PROJECT STATEMENT: E-racer

TEAM 3
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Project for NSF

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Statement of Need

People with cerebral palsy generally have tremors, poor limb control and poor muscle control. As such, they often cannot fully use many traditional products. The client is a young boy with cerebral palsy who cannot use commercially available go-karts. He has issues with his trunk, his entire left side, and his legs, which he cannot use for extensive weight bearing or fine motor control.

Existing go-karts are far from ideal for the client. Usually, go-karts have a foot brake and accelerators, which he cannot effectively control as a result of limited use of his legs. Also, go-karts tend to have a steering wheel, which requires two hands. Since the client’s ability to use the left side of his body is limited, a steering wheel is problematic. Finally, the seat of a standard go-kart is insufficient for the client. It does not offer the type of support and restraint necessary for the client.

Basic Preliminary Requirements

The client requires good support and restraint in the trunk, head and neck region. This must be not only comfortable, but also safe to prevent too much movement when the go-kart is in use. The seat needs to support his core, and he should be restrained by strapping his hips down on the seat with some sort of belt system.

Another requirement is to have controls which only require the client’s right hand. This requires the incorporation of three tasks into one device: (1) acceleration, (2) braking, and (3) steering. It seems that this will require some sort of joystick mechanism. The controls must not be too sensitive as the client experiences tremors, but should be able to respond to a force exerted by the client. The standard mechanical braking system will need to be modified to allow the user to brake without needing to exert excessive pressure on a braking mechanism (joystick).

Since the client has poor muscle control, he needs more support than there is with a traditional go-kart. His neck and head will probably need some sort of cushioned support, in addition to the core support mentioned above. There needs to be some shock absorption with the go-kart so that the client is not jostled too much while riding. This could be incorporated into the tires, seat design and/or seat material.

Finally, the maximum speed and acceleration might need to be modified, depending on the go-kart selected for the project. The client should not be able to travel or accelerate too quickly, as this may be dangerous for him. The client will be under adult supervision while using the go-kart, but it must be safe for him regardless of his supervision.

Basic Limitations

The go-kart must rely solely on motorized or battery-powered parts. The go-kart itself will be motorized, so any modifications made to the go-kart must be either battery powered or also motorized. Any electrical or mechanical parts either must be able to work when jostled and/or in a dusty atmosphere or must be properly protected in these conditions. The go cart is going to likely have a small combustion engine. The rest will require a battery.

Another limitation, which was detailed above, is that all controls must be hand operated. A limitation associated with these controls (also mentioned above) is that the joystick cannot be overly sensitive since the client experiences tremors. The client has
some range of motion, but it is limited. This information has not yet been shared with the
design team, but will be known early in the design process.

Other Data
The client has a limited range of motion as discussed above, and this information
will need to be factored into the design of the go-kart. Also, the client is young (eight
years old) and ideally, he will be able to use the go-kart as he grows. Due to the client’s
condition and the inherent risk associated with go-karts, he will have to be monitored by
an adult at all times while using the go-kart.

Questions
There are many questions associated with the project, the answers to which will
be determined as the project progresses.
  • Can the go-kart be made so that it can accommodate growth?
  • What is the client’s projected growth?
  • What is the client’s range of motion?
  • How severe are the client’s tremors?
  • What is the force of these tremors?
  • Can all the controls (braking, accelerating, steering) be incorporated into a single
    mechanism?
  • If any added components are battery operated, how long will the battery life be?
  • Will it be easy to access the battery when it needs to be changed?
  • How will the go-kart be started?
  • What is the client’s current mobility equipment?
  • How will he be transferred into the go-kart?
  • What exactly are the postural requirements of the client?
  • What sort of turning radius should the go-kart have? Equivalent to the standard
    go-kart or less?
  • Does the client have control of his head and neck?
  • Has the client picked out what go-kart he wants? If not, what is he looking for?
  • What are the client’s weight, height and other body measurements?