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Design of Bike With All Weather Protection For Intercity Travelers

[1]Reddy Hemanth, [2]Vidyanand. S. Desai,

[1]Industrial Designer, [2]Assistant Professor,

[1], Department of Art and Design,

[1]M. S Ramaiah University of Applied Sciences, Bangaluru, India.

Abstract : The world we are leading has a huge demand for vehicles. Without vehicle no work will be done. Every person like from kid to old person, student to business man, travelling to transporting a vehicle is must and should for each. Among all vehicles bike/two wheeler plays a key role. One of a person's fundamental necessities is transportation. To fully enjoy life and all that it has to offer, mobility is essential. However, mobility also has its limitations, especially in metropolitan settings where many people use many forms of movement at once. Growing mobility needs are a contributing factor to poor air quality, traffic jams, and parking shortages. Alternatives to cars with internal combustion engines are required to solve these issues without severely restricting personal mobility. Electric two-wheelers are one of these solutions. These cars use batteries and an electric drivetrain, unlike their conventionally powered equivalents [1]. Two wheeler vehicles are most preferable for immediate travelling from one place to another in intercity. Basis on the work type, route/area, financial conditions, etc., cases the bike will be chosen by person. As much the flexibility's it consists that much no of harmful situations the user is facing by the two wheeler I.e., sudden accidents, cant able to get protect from rain, summer hot, health effecting dust, snow fall, etc., harmful conditions. There should be some safety measures incorporated in the vehicle in such a way that whenever user gets into situation he can get protect by the safety measures incorporated in it. The main objective of this paper is to find a solution for this all, design a new functional safety measure incorporated electric two wheeler.

Key words: Two Wheeler, Roof Bike, Ev Scooter, NMT (Non Motorized Transportation), Cabriolet Bike.

I. INTRODUCTION

For two wheeler vehicle users it will be a hard situation to pass through some climate conditions like rainy, summer, winter, snow fall and also surviving in sudden accidents. Every year so many accidents were occurring most of the accidents are by bike raiders.

Fig.1.1 Raiding in snowfall

Fig.1.2 Raiding in dust and sun

In order to avoid those entire conditions raider needs a protection/safety precaution that protects him from such climatic conditions and accidents too. If needed raider has to feel new experience in bike raiding.

It has to consists Cabriolet/convertible roof top were incorporated in bike, based upon the need bike can be changed. Aesthetic designs were the user will find the empathy in riding the vehicle. Ergonomically comfortable in riding and accessing the bike and its features.

II. BACKGROUND THEORY

2.1 Motorcycle:

2.1.1 Background

Engineering journal declared in 1901 that the motorbike is "a form of amusement that can, one would think, appeal only to the most enthusiastic of mechanical eccentrics." We deem it unlikely that the motorbike will gain widespread acceptance after the novelty has worn off. In just the United States last year, four million motorcycles were in use. Millions of people around the world have demonstrated that the novelty has most definitely not worn off, regardless of whether they use them as their primary mode of transportation, for weekend enjoyment, for racing, or to be displayed as antiques. [50]

2.1.2 History

The motorbike developed from the bicycle, a machine propelled solely by human effort, as could be expected. The precursor of the modern motor, the first bicycle with cranks and pedals, was created in 1861 by the French bicycle manufacturer Pierre Michaux and his sons Ernest and Henri. Due to the popularity of their velocipede, the Michaux family, who owned a substantial plant in Bar-Le-Duc, France, rose to the position of being the largest velo maker in Europe. L.G. Perreaux developed the velo-a-vapeur, a steam-powered motorcycle engine that was patented in 1868, in collaboration with Michaux. Around that time, Sylvester Howard Roper of Roxbury, Massachusetts also made a similar invention in the US. [50]

2.1.3 Raw Materials

Metal, plastic and rubber are the main basic materials utilized to make the motorcycle body. The wheels and virtually the entire motorcycle frame are made of metal. Plastic may be applied on top of the frame. the rubber utilised in tyre manufacturing. The seat is made of a synthetic substance, such as polyurethane. The power system consists of a four-stroke engine, a carburetor that transforms incoming gasoline into vapour, a choke that controls the air-fuel ratio, a gearbox and drum brakes. The gearbox system consists of a clutch constructed of steel ball flyweights and metal plates, a crankshaft, gears, pulleys, rubber belts, or metal chains, and a sprocket. A battery, ignition wires and coils, diodes, spark plugs, headlights, taillights, turn signals, and a horn are all components of the motorcycle electrical system. An crucial part of the engine is a cylindrical piston constructed of aluminium alloy (liked since it is lightweight and conducts heat well). Cast iron piston rings are attached to it. Aluminium is used to make the crankcase and crankshaft. The cylinder barrel, which is normally constructed of cast iron or a light alloy, is also a part of the engine. [50]

2.1.4 The Future

Motorcycles are still well-liked, and both collecting and riding vintage motorcycles are equally popular. Older models are expected to continue to appreciate in value even while new, modern versions will still be made. [50]

2.2 Safety impacts of bicycle infrastructure: a critical review

This thesis critically evaluates the current status of bicycle safety research with an emphasis on the data gaps and specific results that have previously been produced with the available data. This thesis integrates the findings, study methodologies, and data sources employed in the investigations to particularly examine the safety literature of 22 bicycle therapies. Many treatments, though, still need more study. The present amount of research on bicycle safety points in the direction of some justifiable conclusions about the security of particular cycling treatments, like bike lanes and the elimination of on-street parking. Additionally, there are issues with data accessibility as well as fundamental data-related questions that need to be resolved. Among these are the best ways to collect accurate bicycle accident and exposure data, the best exposure metrics for bicycles, and the impact of safety precautions on injury severity. [2]

2.3 Risk Riding Behaviors of Urban E-Bikes: A Literature Review

We investigate the study results on the risky riding behaviour of e-bikes from three perspectives: the characteristics and causes of e-bike accidents, the characteristics of users' traffic behaviour, and the prevention and intervention of traffic accidents. This makes it possible for us to examine the riding traits and understand the risky riding behaviour of electric bicycles (e-bikes). The findings of the studies indicate that binary probability models, structural equation models, and questionnaire surveys are the main methodologies employed in current research on risky e-bike riding behaviour. The riskiest forms of cycling involving e-bikes are illegal manned and reverse cycling, riding too fast, stopping at stop signs, and illegally occupying lanes for motor vehicles. Different users display different unsafe riding behaviours because of differences in physiological and psychological traits including gender, age, audiovisual ability, responsiveness, patience when waiting at a red light, crowd, etc. It is advised that quasi-drive systems be adopted, the riding environment be adjusted, safety awareness be enhanced, and training be offered in order to lessen e-bike accidents and assure riders' traffic safety. The authors then highlight three study trajectories that can be further investigated in the future in light of the constraints of the current research. Big data analysis should be carried out to better comprehend the significant correlation between dangerous riding practises and traffic accidents. The risk perception, risk attitude, and risk tolerance scores should be used to examine the relationships between risk awareness, dangerous riding, and traffic incidents. Future studies should make use of coupling theory to examine the risk level, coupling features, interventions, and coupling implications of various combination intervention measures of e-bike riding behaviours. [3]

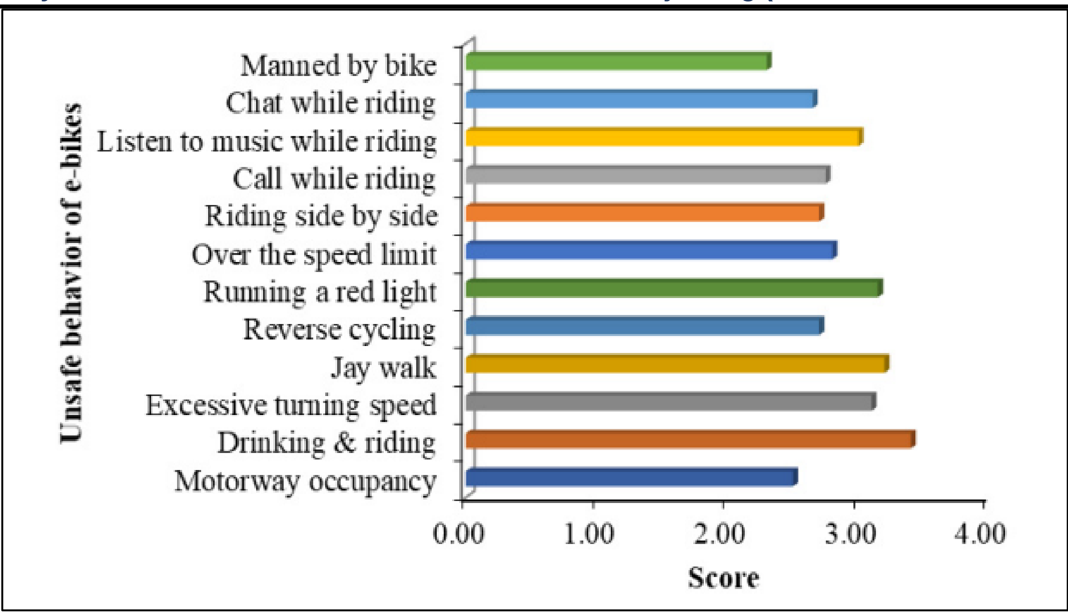


Fig.2.1 Unsafe behavior of e-bikes "3"

2.4 Road safety in less motorized environments: future concerns

High-income countries have significantly different traffic and injury patterns than less mobile countries do. High-income countries have not experienced the condition that was once present in less motorized countries. Accidents involving weaker road users and the usage of buses and other vehicles are common in many less developed countries. All construction projects funded by international organizations in less-motorized countries adopt international designs or a scaled-down variation of those designs because there hasn't been much effort put into developing highway and urban street designs that are vulnerable road user-friendly. These designs create inefficiencies and make life worse for locals by bringing speedy transport without amenities for local needs. [4]

Table 1 Distribution of road traffic deaths and mortality rates by World Health Organization (WHO) Region and income group (high and low/middle), 1998 (Ref. 1)

	WHO Region									
	Africa	Americas		Eastern Mediterranean	Europe		South-East Asia	Western Pacific		World
Income group		HIC[a]	LMC[b]		HIC	LMC		HIC	LMC	
Total RTI[c] deaths (000)	170	49	126	72	66	107	336	25	220	1171
% of global RTI deaths	14.5	4.2	10.8	6.1	5.6	9.1	28.6	2.1	18.8	100
RTI deaths per 100 000	28.2	16.1	25.3	15.2	16.8	22.4	22.6	12.6	15.5	19.9
% of all deaths due to RTI	1.8	1.9	4	1.9	1.7	2	2.5	1.7	2.1	2.2

[a] High-income countries.
[b] Less-motorized countries.
[c] Road traffic injury.

Table 2 Percentage of road users killed in various modes of transport as a proportion of all fatalities

City, nation (year)	Pedestrians	Bicyclists	Motorized two wheelers	Motorized four wheelers	Others
Delhi, India (1994)[a]	42	14	27	12	5
Thailand (1987)[a]	47	6	36	12	–
Bandung, Indonesia (1990)[a]	33	7	42	15	3
Colombo, Sri Lanka (1991)[a]	38	8	34	14	6
Malaysia (1994)[a]	15	6	57	19	3
Japan (1992)[b]	27	10	20	42	1
The Netherlands (1990)[b]	10	22	12	55	–
Norway (1990)[b]	16	5	12	64	3
Australia (1990)[b]	18	4	11	65	2
USA (1995)[b]	13	2	5	79	1

[a] Less-motorized countries.
[b] High-income countries.

Fig.2.2 Road traffic deaths and mortality "4"

2.5 Evaluation of morbidity and epidemiology of two wheelers accidents in central india:

Multiple logistic regressions were carried out to ascertain how the covariates and traffic accidents related. Men dominated the population and were especially prevalent among younger adults. Daytime occurrences accounted for 37% of all accidents, with evening incidences (31%) coming in second. 45% and 49% of all accident victims, respectively, occurred on state highways and Local Pakka road. 25% of the victims were backseat passengers, while 75% of the victims were drivers. Alcohol use disorders were found in 41% of the victims. A helmet was not worn in almost all incidents (99%). 38% of patients required surgery in the OPD or casualty, while 62% of patients were handled conservatively. Overall, the most common causes of two-wheeler accidents were bad road conditions, drunk drivers, and vehicle conditions. Traffic accidents continue to be a social problem and have a high human resource cost to society. The division of various road user types is a critical component. In addition to policing traffic laws, responsible behavior promotion is essential. [10]

Mode of accident

Mode of accident	Frequency	(%)
Skiding of bike	46	46.0
Collision with another two wheeler	14	14.0
Collision with another vehicle	26	26.0
Hit by animal	8	8.0
Collision with non moving object	6	6.0
Total	100	100

Fig.2.3 Mode of accidents "10"

Age distribution of the patients

Age (years)	Frequency
<20	11
20-39	51
40-59	33
60 and above	5

Fig.2.4 Age distribution of patients "10"

Types of injuries

Injury	Frequency
Abrasions only	27 (23%)
Crush injury	5 (4%)
Lacerated wound	25 (21%)
Contusion	7 (6%)
Simple fracture	45 (38%)
Compound fracture	9 (8%)

Fig.2.5 Types of injuries "10"

2.6 The emergence of "fat bikes" in the USA: Trends, potential consequences and management implications

In the past five years, "fat bikes" (bikes with tyres that are 75-120 mm wide) have seen a sharp rise in both sales and use in the USA. These bikes are made to give bikers access to new areas, such as routes that are covered in snow and softer ground surfaces that are inaccessible to regular mountain bikes. In this essay, we examine the prevalence and potential trends of fat bike use, as well as any negative effects, conflicts, and land management strategies. According to the preliminary information we have gathered, riders of fat bikes rarely deviate from well-traveled tracks and use pathways and snow trails equally. We concentrate on that element since snow riding offers bikes a novel application. Due to usage on normally frozen ground, fat biking on snow is anticipated to have little negative effects on the environment. The greatest ecological effects are most likely to come during shoulder season use, when riding may harm muddy paths. From the perspective of the visitor experience, conflicts between winter users appear to be frequent; bicycles have complained about problems with both cross-country skiers and snow mobilers. The creation of maintained winter paths designed exclusively for fat bikes is a quickly emerging strategy for reducing these confrontations. State-managed lands in the USA are setting the standard for trail identification and management, while federal areas continue to be more constrictive. Winter fat riding is an opportunity to expand low-season use of public lands for a healthy activity with potential for minimal environmental effect and beneficial economic impact with adequate management. [16]

2.7 Motorcycle riding in winters: What all to keep in mind

- Choose the right gear
- Don't ride in snow/rain
- Go easy
- Use common sense

2.8 Winter Riding Tips : 11 Things to Note

- Get your bike ready for a rough environment
- Put on the proper motorcycle gear
- Invest in thermals and warmers
- Carry rain gear
- Check the engine

- ✧ Maintain distance on roads
- ✧ Check your tires
- ✧ Drive within limits
- ✧ Avoid salts and black Ice
- ✧ Services that tower
- ✧ Avoid being an idiot and riding your bike in the snow

2.9 Advice for Riding a Motorbike in the Cold:

The list is endless, but the following advice can help make things more simpler and more manageable. [13]

- ✧ "Black Ice"
- ✧ Understand your Limitations
- ✧ Pack the Right Gear
- ✧ Full Face Helmet
- ✧ Balaclava
- ✧ Jacket
- ✧ Thermals/Warmers
- ✧ Gloves
- ✧ Shoes
- ✧ Trousers
- ✧ Visibility and Distance
- ✧ Don't Give Up If It Snows
- ✧ Pay Attention to the Weather
- ✧ Remain Warm and Well-Rested
- ✧ The Motorcycle Is Your Machine
- ✧ Maintain brief rides

2.10 Winter riding:

- ✧ Layered clothing
- ✧ Paper is a good insulator
- ✧ Neck insulation
- ✧ Go for long wrist gloves
- ✧ Drink hot beverages
- ✧ Maintain clear vision
- ✧ Dealing with fog
- ✧ Traction on moist road

2.11 Motorcycle Cold Start Problems:
If your bike won't start, keep an eye out for the following:

- **Battery**

Usually, this is the cause of bikes not starting. Batteries can be picky and degrade if they are not properly maintained. If your battery has been sitting about for a while or is electrolyte low, it may eventually die. A battery will discharge in colder conditions than in hot ones. If your bike makes the terrifying double click sound when you press the start button, get a new battery from your neighborhood motorcycle parts store. [21]

- **Fuel**

Fuel has a limited shelf life, particularly now that more ethanol is utilized to make petrol. Long-term storage of fuel on your motorcycle will likely result in harm from the fuel breaking down in the tank. Ethanol attracts moisture as it degrades. Your tank's rust may begin to accumulate due to dampness, and gaskets and gasoline lines may corrode. Additionally, if it has been sitting for a while, it loses its ability to burn, which makes starting it very impossible.[21]

- **Spark Plugs**

Your engine starts when a spark from a spark plug ignites it. You can have trouble starting the bike from a cold start if they are fouled out. For details on how to remove your spark plugs, consult your owner's manual. A spark plug might foul out for a variety of reasons. If your bike is running wealthy is one of them. This indicates that the bike is receiving excessive fuel. On motorcycles with carburetors, the issue might be resolved by a straightforward adjustment of the fuel mix screw. On fuel-injected motorcycles, it's possible that one injector isn't closing all the way, allowing more gasoline to enter. Not all of the carbon in the fuel can burn if the bike is running rich, and the deposits attach to hot areas like the spark plug tip. Your spark plug tips will turn gray or black when this occurs. [21]

- **Carburetor**

Models with carburetors are more prone to experiencing issues with cold starts. This is because carburetors struggle to enrich fuel when the engine is starting. Since EFI systems are computerized, the air-fuel ratio can be changed. Make sure you are utilizing the choke if you have a carburated bike that is challenging to start in the morning. The choke valve reduces airflow to the carburetor(s) and permits a higher fuel-to-air proportion, which makes it simpler to start the motorcycle. Your bike may also be more difficult to start if the gas in the float bowl of the carburetor is stale. [21]

2.12 Bengaluru has the second-highest number of two-wheelers, at 50 lakh

BENGALURU: The number of two-wheeler s in the city has surpassed a staggering 50 lakh. According to a data from the transport department, there were 50.1 lakh two-wheeler s registered in Bengaluru as of November 2017; this represents 69% of the city's total population of 72.3 lakh. The second-highest concentration of two-wheeler s in the nation, behind New Delhi (67.07 lakh motorcycles as of March 2017), is found in Bengaluru. [17]

Some of the largest cities with the data that is currently available include Chennai (36.45 lakh in 2015), Hyderabad (36.24 lakh through October 2016), Pune (24.96 lakh through March 2017), and Mumbai (17.71 lakh through March 2017). Experts attribute the rise of two-wheelers to the country's pricey but poor and unreliable public transport infrastructure. [17]

2.13 26 lakh 2-wheelers and 1,300 bikes per kilometre in the city

Mumbai: In the last nine months, there have been an additional 50 bikes per kilometre of road, bringing the total density of two-wheeler s to 1,300 per kilometre. More than 43 lakh cars, nearly 26 lakh of which are two wheeler s, are clogging up the metropolis. When compared to other major cities, Delhi has the most registered bikes in the nation with over 87 lakh, followed by Bengaluru with 68 lakh. Both cities have lower bike densities per km than Mumbai, though. Pune has a high two-wheeler density of 1,100 bikes per km, however it is still less than Mumbai. With a density of 731 per km, Chennai has 28 lakh less two-wheeler s than the national average. According to sources, Kolkata has the lowest density at 186/km. [22]

2.14 Countries With The Highest Motorbike Usage:

- **Thailand**

There's a reason Thailand is referred to as "the land of 100 million scooters." Thailand's streets are clogged with bikes of every make and model travelling in all directions. 87% of households in the nation, according to the Pew Research Centre, own at least one motorbike. There are at least 15 million bikes in the country, which has 18 million households. Up to 20 million motorbikes in the country are registered, and another million aren't, according to the BBC. With 5,000 biker fatalities on average each year, Thailand also has the highest rate of motorcycle accident fatalities worldwide. [15]

- **Vietnam**

The most common mode of transportation in Vietnam, a nation of over 90 million people, is the motorbike. In the country, there are about 45 million bikes, and 86% of families possess one or more of them. Despite claims that the two-wheeler market is saturated, sales are still rising. Hanoi, the capital city, with almost 5 million motorbikes occupying the majority of the highways. The Vietnamese government intends to lower the number of bikes on the roads due to the amount of bikes on the streets and the congestion they produce. [15]

Countries With The Highest Motorbike Use

Rank	Country	Households That Own a Motorbike (%)
1	Thailand	87
2	Vietnam	86
3	Indonesia	85
4	Malaysia	83
5	China	60
6	India	47
7	Pakistan	43
8	Nigeria	35
9	Philippines	32
10	Brazil	29
11	Egypt	28
12	Italy	26
13	Tunisia	25
14	Argentia	24
15	Colombia	23

Fig.2.12 Countries with highest bike use “15”

- **Indonesia**

One of the most congested cities in the world is Jakarta, the capital of Indonesia. Approximately 15 million motorcyclists and barely 5 million cars travel through the city each day. In general, Indonesia is the world's biggest market for motorcycles and scooters. In the country, there are almost 80 million motorcycles, according to an AISI survey. A motorbike is owned by at least 85% of homes, and it serves as the primary mode of transportation for the entire family. [15]

- **Malaysia**

Malaysia has 32 million residents and around 7 million households, 5.8 million of which own motorcycles. There are roughly 13 million motorcycles in the country overall, which is virtually the same as the number of automobiles. The majority of drivers are motorbike riders, nevertheless. Therefore, the majority of traffic deaths in the nation involve bikers. In spite of its risks, motorcyclists are a practical mode of transportation in Malaysia. [15]

2.15 Indian commuters travel 35 km/day, says survey:

Since the majority of commuters in India only travel 35 km per day, or less than 1,000 km per month, they won't be very worried with charge range. Consumers are looking for affordability, quality, aesthetics, and ease of charging in the ecosystem of electric vehicles, according to a survey. The majority of people only commute from home to work, according to the survey, which surveyed 650 respondents in 20 locations, including metropolises and Tier-1, Tier-2, and Tier-3 cities. It also found that the use of personal vehicles has significantly decreased thanks to the use of fleet cabs, particularly in big cities. And the majority of e-vehicle adoption is projected there. According to a survey conducted by Feedback Consulting, approximately 75% of car travel is point-to-point. 31% of these are for commuting between home and work, and 44% are for family-related activities. 25% of trips were multiroute, of which 9% were weekend trips, 9% were for distant destinations, and 7% were for other reasons. [12]

2.16 How Many Miles Does the Average Motorcyclist Ride a Year?

The typical motorbike rider logs between 3,000 and 5,000 miles annually. However, there are significant regional differences in the typical motorbike mileage. Additionally, the number of miles that different motorcycle classes travel annually varies. Touring bikes are often ridden substantially more than sport-bikes, which normally only travel about 3,000 miles annually. [18]

Average Motorcycle Mileage Chart

Years	Official National Average Mileage	Real Estimated Average Mileage
1	2-3k	3-5k
2	4-6k	6-10k
3	6-9k	9-15k
4	8-12k	12-20k
5	10-15k	15-25k
6	12-18k	18-30k
7	14-21k	21-35k
8	16-24k	24-40k
9	18-27k	27-45k
10	20-30k	30-50k
11	22-33k	33-55k
12	24-36k	36-60k
13	26-39k	39-65k
14	28-42k	42-70k
15	30-45k	45-75k
16	32-48k	48-80k
17	34-51k	51-85k
18	36-54k	54-90k
19	38-57k	57-95k
20	40-60k	60-100k

Fig.2.13 Average motorcycle mileage chart “18”

The official report of the Bureau of Transportation Statistics states that a motorcycle's average yearly mileage in the country is between 2,000 and 3,000 kilometers. These average estimates, however, are based on the total number of motorbikes that are registered in the US. This implies that any registered motorcycles that are being kept in long-term storage or that have been abandoned are included in these figures. Among them are classic bikes that you seldom ever see on the road. [18]

2.17 Evaluation of Indian motorcycle riders' posture, psychological stress, and driving conduct:

The motorbike is extremely popular in India for a variety of practical, economical, and fuel-efficient reasons. In addition, the National Crime Records Bureau (NCRB) of India reports that 13,787 motorbike riders lost their lives in traffic and driving-related events in 2014. Depending on the incidental societal and personal pressure present at a certain moment, the motorbike rider's actions fluctuate. Both "danger" and "safety" are arbitrary concepts. Low back pain (LBP), spinal injury, and driving-related musculoskeletal disorders (DMSDs) are all brought on by the prolonged unpleasant posture maintained when bicycling. Psychological requirements including meeting deadlines, accomplishing challenging professional objectives, and reaping excessive rewards are also damaging. Additionally, a survey has been conducted to identify the factors influencing young Indian customers' decisions to buy bikes. Advertising is frequently "stunt based" [7], particularly reflecting an aggressive conduct, which is significant in swaying opinions. India has a high rate of motorcycle-related road traffic accidents (RTA), which necessitates close observation and preventative action. The technological alteration of the bicycle and behavior-based safety must both form the cornerstones of any ergonomic intervention designed to stop mishaps involving bicycles in road traffic. The aggressive behaviour of drivers may have a significant role in crashes. Driving safety could be dramatically increased with behaviour control.The postural and psycho-social factors that can result in accidents and injuries should therefore be measured. It is essential to make an effort to assess the degree of aggressiveness among drivers when they are on the road in order to implement the necessary behavior-based safety (BBS) programme. Therefore, it is important to examine and contrast the drivers' own risk assessment with the level of any risky, aggressive, or sensation-seeking activity. [9]

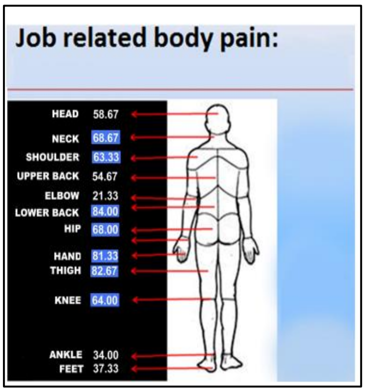
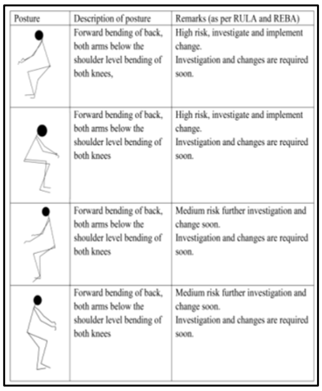


Fig.2.14 Job related body pain "9"



Posture	Description of posture	Remarks (as per RULA and REBA)
	Forward bending of back, both arms below the shoulder level bending of both knees,	High risk, investigate and implement change. Investigation and changes are required soon.
	Forward bending of back, both arms below the shoulder level bending of both knees	High risk, investigate and implement change. Investigation and changes are required soon.
	Forward bending of back, both arms below the shoulder level bending of both knees	Medium risk further investigation and change soon. Investigation and changes are required soon.
	Forward bending of back, both arms below the shoulder level bending of both knees	Medium risk further investigation and change soon. Investigation and changes are required soon.

Fig.2.15 Posture with description "9"

2.18 Ergonomic Posture for Motorcycle Riding:

The findings show that the majority of motorcycle riders felt discomfort in a number of different body parts while riding. The findings also showed that, as opposed to their lower body (knee, calf leg below knee, ankle, and foot), motorbike riders generally felt discomfort in their upper body (neck or head, shoulder, upper back, arm and hand, low back, and buttock). The responders' ages range from 18 to 25, so as you get older and have more riding experience, the discomfort will worsen because your body is less able to repair wounds as you get older. These study results may therefore be useful to designers in the automotive (motorcycle) industry in order to enhance the ergonomic relationship between humans (riders) and motorcycles. It is obvious that additional research is needed to collect more precise anthropometric data and carry out sitting posture assessments given the variances between the various motorbike types, the static and dynamic settings, as well as the relatively small sample size used in this study. [11]

The results of the questionnaire study show that most often, motorcycle riders change their position. Only the agony of riding the motorbike may account for this. [11]

II. Anthropometric Approach:

Anthropometric data was collected for the dimensions identified as relevant to comfort sitting on motorcycle. Following dimensions were recorded for the purpose of identifying variance between anthropometric dimensions [8].The dimensions are given along with their required percentiles and values, mean and standard deviation.

TABLE I
DIMENSIONS AND THEIR VALUES ALONG WITH PERCENTILES

Sr. no.	Dimension	Percentile and values	Mean	Std. deviation
1	Acromial height	95^{th} , 1448	1325	80
2	Crotch height	50^{th} , 760	762	63
3	Ball of foot length	50^{th} , 244	244	17
4	Foot breadth	50^{th} , 92	93	9
5	Buttock height	95^{th} , 911	832	51
6	Buttock knee length	95^{th} , 911	832	51
7	Buttock-Poplitieal length	50^{th} , 451	453	35
8	Elbow rest height	50^{th} , 210	211	36
9	Forearm-forearm breadth (closed)	95^{th} , 479	398	52
10	Forearm-forearm breadth (relaxed)	95^{th} , 632	501	74
11	Forearm hand length	50^{th} , 239	261	26
12	Shoulder-forearm length	50^{th} ,309	311	24
13	Hand length	50^{th} , 184	178	12
14	Knee height (sitting)	75^{th} ,534	511	33
15	Poplitieal height	75^{th} , 439	420	33

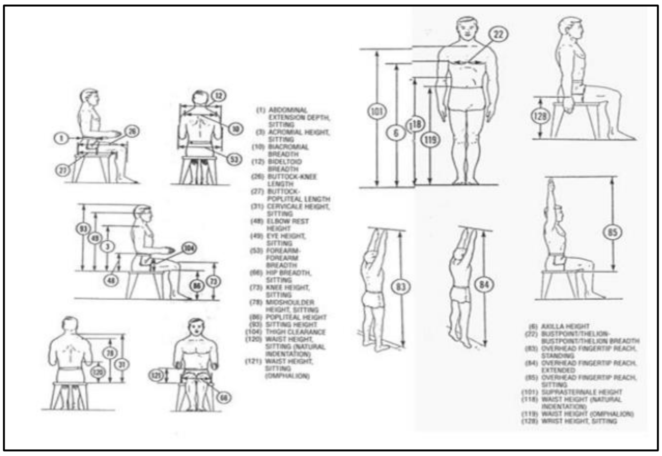


Fig.2.16 Anthropometric data and postures "11"

2.19 Ergonomic Design of a Bicycle- A bike of Rural People:

In this study, the general ergonomic problems with bicycling were found. The findings from the numerous calculations and analyses performed for this study will be able to solve the general human discomforts related to cycling. The goal of this study was to make bicycles more affordable while simultaneously improving their ergonomics. To accomplish this, creative design concepts were used. [11]

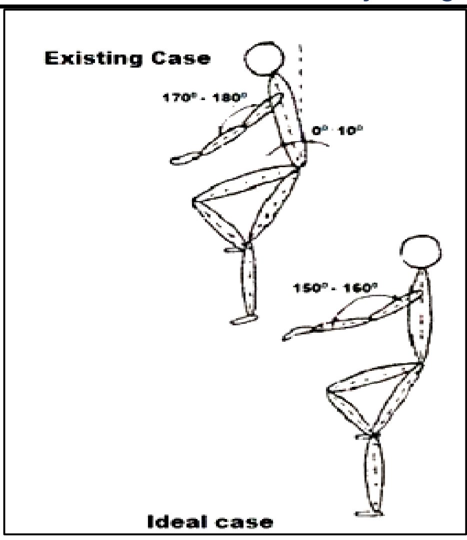


Fig.2.17 Optimum position of hand while riding "11"

2.20 The key anthropometric and range-of-motion measurements for motorbike ergonomics are identified as follows:

Existing anthropometry and range of motion (ROM) datasets of Indian male motorcyclists are either weak in important information or are not representative of the overall Indian population in a country where 92% of motorcycle users are men. Using intra- and inter-observer reliability techniques, a data set made up of 29 anthropometric measurements and 20 ROM measurements were collected from 120 male volunteers. The 14 and 6 most important anthropometric and ROM factors, respectively, were found using the dimensional reduction technique, and they account for almost all of the variance. When comparing the features of the current study with the database of the general population of India as well as other (inter)national databases of the motorcyclist/driver, the percentage of difference ranged from 26% to 56%. Despite the relatively small sample size, the generated data set can be utilised for Indian users' ergonomic motorbike design until a larger database is established taking the current study's conclusions into account. [6]

2.21 Design and Use of an Intelligent Helmet in India to Reduce Bicycle Accidents:

This paper describes an innovative intelligent helmet that ensures the rider cannot start the bike without it. In order to wirelessly switch a bike, this helmet takes use of a simple cable change, making sure that the bike can only be started using the key and the helmet. By turning on and off a led indicator, the model's functionality will be demonstrated. The basic concept is a relay that may be switched remotely. The trigger, which is located on the helmet itself, can only be activated while the rider is wearing it, hence the helmet must be worn in order for the bike to start. By doing this, the relay in the motorcycle's ignition circuit is switched. [10]

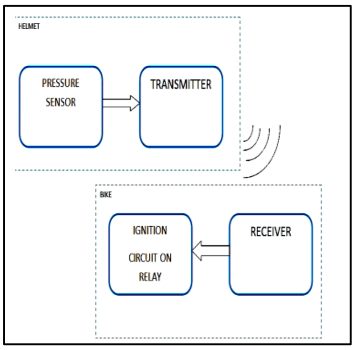


Fig.2.18 Intelligent helmet "10"

III. Data Collection and Analysis

3.1 Product study:

3.1.1 TOP 10 BIKES WITH ROOFS

Bikes with roofs have historically been cast into a disappointing netherworld, falling into the gap between vehicles and real bikes and frequently receiving little affection from admirers. However, there has remained to be a steady flow of prototypes, concept motorcycles, and seldom full-production versions with anything above your head. A top 10 list that highlights some of the strangest, finest, and (sometimes) most successful members of this specialist species is justified despite the fact that few have achieved tremendous success and even fewer deserve it. Is the idea inherently unworkable or has no one yet succeeded in making an appealing bike with a roof? [44]

- **Peraves Ecomobile/MonoTracer/Monoracer**

Fig.3.1 Paraves eco mobile "44"

- **BMW C1**

Fig.3.2 BMW c1 44"

- **Benelli Adiva**

Fig.3.3 Benelli adiva "44"

- **Quasar**

Fig.3.4 Quasar "44"

- **Honda Gyro Canopy**

Fig.3.5 Honda gyro canopy "44"

- **Peugeot HYmotion 3**

Fig.3.6 Peugeot HYmotion 3 "44"

- **Honda Elysium**

Fig.3.7 Honda Elysium "44"

- **Toyota i-Road**

Fig.3.8 toyota I-road "44"

- **BMW Simple**

Fig.3.9 BMW simple "44"

- **Lit C1**

Fig.3.10 Lit c1 "44"

3.2 Mechanism study:

Honda max - 5 car having cabriolet.

Fig.3.11 Honda max - 5 car “41”

The following is the analysis of mechanism.

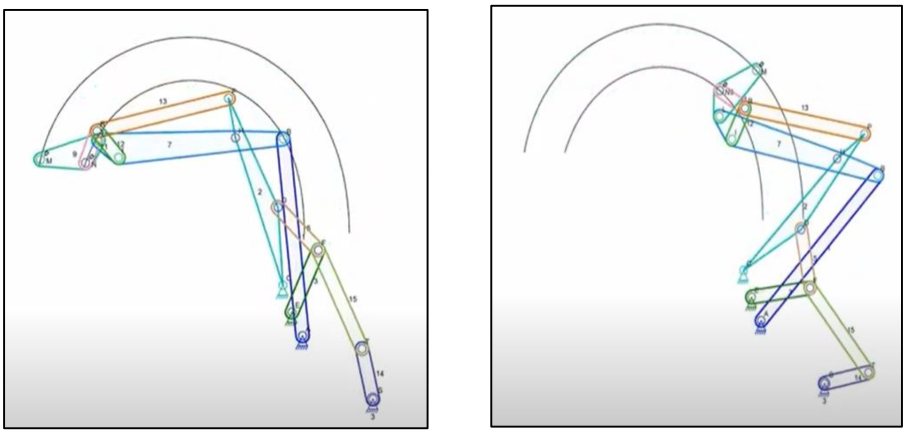


Fig.3.12 Mechanism motion analysis “31”

- **Actuators**

Actuators are machinery that create motion out of stored energy. The form of the stored energy typically takes the form of liquid pressure (hydraulic pressure), electrical potential, or compressed air (pneumatic pressure). Each actuator works to apply the necessary force that the current task requires across a wide range of machines in numerous sectors. [24]

- **Cams**

Mechanical tools called cams transform rotational motion into linear motion. You're certainly aware that "pear" cams are used in internal combustion engines, but did you know that there are countless design options for cams? The cam follower moves in numerous ways depending on the design. Heart cams maintain a constant velocity in the cam follower, drop cams provide a quick and discontinuous linear motion, and circular cams produce smooth linear motion. Engineers can approach mechanical designs in new ways and come up with new, more effective methods of doing things because to the various cam variations. [24]

- **Gears**

One of the most popular and versatile categories of mechanical devices is the gear. The transmission of torque and modification of rotational velocity are the two main purposes of gears. Typically, a "spur" gear—basically a circle with teeth—comes to mind when you think of a gear. Helical gears, worm gears, planetary gears, and bevel gears are only a few of the numerous varieties. When compared to spur gears, helical gears function with less friction, and some worm gears (self-locking varieties) can only transmit motion in one direction. Bevel gears are a crucial component of vehicle drive trains because they allow rotation to be translated by 90 degrees. [24]

- **Levers**

A lever is a mechanical tool that transmits and amplifies force by revolving its input and output around a pivot or fulcrum. Levers are used extensively in industrial settings. As long as the arithmetic and the materials used to construct the lever are sound, machines can easily move large materials and transport them from one location to another. [24]

- **Ratchets**

The ideal tool for mechanics and handymen is a ratchet. A ratchet has likely been used by anyone who has ever leased a UHaul to transport items between cities to secure items in storage or to keep a vehicle's wheels fastened to the trailer. Ratchets are wonderful because they lock in one direction so you can tighten them without worrying about actually "going backward." Zip ties and "ratchet" wrenches are two other awesome everyday things that make use of ratchets. [24]

- **Springs**

Mechanics that store and release energy include springs. There are numerous different varieties of springs, just like there are. Compression, torsion, leaf, and continuous force are a few of the most prevalent types. The majority of industrial gear is equipped with springs, which enable these sophisticated devices to carry out their fundamental duties. [24]

3.3 Motorcycle Frames 101: Types, Materials, and Weights:

The fundamental support framework of a motorcycle is known as the frame or chassis. This metal backbone supports the bike's engine as well as a number of other parts. Steel or aluminium are the most common materials used to make motorbike frames. However, certain expensive and racing motorcycles have frames made of titanium, magnesium, or carbon fibre. The most common motorcycle frame types in terms of design are backbone, cradle, and trellis/perimeter. [39]

The many designations given to the various motorcycle frame types are frequently used in their design. The following are the top seven categories of motorcycle frames: [39]

- Backbone or Spine
- Diamond
- Single-cradle
- Double-cradle or duplex
- Trellis
- Perimeter
- Monocoque and pressed

3.4 The Foundational Parts of a Motorcycle:

The majority of the components that make up the fundamental structure of a motorbike are made of steel, iron, alloy, metal, rubber, and plastic. Let's look at each one individually.

- **Engine:** A motorbike's engine is what powers the gearbox and other functions necessary for the vehicle to run smoothly. The engine's valve, which aids in combustion and circulates gasoline and air to other motorcycle components, is one of the most crucial components. [34]
- **Carburetor:** The carburetor is a part of the engine that contains chambers, valves, and tubes that may mix fuel and air to help with combustion. [34]
- **Cylinder:** The motorbike's liver is made up of the two engine cylinders. An engine on a motorbike may sustain combustion with up to six cylinders. [34]
- **Pistons:** By moving up and down, the pistons inside the cylinders assist in transferring energy from the engine to the other components. The wheels can move more easily as a result of this. [34]
- **Fuel tank:** As everyone is aware, the gasoline tank is situated above the engine and can hold a certain amount of fuel based on the size of the motorcycle. [34]
- **Oil and fuel filters:** Your motorbike is equipped with separate filters to keep dust and other particles from contaminating the oil and gasoline. [34]
- **Wheels:** Every motorbike has two wheels, one at the front and one at the back, each with a tyre, rim, hub and spokes to help the bike slide. [34]
- **Handlebars:** On a motorbike, the handlebars aid the rider in maintaining balance and control for a smooth ride, in contrast to automobile steering. Rubber grips are advised for a firm grip on the handlebars. [34]
- **Speedometer:** A digital speedometer is mounted in the centre of the handlebar. The rider is always informed of their current speed and distance travelled. [34]
- **Mirrors:** Two mirrors are located on either side of the handlebars to help you observe traffic coming from both directions and prevent any accidents. [34]
- **Headlamp:** Headlamps, a motorcycle's "eye," keep you safe when vision is poor. [34]
- **Brakes:** The brakes on a motorcycle, like those on any other vehicle, aid in regulating speed as well as in emergency situations where you may need to abruptly stop your motorcycle in traffic. Drum and disc brakes fall into different categories. Due to their excellent performance in slick conditions, disc brakes are now found on the majority of motorcycles. [34]
- **Battery:** Unlike a car, a motorbike contains a tiny battery that aids in energy bursts and continuous running throughout the day. The most common battery type used in bikes is a 12-Volt battery with six sulfuric acid-filled cells. [34]
- **Seat:** A motorbike's leather-covered, extended, cushioned, and well-padded seating configuration makes for a pleasant ride for two people. [34]
- **Kickstand:** The kickstand is used to maintain the bike upright and keep it from tipping over when stationary. [34]
- **Frame:** Last but not least is the frame, which is a crucial component of a motorcycle. It has a top tube and a down tube that support the motorcycle's chain and seat clamps. [34]

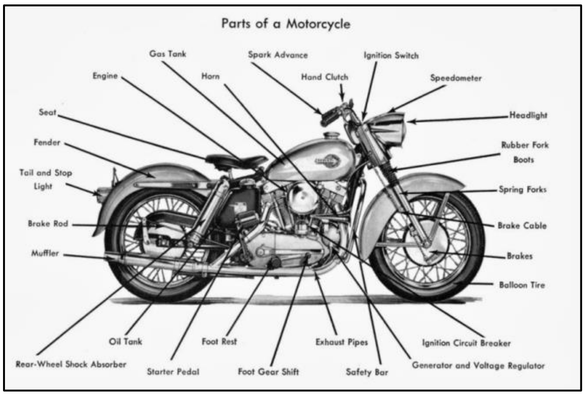


Fig.3.13 Bike basic component "34"

3.5 User persona :

- A normal person who finds use of bike.
- Age from 18 - 70.
- the one who cares for health and safety.
- the one who wants to travel in intercity in all weather conditions.
- the one who give first prferance to safety precautions.
- the one who are intrested in experiancing new in riding the bike.
- the family person, taking decisions considering family members also.

Fig. 3.14 User persona "46"

3.6 Ergonomic dimensions:

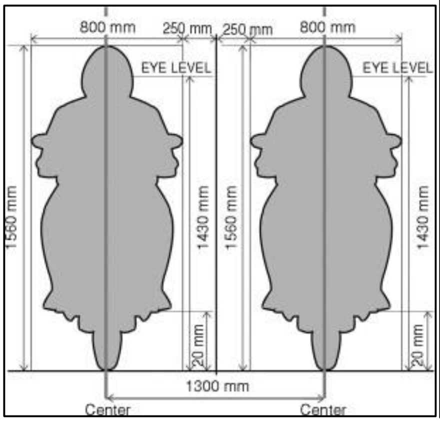


Fig.3.15 Bike ergonomic dimension 1 "47"

Dimensions

Seat height	780 mm	Length*Width*Height	1837*734*1250 mm^3
Wheelbase	1295 mm	Length	1837 mm
Ground Clearance	153 mm	Height	1250 mm
Width	734 mm	Kerb Weight	111.6 Kg
Tail Light	LED	Front Brake Diameter	200 mm
Rear Brake Diameter	190 mm		

Fig.3.16 Bike ergonomic dimension 2

3.7 Finalizing the base product:

Fig.3.17 Base product “27” “28” “32” “40”

3.8 Theme Board:

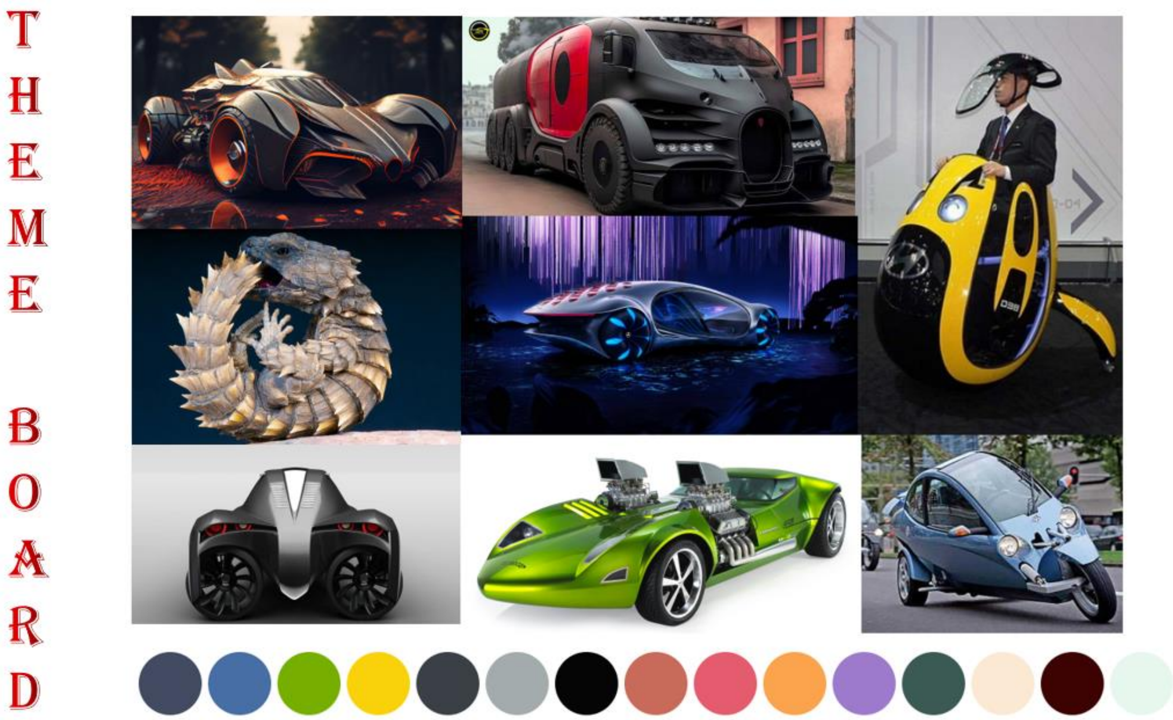


Fig.3.18 theme board

3.9 Mood board:

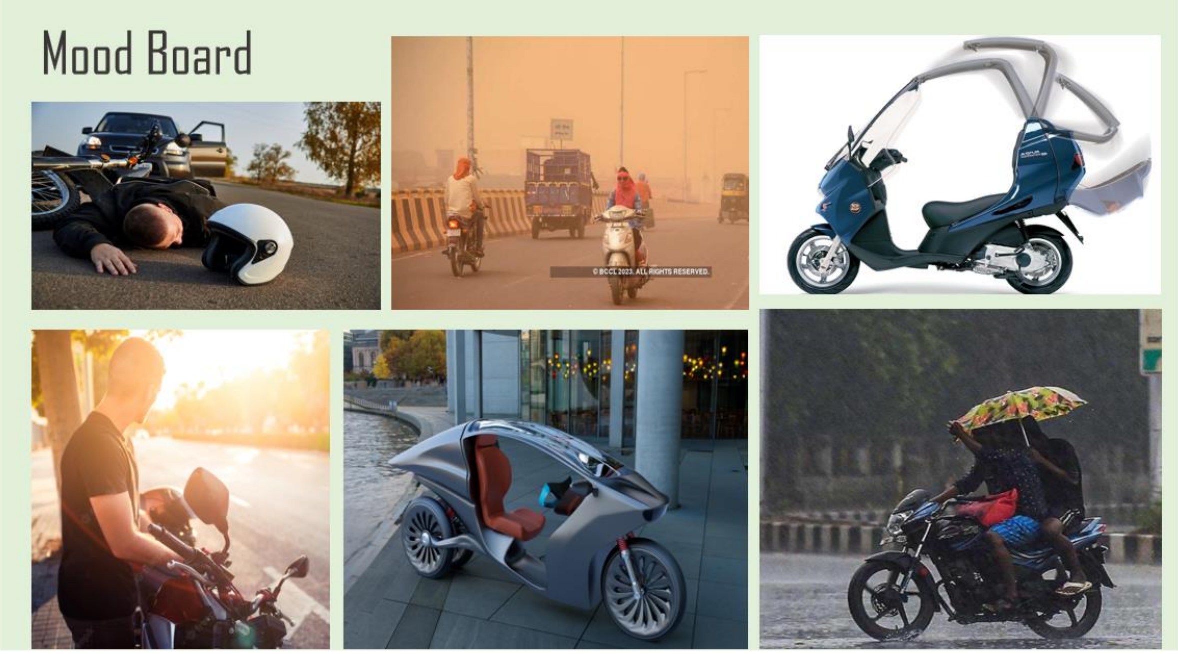


Fig.3.19 mood board

3.10 Mind mapping:

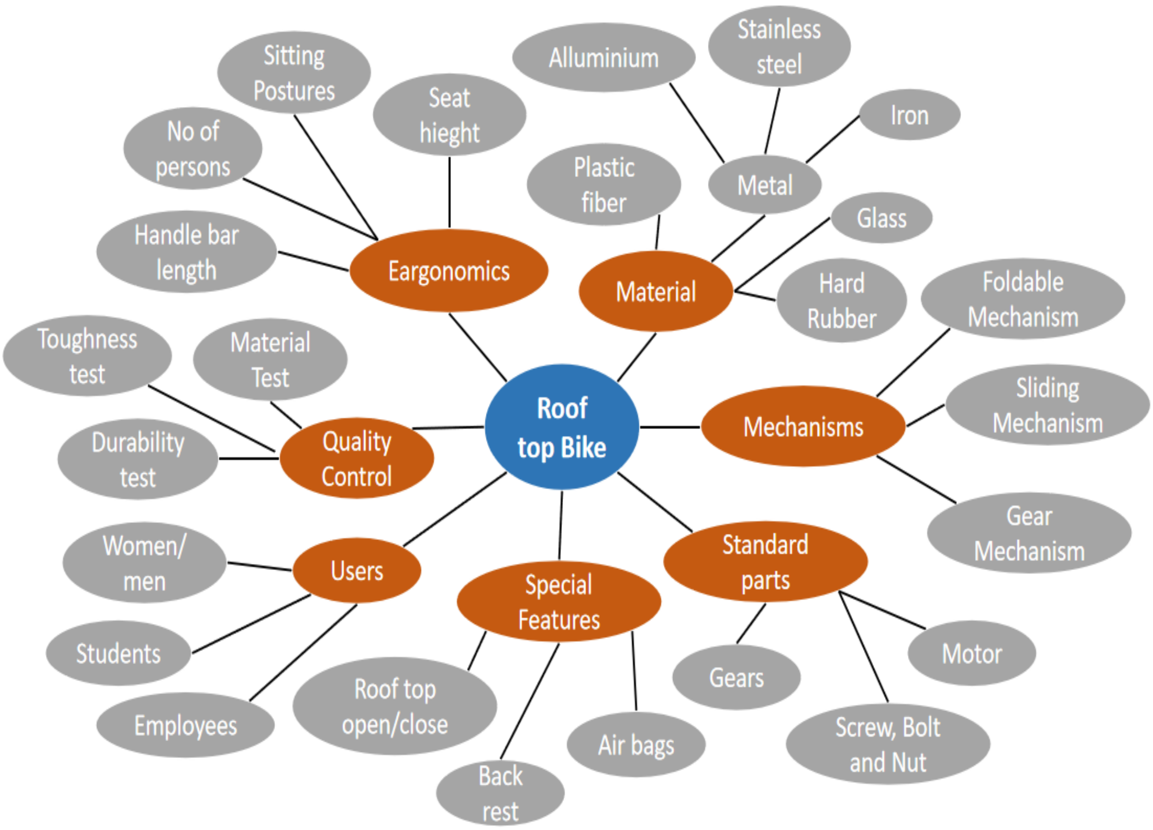


Fig.3.20 mind mapping

3.11 QFD Chart:

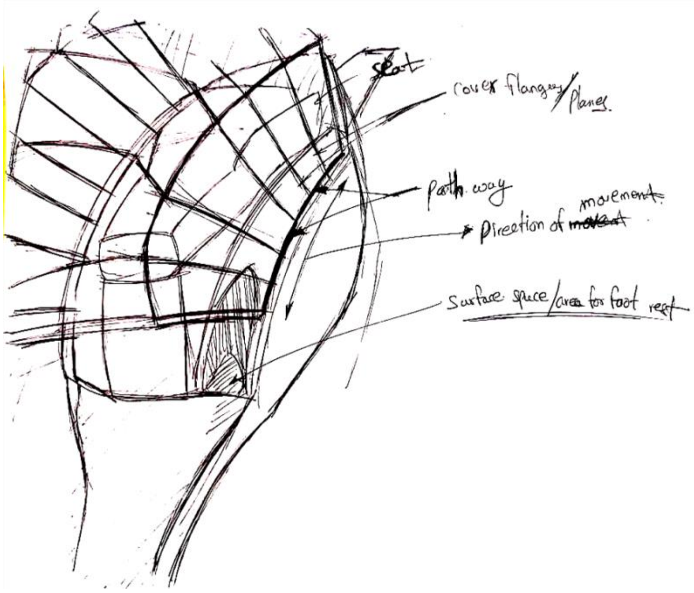
Customer importance rating	Technical Requirements → / Customer Requirements ↓	Average speed per hour (kmph)	Special features (no's)	Safety measures (no's)	Aesthetics (no's)	Power source (fuel/watt)	our product	Competitors product	Planned rating	Improvement factor	Sales point	Overall weight	Percentage total
	Direction of improvement	↑	↑	↑	↑	↑							
5	Safety	1	3	9			5	3	5	1	1.5	7.5	28
5	Milage	9				3	4	4	3	0.6	1.4	4.2	16
4	Speed	9		1		3	3	3	4	1	1.3	5.2	20
3	Comfortness		9	3	1		5	4	4	1.3	1.4	5.5	21
3	Appereance		3	1	9		4	4	3	1	1.4	4.2	16
	TECHNICAL PRIORITIES	92.1	84.6	93.4	43.3	28.2							
	Percentage Total	27	25	27	13	8.3							
Technical Bench marking	Our Product	40 kmph	5	4	3	13 kw							
Technical Bench marking	Compititors Product	50 kmph	3	2	2	11 kw							
	Design Targets	50 kmph	5	5	3	11 kw							

Fig.3.21 QFD chart

According to the analisys of QFD chart in the product Average speed per hour(kmph), Safety measures and eargonomic conditions are the important specifications that gonna play crucial role in market. Also customers needing features.

IV. CONCEPT GENERATION

4.1 Mechanism concept sketches:



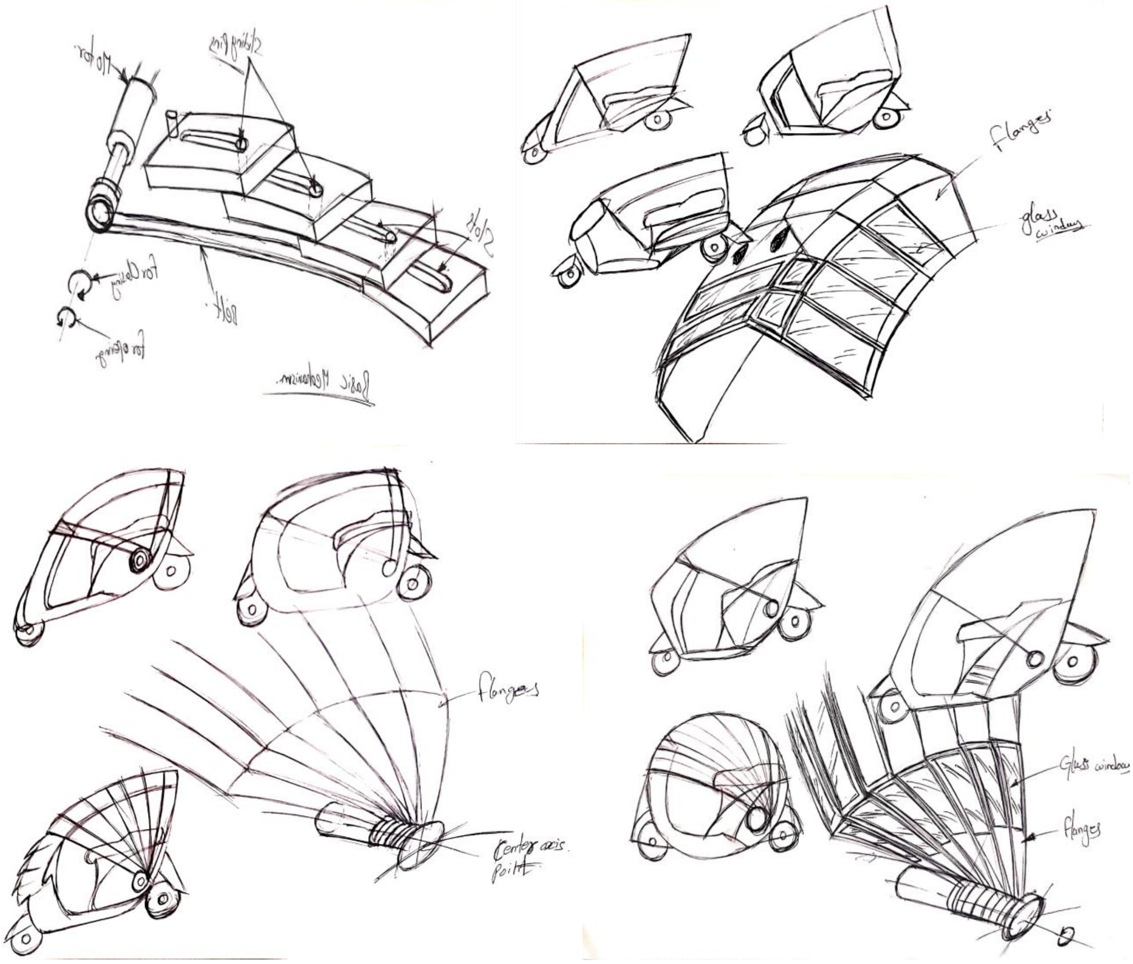
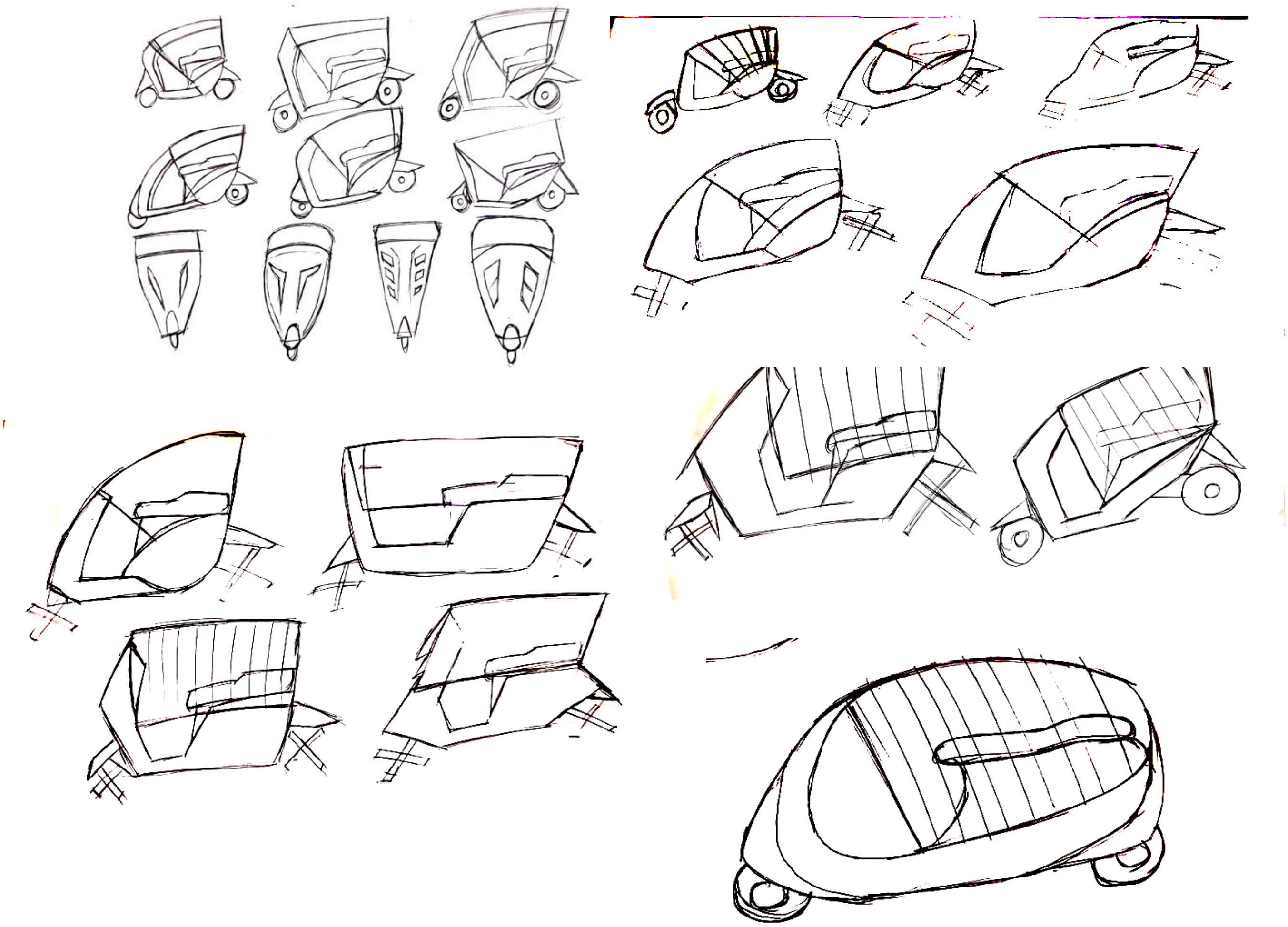


Fig.4.1 mechanism concept sketches

4.2 Concept sketches:



V. CONCEPT DETAILING

5.1 Digital concept sketches:

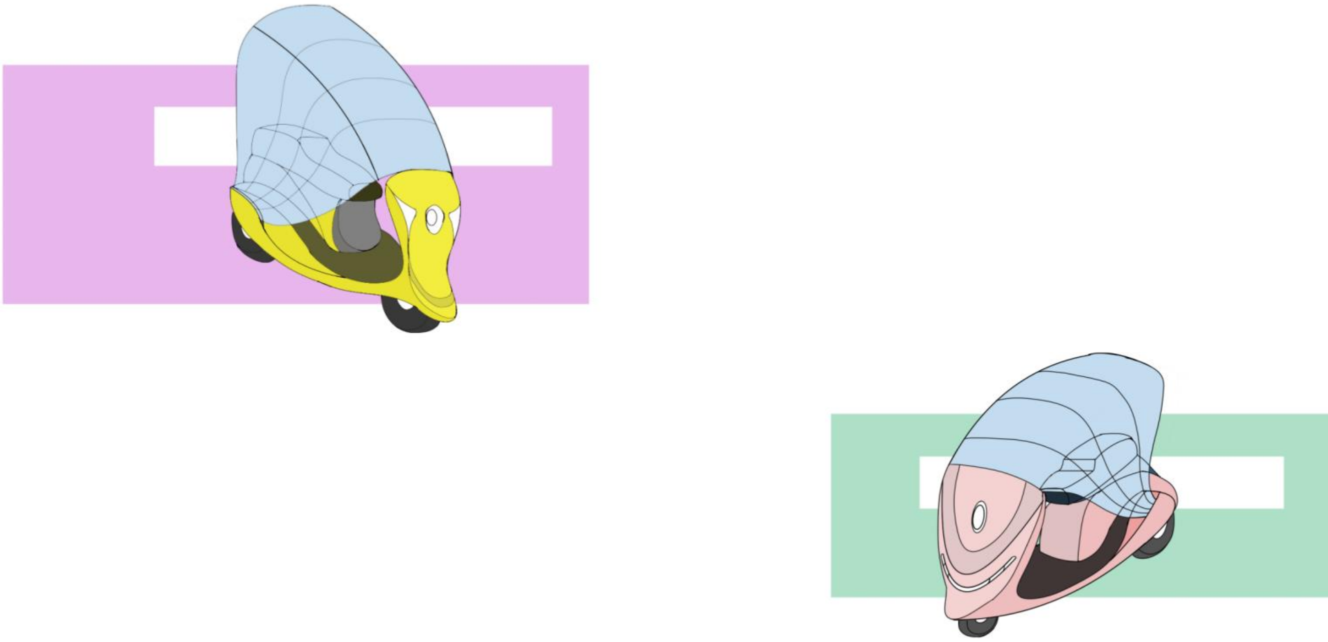


Fig.5.1 digital sketches

5.2 Line diagram of mechanism:

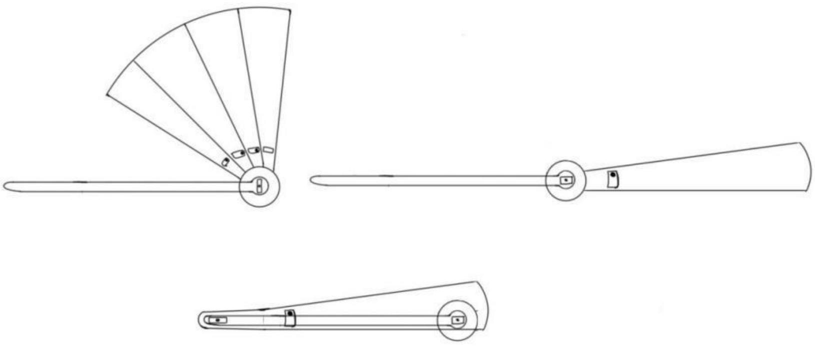


Fig.5.2 line diagram of mechanism

5.3 Concept models:

5.3.1. Radial open/close flanges

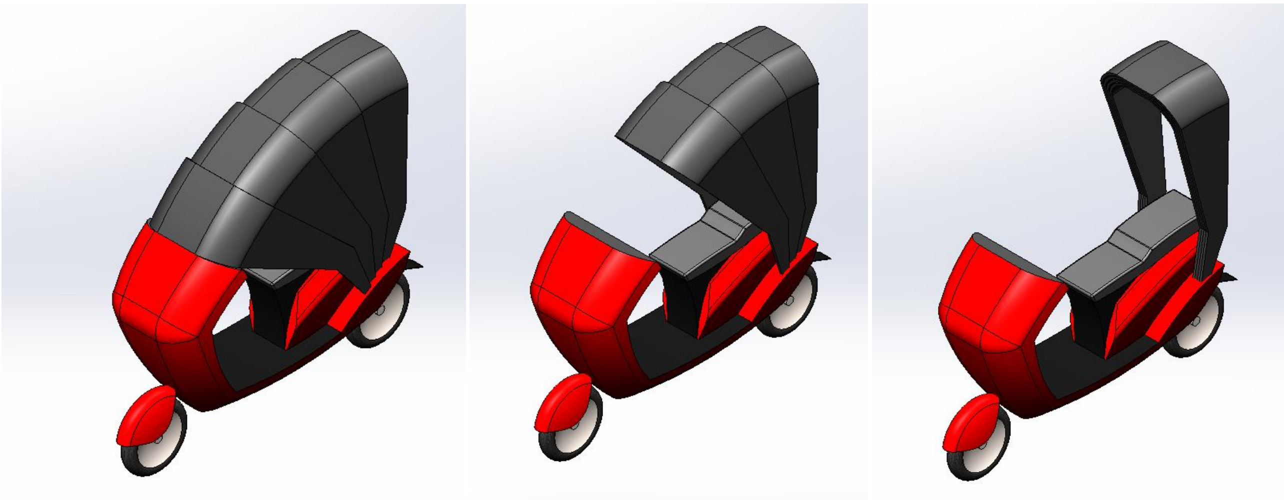


Fig.5.3 concept model 1 radial

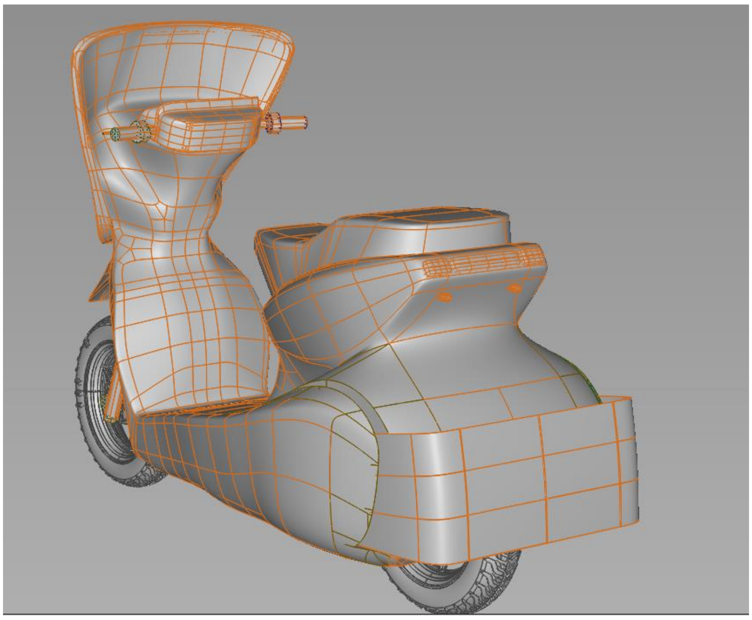
5.3.2. Guided path way open/close flanges

5.3.3. Tangential open/close flanges

Fig.5.4 concept model 2 guide path

Fig.5.5 concept model 3 tangential

5.4 3D Models:



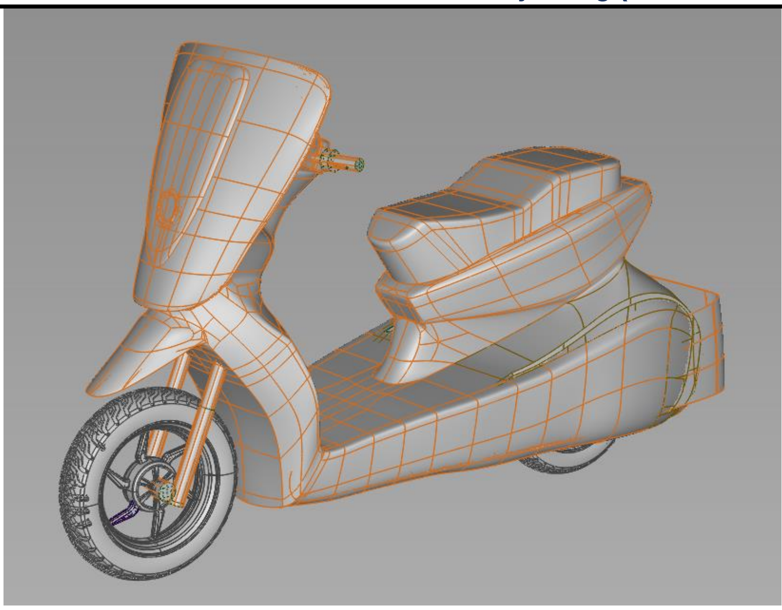


Fig.5.6 3d model

5.5 Rendered models:

Fig.6.7 3d model 2

Fig.5.7 rendered models 1

Rendered models:

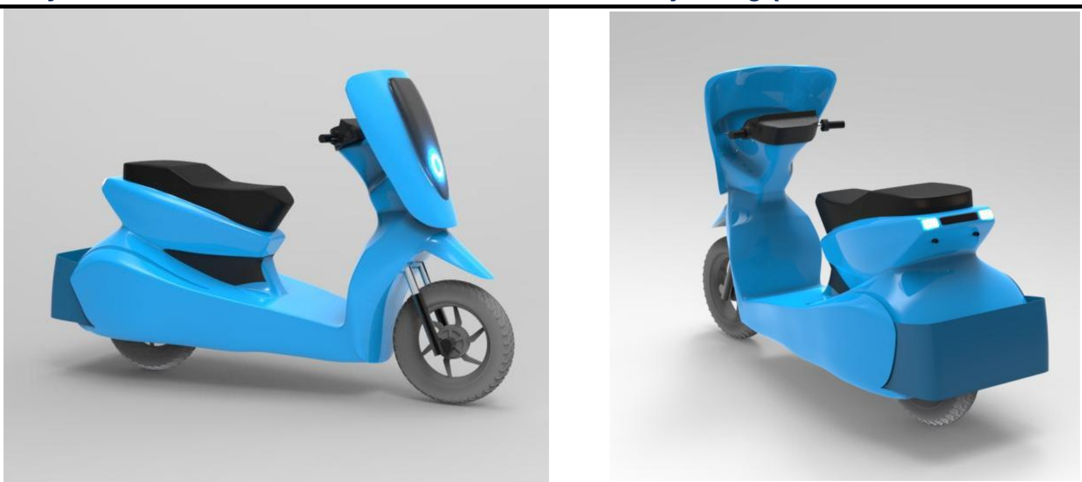


Fig.5.8 rendered models 2

5.6 User Experience:

Fig.5.9 user experience 1

Fig.5.10 user experience 2

VI. Conclusions and Future Work

6.1 Conclusion

As per the result, the design of vehicle achieved the protection of intercity raiders in all weather conditions. We can see the raiders using this vehicle can get protected from heavy sun light, rain, dust, snow and sudden accidents. It has been designed with all aesthetic and ergonomical conditions in such a way that raider can feel new experience and more comfortable in raiding the bike. The raider can access easily the special features incorporated in bike like open/close flanges.

6.2 Future Work

I'm looking forward to develop more possible things in this design like making a self balancing even in ideal position, covering more space for raider so that raider safety will increase more and also improving/exploring more aesthetic in design of vehicle.

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