Shell Eco-marathon, Urban Concept Vehicle Drivetrain

Overview
The Shell Eco-marathon competition challenges students to design, build, and test highly energy efficient vehicles. The sponsor, Ryan Moyer, wanted Penn State’s Urban Concept vehicle (UCV) to compete in the compressed natural gas (CNG) category in the 2016 competition. Since the UCV previously ran on an electric motor attached directly to the wheel, the Powertrain team had to design and build a drivetrain to transmit the torque of the engine to the wheels of the vehicle.

Objectives
1. Build a working drivetrain that passes all Shell Eco-marathon inspections.
2. Build an efficient drivetrain that optimizes fuel economy.
3. Build a drivetrain that can be optimized by future capstone teams.

Approach
• Customer needs were created based off the 2016 Shell Eco-marathon rules, the goals of Ryan Moyer, and the overall goals of the entire Eco-marathon Team (Engine and Powertrain teams). These customer needs were weighted using an AHP matrix.
• The team researched other cars which compete in the Shell Eco-marathon competition.
• Twelve different designs were considered which involved different types of transmissions and drives, along with different power transfer, axle, sprocket attachment, and wheel connection designs. Four of the initial twelve designs were chosen and weighted in a concept scoring matrix.
• The main aspects of the final design are a CVT and a one wheel drive.
• The design also includes a chain, wheel affixed axle, two bearings, and a flanged wheel connection.
• The team completely manufactured and assembled the design on the UCV.
• The drivetrain passed the 20% incline brake test and is definitely functional up to the CVT.
• At this point, the entire drivetrain with the CVT cannot be tested because the functionality of the engine is required.
• A MATLAB model was developed to determine the fuel consumption based on different speeds the vehicle is run at.
• The Spring 2016 team should focusing on light weighting the drivetrain and tuning the CVT for optimal efficiency.

Outcomes
• At this point the UCV is expected to successfully complete the course and run on 150 mpg gasoline equivalent.
• The drivetrain can be optimized by future teams.
• The project cost a total of $568.36.