TRANZVOLT 2.0
FINAL PRESENTATION

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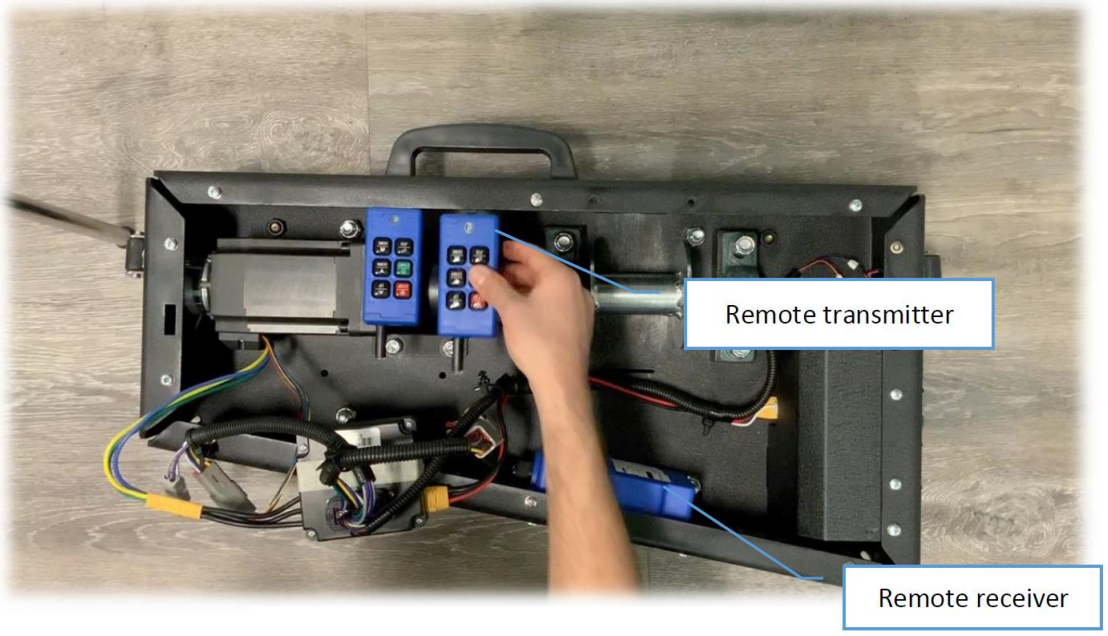
TRANZVOLT

THE DESIGN PROBLEM

PROJECT FOCUS

- Develop new motor box
  - Improved Battery Management System
  - Plug-in wired controller with new UI
  - Auto-homing mechanism
  - Bluetooth adaptable controls
- Three Subsystems:
  - Battery Management System (BMS)
  - User Interface (Remote Controller)
  - Microcontroller Unit (MCU)



Current TranzVolt Motor Box

NEW DEVELOPMENTS

Modifications from Original Designs:

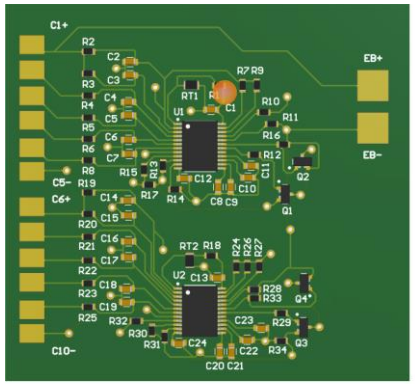
- BMS
  - New Battery Protection IC S-8245A/C
- UI
  - New buttons and cable
  - Changes to overall design of controller
- MCU
  - TieDown Modified I/O instead of original Flipsky I/O

BATTERY MANAGEMENT SYSTEM (BMS)

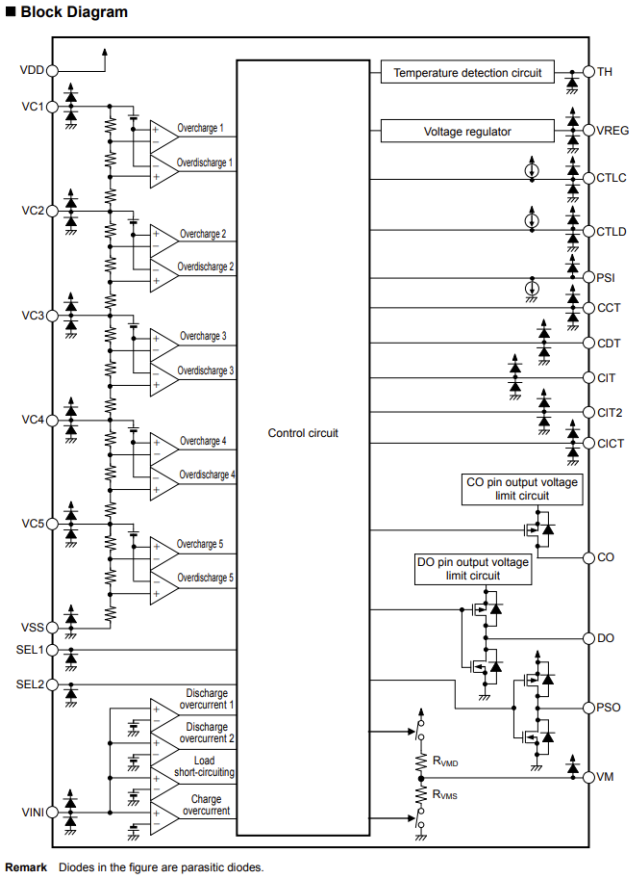
BMS DESIGN

- Batteries:
  - 2x 20V MAX XR Premium Lithium-Ion 5.0Ah Battery Packs
- Existing Problems:
  - Only safety mechanism – Thermal Sensor
  - First Design only provided over-voltage and over-current protection
- Final system: S-8245A/C
  - Over-charge Protection
  - Over-discharge Protection
  - Power-Down Function

DeWalt 20V Premium Lithium-Ion Batteries



BMS PCB on Altium

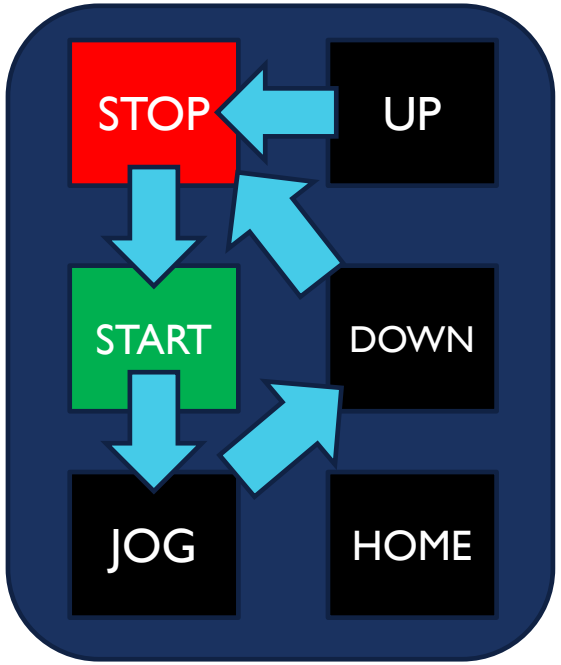


S-8245A/C Battery Protection IC Block Diagram

USER INTERFACE (REMOTE CONTROLLER)

REMOTE CONTROLLER ISSUES

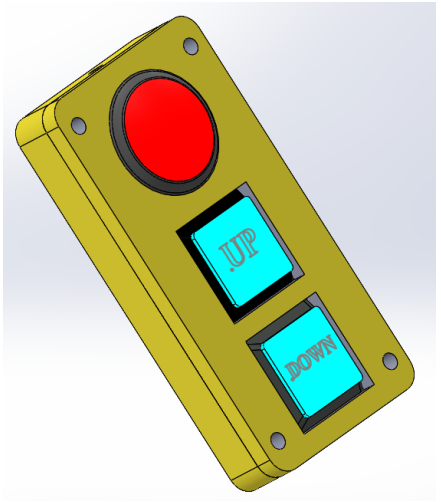
Complexity of Interface

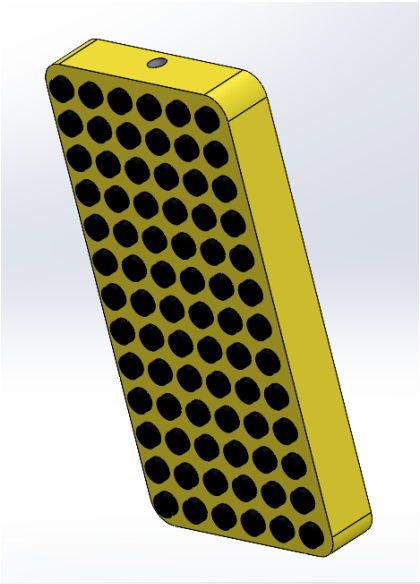


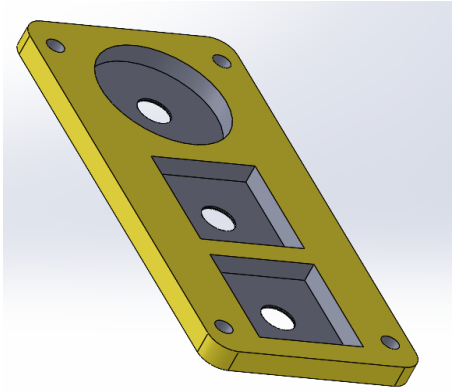
Receiver Redundancy

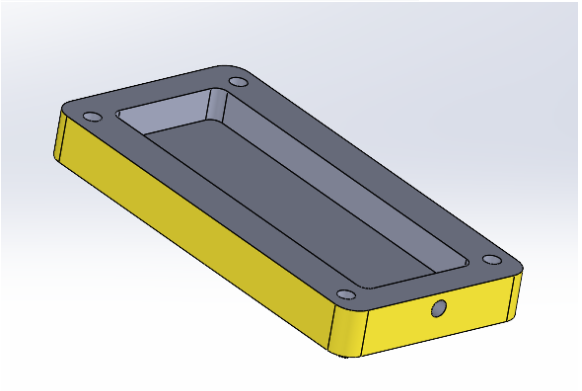
Battery Dependency

FIRST ITERATION OF CONTROLLER DESIGN









- 3 buttons
- Receiver incorporated into microcontroller
- Draws power directly from microcontroller
- Hole for cable on base plate
- Two-part case, drilled together using screws
- Entire case 3D printed

CHANGES TO FIRST ITERATION

- First Iteration Issues
  - Size of Buttons
  - Controller design was way too bulky
  - Cable only had 3 wires instead of the required 6

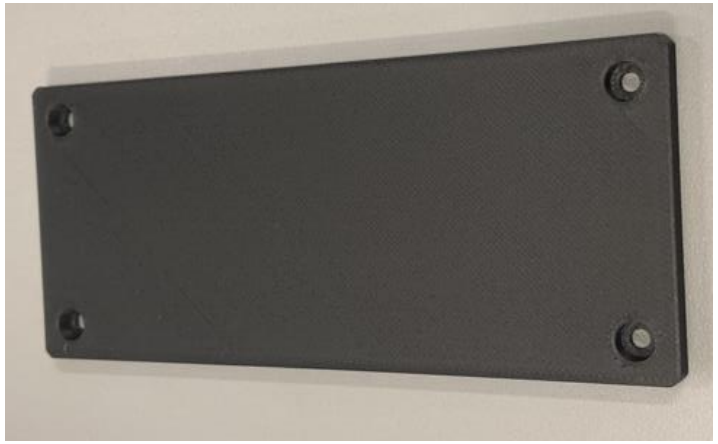
- Final Controller Iteration
  - Reduced Button size
  - Controller design more compact and lightweight
  - Cable has 6 wires
  - Changes to make repair and maintenance easier

COMPONENTS

Push Buttons

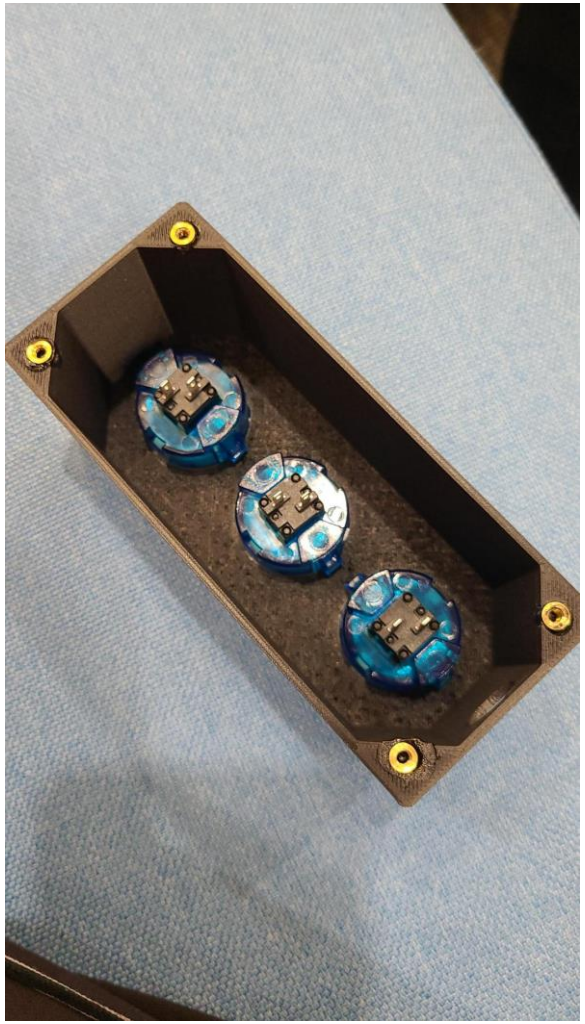
Electrical Cables

3D Printed Components



FINAL PRINT

- Buttons attached to controller using snap-fit assembly method
- Cable hole located in top plate for soldering purposes
- Base plate attached using screws for easy maintenance

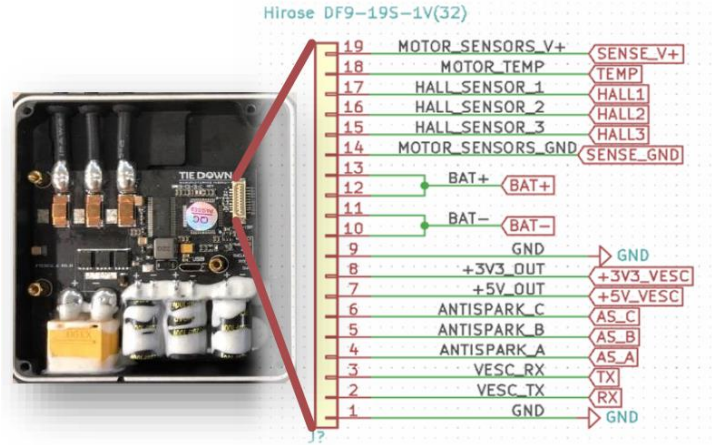


- Chamfers added for structural integrity of controller
- Metal Inserts added to reinforce mechanical properties of 3D printed material

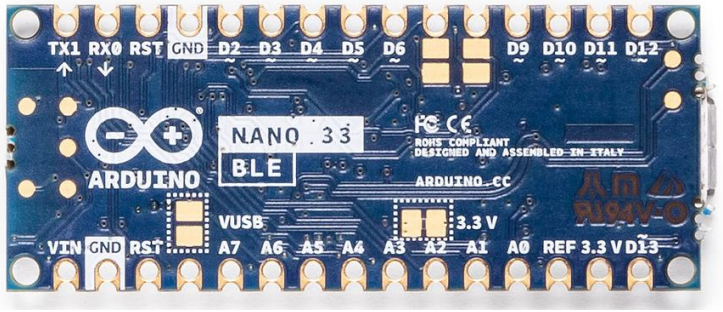
MICROCONTROLLER UNIT (MCU)

MCU DESIGN

- Existing: Icarus Control Unit (ICU)
  - No BLE
- New: Arduino Nano 33 BLE
  - Bluetooth capability
  - Logic interface with UI system
  - UART interface with motor controller



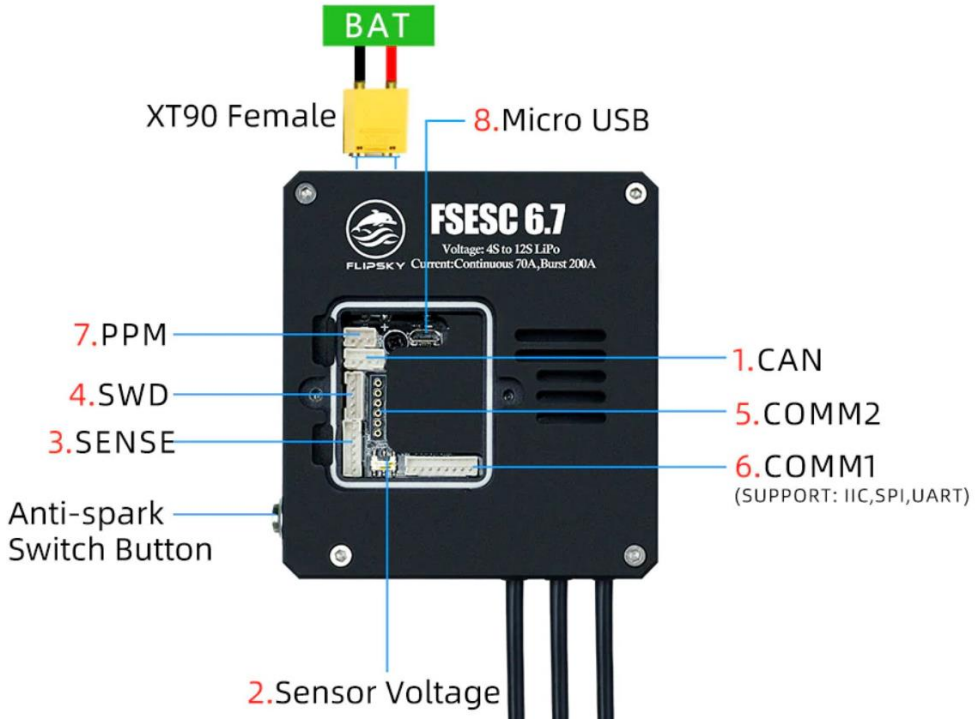
Flipsky Motor Controller Overview and Pinout



Arduino Nano 33 BLE

MCU TROUBLES

Original Flipsky I/O



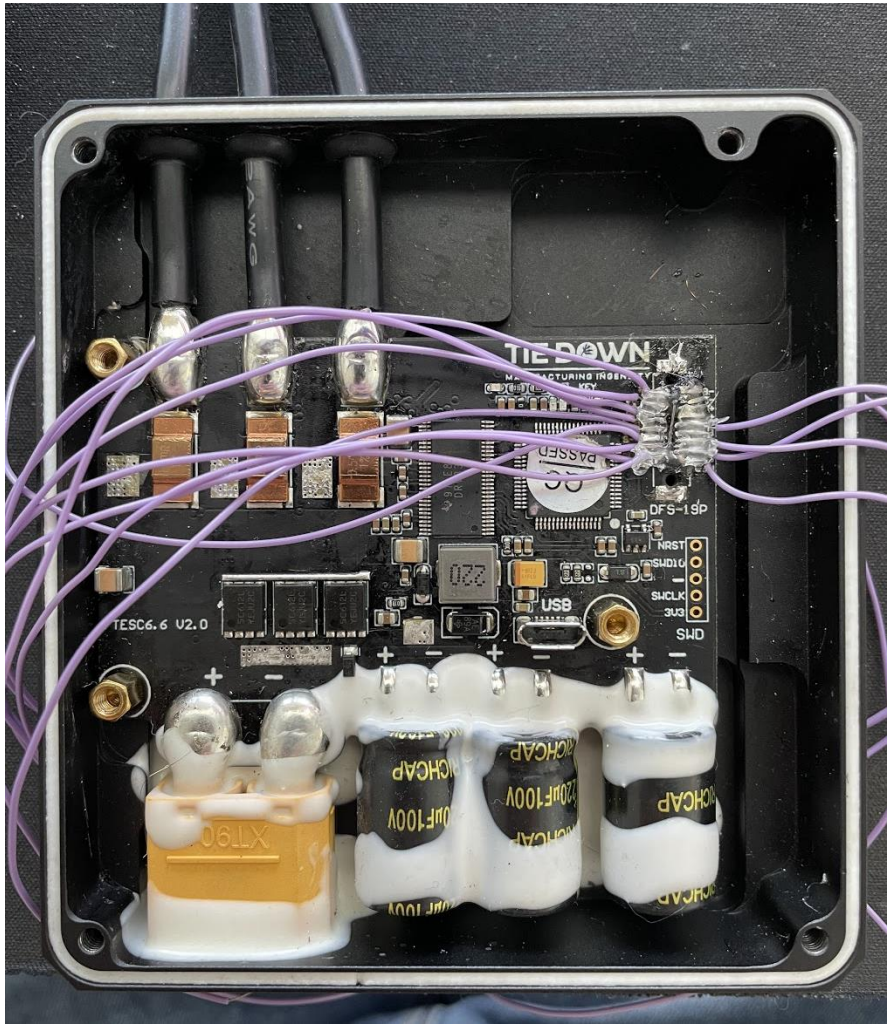
Tie Down Modified I/O

- Throughout this project, documentation provided by Tie Down was sparse

INITIAL SOLUTION

- Removed Hirose DF9-19S Connector
- Soldered Wires to open pins
- Hot glue for strain resistance

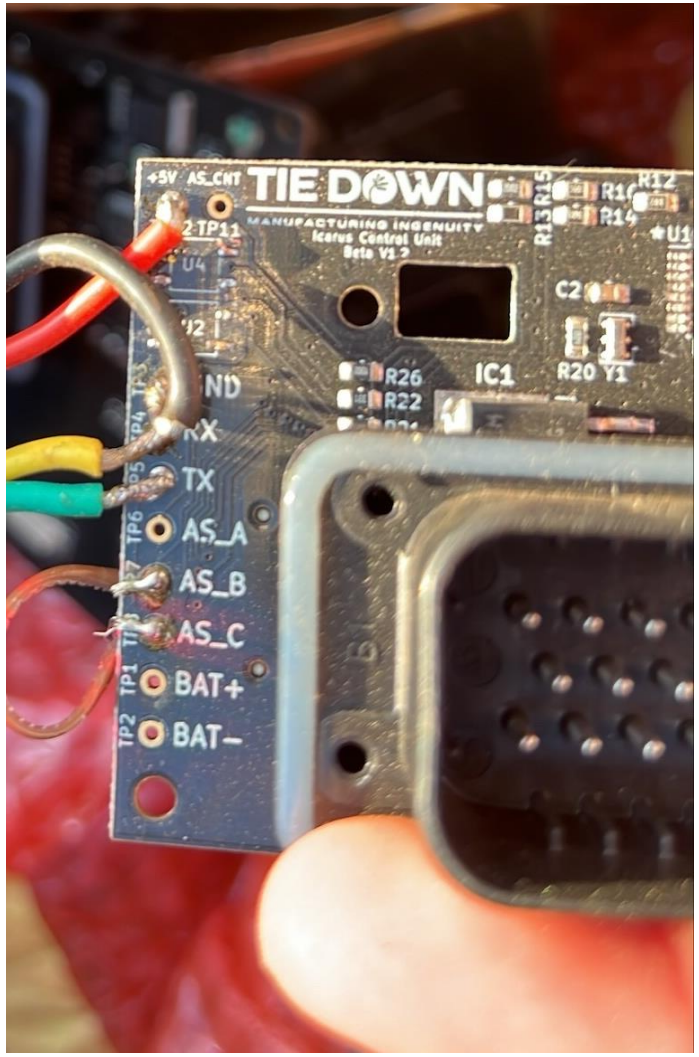
- Unfortunately, MCU would still not be detected by our computer for configuration



FINAL SOLUTION

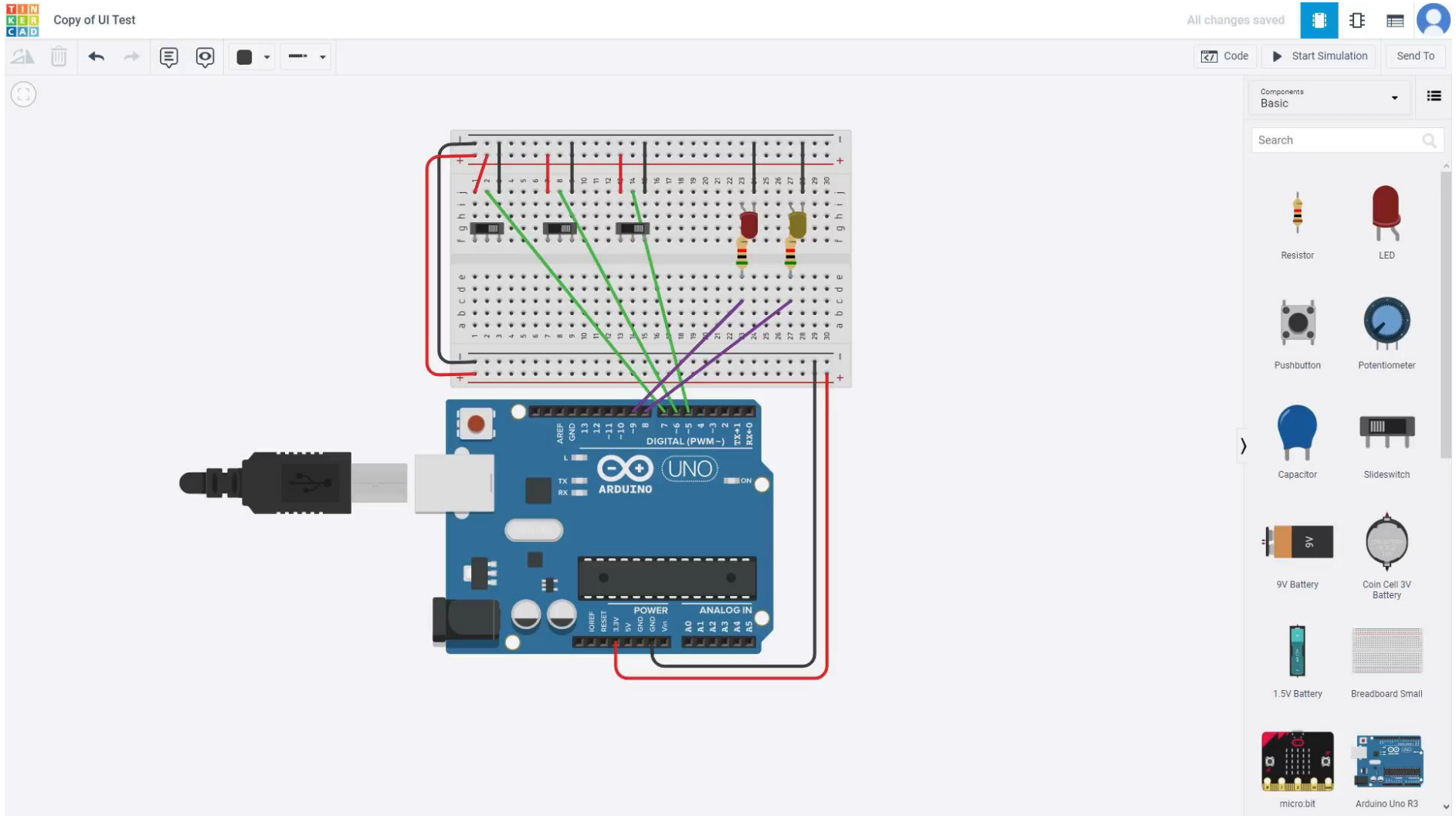
- Tie Down explained that the antispark pins they added need to be shorted for MCU to function

- We received this MCU with much more accessible I/O today, will be working to get it running for the expo



PROTOTYPING TESTS AND SIMULATIONS

MCU TINKERCAD SIMULATION



YouTube Link

WORKING DESIGN

Basic Button Test

Button Test with Motor

FUTURE WORK

FUTURE WORK

For Capstone Design Expo

- Final assembly of different subsystems
- Test assembly with existing TranzVolt
- Make controller more visually appealing and label buttons

For Future Iterations of TranzVolt

- Incorporate Bluetooth capability for wireless usage
- Add auto-homing system
- Design mobile app to improve UI interface

THANK YOU