

Multidisciplinary Senior Design Project Readiness Package

Prepared by Steve Pellow on 7/28/20 / Updated on 1/20/21, 1/21/21 by A. North

Project Title	Robotic Art Drawing Assist
Project Number	P21068
Primary Customer	Karen Knight, Art Educator, Orleans/Niagara BOCES
Sponsor	Kids Miracle Making Club, Inc.
Faculty Champion	Dr. Dan Phillips
Other Support	[As applicable]
Project Guide	Arthur North
IP Considerations (must pick one)	<div><div>a) IP assigned to [organization]</div><div>b) Limited use agreement to allow Kids Miracle Making Club, Inc. to use outcome, team retains ownership</div><div>c) Team retains ownership, no additional requests for use</div><div>d) Client requires result to be placed in the public domain</div></div>

When complete, please submit this document through our online form, located at
<https://goo.gl/forms/J3G8G2jhTUFuJCYe2>

Project Information

Overview

Art education is a required part of NY state education, and it can be challenging for teachers to engage students with disabilities due to a lack of adaptations to standard art drawing devices. Depending on each student's particular level of ability, different accommodations may be required. The overarching goal of this project is to provide broader access to participation in art performance.

Some examples of devices that have been or could be adapted to enable inclusion of people with disabilities are:

- Individual using eye gaze technology to draw intricate art <https://youtu.be/rp4zHlhm0L0>
- Robotically controlled drumsticks/drum set <https://makezine.com/projects/make-robotic-drum-using-arduino-uno/>

This project has generated interest from several teachers, therapists and administrators in the area:

- Karen Knight, Art Educator, Orleans/Niagara BOCES
- Kathy Lee, Special Education Teacher, Mary Cariola Children's Center
- Sara Corona, Art Therapist, Pieters Family Life Center
- Mary Salluzzo, President, Penfield Special Education Parent Teachers Association (SEPTA)
- Kathy Miller, Assistant Director, Holy Childhood
- Peggy Fortune, Marketing Coordinator, Al Sigl Community of Services

These clients have indicated immediate needs for several specific types of adapted art drawing devices. Most of their clients have multiple physical and neurological disorders, with varying physical abilities. Some students would benefit from the use of an eye / head tracking system, and others would benefit from the use of some type of physical interface (e.g. keypad), and ideally both would control robotic art drawing devices.

The goal for the team is to create a system to allow any one of a group of students to draw along with their teacher using basic art drawing devices. Given the wide range of student abilities, the team is expected to focus on both eye / head tracking and manually operated user controls, both of which should interface with the same robotic art drawing devices.

Prior Work - P20068 Robot Drum Assist

Preliminary Customer Requirements (CR)

Category	#	CR
Functional	1.1	Compatible with standard x-y plotter
	1.2	Compatible with standard large screen displays
	1.3	Compatible with standard computer monitors
	1.4	Student-controlled brush strokes
	1.5	Student-controlled erasing

	1.6	Allows students to select from a variety of brushes and colors
Safe	3.1	Safe for student
	3.2	Safe for teacher/caregiver
Easy to use	4.1	Interchangeable (switch from one control interface to another)
	4.2	Portable
	4.3	Compatible with standard wheelchairs
	4.4	Easy to set up/take down

Preliminary Engineering Requirements (ER)

Footprint (in²)

Force to actuate (lb)

Required accuracy (within +/- ##in)

Constraints

- One user interface should be for students who can operate manual device and one should be for students who typically use an eye / head tracking system.

Project Deliverables

Minimum requirements:

- All design documents (e.g., concepts, analysis, detailed drawings/schematics, BOM, test results)
- Working prototype
- Technical paper
- Poster
- All teams finishing during the spring term are expected to participate in ImagineRIT

Additional required deliverables, if needed:

- Submit project/paper to SB3C or RESNA conference on completion

Budget Information

\$1,000

Intellectual Property

Students can retain IP ownership, but clients need to be able to use the output. Limited use agreement.

U.S. Citizenship

none

Travel Opportunities

None, unless project is accepted for publication at a conference.

Project Resources

Anticipated Student Staffing by Discipline

Please provide a brief explanation of the expected activities for each required discipline. This information helps us assign appropriate staffing. If you have identified team members already, list their names here. "Other" includes students from any department on campus besides those explicitly listed (e.g., Design, Business, Software Engineering, Civil Engineering Technology).

Department	Expected Activities
Biomedical Engineering	
Computer Engineering	Design and build user interface and communication between human controls and actuation
Electrical Engineering	Power, controls
Industrial & Systems Engineering	Ergonomics – range of motion, standard body dimensions
Mechanical Engineering	Design and build mechanisms to hold brushes, erasers and custom x-y plotter controls
Industrial Design	Familiarity with art implements

Required Resources

Faculty	Dr. Dan Phillips
Environment	
Equipment	
Materials	
Other	