GO BaBy Go – MROC

Project Overview

Introduction

Studies have shown that power-assisted mobility has positive effects on the development of mobility and socialization skills in children with motor disabilities. However, commercially available motorized wheelchairs are not regularly approved by insurance for children under three years of age. The out-of-pocket cost for a motorized wheelchair would be outside the budget of many families that are already paying for specialized health care costs. The Cerebral Palsy Foundation has created collaborative networks to bring together medical institutions and innovative thinkers in diverse areas such as engineering to address this issue. The Cerebral Palsy Foundation recommends the Go Baby Go (GBG) program, a community-based research and design program that focuses on affording children with limited mobility a means to engage in their everyday activities like their peers without physical limitations. . A primary goal is to provide students a significant design experience in which they demonstrate knowledge and skills acquired, technical and non-technical. Students incorporated relevant engineering standards and realistic constraints in this work.

Project Description

The purpose of this project is to design, build, and implement an upgrade to commercially available ride-on vehicles for disabled children of ages 13-months to 3-years. The project provides an economical solution to combat the issues associated with limited mobility. This solution involves supplying the children with Modified Ride-On Cars. (MROCs). MROCs are customized electric toy cars that are altered to accommodate the specific needs of individual children. MROCs are an ideal alternative to purchasing expensive motorized chairs that many families can not afford. GBG aims to provide additional opportunities for early skill development, and the vehicles allow the children to gain independence and the ability to socialize with others more readily.

Challenges

Multidisciplinary Participation

Mechanical

- Provide Postural Supports
- Install Emergency Stop Switch
- Replace Accelerator with Push-buttons or Joysticks for Accelerator Petal

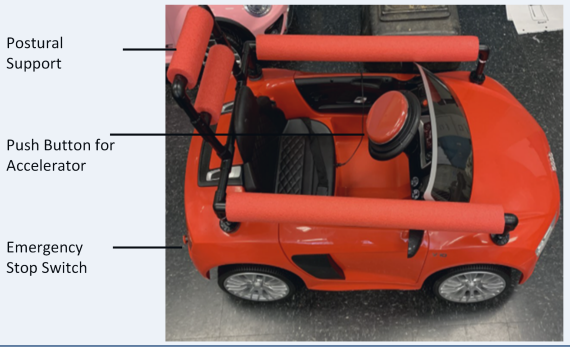
Electrical

- Remove Lurch or Sudden Acceleration
- Meet the System Requirements for a Variety of Small Electric Cars
- Install a Data Logger
- Allow for the Continued Use of Radio Control by Guardians

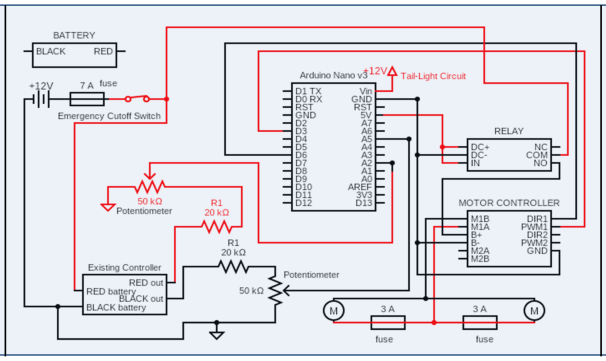
Develop for public use a list of material for the Mechanical and Electrical Systems.

Milestones

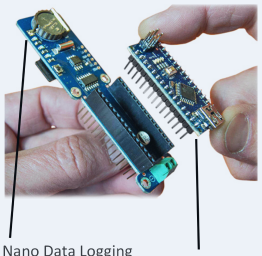
- Spring 2019 students develop the MOD concepts to remove the sudden acceleration, provide structural postural support, remove ability to steer if needed, and reduce maximum speed of cars.
- September 2019 to May of 2020 students completed the design of the electrical controls hardware and developed software to control the maximum speed for forward and reverse and control the rate of acceleration and acquired a free software license.
- September 2020 to May 2021 students incorporated a data logger into the electrical control system, installed an emergency stop switch, substituted a large push button for the accelerator pedal, improved structures for postural support, and created a blog to communicate design concepts and solutions from remote locations due to the pandemic.
- Developed an "Authorization and Release of Liability" between the universities and parents of the children.



Modified Ride-On Car



Circuit Schematic for Modified Ride-On Cars



Data Logger

Multi-Professional Collaboration

Mentors consisting of Electrical, Mechanical, Civil, and Computer Engineers supported the students throughout the project's development. Industry collaboration included the local chapter of TSPE and the local section of IEEE.

- 16 professionals, consisting of 8 PEs, 2 EIs, an attorney and 5 health and physical therapy-related specialists along with 8 individuals from industry and university staff,mentored student teams or served as consultants and evaluators for the project.
- This is a joint project between University A with ABET Engineering Programs and University B with Physical Therapy and Occupational Therapy Departments.

Public Health and Safety

Risks	Mitigation
Electric Shock	Remove power to any component being worked on, if possible. If working on energized equipment is needed have a safety observer.
Overheating of Components	Test the existing system for voltage and current levels. Review data sheets of all new components to ensure they are compatible with the existing system. Fuses were placed in the motor circuitry to prevent overheating if the motor is stalled, and the fuse value will need to be determined for each car type.
Vehicle Collision	Prior to MROC getting underway, ensure safety checks are performed on all controlling devices. Clear the MROC's path and ensure all nearby pedestrians are aware of MROC. Depending upon capabilities of child, guardians should remain within sufficient range to stop MROC with emergency cutoff switch if needed.

Skills Gained

Soft Skills

- Communication
- Creativity
- Collaboration
- Time Management
- Critical Thinking
- Interactive Design
- Problem Solving

Technical Skills

- Schematic Design
- Hardware Design and Development
- Software Design and Development
- Electrical Wiring
- Multisim
- Reverse Engineering
- Create a Blog
- Acquire a Free Software License

Cost

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Cars for this project cost from $150 to $200. The cost for the electrical components, and postural supports is $100 for all features described. Cost greatly depends on a child's needs.

Conclusion

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The goals of providing an economical MROC were obtained. Students are proud of their accomplishments as are the professional engineers who mentored them. Students were evaluated at each milestone by faculty and professionals. Projects are undertaken for many reasons, but few are as fulfilling as helping a disabled child and their family.