CHAPTER 11
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GOLF CART RETROFIT FOR GOLFERS WITH DISABILITIES

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INTRODUCTION

Over the last year, student teams have been pursuing the goal of a practical retrofit for conventional golf carts that will permit individuals with disabilities to enjoy the game of golf. The current version (Fig. 12.1) is designed for golfers with paraplegia, but could also be useful for people with a variety of conditions where it would be convenient to play without having to leave the golf cart. This design is innovative in that it offers features similar to those on golf carts devoted to a user with a disability such as the Club Carts Solorider, but because it is a retrofit to a regular golf cart, it promises to have a much lower incremental cost. Currently available specialty golf carts range in price from $4,000 to $10,000. The goal was to design a retrofit kit that would have a manufacturing cost in the range of $1000 at a production level of about 50 and could sell in the range of $1,500, including hand controls. To the authors' knowledge, no one offers comparable golf cart retrofit kits.

SUMMARY OF IMPACT

Participation in sports can play a critical role in improving the mental and physical health of people with disabilities. Golf is one activity that people with a disability who have sufficient upper body strength and limited or no use of their legs can play and enjoy. However, there is a significant barrier to wider participation because the cost of specially designed golf carts has made it impractical for golf courses to provide them. This means that golfers with disabilities need to invest in their own fairly expensive units. If the golf cart retrofit that is being developed is successful, it would remove this barrier. Golf courses might then find it to their advantage, or even be required, under the American's with Disabilities Act, to provide this accommodation and provide independent access to golf for millions of individuals with disabilities.

Figure 11.1. Golf Cart Retrofit Undergoing Field Trial.

TECHNICAL DESCRIPTION

The current design includes several simple elements, that when incorporated together create a unit that allows sliding from a driving position to a playing position, a comfortable all-weather seat that pivots and locks, and a hand control for driving without use of the legs. The main structure of the seat system consists of a track structure that replaces the normal golf cart seat. The sliding seat frame is supported in the track by four rollers. An electric motor moves the seat between the driving and playing positions. In Fig. 12.2, the assembly that provides the basic functions required for a disabled golfer to play from a seated position is shown. The person translates the seat to the side of the cart by actuating the electric motor. The seat is then rotated to the outside of the cart for hitting the golf ball. A right-handed golfer swings toward the rear of the cart. The golfer is supported by a harness of the type used by rock climbers that provides support without

interfering with upper body motion. An optional midriff-level seat belt support is also provided.

The design also includes hand controls that actuate the brake and accelerator without use of the legs. A commercial automobile hand control modified for the golf cart was tested as well as a specially constructed hand control as part of the retrofit kit. Both controls work, but tests indicate that the hand control that was designed for the golf-cart is more effective and less costly than the modified automobile hand control. The specially designed hand control is shown in Fig. 12.3.

The cost of parts/material used for the field test prototype with the specially designed hand control is about $500.

Figure 11.2: Seat Assembly in Playing Position.

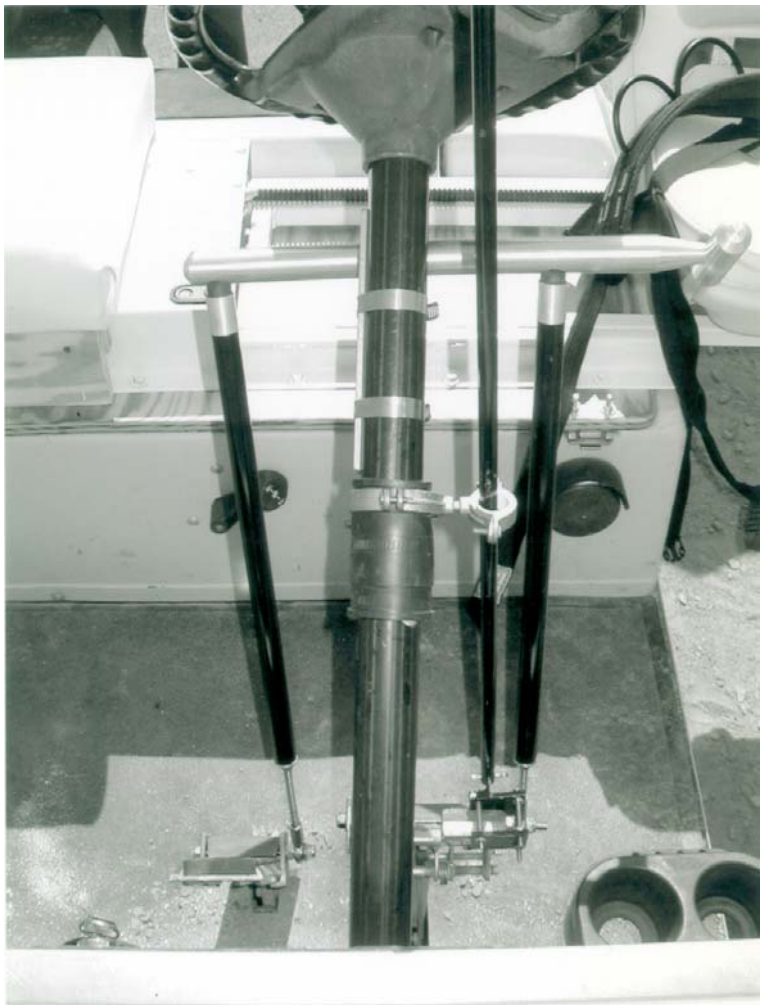

Figure 11.3: Hand Controls.

ADAPTIVE FEEDING DEVICE

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INTRODUCTION

The purpose of this project was to design and build a device that would allow a young boy with Cornelia De Lange Syndrome to eat more autonomously. Cornelia de Lange Syndrome is a congenital disorder that includes digestive problems, deformities in the lower arms, and mental retardation. Because of these problems, the client has to be fed by a caretaker. The adaptive feeding device is designed to allow the client, lacking a conventional hand, to use a spoon to bring food from the tabletop to his mouth. The device consists of a neoprene sleeve, spoon, two bearings, a collar, a bearing holder, a brace, and a counterweight.

SUMMARY OF IMPACT

The client lacks wrists that would normally provide him with the rotational movement needed to keep a spoon level, and fingers to properly grasp a spoon. Therefore, without a device to provide for these functions, the client is unable to grasp and manipulate a spoon. The adaptive feeder provides for these functions and, if successfully integrated into the client's daily routine, could have a profound positive impact on his eating habits.

It is also possible that this device, through simple modifications of the size and shape of the brace and sleeve, would be adaptable for other people with similar disabilities. It is possible to attach other devices to the end of the bearing holder such as paintbrushes, drawing implements, and a toothbrush. This would add to the versatility of the device and expand its relevance to a broader spectrum of application.

Figure 11.4 –Adaptive Feeding Device.

TECHNICAL DESCRIPTION

The most essential element of the adaptive feeding device is the bearing holder. The bearing holder acts as the housing for the spoon and bearings, which are the moving parts of the device, and is the attachment point for the brace that secures the entire device to the user. It is machined out of Delrin, a plastic that is FDA approved for contact with food, and has an extremely high strength to weight ratio. This provides the client with a lightweight device that will not require great effort to manipulate, as well as a durable product that can stand up to the wear and tear of a young child.

Inside the bearing holder are two plastic/glass bearings. They are press-fit mounted at the front and rear of the bearing holder so that they can be replaced without much difficulty. The spoon, made from stainless steel, slides into the bearing holder and sits firmly in the two bearings. A small C-clip prevents the spoon from sliding too far back into the holder, while a collar at the rear of the holder tightens down on the spoon to prevent it from sliding out of the device. The counter weight is mounted to the bottom of the collar and rests behind the bearing holder so it is out of the way while the device is in use.

The working end of the device is attached to the client's arm with a brace and a specially fitted neoprene sleeve. The brace is made from a thermoplastic casting material donated by Chesapeake Medical Products, Inc. It is molded to the shape of the client's arm and can be adjusted for growth by simply heating and reshaping it. The brace is attached to the bearing holder using nylon screws. It must be noted that due to the material properties of the thermoplastic, the brace must be cleaned with cold water. The neoprene sleeve is designed to wrap around Will's arm and uses hook and loop (i.e., Velcro) fasteners to adjust and attach

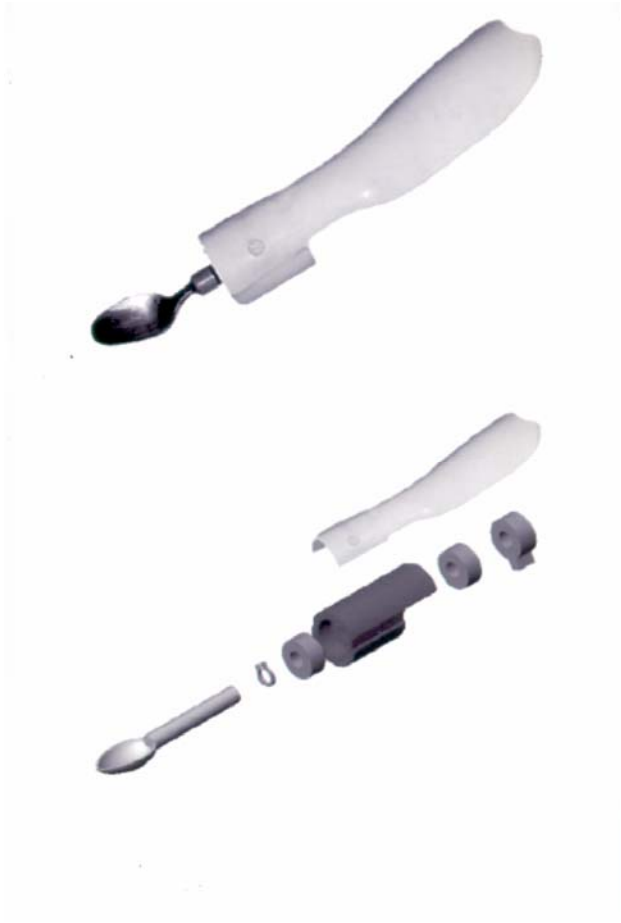

Figure 11.5 – Final Prototype and Exploded CAD Assembly.

to the underside of the brace. The neoprene sleeve can be detached and cleaned in a washing machine.

The total cost of the adaptive feeding device is $450.