AUDITORY & VISUAL STIMULI
GO KART FOR SHANE

Clients:
Dr. John Enderle
Shane Davis

Team 3
Steven Kapinos
Brian Lewis
Anthony Vessicchio
Overview – Auditory and Visual Stimuli

- Client
- Objective
- Specifications
- Components of Device
Has been researching rapid eye movements and their respective neuronal activities for the past thirty years

- Led to the belief that there is a way to determine whether or not a person has suffered mild traumatic brain injury or not based on their results from a visual/auditory stimuli eye movement test
In the U.S. alone, more than one million people suffer at least one concussion every year.
If ignored or treated improperly, concussions can lead to very serious long term traumatic brain injuries and even death.
In today’s society, many people are at risk for concussions:
- Contact sports
- Military
Objective of Visual/Auditory Stimuli System

- Design a safe, efficient, and accurate device to test for mild brain trauma
- Device is able to record eye movements in response to visual and auditory stimuli
- Device can be used on any patient
  - Age
  - Weight
  - Height
Specifications

Device needs to:

• Record eye movements using an EOG
• Have the option to activate auditory stimuli and visual stimuli simultaneously and separately
• Activate the stimuli sources in a manner that appears random to the patient
  • Makes for a more accurate test
• Display results in a user-friendly manner
Arched Black Board

- Main component of device
- Contains an 11x7 matrix of auditory and visual stimuli sources
- Mounted to wall
Piezo Buzzers

- 77 Piezo Buzzers
  - Evenly spaced out in 11x7 matrix
- Black with hole in the middle
  - Allows for LEDs to be implemented at same spot
- Color matches board
- Programmable through an Arduino microcontroller
• 77 LEDs implemented into the center of each buzzer
• Can also be activated using Arduino microcontroller
• Red
  • Contrasts with board and allows for patient to better focus
LED/Buzzer Combination

- Two holes drilled into the side of each buzzer
  - Allow for each lead of LED to be placed through
  - LED slid through the top and secured into holes
- Allow for same location
• Microcontroller that is able to activate both speaker and LED component
• Programmable using C language
• Able to activate the LEDs and speakers individually or simultaneously
• 54 Digital pins allow for many connections
Testing

- Protoboard primarily used
Prototype Development
Overview – Vehicles for Shane Davis

- Client
- Objective
- Major Components
- Design Features
21 year-old male diagnosed with Spastic Quadriplegia and Cerebral Palsy

- Limited mobility in all four extremities
- Most movement in left arm and hand

Confined to an electric wheelchair

Shane Davis
Cerebral Palsy is a neurological disorder that affects one’s motor controls

- Spastic Quadriplegia is a type of CP that affects all four limbs of the patient and reduces his fine motor controls

The objective is to modify a go-kart that allows Shane to operate the vehicles

- A joystick, similar to the device on his wheelchair, will be used in place of the pedals
110cc Dune buggy

- Engine Type: 110cc single cylinder, 4-stroke
- Fully automatic transmission
- Emergency Brake
- Disc Brakes for Front and Rear
- 1.8 Gallon fuel tank
- Height: 47.2 inches
- Pedal to Seat: 21 inches
- Weight: 220 lbs
- Arduino Mega 2560 microcontroller is being used
- Board will process inputs from the joystick
- Programming is accomplished by connecting a USB cable to the board and using the company’s software to write the code
Pololu VNH2SP30 – DC Motor Driver

- H-Bridge
- Ultrasonic PWM
- 5.5V to 16V
- Continuous current of 14 amps, and a 30 amp peak
8-Way Competition Joystick

- Contains 4 switches to allow microprocessor to know which outputs are active
- Spring Return-to-Center capabilities
- Ideal height for Shane is 3 to 5 inches
  - Joystick is 3.66 inches
2 Firgelli Micro-Linear Actuators
- One 1-inch stroke for the braking system
- One 2-inch stroke for the throttle system
- Attached to the steering wheel
- Allows Shane to move the steering wheel with ease
Design Features

- Electrical System
- Braking System
- Platform for electrical components
  - Weather-Proof Box
- New Seat with Harness
Joystick → Arduino
- Arduino will receive inputs from the joystick and process the signal according to the code

Arduino → Driver
- The drivers amplify the current taken from the Arduino signal

Driver → Actuator
- The signal from the Arduino “tells” the actuator to either pull or retract. The driver allows the current to be powerful enough to activate the actuators

Actuator → Cable
- The actuators will be pulling the throttle and brake cables to simulate the movement of the pedals.
Braking System

- Apparatus created to mount the brake cable in a stationary position
- Cable is securely fixed to the brake pedal
- Actuator will be pulling the brake cable which is attached directly to the brake
Platform

- Platform mounted on the back of the go-kart to store all electrical components
- Electrical components will be placed in a weather-proof box for safety
Shane preferred a larger seat with armrests

Had to design custom made brackets in order to mount to go-kart frame
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<thead>
<tr>
<th>Auditory Board</th>
<th>Go-Kart</th>
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<tr>
<td>Piezo Buzzers</td>
<td>Dune Buggy</td>
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Acknowledgments

- Shane Davis & his family
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- Xui Zhai
- Joe Calderan
- Jen Desrosiers
- Anthony Calderoni, Covidien
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Questions?