Team 1: The S-90 Go-Kart

By
James Paolino
Tarek Tantawy
Alex Jadczak
Eric Leknes
The Client

- Sean Stenglein
  - 10 years old
  - 55 pounds
  - Under 60 inches tall
  - Suffers from CP
  - Active life
  - Normal mental abilities
Cerebral Palsy

- Neuromuscular disorder
- Muscles involuntarily activate
- Fine and gross motor skills hindered
- Often caused at birth
- Mental capacities may be hindered
Challenges

- One handed control system
- Remote control system
- Maintaining proper body position during operation
- Safety factors
  - Limiting the go-karts performance
  - Fail safes
  - Etc.
Reasons for Go-Kart

- Client enjoys the outdoors and anything relating to driving
- Allows client to interact with the world
- Challenges the client
- Release from daily hardships
Mechanical Aspects

- Unique Designs
- 2-part chassis
- Independent front, semi independent rear suspension
Capabilities

- The go-kart will be able accelerate quickly to a pre-programmed top speed

- 10” disk brake allows for fast stopping

- Powerful steering motor and high amperage controls allow for fast, reliable steering
Two types of components
- Inputs
- Outputs

Responsible for sensing all of the user inputs and relaying information to the software

Responsible for converting the outputs from the software into useful tasks
Inputs

- 3 overall control systems
  - Remote control
  - Joystick
  - Steering wheel with pedals
- Kill switch and other buttons
- Feedback from various systems
  - Position sensing
  - Safety information
- All sources of physical input are relayed to the microcontroller for processing
Outputs

- **Steering**
  - Gear motor connected to rack and pinion
  - H-bridge control for left/right
- **Throttle**
  - Servo motor control
  - Takes PWM from microcontroller
- **Braking**
  - Gear motor
  - H-bridge control for brake on/off
- **Forward/Reverse shifting by servo control**
Software Control

- Takes inputs from electrical systems, interprets the data and adjusts outputs accordingly.

- Two main loops:
  - Primary main loop
  - Emergency main loop

- Primary loop controls normal operation of vehicle.

- Emergency loop dedicated to preset routine of stopping and shutting down the vehicle.
Specific Requirements

- Special 90 degree seat:
  - Seat must be interchangeable so test drivers can operate the go-kart
  - Seat needs to move back as the client grows into the go-kart – linear actuator

- Head operated kill-switch

- Numerous Fail-safes: auto kill switch, auto brake, safe electronics shutdown
Division of Tasks

1. James:
   1. Mechanical design and implementation
   2. Engine and drive systems

2. Eric:
   a. Software controls
   b. Electrical systems

3. Alex:
   a. Electrical systems
   b. Control system interface with mechanical systems

4. Tarek:
   a. Mechanical design and implementation
   b. Seating system
## Costs

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<th>Category</th>
<th>Cost</th>
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<td>Other</td>
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<tr>
<td>Control Systems</td>
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<tr>
<td>Servo and Gear motors</td>
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<td>Position Sensors</td>
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Conclusion

- Go-Kart provides the client with fun driving experience he desires
- The vehicle is safe
- Three methods of control allow the client to use the go-kart right away and learn other skills
- Design is cost effective
- Go-Kart designed from the ground up with special focus on the needs of the client