

P132 Project



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10/31/18 - 11/16/18

[Gantt Chart](#)

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Design Brief

Client: Tesla Motors

Problem:

Tesla Motors is investigating the use of solar and hydrogen to power their cars. The company needs information about the power and speed capabilities of these sources to support their designs

Problem Statement:

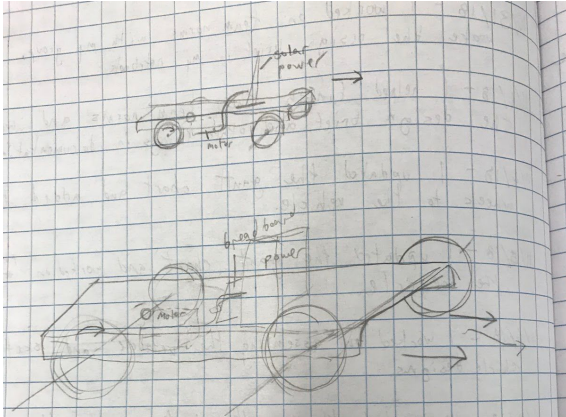
Formulate a recommendation for power generation based on the prototype derived from a solar module and fuel cell power source

Constraints:

- The vehicle must be made using only the materials specified in the equipment list.
- The vehicle must be able to hold the solar module or hydrogen fuel cell securely and run without tipping the fuel cell.
- Top view of vehicle must be no larger than 5"x12"
- The vehicle must use a breadboard to be able to easily change between power source configurations for testing purposes - see Instruction Page for required configurations.
- Team Documentation due by November 16, 11:59 pm.
- Individual Deliverables due by November 27.

Initial Design Solution

Early Design Sketch

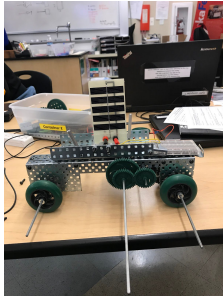
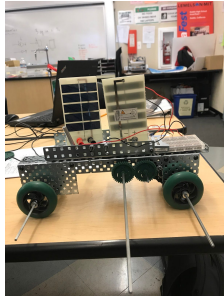
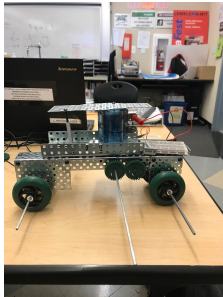
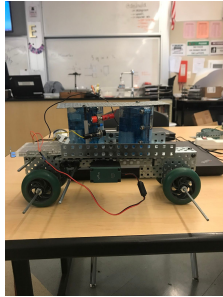


Description: This sketch shows an early design for the vehicle. It does not have a place to secure the power source or the breadboard, which we resolved in later designs. It has a similar design, however, for the motor.

Signatures:

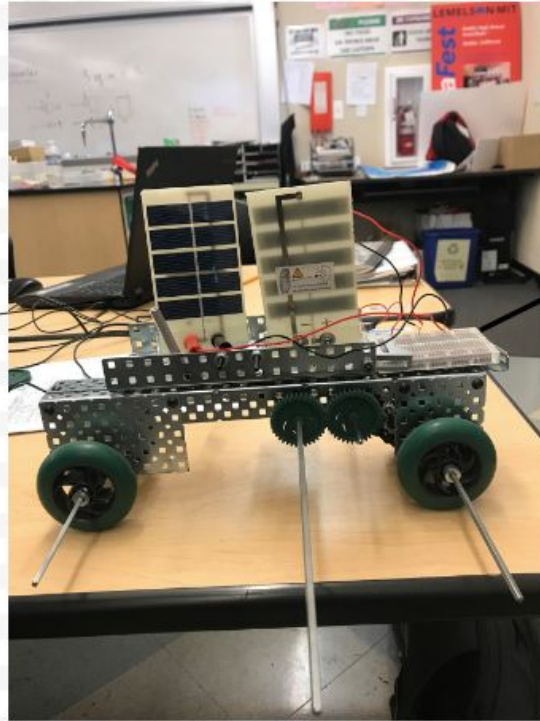
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Joshua Beatty 11/14/18

Testing Summary Table

	1 Solar	2 Solars	1 Hydrogen Cell	2 Hydrogen Cells
Picture				
Modifications	Added 1 flap of metal to the top of the vehicle to keep the solar cell secure	Added an extra flap to the top of the vehicle to secure the second solar cell	Added two screws along with a flat metal to stabilize the one hydrogen cell	Did not make any other modifications different from the 1 hydrogen cell
Voltage	2.6 V	3.2 V	0.8 V	1.48 V
Current	0.150 A	0.150 A	0.115 A	0.145 A
Force	1.3 N	3.1 N	1.24 N	2.9 N
Time	24.9 s	13.17 s	118 s	26.11 s
Speed	0.0402 m/s	0.076 m/s	0.0085 m/s	0.038 m/s
Electrical Power	0.39 W	0.48 W	0.092 W	0.2146 W
Mechanical Power	0.052 W	0.24 W	0.0105W	0.1111 W
Efficiency	13.39%	50.0 %	10.59%	51.77%

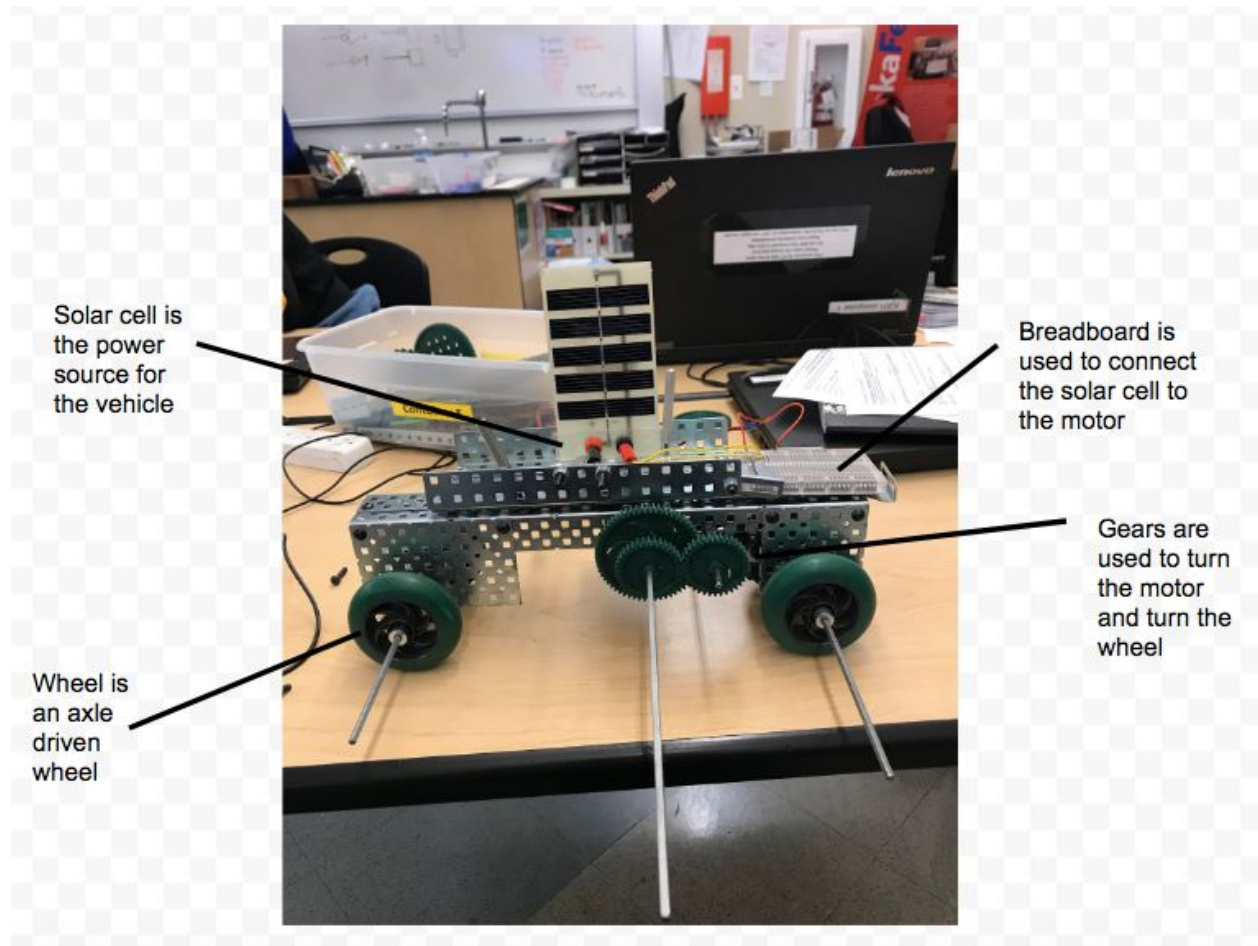
2 Solar Cells

There are two solar cells for more energy



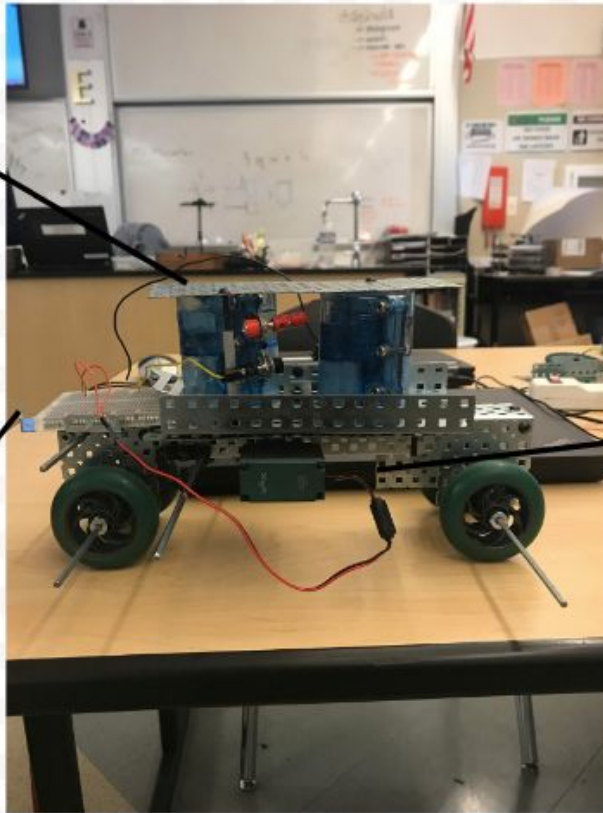
2 solar cells are in a parallel circuit

1 solar cell



2 Hydrogen Cells

Flat metal is used to secure both of the hydrogen cells

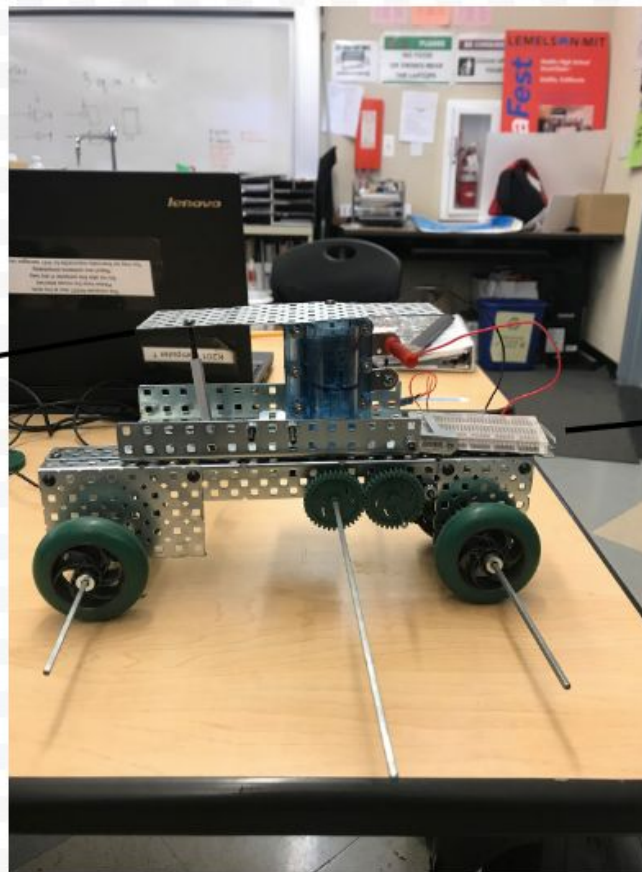


Motor is used to power the wheels

Breadboard is used to connect the hydrogen cells to the motor, in a series circuit

1 Hydrogen Cell

Flat metal and screws are used to secure the hydrogen cells



Breadboard is used to connect the gears to the hydrogen cell

Power Source Evaluation

From our testing, we can make conclusions about the four energy source configurations. When using one solar cell, the speed of our vehicle was rather fast compared to the other energy sources. It took our vehicle 24.9 seconds to reach a distance of one meter. Benefits of using one solar cell, is that the speed of the vehicle was the second fastest of all four energy sources. But there were downsides of one solar cell. It was only able to produce 1.3 Newtons of force and had an efficiency of 13.39%. This solar cell produced the second least amount of force and also had the second lowest efficiency. When using two solar cells, on the other hand, the speed of our vehicle was very fast compared to the other energy sources. It took our vehicle 13.17 seconds to reach a distance of one meter. This was by far the fastest energy source beating out the second fastest by approximately 10 seconds. While the two solar-celled vehicle was fast, it also produced 3.1 newtons of force and had an efficiency of 50%. This energy source produced the most amount of force and had the second highest efficiency, with two Hydrogen cells barely having a higher efficiency. Next, when using one hydrogen cell, the speed of the car was very, very slow. It took the vehicle 118 seconds for the hydrogen-powered car to move one meter. This was by far the slowest speed of all four energy sources. Even with the slow speed of the car it was able to withstand 1.24 Newtons of force and had an efficiency of 10.59%. From these testing observations, this power source of one hydrogen cell, is the worst for Tesla Motors as it was the slowest vehicle, least efficient vehicle and produced the least amount of Newtons of force. Lastly, when using two hydrogen cells, it took the vehicle 26.11 seconds for it to reach a distance of one meter. The speed of the vehicle was the third fastest out of the four power sources. Although it was the third fastest vehicle, it was able to withstand 2.9 Newtons of force and had an efficiency of 51.77%. The two hydrogen-powered vehicle produced the second highest amount of force and had the highest efficiency of the other power sources. From all of these testing observations, our group made a conclusion on which power source would best suit Tesla Motors. Based, on the recent data, Tesla Motors should use two solar cells. This was by far the easiest decision to make as the two solar-powered vehicle trumped the rest of the power sources. This vehicle was almost 2x as fast as the other vehicles, and was able to produce the highest amount of force. Although it was not the most efficient vehicle. It was barely second, by 1.77% efficiency. After investigating solar and hydrogen as a power source, we recommend that Tesla Motors use two solar cells because it produced the most power and had the highest speed. This vehicle could be scaled up into the future because of its clear

width and length dimensions. Because the vehicle has a longer length than width it has the look of a real life car. Along with the hydrogen cells there is a roof on top of the hydrogen cell which resembles cars right now. One way it does not resemble a real car is that there are axles sticking out of the wheels. If the axles were shorter than it would have more of an appearance of a real life car. Also this car can be scaled up into the future because there are four wheels and they are all the same size, which is true for a real life car.