1 Assistive Handcycle

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Figure 1. Assistive Handcycle Prototype

INTRODUCTION

A special handcycle was custom-designed and constructed for a child with a complete left-side weakness. Due to his weakness in left side, the child tends to use his right arm and hand whenever possible, which prevents him from regaining the strength in his left side. No existing commercial assistive device is available for solving his problem. This motivated us to create a mobility and rehabilitation device to assist the child to gain strength and improve the control of his left arm and left leg. A tricycle was modified to provide an effective solution. A sprocket-chain system was created to enable the user to ride the tricycle by hand. A disc brake was incorporated as an engaging mechanism to ensure that the left hand and left arm are actively involved in riding the tricycle. Corresponding to the hand-driving design, the steering of the handcycle was designed to use the feet. After finalization, the prototype assistive handcycle will be delivered to the client.

SUMMARY OF IMPACT

The custom-designed assistive handcycle provides an effective solution to the targeted client, which is not available from existing assistive products. With this device, the child can steer with his feet and pedal with his hands, and in particular engage his left hand more than usual, which will assist him to rehabilitate his left side while providing him with more mobility. Moreover, the handcycle design can be easily extended to fit with the needs of different children and adults with different levels of left or right arm weakness.

TECHNICAL DESCRIPTION

A Schwinn Meridian Adult Tricycle was chosen, considering the cost of prototyping and the size to accommodate the individual.

To transform the tricycle into the handcycle, the frame was extended with an additional support on which the hand pedals and engaging mechanism were attached. The foot pedals were removed. A lower sprocket was placed on their shaft, which receives the force and motion delivered by a chain from the upper sprocket engaged to the hand pedals. A chain guard was added to cover the chain.

The engaging mechanism was particularly design to enforce the child to use his left side. The core is a standard bicycle disc brake. The disc was connected to the right side of the upper bracket along with the hand pedal. The caliper of the break was attached to the frame such that the bottom bracket fits properly over the disc. A spring in the brake caliper was connected to one end of a rotating link so that the pads clamp down on the disc when the user releases the left brake lever. The disk break ensures that the left break lever must be held down in order for the child to rotate the pedals. When the brake lever of the engaging mechanism is released, the spring locks the brakes and the crank cannot be turned. When the break lever is held down, it stretches the spring and thus releases the brakes.

The steering system includes a set of links connecting the front fork to a foot-controlled pedal. The foot pedal was attached to the frame from below such that it can rotate left or right. When the foot rest is parallel to the ground, the front wheel is straight forward. When the rider pushes down his right foot, the links connecting the foot pedal and the front fork pull the front fork and wheel to the right, causing the handcycle to turn right. When the rider pushes down with his left foot, the steering links pull the front fork and wheel to the left, causing the handcycle to turn left.

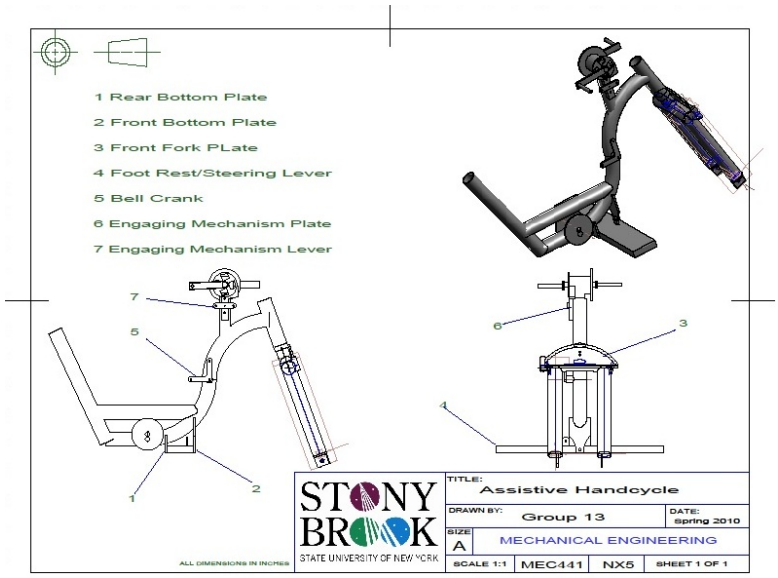

Figure 2. CAD Drawing of Modified Tricycle Frame