GNG5140 Inclusive Bike
Final Prototype and Design day Preparation

Submitted by

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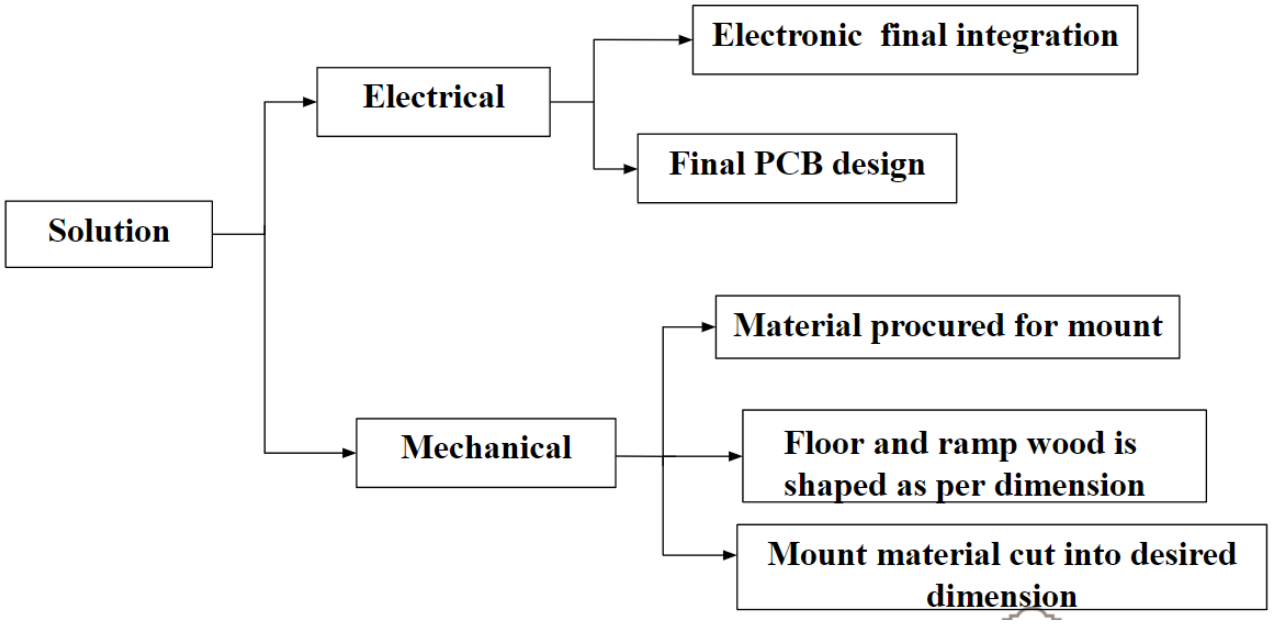
Abstract

This document outlines our final prototype and our brief description of the design day pitch. The prototypes in this document are a combination of simulated and concrete products. The global solution that we have come up with is described in detail using a block diagram. Moreover, the final product and the manufacturing process are explained in detail. Each subsystem's prototype will be documented in detail using sketches, diagrams, and pictures. When testing is possible, the tests completed for these systems are described and the results of these tests are provided. Moreover, a bill of materials outlining the costs of components that will be purchased is provided.

1. Introduction

This document outlines the final product and the brief description of the design day pitch . It serves as a record of the final assembly and testing process . It exists so that future engineers working on the project may understand why one decision was made over another, and what issues became apparent in the early stages of designing the project. The main purpose of this project is to create an inclusive bike that is significantly cheaper than current existing solutions, while also being easy to use and about as durable as competing products. Note that subsystems are often discussed and tested as separate entities in this deliverable; in a future deliverable the system will be shown as a whole.



2. Global Solution

As shown in Figure 1, there are two main subsystems in our solution: the electrical system and the mechanical system. The mechanical features include a system to hold the wheelchair securely to the floor and a ramp designed to hold the weight of the user without bending too much (up to 150kg). This ramp is designed to allow the user to get on and off the trailer hassle-free. Additionally, a mounting system is included to link the trailer and the bike. From the electrical perspective, the design includes a brake light that illuminates when the driver activates the bike's braking mechanism. Blinking signal lights are also incorporated for when the driver intends to turn. Moreover, an LCD display allows the rider to communicate with the driver of the bike. The rider may do so by using the 4 buttons present with the ride.Shown in the figure above is a visualization of the final product. Note that the straps and electronics are not depicted; the combination of each subsystem into a usable product will be shown in a future deliverable and is not the subject of this deliverable.

3. Prototype, Test, and Bill of Materials

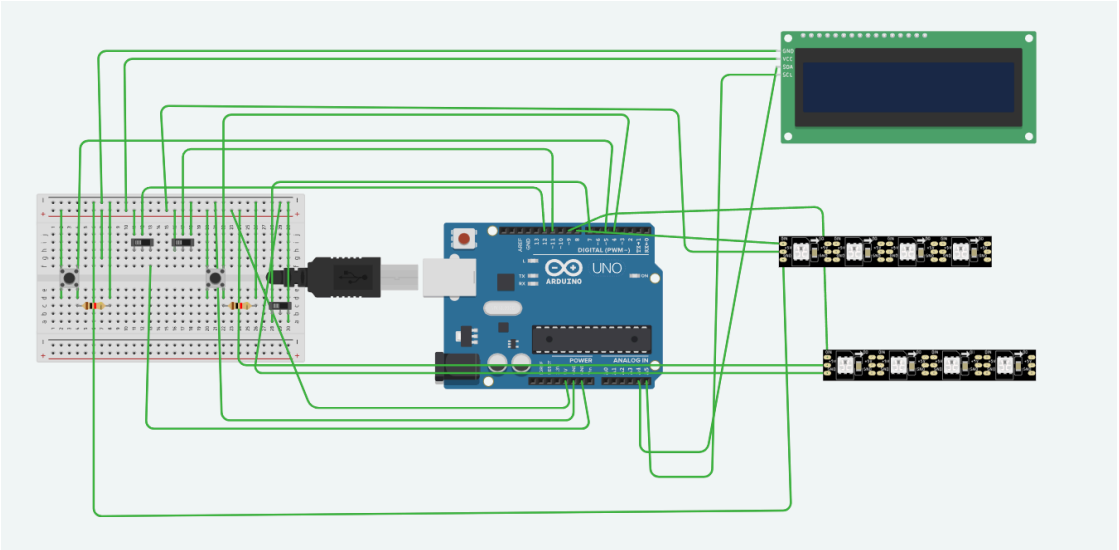
This section documents the initial prototype for the subsystem of the protype. The prototyping is broken down into 5 sections: (1)Mount, (2)Electronic Assembly, (3)The Bike and Carriage Assembly. Lastly the bill of materials for all components is provided

4. The Display, Brake Lights, and Blinkers

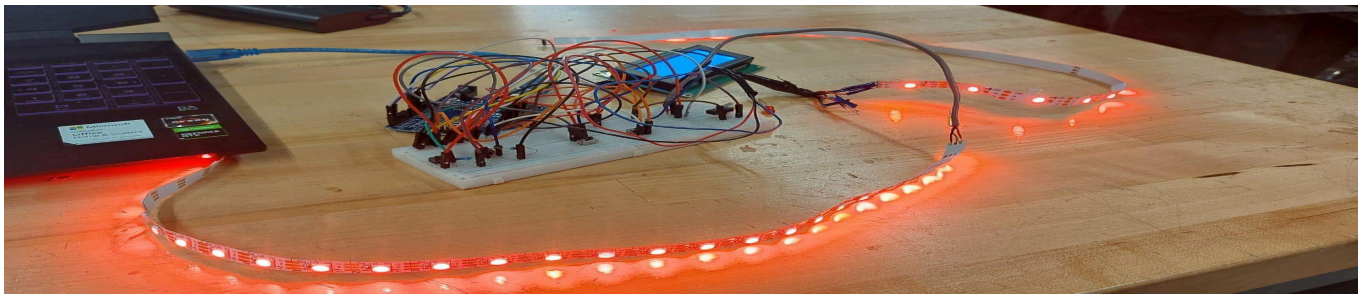
Listed below are the purposes of each component tested in this section.

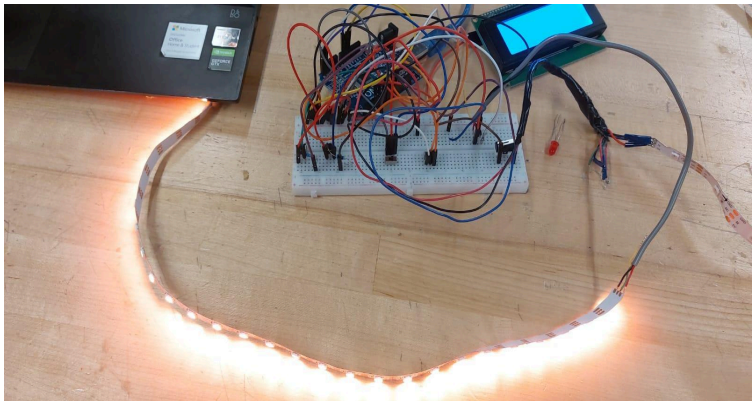
1. In regards to the previous prototype where we demonstrated blinkers using just a single led strip, a lot of new changes have been introduced in the current prototype.
2. For instance two LED strips (WS2812B) for the blinkers which are controlled using two slider switches instead of a single button used earlier that functions as per the final requirements.
3. Finally assembly of LCD on breadboard for communication with the driver using push buttons meeting the communication requirements.
4. Integration of the two LED strips which function as both blinkers and brake lights and LCD (communication) and carried out successful testing on breadboard.
5. In the previous prototypes for basic testing we had used individual LED strip and LED for the blinkers, and brake lights.

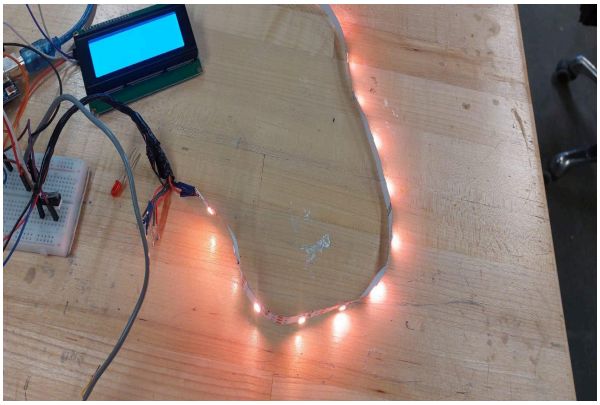
The diagram of these components is shown in the figure below.



The figure below shows the safety system







Electrical final prototype-

1. Design of Protoboard circuit and soldering of all the components on individual PCBs.
2. Initial testing of all the components and systems soldered on the PCBs to ensure there is no change in the previously recorded test results.
3. Design and manufacturing of the casings for the safety and communication systems.
4. Assembly and soldering of all the components
5. Assemble all the components on the bike

Component	Quantity
Arduino UNO	1
M2M jumpers	20-30
M2F jumpers	10
RED LED	1
LED STRIP	2
Slider Switches	2
Contact Switch	1
LCD	1
Voltage Source	5 V
PCBs	3-4
Speaker	1
Resistors	10k ohm(5-6)
Long single-strand wires	10-30
RGB LED strip	1
Buttons	5-10
Bluetooth Module (ZS-040)	1
GPS Module (Beitian BN-880)	1

5. Final Assembly

We have assembled the Bike and the carriage together

We have also assemble all the electronics on the bike

6. **Scalability-**
    - We can come up with user defined designs for fulfillng individual customer demands including varying physical abilities and preferences and also
    - Incorporating robust materials and efficient manufacturing processes while maintaining affordability and sustainability in production

7. **Quality**
    - Improving the quality of inclusive bikes by rigorous testing to ensure durability, ergonomic design for comfort,
    - Incorporating user feedback for continuous refinement, and maintaining quality check protocols.

8. **Sustainability**
    - Sustainability will be obtained by involving utilization of eco-friendly materials,
    - Minimizing carbon emissions in manufacturing and distribution, promoting active transportation for reduced environmental impact, and prioritizing recyclability and renewable energy sources.

9. **Usability**
    - We can increase usability of inclusive bikes involves designing intuitive controls,
    - Incorporating versatile adjustments for various users, providing clear instructions and educational resources, ensuring compatibility with accessories, and offering accessible maintenance and repair services.

10. Updating the Prototype Test Plan

Due to licensing problems with Wrike, this section could not be completed for this deliverable. The team is in the process of changing project management software, and this section will either be provided in a future deliverable or in a separate document following a discussion with the professor.

11. Conclusions

In conclusion, most of the electrical and mechanical features of the inclusive bike have been prototyped, and test results have been promising. On the mechanical side of things, the manufacturing process has started and the physical prototype completion is in progress. On the electrical side, the Components are being soldered onto the PCBs for the final assembly. The electrical system needs to be mounted and wired onto the physical prototype. A box for housing the electronics needs to be created.