Eco-Friendly Mobility Solution For The Future

Project 3

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Eco friendly mobility

What is Mobility ?

Mobility is the state of being in motion.

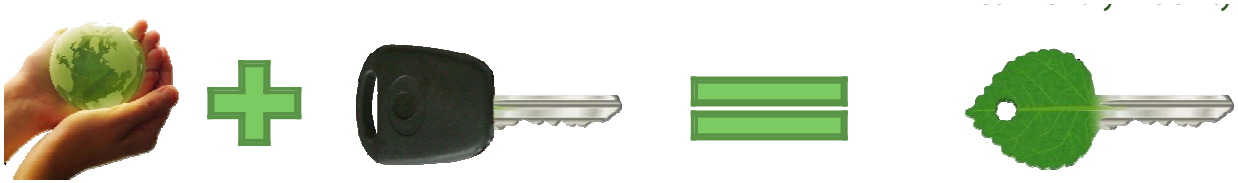
What is Eco friendly ?

Environmentally friendly, eco-friendly and nature friendly are synonyms used to refer to goods and services considered to inflict minimal or no harm on the environment.

Eco friendly mobility

Refers to mobility solutions which

- Produce no toxic emissions
- Run on renewable energy source



Transport scene in India

Transport scene in India

Mobility in India

Family	Personal	Public	Goods

Family and personal transport vehicles

This category is further divided into two sub categories i.e two wheelers and four wheelers.

Two wheelers are classified into Mopeds, scooterets, Bikes.

In India we have cars in various shapes and sizes which are further classified into four segments. A segment, B segment, C segment, D segment.

Vehicle occupancy survey :

The number of vehicles on road is incerasing day by day.

The reasons:

- Increase in household income
- Increase in commercial and industrial activities
- Availability of cheap motorized transport solutions
- Improvement in road transport infrastructure
- Attractive finance schemes

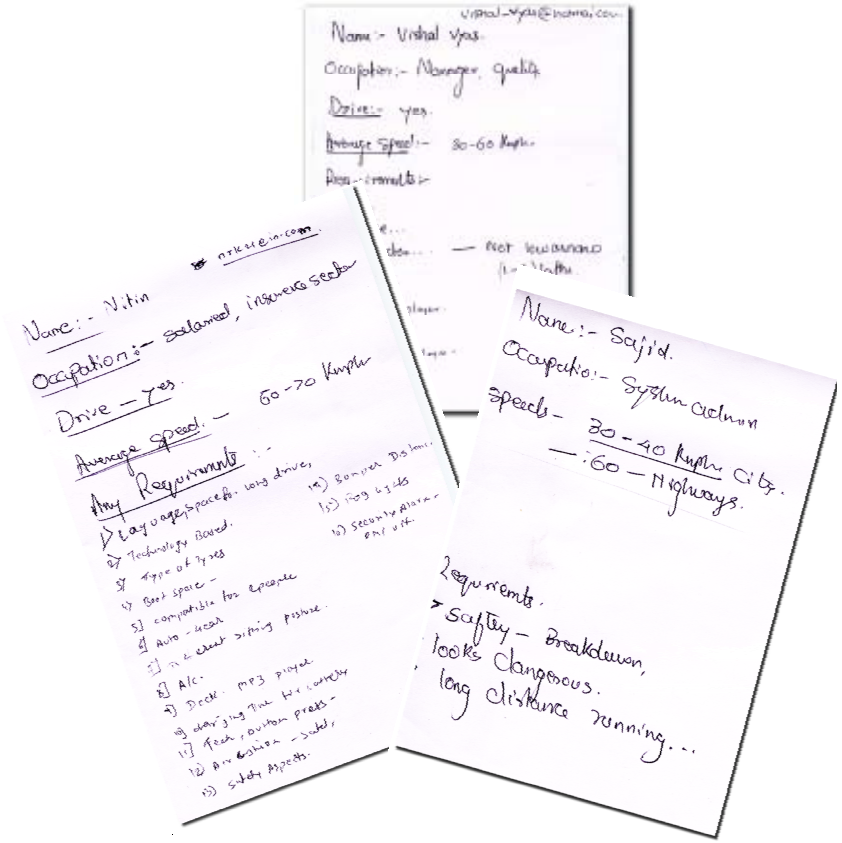
With the increase in number of vehicles, car occupancy has gone down.

Car occupancy varies greatly with the purpose of the driver's journey.

Average number of people per car journey has become about 1.6.

User study

Working class people were interviewed, the users contained a significant number of 2/4 wheeler users.



Comparison 2/4 wheelers

- A car can carry 4 people comfortably.
- It's a enclosed metal structure which provides better saftey.
- A car acts as a status symbol
- Comfort level is higher compared to 2 wheelers.
- Provides protection from heat, dust, rain
- Has more storage space.

- A bike can carry 2 people comfortably.
- It is highly manuverable in city traffic
- Parking is very easy in least possible time
- Has very less foot print
- Fuel economy is higher
- Purchase cost is lower
- Lower maintenance and operating costs

Inferences

- Small cars are preferred for city travel.
- Bikes provide better manuverability with fuel economy and can be easily parked in minimum space.
- Some people use 'rickshaws' for daily commuting.
- People plan their journey by thinking about the parking scenario they will be facing when they reach their destination. Hence parking ability of a vehicle is a key point in making the choice for a vehicle.
- Cars provide a enclosed structure which has lot of benifits like safety, protection against dust, heat, rain etc.
- Car is considered as a status symbol.
- A car offers a higher level of comfort as compared to a 2 wheeler.

Requirements for the future

Most important requirement for the future are mobility solutions which

- Produce no toxic emissions
- Run on renewable energy sources

Eco-friendly mobility solution
Challenges for the project

Go Green

Eco-friendly drivetrain

Affordable

Low maintenance

Reliable

A new vehicle platform

Easy to maneuver through cojested roads

Reduce parking space & time

Small and compact

Better driving interface

A new approach

Using appropriate technology

To lower running costs

Use of alternative materials

Design for mass production

Design Brief :

To Design a mobility solution to carry maximum 2 adults.

It must run on a eco-friendly platform.

The targeted users will be office going people who will use this car in city limits.

The vehicle should be able to quickly maneuver the city traffic.

It must be designed to park in least time, and occupy minimum possible foot print.

World Scenario

Toyota i real

Uno bike

Segway

Suzuki pixy

Toyota swing

Nissan PIVO 2

City car

Peugot future car

Smart city car

Indian scenario

Our current Indian market has two vehicles which run on BEV platform. These are the REVA car and the Chinese electric two wheelers.

Electric bikes

Reva

Benchmarking

Nissan Pivo 2

Suzuki pixy

Reva

Concepts like Nissan Pivo2, Suzuki pixy have set a strong benchmark for city mobility vehciles.

When Compared with the vehicles from the International market Reva car lacks in the features presented by the international vehicles. It also does not make a impressive style statement as it looks old styled and more towards a traditional car.

Smart city car

Peugot future car

Important Requirements

Closed exteriors----protection from dust, rain, sunlight

Easy to park----as lot of time is wasted in parking a vehicle

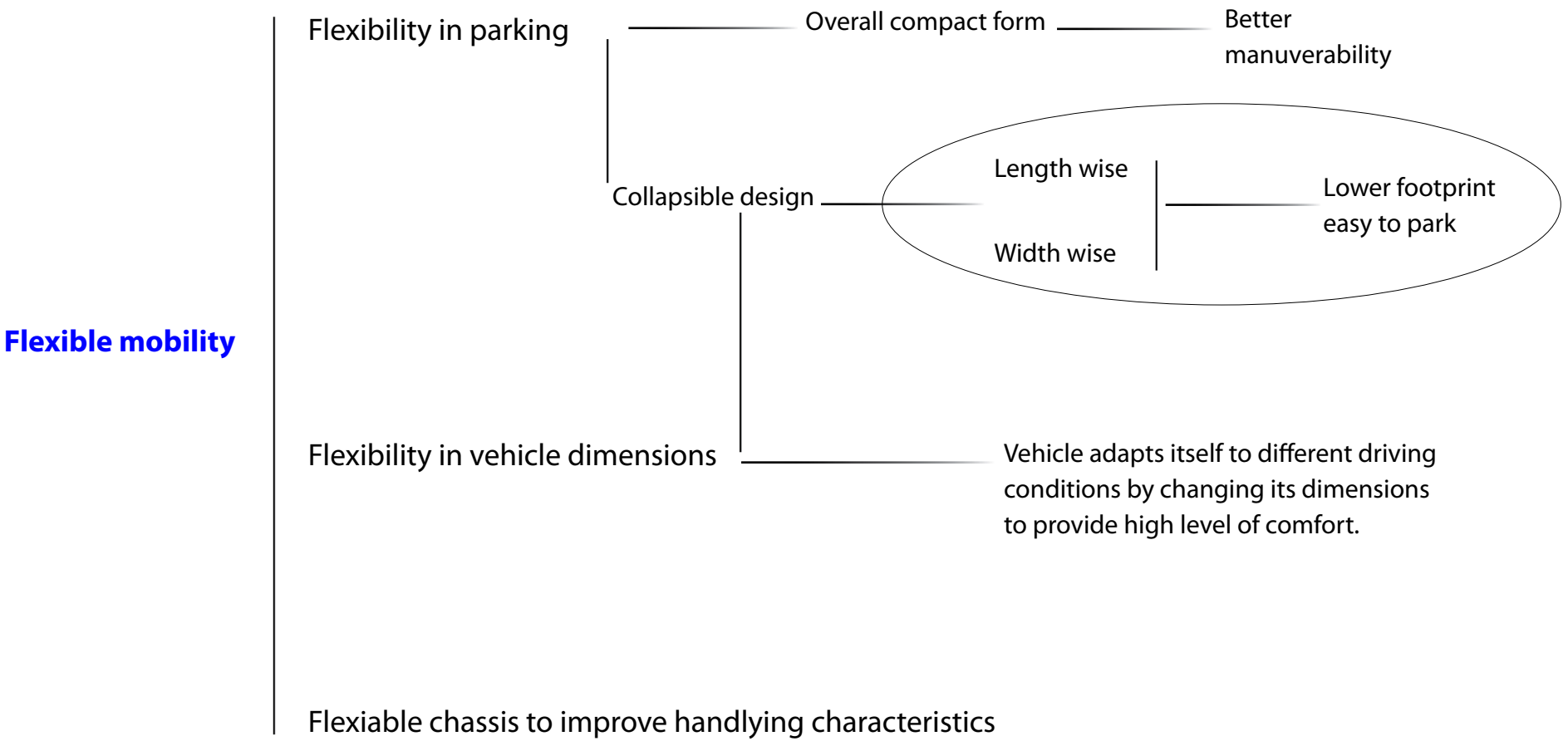
Maneuverability--- To negotiate traffic jams

A pivo2 vehicle parks it's self side ways by turning the wheels by 90 degrees. Such flexibility in parking reduces your parking time.

We require a compact design which can easily manuver through traffic and conjusted roads

Ideation

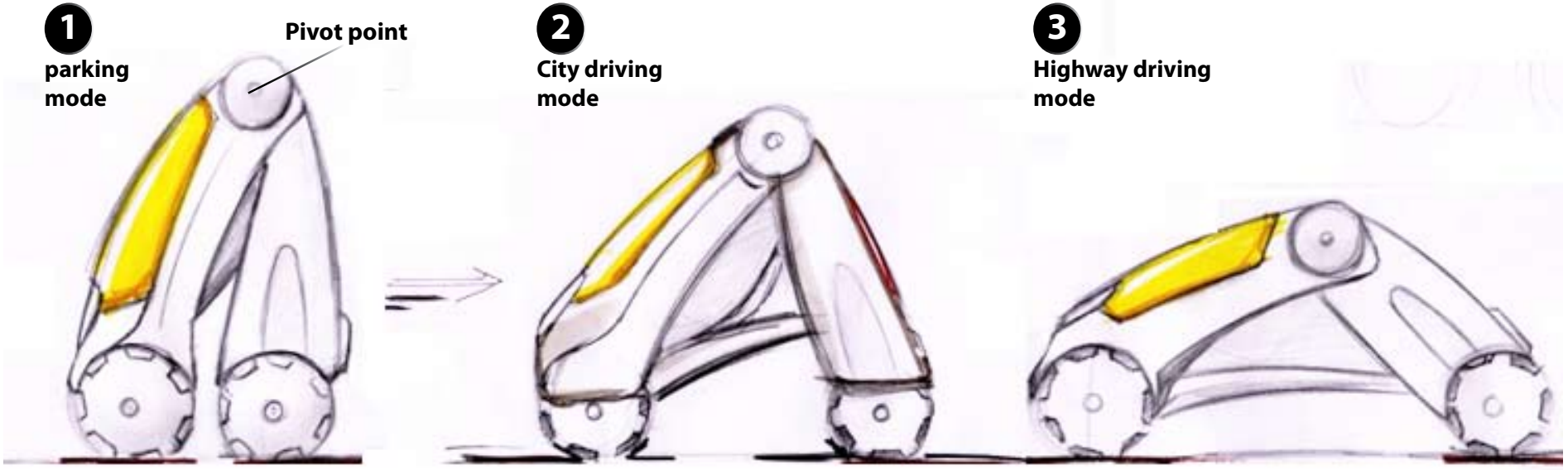
To start with the ideation process **'Flexiable mobility'** was chosen as a theme to develope the concepts.



Concept 1: Collapsible length wise

Inspirations - Inch worm, Flexible body mobile phone

In this concept the vehicle collapses lenght wise to take different forms in different riding modes providing a high level of comfort.

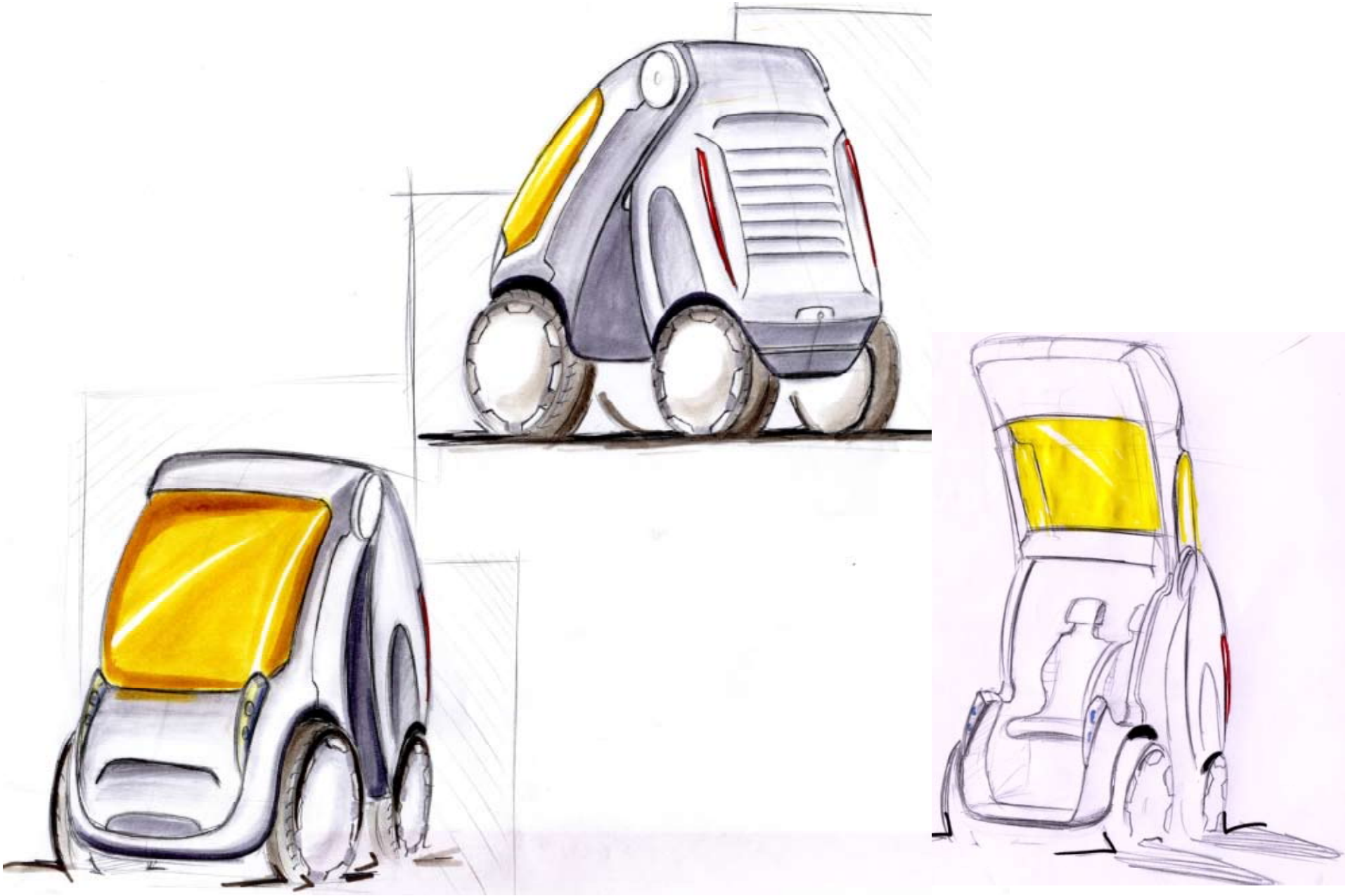


In parked condition the vehicle becomes compact to occoupy minimum footprint.

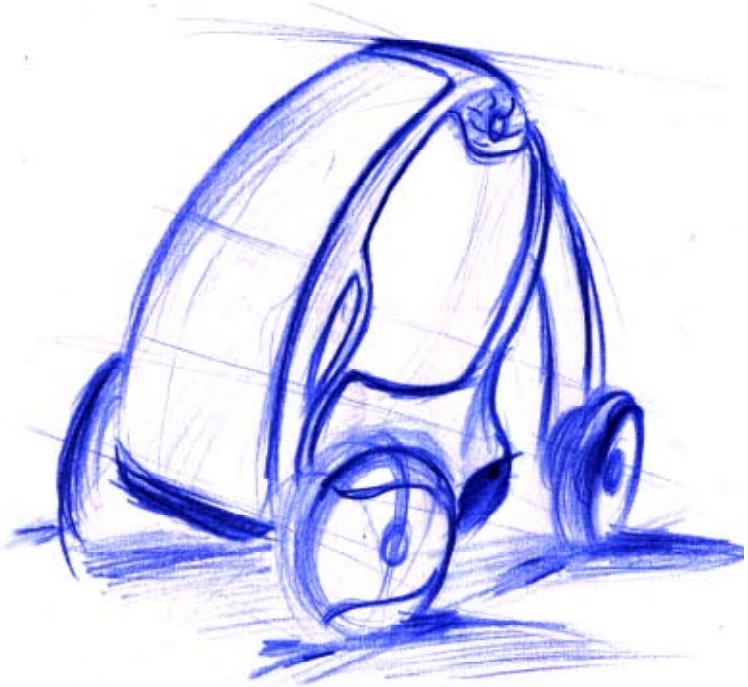
In city mode the vehicle streches so that the person sits in a more upright postre suited for everyday driving

In highway mode the vehicle lowers to provide a relaxed siting posture. with low centre of gravity.

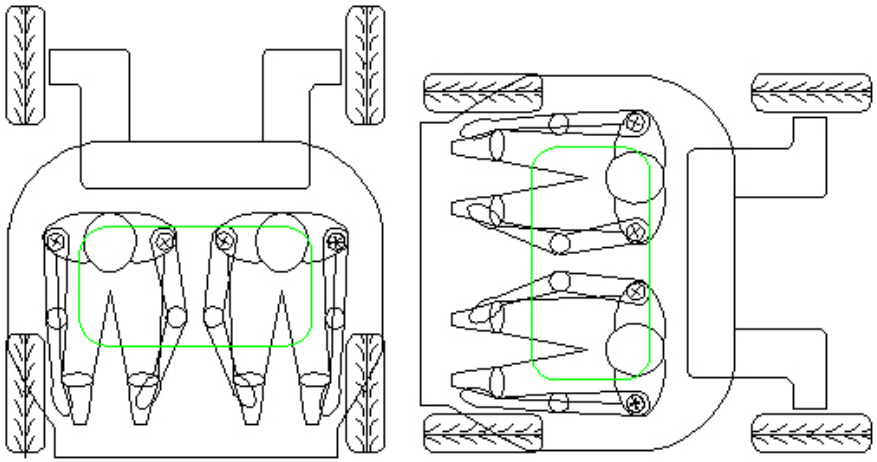
Concept 1: sketches



Further ideation styling options :



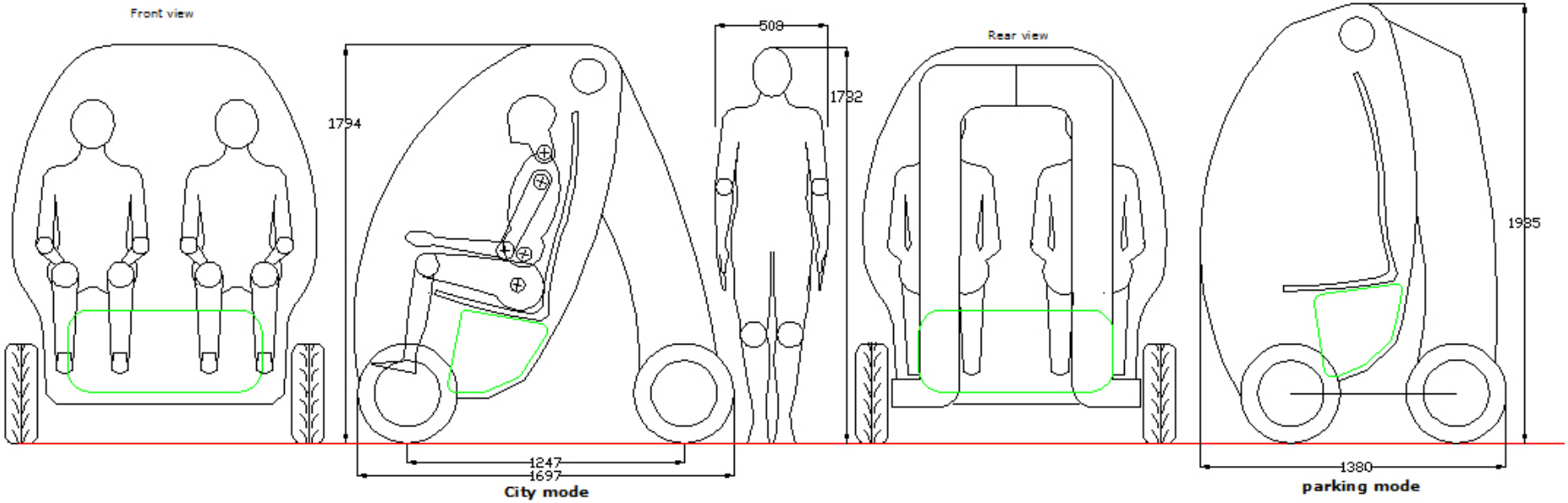
Layout and overall dimensions



Final layout concept 1
All dimensions are in mm
Scale-1:25

Battery space

95th percentile Indian male

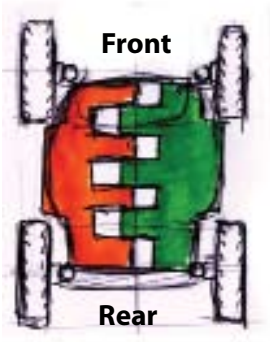


Concept 2 : Collapsible width wise

To effectively compress the car along its width its wheels can be rotated by 90 degrees inwards and then they can squeez the car along its width.

Top view

City mode
Expanded state

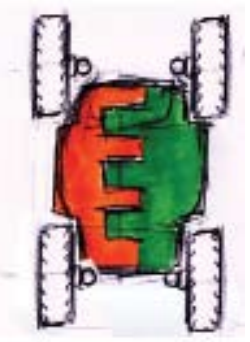


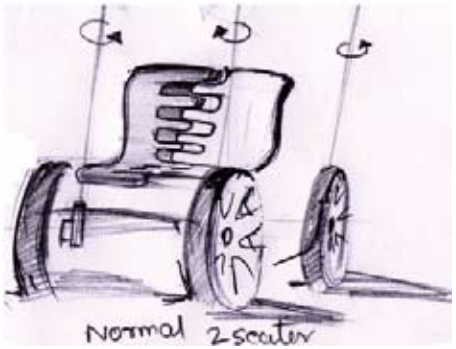
Wheels turn inwards-
Step 1

Wheels rotated by
90 degrees-Step 2

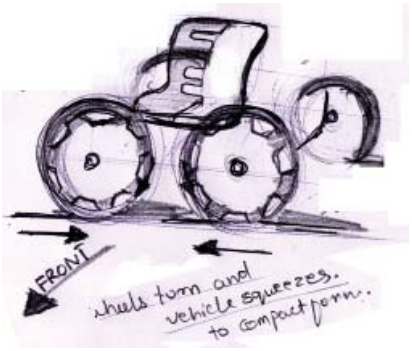
Vehicle squeezes
-Step 3

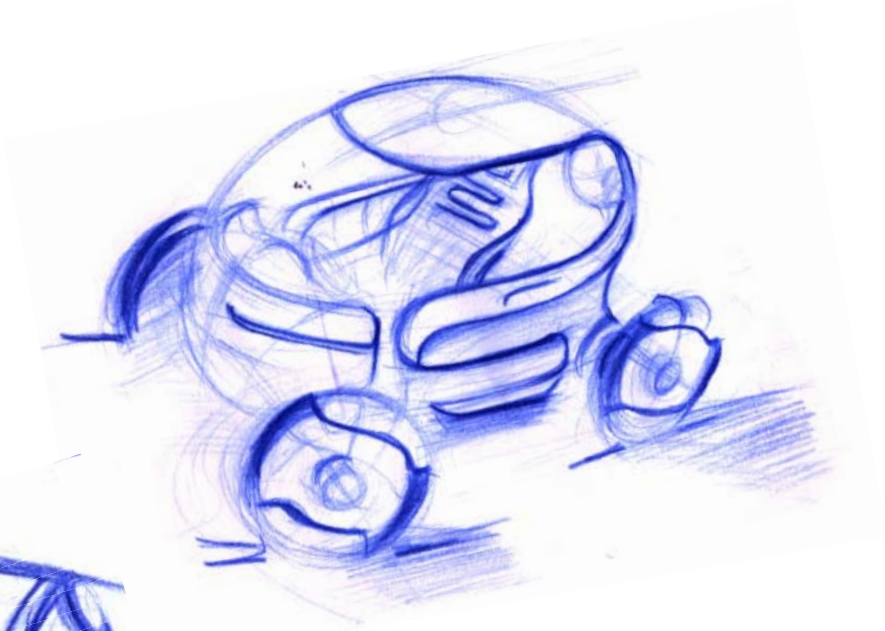
In Compressed mode it
turns into a single seater

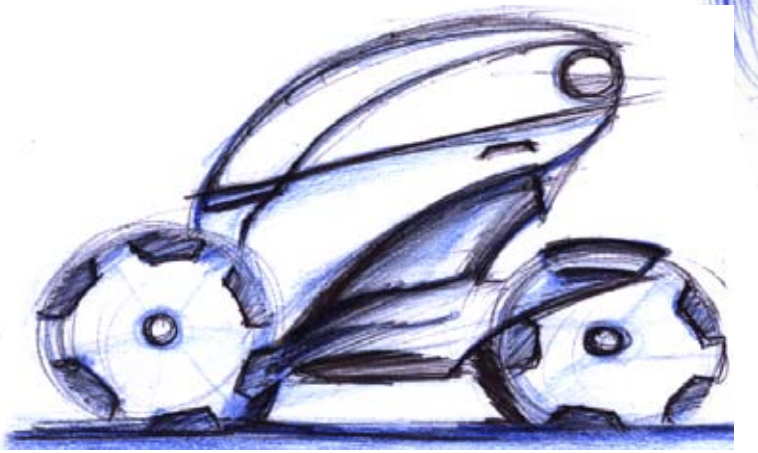




The seats also can be collapsable by having a ribbed design which meshes into each other to form a single seater from a double seater.



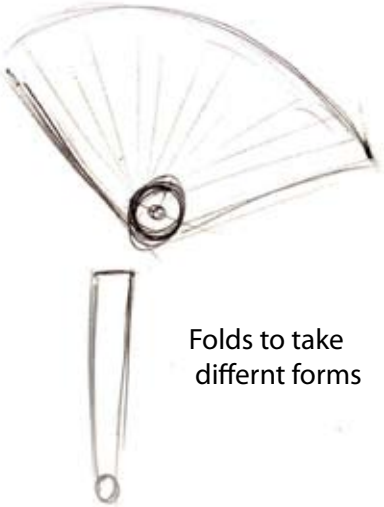




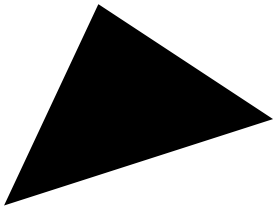
Concept 3 : Triangular platform

Ideation for collapsible designs was done looking at collapsible objects to get inspirations for my concepts.

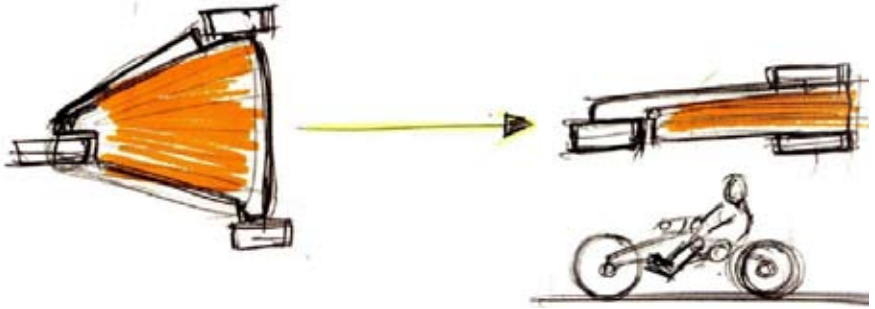
In this concept a japanese fan was used as an inspiration.



Folds to take differnt forms

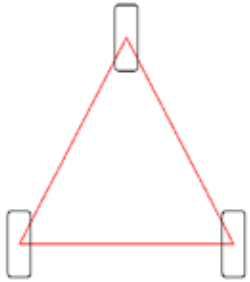


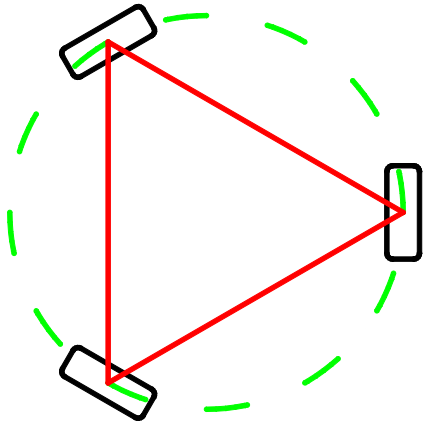
A triangular form



A triangular vehicle platform with three wheels at three corners which can fold to turn into a bike.

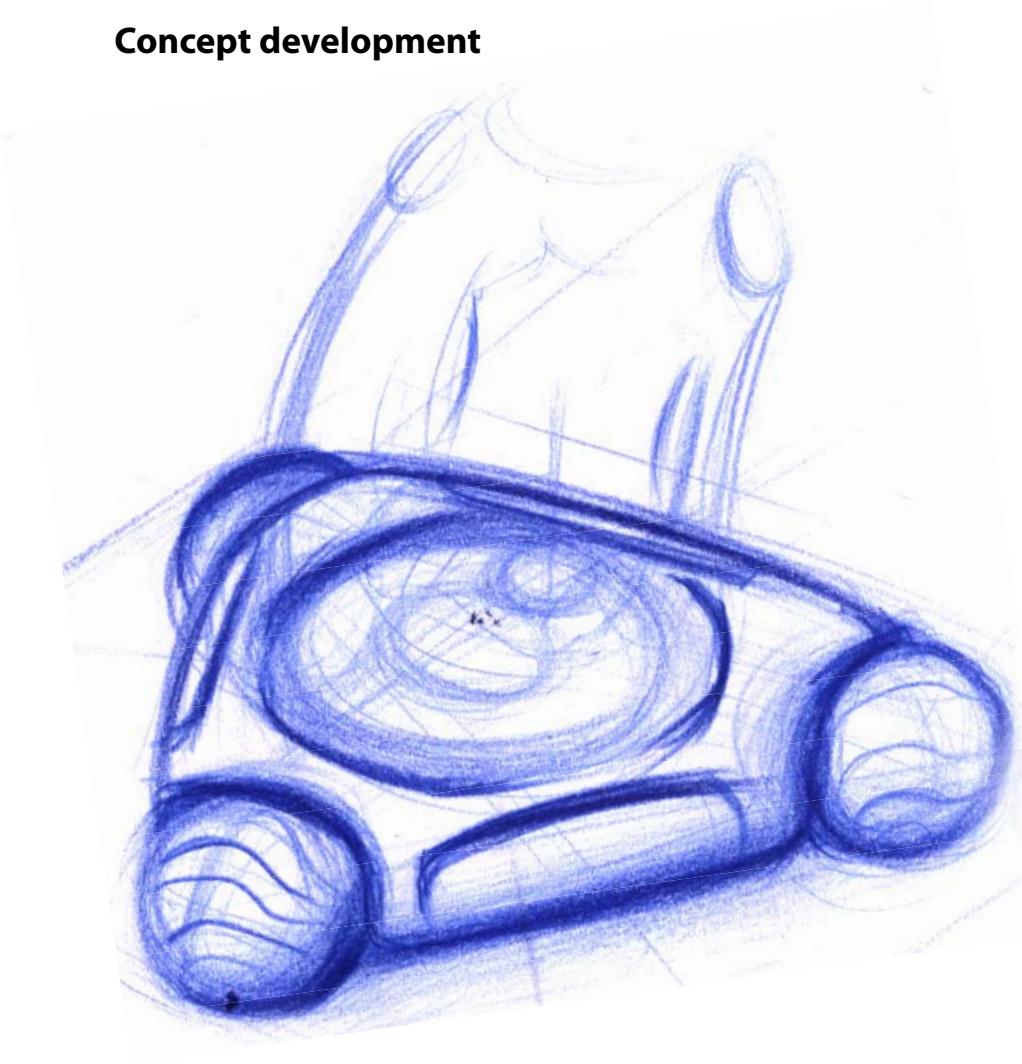
Another option was a triangular platform with three wheels at three corners.

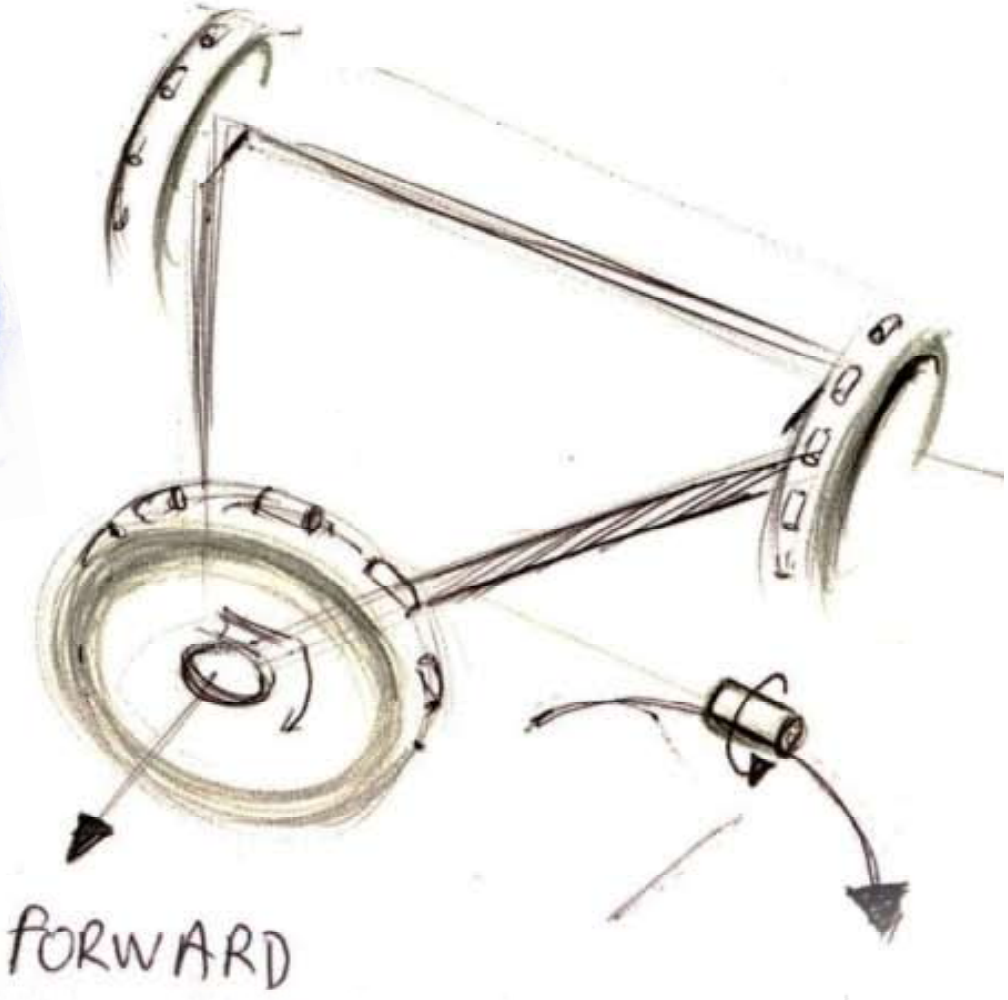




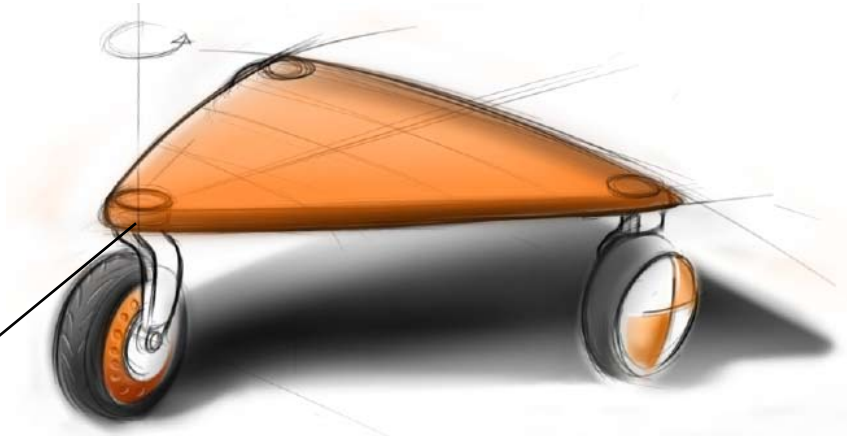
These three wheels can aligned in a circular orbit to provide 360 degrees of rotation for the vehicle at a stand still position.

Concept development

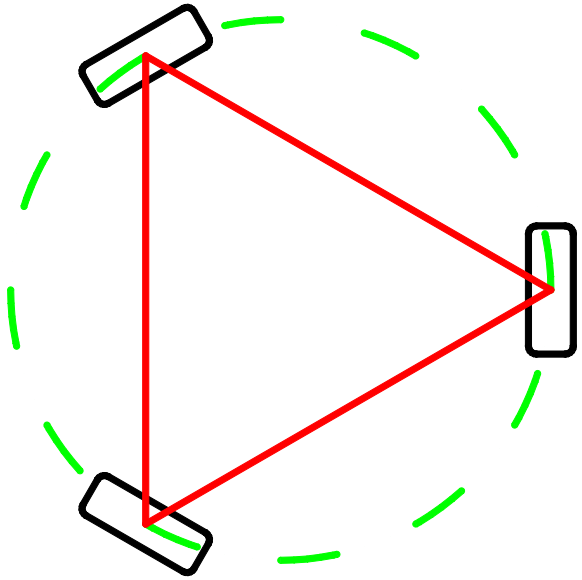


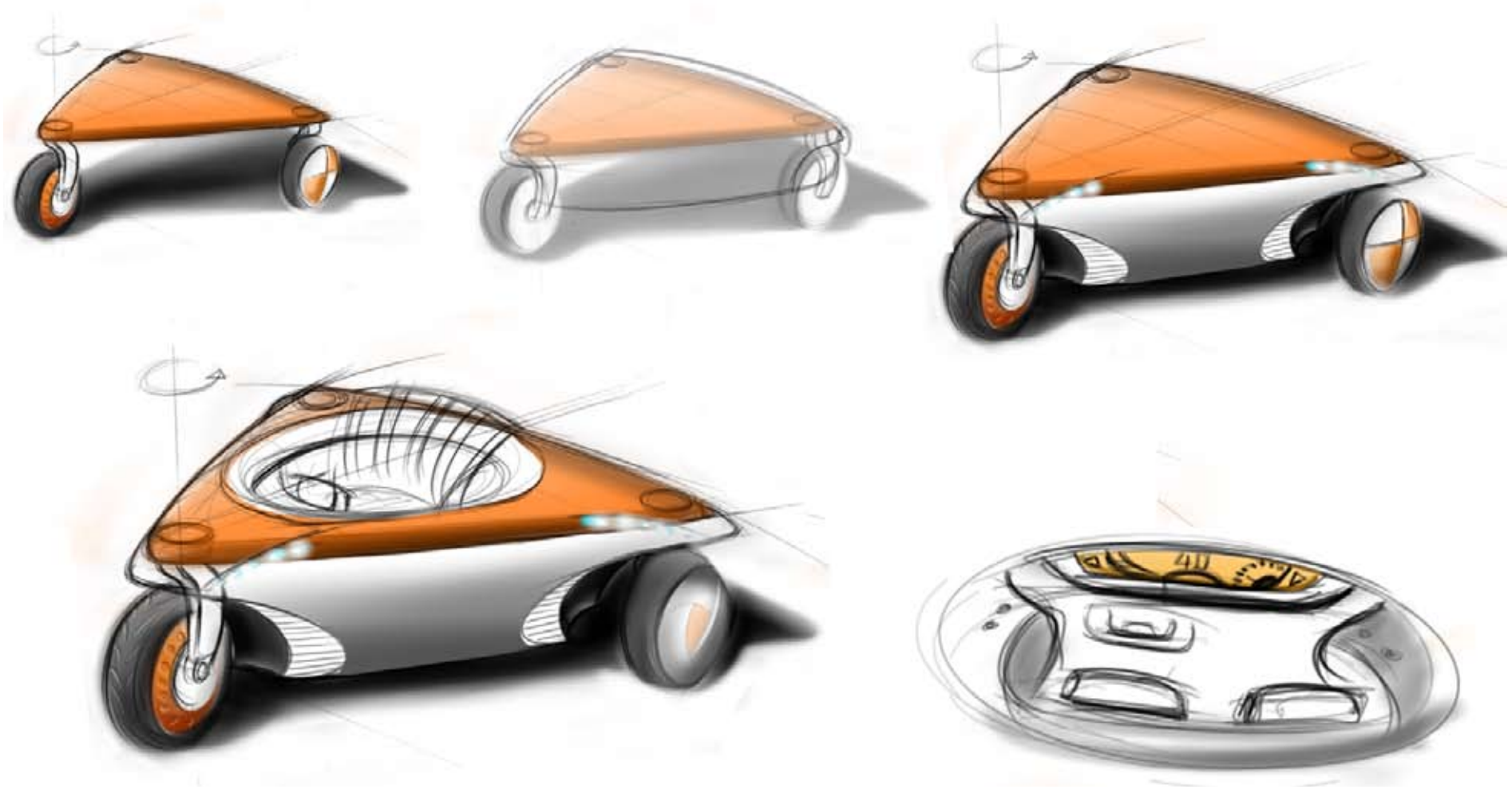


A simpler solution for omni directional movement could be achieved by looking at caster wheels.



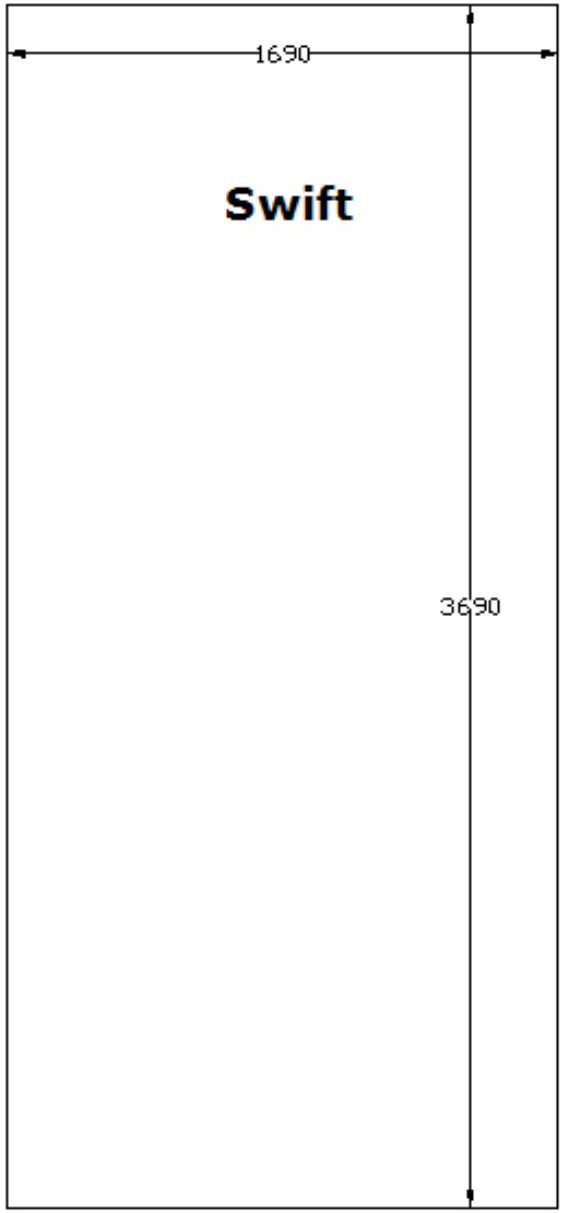
The above image shows a basic triangular platform which can be use to develope a omnidirectional vehicle.

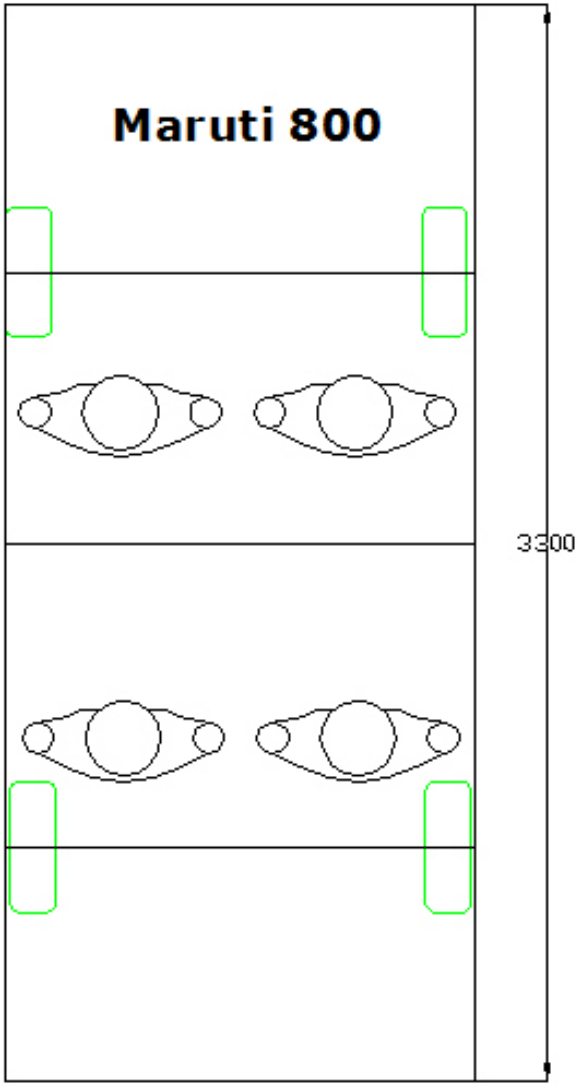




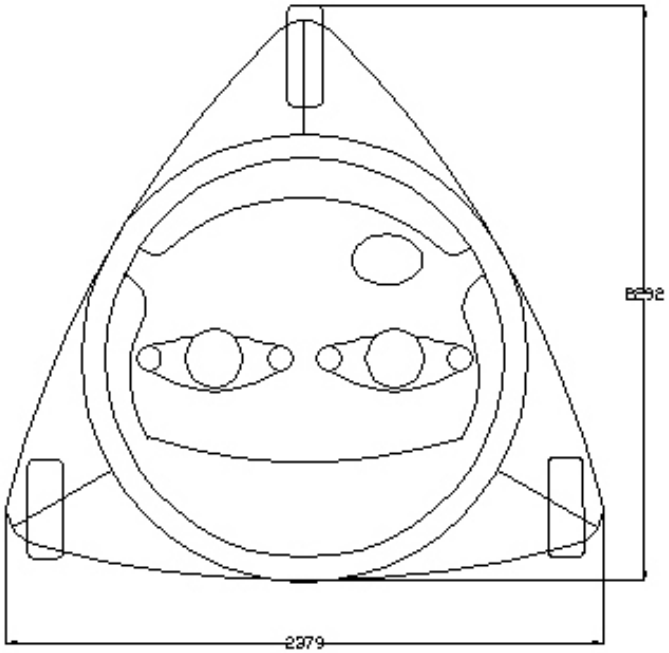
The images above show the basic concept development from a triangular platform to a vehicle with interior space to occoupy 2 persons.

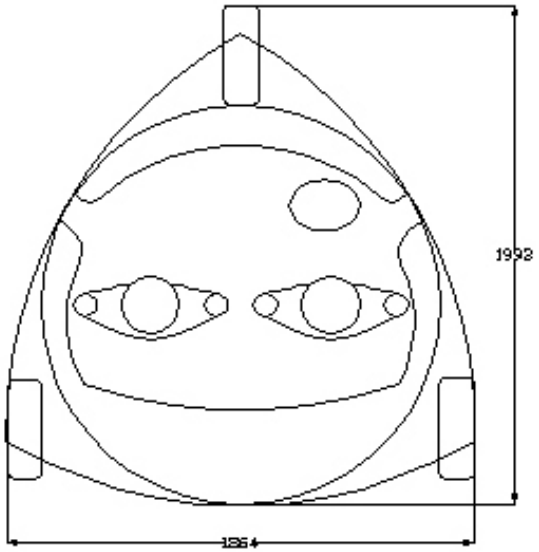
Concept development

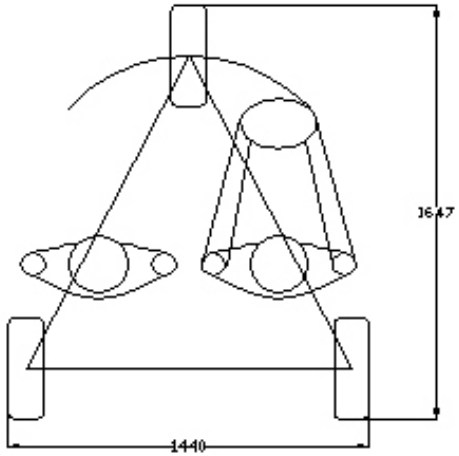


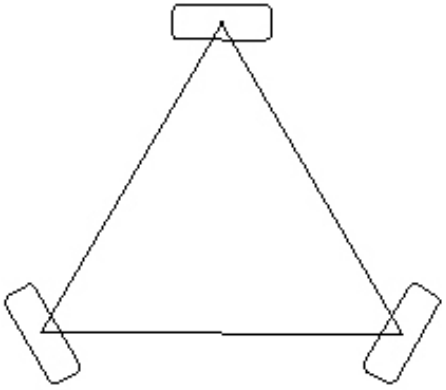


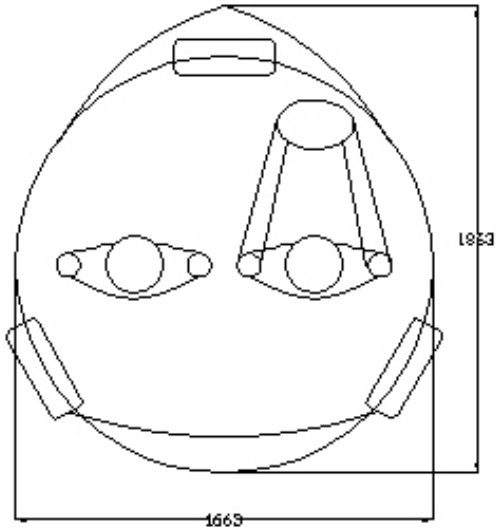
Concept 3 layout Explorations :

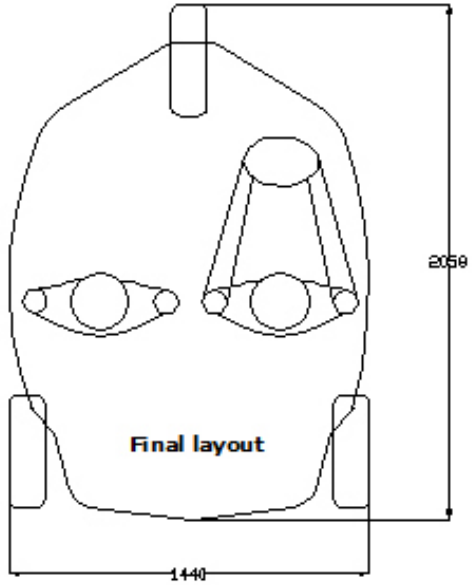








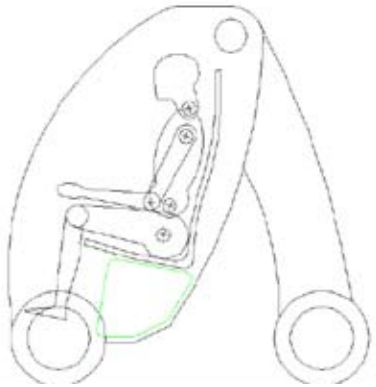




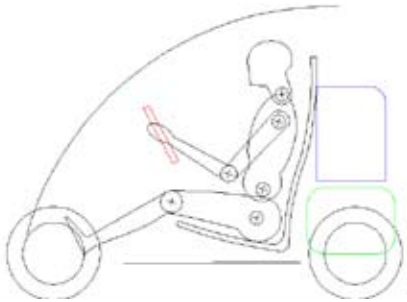
Concept evaluation criteria:

Three concpets were derived and evaluation was done to select the final concept which could be taken forward.

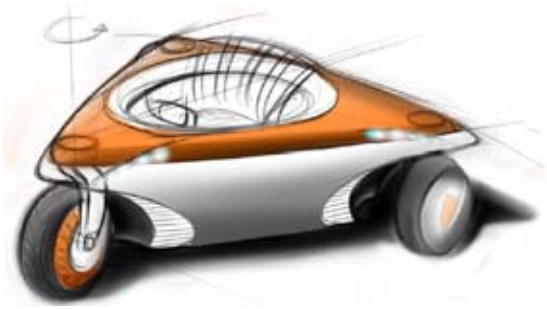
Concept 1

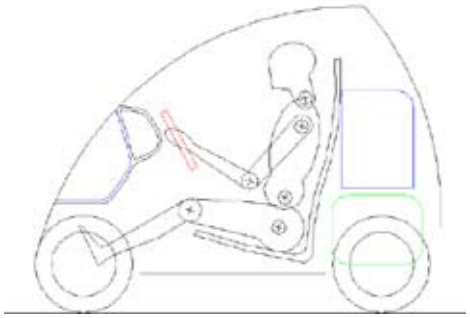


Concept 2



Concept 3





Evaluation Criteria:

Ease of parking

Minimum foot print

Concept Uniqueness

Maneuverability

Cost factor

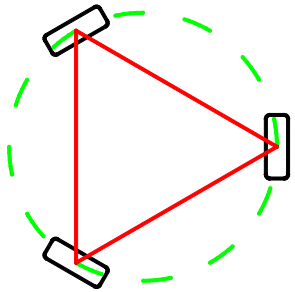
'Car*ness*'

Evaluation chart:

The concepts were graded on a scale of 1-5

Evaluation Criteria	Credits	Concept 1	Concept 2	Concept 3
Ease of parking	9	3	4	5
Minimum foot print	8	4	2	4
Concept Uniqueness	7	4	3	4
Maneuverability	6	4	3	4
'Car*ness*'	5	3	4	2
Boot space	4	2	4	3
Total		134	127	151

Key features of each concept and how they differ from one another.



Concept 3

Triangular Platform, higher manuverability similar to a rickshaw.

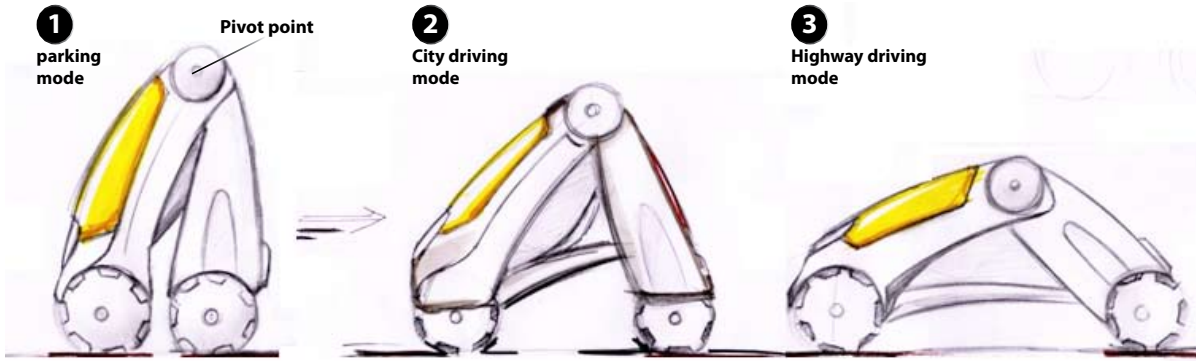
360 degrees self rotation.

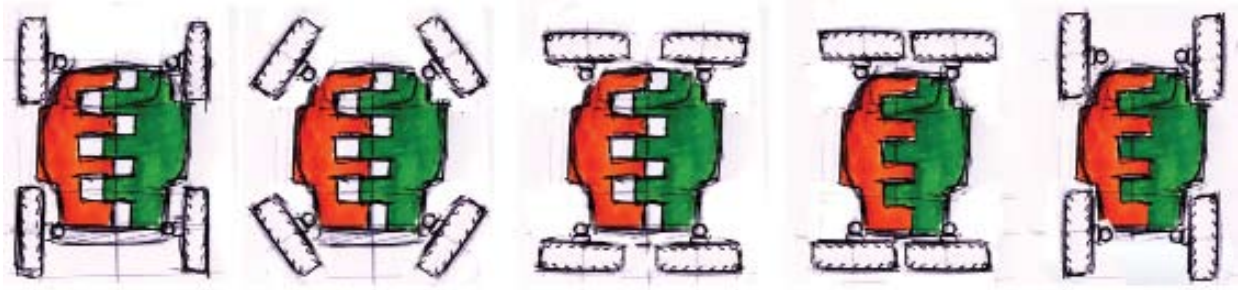
Concept 1

Collapsible length wise

Tall boy design

Occoupies minimum foot print



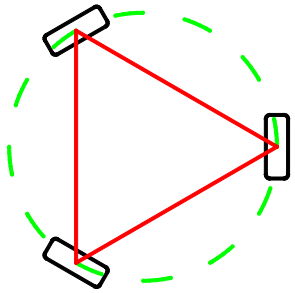


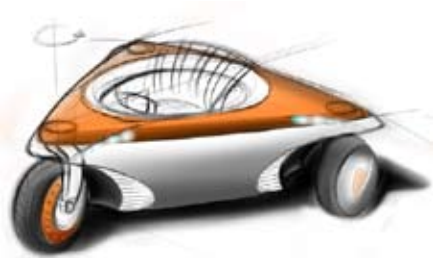
Concept 2

Collapsible width wise

Higher boot space

Key features of each concept and how they differ from one another.





Concept 3

Triangular Platform, higher manuverability similar to a rickshaw.

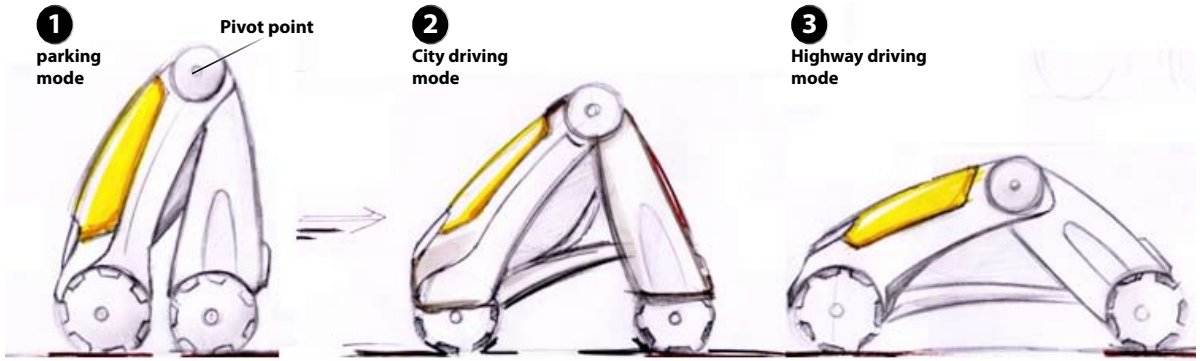
360 degrees self rotation.

Concept 1

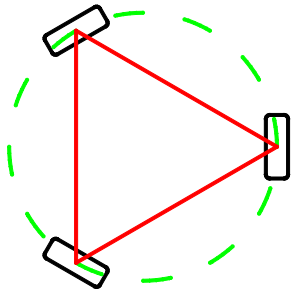
Collapsible length wise

Tall boy design

Occoupies minimum foot print



Key features of each concept and how they differ from one another.



Concept 3

Triangular Platform, higher manuverability similar to a rickshaw.

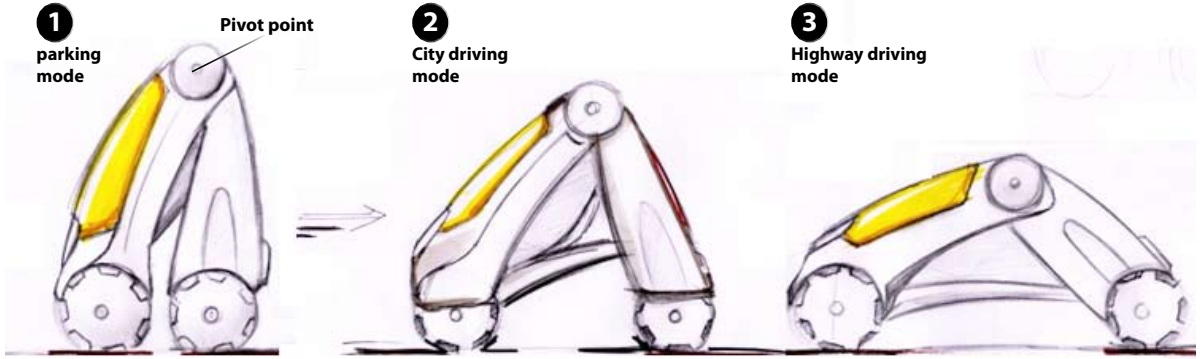
360 degrees self rotation.

Concept 1

Collapsible length wise

Tall boy design

Occoupies minimum foot print



Concept 1 + concept 3 - Final concept

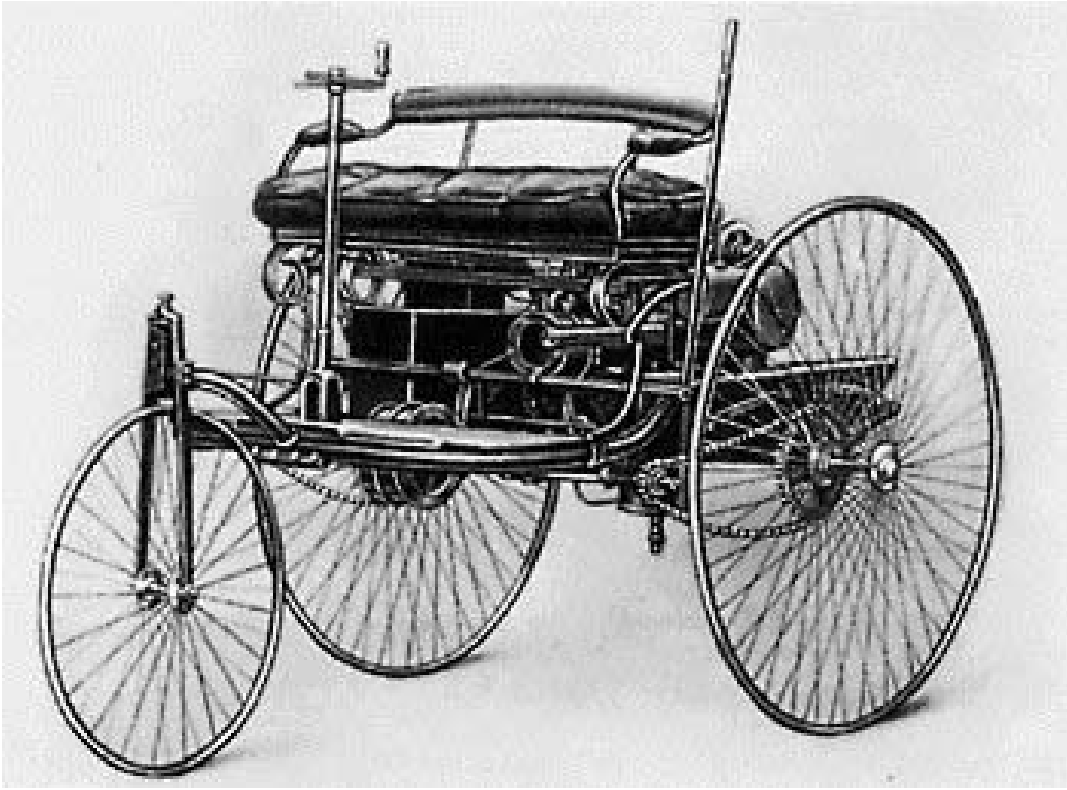
To improve concept 3 amalgamation technique was followed.

To implement the unique features of concept 1 into concept 3

So that concept 3 fits in better within the design theme of flexible mobility and stands out from the other 2 concepts.

Three wheelers :

The Karl Benz Patent Motorwagen (or motorcar), built in 1885, is widely regarded as the first automobile



Three wheelers : One wheel in the front and two at the rear

Two wheels in the front and one at the rear

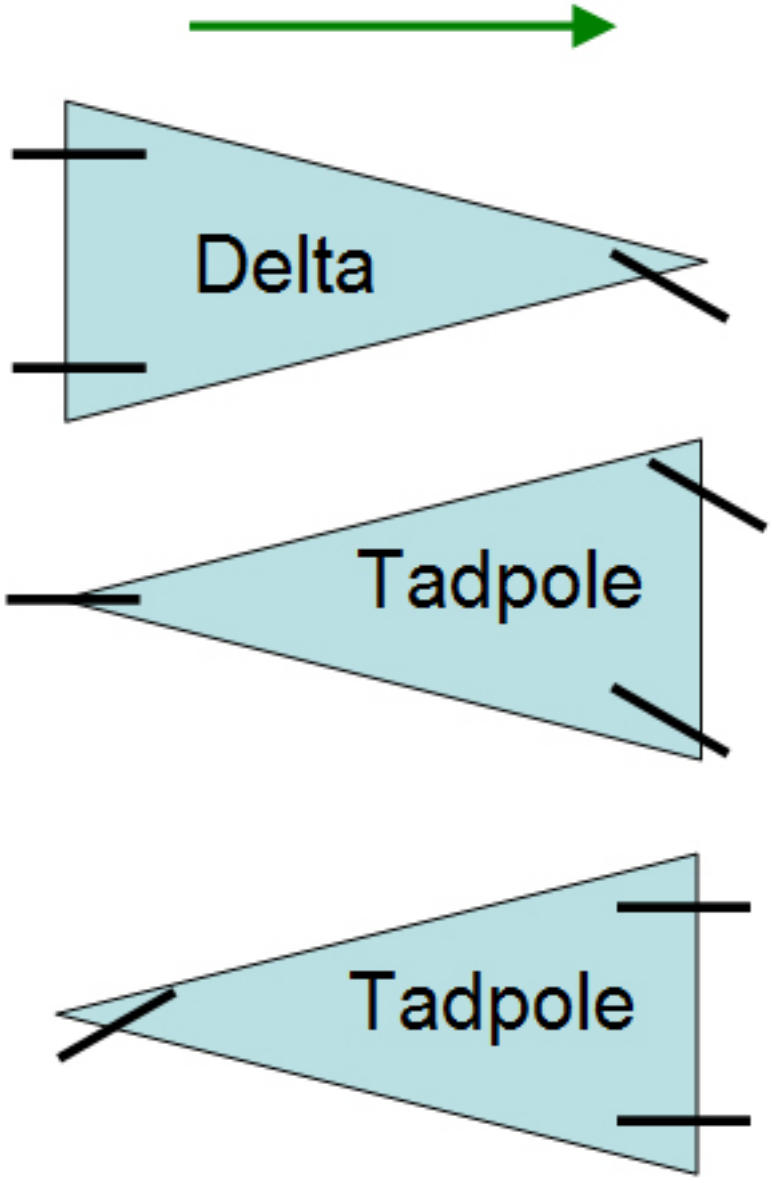









Three wheelers :



Reduces the cost of the steering mechanism, but greatly decreases stability.

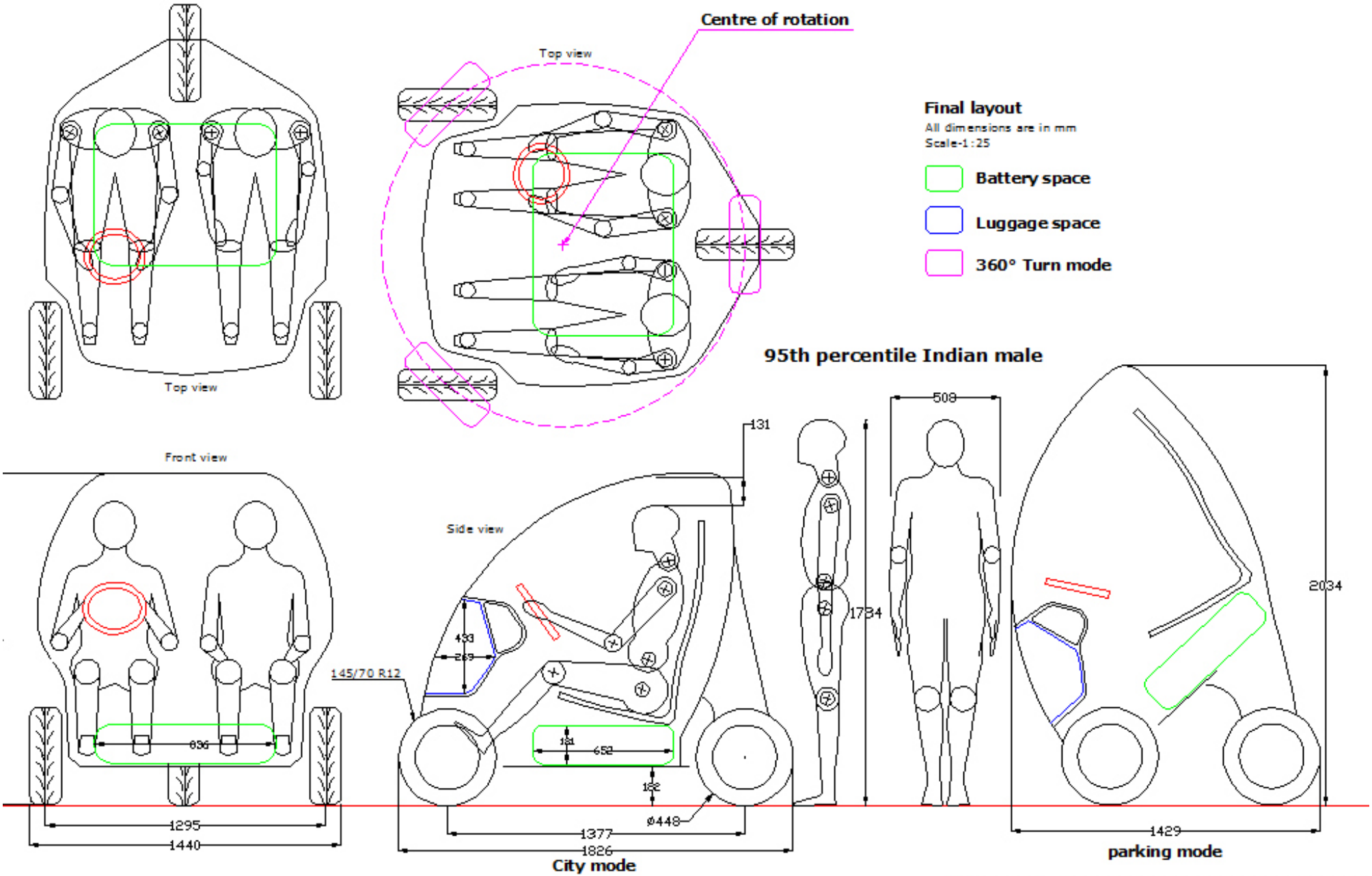
Vehicle tends to Over steer.

Improved aerodynamics

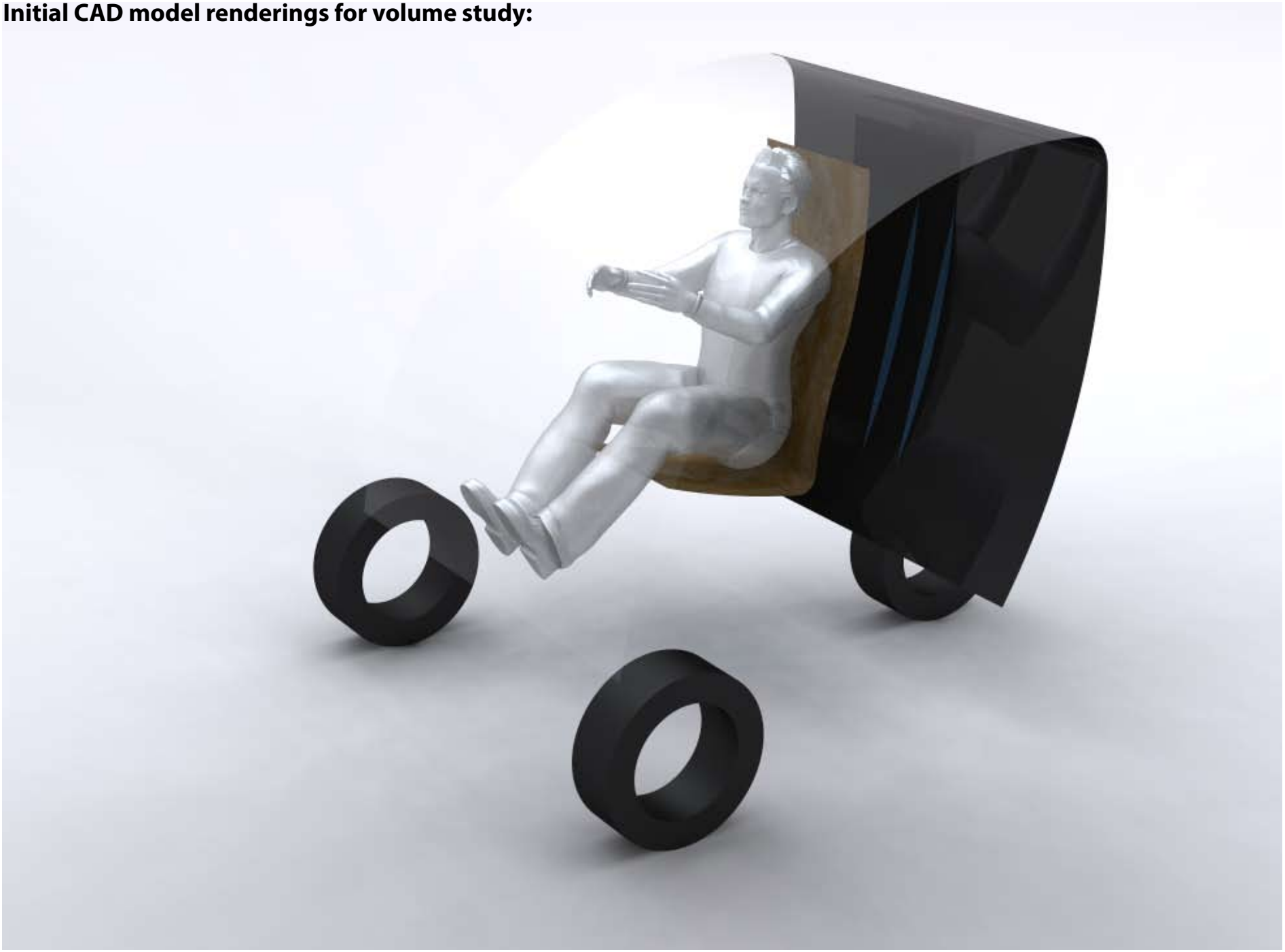
Vehicle takes a tear drop shape.

Two wheels in the front - Brings in *'carness'*

Concept 1 + concept 3 - Final concept



Initial CAD model renderings for volume study:



Initial CAD model renderings for volume study:

Form Exporation :

Design Theme :- Flexible mobility

Futuristic

Unique design element

compact

Image board


SPRINGY
DEXTEROUS
AGILE
DISPLAYS
BANDS
FLEXIBILITY
FUNCTION FOLLOWS FORM
POP N FOLD
YOGA
ORGANIC FORMS
BIONIC
SMART MATERIALS
ARCHITECTURE
LET THE SKIN CREATE FORMS
SKIN

A vehicle platform

flexi structure –
The Base

> material :– steel
:– Carbon fibre
:–

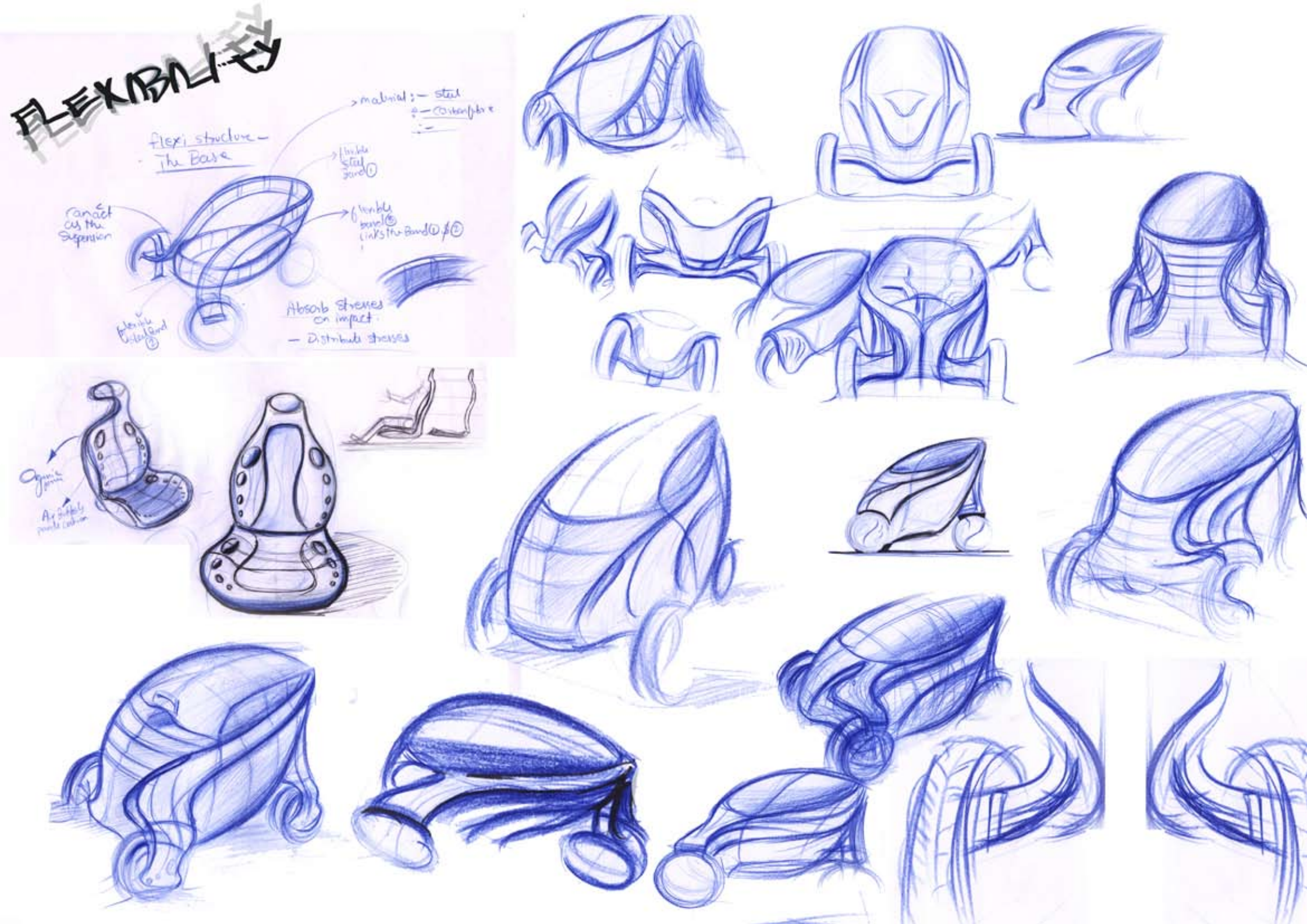
flexible steel band ①

flexible band ⑤ links the Band ① & ②

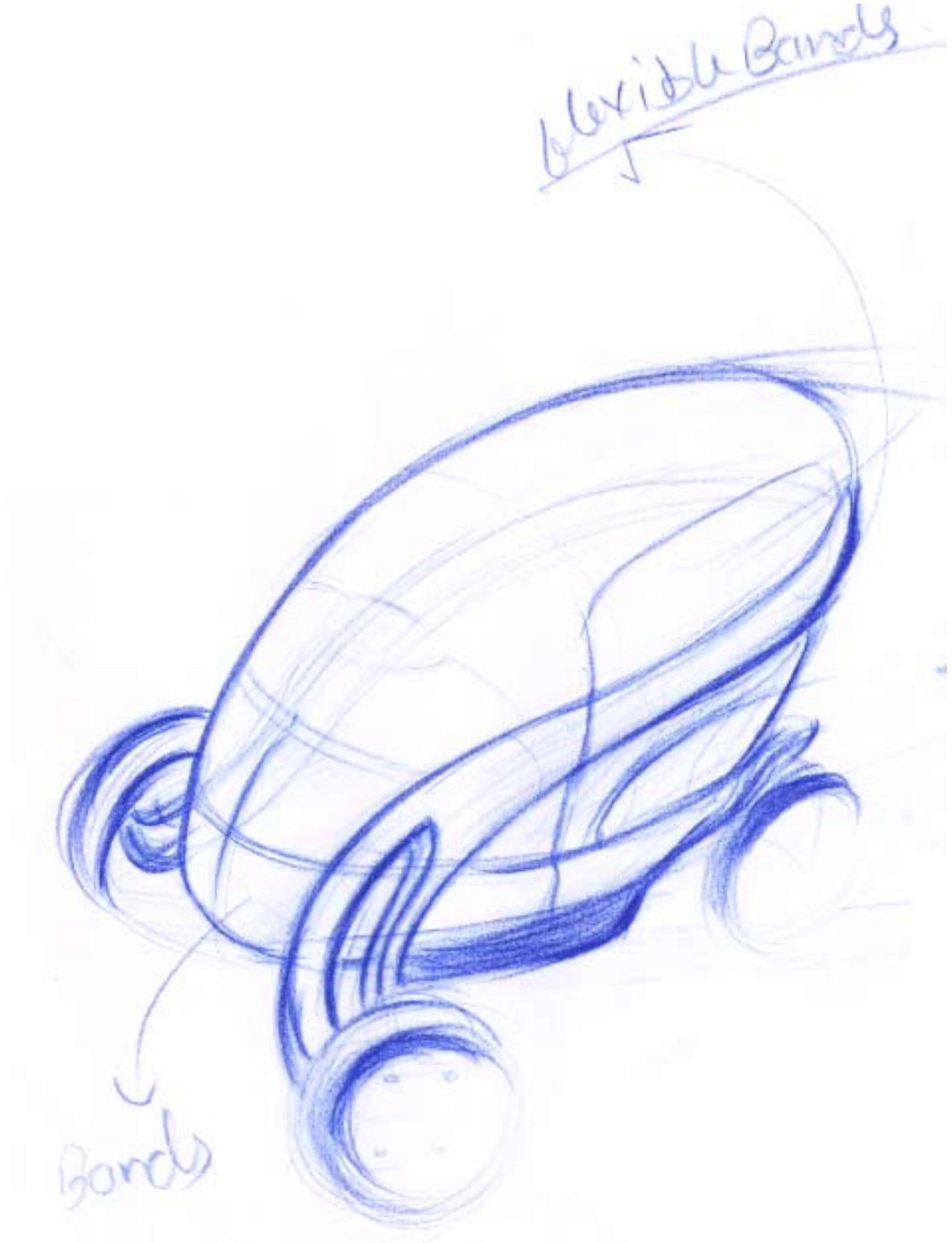
can act as the suspension

flexible steel Band ②

Absorb stresses on impact.
– Distribute stresses


FLEXIBILITY
flexi structure –
the Base
> material :– steel
flexible steel band ①
flexibly band ③ links the Band ① & ②
Absorb stresses on impact
– Distribute stresses
Organic form

Exteriors :



Interiors :

CAD Modelling- Alias studio tools

CAD Modelling- Alias studio tools

Model making process :

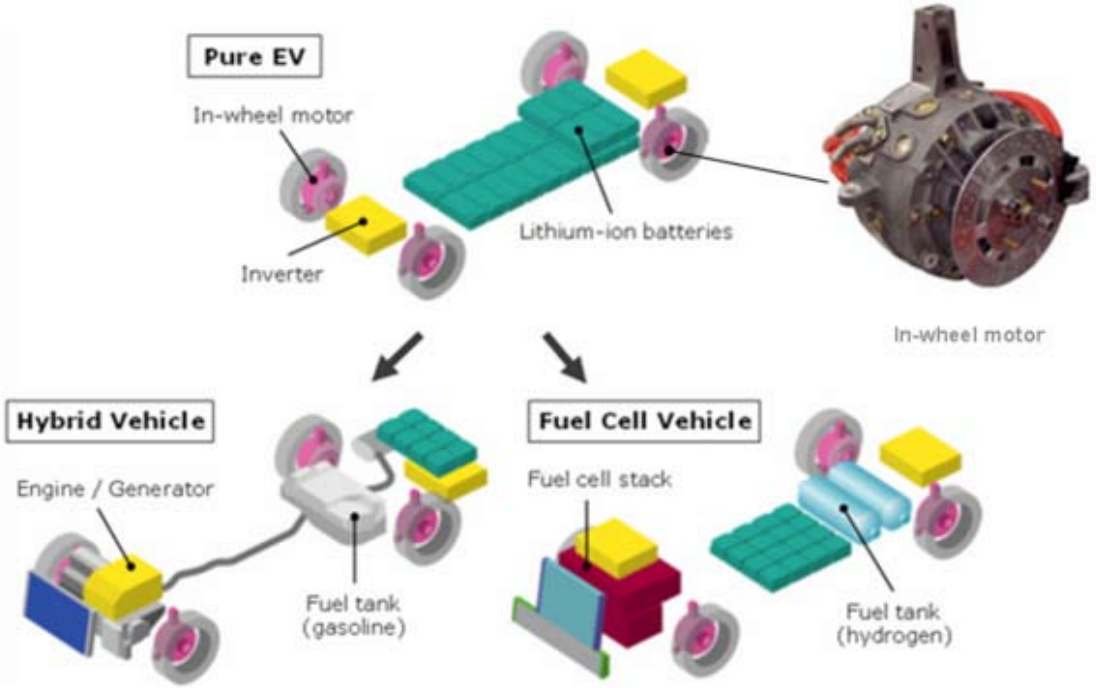
Eco friendly technologies:

To have a car which is non polluting it should run on a eco-friendly source of energy, some of the eco friendly technology platforms which are currently used in production cars are :

Battery electric vehicles--BEV

Hybrid electric vehicles--HEV

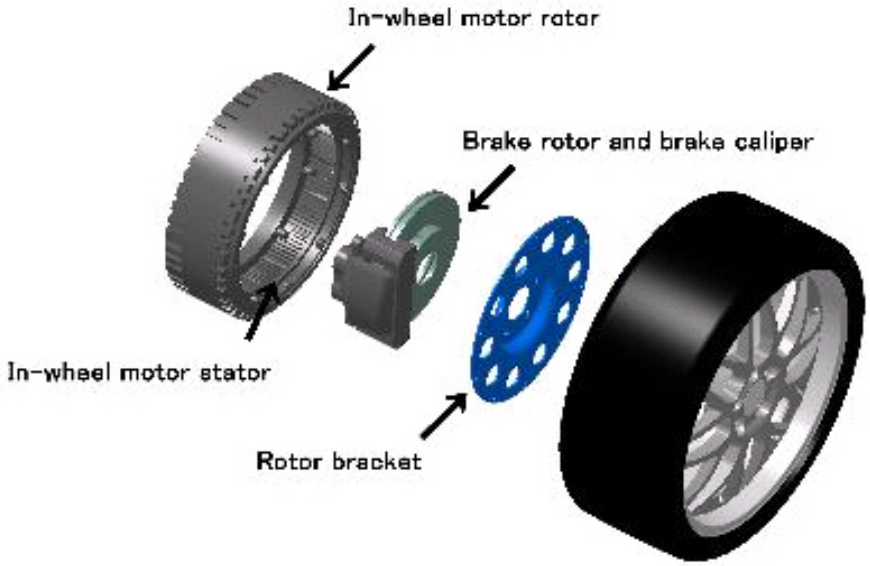
Fuel cell vehicles---FCV



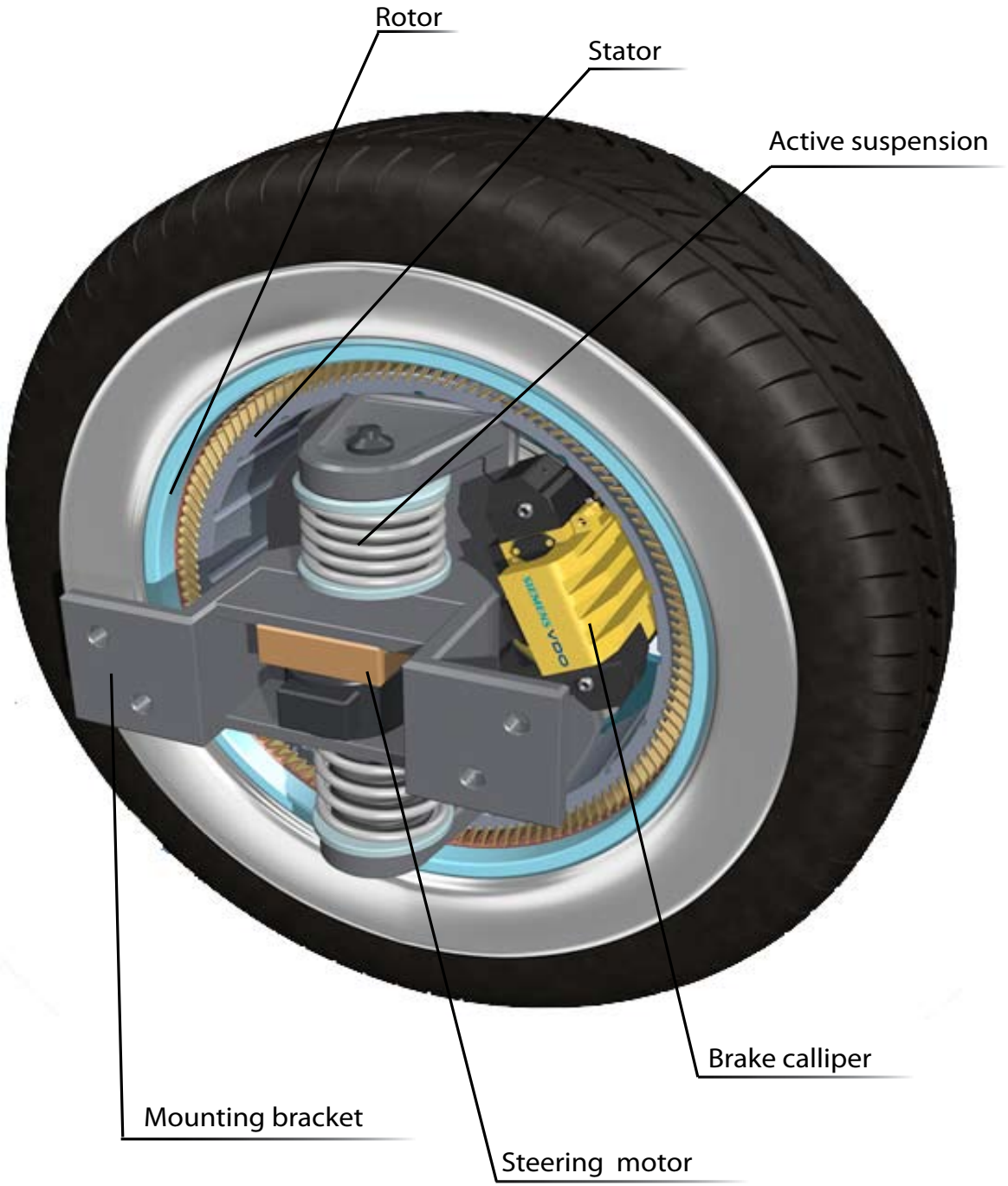
Drive train
In wheel motors

The advantages of In wheel motors are:

- Energy efficiency
- An electric motor has maximum torque from zero rpm . IC engine has no usable power at engine speeds lower than 1000 rpm.
- Regenerative braking is another advantage of wheel motors.
- Drive by wire.
- Weight savings.



Siemens VDO-eCorner
motor-in-hub concept
The final concept will be driven on this platform



Technical specifications:

Type	: Hatchback
Doors	: 2
Pay load	: Maximum 2 adults
Top speed	: 60 km/hr

Dimensions: (City/Parking) mode

length	: 1966/1300mm
width	: 1460 mm
height	: 1534/1976 mm
wheel base	: 1409/741 mm
ground clearance	: 180 mm
Tyres	: 165/70 R13

Integrated power system

Technology	: Siemens VDO-eCorner
Motor	: Brushless electric in wheel motors with permanent magnets
Battery weight	: ~80/100 kgs
Battery technology	: Lithium-ion

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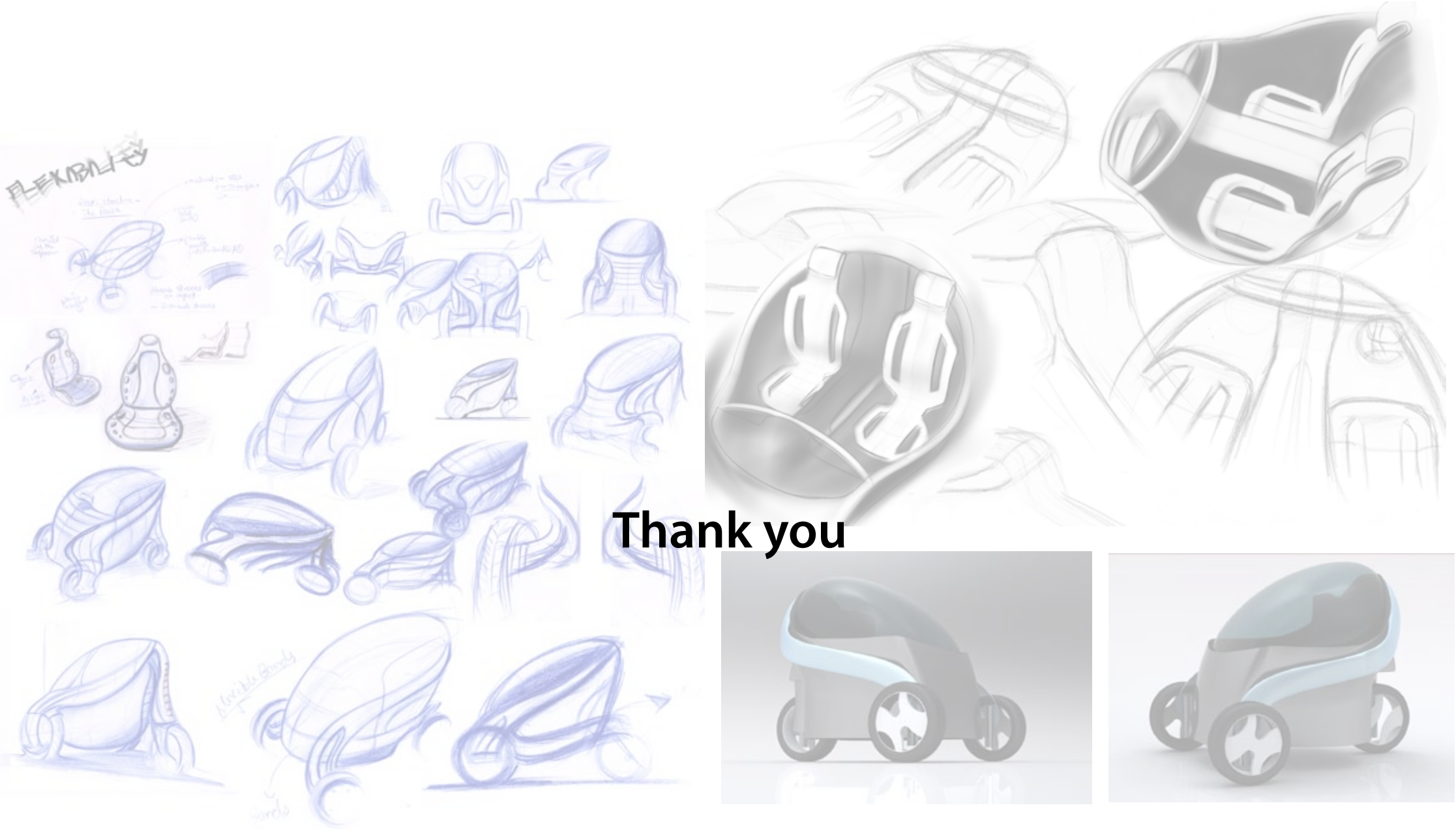

Thank you