Team Eta

About Team Eta:

- The project consisted of making a highly fuel-efficient vehicle that will be used for participating in the prestigious International Design and Engineering Competition “Shell ECO Marathon” organized by the Shell Group of Companies.
- The competition’s main purpose is to challenge teams from around the world to design, build and test Ultra- Energy-Efficient vehicles.
- With annual events initiated in the United States of America, then Europe and Asia, winners are the teams that go the furthest using the least amount of energy.
- The events spark debate about the future of mobility and inspire young engineers to push the boundaries of fuel efficiency & invent new technology.

Achievements:

- Competed at SHELL ECO-MARATHON ASIA 2015 – (Overall First in India and 5th in Asia competing against 120 teams from 17 countries, Achieved a fuel efficiency of 153 km/L).

Team Eta Prototype car ARYA for Shell Eco-Marathon 2015 -

Team Eta Prototype car J-14 for Shell Eco-Marathon 2014 -

Team Eta Prototype car JUGAAD 13 for Shell Eco-Marathon 2013 -

My contribution to Team Eta

Co-founded Team Eta in 2013:

- Co-founded Team Eta with five passionate classmates to successfully execute and complete the undertaken project along with a hand-selected team of disciplinary engineers.
- Designed various automotive parts and Led the different systems throughout the three years, Participated in shell ECO Marathon 2013, 2014 & 2015.

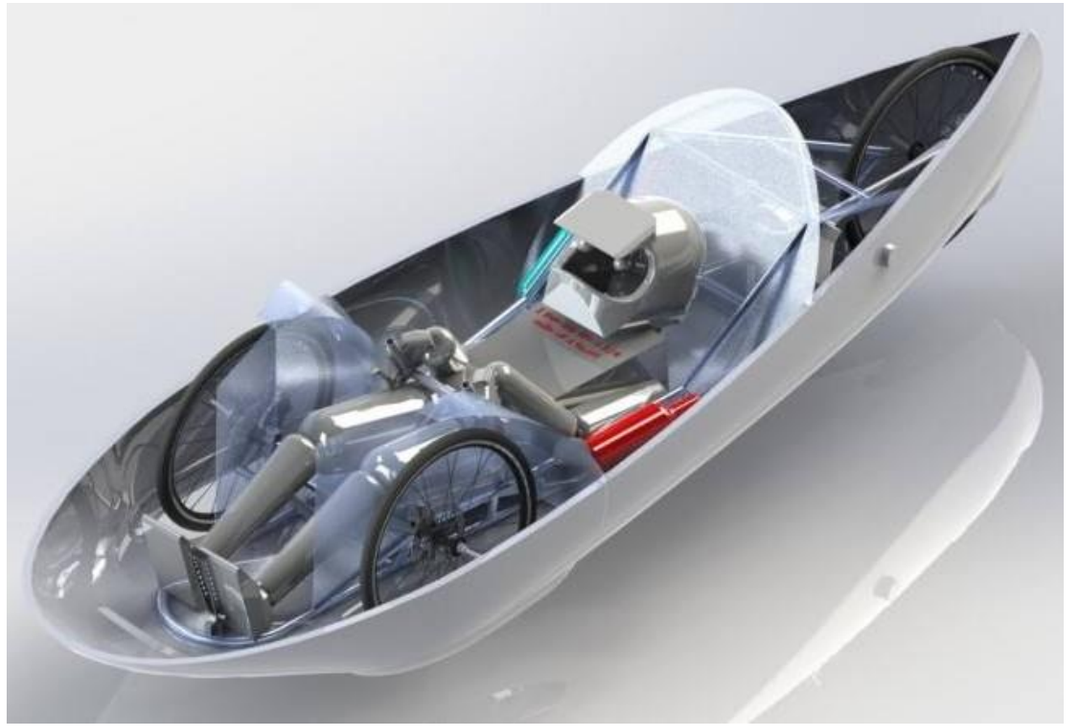
Technical Director & Coordinator (Shell ECO Marathon 2014 & 2015):

- Directed the engineering of a single seater 35cc fuel-efficient Prototype car for an Engineering Design Competition Shell Eco-marathon.
- Major responsibility was to set technical goals and design optimisation Planning for upcoming competitions, also making sure that parts designed by all team members were compatible with dependent systems.
- Lead a team of 30 students to design, manufacture and test the prototype within a timeline of 280 days.
- Collaborated with industries to develop manufacturing strategies in areas of rapid prototyping, Carbon fibre composite manufacturing, frame fixturing, CNC machining and case hardening.
- Created a test plan of 300 Km for vehicle performance tuning and verification of system parameters.
- Competed at SHELL ECO-MARATHON ASIA 2015 – (Overall First in India and 5th in Asia competing against 120 teams from 17 countries, Achieved a fuel efficiency of 153 km/L).
- Competed at SHELL ECO-MARATHON ASIA 2014 – (Only Indian team to complete all inspections and run the car on track).

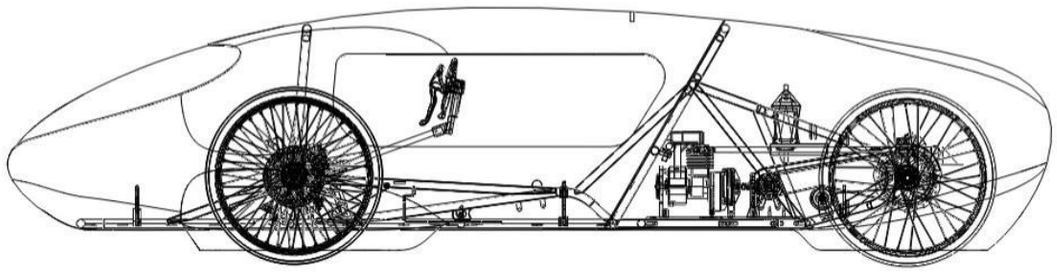
CAD Design & Manufacturing Drawing Manager (Shell ECO Marathon 2013, 2014 & 2015):

- We had a special sub-team for designing subsystems of the Car for example Chassis, Drivetrain, Power train, steering, Suspensions, and Breaks. The responsibility of the CAD manager was to make sure that parts were designed by all sub-systems and fit onto the chassis and with other parts.
- Responsibility also included making assembly drawings and BOM.

J-14 CAD Design for Shell Eco-Marathon 2014 :



Arya CAD Design for Shell Eco-Marathon 2015 :



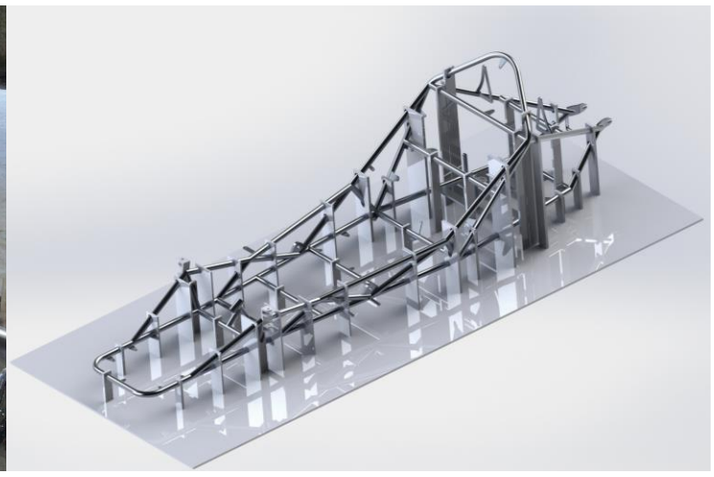
My contribution to Team Eta

Chassis Team Lead (Shell ECO Marathon 2014 & 2015):

- Led a team of two students, analysed different aluminium grades (6061-T6, 6063-T6) and incorporated manufacturing technologies such as laser profile cutting, tube bending and fixture design to fabricate a space frame chassis.
- Designed and developed an ergonomic and lightweight space frame chassis using SolidWorks and structural simulations on ANSYS.
- Incorporated a side geometry that enhanced load distribution and reduced material.
- Increased number of Bent pipes to reduce the number of joints, after annealing of aluminium pipes bending was done followed by Tempering (T6) to achieve high strength.
- Lowered the centre of gravity by 5% which allowed lateral accelerations.
- Developed fixture setups that allowed the manufacturing of pickup points on the frame within an error of 1 mm, verified using a coordinate measuring machine.
- Reduced the frame weight by 20% with a 9% improvement in stiffness in 2014 as compared to the 2013 design.
- Reduced the frame weight by 6% kgs with constant stiffness in 2015 as compared to the 2014 design.

Chassis & Fabrication Fixture Design Shell Eco-Marathon 2015 :

Chassis & Fabrication Fixture Design Shell Eco-Marathon 2014 :



My contribution to Team Eta

Composite team member (Shell Eco-Marathon 2015):

- Key member of the composite team. Functioning as a key member of the Composites Team which made a noteworthy 30% weight reduction of the new prototype designed compared to the year 2014 by analyzing and using carbon fiber in place of glass fiber through a unique process developed in-house for making Vacuum bagging possible (Picture 4).
- The car's outer shell was made using glass fiber & epoxy-based resin composite.
- Worked in manufacturing planning, Material selection and sourcing of advanced materials over the globe.
- Pattern was made of CNC machined from 50mm Thick MDF pieces glued together.(Picture 1 & 2)
- Mold was made using glass fiber and polyester resin(Picture 3) and the outer shell was manufactured from two layers of 100GSM Carbon fiber and **ROHACELL** foam to make the carbon fiber shell stiff (Picture 5).

1) Pattern Machining from MDF:

2) Fixing patten parts and finishing the pattern:

3) Glass fiber Mold Making:

4)Vacuum bagging for the final Carbon fiber part:

5) Carbon fiber Car shell for Shell Eco Marathon 2015:

My contribution to Team Eta

Transmission Design Lead (Shell ECO Marathon 2015):

- Designing a completely new drive train mechanism based on the planetary gearing & and timing belt system.
- Considering the motor torque output and torque required at the wheel designed a transmission with a reduction of 32:1
- Optimized Chassis Mounting to get accurate location of Transmission Components.
- Drive-train components were machined from solid aluminium.

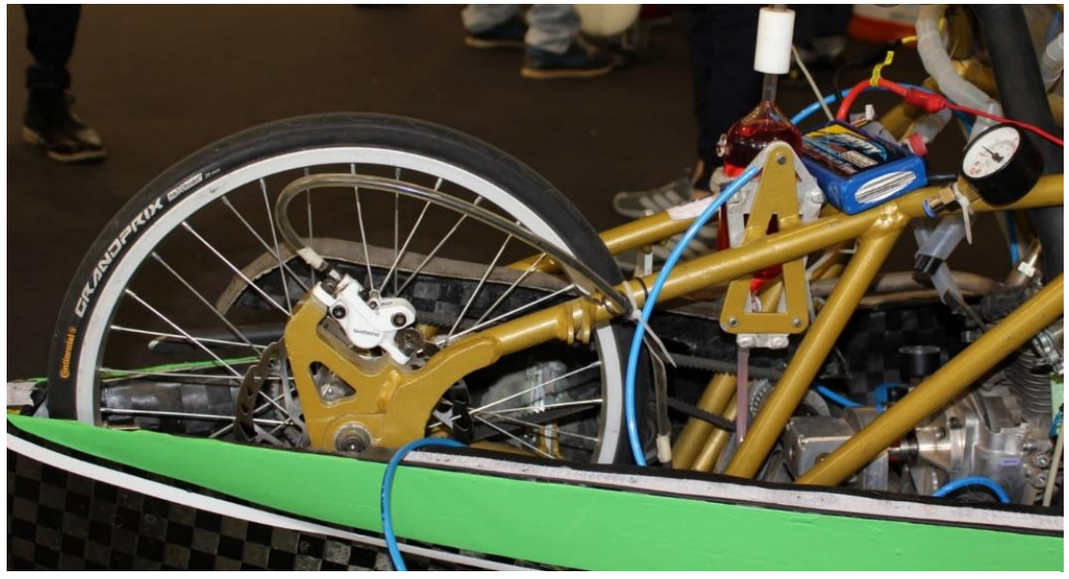
Conversion of crank start engine to Electric switch start (Shell ECO Marathon 2015):

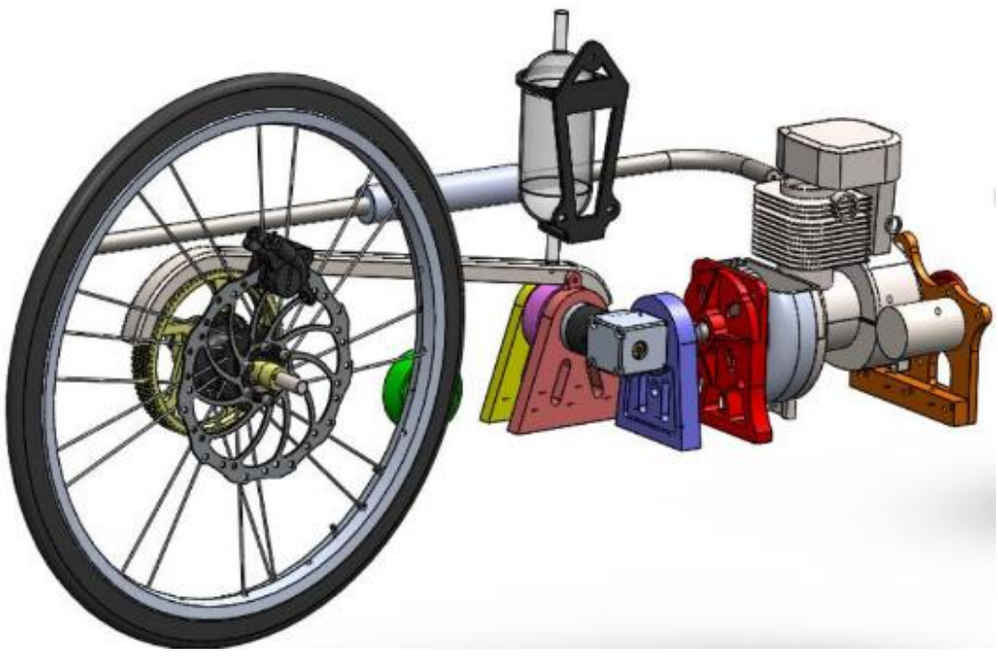
- We used a Honda GX35 engine for powering the car, The engine comes with a hand crank for starting the engine.
- I did a calculation of the starting torque required for the engine and designed a gear reduction powered by an electric motor to make it switch start**.**

Steering system Lead (Shell ECO Marathon 2013):

- Designed steering system for Shell Eco-Marathon 2013 Car, the main objective is to decrease the energy loss due to wear and sliding of tyres when cornering and also to design a responsive and smooth steering mechanism considering ergonomics.
- After calculation decided to go with Ackerman geometry with tie rod steering mechanism.

Transmission Design for Shell Eco-Marathon 2015:





Honda Engine with hand crank :

Engine with an electric start:

Auto disengagement clutch design (BE Project)

Problem:

- When a vehicle is not accelerating and the engine clutch is disengaged from transmission Because the wheel is still connected to the gearbox there is an energy loss due to the rotation of the gearbox and belt drive.
- The aim was to design an auto disengagement clutch to address this issue and install it in Team Eta 2015 Prototype car to enhance efficiency.

Approach:

- I wanted to design a clutch that can disengage the wheel and transmission when the engine is disconnected from the transmission and does not require any external power source.
- Also it should be as small to fit on the wheel hub.

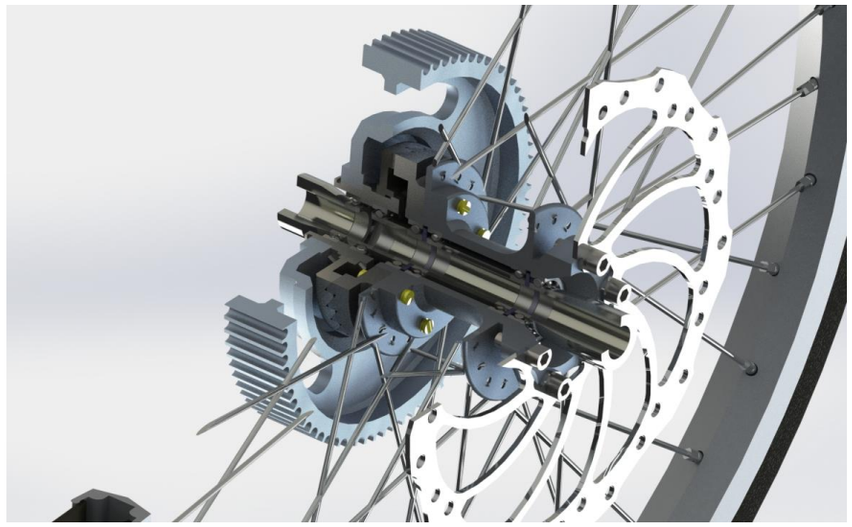
Solution:

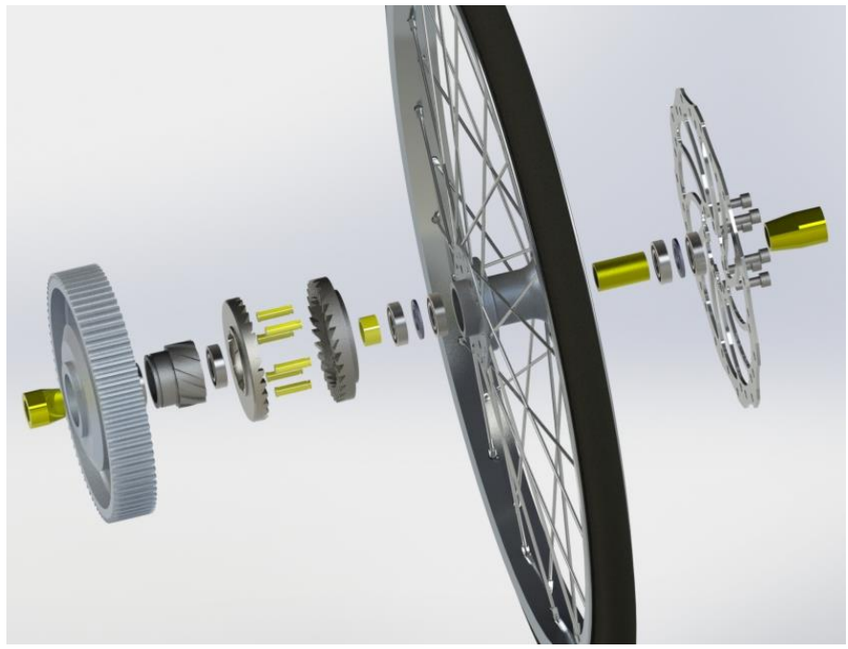
- Designed a clutch system that works on the principle of inertia, friction angle of threads and using clutch teeth similar to dog clutch.
- Reduced the system losses by adopting a unique/customized mechanism for the rear wheel, further improving coasting and efficiency by nearly 48%.

My Role:

- Conceptualization
- CAD & Production drawing GD&T
- Design for Manufacturing & Assembly
- Manufacturing from vendors
- Assembly, Testing

CAD design of clutch Shell Eco-Marathon 2015:





Static analysis of clutch components Shell Eco-Marathon 2015: