Shell Eco-Marathon—Improvement of structural frame components and electrical systems for higher drive efficiencies

Overview
The Shell 1 team was tasked with preparing the existing Urban Concept vehicle for competition in the Shell Eco-Marathon 2013. The Eco-Marathon is an efficiency race in which energy usage is to be kept to a minimum. Integration of the electrical, mechanical and aerodynamic systems was critical for achieving maximum efficiencies.

Objectives
- Integrate 9 solar panels to vehicle body in order to provide charging of the drive battery
- Improve mounting of geared hub motor to vehicle frame
- Clean up and simplify accessory electronics for ease of use and reliability
- Improve brake mounting to diminish rolling resistance
- Meet all requirements for competition in Eco-Marathon and achieve maximum efficiency

Approach
- Customer needs were gathered from Eco-Marathon rules, sponsor Buddy Bealer, and technical advisor Prof. Leland Engel.
- Individual tasks were assigned to team members and progress was tracked on sub-charts within the overall project Gantt Chart.
- Communication with the sponsor and the Shell 2 team was upheld through weekly updates and occasional teleconferencing.
- For construction of the hub motor mount, ANSYS analyses were utilized to determine safety and effectiveness resulting from the new design.
- CAD was used to design the motor mount, as well as generate clean and accurate electrical diagrams.
- All modifications were to be complete and functional in time for the Eco-Marathon.
- Testing was performed at the Eco-Marathon as part of the vehicle safety and qualification checks. Additionally, the race itself generated energy usage data which could verify whether the design modifications had been effective.
- Results were converted to MPG-gasoline equivalent and compared to previous performance by Penn State teams.

Outcomes
- The Urban Concept vehicle came in 3rd place
- The best run produced 1870.35 MPGge which was over 350 less than last year.
- Project was completed on schedule and within the $1000 budget.