# NORTHERN ARIZONA UNIVERSITY

# Steering Wheel Not Included

GORE
Creative Technologies
Worldwide

Project Sponsor: W.L. Gore and Associates

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# Project Description

- Created in 2012 at the University of Delaware

- Developed a set of DIY cars

- Enabling young children to move and interact with their peers

Project Goal:

- Design and build a new version of the GBG retrofits for children that have limited mobility of their arms and/or legs
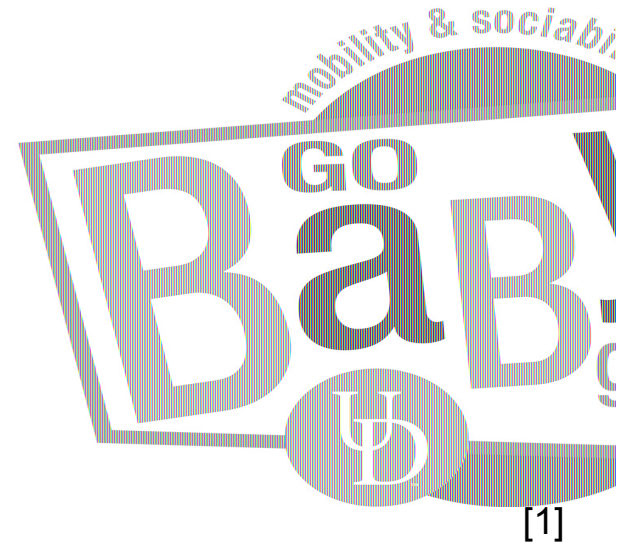


[1]

# Background

Why was GoBabyGo created?

How is Go Baby Go changing?

What did our team hope for?



Figure 1: Previous GBG Solutions [1]

# Customer Requirements

*Table 1: Customer Requirements*

| Customer Requirements | percentage |
|---|---|
| Cost | 11.59% |
| Safety | 14.49% |
| Quality | 13.04% |
| Transportable | 10.14% |
| Unique Solution | 11.59% |
| Longlife Time | 8.70% |
| Material accessibility | 11.59% |
| Easy to assemble | 10.14% |
| Control System | 8.70% |
| Total: | 100.00% |

# Engineering Requirements



Figure 2: GBG Build

*Table 2: Engineering Requirements with Targets and Tolerances*

| Engineering Requirements | Target | Tolerance |
|---|---|---|
| Material Cost | $350 | < $400 |
| # of Securements | 2 | ≥ 1 |
| # of Supports | 2 | ≥ 1 |
| Weight of Car | 60 lbs. | < 100 lbs. |
| Material Access | Local Stores | Shipping < 3 weeks |
| Assembly Time | 2.5 hrs. | < 4 hrs. |
| Significant Material Lifetime | 3 years | ≥ 2 years |
| Adaptability | 4 | ≥ 3 |
| Adjustable Speed | Starting speed of 1 mph | < 2 mph |
| Unique Solution | Unique from past GBG solutions | Unique |

# Design

**Design Aspects**

- Steering System

- Comfortability

- Adjustability

- Safe and Secure Operation

**Design Solutions**

- Arduino Controlled Button System

- Steering Buttons Closer To The Operator's Chest

- Detachable and Movable Button

- 4 Point Harness Seat Belt



Figure 3: Disassembling Car

# Fall 2016 Proposed Design

- Two Button Steering
  - Controlling Back Motors
- Movable Armrests
- 4-point Harness
- PVC/Pool Noodle Structure
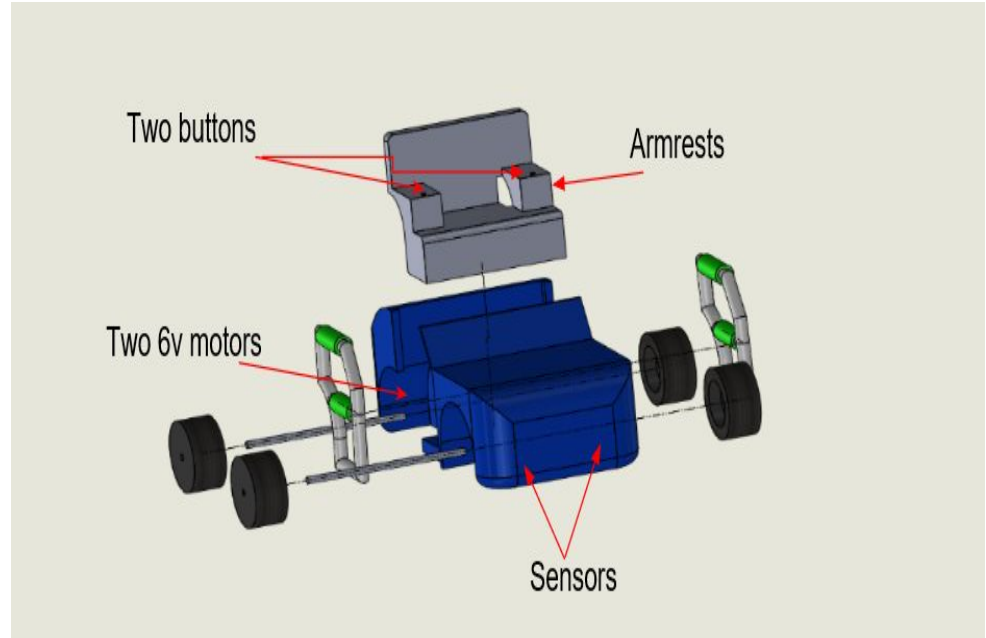- Distance Sensors
  - Kill Switch



Figure 4: Proposed Design CAD Assembly Drawing

# Spring 2017 Final Design Solution

1. Main Motor Button

2. Headboard Support

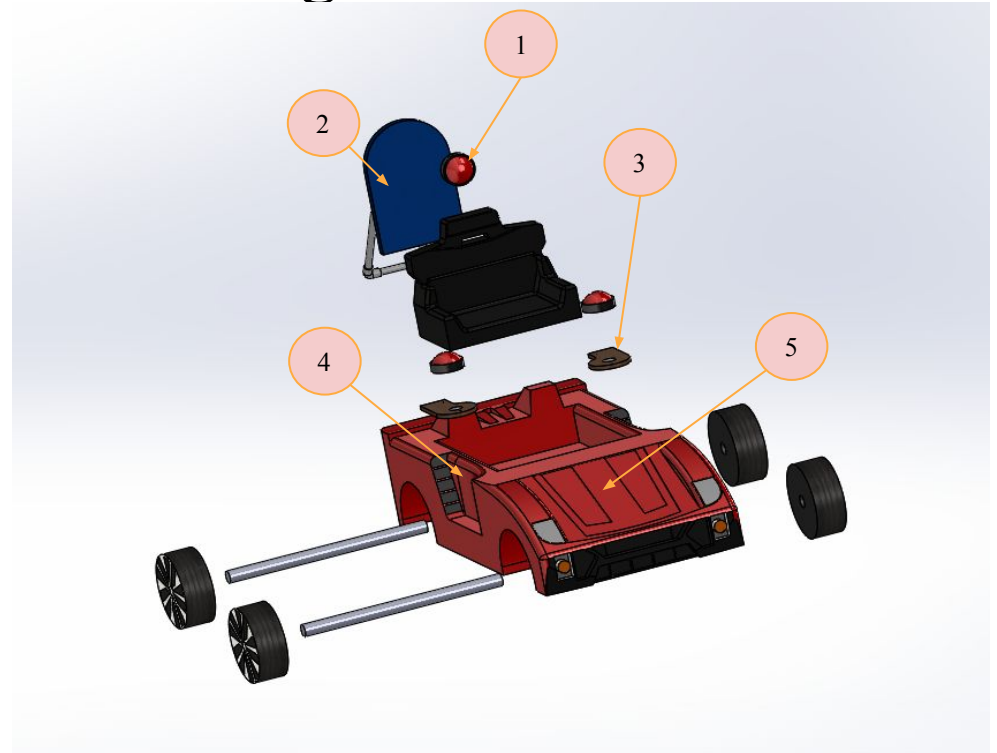3. Static Armrest

4. Closed Frame

5. Steering Motor



Figure 5: Final Design CAD Assembly Drawing

# Testing Final Solution

# Total Cost



Figure 6: Final Design

| Part Name | Cost [USD] |
|---|---|
| Power Wheels Car | 159.99 |
| Push Button x 3 | 50.85 |
| Ultimate Starter Kit | 48.99 |
| Primary Wire x 3 | 15.57 |
| Arduino Motor Shield | 24.97 |
| Kickboard | 5.00 |
| Male and Female Connectors | 5.98 |
| Development Board | 7.86 |
| PVC Pipes x 2 | 3.28 |
| PVC Elbow x 2 | 1.96 |
| Total | $324.45 |

Abdulrahman Almutairi    April 28th, 2017

# Manufacturing

- Armrests
  - Plywood Board
  - Attached Directly to Car
- 4-Point Seat Harness
  - Attached to Seat
- Headboard
  - Secured with PVC
- Electrical Circuit Layout



Figure 7: Armrest CAD Drawing

# Electrical Layout

- Arduino Motor Shield
- Motor Driver
- Steering Motor
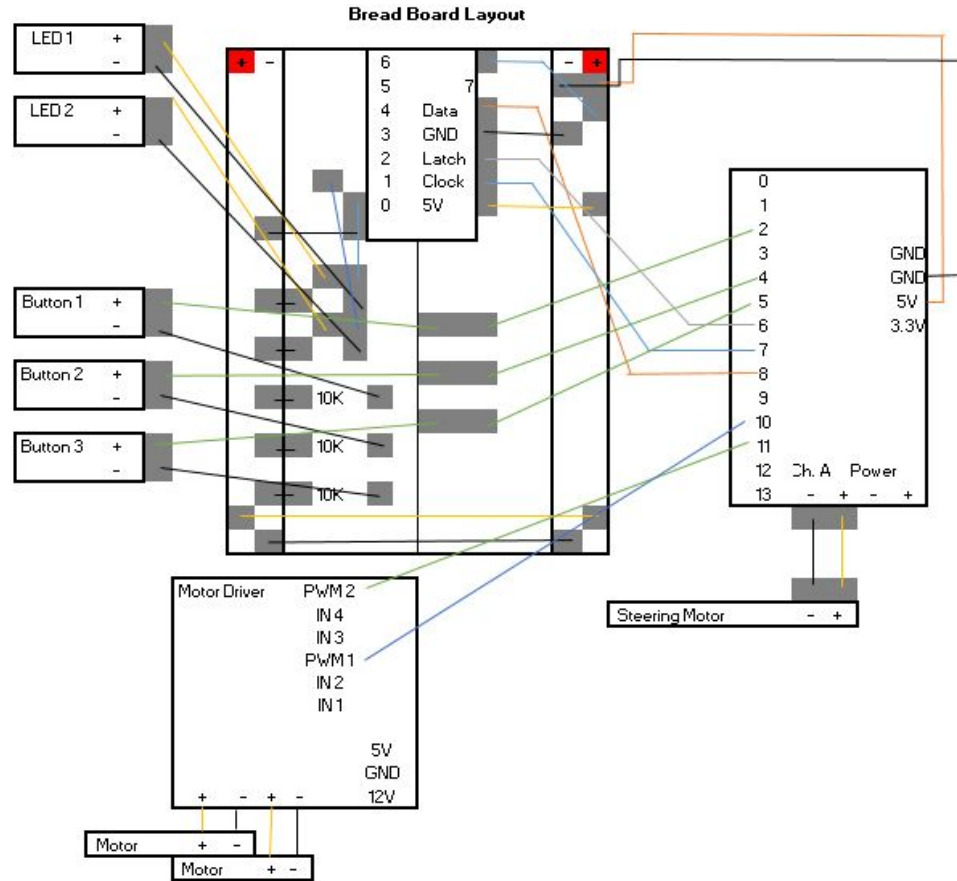


Figure 8: Circuit Layout

# Testing Engineering Requirements

| E.R.'s | Target | Tolerance | Actual |
|---|---|---|---|
| Cost of Final Product | $350 | < $400 | $325 |
| Securements | 2 | ≥ 1 | 4-Point Harness & Headboard |
| Supports | 2 | ≥ 1 | Seat & Armrests |
| Weight of Car | 60 lbs | < 100 lbs | 37. lbs |
| Material Access | Local | Online: < 3 Weeks | Home Depot & Amazon.com |
| Assembly Time | 2.5 hrs | < 4 hrs | 2 hrs for Circuit & 3 hrs for Car |
| Adaptability | 4 | ≥ 3 | 3rd Button, Steering, & Harness |
| Material Lifetime | 3 years | ≥ 2 years | All Components |
| Adjustable Speed | 1 mph | < 2 mph | Arduino Code |
| Unique Solution | Unique from Past GBG Solutions | | |

# Conclusion

- Did We Meet all Requirements?
  - Assembly Time
- Contributions to Success
  - Communication
  - Research
  - Testing
- Areas to Improve
  - Physical Adjustable Speed
  - Smaller 3rd Button
  - Easier Overall Design to Assemble
- What We Liked About the GoBabyGo Project
  - Opportunity to Help (Donated)

# Thank You

- Sarah Oman - Instructor and Client

- NAU Mechanical Engineering Department

- W. L Gore and Associates - Sponsor

# Questions?

# References

[1] "UD Gobabygo!". *UD GoBabyGo!*. N.p., 2017. Web. 26 Apr. 2017.

[2] https://www.cefns.nau.edu/capstone/projects/ME/2017/GoBabyGoA/index.html