To Design Next Generation Electric Motorcycle for Indian Men

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Dehradun

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MASTER OF DESIGN

IN

TRANSPORTATION DESIGN

Under the guidance of

Manas Ranjan Mishra

Head of Department

School of Design Studies

UPES

By

Y.Uday Vikas

Enrolment No: R109213009

SAP ID: 500026632

University of Petroleum and Energy Studies, Dehradun

Declaration

I hereby declare that the project work entitled “To Design Next Generation Electric Motorcycle for Indian Men” submitted by me in partial fulfilment of the requirements for the award of the degree of Master of Design (Transportation Design) at School of Design Studies, University of Petroleum and Energy Studies was carried out by me during 15 Jan 2015 to 16 April 2015 under the supervision of “Manas Ranjan Mishra”.

Date: Sign:

Place: Name: Y.Uday Vikas

SAP ID: 500026632

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This satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of the people who made it possible whose constant guidance and encouragement crowned my effort with success.

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Words are not enough to express my feelings towards my parent, as they have always been the constant source of moral encouragement throughout the completion of my course. I express my heartfelt gratitude to each and every individual who was associated with my project work, including those whom I may have inadvertently failed to mention.

I also thank **Dr.Kamal Bansal**, Dean of COES, UPES for all the encouragement and support for this project

ABSTRACT

Motorcycles have been an integral part of transport for over a century. They epitomize the ultimate freedom of expression, but due to the rampant exploitation of fuel resources there is a dire need to provide alternate mode of transportation for people who would want to travel in a non-polluting and clean way

Electric motorcycles offer all the comforts of a traditional gas powered vehicle also they are better than them in regards of lower noise, maintenances and non-polluting terms. These make them a perfect choice for a country like ours where people crave for vehicles being style statements offering all creature comforts and removing the hassles of maintenance

The trend analysis of the current generation of vehicles have been studied, analysed to predict the future trends, based on these the line study of the vehicle is performed to achieve the balance between power, luxury, aggression and being subtle. The resultant form is forward leaning with ample amount of luxury, oozing confidence and substance

Concepts for the future of electric mobility for men of India have been developed and out of those concepts the resultant vehicle is what the market needs as far as alternate mobility goes in our country

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1.0 INTRODUCTION

The Electric Vehicle segment has gained importance in India, as the Nation is looking into alternative options of energy efficient transportation solutions. This segment has gained importance because it is an environment–friendly, nonpolluting means of transport. In addition, there is hardly any maintenance cost for EV's and spare parts are inexpensive and therefore affordable. Additionally, the Government is also proving subsidies to this segment in order to encourage more people to buy these vehicles.

2.0 DATA COLLECTION

2.1 Literature review

lectric bike (e-bike) use has rapidly expanded in the People's Republic of China (PRC), in the process changing the mode split of many cities. Currently, the PRC produces over 20 million e-bikes yearly, up from a few thousand a decade ago.1 E-bikes in the PRC are defined as electric two-wheelers with relatively low speeds and weights compared to a motorcycle. Both bicycle-style e-bikes (with functioning pedals) and scooter-style e-bikes (with many of the features of gasoline scooters) are classified as bicycles and are given access to bicycle infrastructure.

E-bikes have risen in popularity in the PRC due to restriction of gasoline motorcycles, extensive bicycle infrastructure, and increased car and public transit congestion. However, the rise in e-bikes in the PRC has not spread to the rest of Asia. In fact, few cities in other Asian countries have any presence of e-bikes. In countries with dominant gasoline two-wheeler mode split, replacing those vehicles with electric two- wheelers could improve air quality and reduce greenhouse gases[1].

This study focuses on market potential in Delhi, India, and Pune, Pune. From these cities, the study estimates price, performance, and regulatory factors that can influence the adoption of electric scooters (e-scooters) in these countries. It also focuses on the tailpipe emission reductions that could occur if e-scooters were adopted. It is important to note that the study investigates the potential and relative benefits of substituting electric two- wheelers (e-scooters) for gasoline two-wheelers. This report does not investigate the potential shift to other modes, such as cars, mass transit, or no motorized transport, nor their impacts. It is expected that a shift from gasoline two-wheeler to e-scooter would result in environmental shifts, but that safety and mobility costs and benefits would not change much.

Typical Electric Scooter

Fig 1: Electric motorcycle

Electric motorcycles and scooters are plug-in electric vehicles with two or three wheels powered by electricity. The electricity is stored on board in a rechargeable battery, which drives one or more electric motors. Electric scooters (as distinct from motorcycles) have a step-through frame.

Electric motorcycles: manufacturers include Brammo, Zero Motorcycles, Lightning Motorcycle, Energica Motor Company, Quantya, Electric Motorsport, Hollywood Electrics, Yo and Lito. Yamaha plans to enter the market shortly with at least two models. Spanish company Bultaco intends to enter the electric motorcycle market in 2015. Heavyweight Harley Davidson introduced a new prototype electric motorcycle in June 2014[2].

Electric scooters: the primary commercial production supplier for worldwide markets, is Z Electric Vehicle. The BMW C Evolution electric scooter was released in Germany in May 2014. Honda participated in European lease demonstration and driving tests for its electric scooter in 2012 but has not yet announced its availability for sale. Terra Motors, a Japanese electric vehicle maker, will begin selling electric

scooters in India by 2015. Gogoro announced a swappable battery electric scooter at CES 2015.

Starting of electric motorcycle The early history of electric motorcycles is somewhat unclear. On 19 September 1895, a patent application for an "electrical bicycle" was filed by Ogden Bolton Jr. of Canton Ohio. On 8 November of the same year, another patent application for an "electric bicycle" was filed by Hosea W. Libbey of Boston

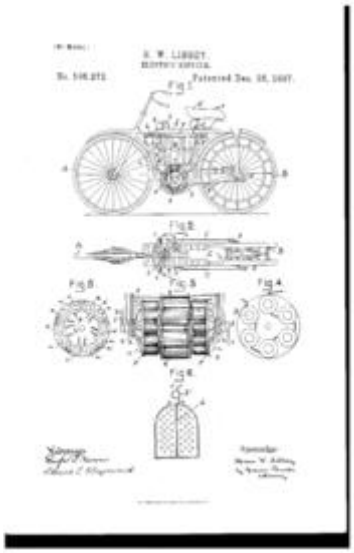


Fig 2: Architecture of E-bike

Comparison: -s

Electric vs Gasoline

Speed

Brandon Nozaki Miller on the first production electric motorcycle to break 161 km/h (100 mph), a 2012 Zero S ZF6 at Bonneville Salt Flats (2012)

Electric and gasoline powered motorcycles and scooters of the same size and weight are roughly comparable in performance. In August 2013 Road and Track evaluated a high-end electric motorcycle as faster and better handling than any conventionally powered bike. Electric machines have better 0 to 60 acceleration, since they develop full torque immediately, and without a clutch the torque is instantly available[3].

Range

Electric motorcycles and scooters suffer considerable disadvantage in range, since batteries cannot store as much energy as a tank of gas. Anything over 130 miles (210 km) on a single charge is considered an exceptionally long range. As a result, while electric machines excel as daily commuters traveling a fixed distance round trip, on the open road riders experience inhibiting range anxiety. Also electric power trades off range against speed. For instance the current longest range electric scooter, the ZEV 10 LRC, travels 220 km (140 mi) at 89 km/h (55 mph), but according to the manufacturer the range drops to about 129 km (80 mi) at 112 km/h (70 mph).

Maintenance

Electric scooters and motorcycles need virtually no maintenance. As Wired magazine's transportation editor Damon Lavrinc reported after an experiment of trying to go six months using nothing but a Zero electric motorcycle: with only a battery, a motor, and a black box (i.e. the controller) to keep you moving, electric motorcycles are a breeze to maintain compared to a conventional motorcycle, what with all the lubricating and adjusting and tuning you have to do. You basically just worry about consumables: brake pads, tires, maybe a brake fluid flush. That’s about it.

Fuel cost

At between one and two cents per mile (depending on electric rates), electric machines enjoy an enormous fuel cost advantage. Three months and 2,800 km (1,700 mi) of commuting on an electric motorcycle cost Lavrinc less than $30 for electricity; on a BMW gasoline bike a single trip of 650 km (400 mi) cost nearly the same.

Noise

Electric vehicles are far quieter than gas powered ones, so silent they may sneak up on unwary pedestrians. Some are equipped to emit artificial noise. Popular

Mechanics called the comparative quiet of electric motorcycles the greatest difference between them and their gas counterparts, and a safety bonus because the rider can hear danger approaching. Whether a loud motorcycle is more noticeable and thus more safe than a quiet one is contested. At high speed the whine of an electric motorcycle is said to sound "like a spaceship.

Around 93% of today's automobiles run on petroleum based product, which are estimated to be depleted by 2050 [1]. Moreover, current automobiles utilize only 25% of the energy released from petroleum and rest is wasted into the atmosphere [2]. Despite recent efforts to improve fuel efficiency and reduce toxic emissions in cars, emissions have continued to increase steadily in the past two decades. For preservation of gasoline for future and increasing the efficiency of vehicle an electric vehicle can be a major breakthrough. An electric vehicle is pollution free and is efficient at low speed conditions mainly in high traffic areas. But battery charging is time consuming. Moreover, it cannot provide high power required by drives during high speed conditions or in slopes of hilly areas. Gasoline engine proves its efficiency at higher speeds in high ways and waste a lot of energy in urban areas. A hybrid vehicle solves these problems by combining the advantages of both the systems and uses both the power sources at their efficient conditions. The objective of this project aims at better utilization of fuel energy and reduces dependence on non-renewable resources using latest technology. The implementation involves development of HEV that uses battery as well as gasoline power for propulsion of vehicle[4].

Electric motorcycles are safer for you and everyone around you. EVs are a boon for safety-minded individuals. Electric motorcycles are called zero emission vehicles (ZEVs) because they emit nothing, whether they are moving or not. In fact, when stopped, electric motorcycle motors are not running and use no energy at all. This is in direct contrast to internal combustion engine motorcycles, which not only consume fuel but also do their best polluting when stopped and idling in traffic. Electric motorcycles are obviously the ideal solution for minimizing pollution

and energy waste on congested stop-and-go commuting highways all over the world, but this section is about saving yourself: As an electric motorcycle owner, you are not going to be choking on your own exhaust fumes. Electric motorcycles are easily and infinitely adaptable. Want more acceleration? Put in a bigger electric motor. Want greater range? Choose a better power-to-weight design. Want more speed? Pay attention to your design's aerodynamics, weight, and power[5]

Pros and Cons of Ev's:-

- People who buy EVs are well aware of the features and how to use it
- Upscale customers
- Second vehicle
- Toyish design
- Lack of spare parts and good skilled technicians for maintenance purpose
- Underpowered
- Merely 1 % of two-wheeler market in India is electric two-wheeler
- Electric two-wheelers dominate the market with 97.5% of the EV market

Findings:-

- EVs in India are at a very nascent stage and is stated to grow in double digits
- EVs in India is dominated by 2-wheeler segment, and the immediate future also seems to be in this segment
- Supplies for 2-wheelers are majorly from China as SKDs, Electric Components come from Taiwan

- 2-wheeler industry is looking at technology for motor controllers, battery & Charging Systems
- In India most of the EVs run on Lead Acid batteries, Li-on batteries are the need of the hour to improve the EV's efficiency
- At present the components and Li-on batteries come from China, Taiwan & Japan; Power controllers come from USA
- In terms of infrastructure there is lack of government support, infrastructure and optimum business models
- Need of public private partnership in the development of EV infrastructure
- Battery leasing options are being considered by the manufacturer, for reducing ownership costs

2.2User Survey:-

Fig 3: Users Pictures with super bikes

Motorcycles give you freedom of expression which no other modes of transport offer you

Motorcycles are your ultimate expression of your self

Motorcycles are indulgent and offer you the space and platform to express your attitude


ROYAL
ENFIELD

Electric motorcycles are necessary to attract the next generation of motorcycle enthusiasts

2.3 Market survey:-

Fig 4: Current Indian Electric vehicle scenario

Fig 5: Market surveyed on this list of companies

In most Indian cities, gasoline-powered two- wheelers (scooters and motorcycles) provide high mobility to households. While mode split varies by city, two-wheelers are a vital component of the transport system[6]. Delhi is the capital of Delhi state in west India. Delhi has a population of about 5 million. In 2007, 30% of all trips were made by a motorized two-

or three-wheeler, 14% by bicycle, 22% by foot, 16% by public transport, and 17% by car. The average trip length of all modes was 6.2 km.[3] In 2000, motorized two-wheelers constitute 38% of vehicle kilometers traveled with an average trip length of 6.8 km.[4] Moreover, the average growth rate of the two-wheeler population in India is 10%.[5]

Interviews with a major e-scooter manufacturer indicate a generally negative public perception of e-scooters. This is based on early models that performed poorly, along with companies importing low-quality scooters from the PRC that cannot operate well in the Indian context and do not have strong after-sales support. Companies based in India are focusing on developing more powerful e-scooters to provide higher speeds and more load-carrying capacity[7].

In Pune, private transport is dominated by gas-powered motorcycles. In 2005, there were 1.5 million registered motorcycles in Pune's capital of Pune for a population of 3 million people, with motorcycles comprising 65% of all vehicular trips.6 Motorcycle ownership in Pune and throughout Pune continues to grow at an average annual rate of more than 14%.7

At the same time, motorcycles are the main contributor to Pune's air quality issues, where levels of particulate matter exceed the national ambient air quality standards. Of all known local emissions of particulate matter, 40% originate from vehicular sources, and motorcycles have the largest share of vehicle emissions, emitting 43% of particulate matter and more than 54% of carbon monoxide (CO) and hydrocarbons.8 In addition, motorcycles are the primary source of Pune's urban noise pollution.

The prevalence of motorcycle use and the related environmental issues would make Pune seem, like many cities in the PRC, a market primed for e-scooters. In Pune, however, the transition from motorcycles to e-scooters has been the very opposite of that in the PRC, with e-scooters failing to make market penetration. 3

In interviews conducted in Pune, Pune motorcycle riders conveyed a number of reasons that potentially explain why Pune has not yet adopted e-scooters, including

their inferior speed and range, but also the perceived greater comfort and style that is offered by a motorcycle. In the PRC, regulations against motorcycles are extensive and exclusive bicycle infrastructure make e-bikes and e-scooters particularly attractive.9 Despite Pune riders' negative perception of them, e-scooters offer a potential solution to Pune's air and noise pollution if adopted as a motorcycle alternative. Thus, it is valuable to explore what limits this adoption, and to understand the ability of technology and incentives such as sales tax breaks to overcome these impediments. Optimally, this investigation would be accomplished by observing the actual purchasing decisions and trade-offs of Pune riders between e-scooters and motorcycles, but the nature of the problem in Delhi and Pune precludes the use of real purchasing data and instead requires the use of hypothetical choice data[8].

2.4Product study: -

The frame is the foundation of your EV conversion. While you might decide to build your own chassis from scratch, there are fundamental principles that can help you with any EV conversion or purchase—things that never come up when you are dealing with an internal combustion engine vehicle—such as the influence of weight, aerodynamic drag, rolling resistance, and drivetrains. This chapter will step you through the process of optimizing, designing, and buying or building your own EV. You will become familiar with some of the trade-offs involved in optimizing your EV conversion. Then you will design your EV conversion knowing that the components you have selected will accomplish what you want them to do. When you have figured out what is important to you and have verified that your design will do what you want, you will look at the process of buying a frame, an existing motorcycle, or maybe a rolling frame[9].

Knowledge of all these steps will help you immediately and assist you as you read other chapters in this book on crucial components. I will try to guide you through every pitfall that I encountered. After reading Chapter 5, you should have a good knowledge of the frame geometry and what to do and not to do. The principles in this book are universal, and you can apply them whether buying, building, or converting. Choose the best frame or complete bike for your EV conversion. Stick with something that is simple yet easy to work with as the foundation for your EV.

I have found it better to try to work with what is available and off the shelf rather than to try to make everything from scratch. In some cases, it takes a little thinking and ingenuity, but you will figure it out. The biggest selection and most available parts are for Harley-Davidson motorcycles. However, you literally can pick up a book from five different aftermarket companies such as Custom Chrome, and in each book you will find over 1,000 pages of parts and accessories to choose from. Your build will take on a life of its own, and there are many choices you can make.

You are likely to be converting a vehicle, but that could be almost like building from scratch. There is not much to a motorcycle once you take out the engine. Even after you select the frame or bike conversion, there is so much you can do that you are not limited. The secret is to plan ahead and be clear (or just have a very good idea) about what you want to accomplish before you make your selection.

Keep in mind, though, that at any point during you calculations or design, something can happen to change things, so be prepared. Unlike converting a car or truck, a motorcycle or smaller vehicle has less room for error or just less room. One simple design error can hit you like a domino effect. Keep in mind the added weight you may have to carry when choosing your frame and suspension. From Chapter 5 you should have a good idea of your suspension options and how to beef your suspension up if necessary[10].

You can forget about aerodynamics unless you are building a sleek “crotch rocket.” In addition, your frame must be big enough and strong enough to carry you and the additional weight, along with the motor, drivetrain/controller, and batteries. Moreover, if you want to drive your bike on the highway, federal and state laws require it be roadworthy and adhere to certain safety standards.

The first step is to know your options. Your EV should be as light as possible; streamlined, with its body providing minimum drag, and optimized for minimum rolling resistance from its tires and brakes and minimum drivetrain losses. The motor-drivetrain-battery combination must work in conjunction with the space available and the size of the vehicle you select. It also must be capable of accomplishing the task most important to you: high speed, long range, or something midway between the two. Therefore, step two is to design for the capability that you want. Your EV’s weight, motor and battery placement, rolling resistance, handling, gearing, and safety features also must meet your needs. You now have a plan.

Step three is to execute your plan—to buy the frame or bike that meets your needs. At its heart, this is a process that is no different from any other vehicle purchase you’ve ever made, except that the best solution for your needs might be a vehicle that the owner can’t wait to get rid of. The tables are completely turned from a normal buying situation. Used is usually the least expensive, but with a motorcycle, you can just start with a frame and work your way from there. Figure 6-1 gives you the quick basic picture (see page 82). The rest of this chapter covers the details.

Selecting a Frame Dos and Don’ts

During your building phase, whether you are building your motorcycle or other vehicle from scratch or converting an existing vehicle, there are certain guidelines established by your state department of motor vehicles (DMV) that you must follow. In saying this, I am assuming that your vehicle will be a highway-use vehicle with two or three wheels. The equipment guidelines I have listed are the requirements set forth by the State of New York DMV (nysdmv.com). From my knowledge, New York has some of the strictest requirements in comparison with other states. To find out more information and the exact requirements of your state, locate your state DMV Web site or call for more information. You will need to access the division of safety services.

Given that the New York guidelines probably are the strictest, I would go with these guidelines as you start. Do not assume that these are all the requirements or that I am 100 percent correct; requirements may change. Make sure that you follow up with your state DMV. Again, I strongly stress this point: Follow the guidelines, if not for the sake of following the law, then for your own safety! What would be truly uncool would be if, after you complete an exceptionally built vehicle, you fail the requirements and the inspection. This could mean anything from a simple fix to an expensive design change that you could have avoided from the start.

Whether you decide to build from scratch or from an existing motorcycle, I will supply you with some priceless advice and knowledge. First off, I highly recommend converting an existing vehicle. If this is going to be an on-road vehicle you are converting, make 100 percent sure that you have all the papers, title, and vehicle identification number (VIN) for this vehicle. I cannot stress this enough. I don’t care if it was free or your buddy got you a great deal, it is not worth it without the proper paperwork. Don’t do it! Unless you are willing to waste months of time tracking down paperwork, keeping records, holding receipts and serial numbers on all parts, scheduling daylong treks to the DMV field investigation unit, and paying hundreds of dollars in fees, don’t do it.

Additionally, with all that stated, you will need to have the vehicle weighed on a certified scale with an official receipt. You will need to verify and supply the state department of transportation (DOT) with numbers from your tires, windshield (if

you have one), all lights and turn signals, and other equipment. I think you get the picture. Unfortunately, this was my experience, I built a motorcycle from scratch with no VIN or anything. It took me well over 3–5 months to get my VIN, and I kept on top of it and pushed the DMV hard to get it done. This is not counting all the time I spent on paperwork and much more. To say the least, it was a learning experience that I do not want to experience again. My experience is yours to gain from.

Optimize Your EV

Optimizing is always step number one. Even if you go out to buy your EV ready-made, you still should know a little bit about the vehicle so that you can decide if you're getting the best model for you. In all other cases, you'll be doing the optimizing—either by the choices you make up front in vehicle and component selection or by your decisions later on. In this section you will learn how to calculate the following factors:

- Weight, climbing, and acceleration
- Aerodynamic drag and wind drag
- Rolling resistance
- Drivetrain system

We will look at equations that define each of these factors and construct a table of real values for a 300- to 1,000-lb vehicle with nine specific vehicle speeds. These values should be handy regardless of what you do later. If your design changes a

little, you will have your notes to fall back on. When you calculate the real vehicle's torque requirements, you will see if the torque available from the electric motor to the drivetrain is sufficient for your needs and performance requirements. This design process can be infinitely adapted and applied to any EV you have[11].

Standard Measurements and Formulas

For calculations, we will use the U.S. vehicle standard of miles, miles per hour, feet per second, pounds, pound feet, foot pounds, etc. rather than the kilometers, newton-meters, etc. in common use overseas. Regarding formulas, you will find the following 13 useful; they have been grouped in one section for your convenience:

1. Power [(lb • ft)/s] = torque (ft • lb) 3 speed (rad/s) 5 force in feet per second (force times velocity, or FV)

2. 1 hp 5 550 (ft • lb)/s Applying this to Equation 1 gives you

3. 1 hp 5 FV/550 where V is velocity (speed) expressed in feet per second

4. 88 ft/s 5 60 mph Multiply feet per second by (60 3 60)/5,280 to get mph 5. 1 hp 5 FV/375 where V is velocity (speed) expressed in mph and F is force in pounds

6.Horsepower (hp) 5 (torque 3 rev/min)/5,252 = p/60 3 FV/550

7.Wheel rev/min (rpm) 5 (mph 3 rev/mi)/60 8. Power (kW) 5 0.7457 3 hp (1 hp 5 746 watts)

9.The standard gravitational constant g 5 32.16 ft/s2 or almost 22 mph/s

10.Weight W 5 mass M 3 g/32.16 (For the rest of this book, we will refer to a vehicle's mass as its weight.) 11. Torque 5 [F(5,280/2p)]/(rev/mi) 5 840.38 3 F/(rev/mi) Revolutions per mile (rev/mi) refers to how many times a tire rotates per mile.

12.Torquewheel 5 torquemotor 3 (overall gear ratio 3 overall drivetrain efficiency)

13.Speedvehicle (in mph) 5 (rpmmotor 3 60)/(overall gear ratio 3 rev/mi)

Remove the Weight But Keep Your Balance

One of the key factors that you always want to be aware of on your motorcycle is the center of gravity. Simply said, during your planning and build, try to keep all components, particularly the heavy ones, as low on the frame as possible. One heavy component we do lose in a conversion besides the engine is the fuel tank. Depending on the size of the fuel tank removed from the vehicle, you reduced the weight by 40–70 lb. Not only did you reduce the weight, but you also removed weight that was high up on your vehicle that you no longer have to wrestle with when the bike leans. In essence, you changed the centre of gravity of your bike [12].

3.0 Design Brief

To design the next generation electric motorcycles for Indian men

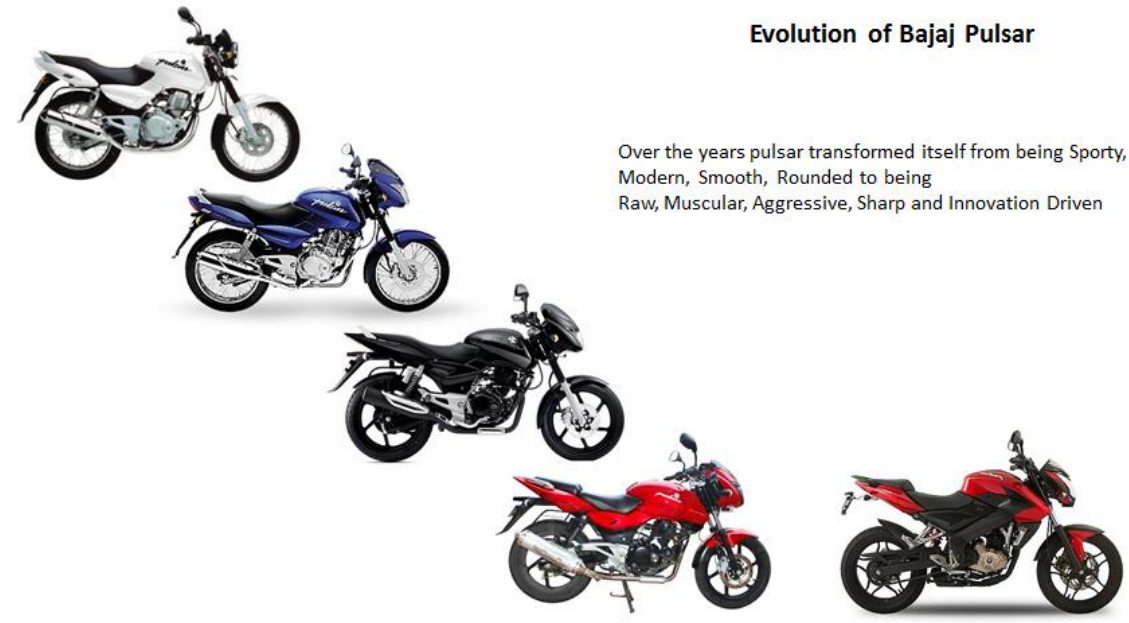


Fig 6: Evolution of Bajaj Pulsar

Fig 7: Evolution of Honda Unicorn

Fig 8: Breakout stars for Indian Street Motorcycles

Fig 9: International Motorcycle Trends

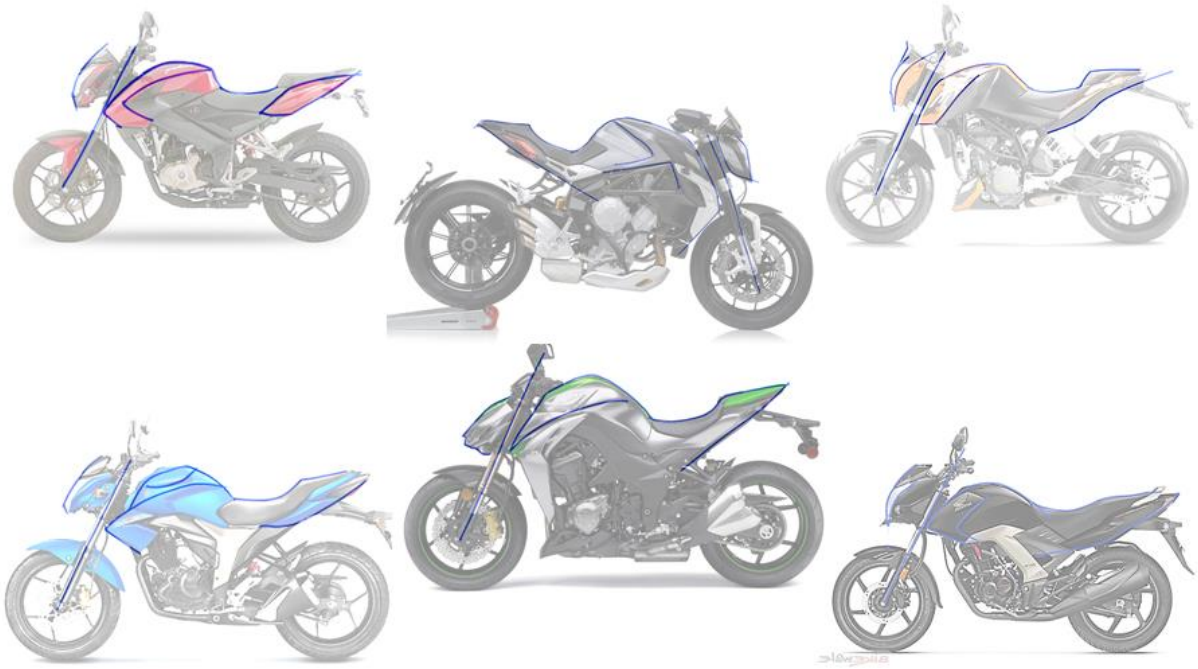


Fig 10: New Motorcycle trends Design lines

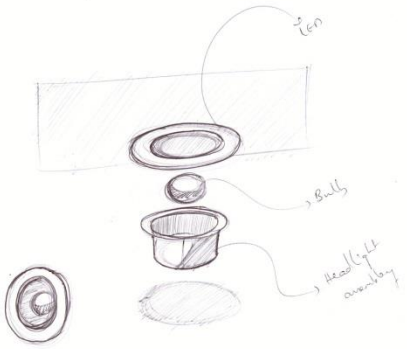
4.0 Concepts:

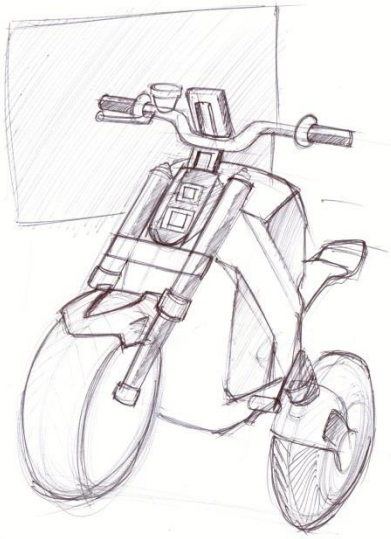
Fig 11: Mood Board

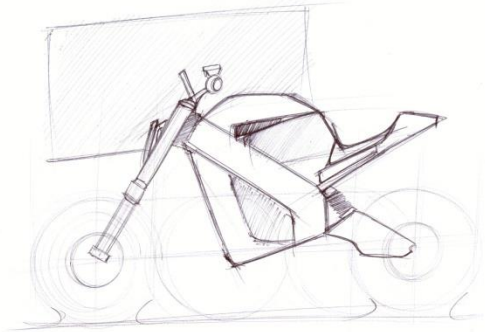
Fig 12: Inspiration Board

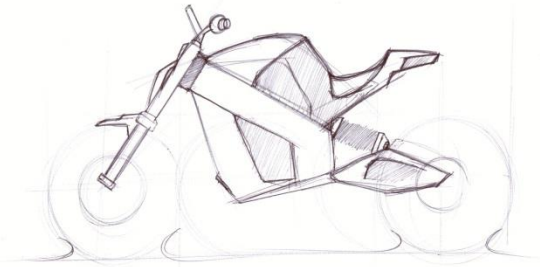
4.1 Initial concepts:-

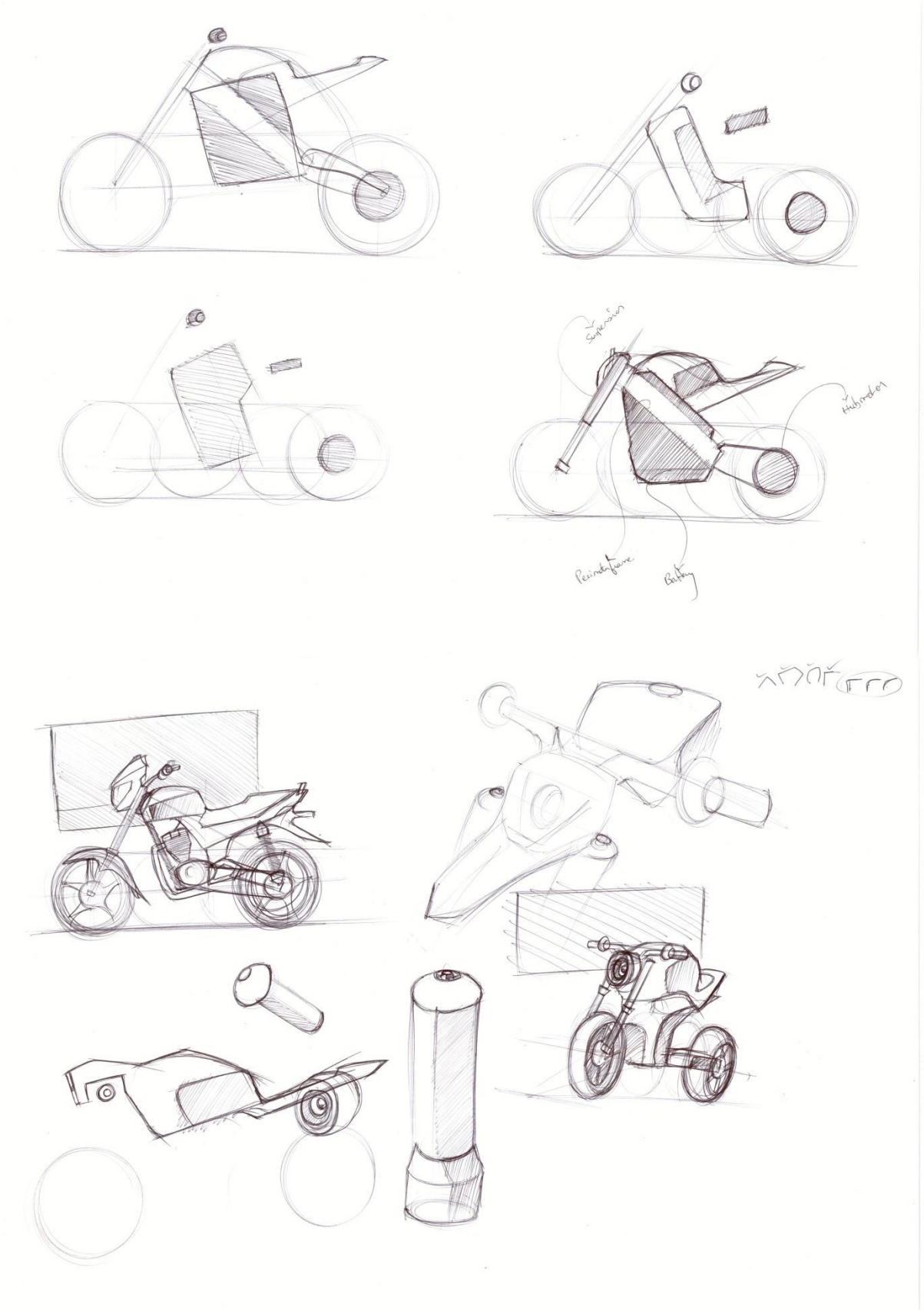
Fig 13: Ideation Sketches

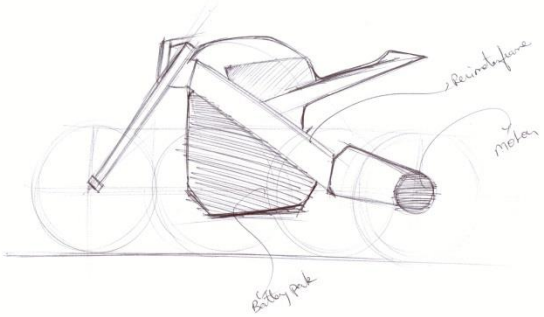

Lens
Bulb
Headlight assembly

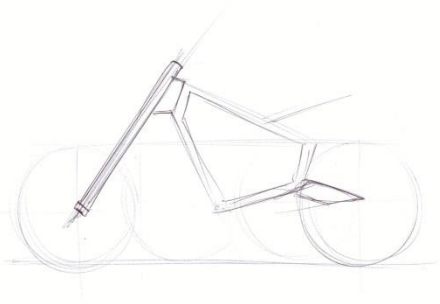


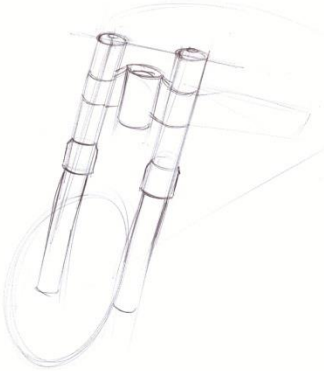


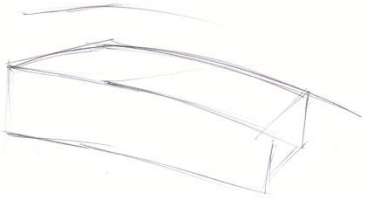


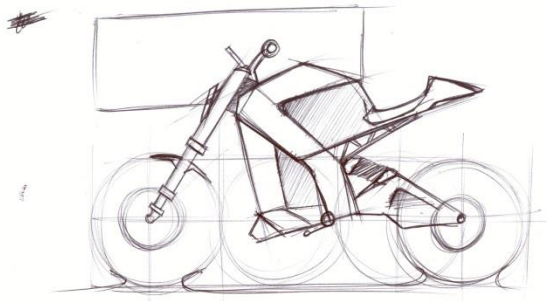

Suspension
Hub motor
Battery

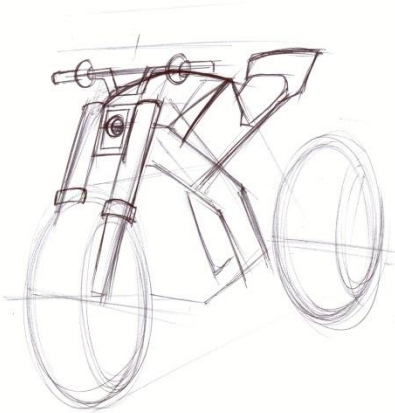

Motor
Battery Pack











4.2 Final concepts:-

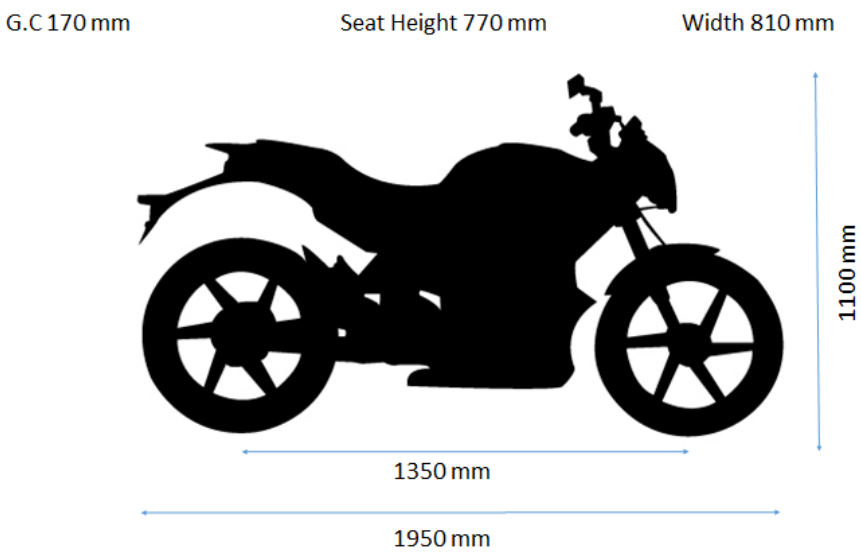


Fig 14: Package Ideation diagram

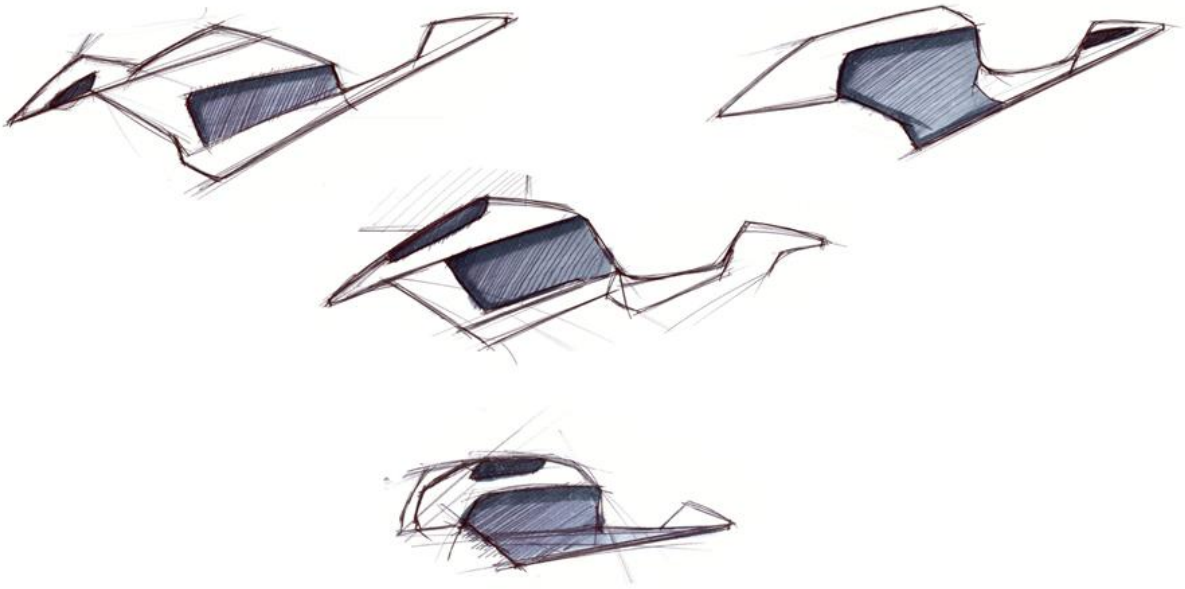
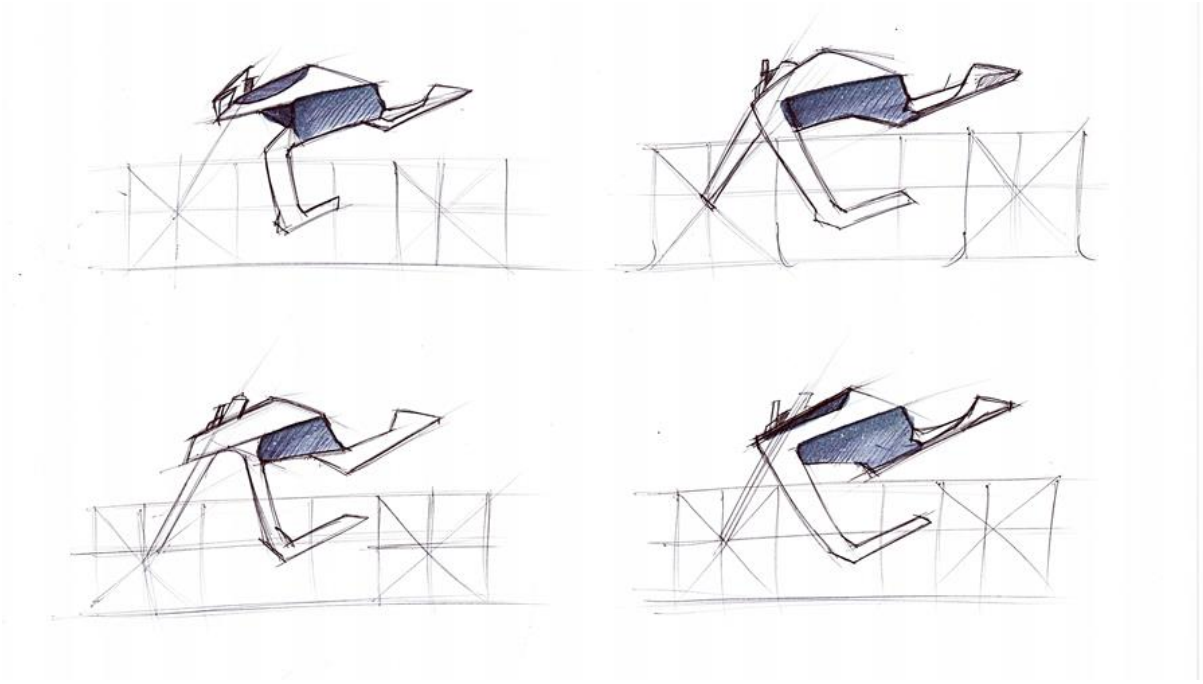
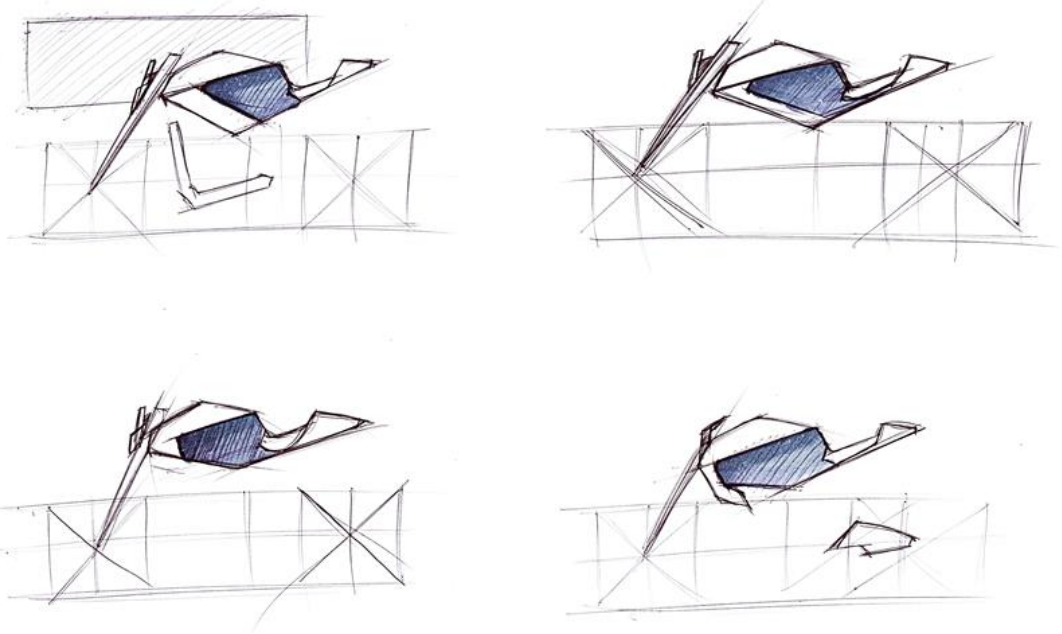
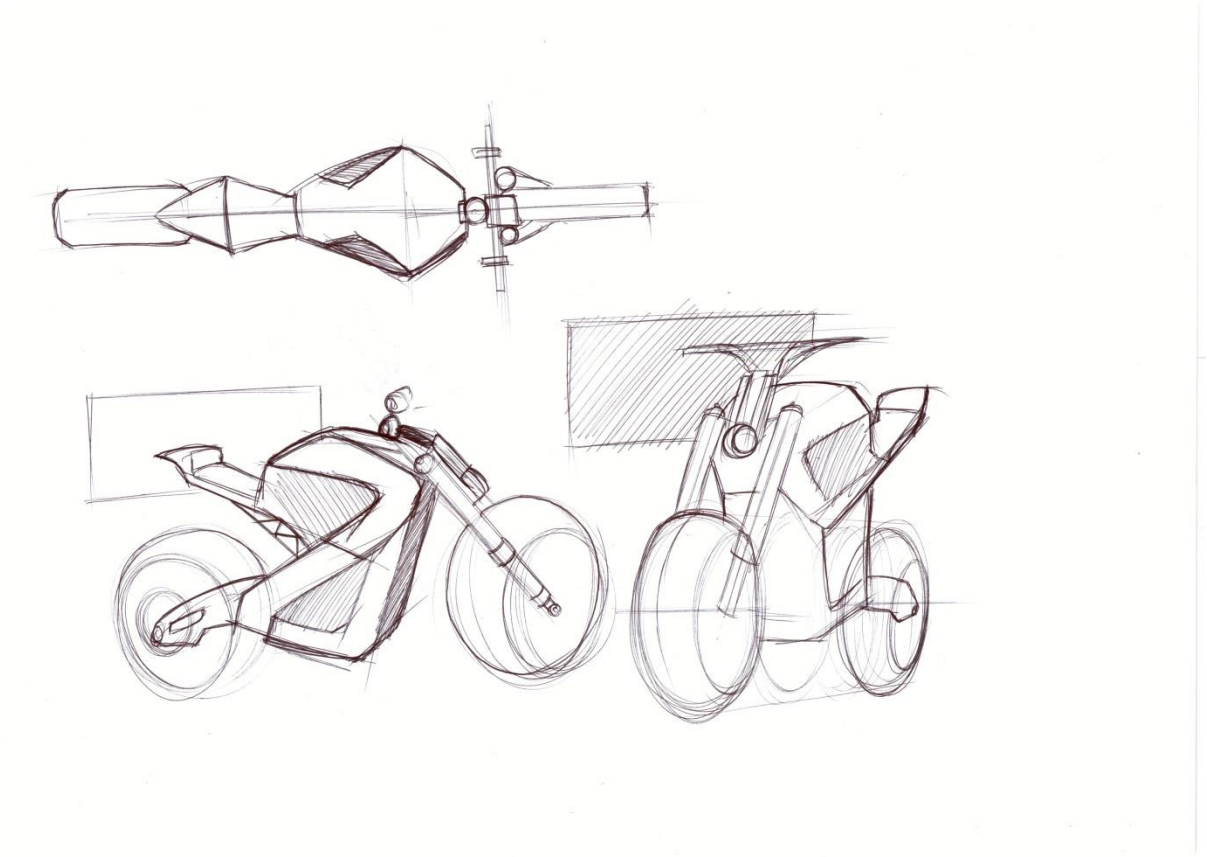
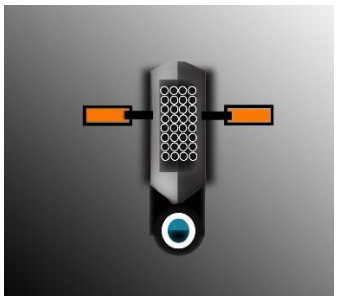


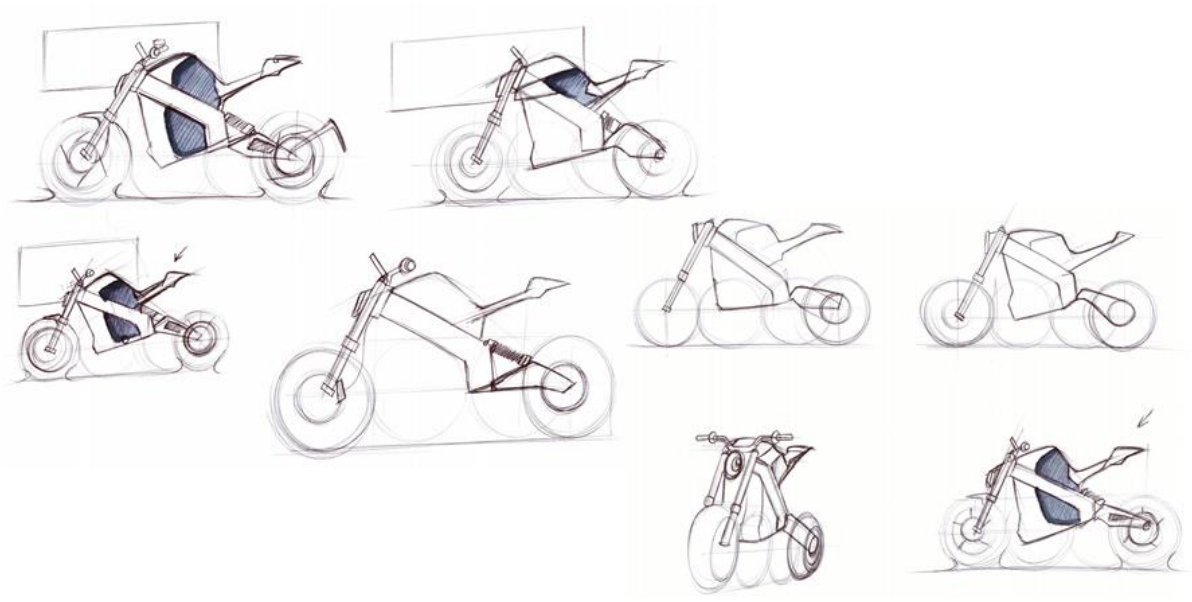
Fig 15: Final ideation Sketches











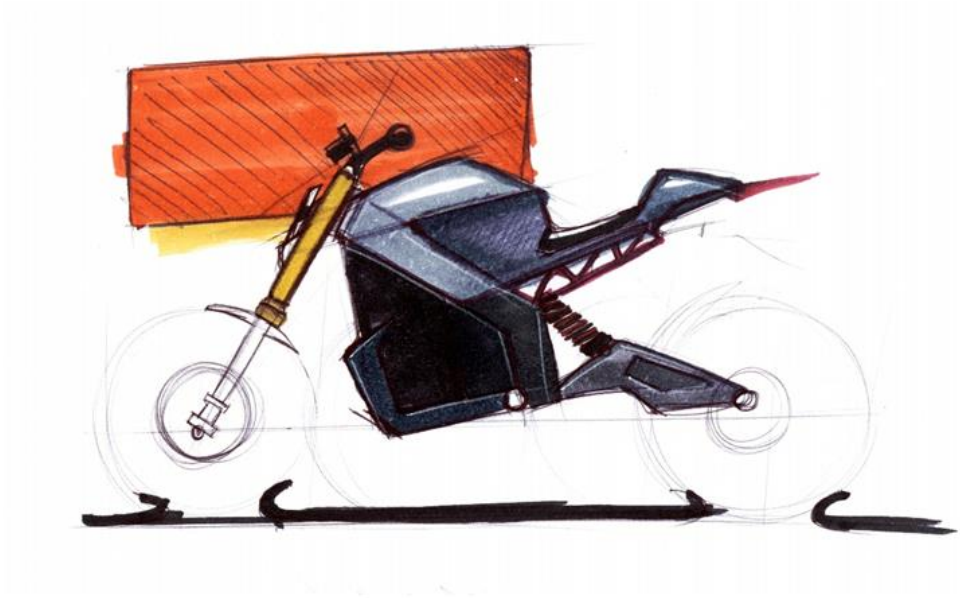


Fig 16: Concept Static Shock

Fig 17: Concept Galvano

5.0 Digital Model

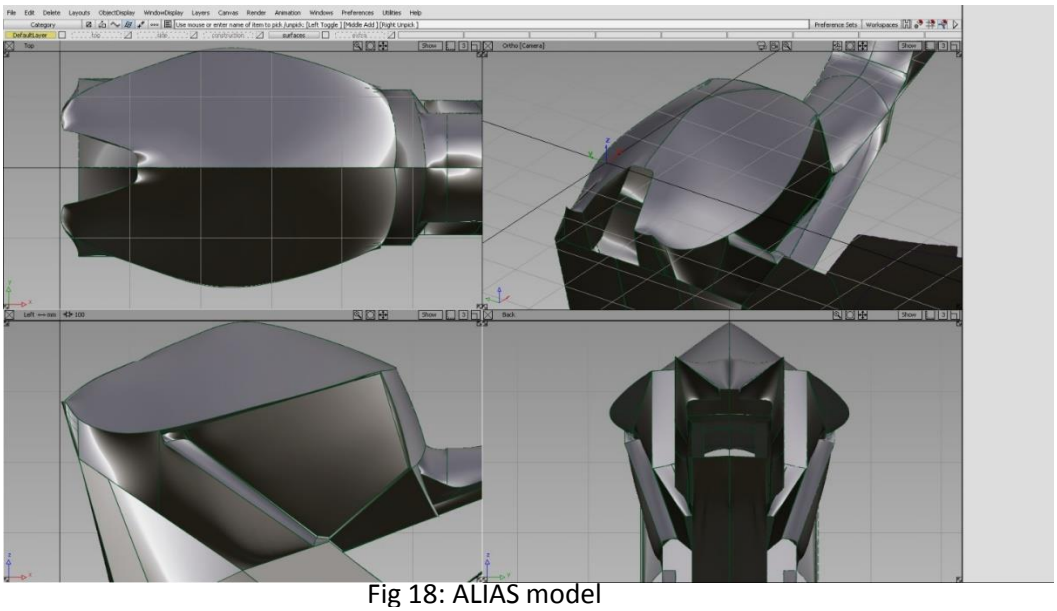


Fig 18: ALIAS model

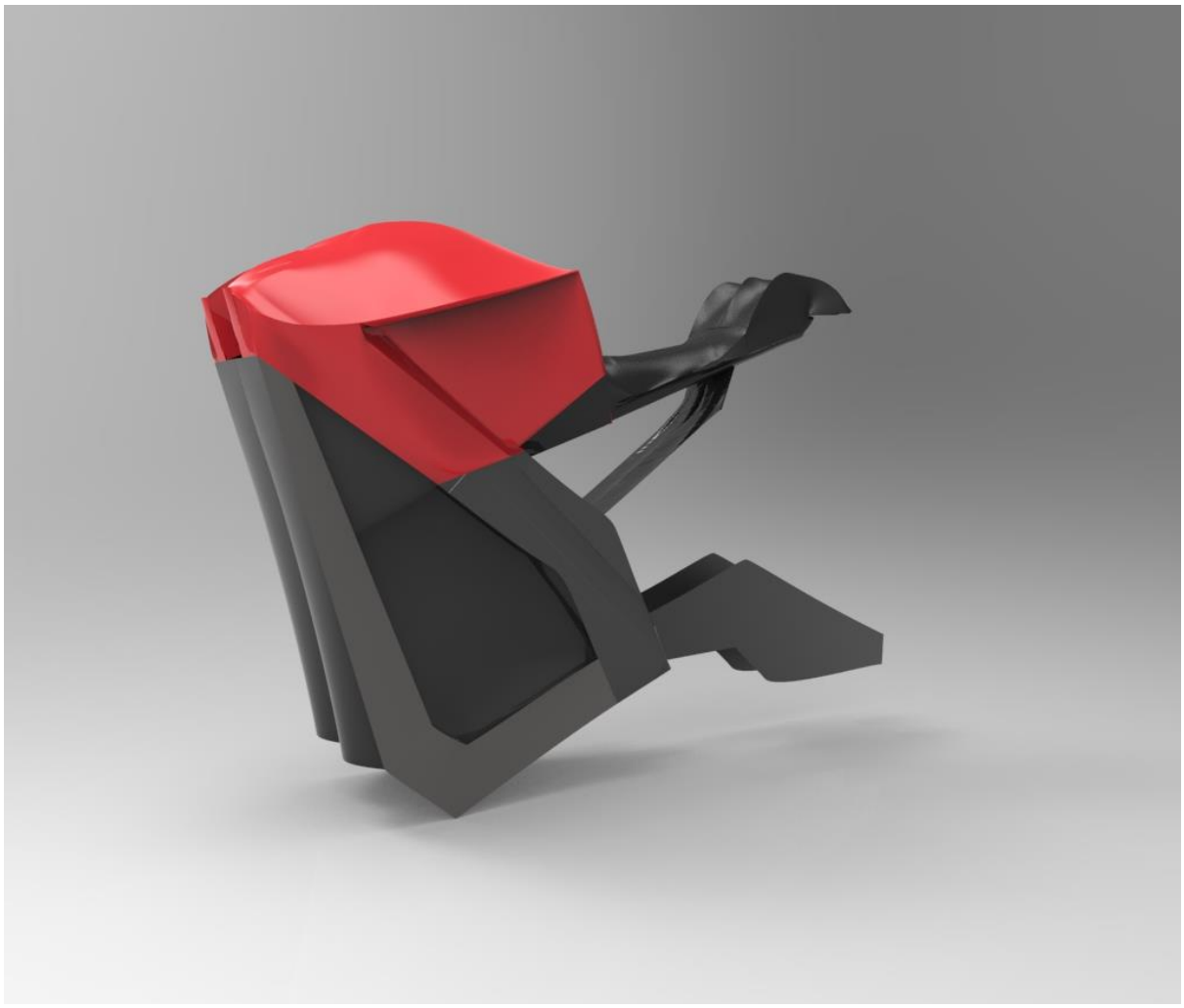


Fig 19: ALIAS model with Keyshot rendering

Based on the form achieved digital model of the product has been completed in alias to show the characteristics of the vehicle only the tank and battery elements have been shown

6.0 conclusion

The issue of alternate mobility in our country is addressed in the project bearing in mind the sentimentality of the people as a nation and their temperaments. A sincere effort has been made to produce the next generation of electric motorcycles for the men of India incorporating the elements of luxury, aggression, and power, oozing confidence.

The produced resultant vehicle has a forward leaning stance with elements of aggression and subtle influence of the galvanic emotions it need to convey.

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