**Multidisciplinary Senior Design**

**Project Readiness Package**

Prepared by Sidney Davis, April 20, 2020

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| **Project Title** | Mind-Controlled Wheelchair |
| **Project Number** | P2XXXX |
| **Primary Customer** | Neurotechnology Exploration Team |
| **Sponsor** | MSD & Neurotechnology Exploration Team |
| **Faculty Champion** | [Optional, assigned by MSD] |
| **Other Support** | Multi-Disciplinary Robotics Club |
| **Project Guide** | [Assigned by MSD] |
| **IP Considerations (must pick one)** | 1. IP assigned to [organization] |

**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**

Make modifications to a mechanical wheelchair such that it can semi-autonomously drive in a populated environment with occasional heading information, ideally provided by an OpenBCI headset, but modifiable enough to receive commands from other devices if desired.

**Preliminary Customer Requirements (CR)**

* Use of three-dimensional imaging to observe and interpret the environment
* Identify locations that require a “Decision” to be made by the user, like an intersection
* Continuous path planning to avoid dynamic obstacles (i.e. pedestrians)
* Establish a communication protocol to receive occasional heading information from any compatible input device
* Weekly Customer-Team communication

**Preliminary Engineering Requirements (ER)**

* Simultaneous Localization and Mapping (SLAM)
* Ability to identify dynamic and stationary obstacles from the front of the wheelchair
* Interpret heading instructions from an external device through serial communication such as
  + FORWARD
  + ROTATE LEFT
  + ROTATE RIGHT
  + STOP
* Frequency of instructions received should correlate to the user’s control
  + More commands within period: user is describing how to move now
  + Less commands within period: drive autonomously unless at a decision point

**Constraints**

* Use of the wheelchair supplied
* The use of at least two Intel RealSense Cameras

**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:

* Demonstrations of overall hardware to sponsors and possibly media as opportunities arise.

**Budget Information**

* Wheelchair: already provided by sponsor
* 2x Intel RealSense Depth Cameras: $355.98
* 1x Intel RealSense Tracking Camera: $199.00
* Central Processing Unit: TBD
* Supporting hardware: ~$50

**Intellectual Property**

None

**U.S. Citizenship**

None

**Travel Opportunities**

None foreseen

**Project Resources**

**Anticipated Student Staffing by Discipline**

|  |  |
| --- | --- |
| **Department** | **Expected Activities** |
| Biomedical Engineering | None |
| Computer Engineering | Cheyenne Dailey, +1:  Create program to interpret measurements taken by the Intel RealSense Camaras; generate “ideal path” from camera data. |
| Electrical Engineering | Sidney Davis, +1:  System connections and power distribution; develop communication protocol from user controller; control motors to follow path as reported by cameras |
| Industrial & Systems Engineering | None |
| Mechanical Engineering | None |
| Other | Members of the Multidisciplinary Robotics Club will fill the “+1” gaps in the afore mentioned fields |

**Required Resources**

Describe the resources necessary for successful project completion. When the resource is secured, have the responsible person initial and date to acknowledge that they are aware and agree. We assume that all teams with ME/ISE students will have access to the ME Machine Shop and all teams with EE students will have access to the EE Senior Design Lab, so it is not necessary to list these. Limit this list to specialized expertise, space, equipment, and materials.

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| **Faculty** |  |
| **Environment** |  |
| **Equipment** |  |
| **Materials** |  |
| **Other** |  |