

Power Assisted Bike for Youth



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Introduction

Bicycle - A World on Two Wheels

- The most widespread forms of transportation in the world
- with it came the chance to explore the unknown world, fascinating voyage to the edge of our imagination
- helped people become healthier



Objective



The study of the scenario of Bicycle in IIT Bombay and problems associated with it.

Exploring new forms to satisfy the Emotional and Physical needs of the young generation

Introduction





Need of the Project

Bicycle needs to be revamped keeping the present user in mind in modern youth context in IIT.

We are dealing with the ZAP86 Generation.

The love for radical Design among Youths

Ban of Motor bikes in the institute

Starting of the efficient Tam-Tam (Bus) facility in the campus

Time has changed and with that thinking too

Culture associated with the campus

New technologies and materials are available on the doorstep to bring a revolutionary change in the bicycle

Irregular maintenance facility

Decrease in Social Interaction (Causes Internet)

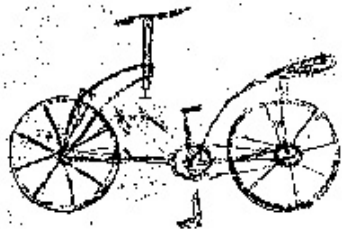
Need for Customization

Sustainability



Timeline of Development of Bicycle

History of Bicycle



Leonardo da Vinci's sketch of Bicycle



The Earliest Bicycle - 1790

Celerifere
Comte Mede de Sivrac
France



1817 to 1860
Draisienne Era

Draisine
Karl von Drais
Germany

Named after its inventor, Karl von Drais of Germany, the draisine was one of the earliest widely used two-wheeled, self-propelled machines.



1863 to 1869
Velocipede /Boneshaker Era

Velocipede
Pierre & Ernest Michaux
France

Attachment of cranks and pedals to the front wheel. Fitted with a rudimentary brake & bell. Most were heavy, being constructed from wood and iron.



1870 to 1891 - High Wheel Era

- **Larger Front wheel** & the **Smaller Rear wheel**.

- Manufacturing improvements through **Mass Production** in factories, **Metallurgy Improvements** with lighter and stronger steel tubing, and engineering advances

- The mechanized production of **Steel Ball-Bearings**.



Child's Currie
Tandem



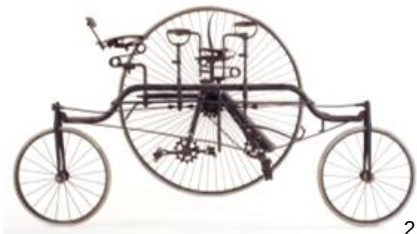
Child's Highwheel
Tricycle



Child's Toy
Horse



Penny-Farthings
1880s



2.9

Coventry Rotary
Tandem



2.10

Eagle



2.11

Loop Frame
Tricycle



2.12

Star



Safety Bicycle Era

High wheel to extinction

Equal size wheels

Low enough to touch the ground with feet

Ending the problematic 1:1 pedal stroke

Pneumatic tire (1888)

Diamond-shaped frame(1888)



2.13

1916 Pierce Arrow
Motorized Bicycle



2.14

Cleveland Lady's Safety
Bicycle - 1893



2.15

Dursely-Pedersen



2.16

Lady's Elliott
Hickory



2.17

Old
Hickory



2.18

Reading Chainless
Spur Gear Drive



2.19

Unknown Dual Suspension
Safety Bicycle



2.20

Waltham
Orient



1908 to 1988 - Derailleur Bike Era

Gearing Systems



2.21

1908 to 1988
Derailleur Bike Era

1971 to 1974

Bike Boom/Baby Boom Era



2.22

1971 to 1974
Bike Boom/Baby Boom Era

1953 to Present - Mountain Biking Era



2.23

1953 to Present
Mountain Biking Era

1980 to 2000

Steel Frames & New Materials Era

New materials aluminium, titanium and carbon fibre gained respectable acceptance among cycling consumers



2.24

1980 to 2000
Steel Frames and New Materials Era



NEXT ?



Types of Bicycles

Road Bike :

- Light & Stiff Frame
- Narrow Wheel Rims & Tires
- Dropped Handlebars
- Uncompromising riding position (Bars lower than saddle)
- Very responsive
- Twitchy feel to ride



- Riding takes a little getting used to
- Design translates effort into speed effectively

Mountain Bike :

- May have suspension
- Sturdy Frame
- Flat Tires



Three Types -

- Rigid**
 - It applies equally to all Road Bikes as well as Hybrid Bikes
 - No suspension
- Hardtail**
 - Only Front Wheel Suspension
- Full Suspension**
 - Suspension on both wheels

Hybrid Bike :

- Includes -
- City Bike
 - Street Bike
 - Urban Bike
 - Utility Bike
- Flat Bar
 - Upright Riding Position
 - Lighter in Frame, Wheel & Tyres than MTBs



Some features of other two Bikes are introduced to satisfy the emotional needs of the user.

Ex-

- Swapping the handlebars for a pair of drops to pass as a Road Bike.
- Bigger Knobblier pair of tyres to cop with moderately serious Mountain Biking.
- Some are called Hybrid because they have front suspension which does soak up the bumps on rough city streets and bike tracks.

Present Bicycles in Indian & International Market...



ATLAS

BSA

HERCULES



HERO Cycles



HERO Octane 26T



HERO Nitrogen



HERO Nitro Integra



HERO Hawk



HERO Buzz Nu-Age



HERO Razorback NE





BSA & HERCULES Cycles



BSA Wow 21 speed



BSA Ryders ACT 105



BSA Ryders ACT 106



BSA Ryders ACT 108



Hercules Flash



Hercules Blazer IC 24"

ATLAS Cycles



STEALTH SERIES 100



MOON RAKER



T-20



FRENZY 26



SHARP SHOOTER SR



DOMINATOR 18 SPEED



DUORSHOX



COLUMBUS SR



SCUD SHOX



Bicycles in International Market



Micargi 18 Speed Mountain Bike



Avenue bicycles



Cannondale Prophet 400 Bicycles



Cannondale 2007 Six13 Team 1 Bicycle



Norco Bicycle



HUMMER Tactical Mountain Bike



Cannondale Raven 3000



Trek Bicycle



Trek 2009 Madone



Electric Bicycles in International Market



Panasonic Electric Bike



Electric Bike



Ohm Electric Bike



The Eight Speed Transmission Electric Bicycle



Rietti GTX Electric Bike



Optibike 800Li



A2B Electric Bike



Yamaha Divide (concept)



Yamaha Deinonychus (concept)



User Study...





Youths of IIT Bombay (Persona)

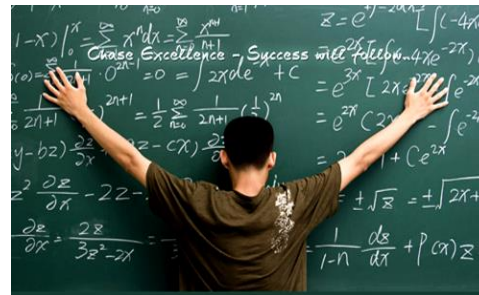


- Age group 17-27
- Party Goers
- Receptive to the New Trend
- Rebellions in Nature
- Status Symbol
- Student
- Gadget Freak
- Bike & Car Lovers
- Generally have Girlfriend
- Believe in their own Identity
- Believe in breaking the rules
- Dream to win the whole world
- Zap 86 Mentality
- Updated with latest Technology
- Used to have Cell phone & MP3 Players
- Experimental in Nature
- Love western as well as Indian Lifestyle
- Life is fast and their product should reflect the same.

Mind Map



Receptive towards
the New Trends



The things Youths are always
CRAZY about...



Body
Building



Girls

Love



Car



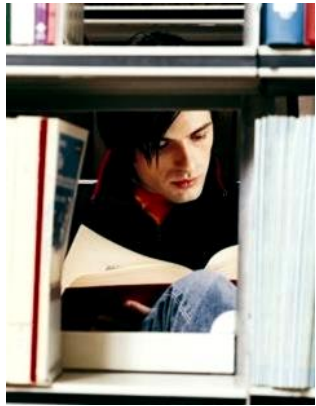
Bike



Movies



Music



Student



Party Goers



Status Symbol



Fast-Food Lovers



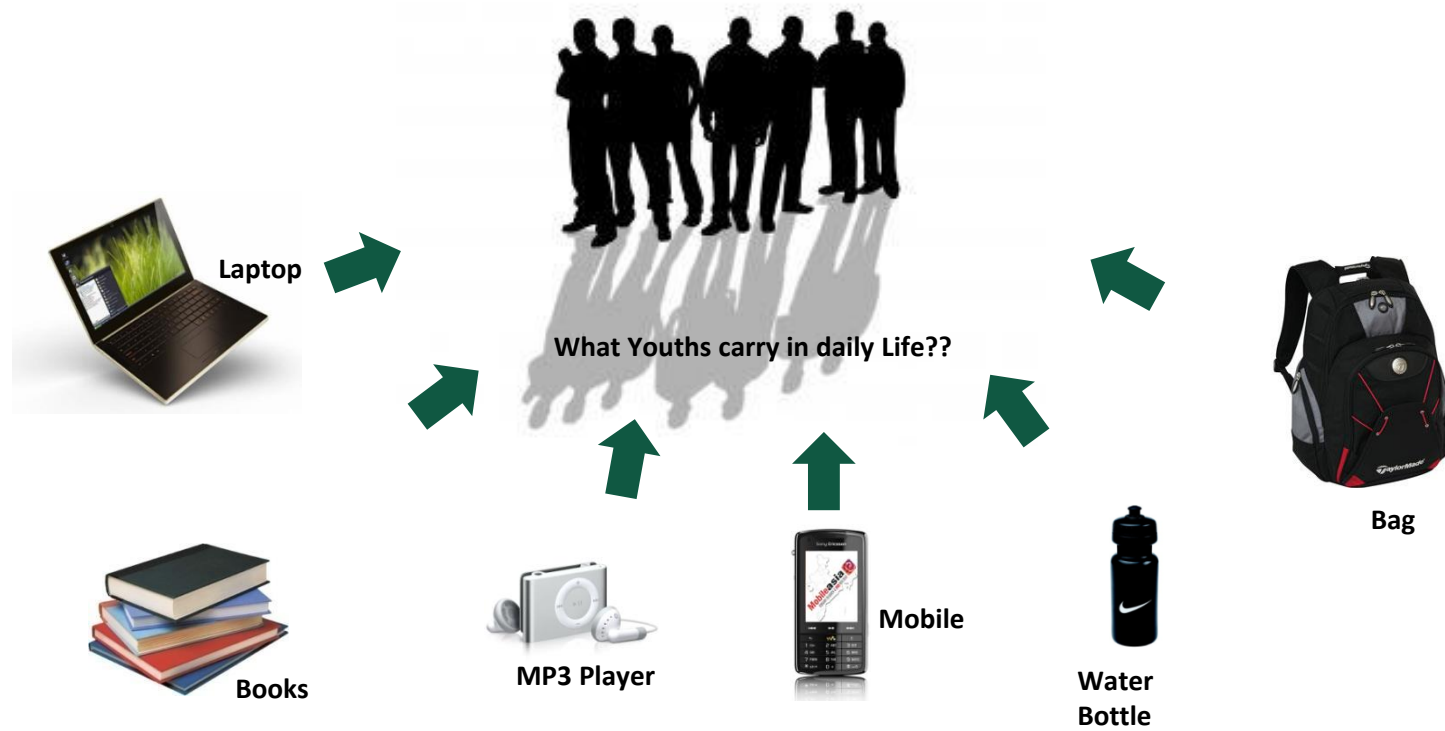
Gadget Freak



Identity

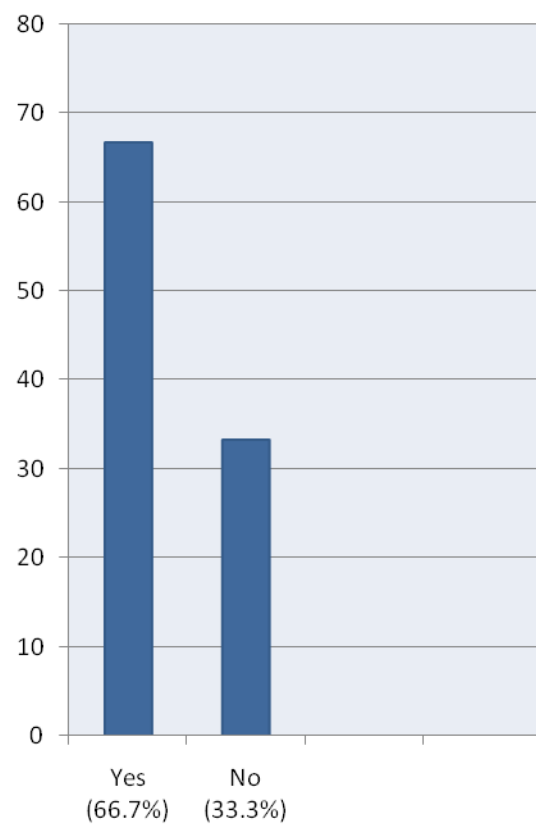


User Requirements



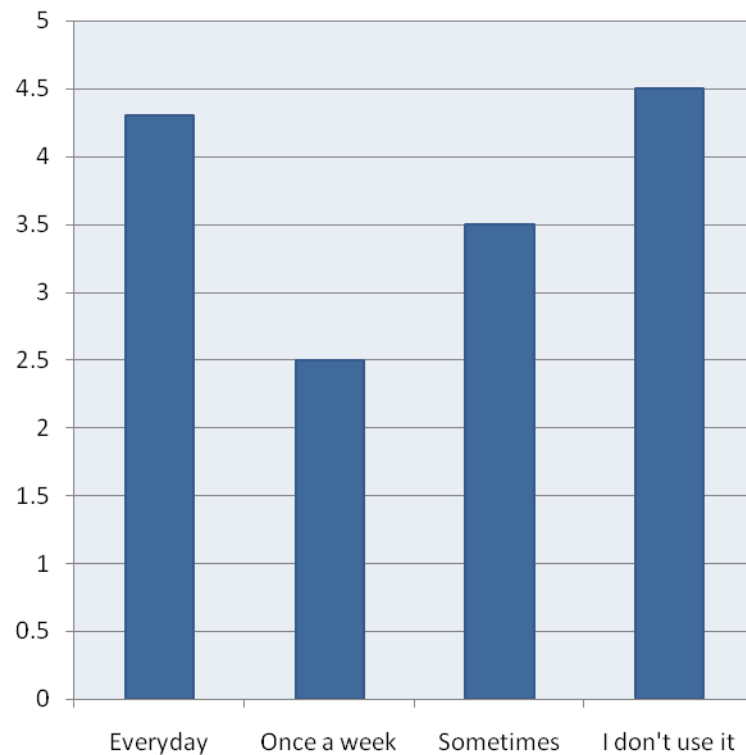


Bicycle Users in IIT Bombay





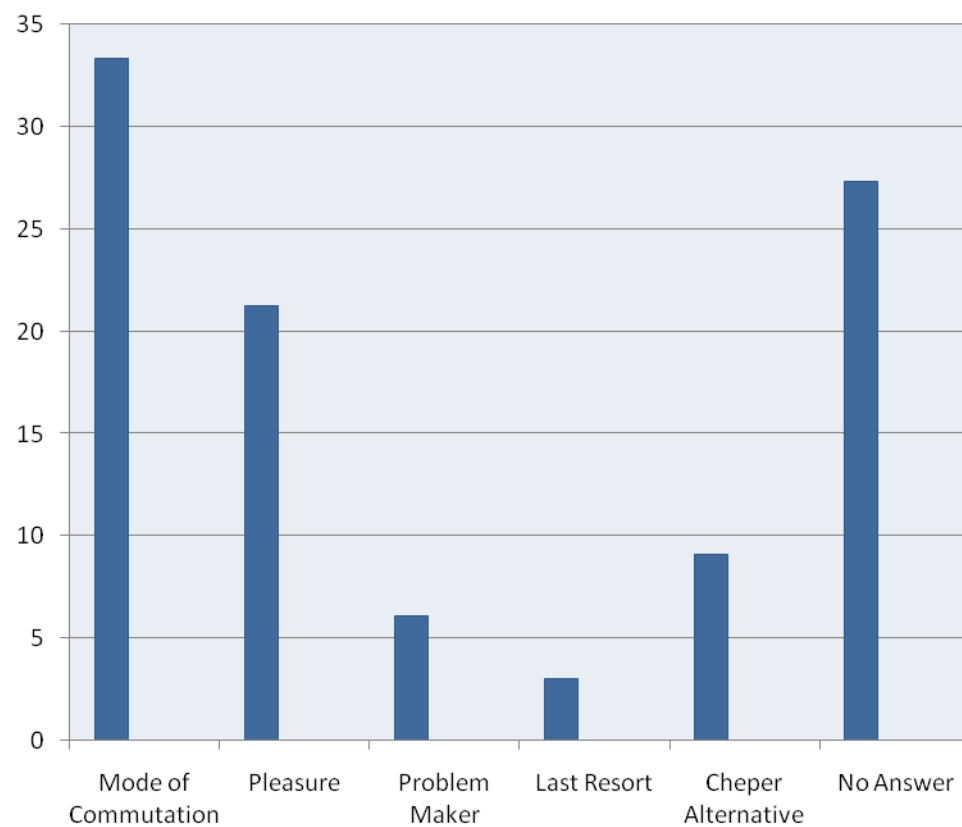
Using Frequency & General Problems associated with Bicycles



- Up-Hill Slope of IIT Bombay
- Sweating on Destination
- Better Affordability
- Maintenance Problem
- Inconvenient to Carry too Many stuffs
- Rainy Season
- Availability of Tum-Tum
- It's better to walk
- Tum-Tum and Autos are far more efficient
- Loss of Track

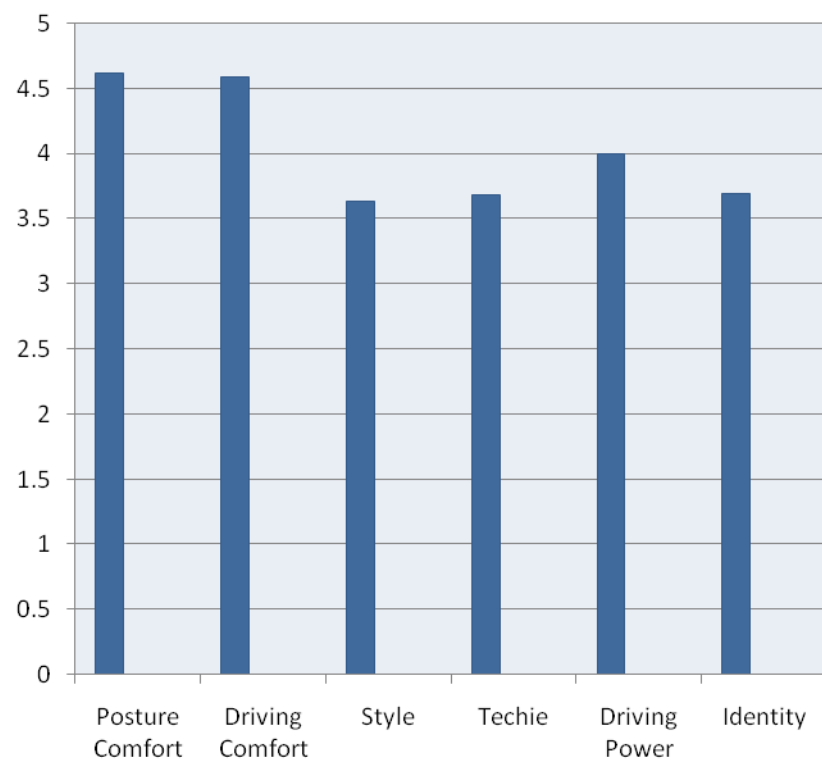


Perception of Bicycle in IIT Bombay





User Preference For Desired Bicycle



Rating of the user on scale of 5 (5-Heighest & 1-Lowest)



Problems associated with Bicycle Carrier

"Its always easy to carry bag on your back"

"Sometimes I need carrier"

"Ya, its always difficult to clean"



"Its always easy to carry bag on your back"

*"Carrying bag on back gives the sense of
balance"*

*"Carrier is most of the time dirty and its always
difficult to clean"*

*"I don't have time otherwise I would have
removed it"*





Bicycles which are common in IIT



HERO Razorback NE



HERO Nitrogen



5.16 HERCULES Flash



HERO Buzz Nu-Age



HERO Hawk



5.17 **BSA** Wow 21 speed



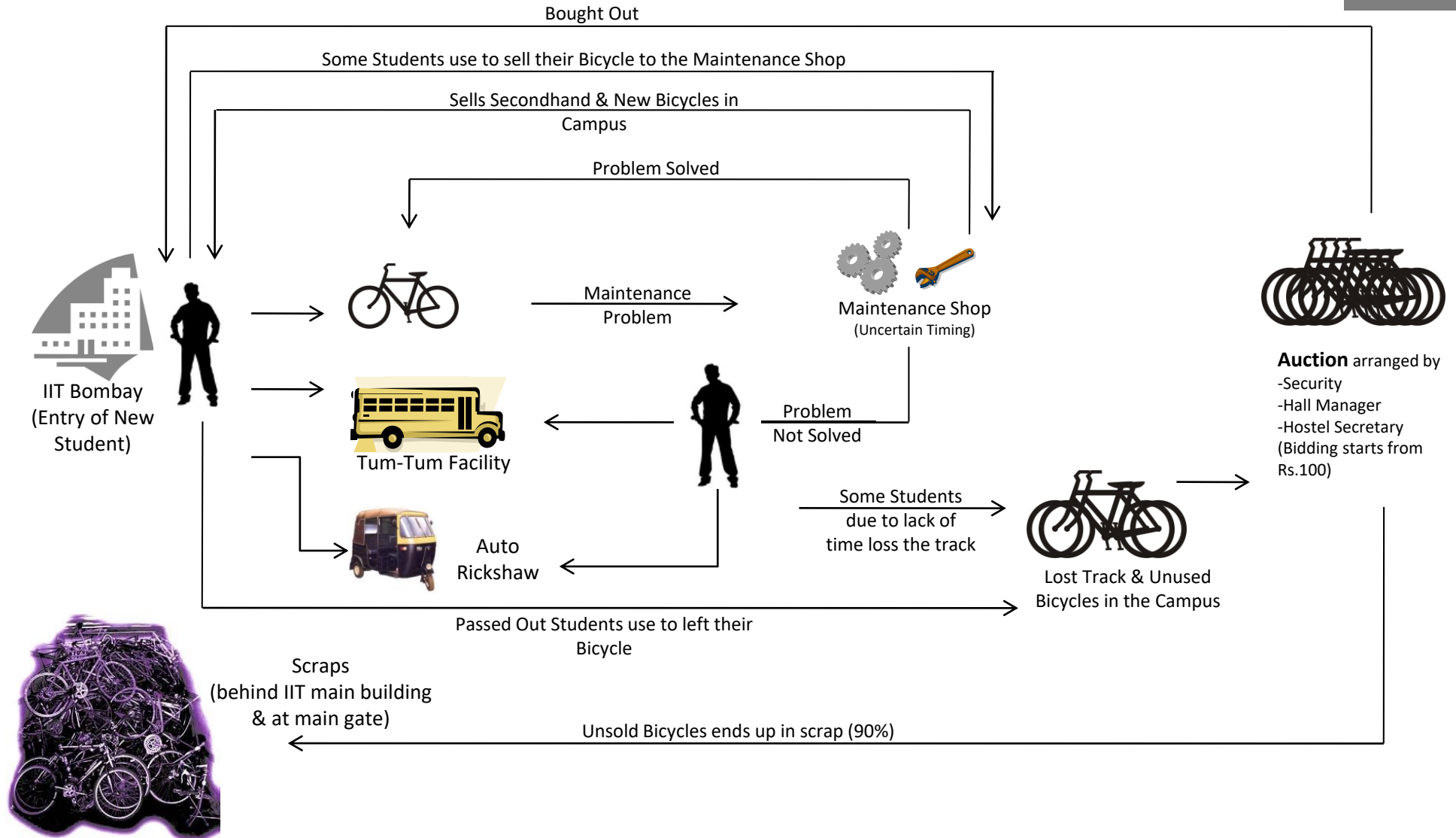
5.18 **ATLAS** DUROSHOX
ATBs/MTBs



How your Desired Bicycle should be....?

Unique Light Weight **Youthful** Foldable **Stylish**
Features Minimalistic Attractive Sleek Funky Color
Aggressive Radical **Comfortable** **Functional** One Piece
Strong Speed Non-Tech Non-Glamour **Awesome** Trendy
Sporty Techie **Bike** Stable Sizable Small
Feminine Cute Elegant Simplistic **No Spokes**

Scenario of Bicycle in IIT Bombay





Project Brief



Designing of a **Power Assisted** &
Maintenance Free bicycle for the **Youths of the IIT**
in present scenario . Its about reviving the lost enigma of bicycle in the potential user serving
their physical as well as emotional needs. Area of focus will be **Exploring**
Technology and **New Form.**



Aesthetic & Styling



Approach to the Unique form

Semantic Shift in the form of bicycle

Fuzzy boundary



Chart 8.1



Target Segment of the proposed Bicycle

Fuzzy boundary
→

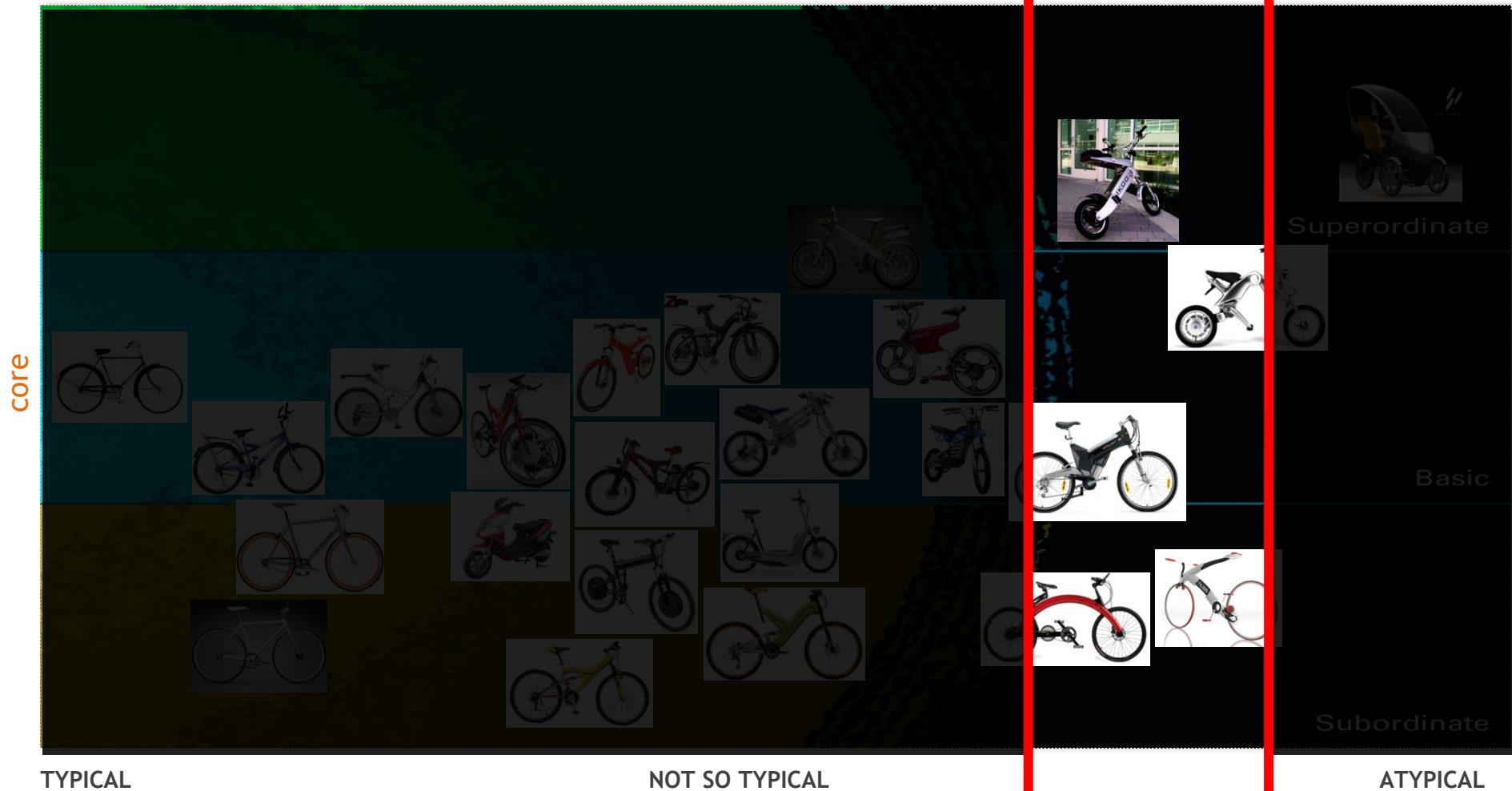


Chart 8.2

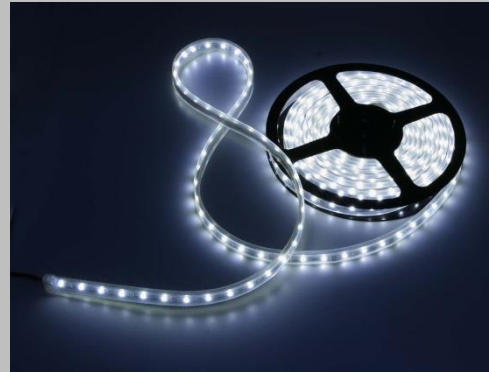


Image Board



Apple iPhone

Techie
Advan
cemen
e
Wis



LED Lighting

Modern
Techie



Yamaha FZ

Force
Dynamic
Muscular
Power



iPod

Simplic
ity
Elegan
ce



Harley Davidson

Muscular Big
Enormous **Elegance**



Sea Waves

Youthful
Energy Power



Nokia 7500 Prism

Modern
Techie



Space Shuttle



Fighter Planes



Concorde

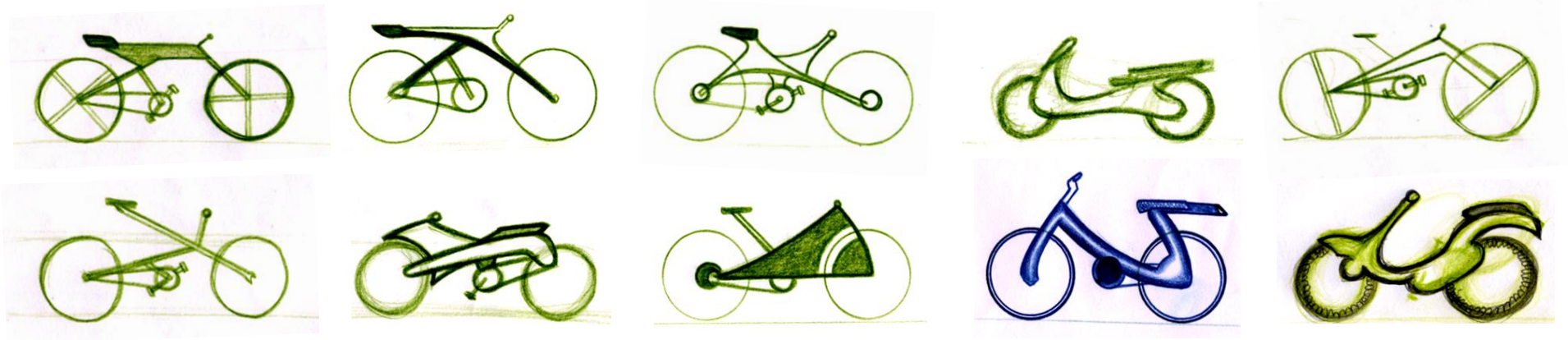
Speed
Freedom
Phenomenal
Energy
Power
Enormous
Techie
Big

Ideation

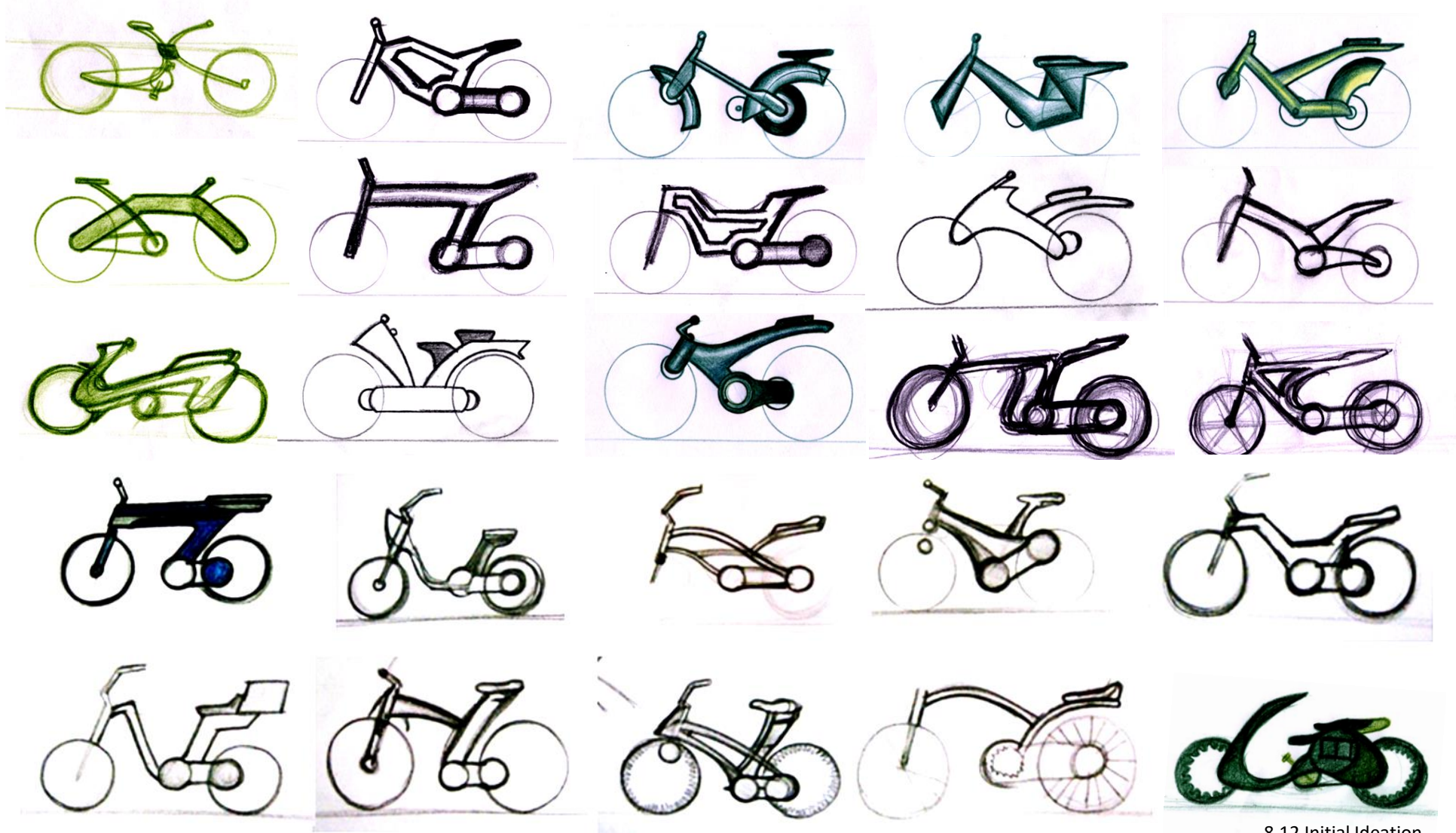




Initial Ideation (Stage - 1)



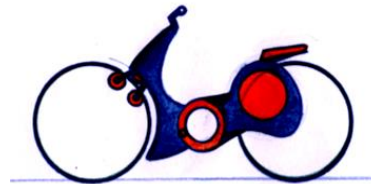
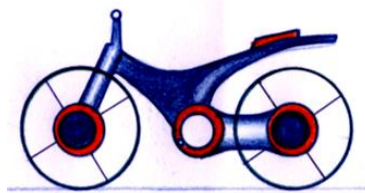
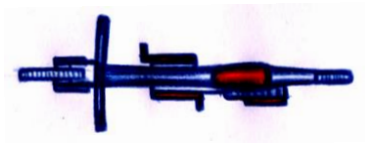
8.11 Initial Ideation

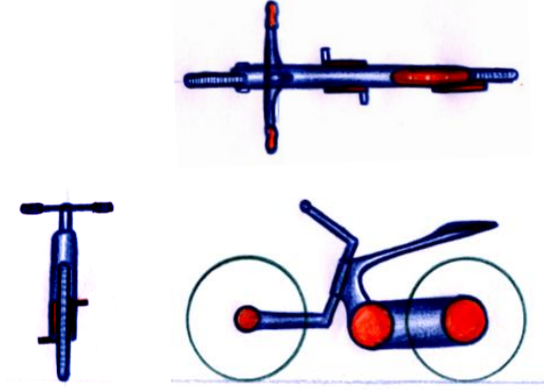
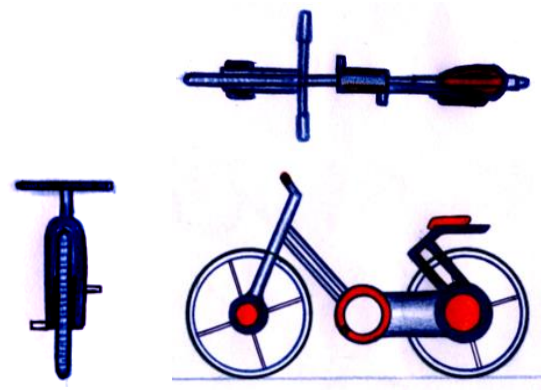
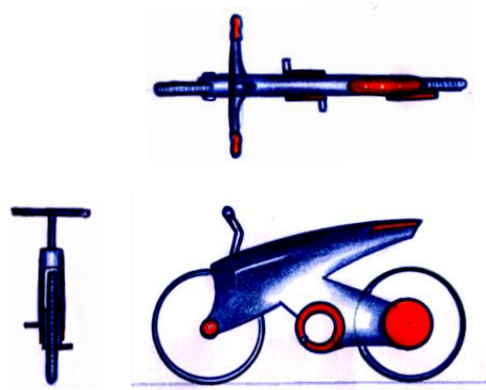
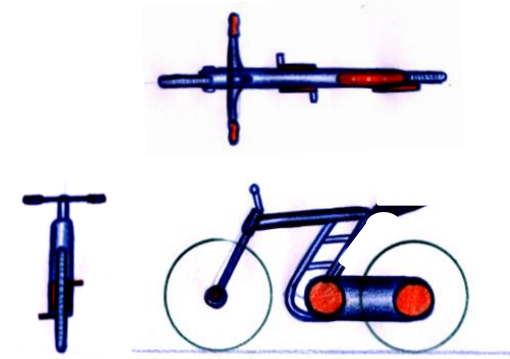
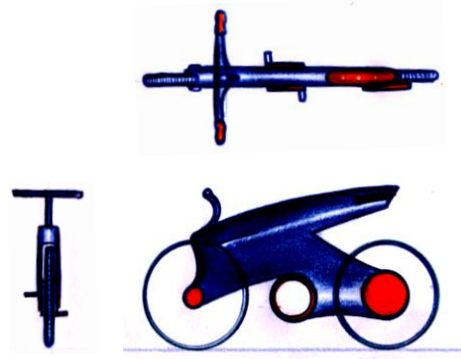
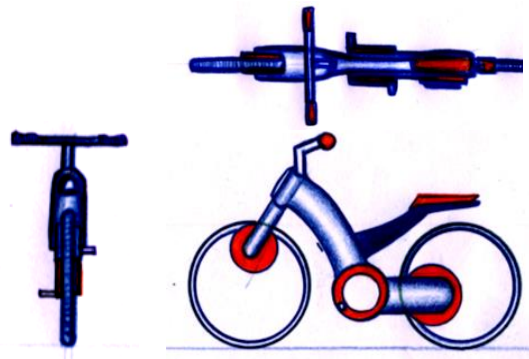


8.12 Initial Ideation



Metaphor Based Ideation (Stage - 2)





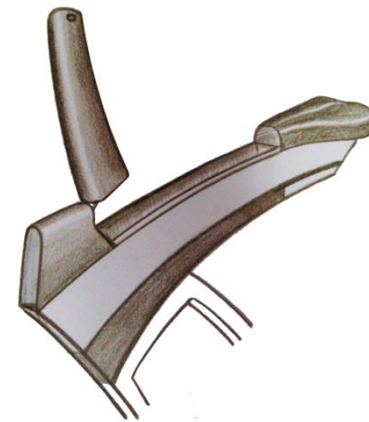
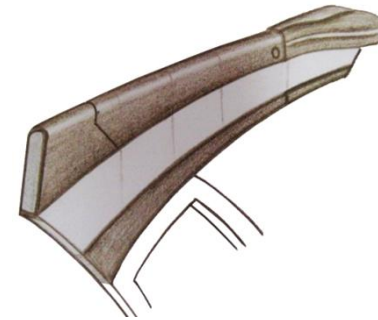
Refinements in Stage - 2

Completely unique

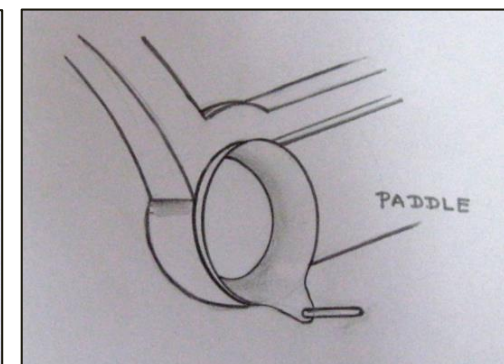
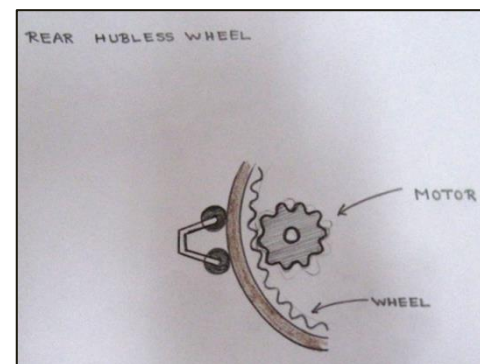
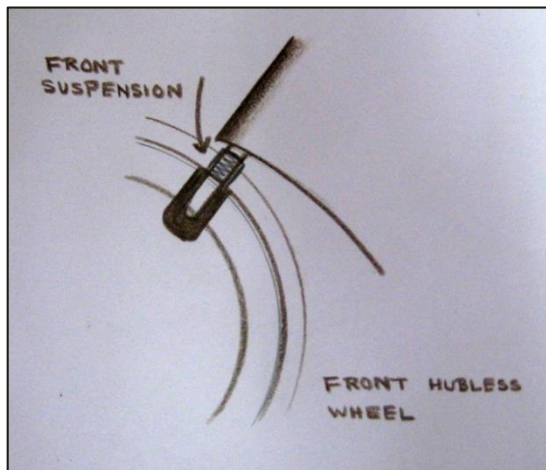
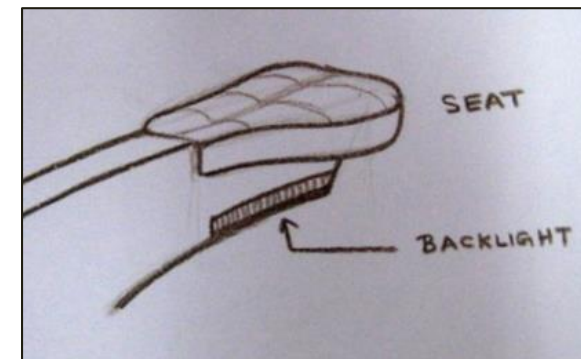
Radical structure

Inspired from the Ocean's waves

Hubless Wheels



Compartment for tools & Umbrella

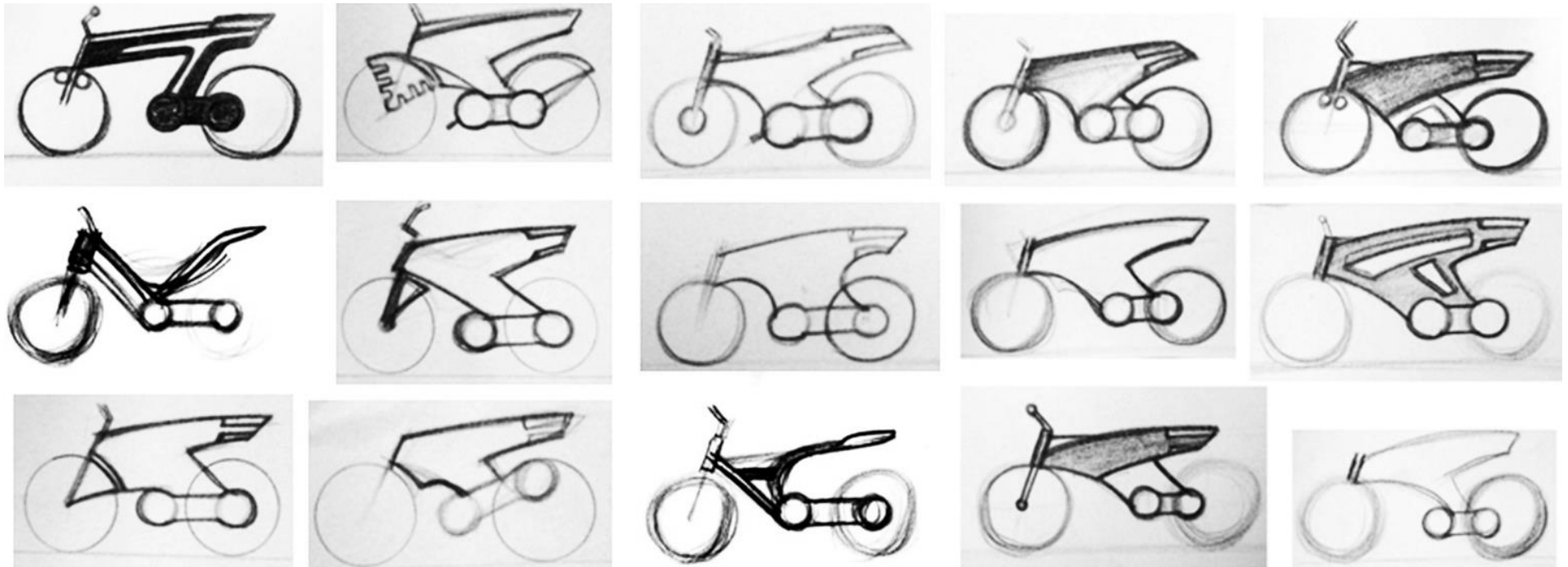


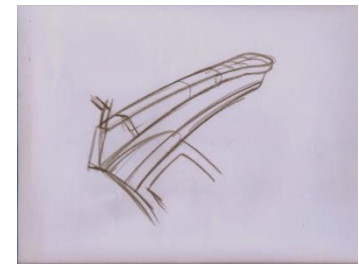
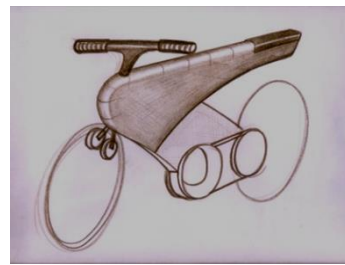
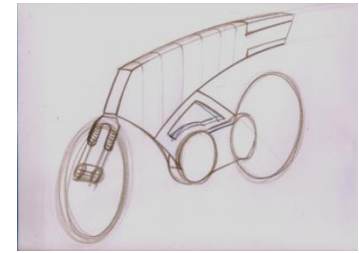
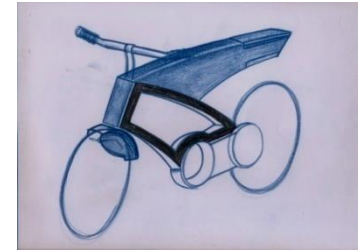
Some Detailing

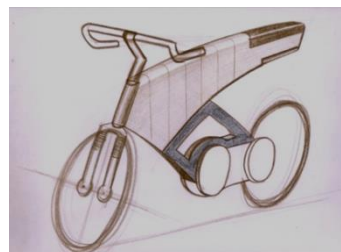
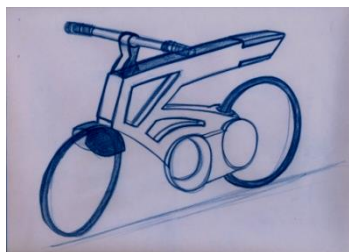
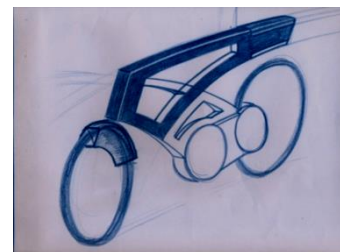
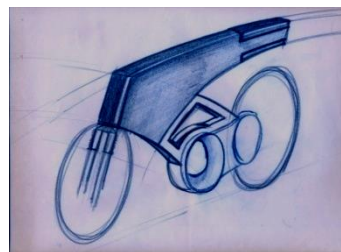
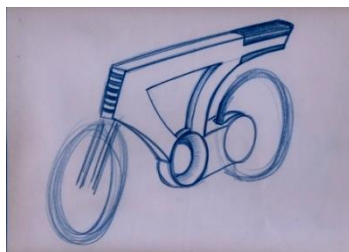
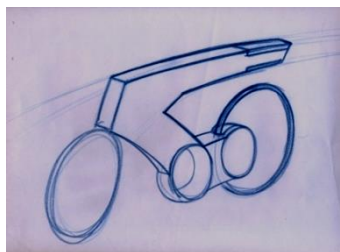


Metaphor Based Ideation (Stage - 3)

Youthful
Energy
Power









Metaphor Based Ideation (Stage - 4)

Speed
Freedom
Techie
Phenomenal
Energy
Big
Power



U2 Blackbird



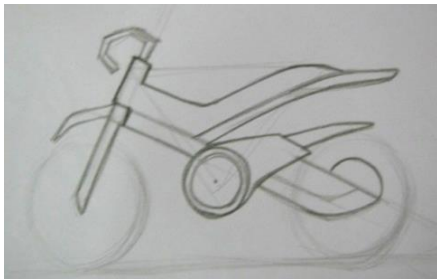
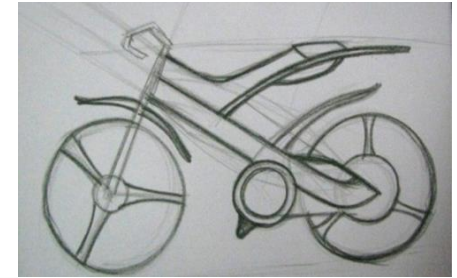
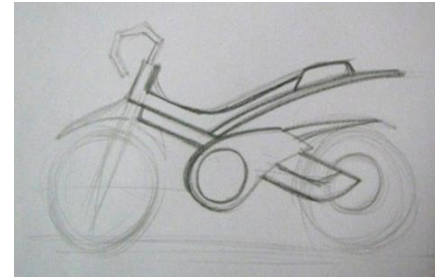
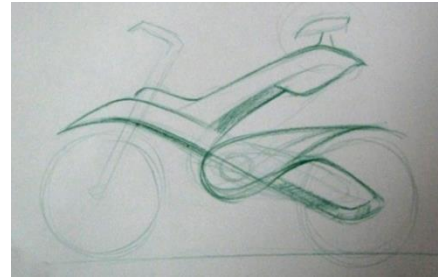
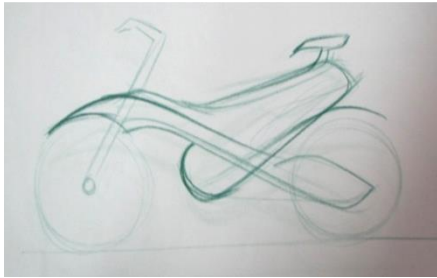
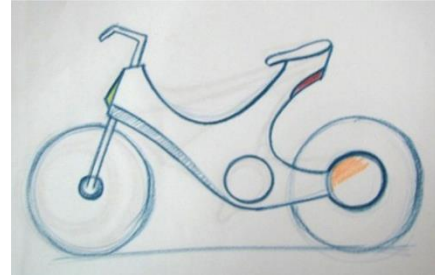
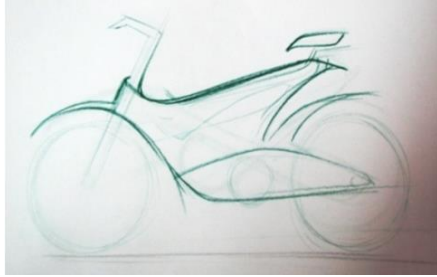
Space Shuttle



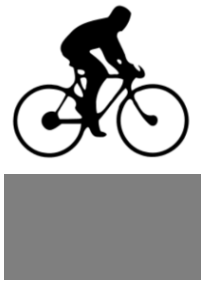
Fighter Planes



Concorde



Concepts





Concept 01

Based on stage 4 ideation.

Inspired from the rocket jet engine.

Sturdy look



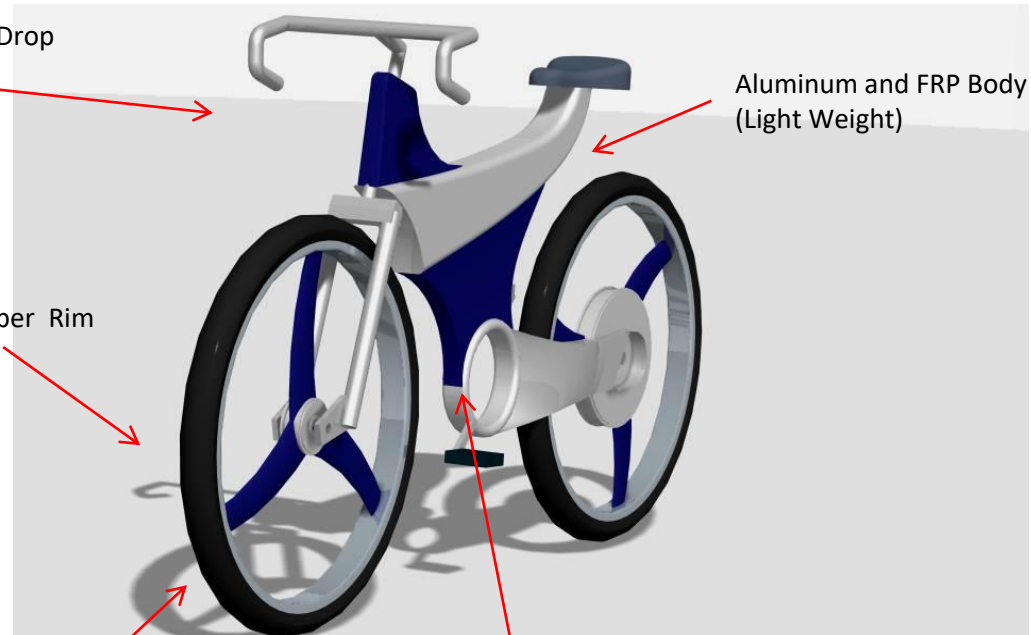
Straight Handle with Drop bars

Aluminum and FRP Body
(Light Weight)

Carbon Fiber Rim

Tubeless Tires

Covered Wheel Chains for
protection of cloths





Concept 02

Radical in shape

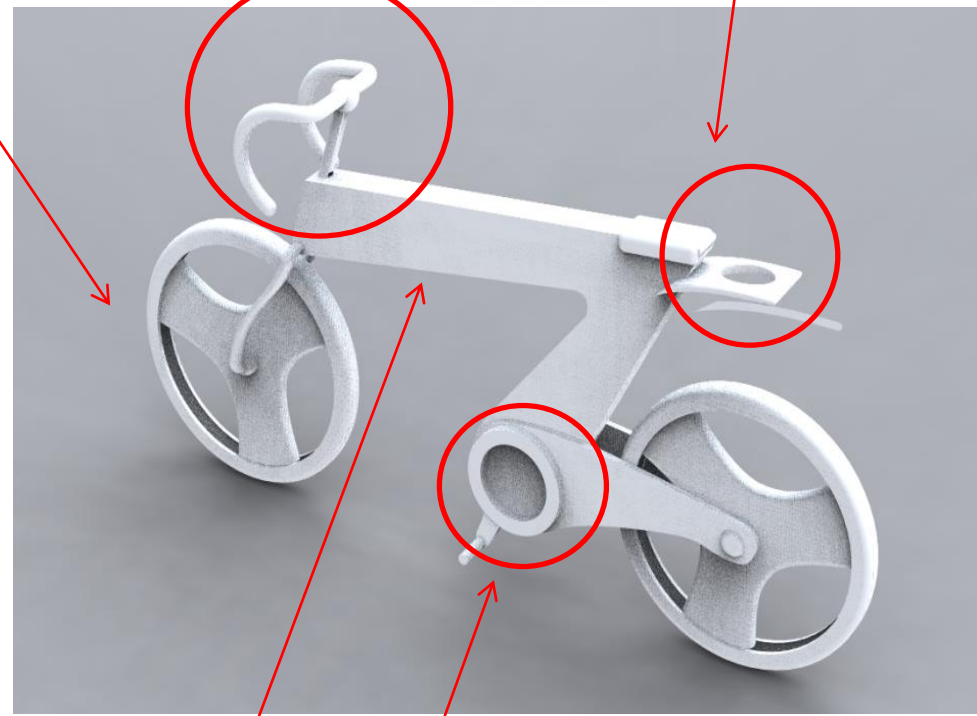
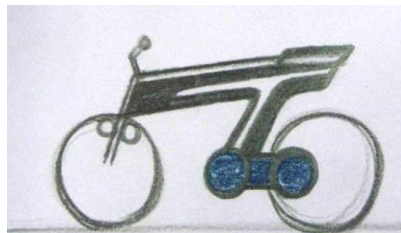
Form Inspiration has been taken from stage 1 ideation

Dropbars serve the need of the rode bike lovers.

Carbon Fiber
Wheels and
Tubeless Tires

Straight Handle with Drop bars to give
pleasure of Mountain Bike as well as
Road Bike

Flat surface Carrier –
Easy to clean, One Piece



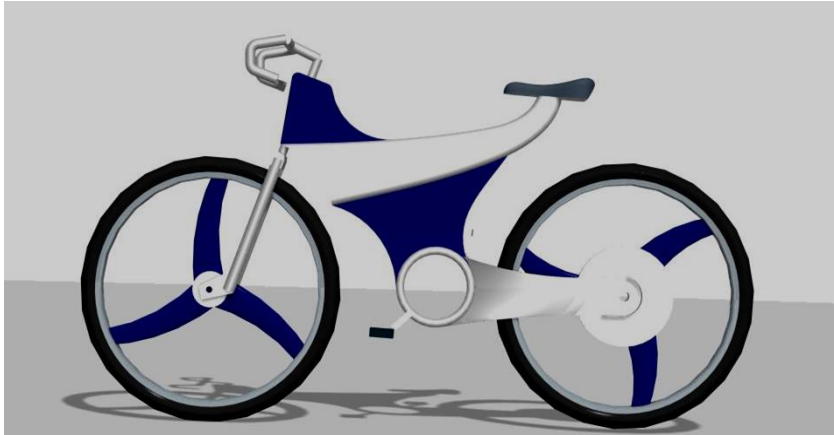
Aluminum and FRP Body
(Light Weight)

Covered Wheel Chains for
protection of cloths

8.29 Concept 02



Concept Evaluation & Selection



Concept : 1 - This was rejected by the users because –

- a) This was looking Bulky
- b) Was looking Feminine due to use of excess of curves

Good Feature : Looks stable

Concept: 2 – Got most of the votes because

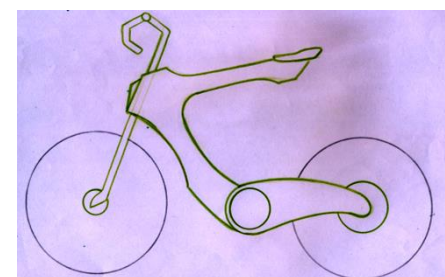
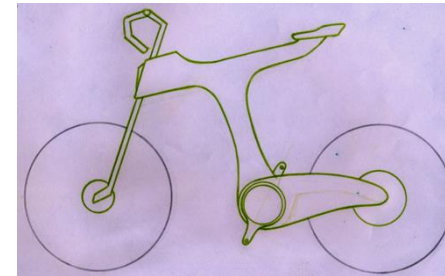
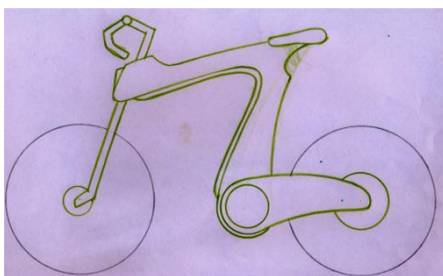
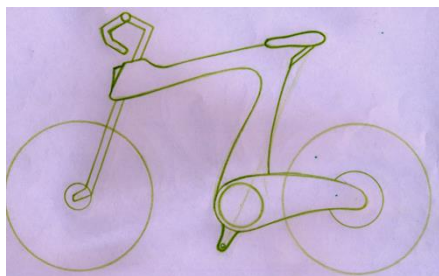
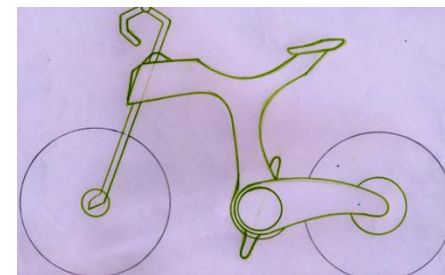
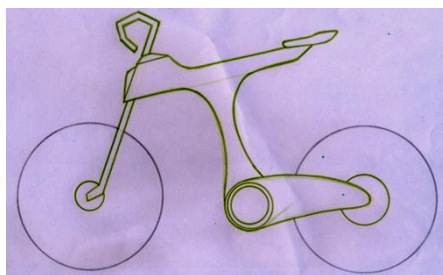
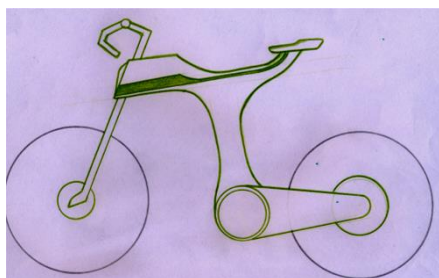
- a) Radical looks
- b) Looks more Youthful,
- c) Minimal and Simplistic.

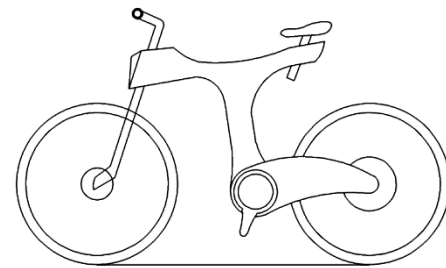
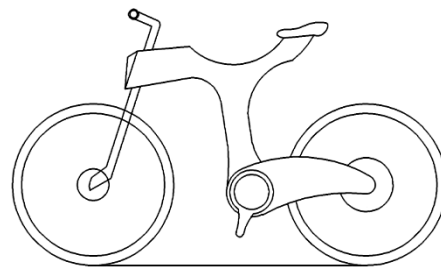
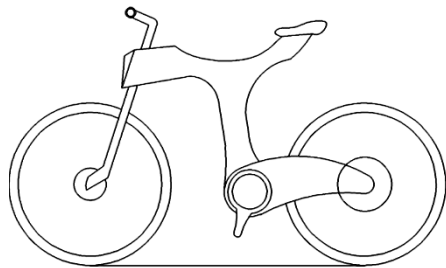
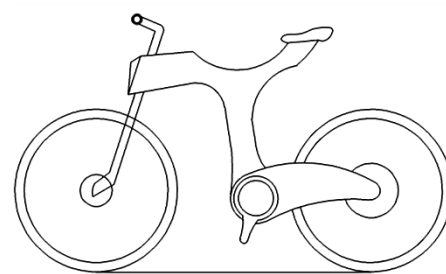
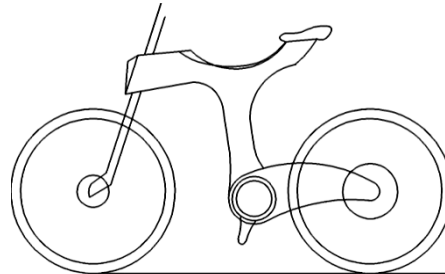
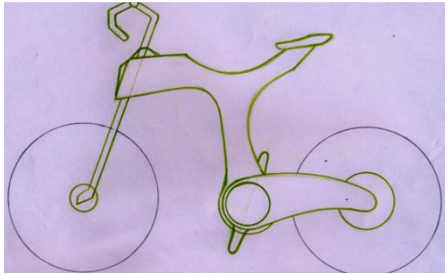


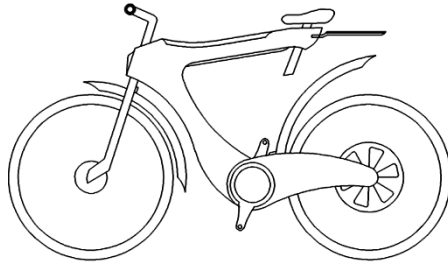
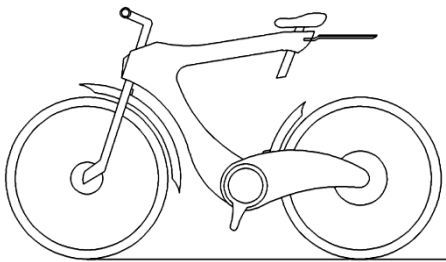
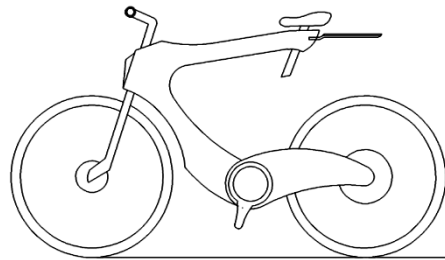
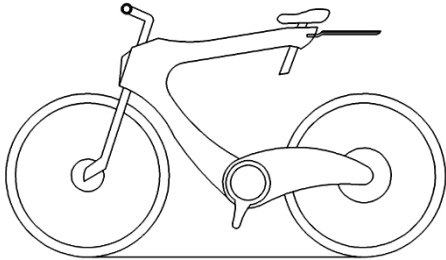
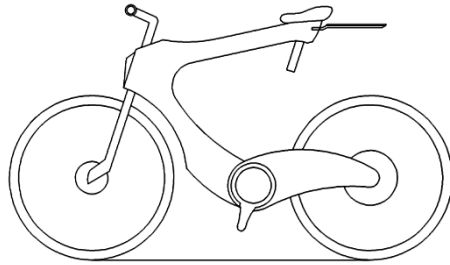
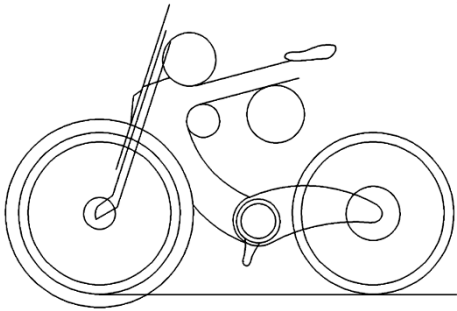
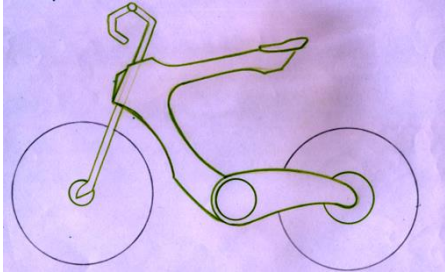
7 Votes

13 Votes

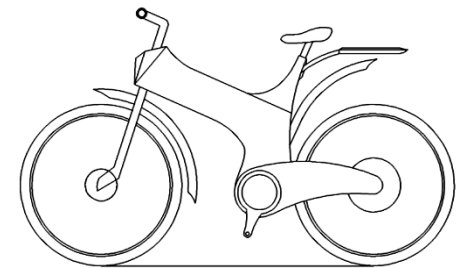
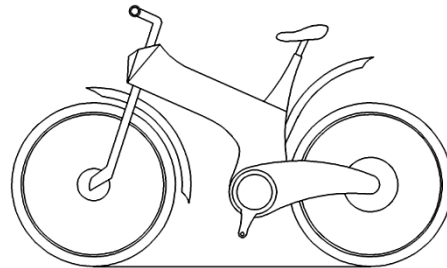
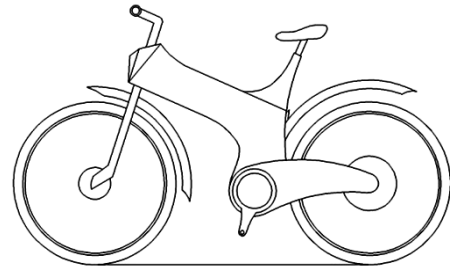
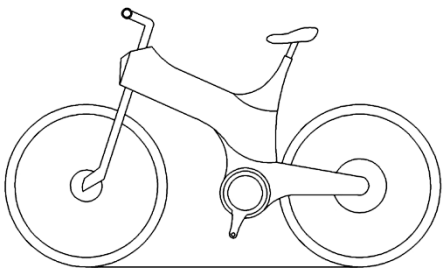
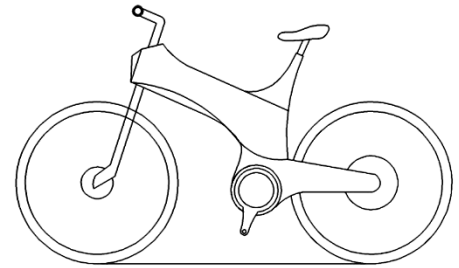
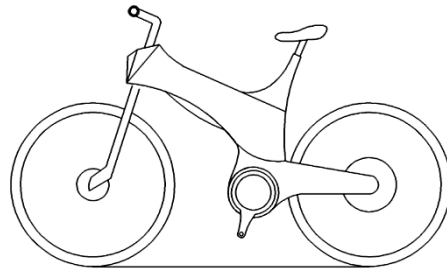
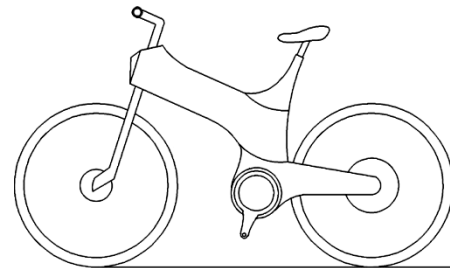
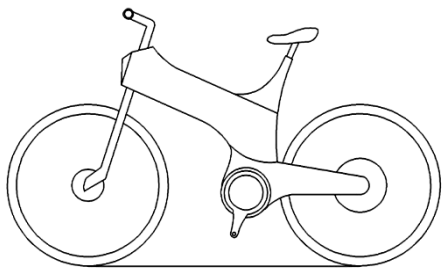
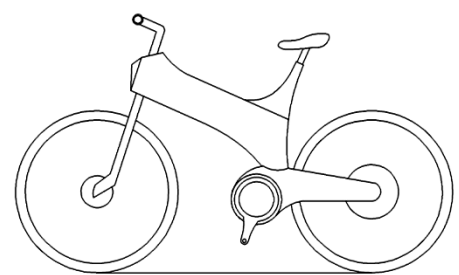
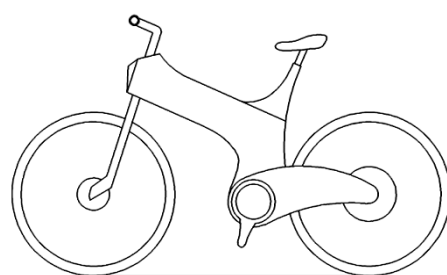
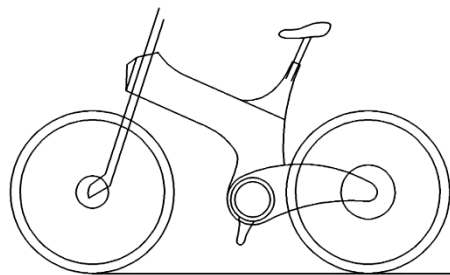
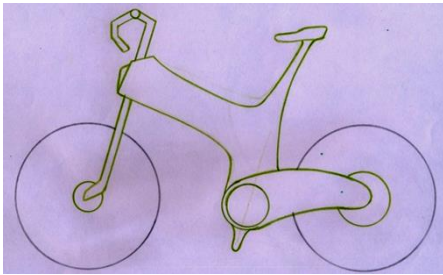
Concept Refinement





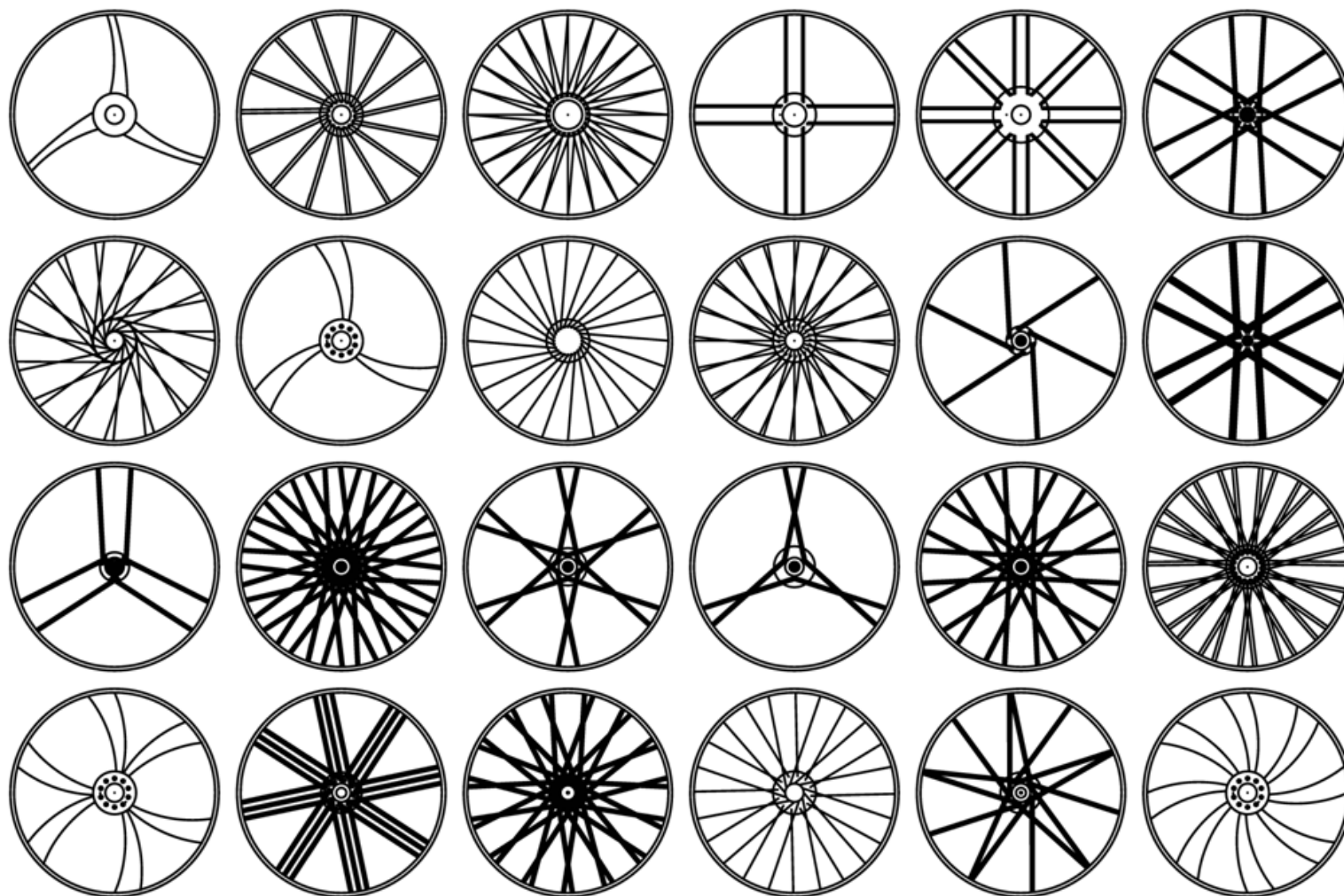


Final Concept Refinement





Bicycle Rim Design



Final Concept



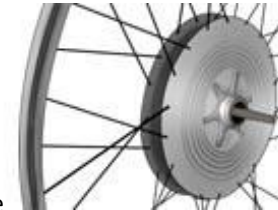




Bicycle Specification & Detailing



Motor & Battery



Hub Motor for Bicycle



Motor Type - Direct Drive, Gearless and Brushless Hub Motor
350 watts (Weight-8.8 lbs)

Battery - Lithium-Ion - 36V 9.6A (Weight-6.8 lbs)

Power assisted

Motor - Direct Drive, Gearless and Brushless Hub
350 watts (Weight-8.8 lbs)

Battery - Lithium-Ion - 36V 9.6A (Weight-6.8 lbs) (30cm*8cm*10cm)

Programmable Anti-Theft Alarm and a Thumb Throttle for Instant
Acceleration

Light Frame - Aluminium Frame and FRP (8kg)

RFID Tagging for keeping the track on Bike

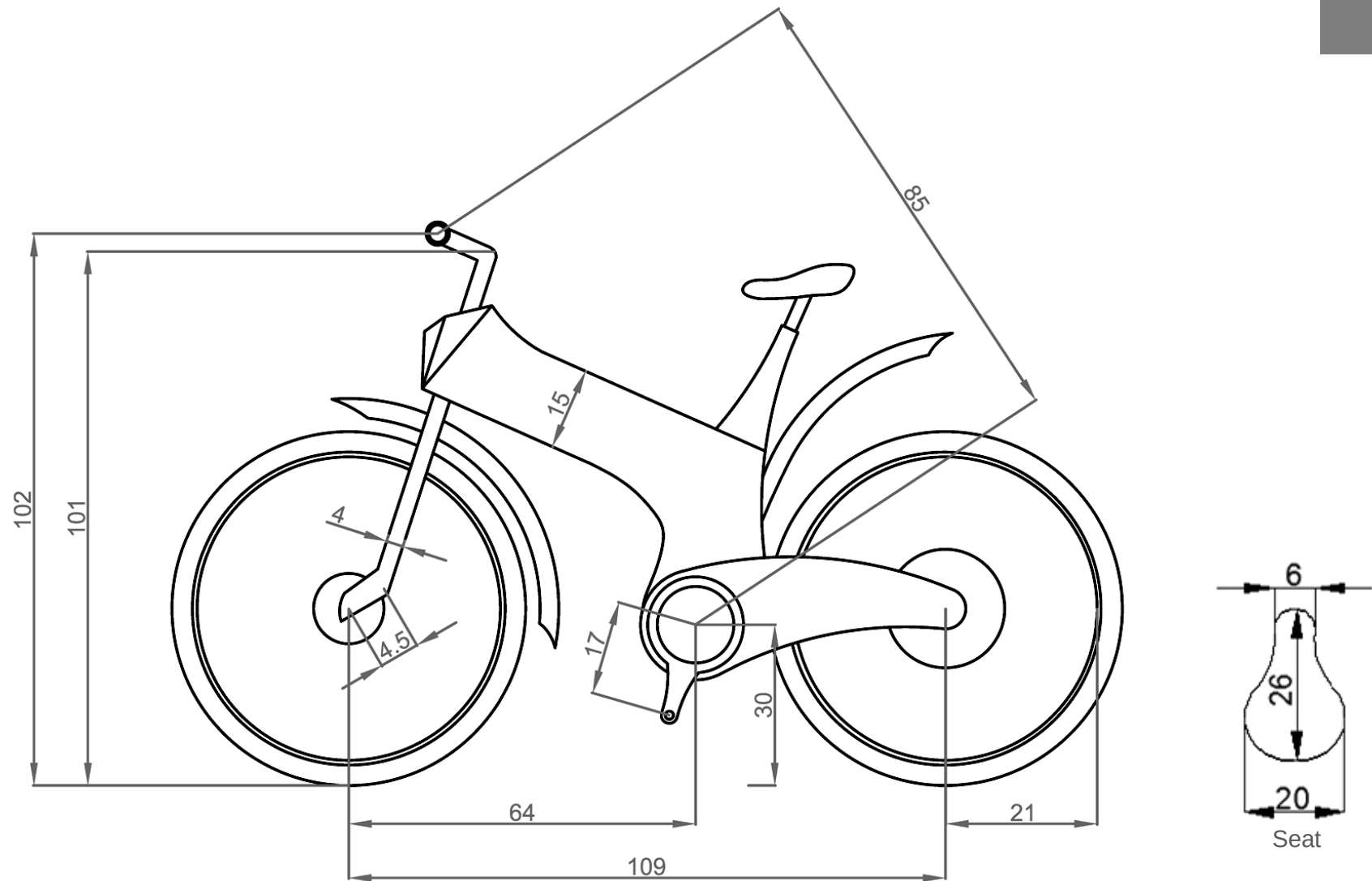
Carbon Fibre Wheels & Tubeless Tyre

Regenerative Braking Charging

Bicycle Specification	
FRAME	Ergonomically designed, Unique design mountain bike frame with integral carrier.
HANDLE	MTB style double curved handle with extended stem. Synthetic resin grips for better riding comforts. Attractive bar ends with comfortable sleeve.
BRAKES	Disc Brakes will be used.
MUDGUARDS	Plastic U-shaped wider section.
CHAINWHEEL & CRANK	44 Teeth x 165mm Crank with attractive plastic molded rotating disc.
CHAIN COVER	Elegantly styled Plastic cover, chains are covered to protect it from water and dust.
SADDLE	Moulded PU foam comfortable.
PEDALS	Synthetic fiber molded wider body single piece reflectorized body.
STAND	Steel Powder Coated side stand.
SIZES	Model will be available in 24T wheel size.

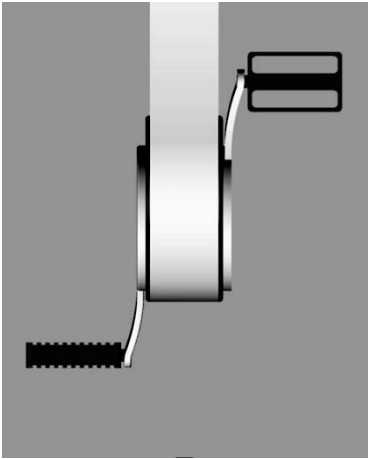


Overall Dimension

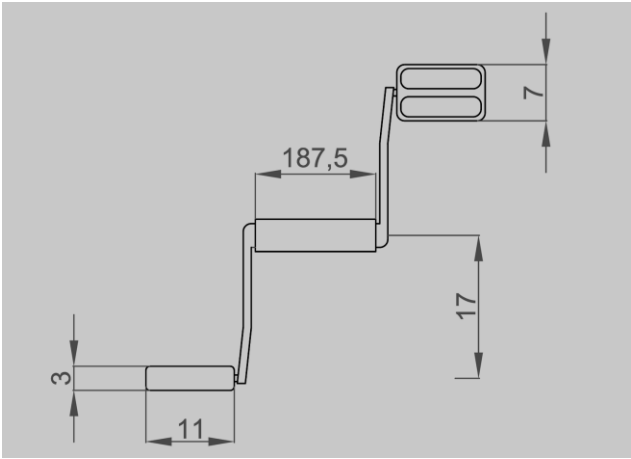


All the dimensions are in cm. Hero Swing has been used for dimensional purpose

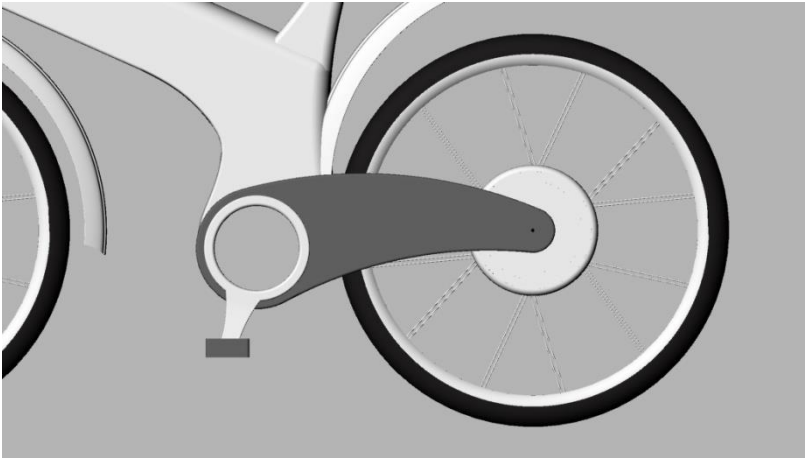
Paddle, Hub & Chain Cover



Paddle



Paddle Dimension



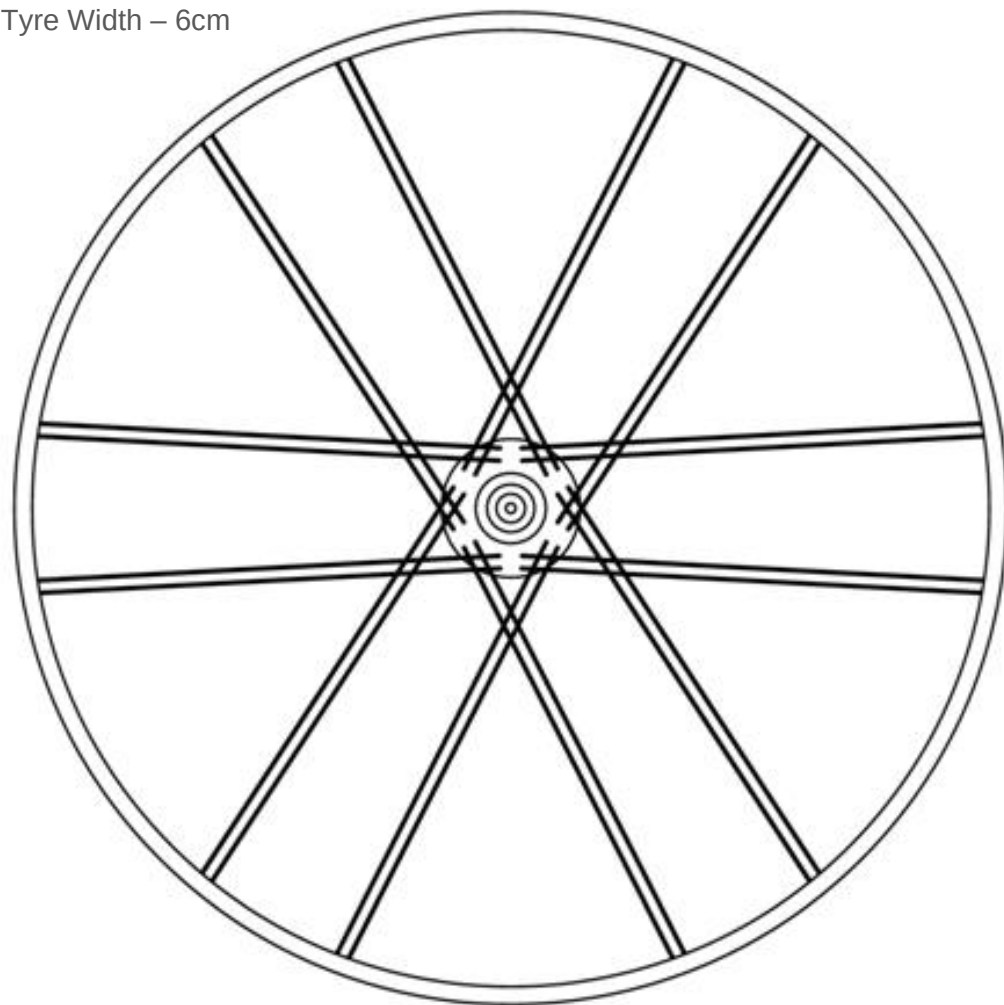
Chain Hub



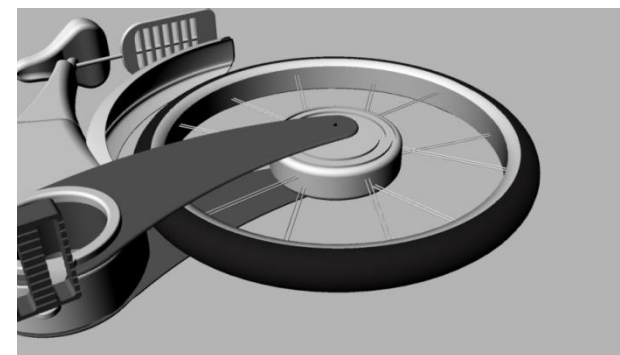
Rim & Tyre

Rim Width – 5cm

Tyre Width – 6cm

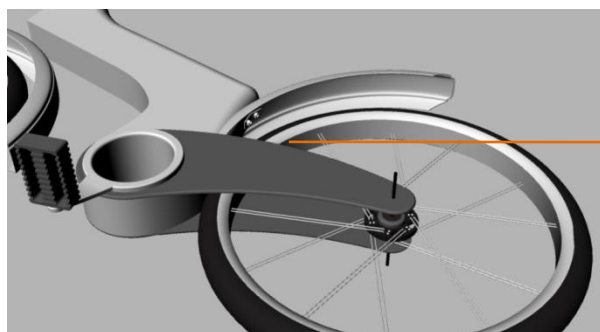


Front Wheel

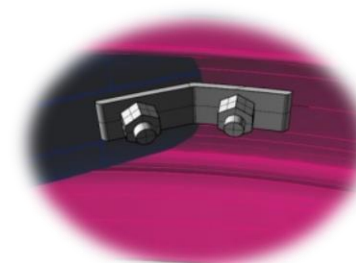


Rear Wheel

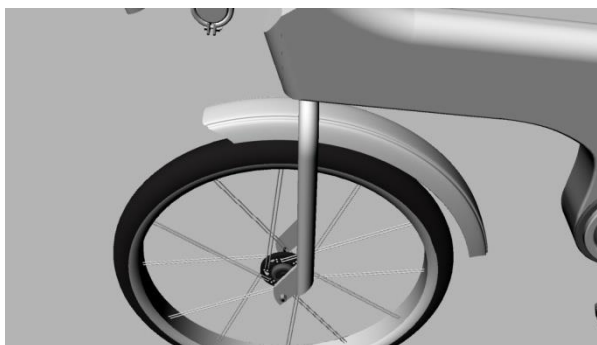
Mudgard



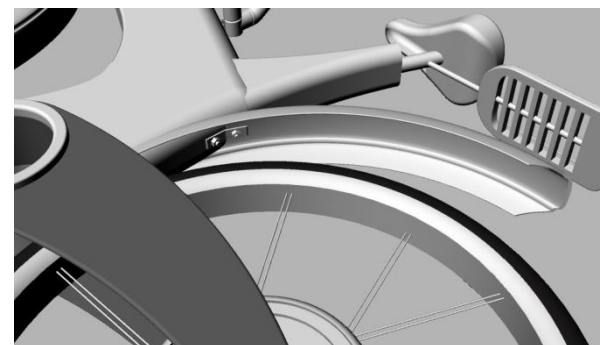
Mudguard & Fixtures



Front & Rear Mudguard (side view)



Front Mudgard



Rear Mudgard



Bicycle Carriage

Most of the students don't like bicycle carriage.

Most of the times they don't need this.

It's always difficult to clean.

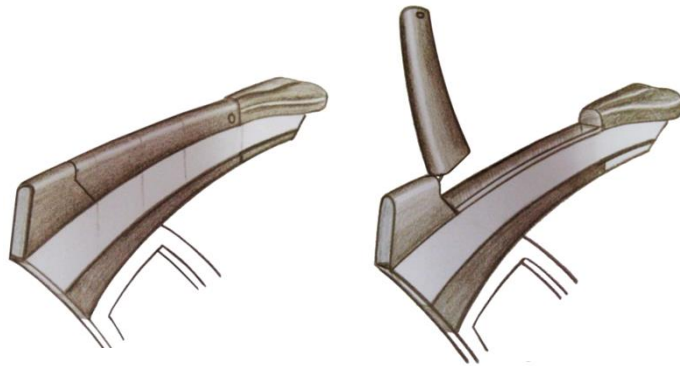
The new carriage will not be a part of the bicycle.

Carriage will be provided as an accessories, those who need can buy.

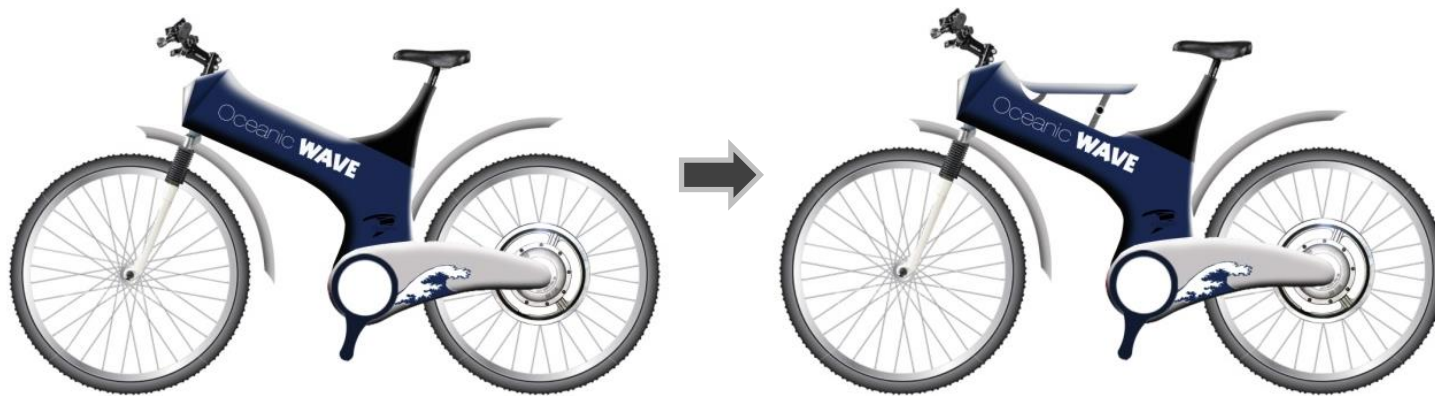




Bicycle Saddle & Tool Compartment



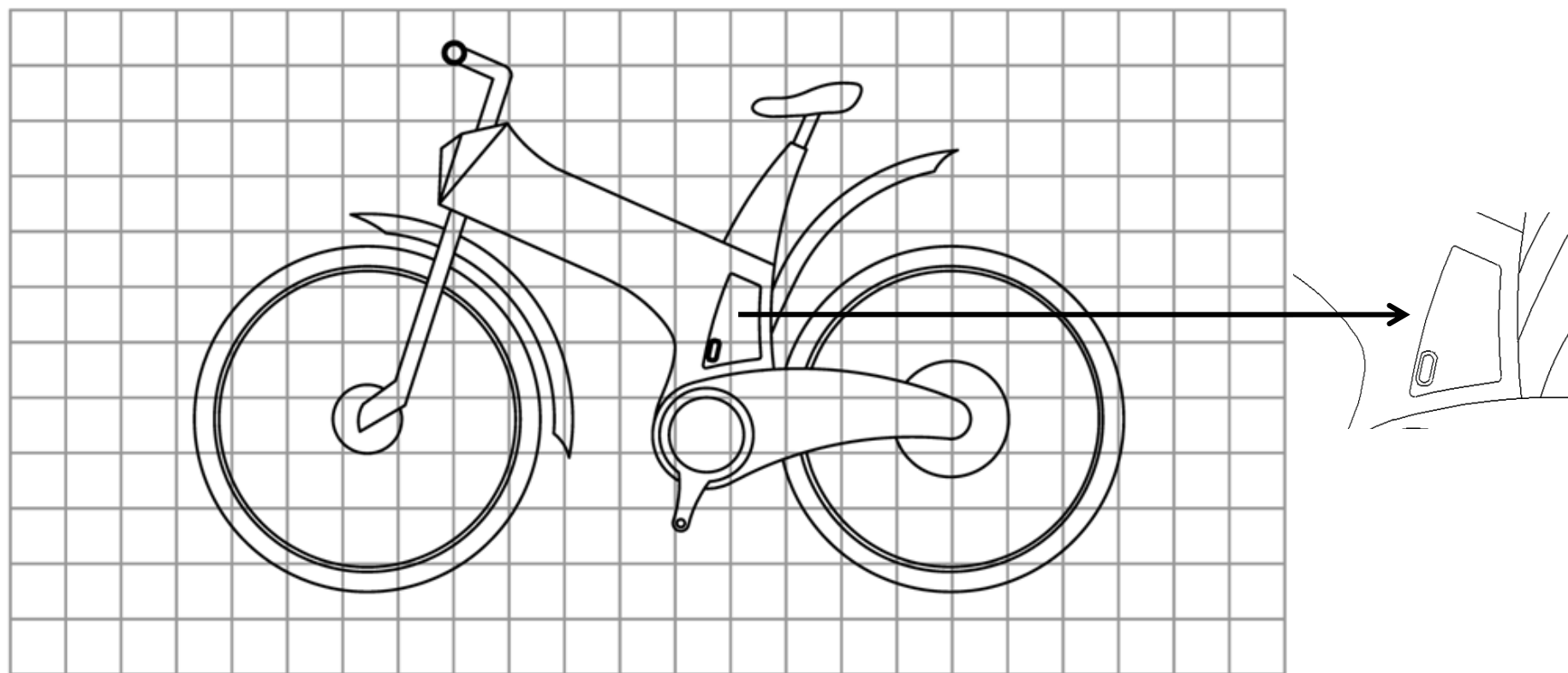
Sketch of Tools Compartment from Concept 1



9.18 Conversion of saddle into front seat of bicycle
& Opening of Tool Compartment

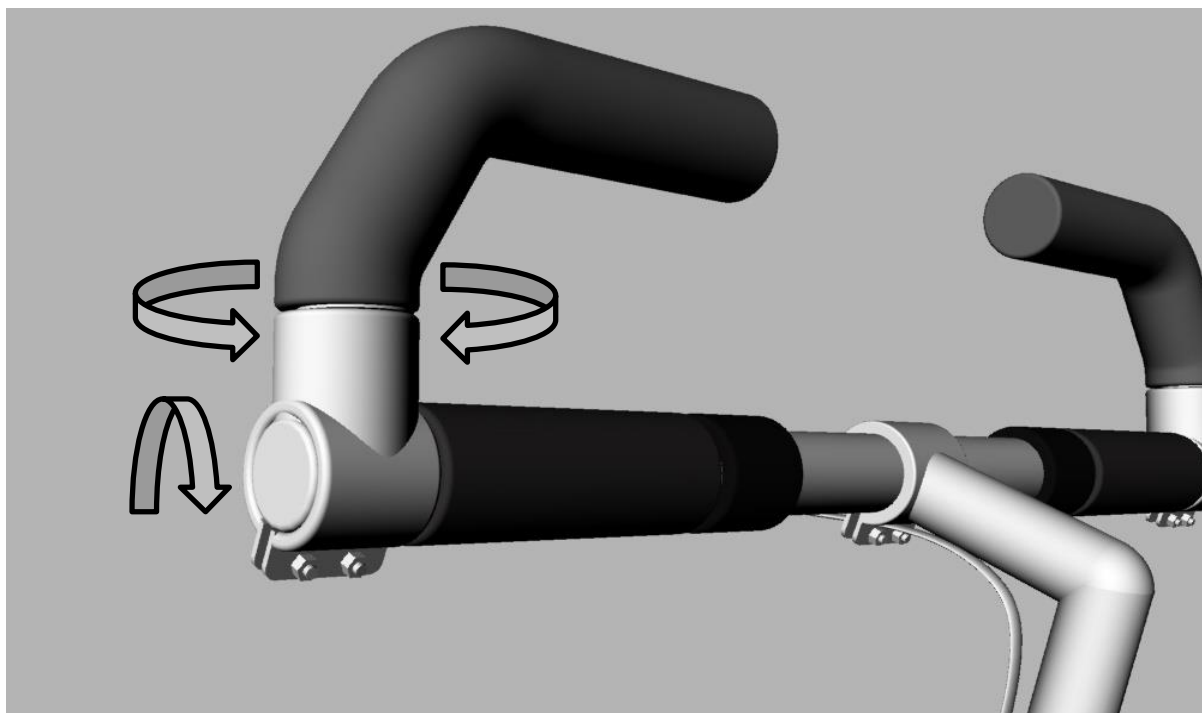


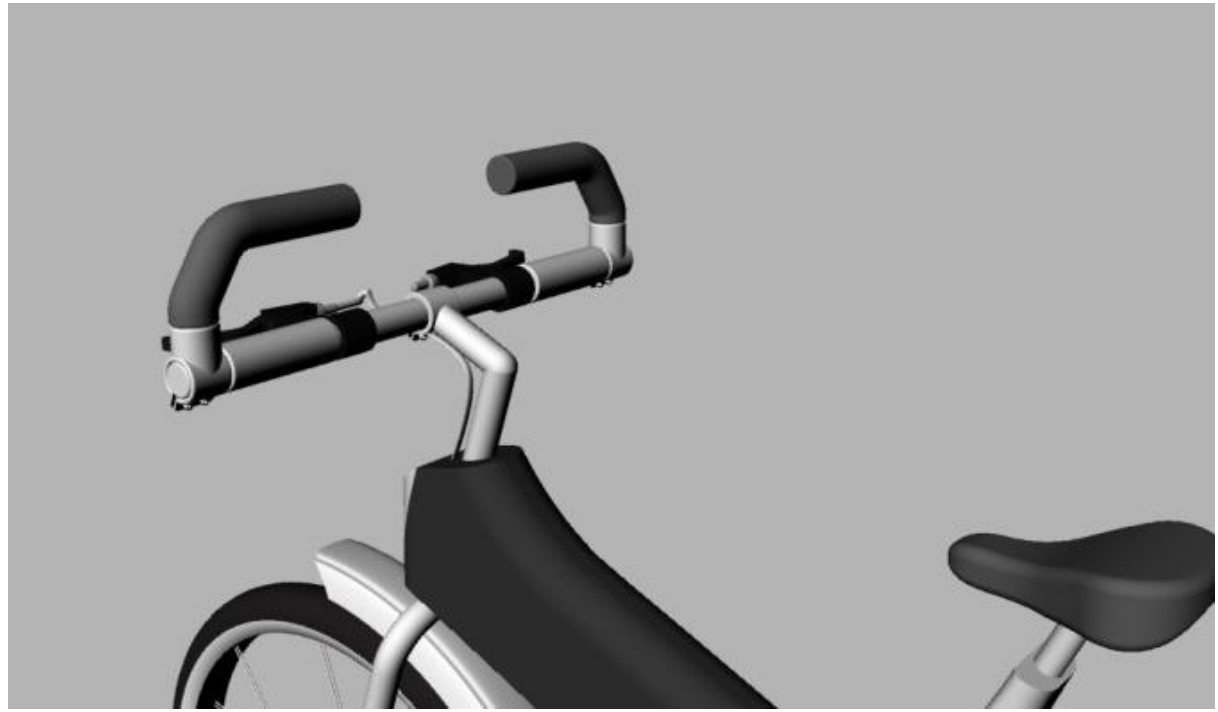
Battery Compartment



All the dimensions are in cm. Each grid is of 10cmx10cm

Handle







Hybrid Mountain Bike Configuration



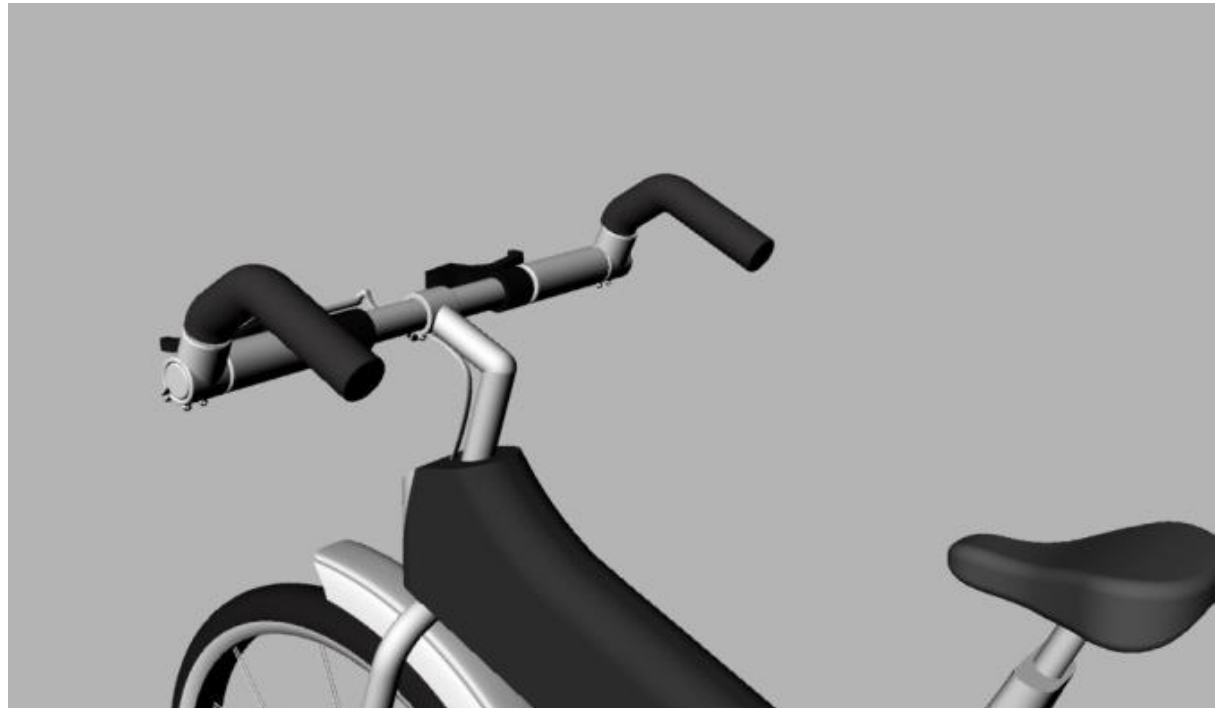


Road Bike Configuration



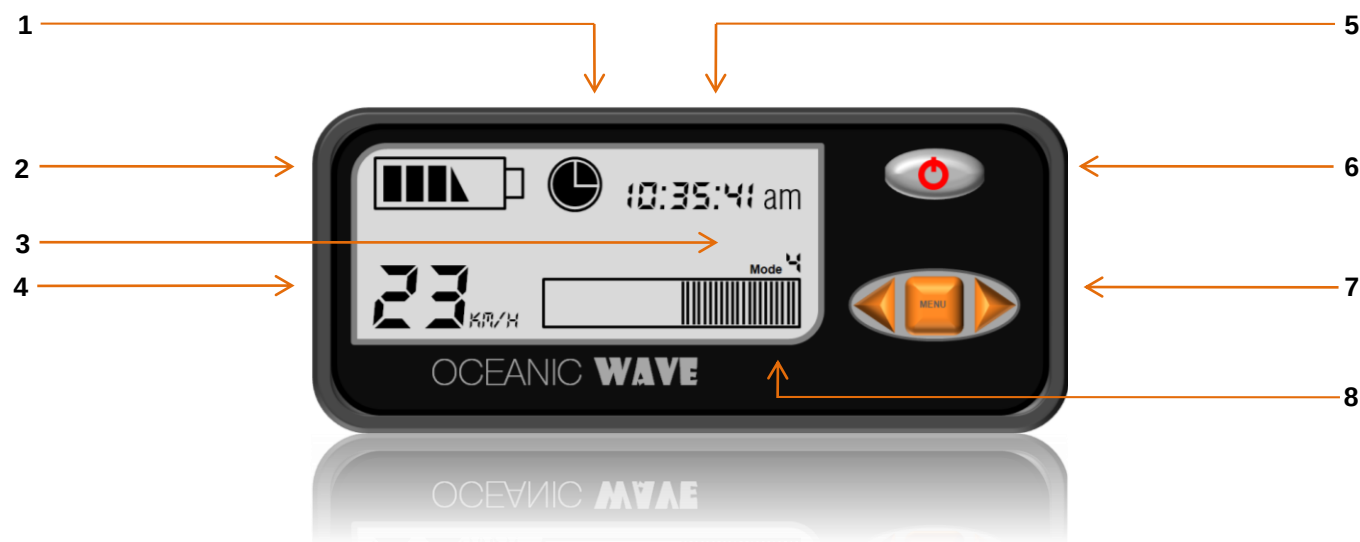


City Bike Configuration





Control Panel & Display



Final Display Unit

- 1 - Chronograph
- 2 - Battery Status
- 3 - Modes of Operation
- 4 - Avg.Speed (in kilometre/hour)
- 5 - Local Time & Alarm
- 6 - Power Button
- 7 - Navigation Buttons
- 8 - Acceleration

Chronograph -

A chronograph facility has been provided for the time calculation or recording purpose.



Chronograph Mode

Current Running
Chronograph

Chronograph Time Display

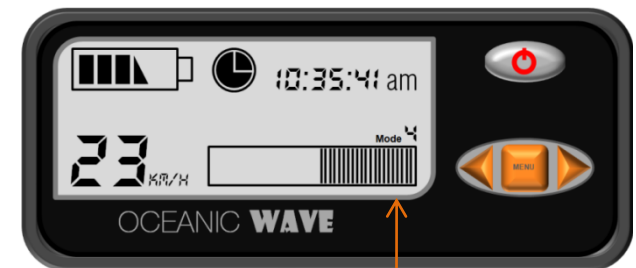
00:00:00:00
00:05:24:3
5

Last Saved Timing

Modes of Operation -

These are the modes in which the bicycle will work. Explanation for each is given below –

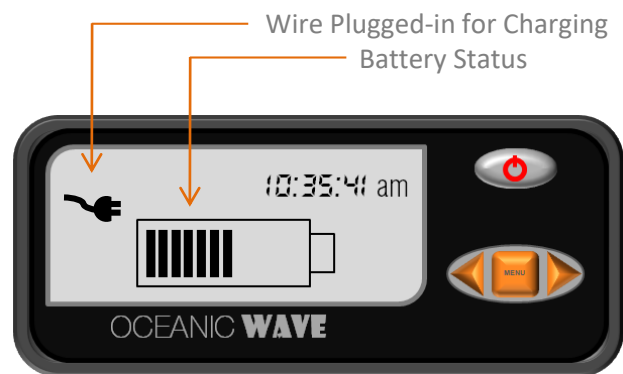
- i) - Power Assistance Off
- ii) - Power Assistance On.
- iii)- Power Drive Mode I
- iv)- Power Drive Mode II



Modes of Operation

Various Functions of the Control Panel





Plugged in - Charging Display



Evaluation of the Proposed Bicycle





How the proposed design meets the Project Brief and need of the Project??

- 1) **The proposed bicycle is power assisted** to help user during up-hill ride. The thumb throttle control adds experience, the zoom factor, to the ride, what an end user wants.



10.2 Control Panel



10.1 Hub Motor



2) Most parts which are sensitive to rusting are **covered**, so they are less likely to need frequent maintenance in the humid and rainy region of IIT Bombay



Front Part



Rear Wheel



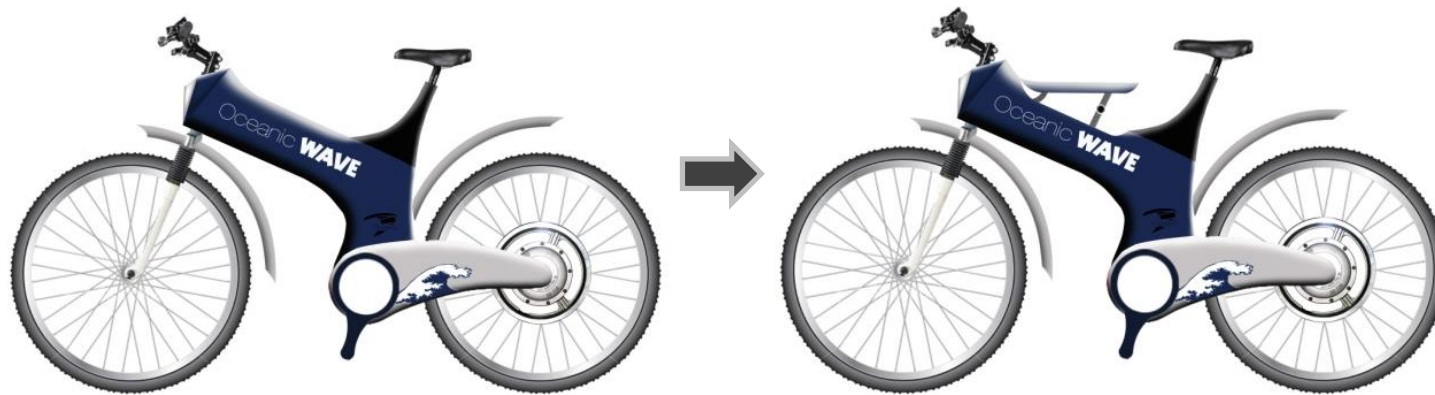
Paddle Hub & Chain Cover



Saddle & Seat



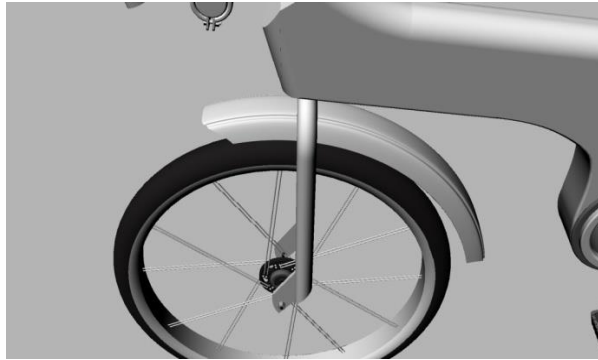
- 3) Thus the age **old culture of riding the bicycle by two user** is also there. This helps in the social interaction and shows the life of IIT. One of the most important need and part of the project brief is done.



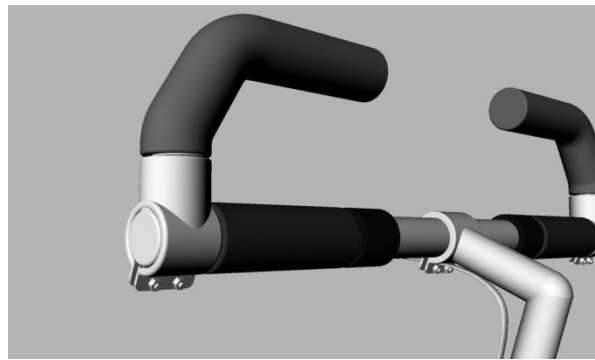
Conversion of Saddle into Front Seat



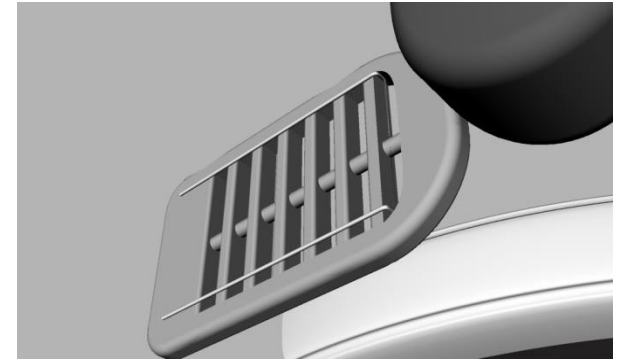
- 4) **Customization** : Many of the parts which are used as per the user needs will be provided as accessories. Ex- Bicycle carrier, mudguards, Chain covers, Handle fittings etc.



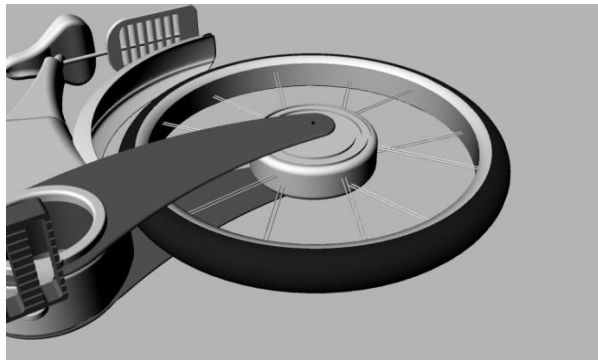
10.8 Mudguards



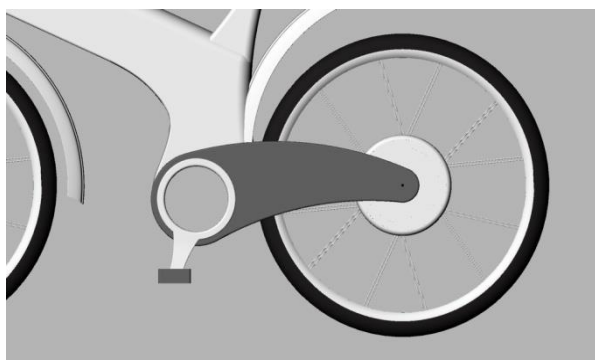
10.9 Handle



10.10 Bicycle Carriage



10.11 Chain Covers



10.12 Rim & Tyres

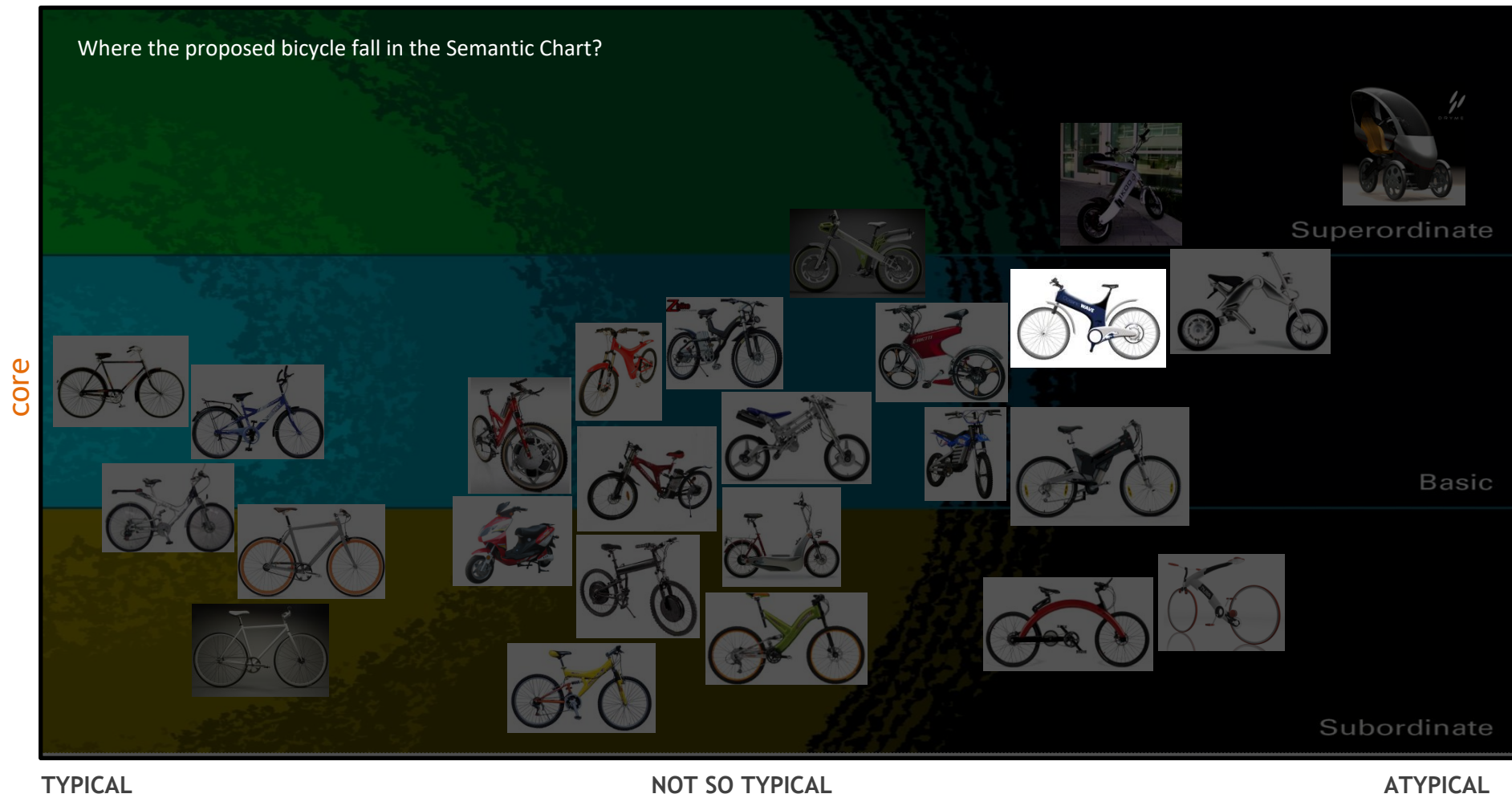


10.13 Handle Configuration



5) Based upon the **semantic study**, new form is explored keeping a proper balance between Form and functionality.

Fuzzy boundary →



- 6) To serve **the emotional needs** of the various users of the bicycle in campus some changes are done –
- Straight handle with drop bars (Mountain Bike lovers)
 - Front suspension can be jammed (Road Bike lovers)
 - Look & Power assistance (Bike lovers)
 - Introduction of Chronograph and other minor health monitoring gadgets (Tech lovers)

Hybrid Mountain Bike Configuration



Road Bike Configuration



Mountain Bike Configuration



City Bike Configuration





Features of the proposed bicycle

- 1) Unique form inspired from the youthful oceanic wave and U2 Blackbird to depict the youth dynamism.
- 2) Freedom to customize – Parts like Bicycle carrier, mudguards etc can attached depending upon the need.
- 3) Power assistance with 350Watt motor and 36Volt:9.9Amp Battery with thumb throttle control to give instant acceleration.
- 4) Tracking of the bicycle, it can be used at a large scale to implement in a city (Preventing loss of track and theft)
- 5) Maintenance Free feature
- 6) Two in One Bike
- 7) Convertible seat in the front which can be deployed in case of need, reviving the age old enigma of social interaction in IIT.
- 8) Compartment to keep Umbrella and small tools in the saddle.

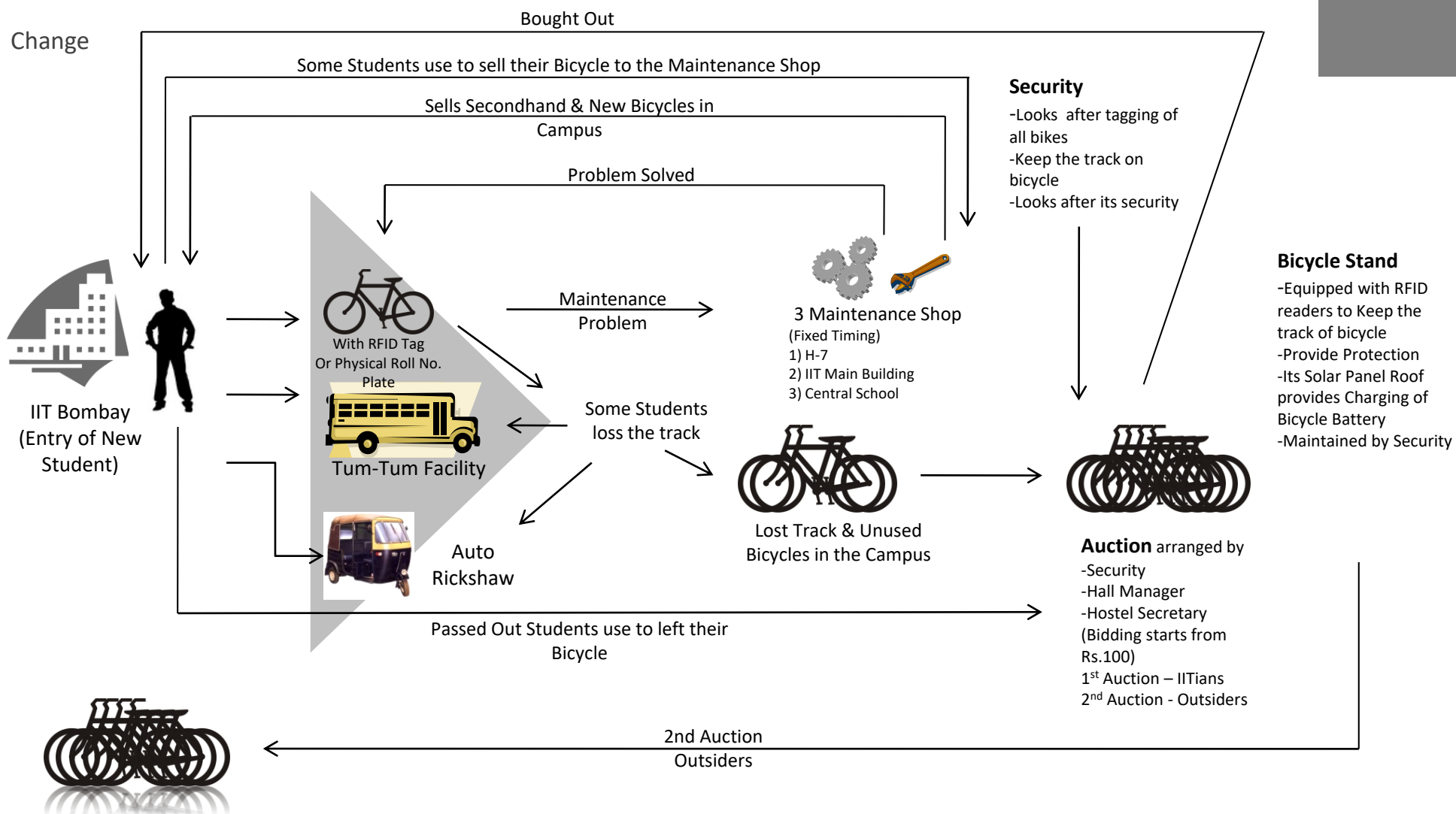


USP of the proposed bicycle

- 1) Unique form
- 2) Freedom to customize
- 3) Being a low saddle bicycle it can also be target on the girls too.
Even in some areas girls like to ride boys bicycle
- 4) Power Assistance for instant acceleration.
- 5) Tracking of the bicycle, it can be used at a large scale to
implement in a city
- 6) Maintenance Free feature

New Bicycle in IIT Scenario





Thank You

