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The Hand-Powered Tricycle for the Paraplegic

Designers: Daniel Raynor and Orlando Wong
Client Coordinator: Thomas Rosati, Premm Learning Center, Oakdale, NY
Supervising Professor: Dr. Michelle Nearon
Department of Mechanical Engineering
State University of New York at Stony Brook
Stony Brook, NY 11794-2300

Figure 1a. The Hand-Powered Tricycle.

Figure 1b. Orlando on the Tricycle.

INTRODUCTION

The hand-powered tricycle is a vehicle that provides physical therapy and recreation for but not limited to paraplegic people. The objective is to create a vehicle that is fun to ride and gives disabled people the joy and freedom of riding a tricycle as well as providing encouragement for them to participate in physical therapy. This vehicle will require the rider to have moderated upper body strength and control.

SUMMARY OF IMPACT

The hand-powered tricycle is mainly targeted for people who has limited or no use or their legs. These individuals will only need to use their upper body to power and steer the vehicle to exercise and have lots of fun.

TECHNICAL DESCRIPTION

The hand-powered tricycle is a fully mechanical system. It uses a system of cables for the steering mechanism and a frame-enclosed sprocket and chain to perform the driving function. The vehicle is powered when the rider perform a bench press motion that drives the chain attached at the lower section of the handlebars downtube (this section is contained within the frame). This pushing motion pulls the chain that goes around the sprocket attached to the rear wheel to create a forward motion of the vehicle. The chain will freewheel backwards due to a tension spring located at the other free end of the chain; this spring is anchored inside the frame.

The design of the steering mechanism allows the rider to steer regardless of the position of the forward stroke. This is accomplished by having the cable mounting points of the steering arms concentric to the pivot location of the handlebars downtube. The steering motion is actuated by cable attached to the spindles and routed throughout the frame. The system consists of four cables, when a right turn is made, the front of the left spindle is pulled inwards and the back of the right spindle is pulled inwards, and the opposite for a left turn.

6061 aluminum was used to fabricate the entire frame due to its strength and light weight. Some of the tricycle's features include Ackerman steering geometry for a better turning radius and vehicle control, disc brakes for all weather braking conditions and outstanding braking modulation, and a racing bucket seat for a secure and comfortable seating.

<u>Total cost</u>:

Materials and parts...	$1,199.55
Estimated machining time .....100 hours x 20$/hr =	$2,000.00
TOTAL….......	$3,199.55

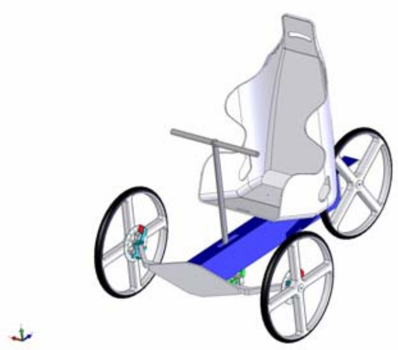

Figure 2a. Final Assembly.
(Front Isometric View)

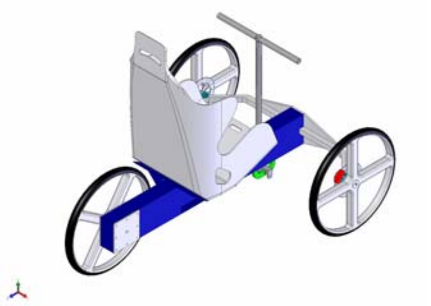

Figure 2b. Final Assembly.
(Rear Isometric View)

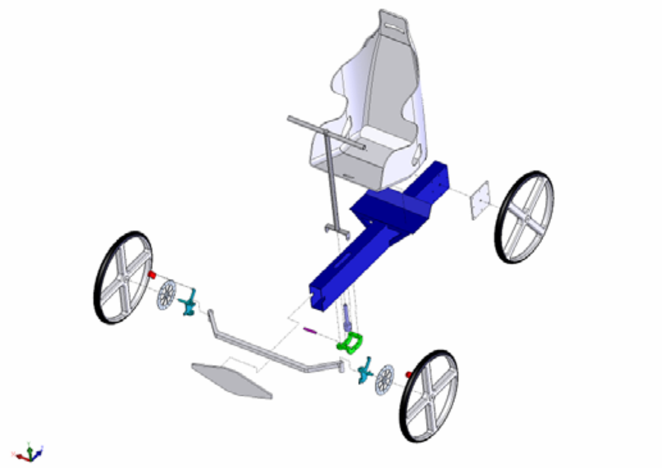

Figure 2c. Final Assembly. (Exploded View)

The Wheel-Stair

Designers: Alia Nagm, & Nicholas Terry
Client Coordinator: Thomas Rosati, Premm Learning Center, Oakdale, NY
Supervising Professor: Dr. Jeff Ge
Department of Mechanical Engineering
State University of New York
Stony Brook, NY 11794-2300

Figure 1a: The Wheel-Stair

Figure 1b: Deforming Wheel-Stair Tire

INTRODUCTION

The Wheel-Stair wheelchair is an innovation which modifies a tradition wheelchair by enhancing its mobility and usage. The objective of the invention is to minimize the amount of input torque required to transport over a curb. The result of this objective allows a greater mobility for disabled persons by decreasing their limitations of travel. This wheelchair is designed to be used indoor and outdoor on level or abnormal terrain.

SUMMARY OF IMPACT

This invention allows paraplegics with limited upper body strength to have an increase in mobility due to the reduction in input torque. This manually powered wheelchair acts similarly to that of a traditional wheelchair but adds it own twist to conventional wheelchair mobility restrictions. The Wheel-Stair expands the terrain in which a wheelchair can function in normal operation with added mobility.

TECHNICAL DESCRIPTION

The design of this manually driven wheelchair is emphasized on the tire. The tire is revolutionized so that it aids the wheelchair over the curb. The tire is selectively compliant so that it holds shape and allows for smooth translation motion; and deforms when it encounters a curb in order to minimize the required input torque. This is achieved by utilizing the air pressure increase in the tire. The tire will be revolutionized by dividing it into 6 equal sized and sealed off bladders. Coming out of each bladder and going into all other bladders is a hollow pipe. The pipe has attached to it a check valve which opens as the pressure increases over predetermined critical pressure. This critical pressure is achieved by the increase of pressure experienced by the bladder which makes contact with the curb at the time of its encounter. The air in that bladder chamber will dissipate to all other chambers, leaving that chamber flat, and deformable. This will allow the tire to conform to the curb. The flat chamber re-inflates as each other chamber makes contact with the ground. This will happen because each chamber now has a slight bit more air in it (coming form the deflated chamber). As each chamber makes contact with the ground the pressure increases and the check valve opens. Pressure naturally flows from high to low, so the air will flow into the flat chamber until the pressure of all the chambers equalize.

The wheelchair frame is made of steel, the tires and all its components are made of two-ply rubber and the tire rims are aluminum. The total cost, excluding labor is $331.

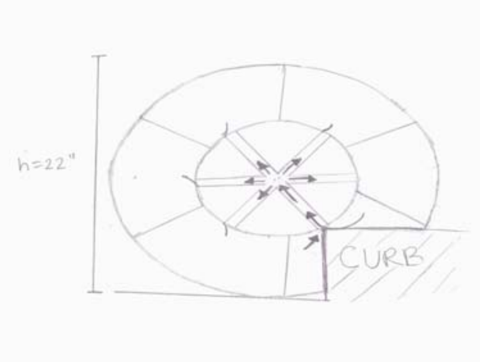

Figure 2: Engaged Tire

Figure 3a: Internal chambers

Figure 3b: Internal Chambers

The Manual Carousel

Designers: Sahdia Khwaja, Yen Li Liu, and Yasmin Nagm
Client Coordinator: Thomas Rosati, Premm Learning Center, Oakdale, NY
Supervising Professor: Dr. Jeffrey Ge
Department of Mechanical Engineering
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Stony Brook, NY 11794-2300

Figure 1: The Manual Carousel

INTRODUCTION

The design objective is to design a manually operated outdoor playground carousel for disabled children (paraplegics and quadriplegics) and non-disabled children. Design engineers met with teachers and administrators at a handicapped school and together the group concluded that this design would benefit the children in the following ways:

- *Muscle Toning* –for a disabled person muscle disintegration is a common and painful problem.
- *Improved Circulation* –disabled children often do not get enough exercise.
- *Improved Motor Coordination* – much like sports enhances our mind-body coordination; the carousel offers similar benefits for disabled children.
- *Goal-oriented Group Cooperation and Increased Social Skills* – goal-oriented group interaction is vital for the psychological development of handicapped children.

SUMMARY OF IMPACT

The manual carousel is targeted for all children who have the psychological ability to passively sit. Only a few individuals will need full use of their upper body. This is because two or three of the eight passengers need to use their arms to drive the carousel.

TECHNICAL DESCRIPTION

The Manual Carousel is human powered mechanical carousel. All components of the carousel are original designs and have been fabricated in the machine shop at Stony Brook University by the design engineers except the following: sprockets and chains, axle shaft and its protective frame, passenger seats, roller bearings, nuts, washers, and bolts. The frame is designed of 1018 hot-rolled steel, and is mostly welded. It houses the seats, wheels, shaft, chain drive, and connects to the central joint via a pivoted extension arm.

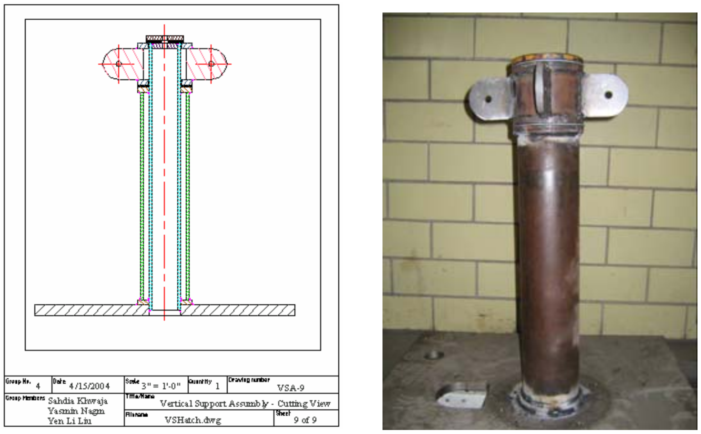
Power is transmitted manually from the hand crank to the drive sprocket through a standard roller chain. The drive sprocket transmits power to the axle, which transfers power to the drive wheel (outside wheel). The wheel transfers power to the carriage frame, which transfers power to the extension arm, which transfers power to the revolute joint (the joint is also an original design) causing it to revolve about the axis normal to the ground.

The shaft is a standard 5/8 inch diameter 30 inch long shaft. It is mounted with a drive sprocket and is rested in a protective frame. The frame makes contact with the shaft in four places, and a roller bearing is implemented at each location. Two of the four are pressed in a factory made frame for the shaft. The other two are pressed in originally designed bearing housings.

Two 20" high traction tires are used, and support most of the passenger weight. A swivel wheel has been mounted on a footrest to prevent toppling of the carriage under the weight of the passengers. It is to be mounted on the frame.

The revolute joint is an original design and was also constructed at the machine shop. It implements a spindle design, and four male pivots which join to the extension arm of the carriage. Refer to the images below. Notice the Teflon bearings between the bottom surface of the spindle and the top surface of the post sleeve. There is a Teflon bearing between the top surface of the spindle and the post cap as well. Also provided are a pictures of the vertical support with the joint mounted.

A drive pin is mounted to the shaft to create one drive wheel, and was modified from its manufactured state for design purposes in two ways. The drive pin spacer was trimmed to increase exposed shaft surface area. The drive pin plate a circular disk on which the pins are located) was trimmed to be flat in one area. This was done to allow the shaft to slide out of the assembly without hitting the vertical support beams of the carriage frame.



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Quantity 1
Drawing number VSA-9
Group Members Sahdia Khwaja
Yasmin Nagm
Yen Li Liu
Title/Name Vertical Support Assumbly - Cutting View
Filename VSHatch.dwg
Sheet 9 of 9

Figure 2: The center piece for mounting the carriage.

An Autonomous Toy

Designers: Vanessa Capanzano, Jesse Fite and Time Tebo
Client Coordinator: Thomas Rosati, Premm Learning Center, Oakdale, NY
Supervising Professor: Dr. Peisen Huang
Department of Mechanical Engineering
State University of New York at Stony Brook
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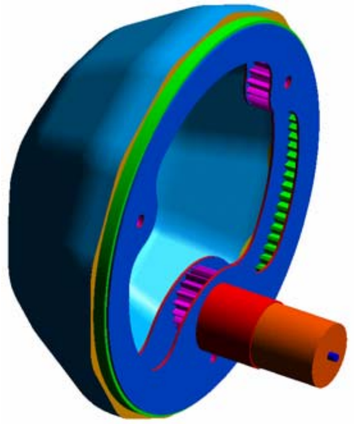


Figure 1: Left half of the toy

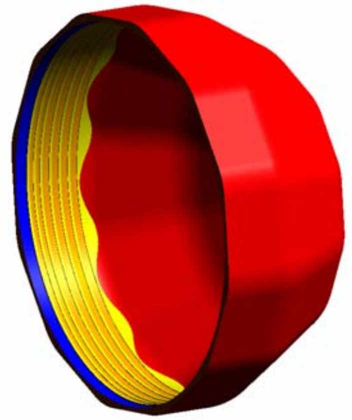


Figure 2: Right half of the toy

INTRODUCTION

The broad goal of this project is to target a specific child or group of children with a common disability and invent a “toy” (or what this target group might consider a fun activity) that also functions as an interactive/learning exercise gizmo. There are two important criterions by which Autonomous Toy will be judged, safety and how well the toy entices the child to play. The Autonomous Toy will be designed with a particular child’s size, fine and gross motor skill abilities and mobility type considered. However, the Autonomous toy can be modified to market non-handicap children as well. In the Autonomous Toy various sounds, motion and vibration, surface textures and lights could be incorporated.

SUMMARY OF IMPACT

The Autonomous Toy is designed to entice play utilizing positive reinforcement while the child benefits from increased exercise. Intellectually, the child will be exercised by using the Autonomous Toy and will learn the concept of cause and effect. In addition to building or refining certain motor skills for the child, a goal of the Autonomous Toy is to create a sense of independence for the child as well as self-esteem, which are important aspects of development, by being able to use the toy without assistance.

TECHNICAL DESCRIPTION

The final design for the toy will be a multifaceted ball. This balls main feature is its programmed random motion and the element of cause and affect (i.e. the incorporation of a child response) that it brings to the user. Due to the constraints of manufacturing for the design team, the prototype will be a representation of the toy's possible features. The drive mechanism for the design will include two motors and the use of a ring and pinion, and a rack and pinion to create 2-D motion. A controller will be used to program the motion and to control the interaction between the power supply and motor function (i.e. the brains of the system). The primary goals for the final design are to incorporate 2 different programmed motions with reasonable complexity, and have corresponding initiation sites. These programs will be initiated with lighted buttons. Aesthetically the prototype will include some lighted surface with the use of LEDs. Secondary goals for the toy will be to incorporate a program to compensate for human intervention, or the incorrect orientation of the toy for proper use. Another secondary goal includes the compensation for encountering objects that will hinder the motion of the toy.

The final design is composed of many components, which contribute to a forward and backward, and a turning motion. The function of all inner mechanisms contributing the generation of motion, and all other component function and specifications are included in Table 1. Other subsystems of the design include rotating electrical contacts, epicyclic gear train, the ball and tube sensors, and micro switches. See Figures 1 and 2 for sketches of the final design.

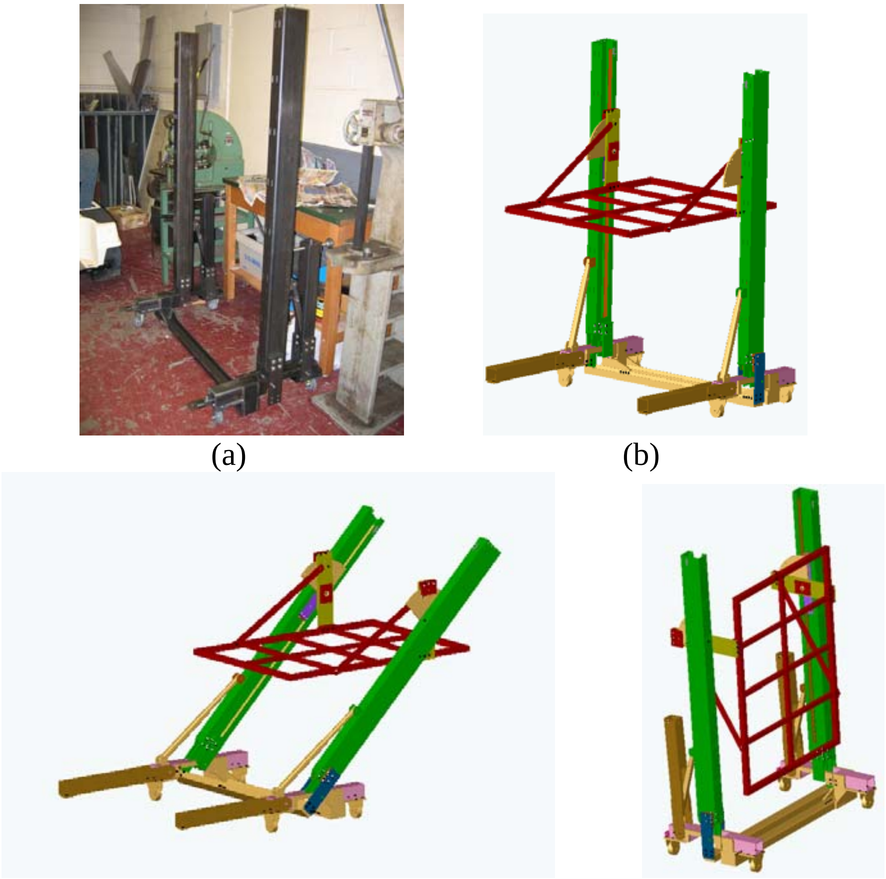
Component List

Component Name	**Function**
Outer Shell	Rapid Prototyping at SUNY @ Stony Brook. Provides structure and aesthetic properties to the toy, protects inner mechanisms from damage from impact.
Motors	Provides torque to move drive pinion and sliding mass
Controller	Controls motors using programmed commands.
Batteries	Provides power to motors and controller
Battery Holders	Organizes batteries for optimal power output and controls distribution of mass in the system
Buttons	Aid in the activation of the system (cause and effect)
LED's	Incorporate an aesthetic value
Wires and connections	Complete the circuit between the motors, controller, h-bridge and power source
Central rods	Located the center of the toy for the sliding mass, provides support for the carriage and central mass
Rack and pinion	Represents the sliding mass, controlled by the motors, provides linear motion for the sliding mass and ultimately provides a *turning radius* for toy.
Internal ring gear and pinion	This mechanical system provides the *forward and backward motion* of the toy.
Carriages	Two carriages are needed. One is located in the central shaft region to proved support for a pinion, motor and controller etc. and the second is located near the drive pinion (motors, batteries, etc.).

Table 1: List of component function.

Compact Wheelchair Lift

Designers: Richard Murray and Yohann Littee
Client Coordinator: Thomas Rosati, Premm Learning Center, Oakdale, NY
Supervising Professor: Dr. Robert Kukta
Department of Mechanical Engineering
State University of New York at Stony Brook
Stony Brook, NY 11794-2300



(a) (b)

(c) (d)

Figure 1: (a) Partial prototype; (b) Vertical configuration; (c) Inclined configuration; (d) Storage configuration

INTRODUCTION

This machine is a platform-type wheelchair lift capable of overcoming both vertical and inclined impediments to wheelchair traffic. Specifically, the lift is designed for a sheer elevation of up to four feet (such as a stage), and an inclined lift of up to five feet along an incline of thirty or thirty-five degrees (such as a short stairway). In addition to the lift's versatility in service, the machine easily collapses into a storage and transport configuration with a footprint of less than twelve square feet and a width of thirty inches for doorway passage. Another outstanding feature of this design is its potential compliance with the current national safety standard for platform lifts and stairway chair lifts (ASME A18.1-2003).

SUMMARY OF IMPACT

Premm Learning Center in Oakdale, New York has a high population of mobility impaired students and needs a portable, storable lift to transport students onto the gymnasium stage, and to use in the hall stairs when the stationary lift is out of service. This environment exploits all three characteristics of the Compact Modular Wheelchair Lift: a vertical lift onto the stage, and an inclined lift along the hall stairs, both combined with the necessity of sporadic use and easy storage. The situation at the Premm Center is not unique. Across the country, rehabilitative and special-needs educational programs are often relegated to retired public school buildings erected long before the Americans with Disabilities Act (ADA) of 1990.

TECHNICAL DESCRIPTION

This machine is powered by a double-acting (roped) hydraulic piston powered by either 120 VAC outlet power, or by batteries. The hydraulic piston (45) actuates the chain or cable (not shown) pulling the platform (23) along the guide rails (18). The chain or cable is routed first to the primary bearing block (42) (inside the guide rail supporting the hydraulic piston). From the bottom of the primary bearing block (42), the cable or chain is routed downward and across the machine on the cable bed/guide rail channel (41). Here, the cable or chain is directed upward along the outside of the far guide rail (18), reversing direction at the top, and terminating at the bearing block in the far guide rail (37).

The bearing block system operates with each bearing block (42,37) having two vee-wheels (36) which ride on corresponding angle tracks inside the guide rails (18). The system provides resistance to moments both axial and radial to the axis of the vee-wheels. This bearing system is neither unique to this machine, nor the only system which could be employed in this machine. Any number of commercially available linear motion systems, or custom designed bearing systems can be substituted for the current bearing block design, possibly with improved results. The machine is illustrated below in the vertical lifting configuration, but can be adjusted to the inclined configuration by setting the platform level (39) and the guide rail incline (33) to the appropriate station. Additionally, the machine is converted into the storage & transport configuration by setting the platform level (39) and forward outriggers (9) to the appropriate selection. The machine can now be wheeled on its casters (6) through most doorways.

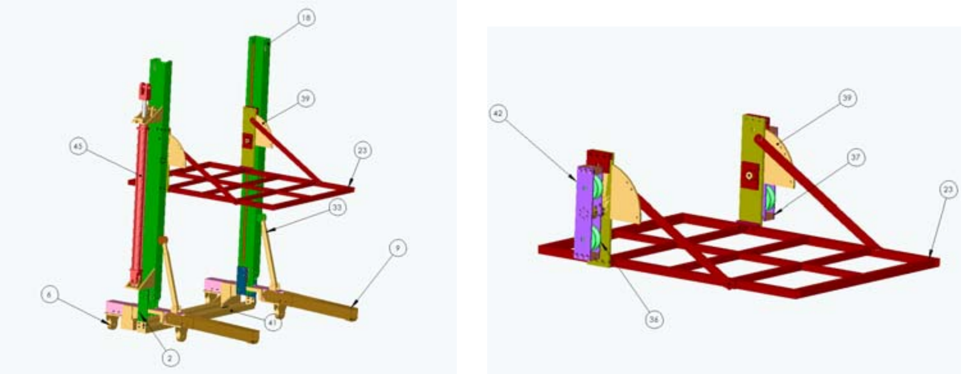


Figure 2:Vertical Configuration and Platform with Bearing Blocks (Both with Annotations)

The All-In-Wonder Entertainment System

Designers: Anthony Tallerico and Adam Olivieri
Client Coordinator: Thomas Rosati, Premm Learning Center, Oakdale, NY
Supervising Professor: Professor Ge
Department of Mechanical Engineering
State University of New York at Stony Brook
Stony Brook, NY 11794-2300

Figure 1
Cabinet Pic 1

Figure 2
Cabinet Pic 2

INTRODUCTION

The All-In-Wonder Entertainment System is an all inclusive recreation/learning center. It was specially designed for a 14 year girl with acute dwarfism. Under the careful tutelage of Thomas Rosati and our advisor Professor Ge, the mechanism was generated to the exact specifications of the customer in order to ensure that this device would provide the user with certain learning and ease of use specifications.

SUMMARY OF IMPACT

The Entertainment System provides the user with a smaller and easier to use keyboard as well as a gyration mouse for normal computer functions. The gyration mouse allows the individual to use the mouse as a normal desktop optical mouse as well as a desk-free, motion sensing, on screen cursor controller. It also comes equipped with certain swipe functions that enable the customer to perform specified tasks and functions with the flick of a wrist. For game play, the All in Wonder Entertainment Center has been fitted with 2 wireless arcade control panels for game play up to 10 meters away.

Figure 3
Ultra GT Compact Keyboard Suite

Figure 4
Control Panel

TECHNICAL DESCRIPTION

This device was designed and constructed over a two-semester period. The cabinet is made primarily of ¾ inch oak plywood which has the strength to hold just about any item that is proportionally sized to the monitor chosen, and of course less than 100 lbs. The shelves were mounted on the top of 1x3x8 plywood batons and then the batons were glued and nailed to the plywood sides.

Figure 5
Control Panel / PC Draw

Figure 6
Keyboard / Mouse Draw

The PC built for this project includes,

- AMD Athlon XP 2500+
- Shuttle XPC SK43G
- 256MB OCZ RAM
- 80GB Hitachi SATA Hard Drive w/8mb buffer
- Sony 52x32x52x16 CD-RW/DVD Drive
- ATI 9600 AIW Graphics Card
- Wells Gardner D9200 27” Arcade/VGA monitor

The Tandem Tricycle

Designers: Maria Caporicci and Ryan Romano
Client Coordinator: Thomas Rosati, Premm Learning Center, Oakdale NY 11769
Faculty Advisor: Professor Ge
Department of Mechanical Engineering
State University of New York at Stony Brook
Stony Brook, NY 11794-2300

INTRODUCTION

The tandem tricycle is designed to provide physically and mentally disabled children with the physical, emotional and social benefits of being able to ride a bicycle. The goal of the design is to allow a disabled child who may have cognitive, balance and strength limitations to be able to pedal, steer and in all other ways have an experience as close to that of a non-disabled child riding an unmodified bicycle as possible. In addition to the physical benefits of pedaling and other movements encouraged by this design, the child will have the added benefit of experiencing one of the most universal experiences of childhood with a degree of control that they may not otherwise have been able to enjoy. The design does require that the student have at least limited use of all of their extremities in order to make full use of the design features. Accommodations can also be made for paraplegic children.

SUMMARY OF IMPACT

The tandem tricycle is designed primarily for students with some use of their arms and legs. These students will be able to pedal and steer the vehicle from a position that accommodates limitations of balance and fine motor control. The design aims to turn necessary exercise into a fun and exciting experience.

TECHNICAL DESCRIPTION

The design of the tandem tricycle is closely based on the bicycle designs that have been in wide use for more than a century. The drive train and braking components, in particular, are commercial parts that have been adaptively used for this application. The drive train consists of one nine-gear cassette and two pedal cartridge assemblies. The vehicle thus has an adjustable gear ratio, which can compensate for changes in road or track grade or for the diminished capacity of the disabled rider to contribute to the pedaling of the vehicle. Both chains have guides and tensioners to prevent the chain from derailing and potential hazards to the riders. The front pedals are ratcheted. This allows them to be locked in a stationary position for a paraplegic child or for one who is simply too tired to pedal. The foot grips for these front pedals incorporate straps that can be used to safely and painlessly bind the child’s feet to the pedals to prevent them from dangling down into the drive train or, worse, dragging on the ground.

The tandem steering is accomplished by means of a dual port rack and pinion. Unlike a standard rack and pinion design, which has only a single port to connect to a single steering axle, the dual design allows two axles to be connected in tandem. This connection provides two key features to the vehicle. First, the child is able to steer the vehicle even though they are seated almost precisely above the drive axle for the front wheels. The steering column can be easily projected forward from the rack and pinion without any compromise in the mechanical viability of the system. Second, and more importantly, the adult caretaker in the rear seating position is able to feel and respond to the child's steering decisions and, when necessary, to take over the steering of the vehicle without harming the child. This allows the stronger adult to either add power to the child's steering in order to make sharper turns or to steer away from hazardous obstacles that the child may not be aware of or may not recognize as dangers.

The chassis of the vehicle is constructed of 4130 chromoly steel tubing due to the combination of strength to weight ratios, corrosion resistance and ease of machining that this material displays. Some of the other features of the vehicle include detachable and adjustable components, a padded seating platform for the disabled rider and hand operated cable brakes. Additional safety features such as rider restraints, guards and extra padding are included in the design of the vehicle but are omitted from the prototype for time reasons.

Total Prototype Costs: $1100

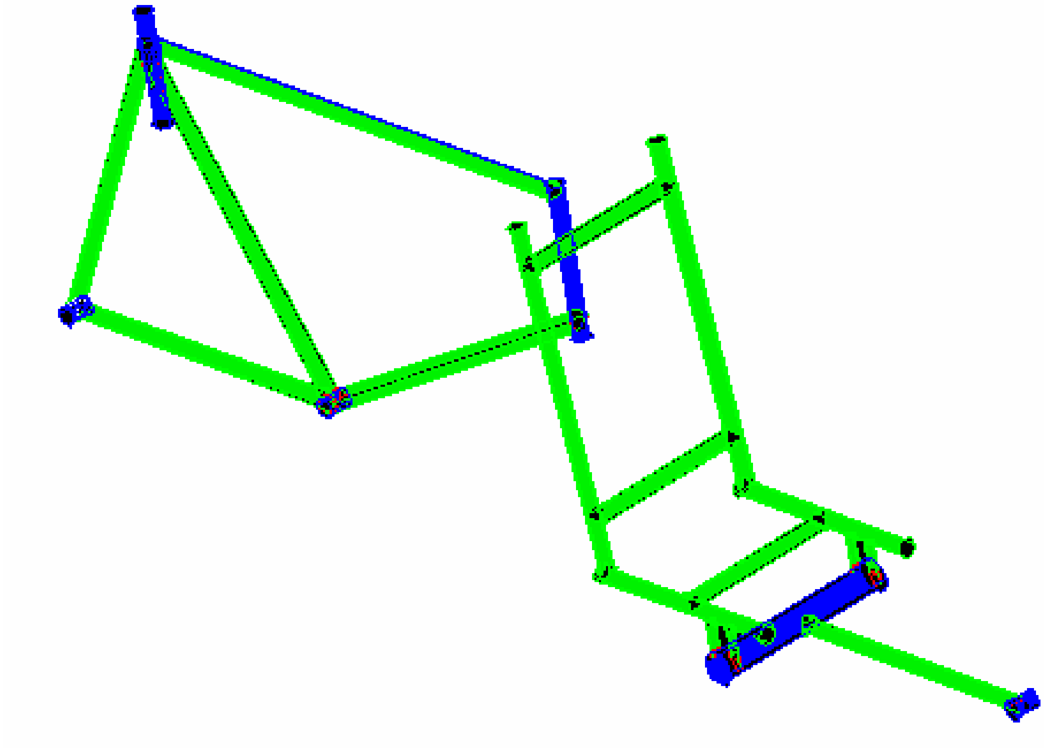


Figure 3 - Frame Design for the Tandem Tricycle

The VIP Lift

Designers: Thomas Altruda, Warren Ang, and Man Ng
Client Coordinator: Thomas Rosati, Premm Learning Center, Oakdale, NY
Supervising Professor: Professor Fu-pen Chiang
Department of Mechanical Engineering
State University of New York at Stony Brook
Stony Brook, NY 11794-2300

Figure 1: The aircraft that needs a lift for the wheelchair bound pilot.

Figure 2: The VIP Lift

Figure 3: The VIP lift in disassembled configuration

INTRODUCTION

The goal of this design group is to design, build and test a safe solution to transport a handicapped person from a wheelchair into a general aviation airplane. The device to be created should be able to lift a maximum weight of 250 lbs. It will also have the capability of being assembled, operated, and disassembled in a relatively short time. Set up and operation should be simple enough to be handled by one person, usually a caretaker or friend. The device will also have to be small and collapsible so that it can be stowed inside the airplane; hence the entire weight of the device must be less then 100 lbs for proper balance of the airplane. The device should also be designed to prevent injury to the subject or the aircraft. The criterion for judging our design includes portability, user friendliness, aesthetics, ergonomics, weight, and whether or not it is mass producible. The motivation of this project is to help Dave, a skydive instructor who was involved in an aircraft accident. He still enjoys flying but has no movement in his lower body and minimal movement in his upper body. It is the goal of this design team to help Dave move into and out of his airplane. There is an organization by the name of International Wheelchair Aviators. It is an organization composing of "Disabled and Able Bodied Pilots".

SUMMARY OF IMPACT

The VIP lift can be used not only for transporting wheelchair bounded pilots and passengers for private aircrafts but also for other situations that require lifting a handicapped from a wheelchair to another desired location.

TECHNICAL DESCRIPTION

Since one of our main criteria is to make the lift collapsible and easy to store, we started to think of ways to collapse the legs on an A-frame configuration. The final solution is the have the legs slide into the upper part of the A-frame as shown in Figure 1. This is a great space saver, as the collapsed A-frame will not consume any more room than the upper half of the frame. When in operation, the legs will slide out and be held by a pin.

One of the main components in the A-frame design is the cross bar. The three initial choices for the cross bar is an I-beam, a round beam, and a square beam. The Square beam is selected mostly due to the stability in resisting twist, and that there is a large bearing area for the carriage. A method of collapsing and storing the beam made it possible to fit within the storage limited storage space of the aircraft.

One of our main concerns when designing our carriage is that we want to minimize the possibility of getting fingers or other body parts caught in the carriage. The first concept for the carriage was a rectangular shell with a square cross section. Two sets of rollers on the top will allow it to roll across the beam. To provide the necessary vertical motion, either a lifting winch or a pulley (with a remote winch) will be added to the bottom of the carriage. A second generation concept consisted of a rectangular cross section, which allowed the pulley to be moved inside the carriage. In an effort to improve the looks and minimize the risk of injury of coming in contact with the sharp corners, the bottom edges on the carriage will be trimmed and rounded.

The lifting operation will be made easier by utilizing an electrical driven (12 Volt) ATV winch to provide vertical motion. A pulley is used to transfer vertical into horizontal motion. After extensive searching, a winch was found that uses 12 volts, has a .45 hp motor, provides up to 1500 lb. of line pull, which is well above the demands of the VIP lift, and is well within our budget. It was later decided to go with a rectangular winch with bearings exposed. The carriage will slide across the top of the cross beam by mounting bearings on a shaft. The winch will be mounted under the carriage to pull the handicapped out of the wheelchair.

The total costs for material and parts are about $1260 for the project.

Design Elevating Reclining Wheelchair

Designers: Lorens Goksel and Raymond Lau
Client Coordinator: Thomas Rosati, Premm Learning Center, Oakdale, NY
Supervising Professor: Professor Imin Kao
Department of Mechanical Engineering
State University of New York at Stony Brook
Stony Brook, NY 11794-2300

Figure 1a: The chair prototype

Figure 1b: The elevating mechanism

INTRODUCTION

The goal of this project is to create a seat lifting mechanism that can be installed onto a wheelchair with reclining function, where the caretaker manually operates the elevating and reclining functions. The chair must be cost effective, efficient, reliable, durable, and aesthetically pleasing. A reclining functionality will be based upon a car seat. Three focused methods in this report relating to raising the seat will be a rack and pinion system, a cylindrical joint arrangement, and finally a four-bar mechanism.

Because the caretaker will be the primary operator, the device installed on the wheelchair must not increase weight dramatically. If human aid is needed to maneuver the wheelchair, size could make use cumbersome. The unit itself must raise a maximum weight of 220lbs to a height of 1ft. While doing so, it must perform this task in any urban setting, especially a medical environment, thus safety to the occupant and its surroundings is paramount.

SUMMARY OF IMPACT

This project develops a wheelchair that can elevate up to 1ft by a caretaker via a hydraulic jack. It is intended for daily home use or for medical purposes.

TECHNICAL DESCRIPTION

The heart of the system is the scissor jack and hydraulic piston. The scissor jack is composed to sliding joints, scissor cross members and interconnecting bars. A piston is positioned at a slight angle when the scissor jack is collapsed. A caretaker actuates via lever arm the piston connected to interconnecting bars via revolute joint. When pumping begins, these bars are pushed by the piston in turn push the scissor cross members. Because the scissor cross members rotate, sliding joint were made to allow the least amount of friction as well as limiting the rotational motion. The initial angle offset forces the general direction to move upward. The scissor mechanism is sandwiched between two plates, the top plate supporting a seat, the bottom plate mounted on by casters. The designs are shown in Figure 2 and 3.

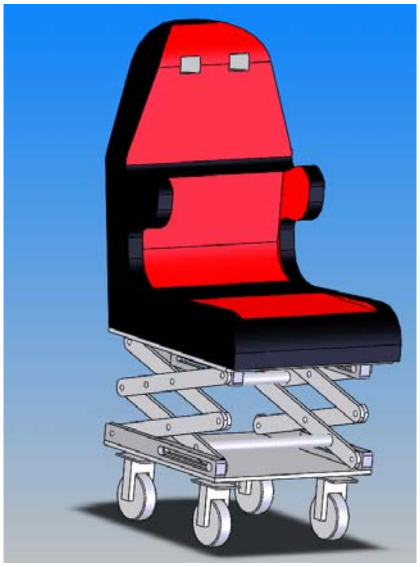


Figure 2: The design of the chair

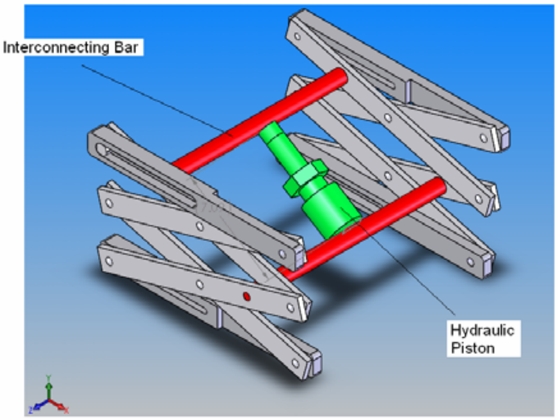


Figure 3: The design of the scissor mechanism

The total cost is $540.00 and the following is the bill of materials:

Products	Description	Quantity	Price/Each	Total Price
4140 Steel bar	4140 Alloy Steel Rectangle 3/8" Thick, 1-1/2" Width, 3' Length	4	22.23	88.92
4140 Steel Rods	4140 Alloy Steel Rod 1" Diameter, 3' Length	1	14.89	14.89
Track Rollers	Radial-Load Stud Track Roller Sealed, 3/4" Roller Dia, 1/2" W, 3/8" Stud Dia, Thread 3/8"-24	4	11.75	47
Hydraulic Jack	2 Ton Hydraulic floor jack	1	32.6	32.6
Shoulder Screws	Socket Head Shoulder Screw, Diameter: 1/2, Length: 1/2 Thread Size: 3/8-16, Alloy Steel - 1137	12	4.16	49.92
Casters	Cart King single wheel caster 4" X 1-1/4" Wheel, swivel, brake and lock, 300# Capacity, ball bearing	4	20.34	81.36
Aluminum Plate	Alloy 6061 Aluminum Oversize Sheet .375" Thick, 18" X 18"	2	90	180
1018 Low-Carbon Steel	1018 Carbon Steel Rectangle 1" Thick, 1-1/2" Width, 6' Length	1	42.14	42.14
Reclining Seat	1987 Toyota Camry Passenger seat	1	0	0