

## Assistive Recumbent Tricycle (A.R.T.)

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Figure 1. Prototype of Assistive Recumbent Tricycle

### INTRODUCTION

The assistive recumbent tricycle serves as a replacement for a traditional tricycle in the life of an individual with an upper appendage disability. This product is capable of serving multiple functions for the user, as a means of transportation, rehabilitation and socialization with others. Currently, if a handicapped person wishes to participate in cycling, they must pay for an expensive custom-made prosthetic or have a customized tricycle made for them. These options are not widely accessible and can be prohibitively expensive. Our approach was to develop a general solution that can be easily applied to each user in an inexpensive manner. To do this we designed for a user with an upper appendage handicap that prohibits any use of one's arms and hands. This leads to the placement of the paddles on the user's hips to allow for any disability to be accommodated. The adjustability of the original tricycle combined with an adjustable version of our steering system would effortlessly allow for any adult-sized customer to use our product.

### SUMMARY OF IMPACT

The assistive recumbent tricycle brings dramatic change to the users' lives. The users are provided with a new means of independent transportation allowing them new freedom of motion and a means to enjoy the pleasures of cycling in an outdoor environment. They are given a new fun option for rehabilitation allowing them to gradually build muscles and improve cardiovascular health. Finally and perhaps most importantly the users are provided with a means of socializing and participating in cycling events with friends and families which previously was completely beyond their reach. These benefits together provide the users with a happier and healthier lifestyle.

### TECHNICAL DESCRIPTION

The implementation of our hands-free steering system was kept as simple as possible. The user leans to the left or right in the direction he/she wishes to turn. By leaning, the user pushes one of

the two steering paddles to the side. As the paddles move, the front steering linkage turns the wheels. When the user wishes to exit the turn, he/she simply leans back against the opposite paddle and straightens the wheels. To stop the tricycle, the user removes the feet from the drive pedals and places them on the brake pedals.

The details of the steering system can be easily described in two sections. The first being the rear paddle assembly. This subsystem acquires the user's input motion and drives the rest of the steering system. The paddle assembly consists of two vertical paddles that are part of a parallel four-bar mechanism. This forces both paddles to move identically regardless of the turn direction. As the user leans to one side, the opposite side paddle follows, this causes the connecting cable to relax on the lean side while pulling on the opposite side. This connecting cable transfers the motion to the second half of the steering system, the front linkage.

The front linkage is comprised of two mirror-image four-bar mechanisms. As the connecting cable is pulled by the paddles, the front pulley turns. As the front pulley turns, the motion is transferred through the linkage to the wheels, causing the tricycle to turn. To exit a turn, the user leans in the opposite direction. The tension of the connecting cable switches sides and turns the front pulley back toward the neutral position, returning the wheels to the forward facing position.

The braking system is made up of the original tricycle's disk brakes with modified brake lever and mounting system. Each wheel has its own independent brake system allowing for slight turning adjustments to be made using the brakes. The user simply moves their feet from the driver pedals to the L-shaped brake pedal and presses downward. This motion rotates the brake lever which in turn pulls the brake cable to activate the brakes.

The cost of the parts and supplies for this project was about \$975.

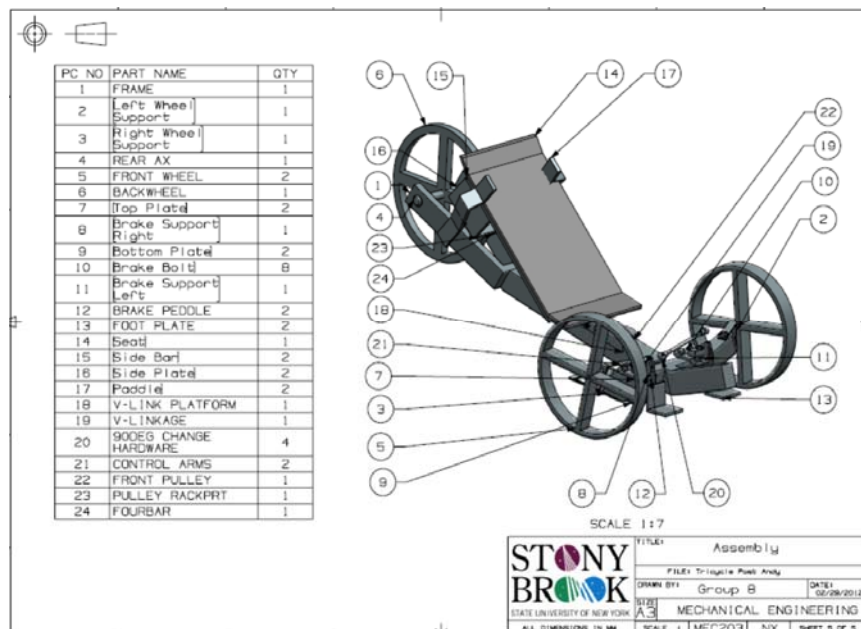


Figure 2. CAD Drawing of the Assembly of Assistive Recumbent Tricycle