Cs: Curiosity, Connections, Creating value

Curiiosity

* Rapidly changing world
* Research question
* Could robots be built cheaper, smaller, faster—by students?

Connections

* Brining things together
* My past research
* Papers I’ve read
* Dr. Aukes

Creating Value

* Impact on others
* Past results
* Potential applications

Overview and explain how 3Cs are integrated. Describe how EM will benefit research and who will be impacted

**Introduction**

<Give a brief introduction of your research, project or conference.>

The proposed research project will continue my work in Dr. Aukes’ lab over the past two semesters with the goal of demonstrating that a high-performance dynamic legged robot can be designed and built by and for undergraduate and high school students as an educational tool. Dr. Aukes’ IDEALab utilizes laminate construction to build simple, yet effective foldable robots from cheap materials, allowing robots such as the one that this research will develop to be constructed from scratch in a couple hours by students using standard equipment. This research will incorporate open simulation methods and modular devices developed over the past two semesters into a completed robot platform. The resulting platform and the methods used to make it will be suitable for use by instructors in teaching robotic concepts to students.

**Curiosity**

<Explain how your curiosity will impact how you approach your research

Traditional robots are complex and their manufacture requires advanced machining tools, largely limiting their use to military and industrial applications. This research employs curiosity to ask the question of whether robots could be simple enough to be designed and built by undergraduate and high school students. With STEM education on the rise, many educators are looking to introduce engineering and technology at younger ages. If a system for designing and building low-cost robots could be developed, then students could use this system to design and build robots of their own from scratch, rather than relying on kits.

**Connections**

<Explain the connections you will make from multiple resources to ensure your research or project results in a valuable solution for all stakeholders. If attending a conference, explain the connections you will make as a result of your participation. Possible connections can be made through: coursework, research, faculty, industry contacts, experiences, and/or the connection of multiple ideas not typically considered related to one another.>

One solution to the problem of making robots cheap and simple enough for students to build is laminate construction. Foldable robots are constructed from cheap planar materials that are laser-cut into the desired shape and then laminated together into the finished device. I have been working in Dr. Aukes’ lab building foldable laminate robots for the past two semesters, developing force-sensing and simulation solutions for foldable robots. This prior work brought together many published sources, such as utilizing a leg design inspired by the robot Atrias and comparing experimental methods with half a dozen research articles on jumping robots. This research will bring together this prior work as well as the mentorship of Dr. Aukes to develop a locomotive robot platform using laminate materials.

**Creating Value**

<Explain how your project will create value for you and/or others.>

Throughout the process, emphasis will be placed on developing not just the robot itself, but also tools and methods that can be utilized by others to build robots of their own. For example, in order to simulate a robot leg design, the game engine Unity was used in prior work in favor of more expensive and specialized software. By taking advantage of more accessible options and developing them beyond their intended use, methods can be developed that are more accessible for students and educators. This work will result in a demonstration of how laminate techniques can be used to build performance robots. These same techniques can then be used by students to build their own robots and optimize them with unique constraints and objectives.