

N F P A

Fluid Power

VEHICLE

Challenge



NFPA
Education and
Technology
Foundation

FINAL PRESENTATION
University of Cincinnati
Dr. Muthar Al-Ubaidi
April 2024



Team Introduction



- Team members
 - Noah Flannery
 - Maggie McDowell
 - Nico Navarro
 - Kyle Prysmont
 - Alexander Whitfield

Team Introduction



- Noah Flannery
 - Mechanical Engineering Technology
 - 5th year
 - From Cincinnati, Ohio
 - Co-op at:
 - Cincinnati Gearing System
 - SETCO
 - Emcor



Team Introduction



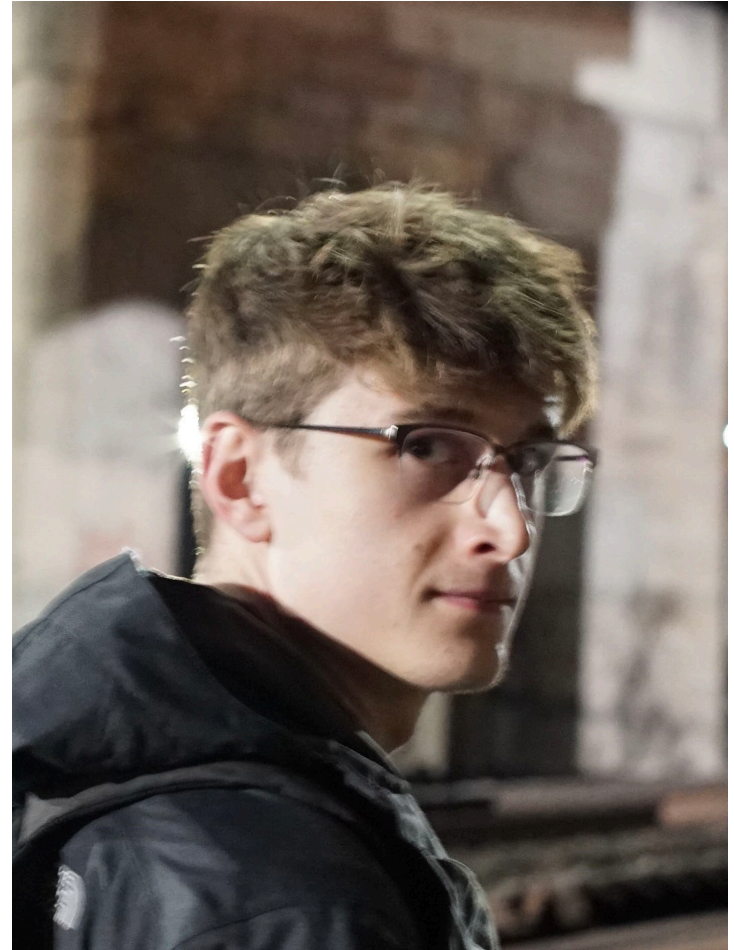
- Maggie McDowell
 - Mechanical Engineering Technology
 - 5th year
 - From Cincinnati, OH.
 - Co-op at:
 - Weiss Technik
 - Metalex Manufacturing



Team Introduction



- Nico Navarro
 - Mechanical Engineering Technology
 - 5th year
 - From Cincinnati, Ohio
 - Co-op at Cliffs



Team Introduction



- Kyle Prysmont
 - Mechanical Engineering Technology
 - 5th year
 - From Cincinnati
 - Co-op at UGN inc



Team Introduction



- Alexander Whitfield
 - Mechanical Engineering Technology
 - 5th year
 - From Cincinnati, Ohio
 - Co-op at
 - Deceuninck North America
 - Robert Bosch Automotive Steering LLC



Team introduction

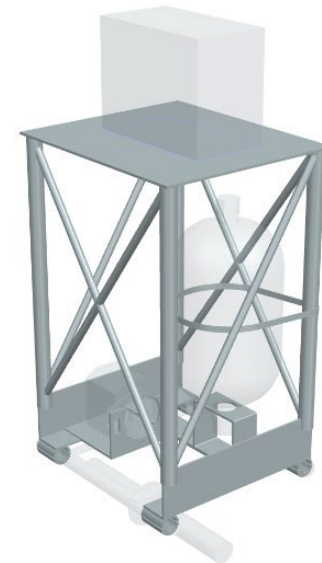


- Faculty Advisor Muthar Al-Ubaidi, PhD
- Professor and Director Mechanical Engineering Technology Program
- Education
 - B.S. Mechanical Engineering, University of Baghdad
 - Masters Nuclear Engineering, University of London
 - PhD Nuclear Engineering, University of Cincinnati
- Hometown
 - Baghdad, Iraq
 - Came to Cincinnati, USA in 1978
- Industry Mentor Austen Nielsen
 - Sr. Product Application Engineer at Danfoss Power Solutions

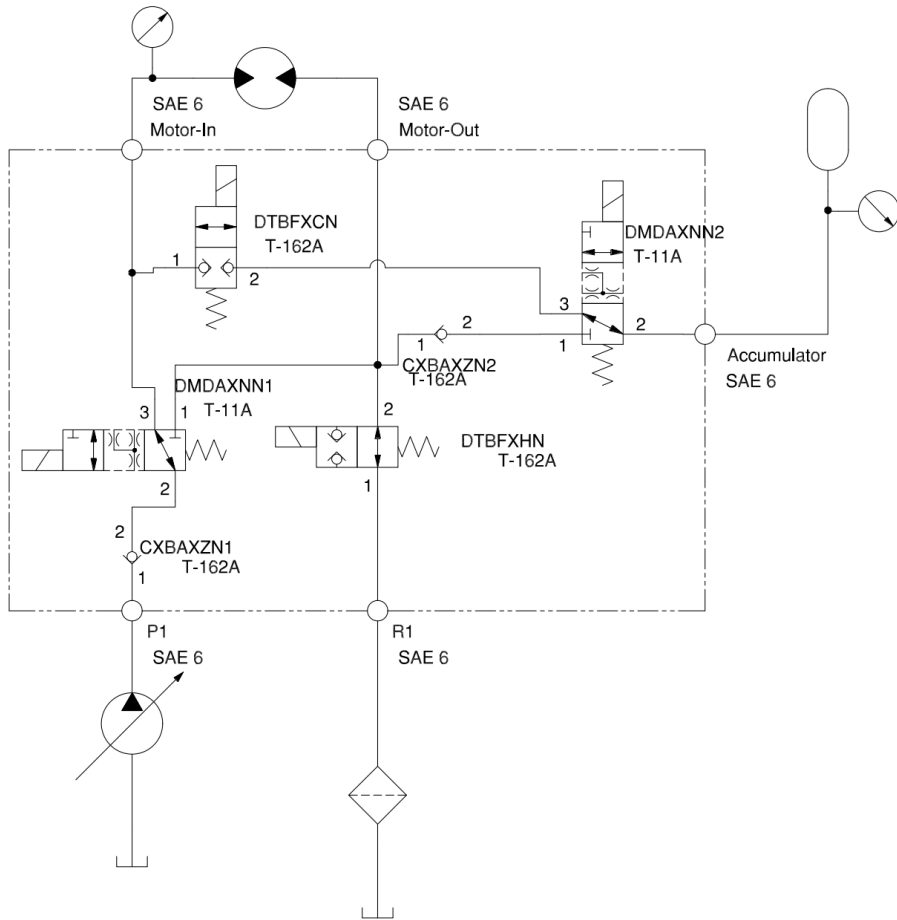


Frame Design

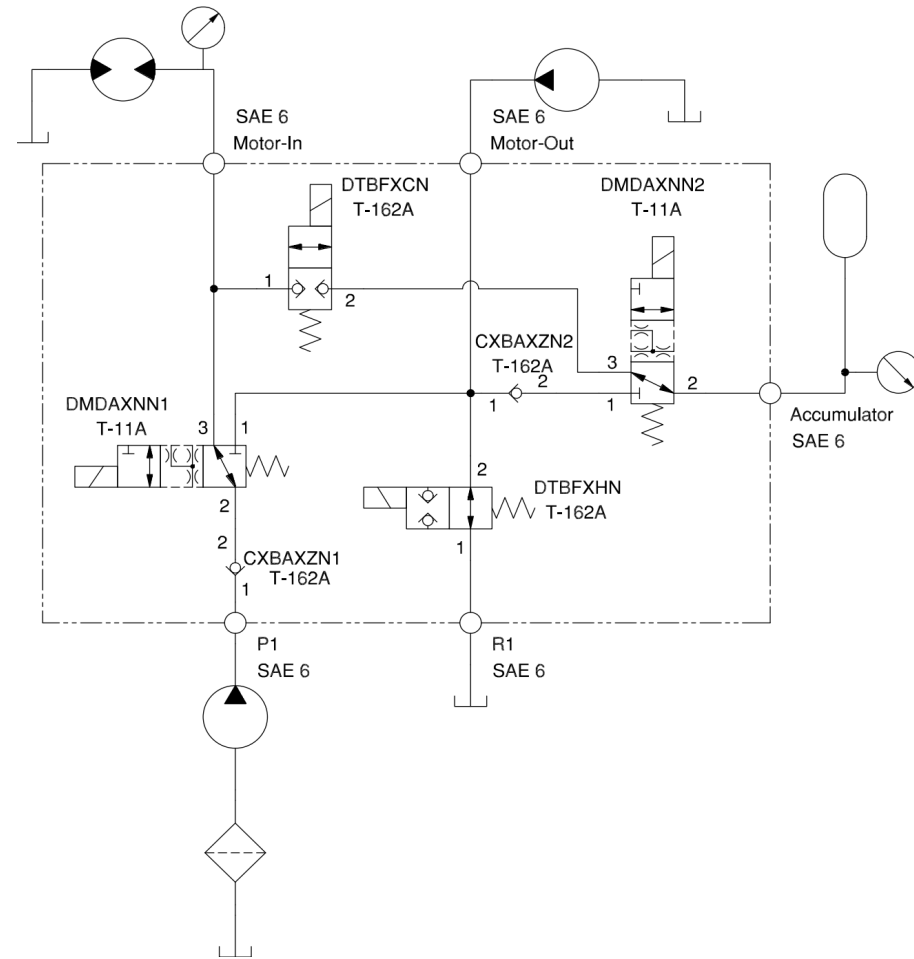
- The frame of our bike is fabricated with the use of strong and light weight steel.
- Our bike contains a rear fork pump mount and an above axle mount.



Hydraulic Circuit



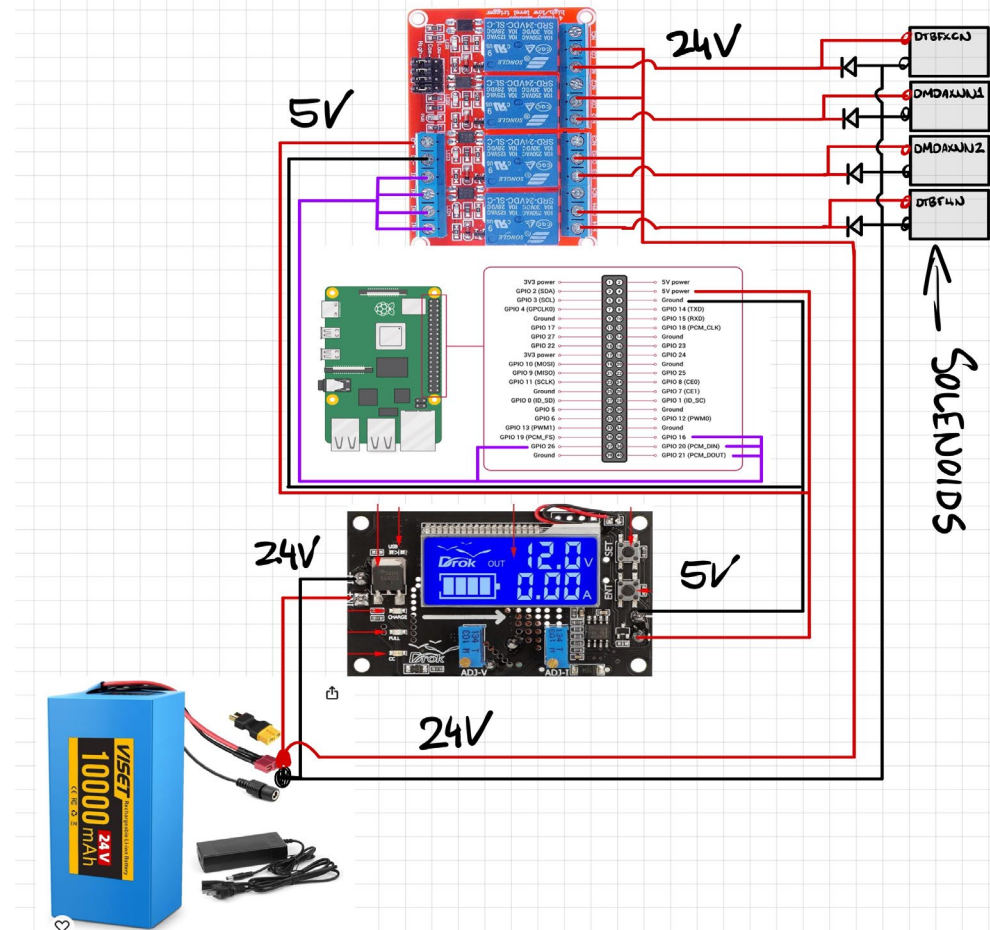
Midway Review Circuit design



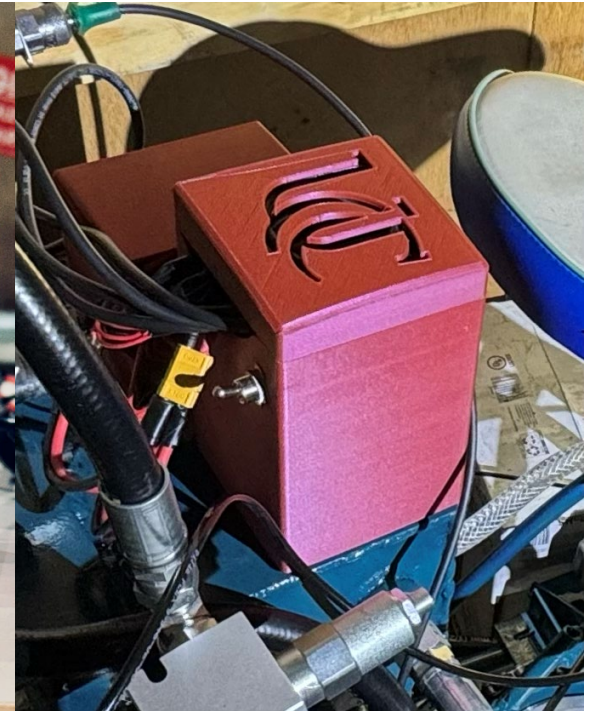
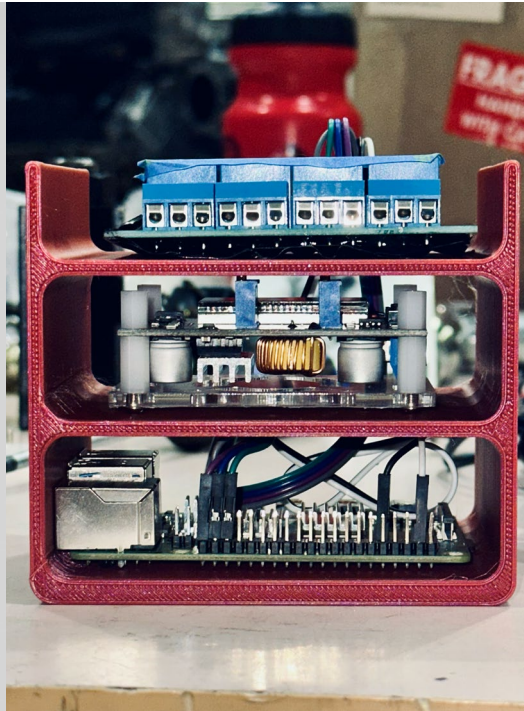
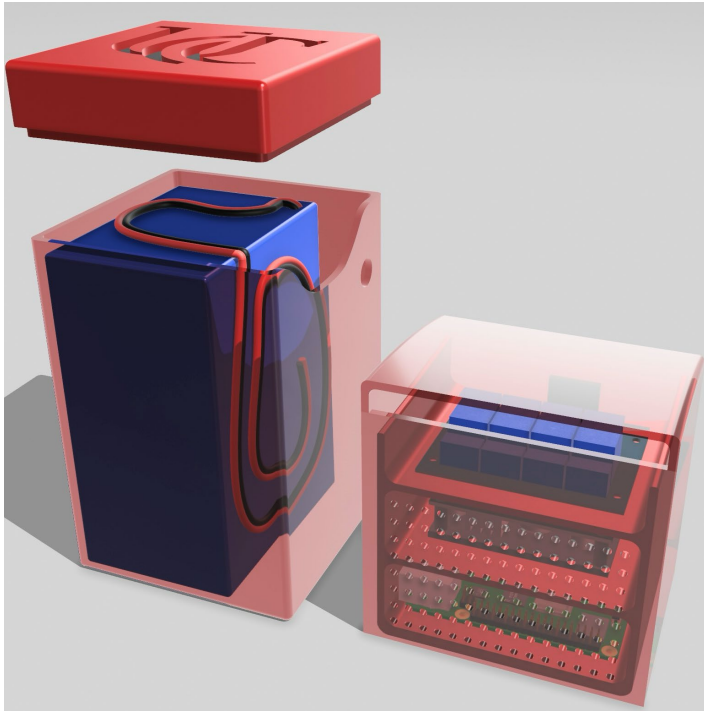
Final Competition Circuit design

Electronics

- Components
 - 24V, 10Ah Lithium Battery (BMS integrated)
 - Variable DC Buck Converter
 - Raspberry Pi 4
 - 5V, 4 Channel Relay



Electronics



Mechanical Components



- Motor
 - Fluid displacement: 10.8 cc/rev
 - Pressure rating: 3625psi
 - Max speed: 4000rpm
- Accumulator (AB30CN010G0N)
 - Operating PSI: 3,000
 - Weight: 10.8 lbs
 - Material: Buna nitrate
- Pump
 - Fluid displacement: 6.56 cc/rev
 - Pressure rating: 3000psi
 - Max speed: 3600rpm



Test run Design



Test Run



- Accumulator was charged to 2300psi
- Almost 2 minutes of run time
- Tires need reinflated or replaced
- Pedaling is difficult at times due to pressure buildup

Changes after Test Run

- Gear ratio was altered to allow for more consistent pressure when pedaling
- Second pressure relief valve was installed
- Tires were replaced
- Electronics casings and mountings were installed

Potential improvements for next year



- Incorporate the reservoir into the bike frame to save space and refine the design
- Use the accumulator to keep the system pressurized to decrease lag between pedaling and the bike moving
- Using a variable displacement pump to allow for a more adaptable system

Questions?

