
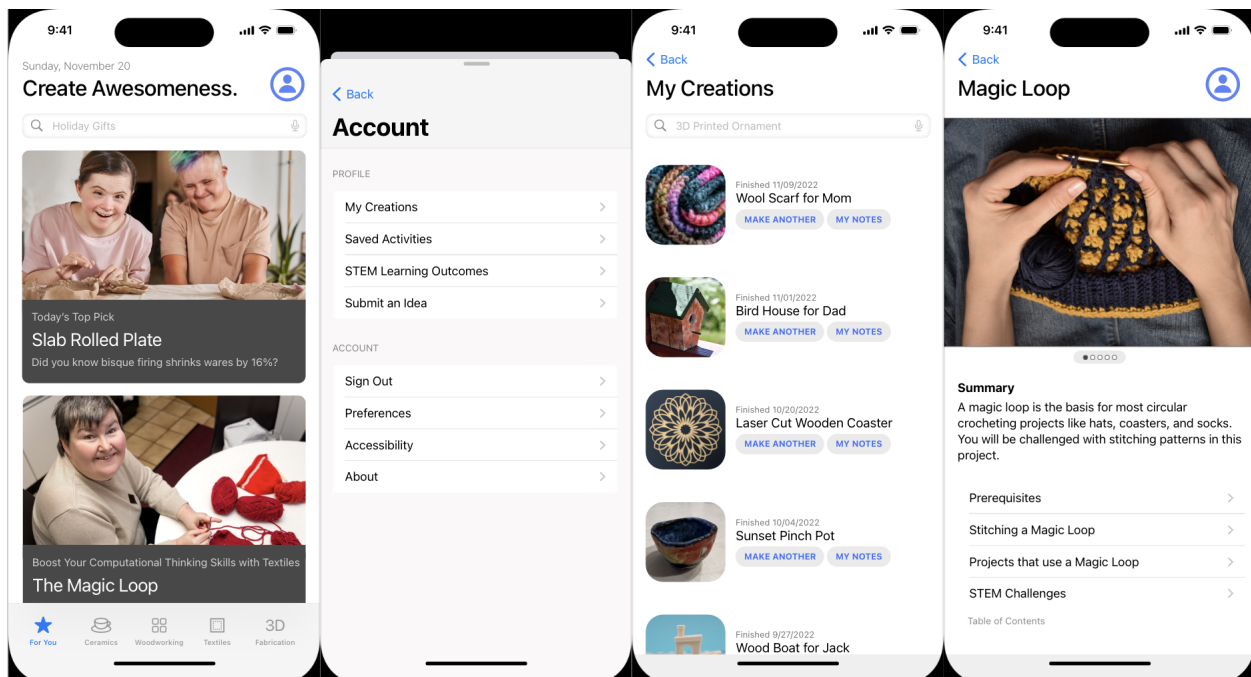


CS486C – Senior Capstone Design in Computer Science

Project Description

Project Title: Disabled Makers Crowdsourcing Mobile Application	
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Project Overview:



Makers are a vibrant community of creative people with diverse skills and interests who utilize tools and supplies to bring an idea to life. Makers' projects are natural incubators of applied STEM knowledge and learning. These communities congregate and collaborate in makerspaces. Therefore, makerspaces are naturally rife with opportunities to build and practice STEM skills outside formal learning environments. Makerspaces represent fertile ground for extending these benefits to people with disabilities. People with disabilities are a historically underserved population that could benefit from participating, learning, and creating in makerspaces. This project aims to make the natural STEM competencies gained in makerspaces available and accessible to people with disabilities. Also, the project will support research that uncovers the needs and desires of disabled populations related to making, as well as the development of supporting resources for integrating communities of makers and disabled people and measured STEM learning outcomes. From this project, one of the significant outcomes will be a co-designed crowdsourcing *Disabled Makers* mobile application that will serve as a centralized location, hosting resources for creating community partnerships, sharing project ideas, accompanying STEM learning resources, and entrepreneurial training for creating businesses owned by disabled people for their maker products.

People with disabilities often learn best with hands-over, hands-on, interest-based, individualized, and differentiated learning. However, these learning styles are often difficult to accommodate in traditional classroom settings due to large class sizes, low teacher-to-student ratios, and traditional views of STEM education. In traditional learning environments, students with disabilities perform below their peers in STEM subjects. Low performance in STEM education dissuades many people, especially those historically underrepresented, from pursuing STEM, exacerbating issues of diversity and representation. Makerspaces are informal environments that naturally afford hands-over, hands-on, interest-based, individualized, and differentiated STEM learning. In these spaces, makers celebrate the process (i.e., planning, building, and reflecting on projects) and realize their ideas into reality. By interacting with each other, makers develop belonging and community. These are the ingredients for building confidence in one's ability to pursue and belong in STEM. Disability is a beautiful part of diversity and should be more represented in society's view of STEM. Disabled participation in STEM plays an essential role in equity. This project aims to bridge disabled and STEM communities through an informal STEM learning environment.

The most influential and formative learning often occurs in extracurriculars because they are interest-based. Children and adults with disabilities commonly develop Individual Support Plans with their service coordinators that define personal goals and strategic plans for their success. Often these goals include skill development and taking advantage of new opportunities and resources, such as collaborating on the work in this proposal that will transform makerspaces into places of learning, growth, and productivity for people with disabilities. One way people with disabilities can achieve personal and educational success in STEM in makerspaces is through space appropriation, utilizing assistive technology to adapt the space to their specific needs. For example, an assistive laser cut mold can be designed and cut to help secure a bowl to a pottery wheel for trimming, reducing the time and challenges of centering the piece (an example of universal design that could benefit both disabled people and non-disabled people). Additionally, people with disabilities can benefit from the collaborative and supportive environment of makerspaces. In these spaces, individuals can work together to develop solutions to challenges and receive support and mentorship from others in the community. Makerspaces are an ideal setting for people with disabilities to develop their STEM skills and pursue their educational and personal goals.

Disability still often has a negative connotation in public. Disability visibility is an important strategy for improving public perception. Improving public perception of disability is essential for dismantling oppressive and ableist structures, which can significantly negatively impact the lives of people with disabilities. By improving the public perception of disability, barriers can be broken down, and individuals with disabilities can participate in society fully. When the public has a more positive and accurate understanding of disability, they are more likely to be supportive and understand the challenges faced by people with disabilities. The improved public perception will create a more inclusive culture where individuals with disabilities have opportunities to pursue their goals and aspirations. One of the best ways to increase disability visibility and improve public perception is by integrating people with disabilities into public spaces, such as makerspaces. Through this project, people at makerspaces may, for the first time, have prolonged interactions with disabled people, building new friendships and partnerships that will positively impact the community as a whole. The insights shared in the *Disabled Makers* mobile application have the potential to have broader impacts on communities beyond this work.

The *Disabled Makers* mobile crowdsourcing application will be co-designed with people with disabilities, their caretakers, makers, community organizers, and researchers to host materials developed through this work. A mockup of what the app could look like is shown in the figure above. The app's purpose is to communicate the outcomes of this work to reach broader audiences and provide infrastructure for people to connect and contribute. The app will support many functions. It will host DIY tutorials for completing maker projects in makerspaces based on the projects developed by participants. These tutorials will include visual design mockups, lists of required resources, lists of required skills with links to accompanying tutorials, media of progress at each step, step-by-step processes, related STEM competency challenges (i.e., questions with instructions for setting up an experiment to test one's hypothesis), tips, possible alternative approaches for accessibility accommodations, and opportunities for other community members to contribute to the original posting. App function also includes hosting resources to develop a business plan and follow the community partnership model of this proposal. The app will be released before the conclusion of this project on mobile phones and tablets. Machine learning will block irrelevant and offensive content, and community moderators can foster productive communication within the app.

Knowledge, skills, and expertise required for this project:

- Knowledge about disability justice and accessible research protocols that are inclusive and respectful to a broad range of disabled populations
- Cloud computing (Google Firebase) for mobile application's backend
- Mobile application development
- Maker competencies

Equipment Requirements:

- There should be no equipment or software required other than a development platform and software/tools freely available online.

Software and other Deliverables:

- A strong report detailing the design and implementation of the product in a complete, clear and professional manner. This document should provide a strong basis for future development of the product.
- Complete professionally-documented codebase, delivered both as a repository in GitHub and as a physical archive on a USB drive.