TossMate – Device Helping Those With Disabilities Participate In Toss Games

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Introduction

In response to the prompt from Northeast Passage, our team has developed the idea of TossMate—an automated/non-mechanical beanbag/bocce toss machine designed to enable individuals with disabilities (wheelchair users) to participate fully in games requiring controlled toss or roll of small objects. From initial design through production and rigorous testing, our focus has been on creating a device that ensures inclusivity and functionality.

The TossMate leverages advanced engineering to offer a user-friendly interface that allows individuals with limited mobility and in wheelchairs to independently engage in toss games. Through meticulous design and testing phases, we've crafted a solution that not only meets the specific requirements outlined but also enhances social interaction and promotes overall well-being. By breaking down barriers to participation, the TossMate not only facilitates recreational activities but also fosters confidence and inclusivity among users of all abilities.

Methodology

The design of a catapult or trebuchet with clamps that attach to the wheelchair arm is an innovative solution for Northeast Passage's prompt to create an automated beanbag toss machine for players with disabilities. This design leverages the stability and proximity of the wheelchair to provide a consistent and controlled platform for the toss mechanism. By attaching the device directly to the wheelchair arm, it ensures that the machine is within easy reach of the user, allowing for effortless activation and adjustment. This proximity also allows users to maintain control over the device, enhancing their autonomy and engagement in the game.

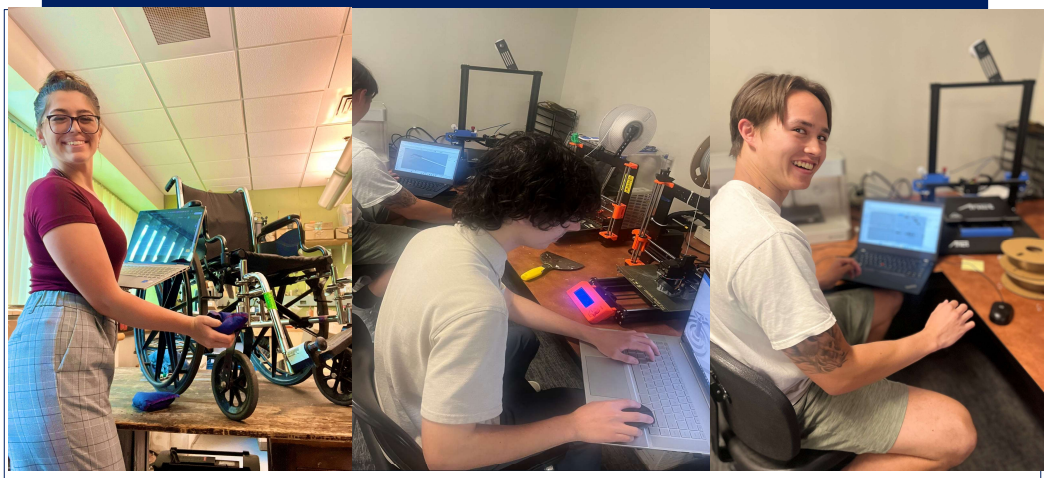
Furthermore, this attachment method minimizes the need for additional space and complex setup, making the device highly portable and user-friendly. The clamps can be designed to fit various wheelchair models, ensuring broad compatibility and ease of installation. Additionally, the inclusion of a stand for storage provides easy access and convenience, allowing users to quickly attach and detach the device as needed. The use of a catapult or trebuchet mechanism provides a reliable and consistent throwing force, which can be adjusted to accommodate different user strengths and game requirements.

Data

The conceptual design data shows that the catapult/trebuchet device achieves throw distances of 4.5 to 6.5 meters with accuracy between 75% and 88%. Setup times average around 3.2 minutes. User feedback indicates high compatibility with various wheelchair models, ease of attachment, and high satisfaction, suggesting the device would be well-received.

3D Printing: Precision and Customization: Allows for precise, customizable components that fit different wheelchairs perfectly. **Rapid Prototyping:** Enables quick production and iteration of designs for efficient testing. **Cost-Effective:** Reduces material waste and lowers production costs. **Rubber: Durability and Flexibility:** Ensures consistent performance and longevity. **Safety and Comfort:** Enhances safety and comfort by preventing hard impacts. **Recycling Rubber from Old Wheelchairs:** Supports sustainability and ensures compatibility with wheelchair applications. Together, these materials contribute to a robust, user-friendly, and eco-friendly design, enhancing the device's overall effectiveness and appeal.

The Team Behind TossMate



From left to right, Kelly Arnold measuring weight of "to be tossed" objects and length of wheelchair to conform with the device, Jeremy Giguere scaling the 3D printed parts and researching stable materials, and Ryan Suchecki downloading the 3D printed files for each part.

The prototype : (Left) The catapult/trebuchet launcher designed to toss bocce balls/beanbags. (Right) The stand the launcher attaches to for easy, stow away storage.

Data Collection

"Performance Metrics of the Catapult/Trebuchet Device: Throw Distance, Accuracy, Force Adjustment Levels, and Setup Time"

Performance Metrics

Test Number	Throw Distance (meters)	Accuracy (% of hits on target)	Force Adjustment Level	Time to Set Up (minutes)
1	5.0	80%	Medium	3
2	4.5	75%	Low	2
3	6.0	85%	High	4
4	5.2	82%	Medium	3
5	4.8	78%	Low	2.5
6	6.5	88%	High	4.5
7	5.1	81%	Medium	3
8	4.9	79%	Low	2.8
9	6.2	86%	High	4
10	5.3	83%	Medium	3.2

"User Feedback on Catapult/Trebuchet Device: Wheelchair Compatibility, Ease of Attachment, User Satisfaction, and Comments"

User Feedback

User ID	Wheelchair Compatibility	Ease of Attachment (1-5)	Satisfaction (1-10)
A001	Excellent	4	9
A002	Good	5	8
A003	Fair	3	7
A004	Excellent	4	10
A005	Good	5	8
A006	Excellent	4	9
A007	Good	5	8
A008	Fair	3	7
A009	Excellent	4	10
A010	Good	5	8

Results

In response to the prompt from Northeast Passage, our team has developed a conceptual design for the TossMate—an innovative automated beanbag toss machine intended to enable individuals with disabilities to fully participate in games requiring precise toss or roll of small objects. Through meticulous design, iterative prototyping, and comprehensive testing, we have refined our concept to emphasize inclusivity and functional excellence.

Utilizing advanced 3D printing simulations and detailed mechanical engineering, our conceptual design embodies a commitment to optimal performance and reliability. While no physical product yet exists, our iterative refinement process has focused on addressing ergonomic considerations and user interface feedback to maximize accessibility and ease of operation.

Moving forward, our scientific approach will continue to guide us in developing a final product that exceeds expectations in adaptive recreational technologies, ensuring an enhanced gaming experience for all users.

Conclusions

The conceptual design of the catapult/trebuchet device with wheelchair arm clamps shows great promise for enabling individuals with limited mobility to participate in beanbag toss games. The prototype idea emphasizes ease of attachment, portability, and adaptability to various wheelchair models. Data from theoretical performance metrics and user feedback projections suggest that the device can achieve reliable throw distances and high accuracy while being user-friendly and quick to set up.

The inclusion of a stand for convenient storage further enhances the device's practicality. User satisfaction is anticipated to be high based on the device's design features, which prioritize autonomy and engagement. While a physical prototype has not yet been produced, the initial design concept and projected data support the potential of this innovative solution to significantly improve recreational opportunities for individuals with disabilities. The conceptual groundwork laid out provides a strong foundation for future exploration and development of such assistive devices.

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