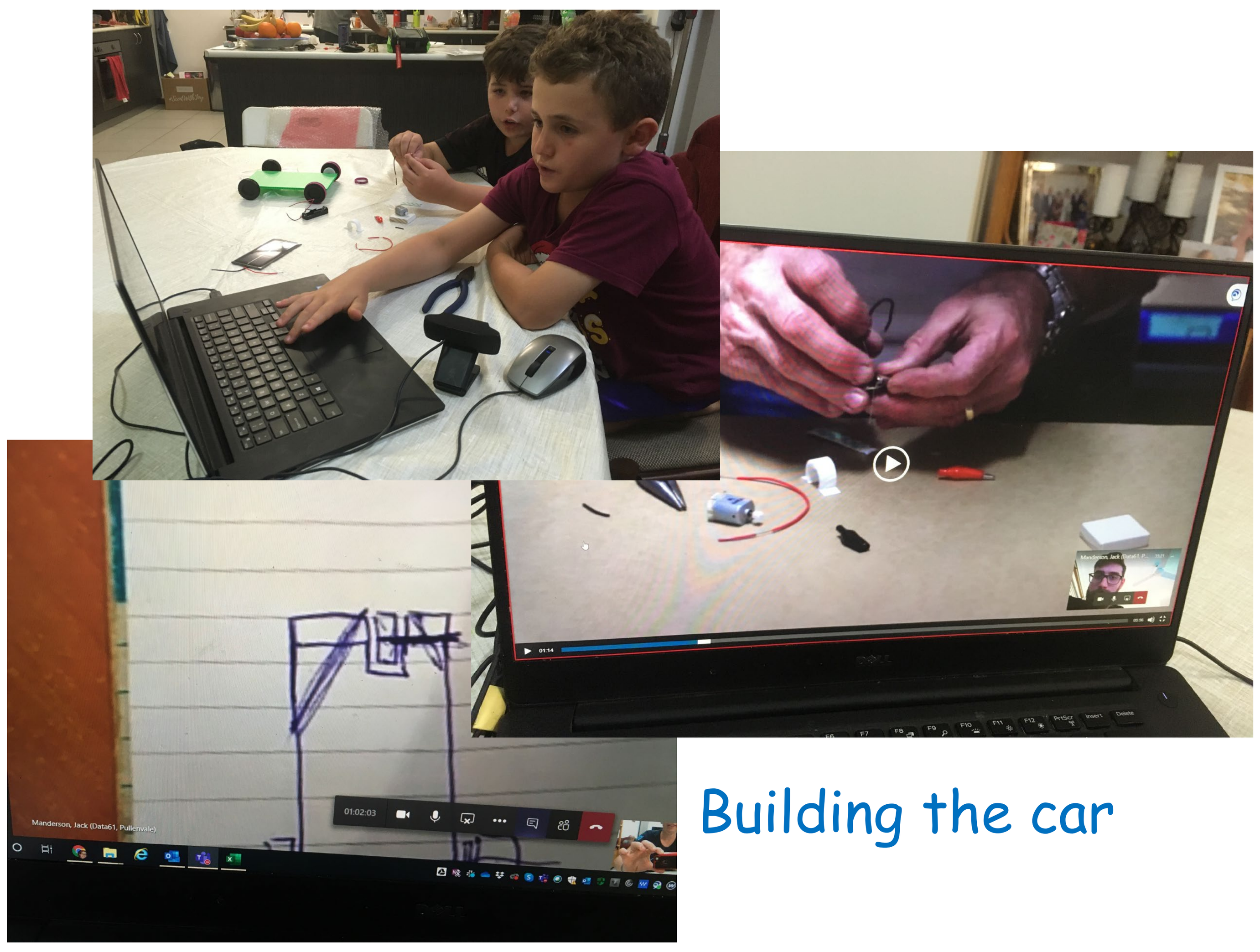
The Darwin Mini Electric Vehicle Challenge

Introduction

We entered in the mini electric vehicle competition which involved constructing and experimenting with an electric vehicle that we assembled and then modified to test its performance over alternate designs.

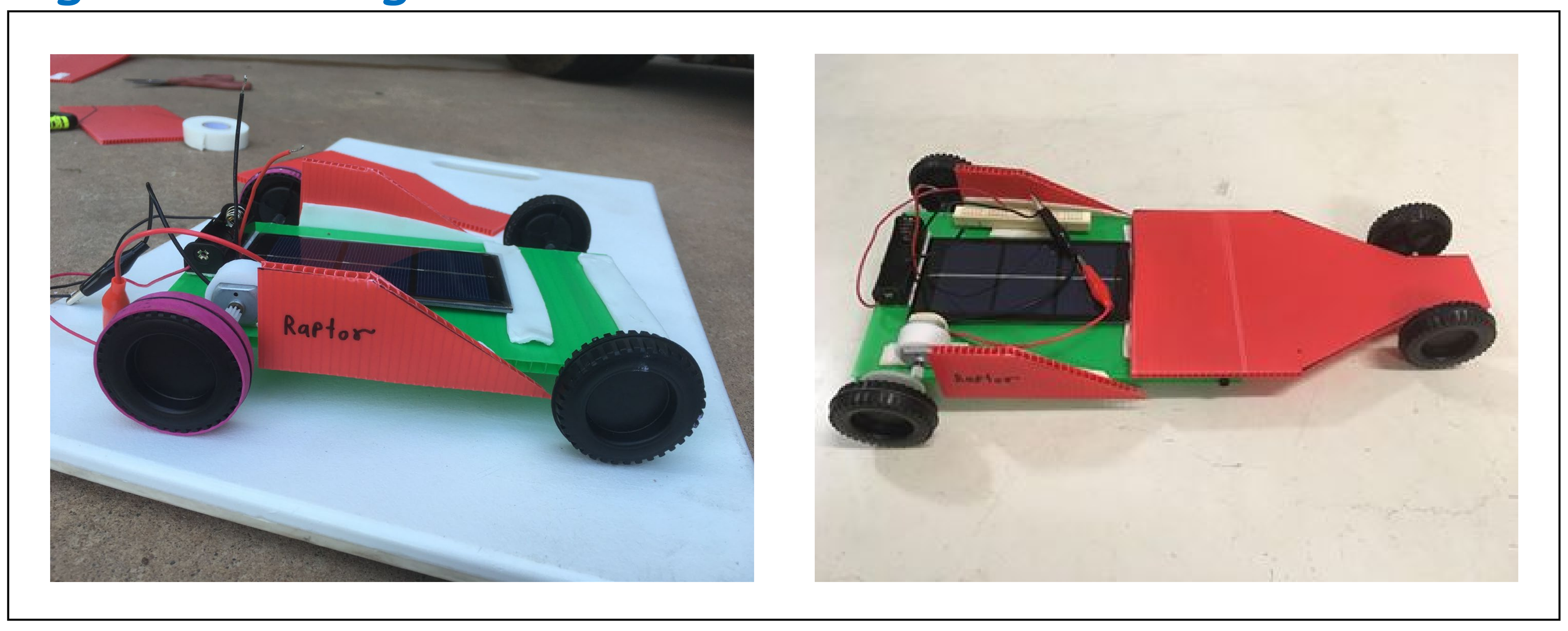
Methods & Design

The original car consisted of a flat green body, plastic wheels, a small DC motor and single gear. The car could be powered by battery or solar panel. We were challenged to find ways to improve the design to achieve faster track time.



Building the car

Figure 1: Designs



We examined four modifications (see Figure 1) using an experimental design set up that had a randomised order (see Table 1):

1. **Power:** Battery versus solar
2. **Friction:** Bare wheels versus rubber bands
3. **Gear:** Large versus small
4. **Chassis**: Long versus short

We ran all 16 combinations three times at 12pm in August 2020. Our test track was a straight track of length 4.8m with a timber guide to ensure the car could not go off course. We recorded the speed in seconds. (See Youtube video below for a demonstration.)

Hypothesis

We hypothesised that due to our sunny location in Darwin, the **solar panels would power the car faste**r. We thought the **bands would make the car grip better and therefore go faster**. We also thought the **long chassis would make it go straighter and therefore faster.** We hypothesised that the **gear ratio would play no effect on the vehicle speed** as it was a flat track.

Results

Our results were surprising. We found that we needed a lot of solar power to run the car. Even in the middle of the day, we couldn't run our "drag car" version because of the extra weight (Test 2,4,6 and 8).

We found that a big gear made the car move slightly faster than a smaller gear. We also found that putting rubber bands on the back wheels did not make it go faster.

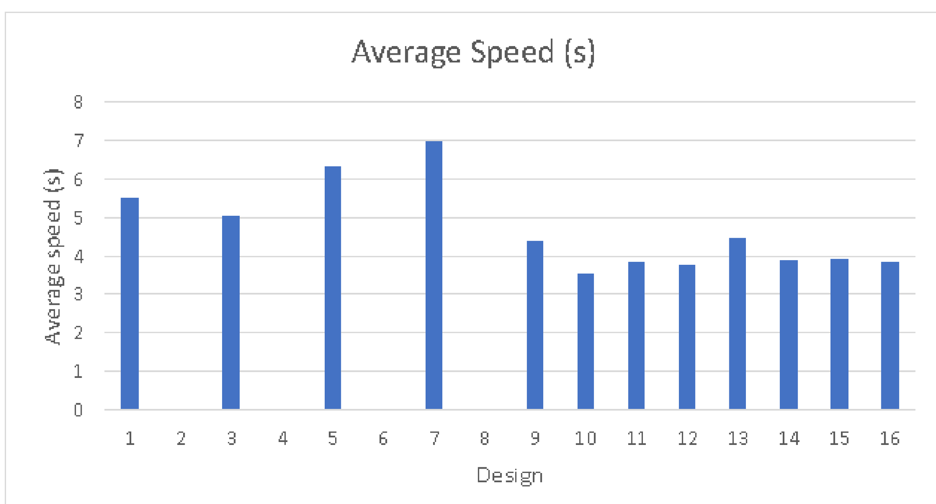
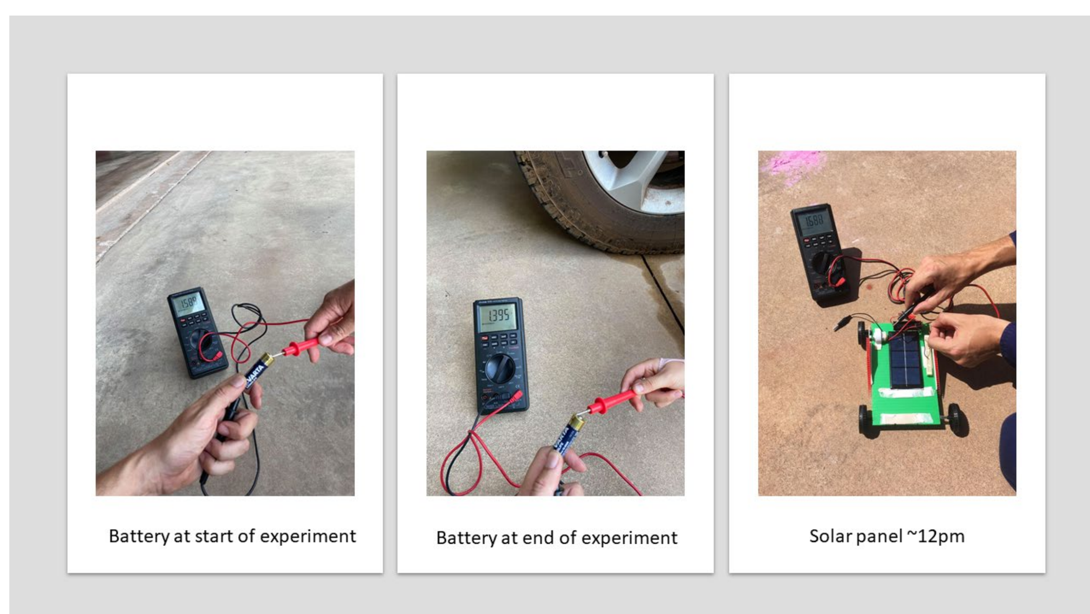


Table 1: Results for each design.

Test	Order	Time 1 (s)	Time 2 (s)	Time 3 (s)	Average	Power	Friction	Gear	Chassis
1	9	5.55	5.49	5.48	5.51	Battery	Bare Wheels	Large	Long
2	4					Solar	Bare Wheels	Large	Long
3	1	4.95	4.6	5.59	5.05	Battery	Rubber Bands	Large	Long
4	2					Solar	Rubber Bands	Large	Long
5	5	5.89	6.9	6.18	6.32	Battery	Bare Wheels	Small	Long
6	6					Solar	Bare Wheels	Small	Long
7	3	7.29	7.26	6.42	6.99	Battery	Rubber Bands	Small	Long
8	12					Solar	Rubber Bands	Small	Short
9	11	4.42	4.56	4.12	4.37	Battery	Bare Wheels	Large	Short
10	16	3.36	3.79	3.4	3.52	Solar	Bare Wheels	Large	Short
11	13	3.79	3.8	3.83	3.81	Battery	Rubber Bands	Large	Short
12	8	3.83	3.99	3.5	3.77	Solar	Rubber Bands	Large	Short
13	15	4.13	4.49	4.72	4.45	Battery	Bare Wheels	Small	Short
14	7	3.85	4	3.79	3.88	Solar	Bare Wheels	Small	Short
15	14	3.75	3.82	4.2	3.92	Battery	Rubber Bands	Small	Short
16	10	4.43	3.6	3.46	3.83	Solar	Rubber Bands	Small	Short

Figure 2: Voltage readings.



Conclusions

Design 10 (solar panels, bare wheels, large gear, short body) proved to be the best with an average speed of 3.52s.

This disproved some of our initial assumptions about the most efficient design. We concluded that he spongy rubber bands did not improve the design and the longer chassis simply added weight that slowed the car down.

As originally suspected, the gear ratio had little effect on the performance of the car. The most surprising outcome was the solar panel results. Despite running the experiments in the middle of the day in Darwin with zero cloud cover, we still struggled to power some of the designs. Our electrical voltage readings are shown in Figure 2. They demonstrate that the solar panel had equivalent voltage to a new battery. However it often struggled to the power the car to the same performance as the one powered by the battery. We found the orientation of the solar panel greatly affected its performance and this we conclude contributed to the solar panel's failure to perform at same level as the battery.

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Youtube: https://youtu.be/0KFaUdNjwK8