John Deere: Distributed Tire Inflations System for Compact Tractors

Overview
John Deere has presented our team with the task of creating a tire inflation system for their sub-compact tractors to help monitor and adjust the tire pressure. This will also help with traction, compaction, fuel economy, stability, and clearance when entering a garage. The more common Central Tire Inflation Systems (CTIS) are typically very expensive and require integration into the machine, therefore there is a need for a system that pertains to one tire.

Objectives
- Design and build a low-cost, distributed alternative to CTIS
- System is isolated from the rest of the tractor components
- Inflate the tire from 50% to 100% inflation within 5 minutes
- System costs $50.00 per wheel

Approach
- The team conducted research to determine the most efficient low cost system that would perform and meet the project's requirements
- After extensive research, several Distributed Tire Inflation Systems (DTIS) were generated and analyzed on their overall functional capabilities.
- Using a variety of different testing methods, concept selection and concept generation, the most feasible DTIS was chosen.
- The team then divided into three sub-groups so the necessary criteria could be met.
- Power generations calculations, charts and graphs were done to validate the system.
- Using SolidWorks, a housing unit consisting of two discs was designed and built inside the tire hub to house the DTIS internal components.
- Contacted the sponsor and discussed the possibility about implementing a test stand.
- Designed prototype to prove feasibility of distributed tire inflation system.
- Made final recommendations, and other alternatives were evaluated and compared to the DTIS system.

Outcomes
- Inflated the tire from 50% to Max Tire Pressure in 7 minutes
- Product was the first self-contained wheel-mounted tire inflation system of its kind
  - Proved feasibility of product for commercial use
- Design was built for $100
  - Affordable design when product is mass-produced by John Deere
- Capability to self charge or charge from a standard outlet
- Provided alternatives to improve efficiency of system