



CALIFORNIA STATE SCIENCE FAIR 2013 PROJECT SUMMARY

Name(s) Dylon M. Tjanaka	Project Number J0328
Project Title Up-Down Stair Climbing Robot Using Push-Pull Wheel Mechanism	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this project is to design, construct, and analyze a simple portable robot that can climb-up and climb-down staircases. This type of robot has many applications, such as space exploration scout, home security watchdog, military drones, robotic vacuum cleaners, agriculture land surveyors, toys, senior citizen wellness monitors, and wheelchairs.</p> <p>Methods/Materials I researched several similar robots, such as the Crawler and iRobot 110 FirstLook. I decided to engineer a stair climbing mechanism that I call Push-Pull Wheel Mechanism. The mechanism works by using the front wheels to pull and rear wheels to push. I implemented the Push-Pull Wheel Mechanism by designing and constructing a portable robot using the Lego Mindstorms NXT 2.0 kit. Then, I wrote the program for the robot using NXT-G programming language. I also built a cardboard staircase for testing purposes.</p> <p>Results I successfully built a portable robot that can climb-up and climb-down staircase steps using the Push-Pull Wheel Mechanism. To validate the functionalities, I tested my robot on the cardboard staircase and a real staircase. I also analyzed how the robot actually climbed up and down the staircase steps. During the course of the project, I encountered many challenges that I had to solve. I listed all these challenges and solutions in my report. One of the biggest challenges was how to make the robot come down the stairs without tipping over. I had to examine the physics of the robot and determine where to position the center of gravity and how to control the speed of the robot. Another big challenge was that the robot was stuck at the first step of the staircase. I fixed this issue by increasing the height of the U-shaped portion of the robot.</p> <p>Conclusions/Discussion I successfully implemented the Push-Pull Wheel Mechanism. However, I believe I could still make several future improvements. One improvement could be to use an accelerometer to detect whether the robot is going up or down. Another improvement is to use a different type of robot kit to provide more freedom with my designs. For example, I might be able to use 4 motors rather than the 3 allowed in the Lego Mindstorms kit.</p>	
Summary Statement I am designing and constructing a portable Lego Mindstorms robot that uses the Push-Pull Wheel Mechanism to climb up and down staircase steps.	
Help Received Mr. Barber (Principal) paid for the application to Synopsys Science Fair; Mr. Tu (Science Teacher) helped with science fair preparation; Ms. Hayden (Science Teacher) taught the science fair class; Mother provided critical opinions and advice; Father provided technical advice and direction.	