



Minor Challenge Set #1

STEM Field: Biomedical Engineering

Level: Junior

Challenge Name: Construct Your Robotic Hand

Project cost: 0-20 USD

Materials Required:

- 5-10 drinking straws
- Thin cardboard or thick A4 paper
- Pens and pencils
- Tape
- Yarn or strings
- Scissors

Safety:

- Some adult supervision is advised with the scissors

Duration:

- This challenge takes approximately 3 hours to finish, however, the time guideline is an estimation only, and students and mentors can complete the tasks around their schedules.

Introduction

A prosthesis is an artificial body part. A prosthetic implant is an artificial device that replaces a missing part of the body. As a biomedical engineer, your task is to design and construct a robotic hand for users.

In this Minor Challenge, we will attempt to create a very simple robotic hand. You can try constructing one using the instructions below, or

construct an improved prosthetic hand model. As this is an engineering project, you have the flexibility to choose the materials of the device and the design of the device.

Instruction

1. Trace and draw your hand on a piece of cardboard or cardstock paper.

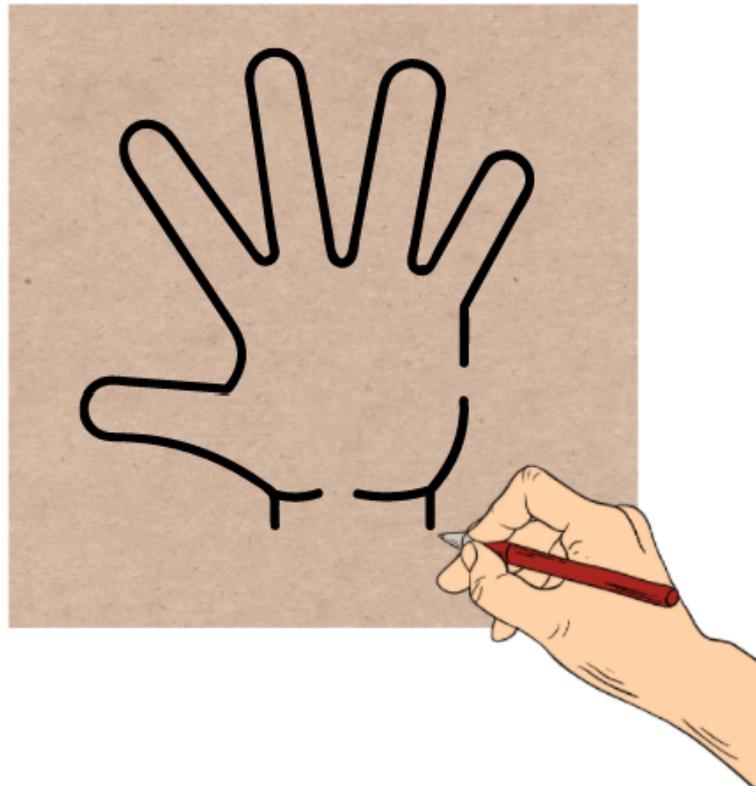


Figure 1: The hand model being drawn on a piece of cardboard paper.

2. Cut the traced hand. Note: it is recommended you cut the traced hand a little bigger than the actual tracing.

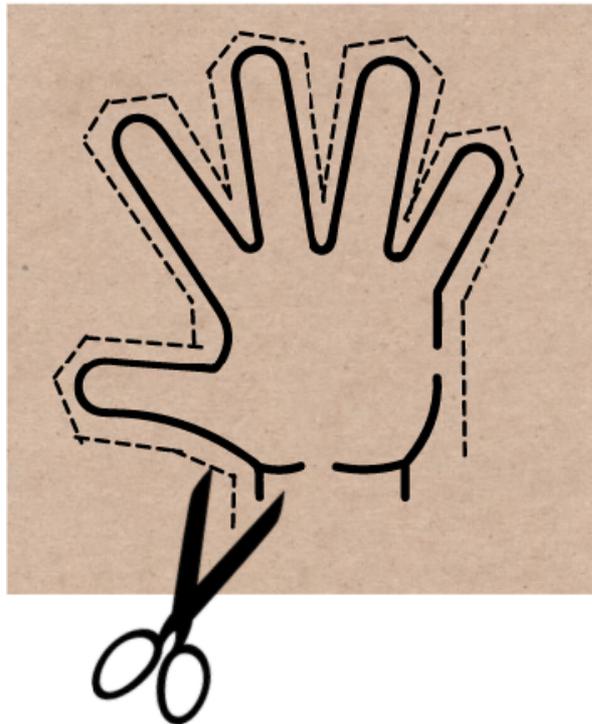


Figure 2: A model of the hand on the cardboard paper. The dotted line is the line we traced to cut the hand model.

3. Mark your fingers' joints on the cutout model of your hand.

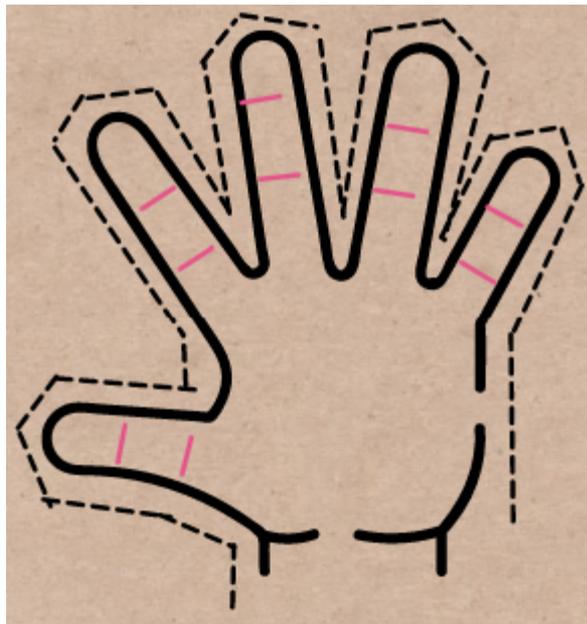


Figure 3: The hand model on the cardboard paper with the fingers' joints being marked in pink.

4. Fold the hand model according to the joints.

5. Cut straws to match the size of the joints then use tape to stick the straws to the joints.

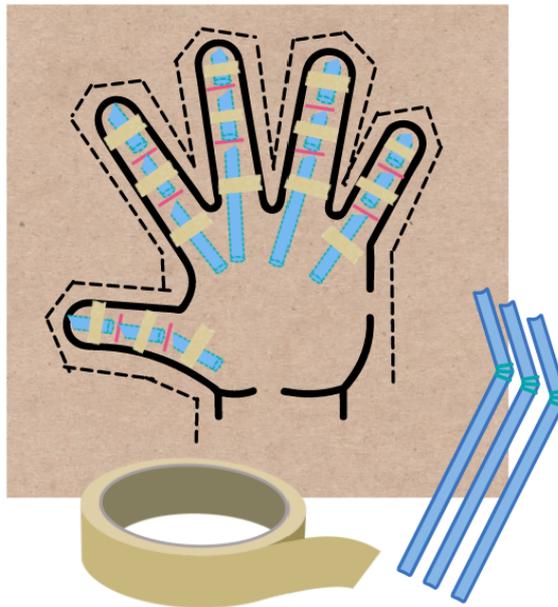


Figure 4: Straws are cut into smaller pieces and taped to the joints of the fingers on the hand model.

6. Thread yarn or string through the straw pieces. Each finger will have a length of yarn or string of its own.



Figure 5: Five pieces of strings are threaded through the straw pieces on each finger of the hand model.

7. Cut a longer piece of straw and tape along the hand. Thread all five pieces of yarn or string through this straw.

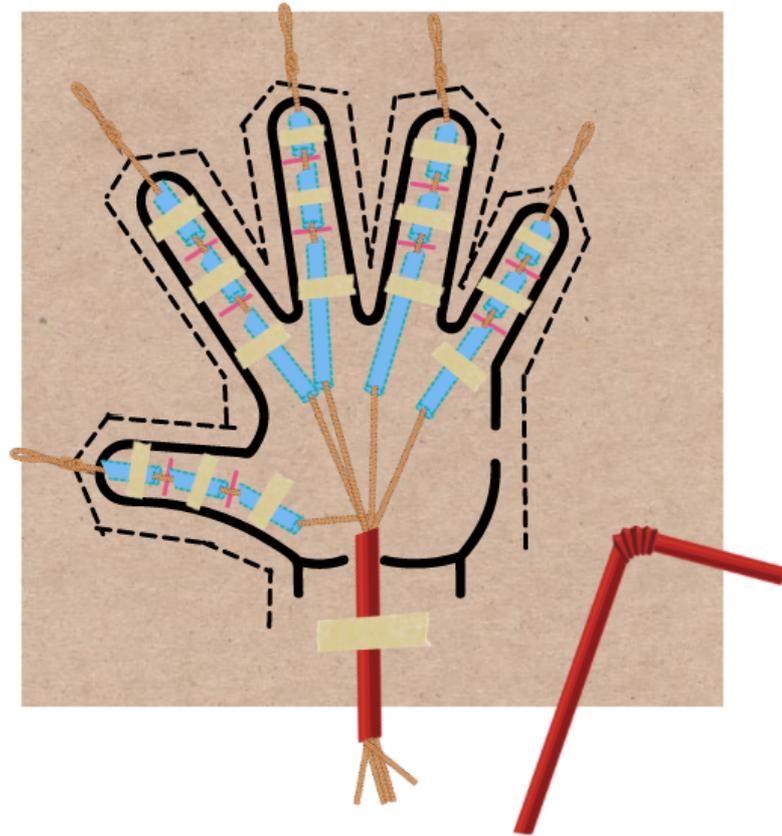


Figure 6: A red straw was cut and taped from the wrist down to the arm. All five pieces of strings are joint together and threaded through the red straw.

8. Pull on the strings individually or all at the same time and have fun with your new robotic hand! Your robotic hand could look like this.

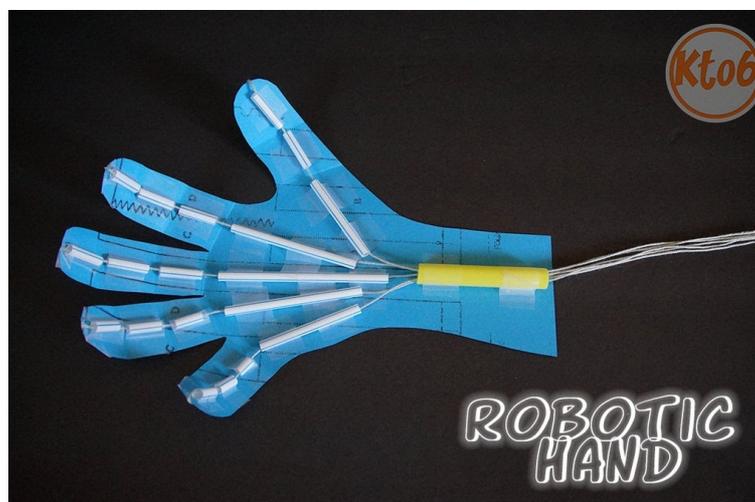


Figure 7: An example of a robotic hand with straws and strings attached to each finger.

Extension - How can you improve on this robotic hand model?

Reflection Questions

- Are there any improvements you would make to this challenge?
- What real world application can you apply the challenge to?
- What are the key concepts of science and engineering that relate to this challenge?

- Did you face any challenge when constructing the device? If yes, what are those challenges and how did you overcome these problems?
- What is one thing you would do differently next time?

Submission Guidelines

- Submit pictures of your robotic hand and answers to the reflection questions.

Note: Remember, if you want to upload pictures of your Minor Challenge that also include you, please check if it is OK with your mentor first.

- The submission form is on the Minor Challenges page:
<https://sciencechallenge.org.au/index.php/minor-challenges/>
Fill out the details and make sure you upload your submission.

Learn More! Resources

- If you enjoyed this task, you may want to read more on possible careers to pursue in the biomedical engineering field.

Biomedical engineer:

<https://www.sciencebuddies.org/science-engineering-careers/health/biomedical-engineer>

Robotics engineer:

<https://www.sciencebuddies.org/science-engineering-careers/engineering/robotics-engineer>

Bibliography

- De Brabandere, S. (2020, November 20). Build a Helping Hand. Retrieved from https://www.sciencebuddies.org/science-fair-projects/project-ideas/HumBio_p042/human-biology-health/build-prosthetic-hand
- Instructables.com. 2015. [online] Available at: <https://www.instructables.com/Robotic-Hand-Science-Project/> [Accessed 20 January 2022].