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2016-2017

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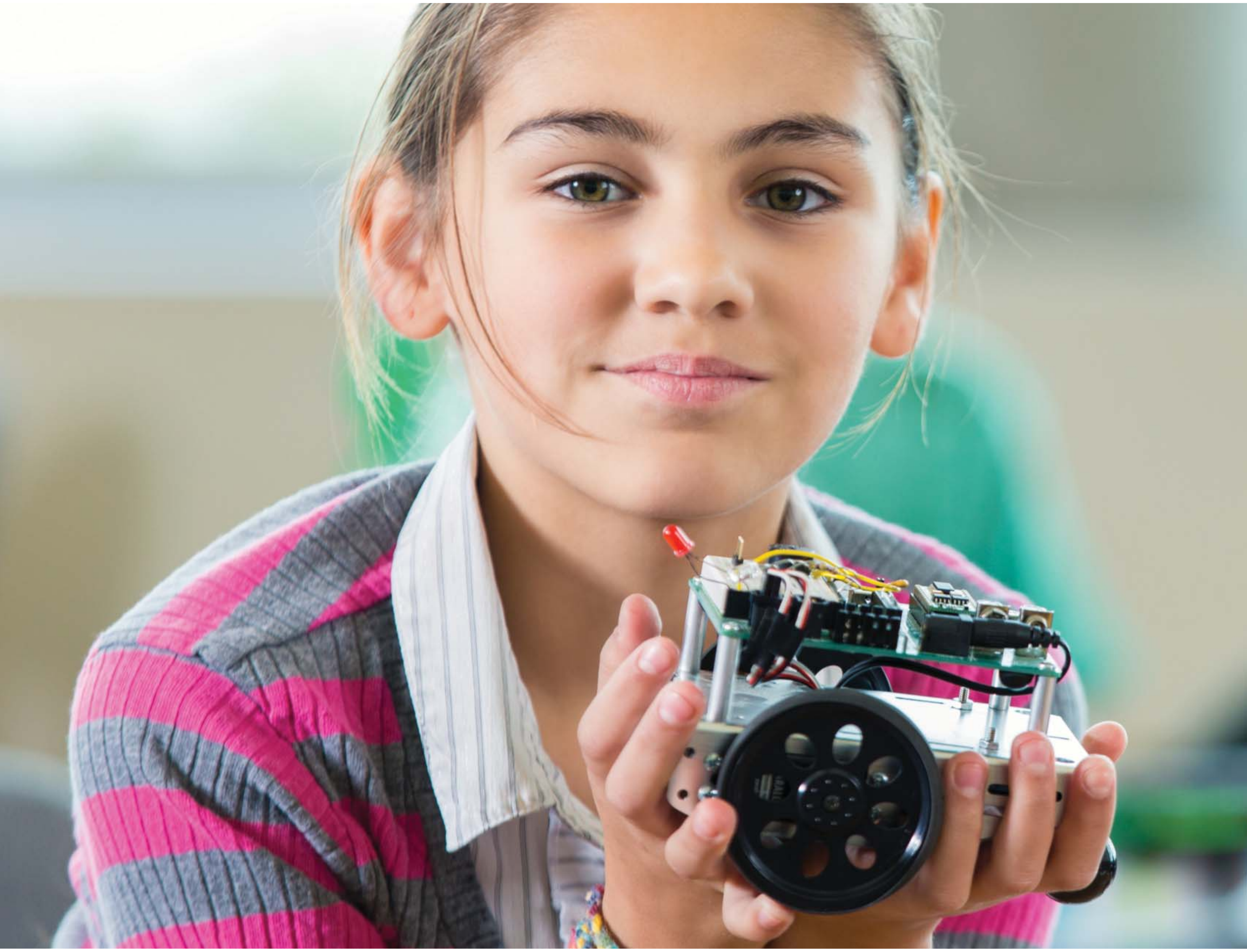

idea packet

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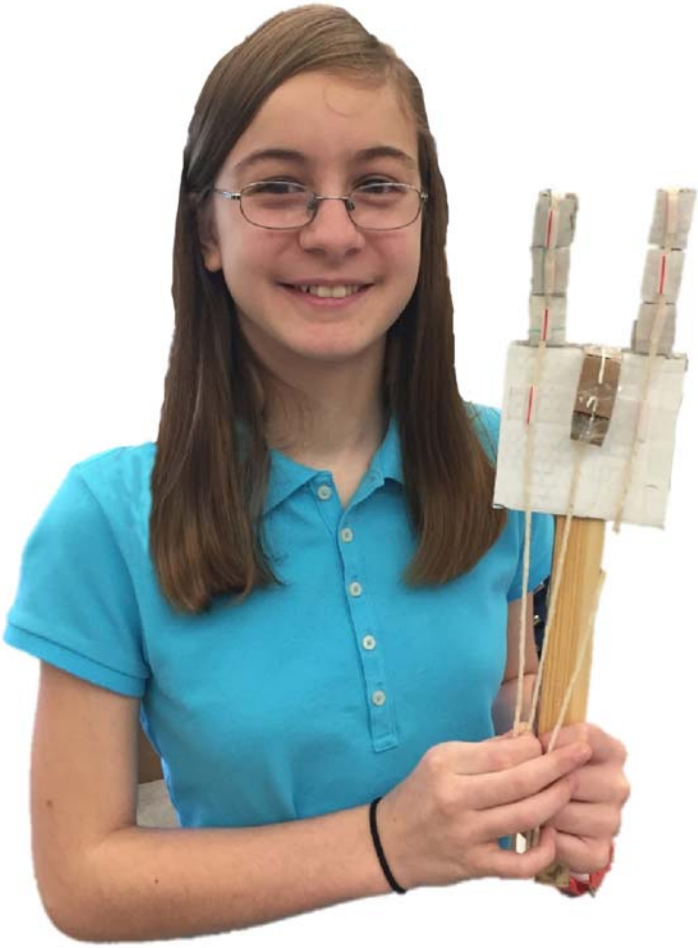
I Want to Hold Your Hand

I Want To Hold Your Hand



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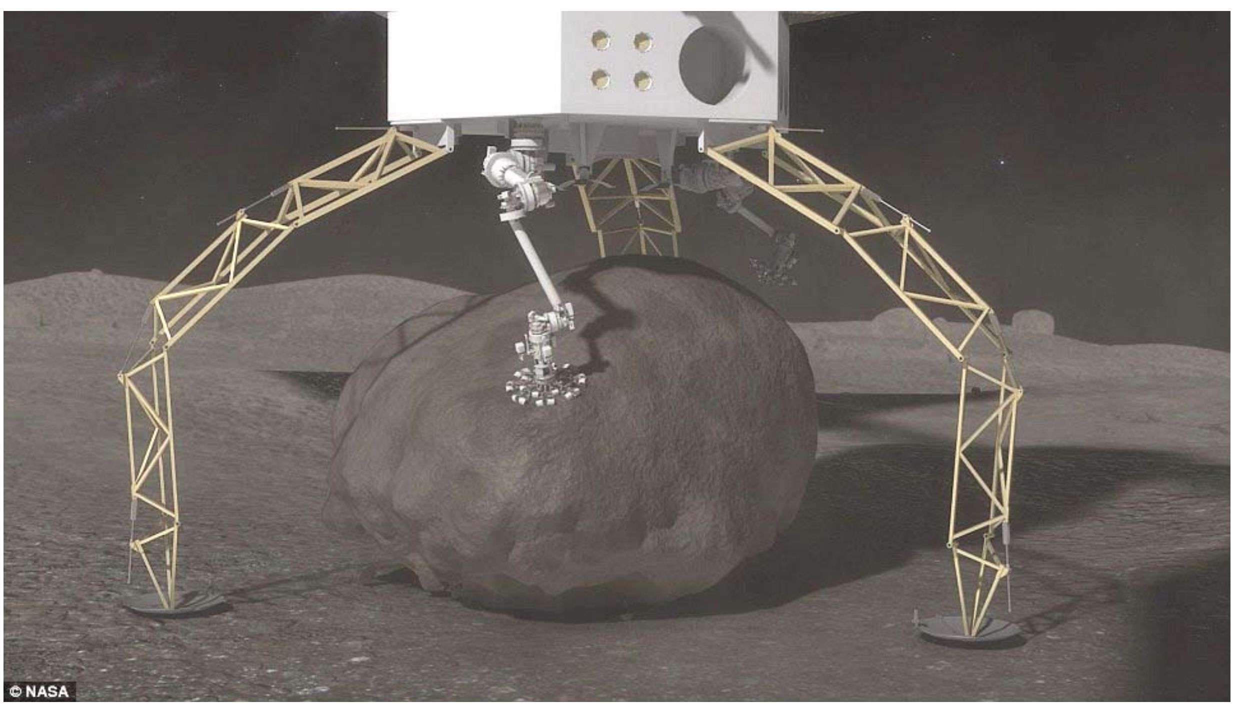
Purpose

To construct a robotic-like hand and to demonstrate how data are collected when using robotic technology.

Background

A robot is a machine that collects information from its surroundings. It uses that information to follow instructions and to complete a task. Today's Robots have multiple sensors and are able to make their own decisions based on given information. Robots come in all shapes and sizes. The jobs they do are also varied. Some robots are used in factories. Others are experimental robots that use artificial intelligence. Artificial intelligence allows robots to behave more like human beings and to act independently in a changing environment. Today, robots are used in hospitals, space and ocean exploration, and other dangerous areas.

NASA is developing a first-ever robotic mission to visit a large near-Earth asteroid, collect a multi-ton boulder from its surface, and redirect it into a stable orbit around the moon. Once it's there, astronauts will explore it and return with samples in the 2020s. This Asteroid Redirect Mission (ARM) is part of NASA's plan to advance the new technologies and spaceflight experience needed for a human mission to the Martian system in the 2030s. NASA plans to launch the ARM robotic spacecraft at the end of this decade. The spacecraft will capture a boulder off of a large asteroid using a robotic arm. After an asteroid mass is collected, the spacecraft will redirect it to a stable orbit around the moon called a "Distant Retrograde Orbit."



Problem: Can you design and build a robotic hand and move an asteroid (Styrofoam ball)?

Florida Standards

SC.6.P.12.1 Measure and graph distance versus time for an object moving at a constant speed. Interpret this relationship.

SC.7.N.3.2 Identify the benefits and limitations of the use of scientific models.

SC.8.N.4.1 Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels.

SC..N.1.1 Define a problem from the grade appropriate curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

SP.PK12.US.1.3c Apply skills and strategies in written communication, including setting a purpose for writing, creating complete simple and complex sentences, and organizing information into different types of paragraphs and essays.

WL.K12.SU.5.3 Write a report based on conducted research summarizing the opinions of others, and analyzing information and facts.

SC.68.CS-CS.2.2 Solve real-life issues in science and engineering (i.e., generalize a solution to open-ended problems) using computational thinking skills.

SC.K2.CS-CS.1.2 & SC.35.CS-CS.1.2 Describe how models and simulations can be used to solve real-world issues in science and engineering.

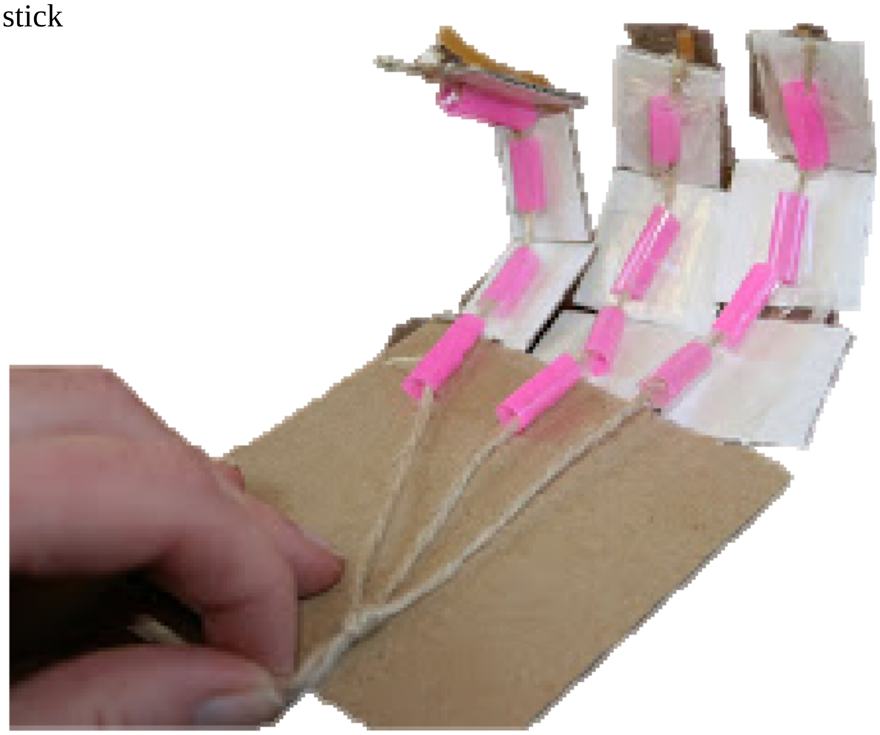
SC.35.CS-CS.2.2 Describe how computational thinking can be used to solve real life issues in science and engineering.

Course Outline

- ✍ Introduce the idea of robotic hand
- ✍ Introduce the Asteroid Redirect Mission (ARM)
- ✍ Have them build in small groups (3-5) a paper robotic hand as directed to see how it works.
- ✍ Practice with the typical robotic hand.
- ✍ In teams have them design, redesign their own paper robotic hand
- ✍ Competition

Materials

- Narrow rubber bands (6 rubber bands per robotic hand)
- Drinking straws (3 straws per robotic hand)
- Cardboard or heavy paper various thicknesses
- Tape clear is best
- Scissors
- Nylon cord or string (3 meters per hand)
- Centimeter ruler for measuring
- “Arm” ruler or paint stirring stick
- Pen or writing instrument
- Directions



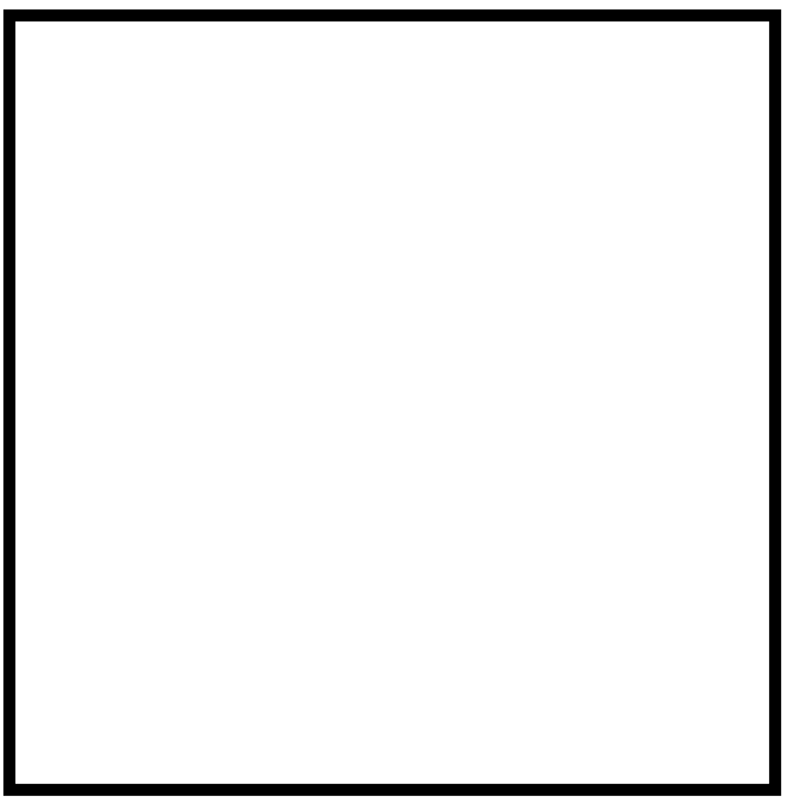
Design and Build

Materials Per Team (up to 3 people)

- Narrow rubber bands
- Drinking straws
- Cardboard
- Tape
- Scissors
- Nylon cord
- Centimeter ruler
- Pen

Procedure

1. To make the palm of the robotic hand, cut a piece of cardboard 10 cm x 10 cm.



2. To make the fingers, cut three pieces of cardboard 2 cm x 9 cm.

3. To make **one** of the fingers jointed, cut one of the cardboard pieces into three equal pieces.

   See diagram 1.

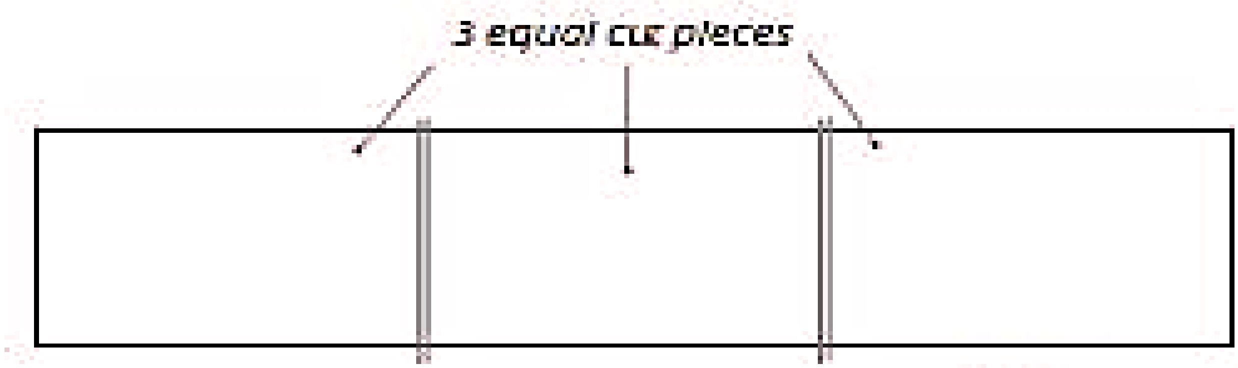


Diagram 1

4. Place the three equal finger pieces back together and use tape to reconnect them. Label one side of the taped finger "inside." See diagram 2.

Diagram 2

5. Cut a rubber band 5 cm long. Turn the segmented finger over so the "inside" is face down.

6. Put the rubber band across the middle of the first joint tightly. See diagram 3.

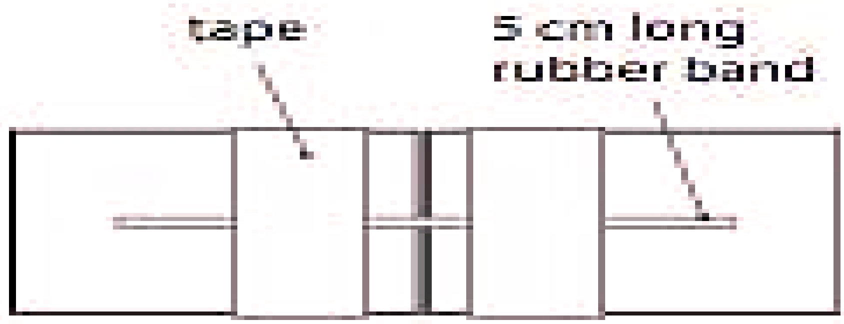


Diagram 3

7. Tape the rubber band on both sides of the joint, making sure to leave the ends of the rubber band untaped.

8. Fold the ends of the rubber band so that they rest on top of the tape and tape them firmly in place. See diagram 4. Taping prevents the rubber bands from slipping.

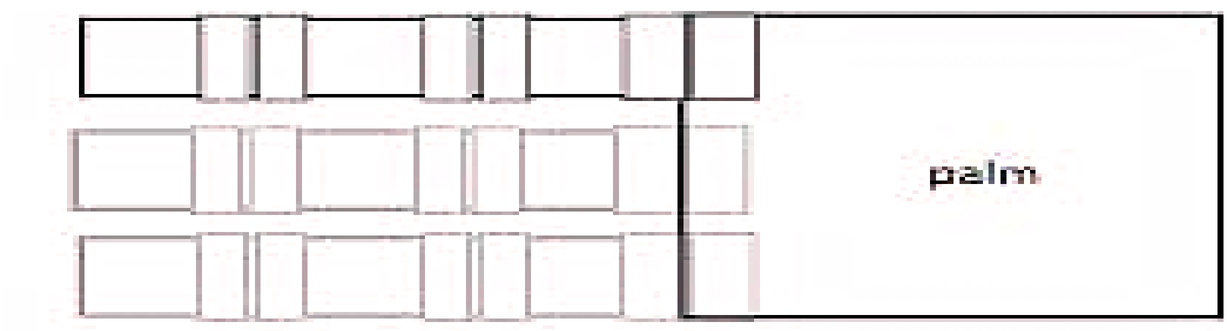
Diagram 4

9. Repeat steps 5 through 8 for the second joint of the same finger.

10. Tape the finger onto the palm with “inside” facing up.

11. Turn the hand over. Cut a rubber band 5 cm long. Put the rubber band across the last joint (touching the palm).

12. Repeat steps 3-11 for the each of the other fingers, connecting each finger to the palm. Placement of the 3 fingers can be anywhere on the palm. See diagram 5 for a typical setup.



connecting fingers to palm

Diagram 5

13. Cut a piece of nylon cord or any string 70 cm long.

14. Tape one end of the nylon cord over the end of the finger. See diagram 6.

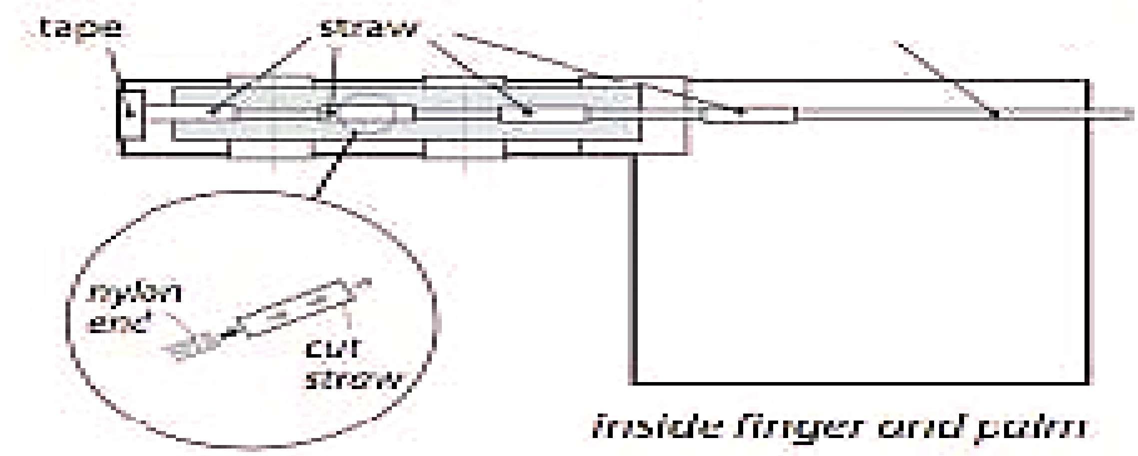


Diagram 6

17. Tape a piece of straw in the middle of each finger section.

18. Tape the last straw to the palm. See diagram 7.

Diagram 7

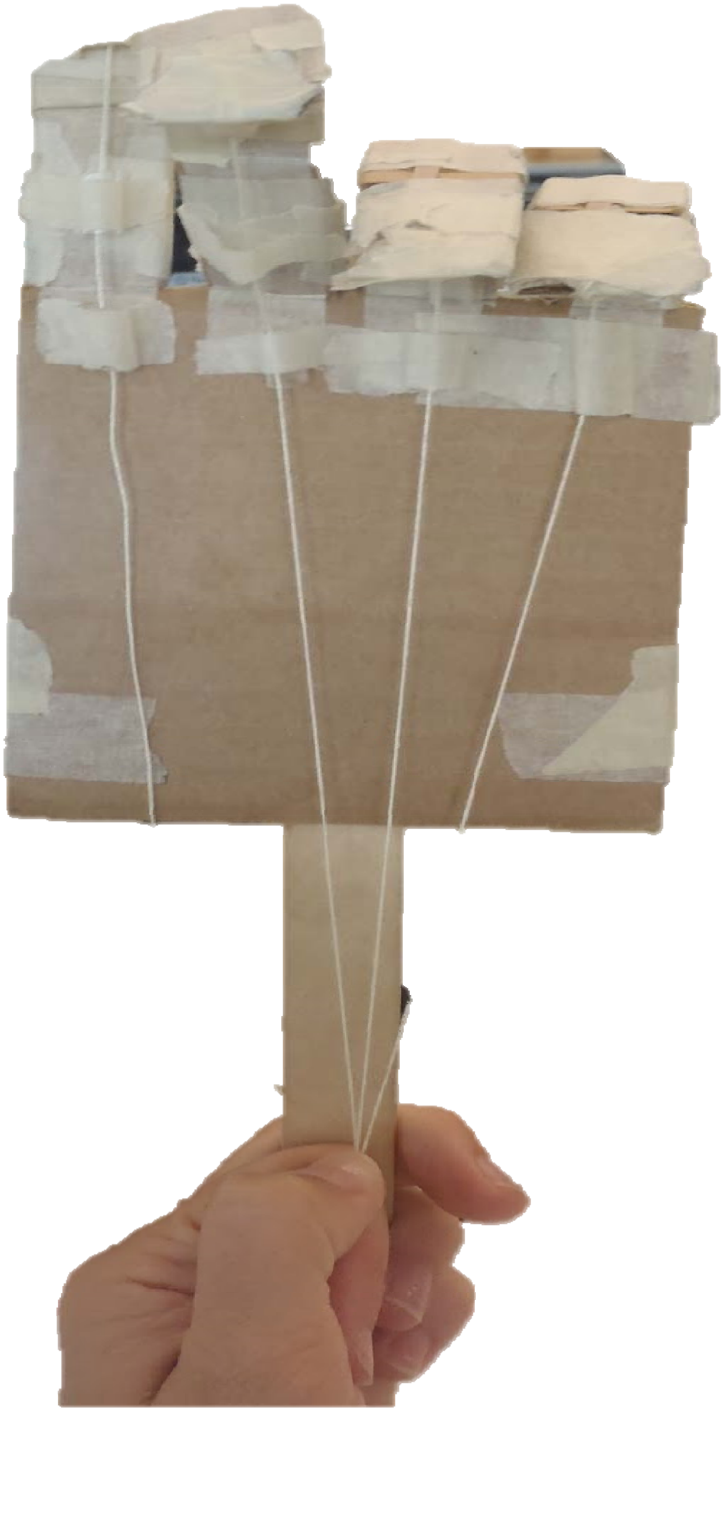
19. Repeat steps 13–18 for the last two fingers.

20. Thread all three pieces of string though a hole in the base of the palm or someway to group them.

21. Attached a ruler or stick to the base of the palm. This is where you will hold the robotic hand and control it.

22. Operate the hand by pulling the nylon cord/string. You should be able to pick up an empty soda can or other lightweight objects. For the competition you will need to pick up a Styrofoam ball or irregular shape and move it a distance.

Tips: May need to cut the tape pieces to make them thinner.
Make sure the rubber bands are taped firmly. If there is any loose area, the hand will not work properly



Evaluate and Redesign

Pre-Competition Checklist	Requirements met	
Construction	**yes**	**no**
Length & Width of palm (10cm)		
Total Length of Fingers (9cm) beyond palm		
3 fingers		
Used only cardboard or paper products		
Used flexible string or yarn or monofilament		
Used tape to attached straws and rubber bands		
Used rubber bands		
Attached “arm” at least 20 cm beyond palm with strings reaching end of “arm”		
Fingers move together when all strings are pulled from the end of the “arm”		
You can give points for construction		
Must meet all requirements before competing.		

Trial #1
Pick up a round 10 cm (4”) Styrofoam ball and hold 10 seconds ______yes _____no

Hold Ball 10 seconds ______yes _____no

MUST BE ABLE TO DO TH IS BEFORE COMPETTING

Traveling 10 m holding ball without dropping it Time:____________________

Place Ball in container ______yes _____no how many tries_________________

Formula N= D/B + D/T larger N score better performance
N=performance score
D=distance travel (base competition is 10 meters but you can change it)
B=Styrofoam ball diameter size (initially 10 cm diameter)
T=time it took to travel distance

Lab Write Up:

A. Variables

Independent Variables:

Dependent Variables:

Controlled Variables:

B. Data

C. Analyze and Conclude

1. Observing:

2. Drawing Conclusions:

3. Designing a Solution:

4. Evaluating the Design:

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D. After Competition

What items can you pick up with your robotic hand?
What would happen if you added more fingers?
What would happen if you added a thumb?

6. Redesigning: Based on your results and your response to the question, explain how you could/did improve your robotic hand? How would these changes help your robotic hand's performance?
Why is it difficult to pick up certain items with your robotic hand?

7. Evaluating the Impact on Society Explain -how is an understanding of robotic hand operation make space exploration possible.
What could a real robotic hand be used for?

Write or draw your ideas

Robotic Hand --Scoring Rubric

	5	***4***	***3***	***2***	***0***
Planning	Student thoroughly considers the factors that would affect the robotic hand. Written reflection of the design process of the robotic hand shows thoughtful design revisions	Student adequately considers the factors that would affect the robotic hand. Written reflection of the design process of the robotic hand shows useful design revisions	Student considers some of the factors that would affect the robotic hand. Written reflection of the design process of the robotic hand shows some revisions	Student minimally considers the factors that would affect the robotic hand. Written reflection of the design process of the robotic hand very little design revisions	No revisions
Robotic hand Building	Student follows all lab procedure, and work shows evidence of having thoroughly tested and modified the robotic hand.	Student follows most of the lab procedures, and work shows evidence of having adequately tested and modified the robotic hand.	Student follows some of the lab procedures, and work shows evidence of having tested or modified the robotic hand.	Student did not follow many of the procedures, and work shows little evidence of having tested or modified the robotic hand.	No robotic hand built
Participation	Student works equally with team members.	Student participates in all aspects of team discussions.	Student participates in some aspects of team discussions.	Student minimally participates in team discussions.	One of more members of the team does not participate
Competition	Robotic Hand competed beyond expectations (Used other ball sizes)	Robotic Hand competed	Robotic Hand did not complete entire competition but was able to compete	Robotic hand was not able to meet requirements to compete	Did not attend
Format	All grammatically correct, spelling, formatted properly, typed	Somewhat grammatically correct, spelling, some formatted, typed	Poor attempt at correct grammar, spelling, not formatted properly, not typed	Does not follow conventions in grammar, spelling, poorly done, not typed	Not typed Poor format
	10	***8***	***6***	***4***	***0***
Robotic hand lab Presentation All information	Lab write up is thorough and well organized. Student communicates all appropriate features of the robotic hand.	Presentation is adequate. Student communicates most of the appropriate features of the robotic hand.	Presentation is appropriate but is hard to follow. Student communicates some of the features of the robotic hand.	Presentation is inappropriate and hard to follow. Student communicates a few features of the robotic hand.	No robotic hand flown or data collected
TOTAL					

<u>Robotic Hand Construction & Operation</u>
Evaluate Worksheet

Team Name:___________________________________

Student Name #1 ____

Student Name #2 ____

Student Name #3 ____

	Requirements met	
Construction	**yes**	**no**
Length & Width of palm (10cm)		
Total Length of Fingers (9cm) beyond palm		
3 fingers		
Used only cardboard or paper products		
Used flexible string or yarn or monofilament		
Used tape to attached straws and rubber bands		
Used rubber bands		
Attached “arm” at least 20 cm beyond palm with strings reaching end of “arm”		
Fingers move together when all strings are pulled from the end of the “arm”		
You can give points for construction		
Must meet all requirements before competing.		

Trial #2 Competition

Pick up a round 10 cm (4”) Styrofoam ball and hold 10 seconds   ______yes
_____no

Hold Ball 10 seconds   ______yes _____no

MUST BE ABLE TO DO TH IS BEFORE COMPETTING

Traveling 10 m holding ball without dropping it Time:____________________

Place Ball in container ______yes _____no   how many
tries_________________

Formula   N= D/B + D/T   larger N score better performance

N=performance score
D=distance travel (base competition is 10 meters but you can change it)
B=Styrofoam ball diameter size (initially 10 cm diameter)
T=time it took to travel distance

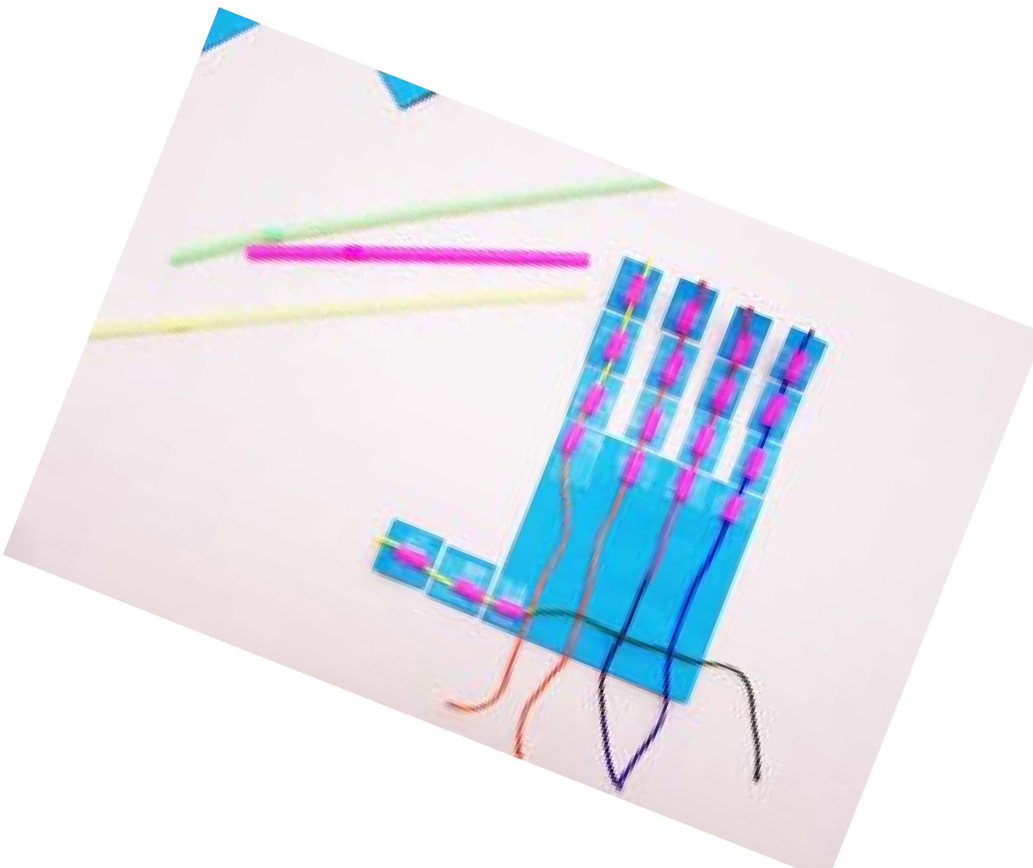
RESOURCES

http://www.nasa.gov/content/what-is-nasa-s-asteroid-redirect-mission

Asteroid Redirect mission parameters (mission brief, images, video)

https://www.youtube.com/watch?v=3UkEximY6lc

video **NASA** Asteroid Redirect Mission: Robotic Segment



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APPLY FOR AN
IMPACT II ADAPTER GRANT!

M-DCPS teachers, media specialists, counselors or assistant principals may request funds to implement an IMPACT II idea, teaching strategy or project from the Idea EXPO workshops and/or curriculum ideas profiled annually in the ***Ideas with IMPACT*** catalogs from 1990 to the current year, 2016-17. Most catalogs can be viewed at The Education Fund website at www.educationfund.org.

- Open to all K-12 M-DCPS teachers, counselors, media specialists
- Quick and easy reporting requirements
- Grants range from $150 - $400
- Grant recipients recognized at an Awards Reception

To apply, you must contact the teacher who developed the idea before submitting your application. Contact can be made by attending a workshop given by the disseminator, communicating via email or telephone, by visiting the disseminator in their classroom, or by having the disseminator visit your classroom.

Project funds are to be spent within the current school year or an extension may be requested. An expense report with receipts is required by Friday, May 5, 2017.

APPLICATION DEADLINE:
Monday, December 12, 2016

Apply online at www.educationfund.org

For more information, contact:

Edwina Lau, Program Director
305.558.4544, ext. 113
elau@educationfund.org

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