Western Engineering

Outreach

Grab the Moon Rocks!

Grade 3-5

Meet Today's ENG HERO!

Emily Lalone – Assistant Professor with Western Engineering

Emily Lalone is an Assistant Professor in the Department of Mechanical and Materials Engineering Department at Western University Dr. Lalone completed her BSc (Medical Science 2007) and her PhD (Biomedical Engineering 2012) at Western University. She then completed a CIHR Fellowship at McMaster University in the School of Rehabilitation Sciences. Her research focuses on biomechanics and joint contact mechanics, among other topics

To learn more about Dr. Lalone visit: https://www.eng.uwo.ca/mechanical/faculty/lalone_e/index.html

Learning Goal:

- Students will learn about movement and how different pieces of a system work together to perform a specific function.
- Curriculum Connections: Grade 3 - Strong and Stable Structures; Grade 4 - Pulleys and Gears

Materials Needed:

- Cardboard
- 2 Paint stirrers (optional)
- Ruler
- Scissors
- Pencil
- 4 Metal Fasteners
- 1 Rubber Band
- String
- Tape
- Popsicle sticks, foam, paper clips, or other material to improve the grabber's grip.

Engineering and Science Connections:

Today, we will be exploring robots!

What is a robot?
A robot is a machine that does tasks without the help of a person. Robots can collect information from its surroundings and use them to follow instructions to complete a task. Robots being built now are very smart and can do things on their own when given a main task to complete. So, if you were to build a robot that could throw things, you can have it throw paper into recycling bins.
Robots come in many different shapes and sizes and can be built to complete many different tasks. When we are building robots, we need to consider what their function will be. The way the robot is built will reflect its function. For example, robots are more frequently being used in surgery. Because they do very small, detailed tasks, the robots themselves need to be small. If a robot is moving huge objects, that robot itself will need to be large. The form of the robot reflects the function.

What type of engineering makes robots?
A mechatronic systems engineer! Mechatronic engineers help create the mechanical (moving) pieces of a robot, the software or code that tells robots what to do, and the electrical components that help power a robot. Some mechatronic engineers work in the aerospace industry. They work with NASA or the Canadian Space Agency (CSA) to build rovers to explore our moon and Mars.

The CSA was the third country to design and build one of Earth's satellites. The satellite, Alouette-I, was launched on September 29, 1962.Today, we are focusing on the Canadarm, Canada's most famous space achievement. The Canadarm is a robotic arm that is in space and it picks things up and moves them around. Engineers working with NASA helped to put together the Canadarm. The Canadarm finished its final mission in 2011, it helped astronauts build space stations and move things for 30 years!

Video Recommendation: *What is the Canadarm?*

https://www.youtube.com/watch?v=cRt8cH1iMp4

Activity:

Before beginning, think about the following questions:

- What are some robots you know?
- If you could build a robot, what would you have it do?

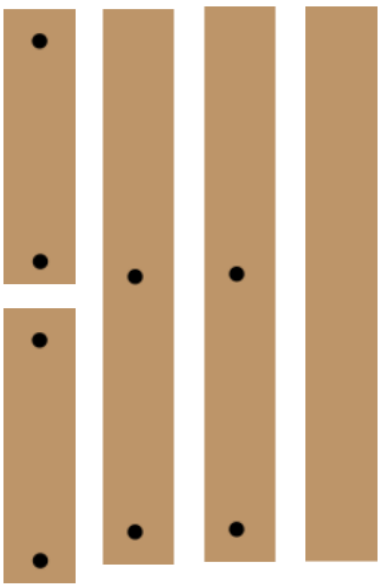
Saturn's Rings Game

If you have a ball and a hula hoop, head outside for this game! It is your job to give Saturn its rings. Stand about 2 feet away and try to get your hula hoop around the ball. Each time you succeed, move back another big step and keep going! How far away can you get and still give Saturn its ring?
When we are exploring space, we are often very far away from the things we want to interact with. That's why robots are so important to help us explore space! They can get much closer to the other planets in our solar system than humans can.

Building Your Robot Arm

Today we are all Mechatronics Engineers working with the CSA. The CSA has run into a problem! They are on the moon and want to collect samples of moon rocks to take back to earth and study to learn about the composition of our moon! The CSA has asked us to build our own robotic arm to so we can help collect the moon rocks!

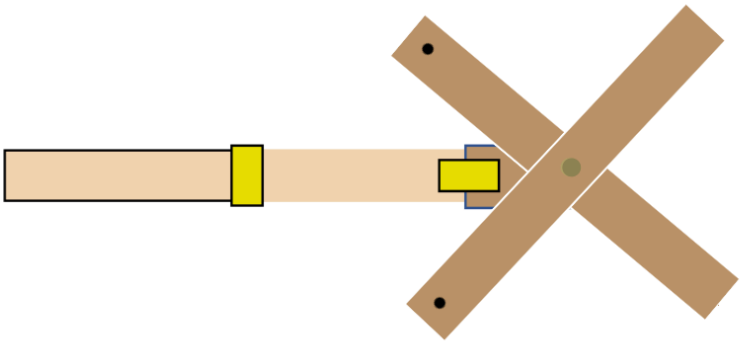
1. First, cut out three pieces of cardboard about 10 inches (23cm) in length. Cut out two 5 inch (12.5 cm) pieces. Use your sharpened pencil to poke holes in the cardboard like the picture below. Note that one of the 10 inch pieces has no holes at all.



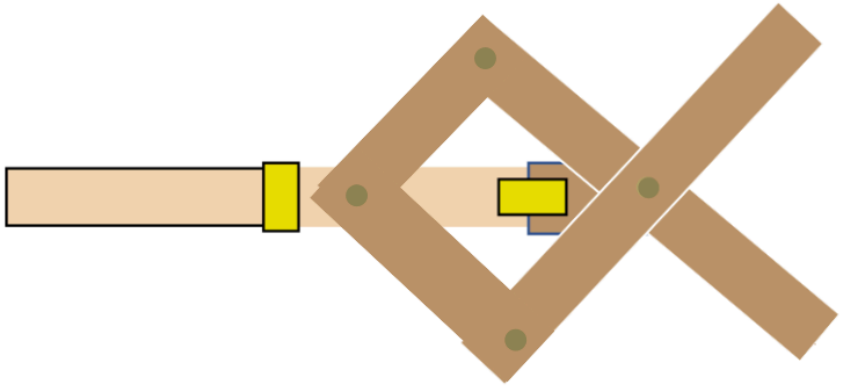
2. Next, build a handle out of paint stirrers, by laying one end over the other's end and tape it securely together. If you do not have paint stirrers, use more cardboard.

3. Take the piece without any holes and bend it in half. Tape this to the end of the handle as shown in the picture below. Most of this piece will be attached to the handle, but leave about one inch on the end longer than the handle. Poke a hole through the cardboard that is not overlapping the handle.

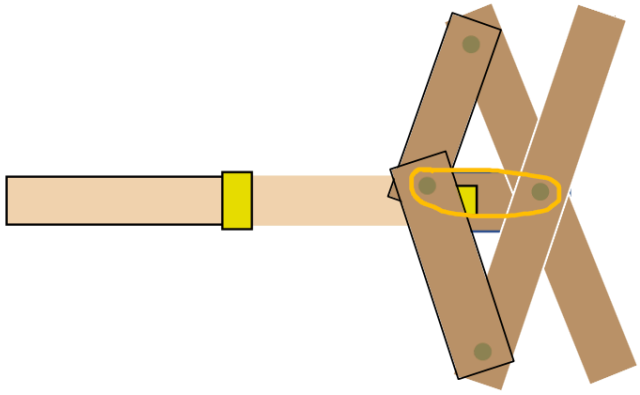
4. Take the 2 long pieces of cardboard and place them in a cross fashion. Place them over the hole in the cardboard attached to the handle. Secure the position of these cardboard using a metal fastener. The holes at the end should be in the direction of the handle. Fold the fastener tabs flat against the back and tape them down to secure them.



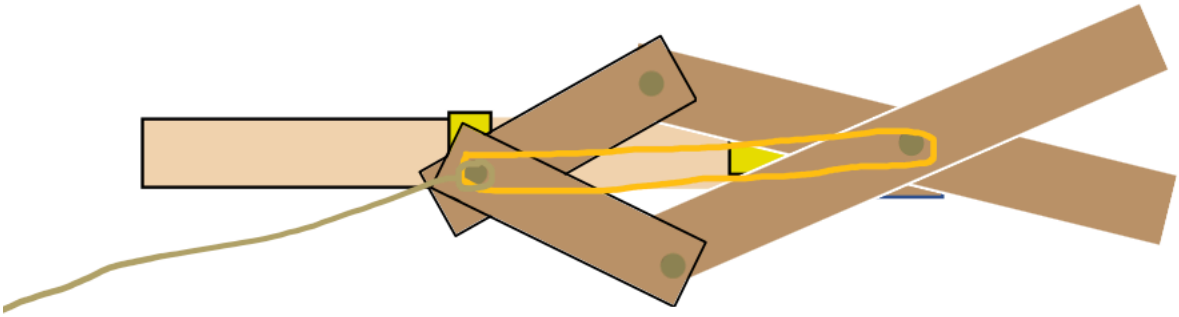
5. Attach the one small 5 inch pieces of cardboard to each of the longer pieces. Using a metal fastener, attach the other ends of the small 5 inch pieces together, like in the picture below. Fold the fasteners flat and tape them down.



6. Attach a rubber band to the grabber. Stretch the rubber band and slip it below the two metal fasteners that are in the middle, like in the picture below. The rubber band will help the grabber open and close.



7. Tie a piece of string to the metal fastener that attach the small pieces too each other. When you tug on the string, the grabber should close up!



8. Use any additional materials to improve the ends grabber so it can pick up the moon rocks that we want to collect!

9. Once modified, try to pick up different objects around your house. Go outside and try to collect some test rocks to see how well your arm will work in space. Make adjustments to your arm to make it even better!

What Did You Learn?

- What is a robot?
- Why is it important to think carefully about the design of the robot when we think about what we want it to do?
- What pieces of your arm are working together? What would happen if there was no elastic or no string?
- Why would NASA and the CSA need mechatronic engineers to help them build a robotic arm to use in space?
- How sturdy and heavy do you think the Canadarm is?
    - Very heavy! It weighs 900 lbs. The arm has to be strong enough to move big objects in space that's why it need to be heavy and sturdy!

Future Learning

- Now that we have made a grabbing arm, think about other things that we can build using a similar method. Can we build a grabbing hand or a foot that walks? Why might these things be useful? Try designing and building your own robotic piece. Remember, drawing out the design first will help you plan. If at first you don't succeed, go back to your plan and make adjustments and then try again!

Share your creations!

We would love to see what you made. Email as at discover@uwo.ca or tag us on social media.

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Thanks for discovering with us!