Exhaust System

only one OEM muffler

Impact and Sustainability

New design employs electric drivetrain system -- clean energy, easier to control and more power provided.

Regardless of the rules, a quick-charge system should be added, then a smaller engine and generator could be used.

Adding batteries could also make the system emissions free, which is preferred for indoor work like greenhouse.

References:

https://www.dearkoo.com/agricultural-exhaust-systems-supplier/

CAPSTONE DESIGN EXPERIENCE 2018
Quarter Scale Tractor
Agricultural & Biological Engineering

Yixian Niu (Agricultural Engineering), Wes Willson (ASM)
James Marschand, Zhongzhong Niu, Yikai Li, Jihang Liu, Wentao Chen

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Instructors:

Dr. John Lumkes

Dr. John Lumkes

Quarter Scale Tractor 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.

**Project Goals**
The team's goals for this tractor design are:
- Design a new drivetrain system to eliminate CVT (Continuously Variable Transmission) due to rules changes
- Improve the data acquisition system to get real time feedback
- Design a new exhaust system for lower noise
- Improve Frame and Suspension

**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 900 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

There are several other limitations and rules that the team must meet to qualify for the competition, regarding component design, safety, noise, etc.

**Economic Analysis**
- Cost breakdown uses ASABE competition pricing constants
- All purchased parts are multiplied by 40% and Fabricated parts by 70%

**Exhaust System**

• Why Electronic:
  - Competitive Efficiency
  - More precise control
  - Lower Noise
• Alternative Designs:
  - Closed Loop Hydraulic System
  - Electric System
- Four Motor System (Design 1)
- Three Motor System (Design 2)
- Two Motor System (Design 3)

**Drivetrain**

- Two Motor System has been chosen based on decision matrix.

**Data Acquisition & Electronics Interface**

- Adjust and save parameter settings, monitor real-time data, and perform diagnostics and troubleshooting even during driving

**Suspension**

Improve operator comfort through the implementation of a flexible front axle suspension system.

**Manufacturability**

Efficient fabrication and assembly practices ensure the customer will have the lowest possible cost for the highest quality product available.

**Project Goals**

- Manufacturing Timeline:

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**Data Acquisition & Electronics Interface**

- 2 motor controllers + 1 PC OEM level programmer + 1 Handled OEM level programmer
- Programmer can change:
  - slew rate, max power, creep, brake regen, contactor output and many more.
- Handled programmer also acts as Display:

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