Tension: Breaking Through the Door

Subject Area(s): Physics, Mathematics, Engineering, Technology

Associated Unit: None

Associated Lesson: None

Activity Title: Understanding tension, four wheel drive, friction

Header: Insert image 1 here, right justified to wrap

Image 1
ADA Description: Students learning about the properties of robots that are needed to break through the door
Caption: Students building robots
Image file name: Breakingthroughthedoor_image1.jpg
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Level: (6,7 and 8)

Activity Dependency: None

Time Required: 50 minutes

Group Size: Five

Expendable Cost per Group US $10.00

Insert Image 2 here, centered

Image 2
ADA Description: Four wheel drive robotic frame and door with tension
Caption: Four wheel drive and bottles with weights, which will be used for the robot to get through the door
Image file name: Breakingthroughthedoor_image2.jpg
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Summary

Students will work as engineers and learn about the properties of four wheel drive vehicles. They will also learn about a good robot design, properties of tension and traction. They will learn about trial and error and the amount of trial and error it takes to have the robot maneuver through the door with tension. It is important for students to learn about the amount of time it takes to design a good robot to complete a task.

Engineering Connection

Students will learn to design good robots with proper weight distribution across the robot. They will also learn about the chains that four wheel vehicles have in their design. They will learn about traction and how to add this feature to their robot. They learn about the properties of tension and how to adjust the door for more or less tension. They will also, learn about how one robot talks to another through Bluetooth.

Engineering Category

Relates physics concepts to engineering

Keywords

Physics, tension, four wheel drive, traction, center of mass

Educational Standards
- New York State Standards
  - New York science: 4.4, 4.5
  - New York Technology 5.1, 5.3, 5.4

Pre-Requisite Knowledge: Physics concepts and technology (basic programming skills)

Learning Objectives
After this activity, students will be able to:
- Design a good lego robot that is 4 wheel drive, well balanced, and can hold weight
- Program a robot with NXT MindStorms software
- Be able to program the robot to go through the door through Bluetooth
- Be able to explain physics concepts such as tension and traction
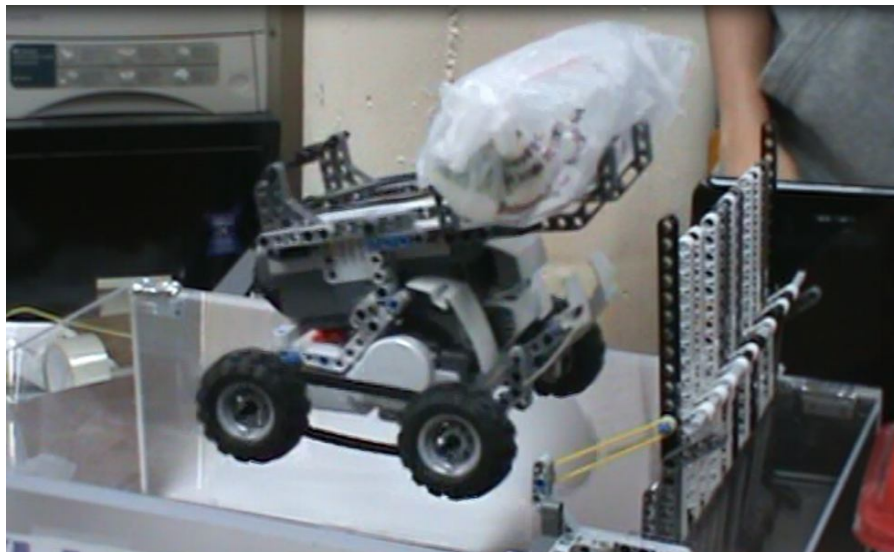- Be able to change tension and have the robot to be able to break through the door

Image 3
ADA Description: Robot breaking through the door
Caption: Robot able to go through the door
Image file name: Breakingthroughthedoor_image3.jpg
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Materials List

Each group needs:
- Lego NXT Kit

- Two NXT Bricks per group

- Three boards of plexi glass with nails and screw driver

- Two 500 mL polycarbonate bottles filled with water and capped

To share with the entire class:
- Computer with NXT MindStorms programming software

- Computer with NXT MindStorms Data logging Program

Introduction / Motivation
One of the most common problems with students and robotics is that they do not know the key elements in building to have a stable robot that moves straight. Students often build robots without understanding why they use the components they use and what each component provides to the stability of the robot. This activity will allow students to understand how to design good robots.

In this experiment, we plan to enrich the students' knowledge physics and merge it with robotics. Students will have a chance to trouble shoot the robot and figure out how it can get through the door with tension. They will learn terms such as the traction, tension, force, weight, four-wheel drive and center of mass.

Vocabulary/Definitions

Word	Definition
Tension	The stretching of an object from and external force
Four-Wheel Drive	All four wheels receive torque from and engineer
Traction	Adhesive friction or force
Friction	The force resisting the relative motion of an object on a surface
Center of Mass	The location of the average gravitational force acting on the body
Torque	Determined by the force of an object and the length of the arm

Procedure

Before the Activity

1. Students will work in groups the entire time
2. Student will learn about the parts of the robots and the lego mindstorms programming
3. Students will learn how to set up blue tooth with two NXT bricks
4. Teach the students the vocabulary words in the vocabulary box provided above
5. Ask students to set up their door with the appropriate amount of tension that they want to apply to the door
6. Ask students to build their robot accordingly to get through the door and mention that they should consider some of the vocabulary words that

With the Students
1. Have students make a table of the 5 different changes (example: bigger wheels, weight, power) they are going to consider changing to try and get their robot to go through the door
2. Have the students agree on a specific amount of tension that the door will have
3. Then have the students test their robot on the door with tension

Attachments
Breakingl_Through_The_Door_Teach Engineering.doc
Breakingl_Through_The_Door _Teach Engineering handout.doc
Breakingthroughthedoor_image1.jpg
Breakingthroughthedoor_image2.jpg
Breakingthroughthedoor_image3.jpg

Safety Issues
- None

Troubleshooting Tips
Make sure that the program is proper and all wires are properly connected and blue tooth is properly set up

Investigating Questions

What robotic features on the robot are necessary for the robot to get through the door? How would you design a robot that needed to get through the door on ice? What important features would you add to the design?

Assessment

Pre-Activity Assessment
Guessing game: Ask them to predict what robotic feature will help the robot get through the door.

Activity Embedded Assessment

Design a robot: Tell the students to make a connection between the robotic feature and physics concept.

Post-Activity Assessment

Tuning the equation: Ask the students how the robot would drive over ice?

Activity Scaling

- For lower grades: 6th grade
- For upper grades: 8th grade

Additional Multimedia Support

None

Other

None

Redirect URL

http://gk12.poly.edu/amps/

Owners

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Contributors