**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

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| **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)** | 1. IP assigned to [organization] 2. Limited use agreement to allow Kids Miracle Making Club, Inc. to use outcome, team retains ownership 3. Team retains ownership, no additional requests for use 4. Client requires result to be placed in the public domain |

**When complete, please submit this document through our online form, located at** [**https://goo.gl/forms/J3G8G2jhTUFuJCYe2**](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/rp4zHIhm0L0>
* 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 (in^2)

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).

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| **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**

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| **Faculty** | Dr. Dan Phillips |
| **Environment** |  |
| **Equipment** |  |
| **Materials** |  |
| **Other** |  |