

Shell Electric Urban Concept

Mechanical and Aerospace Engineering

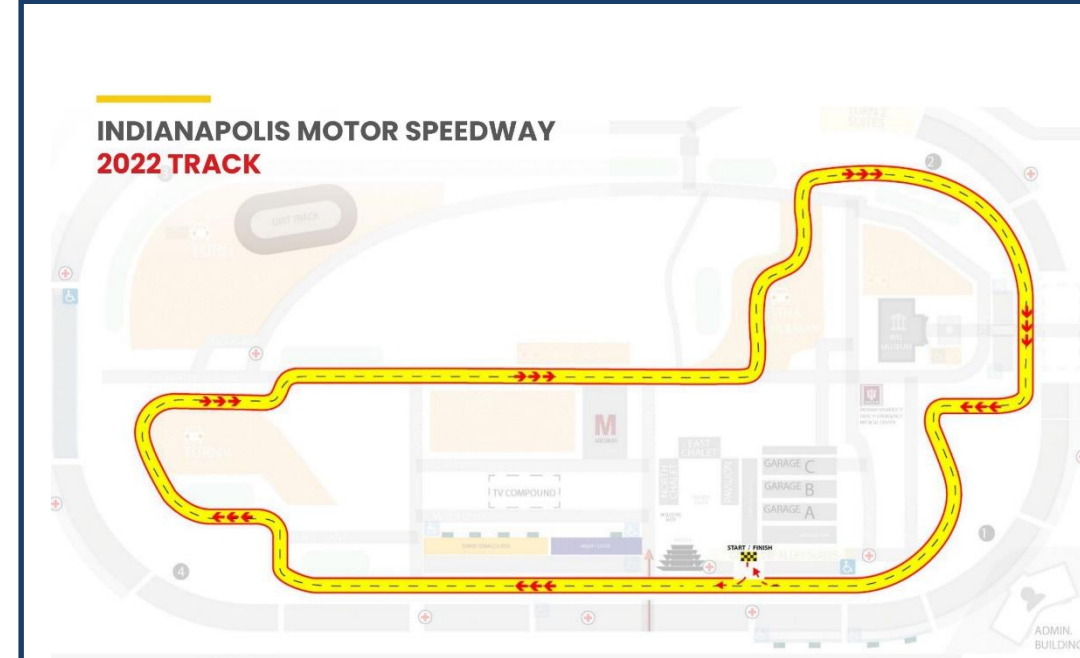
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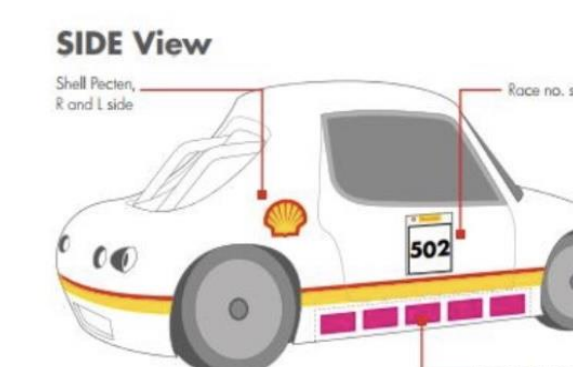
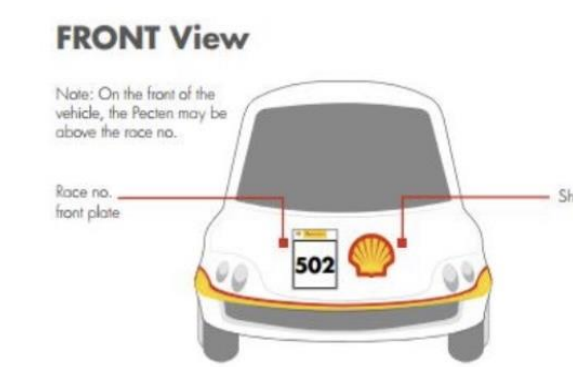
Abstract

Five mechanical engineering seniors designed, built and test an electric car for the Shell Eco-marathon. This electric vehicle was designed and built for the Urban Concept vehicle class. This design project followed the requirements set by the Shell Eco-marathon Urban Concept electric vehicle class. The goal for this first year project was to go to competition and hopefully pass technical inspection and while the team made it to competition, ultimately fell short of the that goal. The team completed several of the subsystems required by the technical inspection teams. During the fall semester the team designed the vehicle based on the given rules and requirements from Shell. In the spring semester, the team built the designed vehicle with several iterations along the way.

Customer Needs and Requirements



URBAN CONCEPT

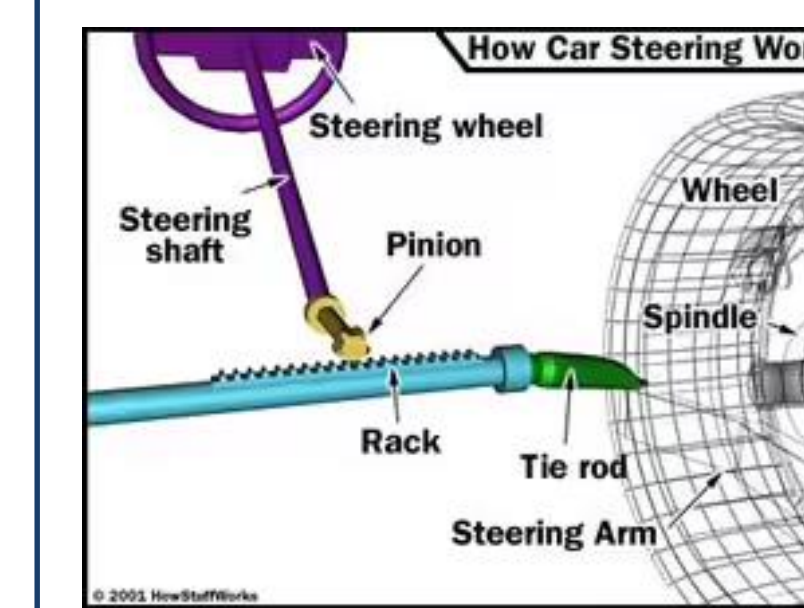


- Complete 4 laps in a maximum of 35 minutes
- Drive the course safely
- Maximize efficiency during the race

Vehicle requirements

- Two doors
- Four wheels
- Running lights
- Brake lights
- Hazard lights
- Four hydraulic brakes
- Parking brake
- Luggage compartment
- Windshield wiper
- Be able to run in wet weather
- Rims of 15"-17"
- Tire tread <1.6mm

Concept Selection

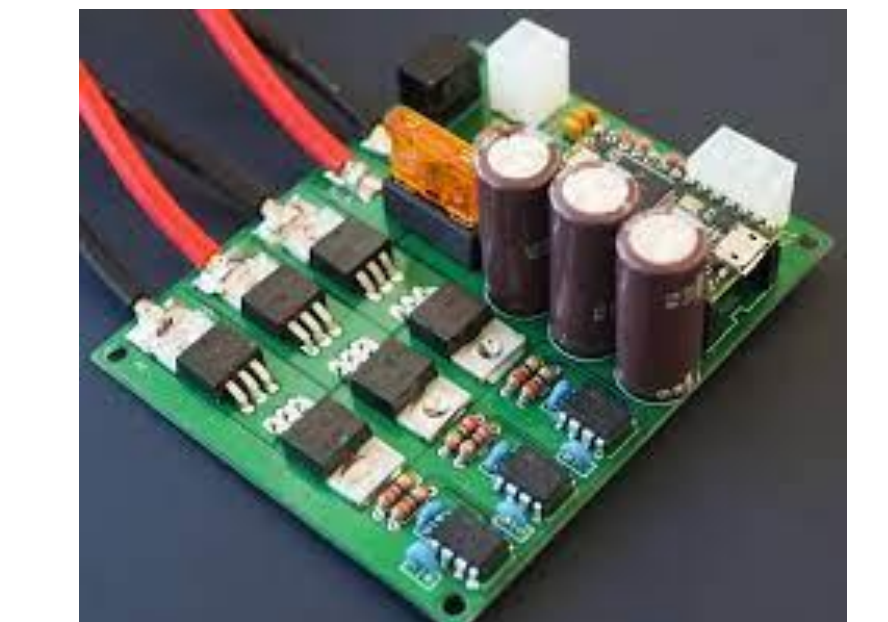


- 3kW motor
- Aluminum ladder frame
- Built battery pack

- Rack and pinion steering

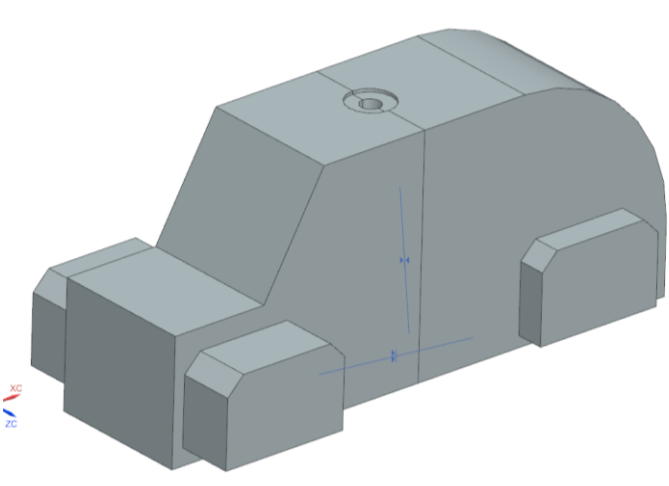


- Rear axle driving



- Purpose built motor controller
- Polypropylene shell

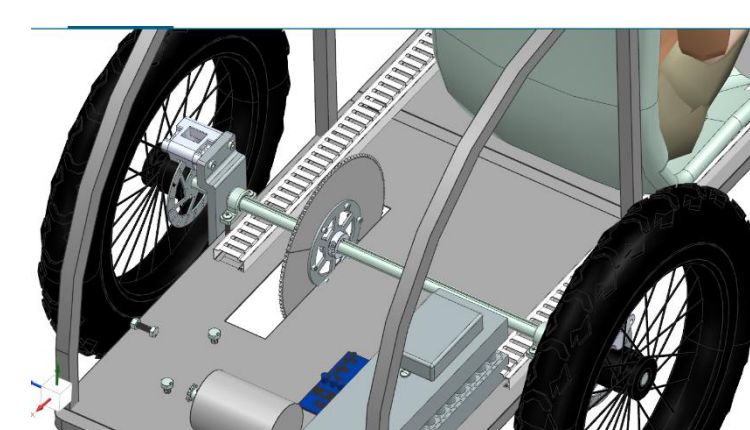
Design Solution



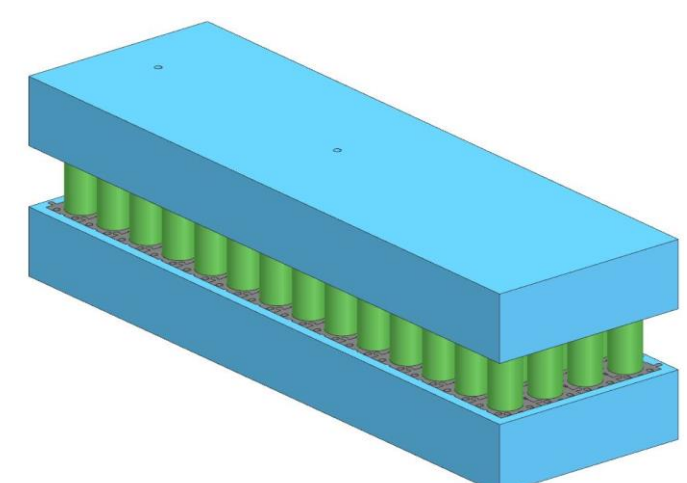
- Shell Cad



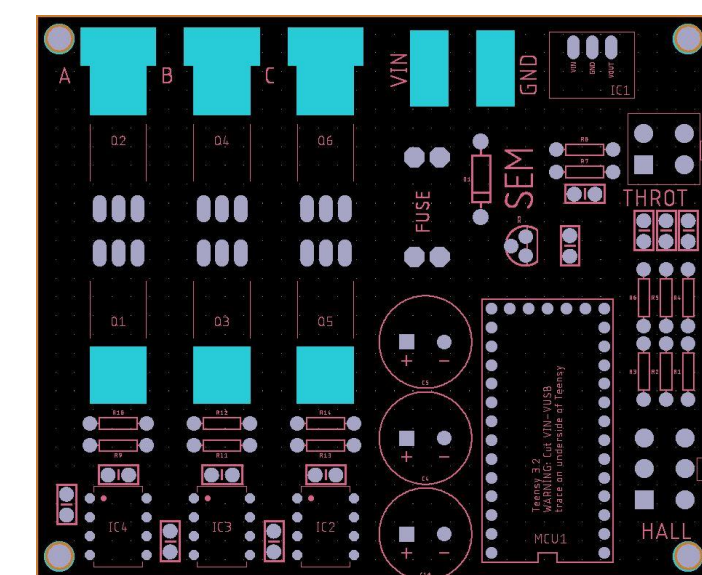
- Frame Cad



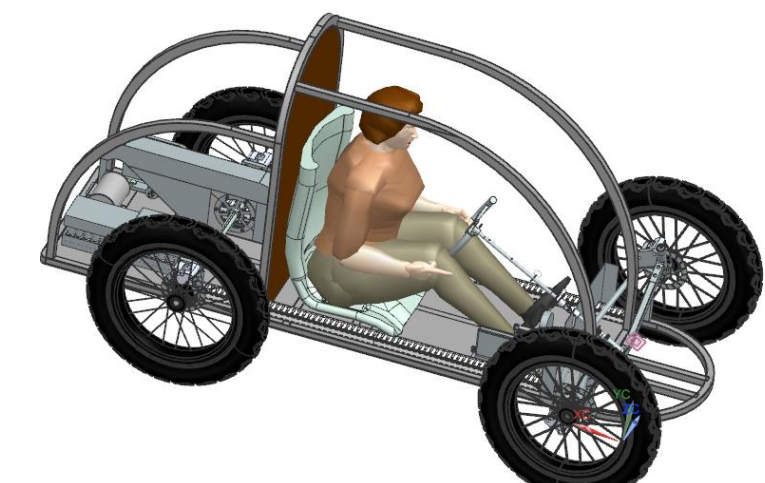
- Rear axle driving



- Battery Pack Cad



- Motor Controller Cad



- Final vehicle design

Manufacturing

Frame Construction



- Frame was constructed from 1" square aluminum tubing and with epoxy and rivets

Hydraulic Brakes



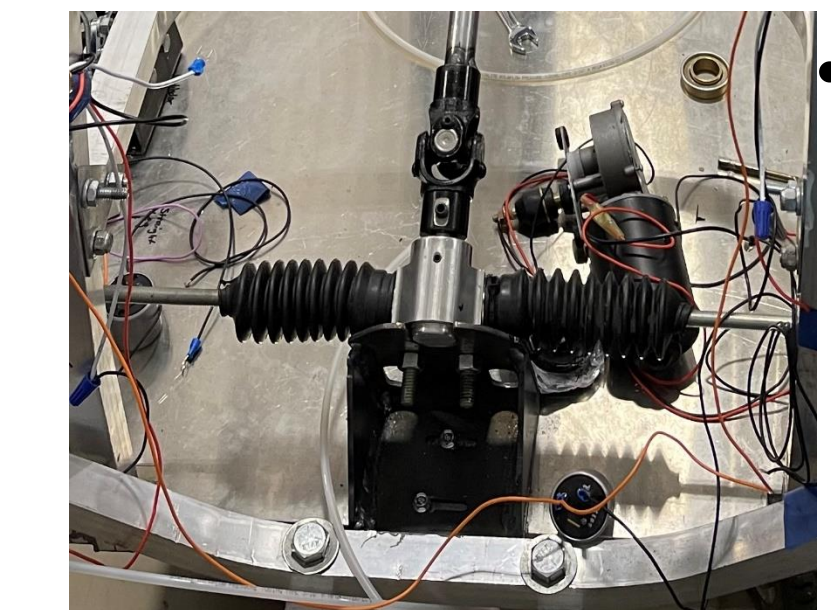
- 4 hydraulic brakes with a dual master cylinder

Shell on vehicle



- Shell construction using polypropylene sheets

Rack and pinion steering



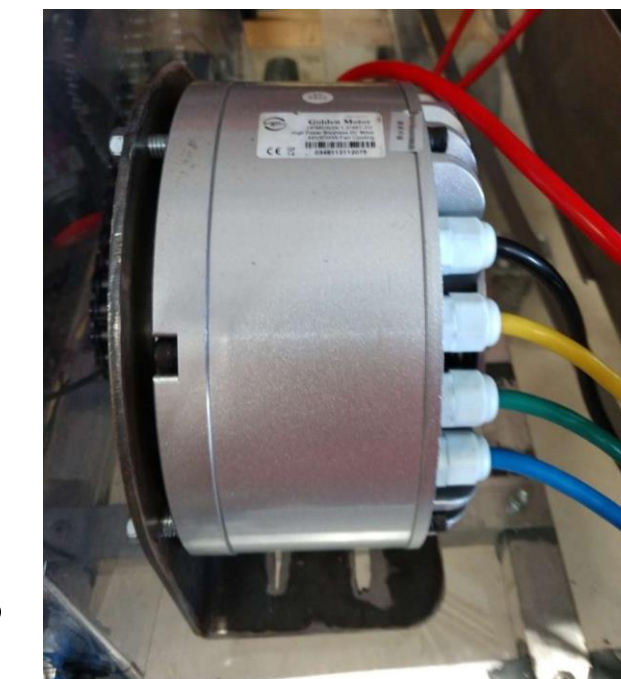
- Rack and pinion steering provides easier turning in comparison to pitman arm steering

Battery Pack



- The battery pack was built with 21700 cells and 3-D printed caps

3kW motor



- The motor drove our vehicle using a chain and sprocket system

Purpose built motor controller



- The motor controller was designed based on the Duke easy motor controller

Fully assembled vehicle



- The fully assembled vehicle is shown at the Shell Eco-marathon competition

Testing and Validation

Test 1:

- Testing the roll bar under a load



Test 2:

- Testing the hydraulic brakes on a 20% incline



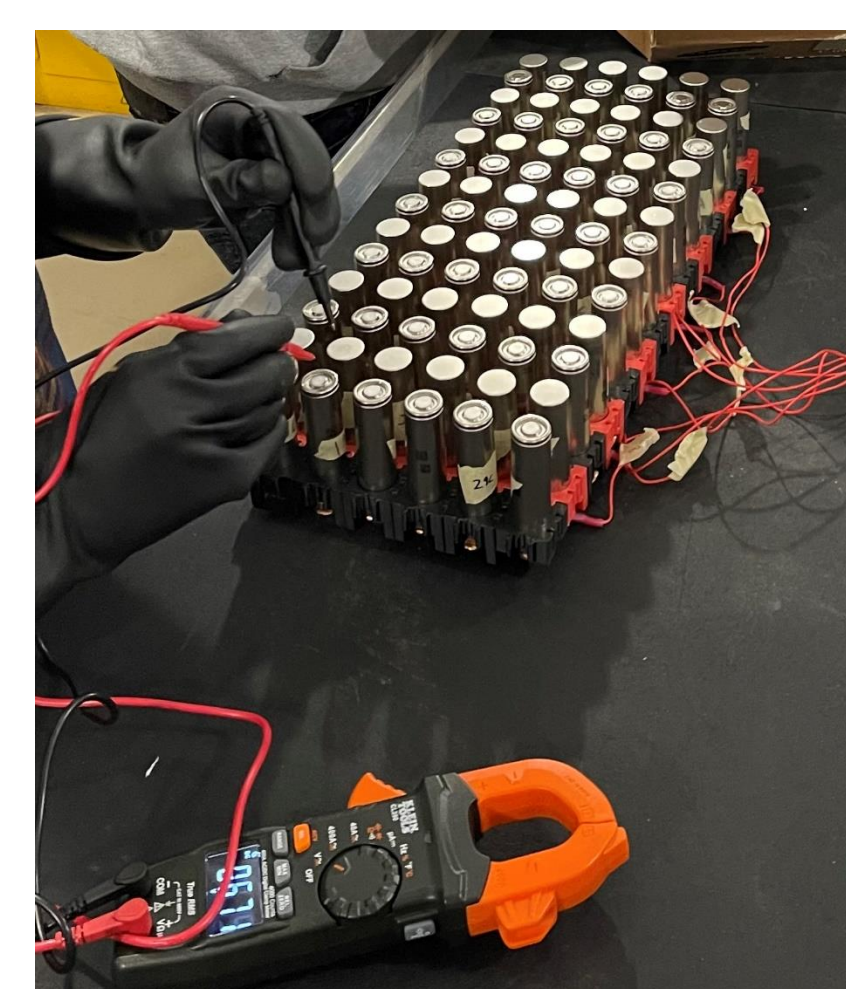
Test 3:

- Steering radius test



Test 4:

- Battery pack testing



Test 5:

- Driving testing



Acknowledgments

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