Final Report

Go-Kart for Shane Davis

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Abstract

Shane Davis is a 21 year old whom has been diagnosed with Spastic Quadriplegia and Cerebral Palsy. Even though he is restricted to a wheelchair, Shane does not let this slow him down. Due to that fact that he has some function and movement in his limbs, Shane is able to live a fairly normal life and can still participate in some outdoor activities. This go-kart will allow Shane to feel that he is not limited to only his wheel chair, and will make him less dependent on other when he wants to enjoy himself.

For this project, a go-kart will be modified to fit the needs of our client. This unique go-kart will be focused on using a joystick, instead of a steering wheel, to control the steering, acceleration, and braking functions. Shane is unable to use the pedals due to his condition; this joystick will replace the pedals and be the main source of power for the vehicle. A microprocessor will need to be used to receive each input and the integrate the information to perform the respective output.
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1 Introduction

1.1 Background

The client is Shane Davis, a 21 year old male with cerebral palsy and spastic quadriplegia. Spastic quadriplegia is a form of cerebral palsy in which all the four limbs are affected and the patient suffers with severe motor dysfunctions. Spastic is defined as the tightness of skeletal muscle that will cause the patient to have limitations in most movements. A person with moderate quadriplegia may be able to walk with a walker, unlike a patient with severe quadriplegia. Shane also has very limited hip movement and strength combined with severe quadriplegia which limits his movement to the wheelchair. Even though he is limited, Shane still has the ability to operate his wheelchair efficiently by using a joystick.

1.2 Purpose

This project will provide Shane with a vehicle that he can use recreationally and will also allow him to enjoy the outdoors. In addition to adding amusement, the vehicle will serve as a rehabilitation tool and can increase Shane’s mobility. This go-kart will be customized specifically for Shane in order for him to use the vehicle efficiently. This project will help Shane experience something that other kids his age take for granted and will provide him with safe movement outdoors.

1.3 Previous Work Done by Others

In 2011-2012, three UConn students, Brahmatej Meka, Raymond Songer and Jeff Marcelus, attempted creating a specialized go-kart for Shane Davis. The students were almost successful; however their finished product had some imperfections that need to be fixed. Our group will use their original design and frame, but alter anything that we feel is not correct or up to standards. It will be our job to redesign and reconfigure the project to ensure Shane will finally have his go-kart.
1.3.1 Products

In 1994 The National Science Foundation began to construct vehicles for disabled clients; one of the earliest projects was designed by State University of New York-Buffalo. The vehicle created by the University of New York-Buffalo was called an “Electra-Scooter”. The device mounts to a wheelchair and allows simple movements; such as circular, forward, and reversal movements. However, this device only allowed the user with very little control once it was secured to the platform. The cost of the Electra-Scooter was approximately $900.

In 2008, and 2001 electric go-karts, named the “E-racer”, were designed so that they could be controlled with an electric joystick. The 2008 E-racer used a steering wheel with switch controls, so the go-kart could be operated completely by a joystick similar to that of an electric wheel chair. Electric go-karts were produced at much cheaper prices than that of a gas go-kart. The electric go-karts described above were produced at a cost estimated to be around $2,500.

Several products and projects have been designed to meet similar requirements to those stated in this project. Some of these projects have been implemented through the Biomedical engineering department at the University of Connecticut. In 2009, a go-kart was built for a child with restricted mobility. The go-kart was built with three controls, a joystick, a remote control, and a steering wheel. The engine of the cart was gas-powered, and had power steering, power braking and power throttle. The total cost for the design was estimated to be around $7,300.

In 2010, a go-kart was designed and produced for a boy with cerebral palsy and global apraxia. The go-kart has two sets of controls. The first control is responsible for the steering, speed and breaking of the go-kart. The second control consisted of “jellybeans like” buttons in order to ensure easy control for the client. The cost of this go-kart was $3,000.

There are also many viable go-karts available for children with disabilities. Mobility4Kids makes customizable go-karts (berg go-karts) for kids with a many disabilities. Another product designed by Mobility4Kids is called The Boss. This car is used for a dirt track racing and uses a joystick as its primary steering. The cost of the two karts described above is between $5000 and $7000.
Child’s Vehicle by Tetra Society of North America makes go-karts use joystick for primary steering. This joystick is designed for kids with very limited hand movement such as cerebral palsy.

1.3.2 Patent Search Results

In 2002, Keith Alan Robert patented a go kart design and it combines the throttles, brake and steering into one column. This design allows for a single handed control of the vehicle (Handi-4 Driver), which allows people with even the most severe disabilities to drive with ease. The design includes a kill switch that can stop the go kart in case of an emergency.

1.4 Map for the Rest of the Report

In this section of the report, the background information for the client as well as any previous projects on the market has been presented. The next section, Section 2, will describe the designs for the go-kart, and will include all subunits that are involved. Section 2 will describe the prototypes and the testing used to determine if the go-kart runs efficiently. Section 3 will provide details of the realistic constraints that need to be taken into consideration including: economic, environmental, sustainability, manufacturability, ethical, health and safety, social, and political constraints. Section 4 will provide a more detailed description of potential safety issues such as electrical, mechanical, biological, chemical, radiation, and thermal hazards. The next section will discuss the importance of this project in a global, economic, environmental, and societal context. In Section 6, our group will talk about the life-long learning that we acquired during the process of constructing this project. Section 7 will include exact details of our budget and timeline planning. The budget will discuss the total cost of building the project, and the timeline feature of Microsoft Project planning will be used to create a timeline to plan out group activities. Section 8 will describe the contributions that each team member made during the project. Section 9 will be a conclusion summary of the project that reviews the project as a whole. Lastly, Sections 10, 11, and 12 will be the References, Acknowledgments, and Appendix, respectively.
2 Project Design

2.1 Introduction

Shane Davis is a 21 year old whom has been diagnosed with cerebral palsy and spastic quadriplegia. His family has asked The University of Connecticut’s Biomedical Engineering program to design and create a custom go-kart for Shane to operate. Shane is unable to use a conventional go-kart because of his weakness in all four limbs; therefore it is our job to assemble a design that will suffice him. Our group will try to best model Shane’s custom-made wheelchair when designing this go-kart. An electric joystick and an arm rest, both of which will be similar to the components on his wheelchair, will be used to allow Shane to comfortably drive the go-kart. It will be our task to alter this go-kart to allow Shane to be able to become more active outdoors.

Alternative design 1 will use an Arduino microcontroller as its main microprocessor; the Arduino will allow more efficient testing and coding. On the other hand, Design 2 will use a 16 Bit Pic Microchip® to operate the vehicle. In both designs, all mechanical components will remain the same and both microprocessors will have the ability to receive the input from the joystick and output the corresponding action. Design 3 focused on the joystick that will be used; the current joystick is too small and too sensitive. The new joystick would be designed to be larger, have a button on top for the Reverse function of the go-kart, and move the go-kart in any direction.

After observing all three designs, it was determined that parts of both Alternative 1 and Alternative Design 3 will be used. The main microprocessor that will be used is an Arduino Mega 2560; this microcontroller will allow more function while keeping the coding less difficult. This microprocessor will be connected to an 8-way Competition joystick. Even though the joystick does not move in a 360 degree motion, the 8-way directional joystick should be adequate to operate the vehicle safely.

2.2 Optimal Design

2.2.1 Objective

The go-kart design for Shane is unique, there are many requirements and specifications that need to be met in order fulfill the client’s needs. The main aspect that our team will be
focused on is the driving, braking, and steering controls. The frame, engine, brakes, and seats are already built and do not need to be altered. Page 7 displays a picture of the Shane’s current go-kart. Notice in the figure that everything external is seems to meet the client’s and our requirements. However, the only imperfections are the circuitry and steering; both of which our group will work on to create Shane a go-kart he can operate.

Our main objective for the design is to replace a normal go-kart’s steering wheel with a hand-held joystick. This joystick should have the ability to mimic the functions on Shane’s wheelchair as well as move the device in any direction. In the final designs, the joystick will have the ability to equate the force being applied by the user and use that input to determine the rate at which the tires should spin. Also, the joystick will be connected to the steering controls to be able to move the go-kart in any direction corresponding to the direction the joystick is moved.

**Go-Kart**

Shane’s current go-kart, Figure 1, is unable to be used any further in this project. The group will order a larger and more efficient go-kart. The current go-kart is too small for Shane,
he currently has no leg room and the roll bar is too low for adequate safety. A 110cc Single Seat Kid Size Go-Kart Dune Buggy (Fig. 1) will be the ideal go-kart to be used. Currently the price of the go-kart is much lower than our anticipated cost, $689.00 plus shipping, and the group believes this go-kart meets all the specifications to create Shane an operable go-kart. Table 1 demonstrates the components of this go-kart compared to our ideal specifications.

![Figure 1: 110cc Kid Size Go-Kart Dune Buggy](image)

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<th>Component</th>
<th>Specifications</th>
<th>110cc Dune Buggy</th>
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</thead>
<tbody>
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<td>Roll Cage with foam padding</td>
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<td>Engine</td>
<td>100cc to 150cc</td>
<td>110cc</td>
</tr>
<tr>
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<td>Cable/Disc Brakes</td>
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</table>

Table 1: Go-Kart Specifications Compared to Dune Buggy

**Microcontroller**

The microcontroller currently being used is an Arduino Uno. The Arduino Mega 2650 (Fig. 2) seems to be capable of having the ability to handle the electrical components of this vehicle.
The Arduino Mega allows the students to have an easier time to program the go-kart than the Microchip®.

Shane’s current go-kart uses an Arduino Uno as it main microprocessor. The Arduino Uno will be replaced with an Arduino Mega 2560. The Arduino Mega will increase the go-kart’s capabilities in function, as well as allow our group to be able to have more control of the programing involved. The Arduino Mega will have the ability to operate the steering, acceleration, and braking systems; the microcontroller will receive the information from the input, process the information, and then perform a certain action corresponding to the input.

Testing for the Arduino Mega will consist of coding, a protoboard, and various tools to connect to the microprocessor to resemble the joystick, engine, and brakes. After being coded, the Arduino Mega will be placed onto a protoboard and 5V of power will be connected to it. LED lights will be used to mimic the engine and a rotary potentiometer will be used to resemble the joystick. With movement of the potentiometer, the LED lights should brighten or dim based on the corresponding input.

**Joystick**

Another issue that needs to be resolved is the current joystick that is being used. The joystick is too small and too sensitive to use on a vehicle as powerful as a go-kart. The current joystick
(Fig. 3) will need to be replaced with a larger and more sufficient joystick. The larger joystick will give Shane great control of the vehicle, and ultimately more safe for him to drive.

![Figure 3: Current Joystick](image)

The current go-kart uses a basic bidirectional joystick to control steering and braking with these basic directions:

- Forward = Throttle, forward movement
- Backward = Braking, vehicle stops
- Left or Right = Steering, vehicle moves in corresponding direction

Our group will remove the joystick and replace it with a larger joystick that will decrease the sensitivity of the pressure applied. The microcontroller will be programmed to understand the following functions:

1. When the go-kart is on and joystick is pushed in any direction (except backwards), vehicle will move in corresponding direction.
2. When joystick is pulled backwards, brakes will be applied.

The optimal size for the joystick will be approximately 3-6 inches in length and thick enough for Shane to be able to grip comfortably. The joystick that will be used to operate
Shane’s new go-kart is Competition Joystick (Fig 4). This joystick has a height of 3.66 inches, 8 directional movements, and a spring return-to-center base.

Figure 4: 8-Way Competition Joystick

Testing for the success of the new joystick will include a protoboard and the previously coded Microchip®. The joystick will be connected to the corresponding ports that were denoted in the coding, and LED lights will take place of the steering and acceleration aspects. The joystick will be used to determine if the correct LED lights brighten when the input is given.

Linear Actuators

Two Firgelli Automations L-12 Micro Linear Actuators are used in the final design in order to provide physical force to both the throttle and brake cables. For the braking system, a 1-inch stroke length actuator was used while the throttle system utilizes a 2-inch stroke length actuator since this cable requires more movement. These actuators are mounted inside the weatherproof encasement and attach directly to both ends of the cables. The attachment was done by machining two specialized pieces which attach to the end of both of the actuators. From here, the machined pieces allow for the barrel-shaped cable endings to attach to it, thus connecting the cables to the actuators securely and safely. The power to both of the actuators comes from the motor output of two DC motor drivers.
Figure 5: Firgelli Automations L-12 Micro Linear Acuator.

Motor Drivers

In order to power the actuators from the Arduino signals, two DC motor drivers are needed in order to amplify the signal since those coming straight from the Arduino are not powerful enough. For the go-kart, two Pololu VNH2SP30 Motor Drivers were used, which contain H-bridge configurations, allowing for the actuators to properly extend and retract, depending on the joystick’s position. The pulse width modulation pins on the drivers also allow for the speed at which the actuators move to be varied to the desired speed.

Figure 6: Schematic of the Pololu Motor Drivers used to power the go-kart’s linear actuators.
Weather-proof Case, Platform

With the creation of such an in-depth electrical modification system, space needed to be created so that all of the components fit and are secure. For this, a metal platform was mounted between the back of the seat and the gas tank and attached directly to the kart’s frame. This platform is the base of the entire electrical modification system.

On top of this platform, a weatherproof case was mounted to enclose the actuators, microcontroller, perforated board, and the motor drivers. This will prevent the electrical system from moisture and humidity, thus ensuring the overall life of the kart. Located on the top of the case is a rocker switch, which was sealed tightly and turns on or off all of the power to the system. This will allow Shane to easily power the kart on or off when he is using it, without having to connect any electrical wires. Also, it will prevent any drain from the battery when the kart is not running.

Figure 7: Platform attached to the back of the kart along with the black waterproof case for all electronics.

Braking System

Close attention was paid to the braking system since it is so important to the overall safety of the kart and the client. Since the braking system is hydraulic, a cable had to be connected directly to the brake pedal. This was done by welding a metal tab to the brake pedal
and creating a mount so that the cable can rest on it. This cable then runs along the kart and attaches to the subsequent linear actuator.

Figure 8: Braking cable and mount used to apply the brake, attached directly to the pedal.

Throttle System

The throttle system of the original kart was stripped and moved toward the back of the kart, allowing for the actuator to pull on it, and subsequently open up the engine. This was much simpler since the cable was already ready to be mounted and the gas pedal could be removed.

Steering Knob

Through meeting with the client, it was determined that the steering wheel will be used to control the go-kart. This was decided upon since the wheel only rotates 90 degrees in both the left and right directions. However, a steering wheel modification knob has been mounted on the top of the wheel making it easier for the client to turn. These knobs are proven to be very effective given that it is the same type as those used in modern modified automobiles.
New Seat

The original seat of the go-kart was removed since it was too small for the client. This was then replaced with a larger, more comfortable seat that contains two armrests. Attached to the right armrest will be a mount for the joystick. The seat will also contain a 3-point harness, increasing the overall safety of the go-kart.

Figure 9: Steering Wheel with mounted modification knob.

Figure 10: Replacement seat mounted to the go-kart showing the right armrest.
2.3 Prototype

The main goal of this project is to modify a go-kart to make it joystick accessible for our client Shane Davis. The concept behind this project is for the joystick to control the movement of the throttle cable and brake cable.

The microprocessor used in controlling this vehicle is the Arduino Mega 2560. The goal of the microprocessor is to control the linear actuators which will then control the pulling of the brake and throttle cables. The controller had to be programmed accordingly through using the Arduino software via USB connected to a computer. The board also allowed for inputs and outputs to be specified by pin, thus the signals from the joystick could be properly processed and transmitted between electrical components.

Along with the use of an Arduino Mega 2560 microcontroller, two Pololu DC Motor Drivers are used in the system. These drivers take outputs from the Arduino, and treat them as their inputs. They allow the actuators to retract and extend according to the joystick’s position by amplifying the signal being processed through the Arduino. The motor driver contains the following pins which were used: INa, INb, PWM, +5V, and a GND. By setting the INa and INb to have either HIGH or LOW values or both, the actuators either extend or retract through the use of the imbedded H-bridge configuration found on the driver.

The linear actuators used to pull the throttle and braking cables were L-12 micros by Firgelli Automations. The brake used a 1-inch stroke length while the throttle used a 2-inch length since it had to be pulled a greater distance. The speed at which the actuators moved was controlled by the input voltage to the PWM pin found on the motor drivers. Both utilized a 5V source.

The electrical joystick used was a 4-way switch, which contained 3 pins: NC for normally closed, NO for normally open, and COM for common. The signal used in this system is NC but opens up when the switch is pressed, sending a signal to the Arduino. The COM switch on the joystick’s switches had to connected to ground in order to function.

A perf board was customized for this system in order to run correctly. The board contained four 1.1k resistors, which filtered the signals from the Arduino to the motor drivers.
There were also two 5V voltage regulators. One was used to power the Arduino, while the other served as a source for the 5V pins on the drivers as well as the PWM pins. The board also contained a common ground for the drivers, voltage regulators, and the Arduino power cable. There was also a common 5V connection along with a 12V connection used on both motor drivers and both voltage regulators.

The overall system involves a series of signal movement and processing. The switch on the joystick is first triggered when moved either forwards for backwards. From here, the Arduino processes the signal according to the coding programmed to the board. These signals are then outputted to the driver through the use of four signals, two for each driver. The motor drivers then amplify the signal and according to the combination of HIGH versus LOW signal, either extend or retract the linear actuators. This actuation then causes either the brake or throttle cables to move and subsequently accelerate or stop the go-kart. It is important to note that the actuators are in a constant extension to allow for a neutral state when the joystick is not touched forward or backward.

3 Realistic Constraints

Microcontroller Limitations

With so many modifications happening to this vehicle, overloading the microcontroller with several different inputs can be too much. The Arduino needs to be able to receive the input from the joystick and perform the corresponding action to ensure that the go-kart works properly. Being able to configure the microcontroller to have the vehicle accelerate based on the pressure applied to the joystick will make this project more difficult. The more complex this go-kart becomes, will lower the probability that the vehicle will work correctly; our group is going to try to keep the coding and actions simple to ensure Shane will have a fully functional go-kart.

Mechanical Limitations

This go-kart will be using parts from many different manufactures and companies; and there is always a possibility that the parts may not function together correctly. The largest mechanical task our group will have to complete is the circuitry of the vehicle that needs to be
redone. Our group needs to rewire the brakes, steering, and acceleration to be compatible with the joystick. The use of many different objects and electrical components can cause the circuit diagram to become too complicated. Another limitation is the dimensions of the go-kart; our group ensured that go-kart is large enough for Shane but there is still a possibility certain things may not be ideal. Shane has limited mobility and therefore anything he needs must be within his range of motion; the joystick, the stick shift, and remodeled seat all need to fit within a small area in the go-kart.

4 Safety Issues

Any time one is building and operating a vehicle, there are many safety issues that need to be resolved. In order to give Shane this go-kart, it needs to be completely safe for him to drive. All existing wires and parts needs to be sealed and covered to insure that nothing can affect them externally. The wires should be covered by weather-proof tubing and there should be no loose ends or frays. Also, all components should be securely mounted or fixed in a position to prevent any movement while the go-kart is being driven. The armrest will have a plastic case attached to it to cover and uncover the joystick when the vehicle is being used. The current harness system for Shane does not fit him correctly; our group will re-engineer a seat belt for him to increase his safety.

In addition to electrical safety, there are several mechanical and frame safety factors that need to be considered. A secure roll cage needs to be implemented for Shane just in case over roll-overs while driving the go-kart. This roll cage needs to be thick, securely welded, and effective. The size of the go-kart is very important for Shane because with his disability, everything needs to be within reach of him. As of now, the drive stick is too far away and the joystick is not in an ideal position; the new go-kart will allow Shane to be able to reach everything that is needed. While reconstructing the go-kart, Shane will meet with our team and sit in the go-kart so we will be able to place object at a distance in which he will be able to reach.
5 Impact of Engineering Solutions

Global

With companies, medical facilities, and distinguished faculty members attending the presentation at Gampel Pavillion, we are hopeful that Shane’s go-kart will raise awareness for cerebral palsy. Cerebral palsy is disorder that dramatically affects approximately one in three hundred children; our hopes is that as long as one person at the fair takes in interest in cerebral palsy and tries to help out those diagnosed, then we accomplished one of our main goals.

Economic

The design for the go-kart will not be too expensive compared to previous designs. The mechanical components will all remain in place, and our design will only focus on the circuitry of the go-kart. The microcontroller, joystick, and wiring will all need to be replaced; causing the cost to be approximately $200-$300 dollars, depending on if nothing else needs to be replaced. Keeping the cost low will allow this modified go-kart to be able to be bought by more patients diagnosed with cerebral palsy.

Environmental

Shane’s go-kart is designed to have the same environmental impact as pre-existing gas powered vehicles. Due to this project being gas powered, it’s not completely friendly for the environment. When running, the go-kart will release carbon dioxide and several other toxic fumes into the atmosphere. As the demand for modified go-karts increase, the amount of toxic fumes being produced will also increase.

The products from the engine are not the only aspects that are unsafe for the environment. All electrical components need to be properly disposed of to reduce any environmental littering and to reduce the amount of amount of chemicals being released. The battery is most dangerous to the environment because it contains substances such as mercury, lead, nickel and cadmium; all of which have the possibilities of being harmful to the environment. The battery and all other electrical components should be disposed of at local recycling centers or returned to certain manufactures for them to properly rid.
Social

Shane’s go-kart can hopefully narrow the gap between disabled children and non-disabled children. This go-kart will give Shane and other children diagnosed with cerebral palsy the ability to feel independent as well as being able to operate a motorized vehicle. All of the things that we take for granted, these kids do not. Shane may be diagnosed with cerebral palsy, but he does not let that slow him down. He loves art, he skis in the winter, and he wants to be able to drive a go-kart; all actions that the most of us take for granted. However, the construction of the go-kart is not only for Shane, but for other kids in his position. This go-kart will be another method for kids with cerebral palsy to enjoy themselves recreationally. This will increase their social interactions and social behaviors, both are important factors for children to mature into adults.

6 Life-Long Learning

In every design, there will be a countless amount of problems an engineer will face. Those who can overcome diversity and mistakes will be successful. Shane’s go-kart project taught our group several lessons each of us can use as future engineers. Being biomechanics tracks, none of us had previous ability to program using C code and minimal experience with microcontrollers. Over the course of this project, our group will learn to program microcontrollers and use our knowledge with basic circuits to create a functional go-kart for Shane.

The circuitry completed in Shane’s go-kart is unlike any project we have done before. Using an Arduino for the first time will allow our group to discover how components of motorized vehicles can be inputted into the microcontroller. Our group will learn about microcontrollers through the usage of tutorials and videos. The toughest challenge for the circuitry aspect is the testing that is required before the system can be placed in the go-kart. We will have to use potentiometers, LED lights, joysticks and various other parts to determine if our microcontroller will work properly in the go-kart.
7 Budget

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8 Team Member Contributions to the Project

**Steven Kapinos**

Steven Kapinos is responsible for the mechanical components needed to operate the vehicle. He has focused the majority of his attention onto the joysticks, drivers, actuators, and safety. Steve determined the ideal actuators that will be used to be compatible with the go-kart and the microcontroller in order to control the steering and braking. Also, Steve focused on the safety of the client and the safety of the go-kart’s mechanisms. The joystick and weatherproof box needed to be mounted and weather resistant, and Steve was responsible for both of those priorities. In addition, he thought of the idea of using the driver’s seat off of last year’s model and transplanting it to the current go-kart; he created custom brackets for the seat to be mounted. Steve was responsible for creating the braking apparatus, allowing the actuators to pull the brake cable efficiently.
**Brian Lewis**

Brian Lewis has been very helpful with researching to determine the mechanical components needed to operate this vehicle. Brian researched and ordered most of the main components of our project; he was responsible for the motor drivers, joystick, actuators, and voltage regulators. Brian spent the majority of his time determining the circuitry needed to run the system efficiently. He created the electrical system on a table and then transferred it over to the go-kart in order to control the acceleration and braking of the go-kart through the use of a joystick. In addition, Brian created the mounting for the joystick and for the weather-proof box.

**Anthony Vessicchio**

Anthony Vessicchio has been helping the group with his knowledge of basic coding using the Arduino Mega 2560. Anthony has been working mainly with the Auditory and Visual Stimuli Board, and therefore has been helping Brian and I with the basic coding of the microprocessor. Anthony’s main focus on this vehicle was to determine the coding needed for the microprocessor to control the linear actuators using the joystick. He talked to Tony Calderoni about certain code needed to reverse the inputted voltage in the actuators; allowing the actuators to retract or extend given the input from the joystick.

**9 Conclusion**

The purpose of this project is to modify a current go-kart to allow our client to have independence and fun outdoors. Our client, Shane Davis, is 21 years old and is diagnosed with cerebral palsy and spastic quadriplegia; this condition does not allow Shane to be able to operate a normal go-kart. Shane and his family want him to feel independent when he is outdoors; this vehicle will give Shane freedom outside with his family and friends.

Our group ordered a 110cc Dune Buggy (Fig. 1) that meets all of the required specification that was given by the client. An 8-way joystick, similar to the joystick on Shane’s wheelchair, will be used replace the steering wheel on the vehicle. This joystick will control the steering, acceleration, and braking; the outputs of the joystick will be programmed to be inputted into an Arduino Mega 2560. The Arduino Microcontroller will take the information from the joystick and perform the corresponding function.
10 References


11 Acknowledgments

Our group would like to give thanks to the following people:

- Shane Davis and his family
- Dr. John Enderle – UConn BME Professor and Project Advisor
- Joe Calderan – Teaching Assistant for Senior Design
- Anthony Calderoni – Engineer at Covidien
- Pete and Serge – Machine Shop
- Jennifer Desrosiers – Help in Ordering Products
12 Appendix

12.1 Updated Specifications

Operational Specifications

The go-kart must be able to be operated by Shane, a 21 year old with cerebral palsy. The current design must be modified so that the joystick, which controls steering and acceleration, functions much more safely and effectively. The speed of the kart must be reduced to a safe, reasonable amount. All other hardware, besides the joystick controlled system, is acceptable; however any increased safety features are welcomed.

Technical Specifications

Mechanical and Physical
Type of material: High strength, reinforced steel
Size: 69” long x 44” wide x 47” high.
Weight: 274 lbs
Speed: Maximum speed of 35 MPH
Engine: 110cc Single Cylinder, 4 stroke, automatic transmission
Brake: Disc Brakes
Fuel Tank: 1.8 gallon

Electrical
Battery: 12V/9aH
Steering: Joystick operable

Safety
If driven improperly, a go-kart can crash into surrounding objects or even roll over, causing harm to the user. Prolonged use may lead to slight discomfort, given the terrain. A 5 point harness seat belt will be used to ensure safety for Shane while driving outdoors.

Maintenance

- Recharging Battery
- Tire Pressure
- Check Fluids
- Clean