Exercise Bicycle for Amputees
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Abstract

The exercise bike for this project was designed for leg amputees. The exercise bike includes a back frame, CPU monitor, resistance mechanism, and foot attachment. The resistance mechanism has the ability to generate three different resistance forces, and can easily be adjusted by the user’s preference. The CPU monitor displays the user’s heart rate and the time during cycling. The foot attachment is a simple Velcro system attached to the pedals and can be adjusted for different foot widths for a variety of amputees.

Methods and Materials

The Exercise bike’s frame was made from aluminum extrusions coupled with two stainless steel bracket assemblies. The CPU monitoring system includes a heart beat display, a timer (the android phone), the Arduino, pulse sensor, and a 6 AA battery.

Resistance Results

The resistance force for the resistance mechanism was found using a force gauge. The force gauge consists of a hook and an analog measuring scale that measures the resistance in pounds and Newtons. The test results concluded that the maximum amount of resistance force that can be applied with pedal capabilities was 35.6 N (8 lb.). The range of the resistance force was between 20.57 to 35.59 N (4 to 8 lbs.).

Heart Rate Monitor Results

The overall percentage error in all of our trials was 6.25%. Our success criteria are to have a final accuracy that is greater than or equal to 90%, and a final error that is less than or equal to 7%. Since our final accuracy was 93.75% and our final error was 6.25%; then the heart rate monitor has passed the Heart Rate Monitor Accuracy Test.

Recommendations

We recommend using a recumbent bicycle design instead of an upright bicycle design. The recumbent bicycle design is more suitable for amputees by providing a comfortable amount of back support. If our upright bicycle design is used for future modifications, we recommend using an axle diameter that is greater than 3/8 inch to avoid deflection and permanent plastic deformation to the bike’s axle.

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Exercise bicycles for amputees are not widely used and have become very expensive; but they are a great way to strengthen thigh and hip muscles, along with helping train vascular systems. The biggest problem amputees encounter when using a bicycle is trying to keep their prosthetic foot on the pedal. Bicycling provides amputees with a way of developing balance and coordination. The rehabilitation process involves a series of stages and can be long and frustrating at times for the patient who is eager to walk again soon. It is for this reason, that we have taken the task to provide a cheap alternative to exercise.