

Project: Soft Robots for Humanity

The purpose of this project is for you to build and analyze a novel soft robot that serves a humanitarian purpose. The project must include soft structures or materials, be constructed by you, and use readily available materials. The device must also have a humanitarian purpose, i.e. seeking to promote human welfare. Beyond that, the options are quite open. Your project must:

- be clear in its objectives: know how you define success!
- be demonstrated in the lab on demonstration day
- include a technical analysis of the mechanical principles involved
- include a qualitative analysis of the humanitarian nature of the robot

Project partner: The project is to be completed by a group of 2 students. Each project partner will receive the same grade for the project. We encourage you to partner with someone who has different skills/experience from your own.

Project Proposal and Review with Teaching Staff: By the end of class on Tuesday, November 12, identify your group here: <https://tinyurl.com/ME23N-Autumn2019-ProjectTeams>. In class, have a 30-minute brainstorming session with your partner, and develop a list of at least 10 different soft robots you could build for this project. Then pick 2-3 of these soft robots, and identify the mechanism, the materials required, and the humanitarian purpose for each one. Write and draw this information in your lab notebooks, and bring them to class on Thursday, November 14. We will schedule a meeting with your team during class on November 14 to discuss your project plans. Together with the teaching staff, you will devise a set of milestones you need to have accomplished on each of the following checkpoint dates:

Checkpoint 1 wiki report due: Tuesday, November 19 at 12 pm

Checkpoint 2 wiki report due: Tuesday, December 3 at 12 pm

Demonstration: Thursday, December 5 (during class time)

Final wiki report: Tuesday, December 10 at 5 pm

You will post your checkpoints on the project wiki pages at <http://charm.stanford.edu/ME23N2019>.

(Instructions on how to access and edit your wiki page will be sent by email after groups are formed. You can see posted examples from a different class at <http://charm.stanford.edu/ME20N2017>.)

Materials and Fabrication Resources: You should be able to make your project from the materials in your lab kits and using the 3D printer available for this class. During the initial project meeting we will review what materials you would need, and help you procure additional materials if necessary. You can work on your project in 520-145. You can store your project materials in 520-145 if desired; keep them in a box that is clearly labeled on a shelf in the alcove.

Demonstrate your Project: We will have a Soft Robots for Humanity Demonstration Day on Thursday, December 5 in 520-145 (the d'Arbeloff lab) during class time. Please reserve some time before the open house to set up, as well as afterward to clean up. At the demonstration, you will:

- Demonstrate and explain your project to the teaching staff for grading.
- Show a 1-page simple flyer that gives (in large font) the title of your project, your names, an overview of the project, and describes its humanitarian aspect.
- Invite visitors to see your demonstration, while you explain your project and answer questions.

Checkpoint Reports and Final Report: To document your project, you will create short checkpoint reports and a more detailed final report via your project wiki page at <http://charm.stanford.edu/ME23N2019>. The wiki page will be a single document with the checkpoints in an Appendix at the end. You will receive a login after we review the project proposals. Note that the layout of the page will appear a little different when you are logged in versus when you are logged out.

For each checkpoint (deadlines given above), you will update the title and summary (if needed) and add material to the “Appendix” of your team’s wiki page. For the final report (due Tuesday, December 10 at 5 pm), you will fill in the rest of the wiki page and leave the Appendix with the checkpoints as they were. We recommend that you do your major writing/edits in an external word processor to help you keep track of versions and do automatic spelling/grammar checking. It is easy to accidentally delete wiki text while you are editing, so make sure to keep backups!

The updates you need to make to your wiki page by the end of the project are as follows:

- Add a representative image of the overall project to the upper right corner of your wiki project page, with caption. The sample wiki page has the correct format for this – and it will be the first line in your wiki code.
- Edit the title and summary, to reflect what was actually done in the project. The summary is your final short (<150 words) abstract of your project.
- Place all the components of your final report. Please use these specific sections:
 - Introduction: Explain the motivation for your project in terms of the target application and why your soft robot uses a good approach. (1 paragraph)
 - Background: Explain the relevant prior work in the field of soft robotics or the application area, and provide at least 3 scholarly resources. (1 paragraph)
 - Construction: Provide a detailed description of how to make your soft robot. Add images and videos as needed to support the description. You can refer to downloadable drawings and/or code in the “Files” section (later). You can use subsections if desired. Also, in this section add a list of components and their approximate costs. (likely several paragraphs)
 - Results: Describe how your robot functioned – what was the mechanism and how well it performed. Explain any tests, qualitative or quantitative, that you performed. Please also describe how your design can be improved, and how it would be applied to your humanitarian mission. (likely several paragraphs)
 - Acknowledgments: Here you can list any individuals or groups who helped you with your project. This is optional, so delete this section if you aren’t using it.
 - Files: Drawings, code, and anything else that cannot be directly shown in the report should be linked here. You can upload these using the Attach command.
 - References: List the referenced literature, websites, etc. here.
- Keep your Checkpoints as they are in the Appendix.

Grading:

Humanitarian Concept	20 pts.	<i>Does the humanitarian concept make sense?</i>
Technical Approach	20 pts.	<i>Is the technical approach appropriate?</i>
Functionality	20 pts.	<i>Did the robot function compellingly during the demonstration?</i>
Technical Analysis	20 pts.	<i>Is the report technically accurate?</i>
<u>Presentation</u>	<u>20 pts.</u>	<i>Is the report well written, with appropriate supporting images/videos?</i>
TOTAL	100 pts.	

We prefer that you aim to do a simple thing very well instead of trying to do a complicated thing and not succeed. Note that the project is 40% of your overall course grade.