Wheelchair-Mounted Disc Golf Launcher

PROJECT S.E.R.V.E.
Student Engineering for Resilience of Veterans & Emergency Responders

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DESIGN CENTER COLORADO

MISSION

Project S.E.R.V.E. partners with veterans and emergency responders to develop personalized solutions that enhance quality of life

- Focuses on enabling paraplegics with limited upper body mobility to participate in disc golf
- Promote inclusivity and independence in recreational activities

OBJECTIVE

- Design and engineer a wheelchair-mounted device for frisbee launching for improved accessibility
- Addresses the physical challenges of frisbee throwing, which requires significant strength and coordination, especially in the lower body
- Allows users to aim their shot, then push the loading button, activating the motor to pull back the arm. Once the trigger system locks the arm, pressing the launch button actuates a servo to fire the device

REQUIREMENTS

- ✓ 3 second launch delay with alarm sounds
- ✓ Subsequent user input during launch causes the device to be disabled for 30 seconds
- ✓ Safety switch is activated by a caregiver to ensure people are clear of the line of fire
- ✓ Operates for a full 18-hole round
- ✓ Accuracy of 80% of launches within 5 ft window
- ✓ Launch disc over 100 ft
- ✗ Weight does not exceed 15 lbs

USER INTERACTION

Automated | User Control

Start / End → Aim Launcher → Press Loading Button → System Loads & Locks Arm → Load Disc Onto the Launcher → Stand Clear and Switch Safety → Press Launch Button → Disc is Launched From the Spring Tension

DESIGN OVERVIEW

Exploded Arm View

ELECTRONICS

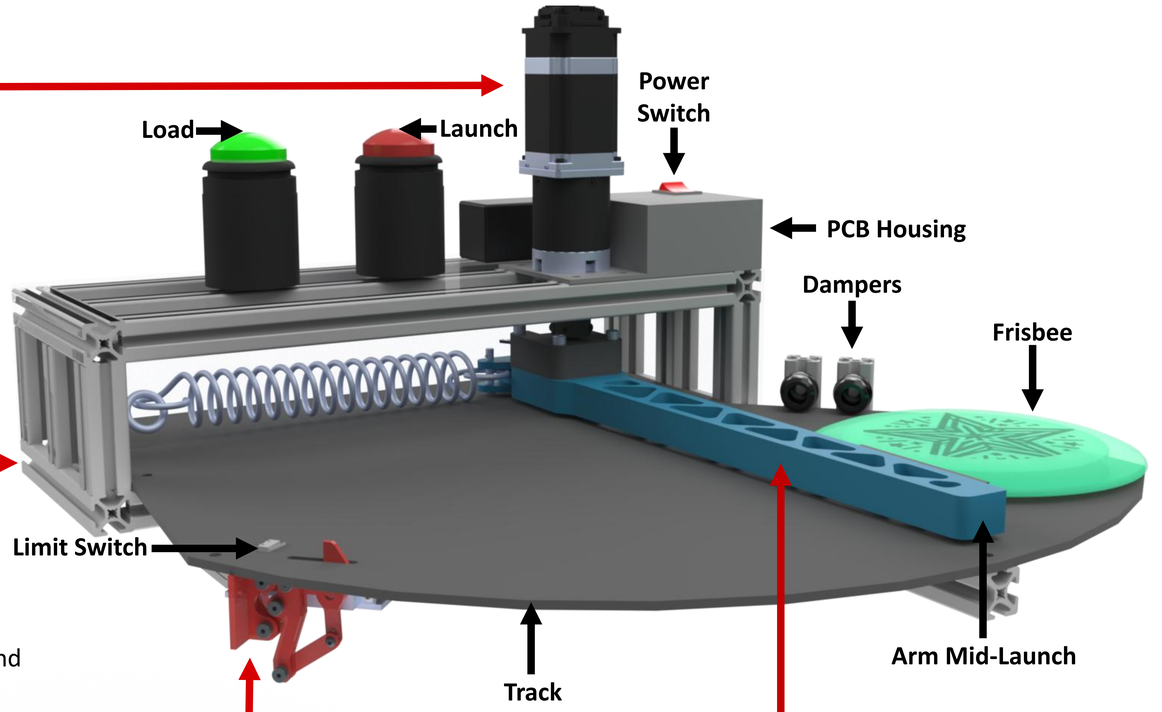
- Safety warnings include buzzers, blinking LEDs, and a key-switch
- Modular auxiliary input for buttons and head switches
- Arduino Uno paired with PCB for system control
- 80+ hours of battery life with current charge displayed

HOUSING/MOUNT/AIM

- 80/20 framing for light weight, high strength, and modularity
- Polycarbonate walls for safety and view of internals
- Post is attached via pin mount to device, and slides into universal seat plate
- Aiming via mount rotation

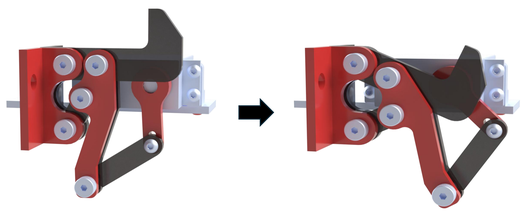
RATCHET

- Ratchet with directional variability allows for clockwise (CW) and counterclockwise (CCW) motion
- CW motion engages the ratchet teeth, and CCW works as a freewheel, detaching the arm from the gear system
- Servo automatically disengages the clutch once the arm is locked in the loaded position



TRIGGER SYSTEM

- Over-center latch ensures material failure before mechanical failure
- Holds 24 lbs (FOS = 65)
- Quick release by servo to avoid interfering with the arm

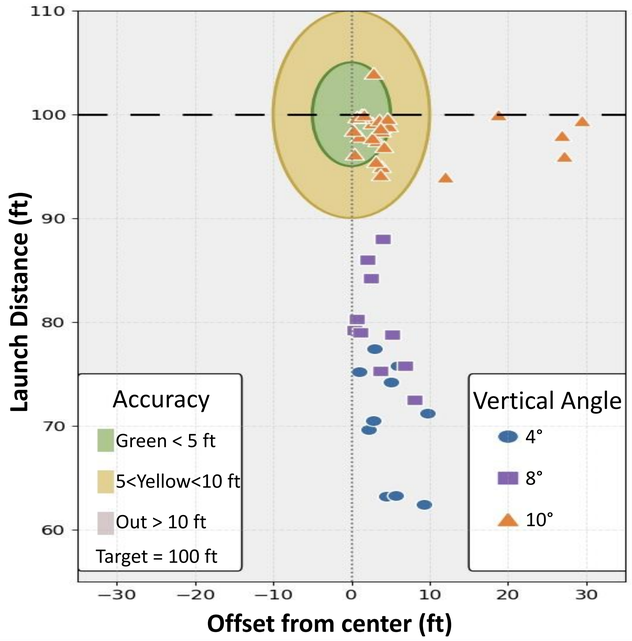


ARM SYSTEM

- Internal truss structure saves weight while maintaining strength (FOS = 25)
- Spring attaches via self-locking clevis pin through the launch arm (FOS = 31)
- 10 in section of grip tape on launch arm to help induce spin
- A high-torque motor retracts arm until hitting limit switch
- The damper system, rubber compression springs, stop the arm and reduce recoil once device is fired

TESTING RESULTS

- Conducted user testing with clients at Craig Hospital
- 80% of final launches within 5 ft horizontal spread
- Strongest spring and sandpaper-like grip material used
- Angle of launch chosen at 10 degrees for max distance
- Launch distance improved from 60 ft to 100+ ft



FUTURE WORK

- Injection-molded plastic frame, arm, and track to reduce weight and increase arm speed
- Custom spring that stores more energy with less length and wire diameter
- Adjustable mount that allows changeable launch angle
- User-controlled distance with variable arm set positions
- Lighter, smaller, and more powerful motor

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