Background
The ASABE hosts the International ¼ Scale Tractor Student Design Competition each year where 27 universities build a tractor and compete in a unique 360-degree workplace experience. Teams are only given an engine and rear tires and the rest must be designed following strict rules similar to design standards. The Purdue Quarter Scale (PQS) team strives to deliver a tractor that focuses on manufacturability, serviceability, maneuverability, safety and ergonomics.

Project Goals
The team’s goals for this tractor design are:
- Drivetrain capable of 2750 lb. chain load
- Simplified operator station- fewer and less complicated parts
- Real time speed feedback
- Operating noise below 90dB
- Eliminates need for transfer case

Design Constraints
Each team of engineers were constrained by the rules of the ASABE ¼ Scale Tractor Student Design Competition. The design constraints were:
- Weight – Tractor may not exceed 800 lbs. maximum gross vehicle weight
- Length – No part of the tractor may protrude further forward than 96 inches from the center of the rear axle
- Width – No part of the tractor may be wider than 72 inches

Impact and Sustainability
- New designs reduce number of components and shielding
- Fluid drainage tubes to ensure controlled disposal
- Light weight, 4x4 drivetrain reduces soil compaction and yard damage.

Drivetrain
Objective: Increase reliability & Reduce noise.
- Cub Cadet 3 speed w/ reverse transaxle
- Final drives and lock out hubs
- Continuously variable transmission (CVT)
- 4WD Kubota front axle
- Engine orientation rotated 180°
- Eliminates need for transfer case
- 5% weight reduction
- Alternative designs: 2WD, actuating CVT, hydrostatic transmission, electronic locking differential

Operator’s Station
Objective: Simplify Steering System.
- Closed loop hydraulic steering system
- Hydraulic pump and reservoir
- Suspension operator station
- Tilt Helm and adjustable seat
- Accommodates a 95th percentile operator
- Alternative designs: electronic steering, electric throttle

Data Acquisition & Electronics Interface
Objective: Provide real time performance feedback, data logging, and electronic controls.
- Real Time feedback
- Engine speed
- Wheel speed
- Ground speed
- Basic touch screen controls
- Access to operators manual and maintenance log
- Phone application provides mobile feedback

Exhaust System
Objective: Minimize operating noise.
- Twin muffler system
- 27% noise reduction
- Shielding allows maximum heat dissipation and safe operation
- Multiple exhaust packages in order to meet customer needs
- Alternative designs: delta/vortex flow exhaust, added heat absorption material

Customer Requirements
- Competitive tractor pullers
- Durable drivetrain
- Serviceable design
- Safe and easy to control
- Maximize gear ratio

Serviceability
- Simplified shielding
- Accessible without removing tractor shielding
- Maintenance log available
- Tractor display monitor or android app
- Minimal hardware variations

Economic Analysis
- Cost breakdown uses ASABE competition pricing constants
- 3.5% reduction in adjusted manufacturing cost form 2016 tractor
- Engine, transmission, and drivetrain account for 33% of costs

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