks and the people involved.

	A	B	C	D	E	F	G
1	Big Tasks	Sub Task	Person(s)	Sub Task	Person(s)	Sub Task	Person(s)
2	Verification	LTSpice	Rachel and Elba	Cross-checks	Mohamed		
3	Testing Circuit	Programming Arduino	Aydin	Building Arduino	Connor	Watching	Connor
4	Battery Assembly	Test Battery on breadboard	Jack	Electrical Assembly	Jack (Seth backup)		
5	Case Design	Model	Seth	Electical Connections (battery to derailleur)	Mohamed	Weather Proofing	Seth
6	Documentation	Biweekly Report	Rachel and Elba	Correct/Update Design Document	Rachel and Elba	Update website	Seth

### Group 1: Aydin, Connor, and Mohamed

1. Connor designed a circuit to simulate the current draw on the battery when the derailleur is shifted. The circuit can be seen below in figure 1.
2. Created Arduinio program to observe and record voltage of battery with a simulated shift of derailleur with current draw of 470 mA per shift. The program can be seen in figure 2.
3. Set up and tested the circuit with the battery to simulate current draw of 470 mA, the circuit can be seen in figure 3.
4. Figure 4, demonstrates a sample output of time vs. voltage, as seen the voltages are within an appropriate range for the battery.

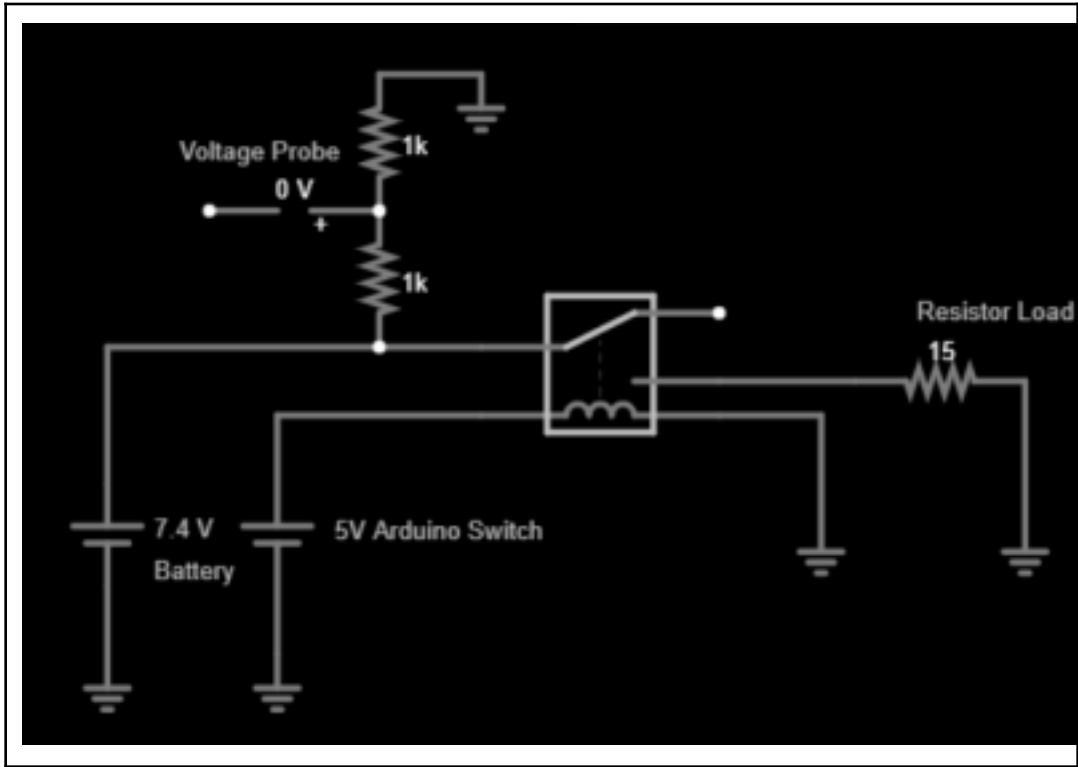


Figure 1

```

void setup() {
  pinMode(7,OUTPUT);
  pinMode(A0,INPUT);
  Serial.begin(9600);
}

void loop() {

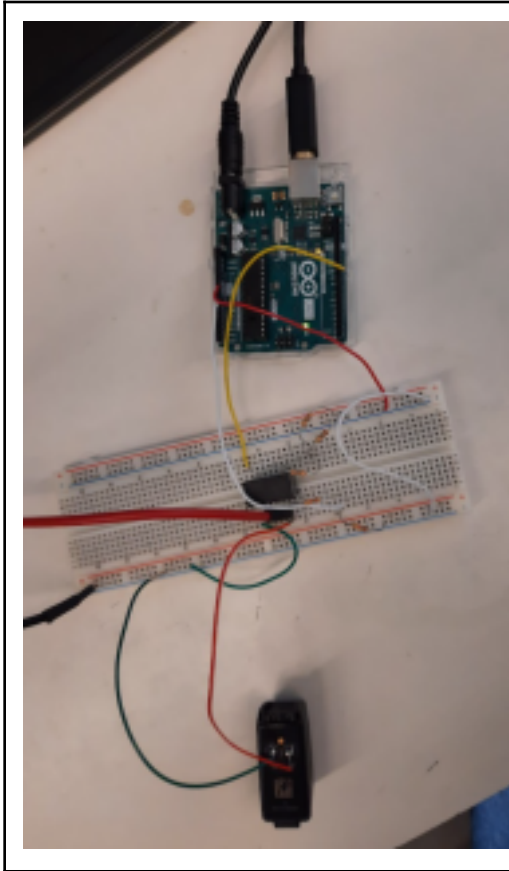
  digitalWrite(7,HIGH); //turn supply on
  unsigned long CurrentTime = millis(); // Gets current time
  unsigned long TotalSeconds = CurrentTime/1000; // Calculates total time in hours
  int sensorValue = analogRead(A0); //get input information
  float voltage= 2 * sensorValue * (5.0 / 1023.0); //convert information to voltage value
  Serial.print(TotalSeconds); //print voltage values
  Serial.print(",");
  Serial.print(voltage); //print hours elapsed
  Serial.print(",");
  Serial.println();

  delay(1000); //wait 1 second

  digitalWrite(7,LOW); //turn supply off
  delay(30000); //wait 30 seconds
}

```

Figure 2



TIME	CH1	CH2
15:34:04.74	248	3.89
15:34:35.76	279	4.00
15:35:06.78	310	4.11
15:35:37.81	41	3.80
15:36:08.82	372	3.80
15:36:39.84	403	4.11
15:37:10.87	434	4.42
15:37:41.89	465	4.42
15:38:12.91	496	3.80
15:38:43.93	527	4.42
15:39:14.95	558	3.80
15:39:45.97	589	4.42
15:40:16.99	620	3.80
15:40:48.00	651	3.91
15:41:19.03	682	3.91

Figure 3 Figure 4

### Group 2: Jack and Seth

1. We received the DC converter, and Jack began to put all the components together on the breadboard to test.
2. Jack designed a charge controller to overcome the issue with the current DC converter, this charge controller can be seen in figure 5.
3. Jack tested new solar cells and found the voltage output to be 5V. 4. Seth created three 3D models and printed them to determine the model most suitable for the design.
5. Seth received an email back from SRAM with the voltage drop and current withdrawal for each shift, this can be found in figure 6.
6. Seth added the 3D modeled case to the derailleur, the case alone can be seen in figure 7 and the case attached to the derailleur is in figure 8.

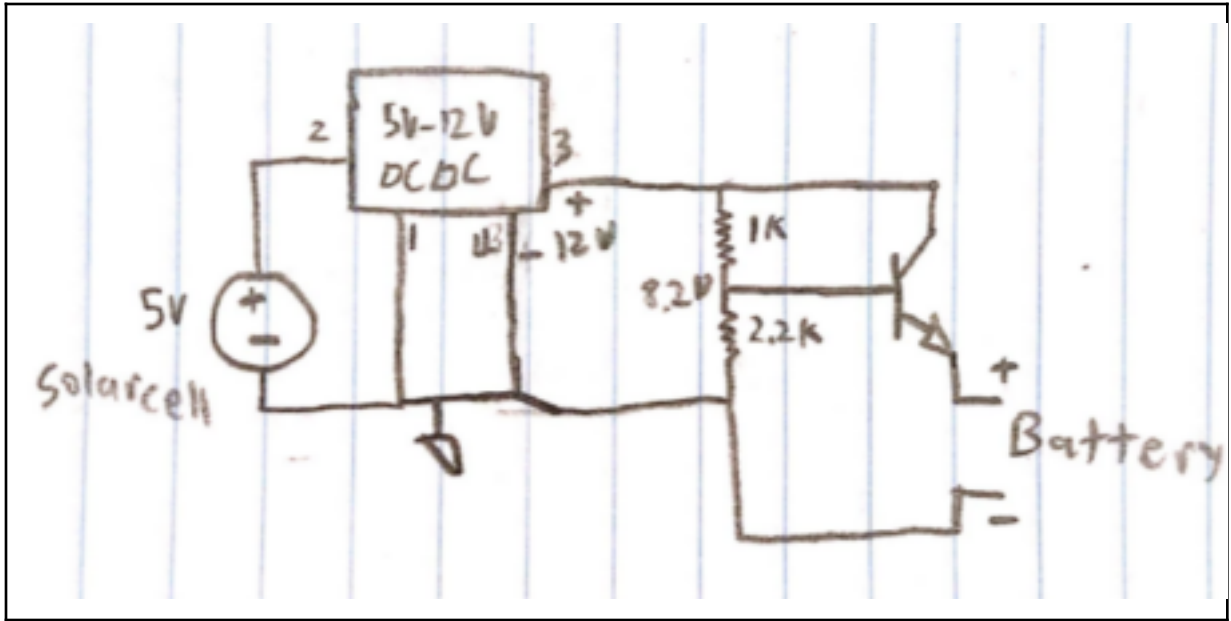


Figure 5

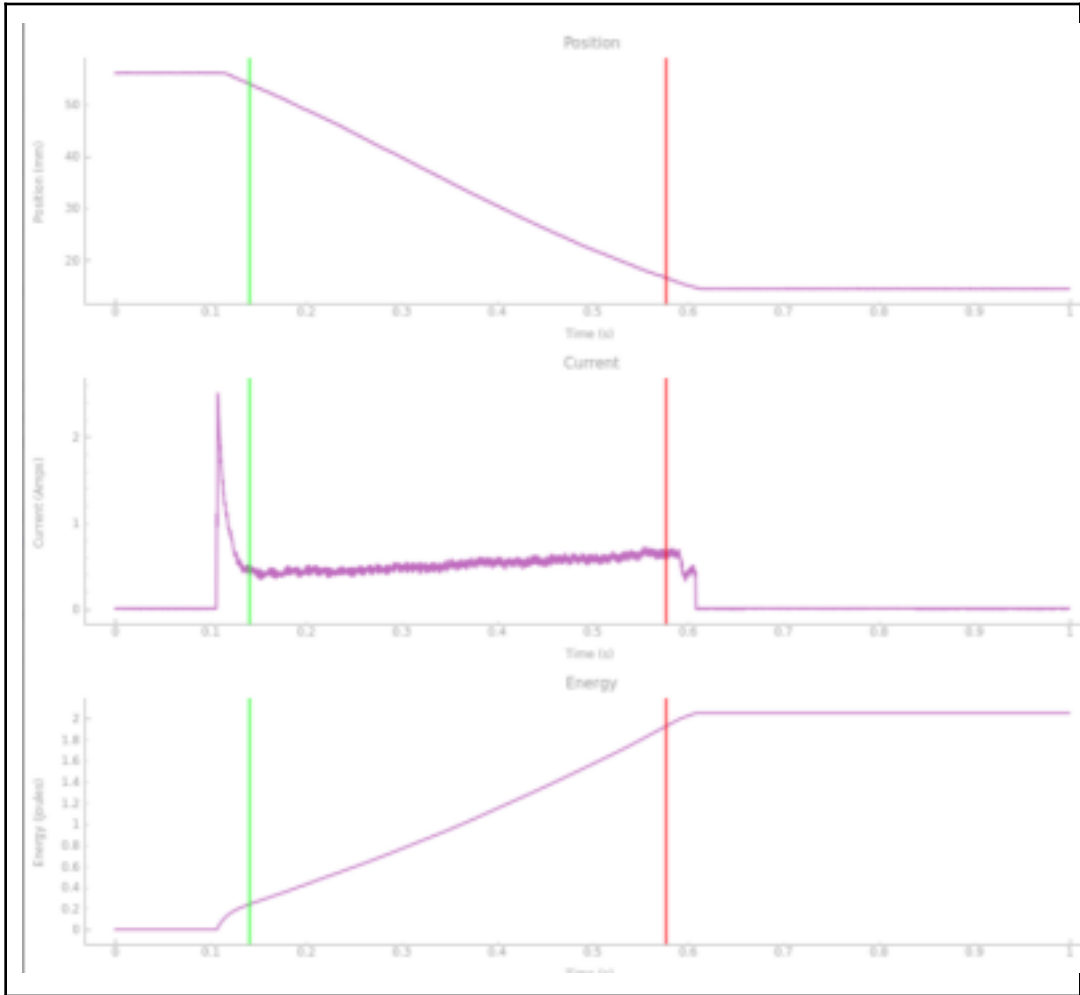


Figure 6

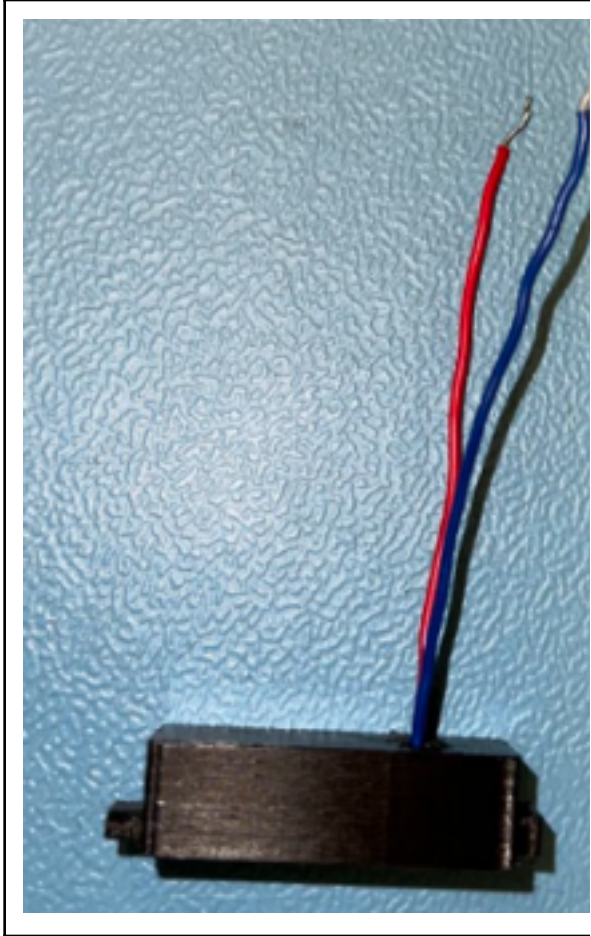


Figure 7 Figure 8

### Group 3: Rachel and Elba

1. Researched programs for modeling and simulating the system. 2. Created a simple solar cell in LTSpice to observe how current, voltage, and power should behave. The model can be found in figure 9 and the outputted graph can be found in figure 10.
3. Started version 2 of the design document.

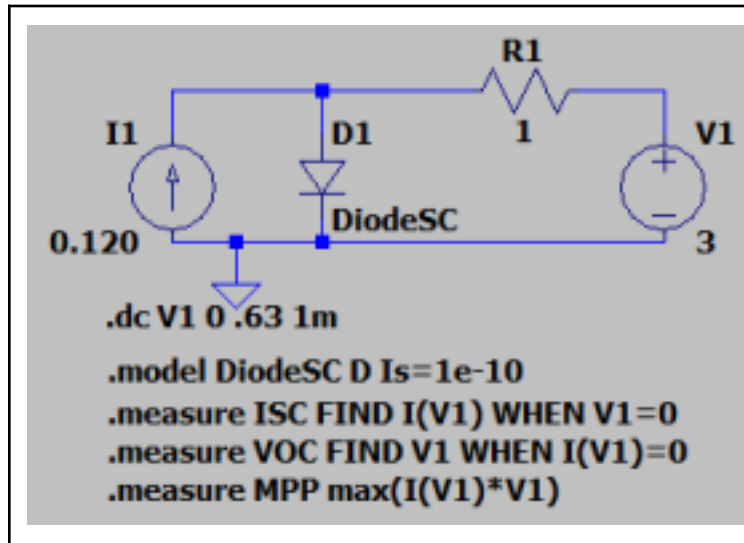


Figure 9

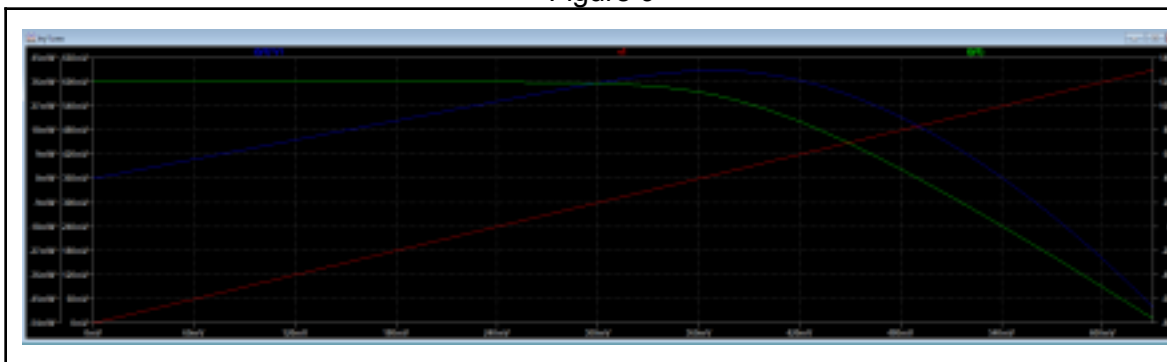


Figure 10

○ **Pending issues** Currently, we have not had an opportunity to test the solar panel under good lighting conditions, so the current is not 100% accurate.

○ **Advisor Input/Signature:**

Please select one of the options below and sign.

\_\_\_xxx\_\_\_ I am pleased with the progress the team is making.

\_\_\_\_\_ The team's progress could use some minor improvements, which I will discuss with them.

\_\_\_\_\_ The team's progress has some major concerns that I will discuss directly with Dr. Bigelow, bigelow@iastate.edu , 515-294-4177



Signature: D. Raj Raman

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