Problem Statement
Fluid Power Vehicle Challenge (FPVC) is a competition between universities to develop high-performance fluid power vehicles without the use of chains or belts. The main problem, of course, is to stand out among other universities in both speed and efficiency. The team will have to first design with the help of computer software, then build the vehicle according to their best design. The design quality will be eventually evaluated and indicated by the final competition score.

Hydraulic System Design

AMESim Simulation Process
- Basic Calculation Estimation
- Simulation Models
  - Model 1: Optimization Test
  - Model 2: Performance Estimation
- Simulation Result

Components Selection
- The components of the hydraulic system are selected base on the simulation result

Performance
- Maximum Speed – 25 km/h
- Boosting Distance – 300 m

Cost Analysis
- The components of the prototype vehicle are grouped into seven subsystems

Electronic Control Features
- Arduino Control
- Bluetooth Connection
- Phone App Interface
  - Vehicle Data Display
  - Gear Shifting
  - Valve Control
  - Heart Rate Monitored

Electronic Control Features
- Bluetooth connection between devices
- Phone App Homepage

Frame Features
- Self Designed & Built
- Internal Oil Reservoir
- Triangular Structures
- Made of Aluminum

Frame Processing
- Order Varies-sized Tubes
- Create Drawings
- Cut & Weld

Regeneration System
(Example of Alternative Design & Evaluation)

Societal Impact & Conclusion
- The FPVC provides college students a chance to go deeper in fluid power. After this challenge, we gained progress both in theoretical knowledge and industrial designs.
- Our aim to design a product that could be successful in the free market is achieved. We believe PurdueTracer is very competitive for its weight, speed, and efficiency.

Cost Analysis without Donation from Sponsors
- Thanks to the generous donations from Casappa, Steelhead, Eaton and MiSUMi, which greatly reduce the cost of the vehicle.
- The total cost of the prototype vehicle included the donation is calculated as $4237.14
- The total cost without the donations from the sponsors is $6314.79

Background
Purdue ABE has attended FPVC for multiple years. The previous experience is the team’s best resource. Should the team this year do well or not, at least, team members will have valuable experience, and also give advice to next year.

Mechanical System Design

Frame FEA
- Max. Stress 14.05 MPa
- Yield Stress 55 MPa (Al 6061 weld)
- Safety Factor 3.9

Frame Features
- Self Designed & Built
- Internal Oil Reservoir
- Triangular Structures
- Made of Aluminum

Frame Processing
- Order Varies-sized Tubes
- Create Drawings
- Cut & Weld

Selected Design
- Old Version
- 2-Stage transmission
- Driving less friction to normal pedaling
- More compact

Performance
- Maximum Speed – 25 km/h
- Boosting Distance – 300 m

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Hydraulic System Design

Hydraulic Circuit Layout
- A hydraulic circuit layout was developed to describe the working principle of the hydraulic system

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