GOALBALL LAUNCHER

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ABSTRACT

Goalball is a paralympic sport for the visually impaired. Pitches often exceed speeds of 35mph & must bounce in two zones, following game rules. These intensive pitches become strenuous on the body which triggered coaches from Turnstone to seek a machine that could deliver a pitch in place of a human during practices. This team partnered with Mr. Edward Whitney of Turnstone & Mr. Keith Young of the U.S.A.B.A. to better understand the sport and outline key product requirements. The goal was to design and fabricate a reliable ball launcher offering Olympic level pitches with human like variability. Figure 1 shows the court and common pitch styles.

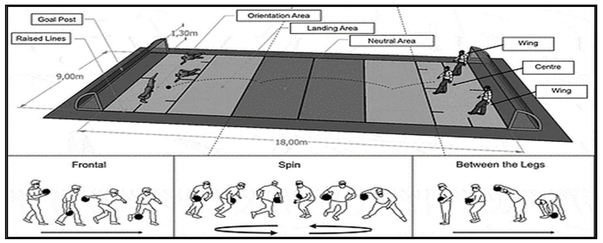

Figure 1: Goalball Court

CUSTOMER NEEDS/SPECS

Prior to any major research or design work, Mr. Whitney & Mr. Young were consulted to create an outline of the needs and target specifications for the launcher. The most important requirements were to deliver a fast, adjustable pitch with components which remain quieter than the ball. Additionally, safety and having a one-man operable machine were necessities for the success of the device. Table 1 shows the needs and specifications for the project.

Table 1: Customer Needs & Target Specs

Customer Needs	Target Specs
Must be quiet	≤70 dB During operation
User Safety	Enclosed structure with 4 protection panels
Light Weight	Weighs ≤75 lb.
Launch Speed Variability	5-35 mph pitch Speed
Angular Launch Variability	Pitch 0-45° from horizontal position

DESIGN CONCEPTS

The team created several rough concept sketches, which led to the creation of three system-level design concepts with more detail. Figures 2 and 3 display some concept sketches created by the team. The final chosen concept was the snowblower-style launcher.

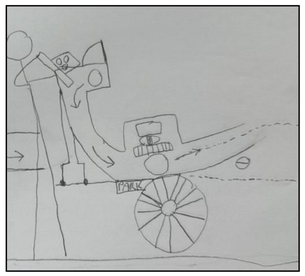

Figure 2: Snowblower Concept

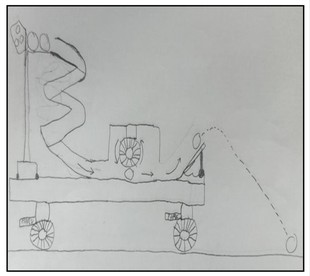

Figure 3: Twisty Slide Concept

The Goalball Launcher was created utilizing SolidWorks, with several components mounted to an assembly of the finished product. Figures 4 & 5 display some different component concepts of the machine.

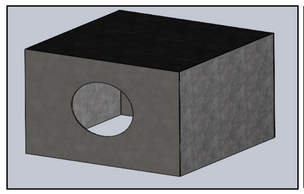

Figure 4: Casing Concept

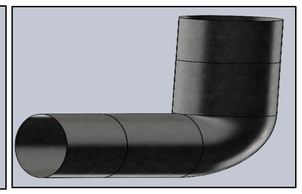

Figure 5: Hopper & Feeder

FABRICATION

Mechanical components were fabricated first including the initial chassis of the launcher as seen in Figure 6. The handle and drive system that pitches the ball are shown installed in Figure 7.

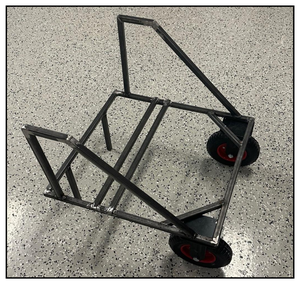

Figure 6: Goalball Launcher Frame

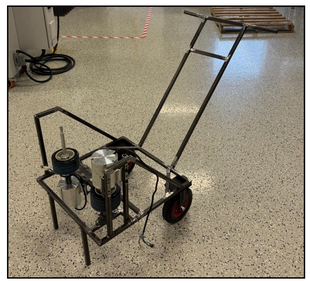

Figure 7: Pitch Drive System Installed

TESTING

The team performed several tests on the electronics which included the batteries and motors. These components were tested to ensure motor functionality, speed variability and battery to motor compatibility. Figures 8 and 9 show these tests. Once built the team also tested the launcher for pitching a ball and for noise level. Figures 10 and 11 show placing a ball and launching it respectively.

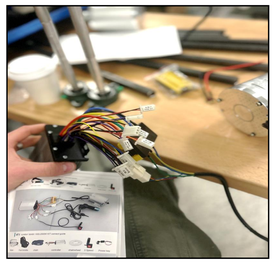

Figure 8: Motor Control Box Testing

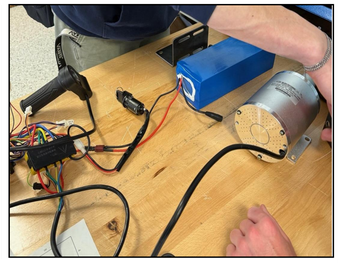

Figure 9: Motor and Battery Testing Setup

Figure 10: Placing a Goalball

Figure 11: Launching a Goalball

FINAL DESIGN

The initial and final CAD designs of the assembly model are shown in Figure 12a-b. 12a shows the flywheels, motors, handlebar, ball track, wheels, frame, brackets, and shafts. Figure 121b shows the final design with the casing and revised handlebar.

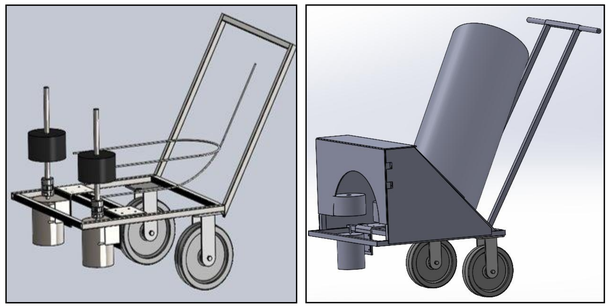

Figure 12a-b: Goalball CAD Design

CONCLUSION

The team has gone through a series of phases to create a Goalball Launcher that is quiet enough for the visually impaired Goalball players to hear the bells of the moving Goalball. The team utilized a Gantt Chart to stay organized, on schedule, and meet set deadlines. The Goalball Launcher can work at different speeds and angles based on flywheel set-up, Figure 13. This gives the Goalball players a new practice tool which will simulate the Goalball's coming towards the goal. Figure 14 displays the physical Goalball Launcher.

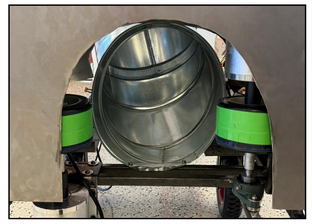

Figure 13: Flywheel Setup

Figure 14: Goalball Launcher

LESSONS LEARNED

The team has learned a few key lessons during the Goalball Launcher Project. These key lessons include:

- Research used was not supported as the Goalball is not inflated like a typical sports ball, leading to different launch characteristics.
- Supply chain and specification errors lead to part failures and product redesign
- Lack of knowledge regarding manufacturing processes is costly.

ACKNOWLEDGEMENTS

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