**Multidisciplinary Senior Design**

**Project Readiness Package**

Prepared by Jim Whritenor 7/16/2020

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| **Project Title** | Articulating Toilet V4 |
| **Project Number** | P21011 [Continue numbering for follow-on team, or assigned by MSD] |
| **Primary Customer** | Art North |
| **Sponsor** | [Who is providing financial support – may be different from customer] |
| **Faculty Champion** | [Optional, assigned by MSD] |
| **Other Support** | [As applicable] |
| **Project Guide** | [Assigned by MSD] |
| **IP Considerations (must pick one)** | Client requires result to be placed in the public domain |

**Each section contains a brief explanation to help you complete the form. Please remove any gray text before submitting.**

**Project Information**

**Overview**

Modern day public restroom facilities are expected to be accommodating for a variety of people. Some of these people include individuals who are required to use wheelchairs for daily transportation and have little or no ability to use their lower body. The restrooms, as well as the toilets themselves, should provide the occupant with the necessary means to go to the restroom in an efficient, organized, and timely manner. Despite this, some people who currently use wheelchairs are still encountering issues when using wheelchair accessible restrooms. Some of these issues include not having the means or strength to lift themselves onto the toilet seats, experiencing a difference in height between the toilets and the wheelchair, and not having enough room to clean themselves after using the toilet. In an attempt to resolve these problems, a prototype was designed and built by the 2018/2019 senior design team (W.A.R.3). Related Projects are P18011, P19011 and P2011. This device will fit around/over an ADA compliant toilet and make the bathroom process feasible for the with limited lower body function.

**Preliminary Customer Requirements (CR)**

Safe for the user during use and during transfer from the wheel chair

The design should be intuitive in order to help keep it clean of waste

Easy to clean up

Accommodates different types of wheel chairs

The seat is adjustable to aid in transfer, self-cleaning, and comfort based on user size.

Seat position is ergonomic

The design should look good

Easy to install

Low cost

No sharp edges (safe for user and cleaner)

Fits ADA compliant toilets as an add on.

Meets all ADA requirements

The system should feel stable to the user and not slip around during transfers

Accommodate an assistant helping the user get on and off the toilet

**Preliminary Engineering Requirements (ER)**

The seat should be adjustable between 17 and 27 inches from the floor

Foot print should be about 32x28

The grab bar can be moved out of the way

Seat velocity about 2in/s

Torso support bar capacity 400lbs

Over all weight capacity 400 lbs by all user support features

Factor of safety requested = 2

ADA compliance

Instillation time should be under 30 min

**Project Deliverables**

Minimum requirements:

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

Additional required deliverables, if needed:

* (e.g., submission to a particular conference or competition, invention disclosure, on-site installation, video clip of final project/lightning talk video)

**Budget Information**

Include total budget, any major cost items anticipated, and any special purchasing requirements from the sponsor(s).

**Intellectual Property**

Students retain ownership of any IP

**U.S. Citizenship**

None

**Travel Opportunities**

No travel required

**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 | Define ADA requirements that effect the design  Help define parameters to improve transfer and re transfer  Help define what’s required for the comfort of the user  Help define ease of use with respect to human subject operation. |
| Computer Engineering |  |
| Electrical Engineering |  |
| Industrial & Systems Engineering |  |
| Mechanical Engineering | Structural design, seat raising and lowering means, verification of foot print, selection of materials, stress analysis to meet the strength requirements for use. |
| Industrial Design | Help it look good and be functional |

**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** | [List individuals and their area of expertise (people who can provide specialized knowledge unique to your project, e.g., faculty you will need to consult for more than a basic technical question during office hours)] |
| **Environment** | [e.g., a specific lab with specialized equipment/facilities, space for very large or oily/greasy projects, space for projects that generate airborne debris or hazardous gases, specific electrical requirements such as 3-phase power] |
| **Equipment** | [Specific computing, test, measurement, or construction equipment that the team will need to borrow, e.g., CMM, SEM] |
| **Materials** | [List materials that will be consumed during the project, e.g., test samples from customer, specialized raw material for construction, chemicals that must be purchased and stored] |
| **Other** |  |