

Adaptive Fishing Rod and Reel for Disabled Individuals

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I. ABSTRACT

Team 6 has proposed, developed, and produced a proof-of concept prototype for a novel adaptive fishing rod and reel retrofit device that allows persons of varied degrees of disability to participate in sportfishing in a manner that is congruent with their normally abled peers. Bait casting style fishing reels and rods are a mainstay within fishing arsenals of many individuals in North America. Due to their inherent construction, they are unwieldy, or at times, impossible for differently abled fisherman to use as their design hinges on two-handed operation. In response, a retrofit device was created such that people experiencing total inability to use one hand and/or arm may now use bait casting equipment in a manner that emulates the experience had by those with full use of both hands and arms.

II. INTRODUCTION

The team underwent experimentation to set appropriate human input parameters and subsequent output power needs. Advanced electrical power storage devices and motors were sourced to provide a modular device that is the first of such devices to provide variable speed retrieve capabilities to the user. Likewise, electrical, and mechanical design features allow the user to operate the device while utilizing all the features of the fishing rod and reel in a safe and ergonomic manner.

III. MATERIAL AND METHODS

The objective of the project was to be able to create a device that would facilitate the task of fishing for individuals with limited mobility with one arm. The main challenge from the project was to retrofit a device into an existing fishing reel. This was achieved by using multiple off the shelf products to be able to create a proof of concept. The major components of the assembly are displayed in (Fig 1) of the high-level block diagram.

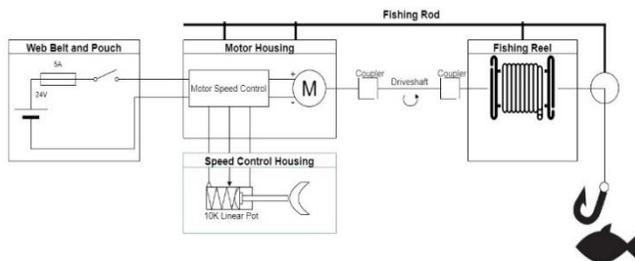


Fig 1. High Level Block Diagram

A. Brushless motor

The main challenge when the project was started was being able to find an appropriate motor for the intended use of the fishing rod. To meet the appropriate specifications that were needed for driving the fishing reel; two tests were performed on the fishing reel to meet these specifications. The first test was testing the torque need to engage the fishing reel drag. Testing the fishing reel drag was done by using a torque wrench and reading the value at where the torque wrench would engage the drag setting. The result was 2.71 Nm, and this torque was used to narrow down the motor selection. The second test was done to find an equivalent rpm that a normal user could perform on the reel. Measuring reel speed was measured by counting the revolutions as the wheel was spun by hand. The average speed result from the test was 170 revolutions per minute. After the test was performed, we narrowed down the motor selection to a motor that would be able to hit the desired specification such as 2.7Nm and have at max rpm of 200. Additionally, the brushless dc motor we used was able to fit the desired specification and it included an integrated board (Fig 2) that would allow the user to run the motor without additional hardware development.



Fig 2. Interior of Brushless DC Motor w/Transistors

B. Potentiometer

Being able to control the speed of reeling in a line is an important process of being able to fish since fishing is not only the equipment but technique as well. When the motor arrived, the team noticed that the board included an integrated potentiometer (Fig 3). The placement of the potentiometer was problematic, and the style of potentiometer was not ideal for fishing. The team was able to find an equivalent potentiometer that was in a style of a spring-loaded plunger that was attached to the board via external cables. This was ideal because it would allow for the potentiometer to be placed in a more ideal position and create a trigger system that when let go, it would turn off the motor.

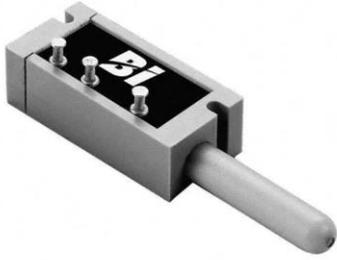


Fig 3. Spring Loaded Potentiometer

C. Flexible drive shaft

The flexible drive shaft is one of the most important parts of the build it allows for the motor to be placed in a more ideal location, while allowing it to still be connected to the reel. The team went with a DeWalt flexible drive shaft since the drive shaft has the moving components enclosed, this allows to minimize danger to a user. The only drawback that a future revision would be is finding a drive shaft that would still be shielded but be much lighter in weight.

D. Couplers

To be able to attach the motors and fishing reel to the flexible drive shaft, couplers are needed. The team decided to go with two aluminum set screws couplers. One of the couplers was treaded to attach to the fishing rod handle screw was. For a future revision getting a stronger material would be advised.

E. Batteries and safety switch

For ease of use for a potential user the team decided to go with a battery that would be found at almost any store. We went with a 24v, 4 Amp hour battery. This battery was able to match the motor specification. To attach to the motor, we used an adapter that would convert the three prong leads from the battery into just a two lead that would simply attach into the motor. During construction, the team notice a potential hazard with the battery, and it was decided to add a switch that would be able to power off the board while switching battery. This switch was attached with a fuse that would protect the board from potential hazard.

F. Battery Pouch

While the team was in the initial phases of discussion on the project one of the things that was discussed is where would the battery be attached. It was designed to reduce weight on the rod itself, a better location to place the battery would be in a case. The team was able to find a military style belt pouch that would allow the user to insert the battery in it and to rest the fishing rod on top of it while in operation.

G. Case

The case is what hold the whole project together. The case was design to house the motor board, the motor and hold the rod on top of it. For testing purposes, a 3d printed case was designed

and printed that allowed for a friction fitted motor and a retrofitted rod that was secured with a house clamp. Despite the case not being build out of the strongest material it is able to withstand the torque outputted from the motor. Additionally, a case was design that transform the potentiometer into a trigger, which worked out great. For future revision stronger material and some revisions are needed to accommodate the board.

IV. DISCUSSION AND RESULTS

Upon completion of the project, the Adaptive Fishing Rod and Reel for Disabled Individuals successfully pulled a weight of 5lbs over 50 yards. The device's design successfully incorporated a variable speed retrieval system, which is the first incorporated in this type of product. Design and construction of the device lends itself to easy use as it properly orients the user's hand to the device. Along with successful testing of the prototype, the parts making up the assembly are low cost and easily sourced.

V. CONCLUSIONS

The device described here within should act as a basis for which a manufacturable product may be further developed for this niche in the adaptive fishing market. This prototype suffices as proof that advanced, electric motors and respective control circuitry are economically available, off-the-shelf battery options are easily procured, and capable technologies exist to produce the mechanical drivetrain parts and covers to facilitate a venture to produce this product within the sportfishing marketplace. In this, greater development may be taken to produce casements, user controls, and an appropriate drive shaft mechanism to be feasible for large scale manufacturing activities.

Upon initial design and assembly, it is apparent that the product could be produced a price point that is both economically advantageous for a company operating within the fishing market and could be provided to the consumer at a price point that allows for a great deal of inclusion for the target population. Furthermore, the adaptive fishing rod and reel retrofit device would allow far greater inclusion of individuals within these sportfishing communities and provide recreational and therapeutic opportunities not currently available to several hundred thousand differently abled people on the continent of North America.

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