Design Competition Results
Includes photos shot during the competition and Report Submitted by the Team.

Team 3

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The design we chose for our competition car was a low profile, front wheel driven, four wheel car. The wheel radius and gear ratio are given:

Wheel radius:
Front: 17.5 mm
Rear: 19.5 mm
Gear Ratio = 1:1

Our team chose a 1 to 1 gear ratio for simplicity and lack of ease of testing different ratios. After trial and error we found that this ratio would work best with our design.

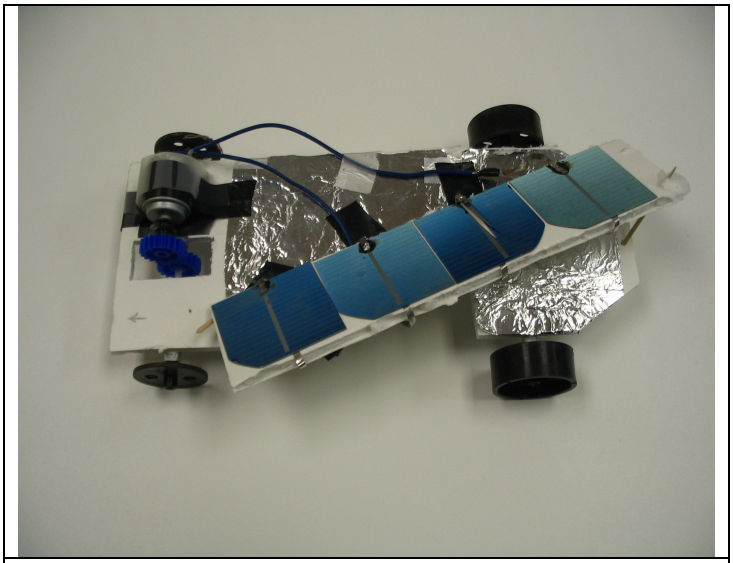


Figure 1. Team 3 competition car. Design used series connection of solar cells to have highest voltage.

Since the race was going to be in a straight line, we chose front wheel drive so the car would go straighter pulling its weight as opposed to pushing it. We went with a 4 wheel design for added stability. To add to our speed we wanted to stay light weight and decrease drag as much as possible, so we left out any reflectors that stuck out and just covered what surfaces we could with tin foil. Any extra material we tried to cut off.

To calculate the declination angle we had to find the latitude for Piscataway which is 39°N and we would be racing at noon. The Fall Equinox is Sept. 23, requiring a declination of 39°, and the winter is Dec. 22, requiring a declination of 39 + 23.5(tropic of Capricorn) = 62.5°. We raced in the beginning of November, which is directly in the middle, so tried to establish an angle at (39 + 62.5)/2 = 51°. Also with the orientation of the raceway heading in a mostly easterly, but a little south direction, we tried to orient the panels facing right and forward.

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Our solar cells are connected in series to obtain the highest voltage. This is because we found that the DC motor ran better at higher voltage than higher current.

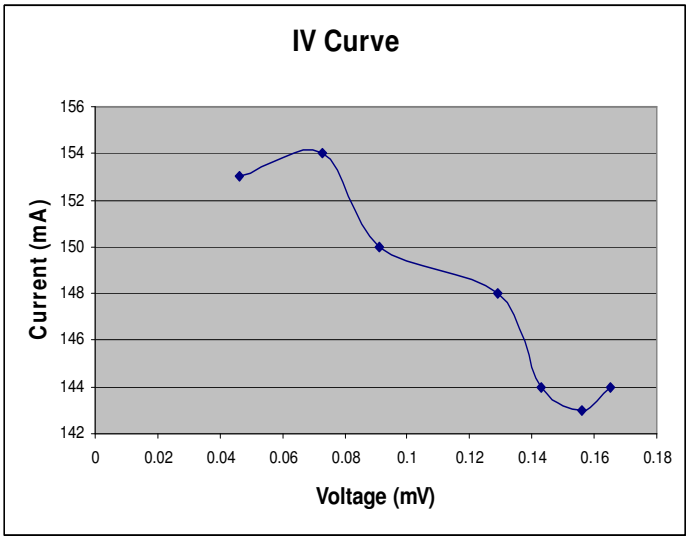


Figure 2. IV curve drawn from panel testing day

We characterized our four silicon solar cells in series using two multimeters and a series resistance box. The short circuit current was 199 mV at good sun, and the open circuit voltage was 0.538 mV.

The trend was clearly seen that the more weight we used the slower the car was and in fact, we went above our motor's weight limit when pulling 232 grams. When designing the car we were focusing on speed so we used a lower gear ratio. This sacrificed our torque output and gave us a much lower ability to pull heavier loads. We feel if this were a longer race where we could stay at a top speed for some time, and didn't have extra weight, our car's performance would have been much higher compared to the competition.

Trial	Weight (g)	Dist (ft)	Time (s)	Score
1	92	20.25	6.28	296.65
2	120	20.75	6.82	365.10
3	232 - could not pull this weight			
4	176	18.08	16.00	198.92

Table 1. Weight and performance data for car, including raw score.



Figure 3. Race Day!