E-Racer

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Overview

- Objective
- User
- Similar Devices
- Design
- Budget
- Conclusion
Objective

- Create a go-kart for a child with cerebral palsy.
  - Vehicle must:
    - Be controlled without the use of the user’s legs or left hand.
    - Provide safety measures to ensure that the user is properly restrained and is comfortably in control of the vehicle at all times.
    - Allow the user to enjoy recreational time
Mason McClement

- 8 years old
- Does not have use of his legs other than standing either for a very short period of time or with external support
- Left hand is not fully functional and operates as more of a “helper” hand, but can grip a steering wheel
- Right hand is essentially fully functional to the point where he can play video games
Mason McClement

- When Mason becomes excited, his chin tends to drop towards his chest
- While many patients with cerebral palsy have tremors, Mason does not
- Is very good at using his current wheelchair, which uses a joystick control
- Requires some support for both sides of his torso
Similar Devices

Products

- Drive-by-Wire Go-Kart (Swarthmore College)
- Recreational Electral Scooter for Special Children: A Fixed-Radius-Turn, On-Off-Control Wheelchair Carrier (SUNY-Buffalo)
- E-Racer (University of Connecticut)
- Mobility4kids
The Handi-Driver

- Created in 2002 by Keith Alan Roberts.
- Combines three functions into a single steering column and includes a kill switch.
- Can be used to operate any vehicle with automatic transmission by using a single hand control.
- The Handi-Driver uses a steering column, steering and brake lever, universal joint, motorcycle type hand throttle, a brake and throttle cable, and a kill switch.
This project must achieve the following:

- Allow the client to use a joystick control until they are comfortable with the go-kart and then switch to a wheelchair
- Rely only on the right hand
- Provide a proper restraint system
- Provide numerous safety mechanisms in case:
  - The client’s chin drops to his chest
  - The go-kart tips
  - The client slips out of the restraint system
  - The client loses control of the go-kart
- Provide proper support for the child
- Allow for adjustment as the child grows
- Allow for ease of entry into the go-kart
There are many ways to achieve these goals including:

- Create a switch mechanism to allow the client to choose between a steering wheel or a joystick
- Create a joystick which incorporates all controls into a single mechanism on the right side and create a steering wheel which (a) can be used with one hand and (b) incorporates gas and brakes into the steering wheel mechanism
- Design a kill switch mechanism in the go-kart which the client can activate if needed
  - Design a mechanism which activates a kill switch if the head drops below a certain level or create a helmet which only allows for left to right motion
  - Create a roll cage around the go-kart if it does not already have one
  - Create a system on the sides of the go-kart so the client cannot fall out the side
  - There will be a kill switch in the go-kart as well as a remote kill switch
- Design a seat which will be comfortable for the client as well as provide the proper support, particularly for his left side
- The restraint system will be designed to be adjustable as the client grows
- The chair could have a swivel mechanism which allows it to turn 90 degrees so the client can be placed in the seat
An electric go-kart will be purchased from Minimoto—the Jeep Dune Buggy. Kart will be modified to accommodate requirements specified by the client. Major modifications will be performed on the restraint, control, and braking systems.
Design
Restraint Modifications

Moveable seat for easy access loading
Design
Restraint Modifications

5-point harness and foot straps
Neck Brace- Leatt Brace

- The intent of the brace is to prevent Mason’s head from falling to his chest when he’s excited.
- This brace will allow left to right movement, but resist forward and backward motion.
Design
Control Modifications

Control box
Design
Control Modifications

Dual control methods
Design
Control Modifications

Emergency shut-down conditions

Emergency Stop Procedure
- Emergency Stop Button is depressed on kart
- Emergency Stop Button is depressed on Parental Remote
- Kart is no longer in range of Parental Remote
- Operator’s head moves off of headrest
- If true, activate Emergency Stop Procedure
- Brakes applied and power cut to electric motor
Design
Braking Modification

Use of linear actuator to provide mechanical braking force
Budget

- Allowance for E-Racer project is $2,000+
- Projected expenditures are approximately $1,400 as shown in following slide
- Expenditures may increase as other stock go-kart models are used in alternate designs
<table>
<thead>
<tr>
<th>Major Component</th>
<th>Parts Necessary</th>
<th>Quantity</th>
<th>Est. Price</th>
<th>Subtotal</th>
<th>Manufacturer</th>
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<td>Minimoto Jeepster Dune Buggy Electric Go-Kart</td>
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<td>800</td>
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<td>Braking/ Restraint</td>
<td>5-Point Harness</td>
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<td>Linear Actuator (Brake System)</td>
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<td>Highland</td>
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<td>Neck Brace and Support</td>
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<td>Leatt Brace</td>
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<td>Seat Slider for Adjustment</td>
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<td>50</td>
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<td>Material for Roll Cage (Square, 3/4 x 3/4 Steel)</td>
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<td>.89 per ft.</td>
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<td>Control</td>
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Conclusion

In conclusion, this go-kart will accomplish many tasks:
- providing the option of switching between joystick and steering wheel
- incorporating numerous safety measures
- designing a seat which can provide sufficient support and comfort

Many aspects of the project make it unique:
- the ability to switch between controls
- the ability to be adapted as the client grows
- allowing for easy entry into the go-kart
- providing additional restraints not found in other designs

The currently available go-karts are insufficient:
- not enough safety measures
- too expensive
- only travel up to 7 mph