CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
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Project Number
J0326

Project Title
Which 3D Printed Wheel Could Operate Most Efficiently on Mars?

Abstract

Objectives/Goals
Curiosity is the name of the rover that landed on Mars on August of 2012. Early on in the mission Curiositys two front wheels began to accumulate damage. Further on into the rover#s explorations, the wheel damage began to worsen causing the robot not to be able to take short routes to various mission sites. The wheel damage is a big problem because it restricts the scientist driving the rover reach different landforms in order to collect data. This is also the core purpose of sending a rover to Mars. The purpose of this science fair project is to design and 3D print different wheels that are able to withstand and drive through the many obstacles of Mars.

Methods/Materials
In order to design the wheels I used Sketchup, Netfabb, and Meshlab. After designing I used a Makergear M2e 3D printer to produce the wheels using PVA filament. I tested the wheel on a Martain simulated course using a Parallax ActivityBot robot that I programmed using Java Script.

Results
Wheel efficiency was tested using the time it took the robot to officially complete the two sections of the course. The results, in order from most efficient to least efficient, over the rock filled crater are Wave Wheel, Rover Wheel, Arch Wheel, Chevron Wheel, and Control Wheel. The results, in order from most efficient wheel to least efficient wheel over the incline are Rover Wheel, Wave Wheel, Arch Wheel, Chevron Wheel, and Control Wheel. In conclusion, the top two wheel designs were the Rover Wheel and the Wave Wheel.

Conclusions/Discussion
This project help discover qualities of a poor preforming wheels. Some of these qualities are: treads that are spaced too close together (chevron wheel), thin treads that are unable to have traction (arch wheel), and wheels with no treads that are unlikely to even scale obstacles (control wheel). The two wheels that lacked any of these poor qualities made them the most efficient wheel designs. For example, the rover that was sent to Mars in 2004 had an underdeveloped wheel design. The wheel design on the rover had straight treads, making the rover venerable to slide slip and punctures. Later in 2012, NASA created a more advanced wheel design that had a chevron pattern with a curved barrel-like structure. Still, this design had trouble navigating through Mars. This goes to show that even the smallest components, like the tread and wheel design, can affect the performance of a rover as a whole.

Summary Statement
In this experiment two wheels, one of my own design and one similar to NASA's design, were able to effectivly get over a Martain simulated terrain.

Help Received
I received help from my dad when using heavy cutting and hammering tools to create the base for the martian simulated course.