Project Specifications: E-Racer

TEAM 3
Kevin Arpin, Michael Marquis, Allison Meisner and Travis Ward
Project for NSF

Client Contact:
Gregg and Laura McClement
Calgary, AB, Canada
Introduction and Overview

The purpose of this project is to design a go-kart for a child with cerebral palsy. The goal of this project is to allow the client to play with his friends as a healthy child would. People with cerebral palsy often have tremors, in addition to poor limb and muscle control. As a result, they often are not able to fully use traditional products. In this case, the client is a young boy who cannot use commercially available go-karts. This particular boy has issues mainly with his trunk, his left side and his legs. Existing go-karts are not ideal since they tend to have a foot brake and accelerator, and the client cannot fully use his legs. In addition, go-karts usually have a steering wheel, which requires two hands to operate safely. As a result of the client being unable to use most of the left side of his body, a steering wheel would be problematic. A final issue is that the seat of a standard go-kart is not sufficient for the client as it does not offer the type of support and restraint needed, and makes entry to the vehicle difficult.

There will be many unusual aspects to this go-kart. The finished product must have all controls contained in one mechanism. The go-kart must also provide customized core and neck support and proper hip restraint. Another important requirement, yet slightly unusual for a go-kart, is an emergency stopping system to insure the safety of the client. Also, the go-kart must be modified so that it is easier for the client to maintain control (i.e. variable speed and acceleration controls and a way to restrict turning radius).

The project requires the group to be able to modify existing controls and condense them into a single control. It also requires the ability to incorporate an emergency stopping system, as well as design an appropriate seating and restraint system.

The finished device will accommodate the special needs of the client. In addition, increased use of his right arm and hand will likely aid in the strengthening of this area. The device will provide a safe, comfortable way for the client to enjoy recreational time with his pairs.

Realistic Constraints

There are several constraints associated with this project, including economic, environmental, sustainability, manufacturability and safety questions. The budget for this project is $2000. Generally, go-karts sell for about $1200-$1800, and it will be up to the client to choose which go-kart he wants. The amount of money spent on adjustments to the go-kart will depend greatly on which go-kart is modified. The only real environmental concern associated with this project is that the go-kart will produce emissions. This is essentially not under the control of the group, and the planned modifications will not increase these emissions.

The sustainability of this device depends greatly on the go-kart which is modified. The need to recharge or change the battery of any modified portions will depend on the nature of the added components. There is no foreseeable reason why this device, when finished, could not be commercially produced by a third party company (likely one specializing in the conversion of traditional vehicles for the use of disabled persons).

The most important constraints associated with this device involve the safety of the client. Go-karts can be dangerous for anyone, and even more so for a client who lacks complete muscle control. The restraint system must be carefully considered. Also, the go-kart should not
allowed to go too fast, which suggests a variable speed control of some sort, perhaps through the use of a mechanical governor.

**Technical Specifications**

**Electrical Parameters**
- Power alternator or wall charger if internal combustion engine is used for propulsion.
- Wall changer if electric motors are used for propulsion.
- Battery life as a result of any added parts
- Joystick
  - Incorporate steering, acceleration and braking in a single control
  - Push/pull acceleration and braking control
  - Rotational steering control
  - Will be incorporated into a circuit with a microprocessor
- Kill-switch on joystick
  - Cuts power to motor(s)
  - Applies brakes

**Mechanical Parameters**
- Client is approximately four feet tall and 55-60 pounds
- A support and restraint system is needed
  - A 3-5 point belt around the hips
  - Core support
  - Neck support
  - 90 degree rotation of seat for ease of entry
  - Client is young and his growth needs to be accommodated
  - The client’s left side must be restrained
- Joystick
  - Two-dimensional control
- Drivetrain
  - Electric motor(s)

**Environmental Parameters**
- Dusty atmosphere is possible – approx. 10 PPM
- Temperature
  - Storage temperature: -20 to 60°C
  - Operating temperature: 0 to 50°C
- Controls (joystick and other added components) must be weather proof or weather tight

**Software Parameters**
- Microprocessor in joystick
- Programmed in C++