Project Proposal
Project to Aid a Person with Disabilities: Two-Passenger Go-Kart

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Executive Summary

This project involves the design and modification of a two-passenger go-kart for a young boy who suffers from spina bifida, cognitive challenges, as well as autism. The kart is to be modified so that both of the passengers are able to control the steering and acceleration of the vehicle. This will all be done by the use of a single joystick, on either side of the kart to accommodate to Nathan’s conditions. Without full range of motion and limited dexterity, this joystick must successfully replace both the gas pedal as well as the steering wheel. For safety purposes, the adult’s sides (right seat) joystick control will override the other control when moved from the neutral position. Along with the preexisting safety features, two more roll bars will be added to the frame of the kart as well as an engine shut off switch. There will also be modifications to the kart that control the overall speed top speed of the kart.

The preexisting go-kart has many positive, customized features, such as a more supportive seat, 5-point harness, lights, all-terrain tires and increased suspension. By implementing a successful joystick control, the client will have well-built, safe, and user-friendly go-kart.

1 Introduction

1.1 Background

Nathan Lamb is a twelve year-old male from Stonington, CT who suffers from spina bifida, cognitive challenges, autism, and scoliosis. These disabilities have cost Nathan a large range of motion and dexterity of his limbs. He is limited to the use of his left arm only and has poor trunk support, forcing him to remain in a seated position; therefore he is restrained by a wheelchair. These challenges have also hindered Nathan’s social development with his peers.

Specifically, Nathan suffers from spina bifida manifesta, a condition that occurs when the membranes (meninges) of the brain and spinal cord push through the hole in the vertebrae. Due to this condition, Nathan has hydrocephalus, which is an accumulation of cerebrospinal fluid around the brain. This forces Nathan to have to have a shunt in his brain to drain this fluid. Autism is a neural, developmental disorder that causes those affected to lack social and communicational skills. This disorder alters how information is processed by the brain due to the abnormal connections of nerve cells within the body. It is not classified by any one symptom; instead it takes a collection of symptoms in order to distinguish it.

1.2 Purpose of the Project

The purpose of this project is to modify a go-kart so that the client, Nathan Lamb, can successfully control it, offering him much improved mobility. A successfully implemented joystick, which can control both the steering and acceleration of the go-kart, will allow Nathan to travel more quickly and much more enjoyable. In turn, the use of a go-kart will give Nathan a chance to blend in with his peers and share common interests.

1.3 Previous Work Done by Others
1.3.1 Products

There are several other products that involve the implementation of a joystick in order to control a go-kart. One example of this is the company Mobility4kids, which created a more user-friendly go-kart for disabled children. Another example is a customized kart, known as the E-Racer, which was created by University of Connecticut students in 2001. This kart is similar to the one being designed for Nathan since it is also electric and uses a single joystick, along with actuator motors.

The most important previous product in this case is the go-kart itself since the kart being modified by Nathan was previously worked on by a University of Connecticut design team from 2011-12. The main components of this design, such as the frame, seating system, suspension, tires, and engine will still be used going forward. However, the electrical components and wiring from the joystick to the power source (battery) must be re-modified since the preexisting control system was unsuccessful, resulting in a less than satisfied client.

1.3.2 Patent Search Results

Currently, there is a patent for a device called the Handi-Driver, which can convert an automobile, or a go-kart to be suitable without the use of any lower limbs. This device was patented by Keith Alan Roberts and allows users to control the vehicle with one hand, if there is an automatic transmission. The use of a second hand is needed for all standard transmissions.

2 Project Description

2.1 Objective

The product being designed must be able to be driven by Nathan Lamb, as well as an adult at the same time. There will be two joysticks, one for each passenger, which control both the steering and acceleration of the kart. The adult’s control will automatically override Nathan’s when moved from the idle position. An engine kill switch will also be added to the kart for added safety. In addition to the electrical components of the engine, a roll bar will be added to the preexisting one.

All basic, necessary components of the previously designed kart will remain in our design. The motor and its new controls must now be accounted for and placed in a protective box, to ensure the longevity of each electrical component. All other desired changes of the client will be accounted for as well, to guarantee the satisfaction of the family upon completion of this project.

2.2 Methods

To complete this project, the necessary modifications of the go-kart need to be carried out successfully. Most importantly, the controls of the kart must be modified. This will require the use of a microcontroller(s) wired to the joysticks,
in order to control the steering and acceleration of the kart. There must also be electrical components which allow for the implementation of an adult override switch, causing Nathan’s controls to shut off when the other joystick is moved. The drivers to the microcontrollers are crucial towards the success of the vehicle, since they must be able to safely control the sensitivity of the kart’s turning and acceleration. A final electrical customization will be the creation of an engine kill switch, which must also be easily accessible for safety purposes.

With safety being a main concern, the speed of the go-kart must be regulated to the client’s liking. This is to be done electrically by properly modifying the motor. Additionally, since the previous designs lacked power, any additional power sources will be looked at to ensure that the finished go-kart is within a range of power suitable for Nathan and his family.

A final modification will involve adding two vertical roll bars to the frame of the go-kart. Currently, there is only one roll bar located above the heads of the passengers. By connecting reinforced steel bars from the current roll bar to the front of the frame, the safety of the go-kart will increase dramatically, even with the several other safety features the kart has to offer.

The main physical components of the current go-kart will also need attention. Every piece of the kart, from the frame to the tires will be investigated to ensure that they are still in proper working condition. Any and all components that need to be replaced will be replaced; making sure the final design of the go-kart is a success.

Go-kart that is to be modified so that there are single joystick controls on either side of the kart.

### 3 Budget

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The overall cost here does not reflect the total price of the cart itself, but the cost of the modifications that are needed. By looking at the previous years’ budgets for this cart and adding on this year’s 35% increase, the go-kart would be marked at a product price of $1743.00. This would be a reasonable price for a vehicle with this level of customization.

4 Conclusion

For those suffering from developmental disabilities, mobility is a rare commodity in everyday life. This leads to an unfair lack of independence for these individuals. This go-kart will give Nathan Lamb some of his independence and mobility back since it will be a vehicle that he himself can control. A go-kart not only offers a faster sense of travel for Nathan, but an enjoyable and adventurous one as well. This will allow Nathan to transition much more easily into an electrical wheelchair if he decides to do so in the future. This transition will also be a safe one, given the several safety precautions and features of the go-kart.

The budget of this kart has continued to rise due to the increased amount of senior design teams chosen to work on this project. This means the final prototype value will be much higher than necessary, since different parts have been bought throughout the years, and not all of them needed. With that being said, the overall price of the go-kart is not extremely unreasonable, since this vehicle is undergoing a vast amount of specific and custom designs. Once successfully designed, these karts could appeal to many of those in situations similar to that of Nathan.

References

<http://www.bme.uconn.edu/sendes/Spring11/Team9/index.htm>

<http://www.bme.uconn.edu/sendes/Spring12/Team2/index.htm>

“Go-Kart for Mobility4Kids”. 16 September 2012.