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ADVANCED SUSPENSION QUAD WHEELS VEHICLE

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ABSTRACT

This vehicle works on the principle of lean suspension in which all four wheels are having independent suspension (lean suspension) by which we can increase stability, safety of vehicle. This project is mainly focused on an idea about lean suspension to increase the cornering safety and stability of the vehicle at high speeds as according to the local survey done the bike riders face difficulty in cornering and controlling the vehicle at high speeds. We are using control arms (four linkage mechanism) for allowing the vehicle to tilt or lean. It can provide many performance and design advantages including greater stability while turning and reduced probability of rollover while taking a turn. The controlling of this vehicle is easy as compared to other two or three wheelers. It is capable to withstand bumps and shocks.

Keywords—cornering, leaning, safety, stability, suspension, tilting

I.INTRODUCTION

Motorbike is a great technology that is very common today. In a local survey, bike riders found it hard to ride in rainy season due to the slippage occur and have to take shelter. We are going to decrease these disadvantages by using the new concept of leaning mechanism. We all know that four wheels have more grip than two and leaning shifts the centre of gravity lower and to the side of the corner.

Independent suspension is a broad term for any automobile suspension system that allows each wheel on the same axle to move vertically (i.e. reacting to a bump in the road) independently of the others. This project vehicle has fully independent suspension that means it includes independent front suspension (IFS) and independent rear suspension (IRS) both. Road vehicles can expend a significant amount of energy in undesirable vertical motions that are induced by road bumps, and much of that is dissipated in conventional shock absorbers as they dampen the vertical motions. A conventional automotive shock absorber dampens suspension movement to produce a controlled action that keeps the tire firmly on the road. This is done by converting the kinetic energy into heat energy, which is then absorbed by the shock's oil.\

II.AIM OF THE PROJECT

a) The main objective of this vehicle is to provide anti skidding effect in bikes by using leaning mechanism which have independent front suspension as well as independent rear suspension) due to which this vehicle

provides greater stability in rainy season on road.This quad wheel bike can be used for off road purpose due to the anti-skidding effect and leaning mechanism it provides better riding comfort and safety to the riders.

b) At sharp turning two wheelers get slower and sometimes get roll over the road but in our project, there is leaning mechanism with differential and four wheels(each wheels have its own damper) for the better balancing and controlling. The goal of our project is to functioning double suspension system.

c) For some handicapped peoples, it is difficult to balance and control the bikes but this quad wheel bike may provide them better balancing and comfort.

III.LITERATURE REVIEWS

1.1 Leaning suspension mechanics

On 22nd SEP 2009, Ryan J. Suhre and co. worked with Harley Davidson Motor Company and filed a patent (US 7,591,337). They had implemented their design on front wheel. The limitations of Lawayne were overcome. But the Ryan and co. had used hydraulic actuators to force the bike into leaning position while turning and back to upright position while tracking a straight line. The vehicle, which will be described herein as a trike, includes a frame, a rear drive wheel; conventional gasoline fuelled internal combustion engine, and two front wheels with a leaning suspension system. [2].

1.2 Leaning Vehicle with tilting front wheels

On 19th JAN 2010, Daniel Mercier implemented the leaning mechanism on vehicle. According to his design, vehicle has a frame pivotally connected to the lower end of a shock tower, the pivotal connection defining a frame leaning axis wherein the frame is adapted to lean to a right side and to a left side relative to the shock tower about the frame leaning axis [3]. The leaning vehicle includes an actuator operatively connected to the frame and to the shock tower which is adapted to impart a leaning motion to the frame relative to the shock tower about the frame leaning axis.

IV.METHEDOLOGY

4.1 Deciding the design and theoretical analysis: Our first step is to design the frame which is adaptable for leaning mechanism based on the common studies of literatures. The design should sustain the type of loading acting on the mechanism. Till now we have decided the design and what is the design will come to know further.

*4.2 Calculations***:** Calculation of dimension of each part depending on the stress acting on it which will prevent the failure of the parts by using CATIA software.

4.3 Design and Analysis on software: After all this we are going to make the 3D model of leaning mechanism in *SOLID WORKS* to analyse that the dimensions we have calculated are acceptable. Then by importing the 3D model of mechanism in *ANSYS* we will do stress analysis to confirm that there is no failure in the assembly.

4.4 Making leaning mechanism: After confirming that the design is safe we will go for actual working model of leaning mechanism.

4.5 Implementing it on bike: We use this leaning mechanism for modification in bike.

V.CONSTRUCTIONAL FEATURES

5.1 FRONT SWING

Front swing consists of round pipe square pipe, MS plate, end bearing, hinges and bearing with bearing hub. The function of front swing used to give the flexibility in vertical as well as horizontal direction the hinges and end plane bearing very important.

Fig5.1. Front *swing arm*

5.2 REAR SWING

Rear swing consists of round pipe square pipe, MS plate, plane bearing, hinges and bearing with bearing hub. The function of Rear swing used to give the flexibility in vertical direction the hinges and end plane bearing very important role in swing.

Fig5.2. Rear *swing arm*

5.3 POWER TRANSMISSION SYSTEM

Power from engine is transmitted to the both rear wheel of the vehicle with the help of chain and sprocket mechanism mounted on differential. Power from engine is to be transmitted to the differential with the help of sprocket and differential is connected to the rear axle which will transmit power to both the rear wheels.

Fig5.3. Power transmission

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VI.DESIGN DISCRIPTION

a) In the frame design of the advance suspension the all four shockers are connected to two linkages and to the chassis frame.

b) The shockers are having a cage like structure formed by linkage which provide them load bearing capacity.

c) There is a differential at last of engine which transmit power independently to both rear wheels.

d) The steering is formed with tie rod which control of turning of vehicle.

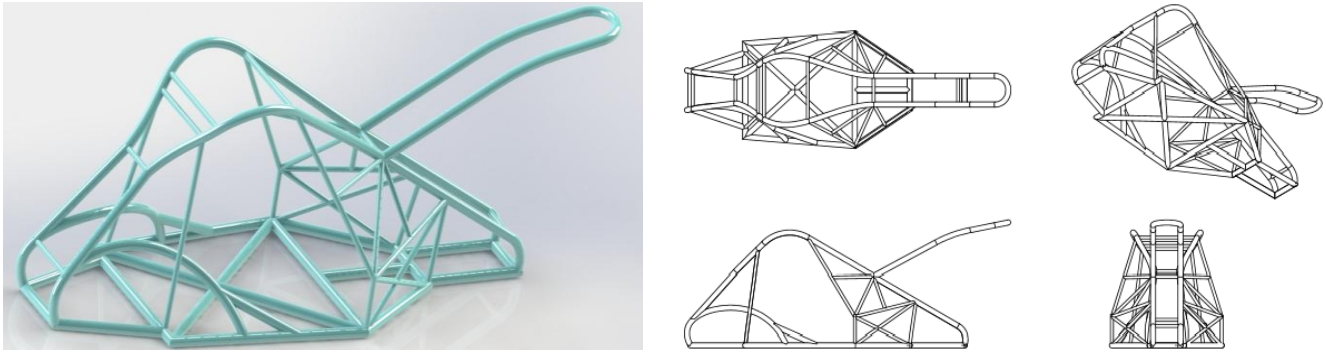

Fig 6.1: *3-D and 2-D views of Chassis of the vehicle*

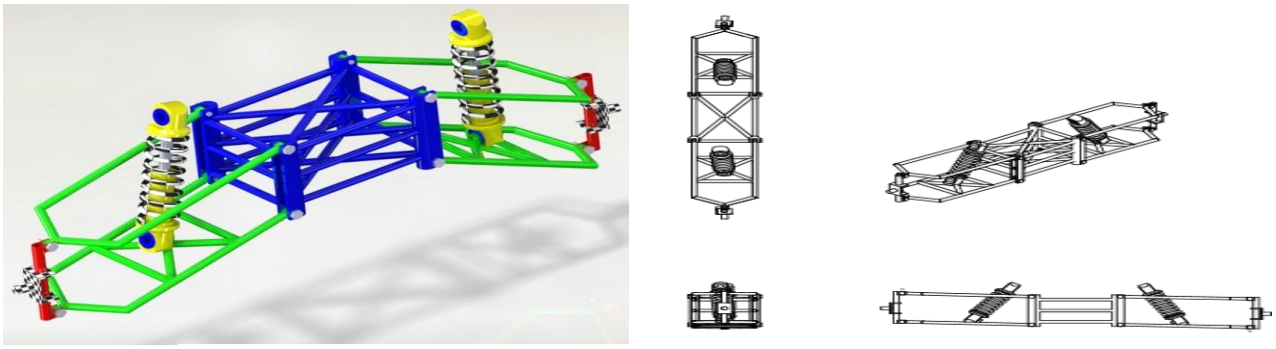

Fig 6.2: *3-D AND 2-D views Front suspension with shock absorbers*

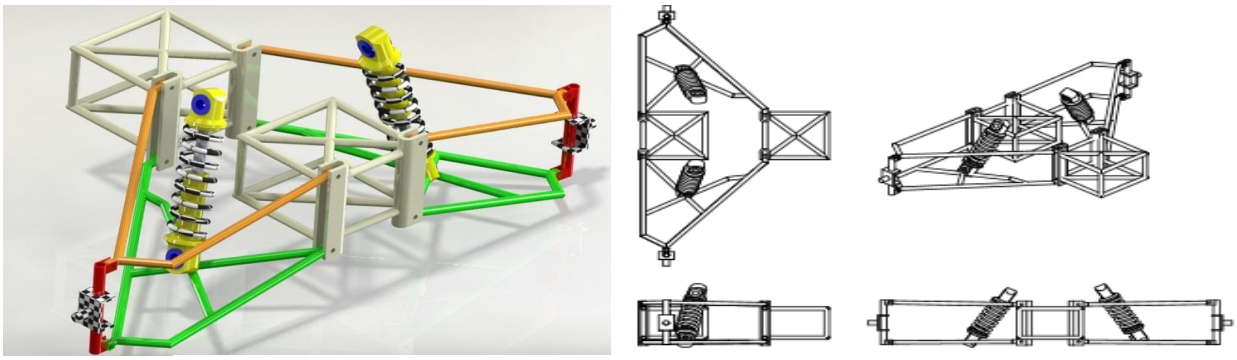

Fig 6.3: *3-D and 2-D views of Rear suspension with shock absorbers*

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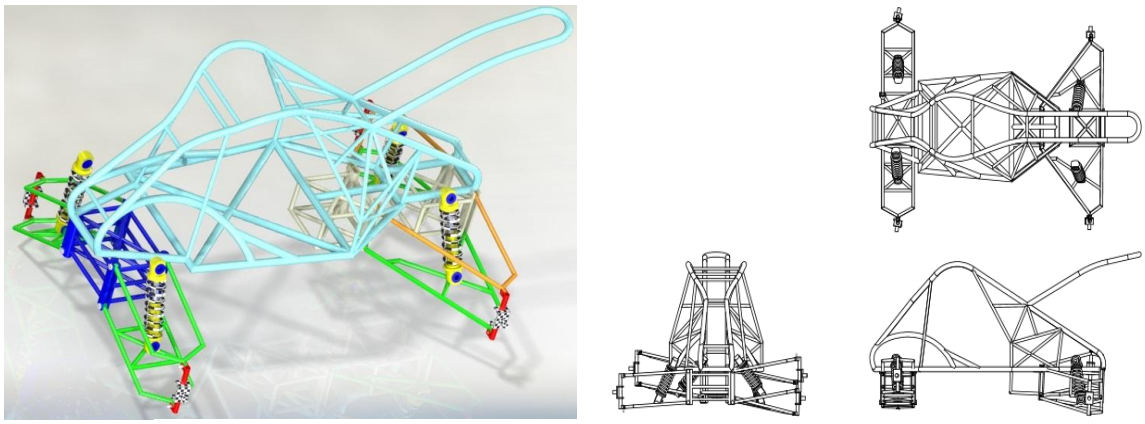

Fig 6.4: *Complete assembly of rear, front suspension and chassis*

VII.ANALYSIS RESULTS OF CHASSIS (IN ANSYS)

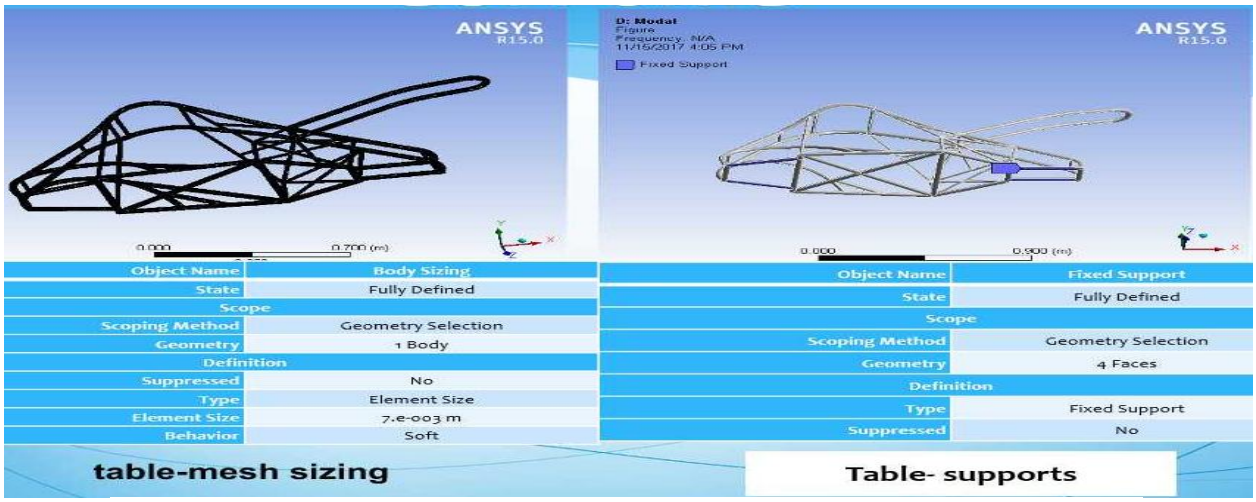

Fig 7.1: Conditions of meshing and supports

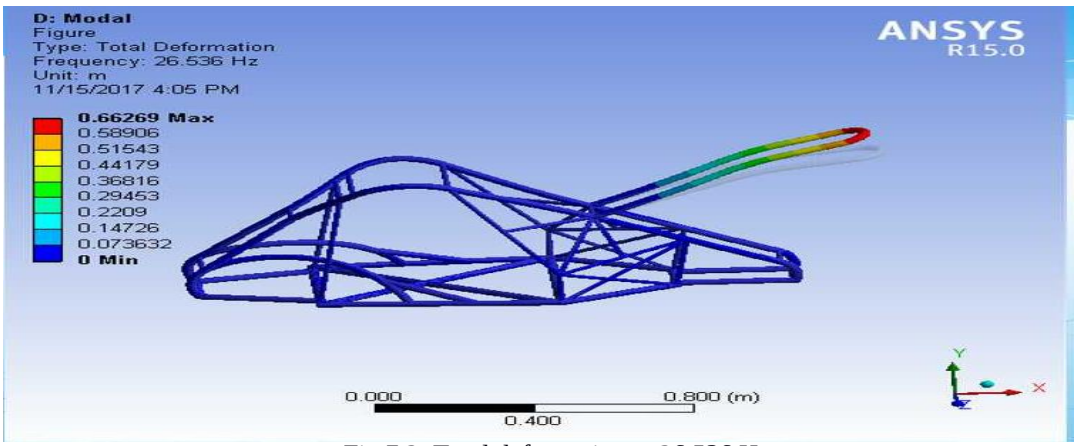

Fig 7.2: Total deformation at 26.536 Hz

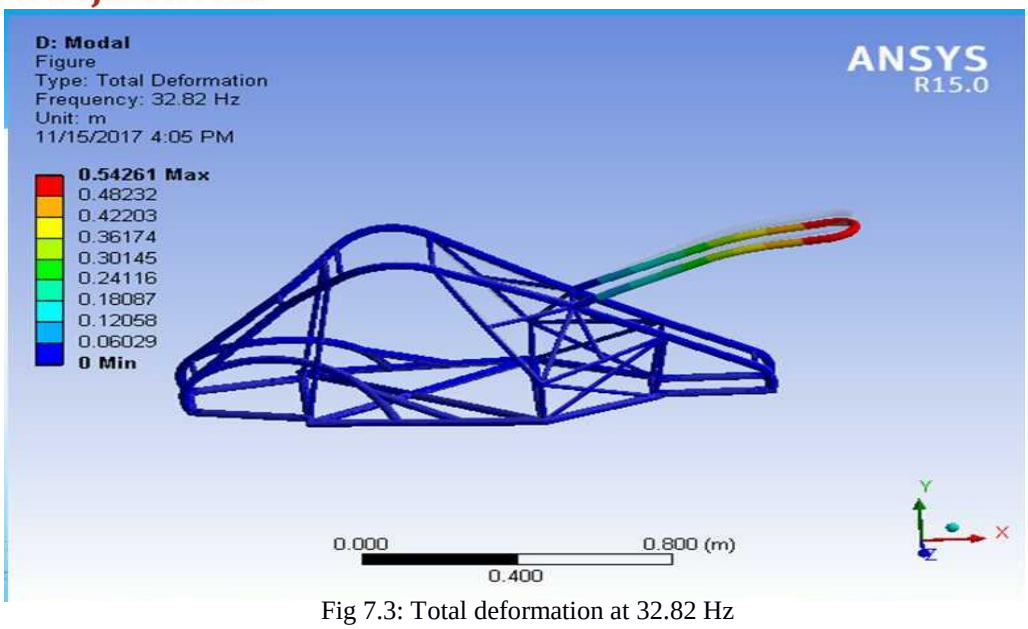

Fig 7.3: Total deformation at 32.82 Hz

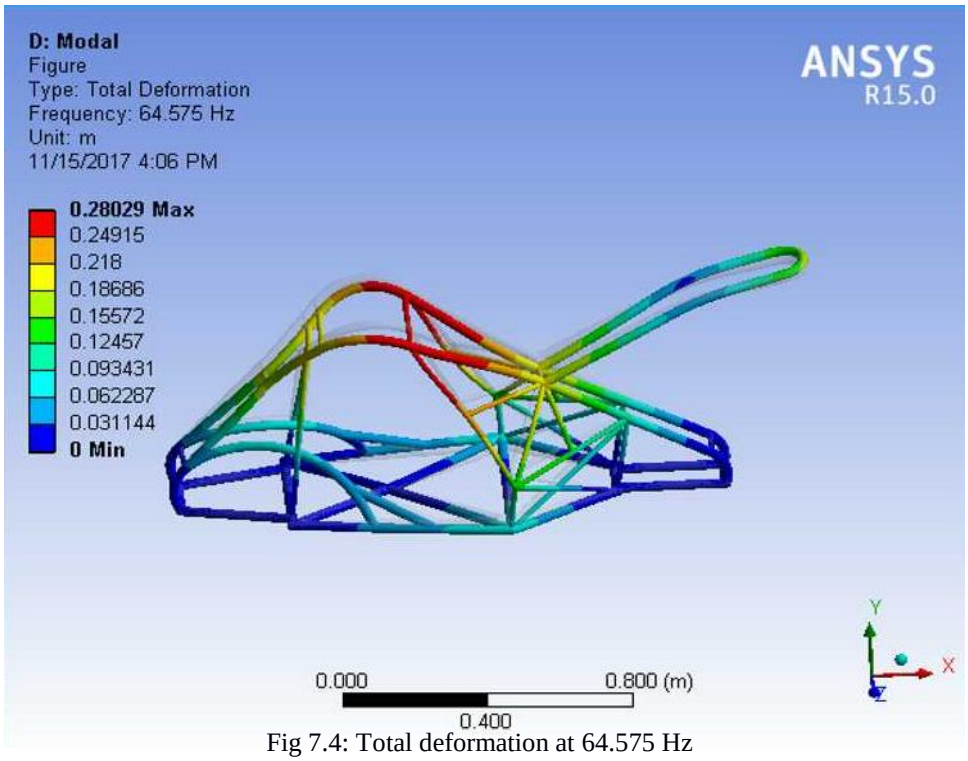

Fig 7.4: Total deformation at 64.575 Hz

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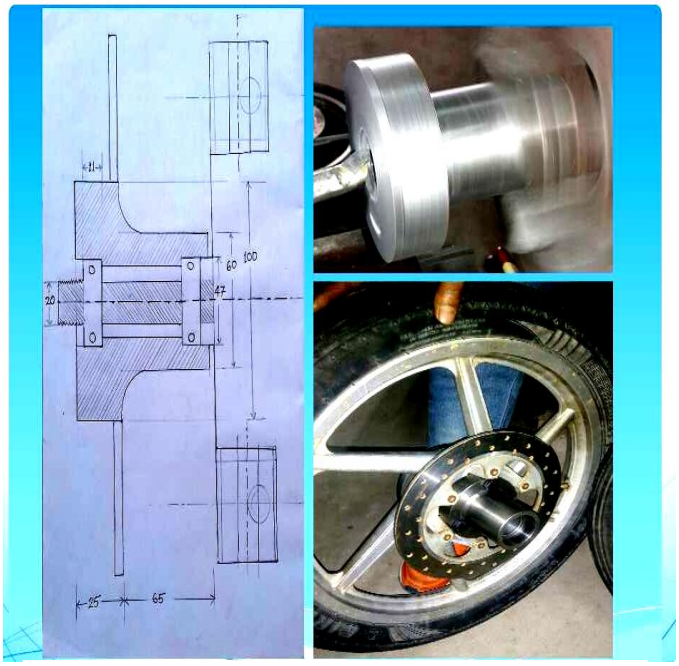

Fig7.5. Design of front wheel hub (in mm)

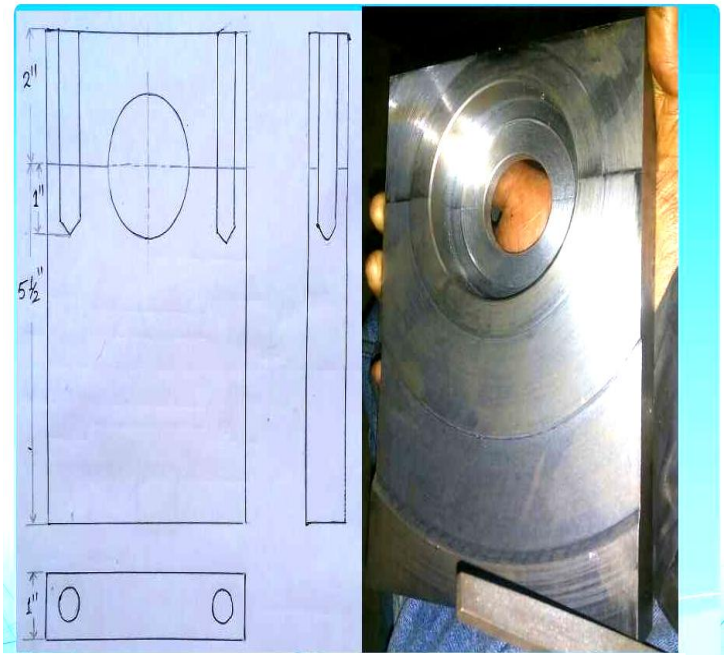

Fig7.6: Design of differential holding block (in inches)

VIII.SPECIFICATIONS

	Engine and transmission	
1)	Engine displacement	223cc (13.61 cubic inches)
2)	Stroke (mm)	66.2
3)	Engine type	Single cylinder 4 stroke
4)	Power	17.00 HP (12.4 KW) @ 7000 rpm
5)	Gear box	5 speed
6)	Transmission type	Chain sprocket, differential
7)	Fuel capacity	15 liter (3.96 gallons)
8)	Ground clearance	12 inches
9)	Brake type	Disc brake

10)	Wheel type (4)	Alloy
11)	Tire type	Tubeless

12)	Shockers	5 way adjustable Nitrox shock absorbers
13)	Wheels (4)	17 inches
14)	Length of vehicle (front to back)	77 inches (1955.8 mm)
15)	Width (track)	52 inches (1320.8)
16)	Height(handlebar to floor)	45 inches(1143 mm)
17)	Seat height from floor	37 inches (939.8 mm)

IX. ADVANTAGES

a) It provides anti-skidding effect.
b) Bike can be used for on road as well as for off road purpose.
c) Assembly is reliable.
d) Bolt on assembly gives redundancy to use vehicle as per requirement.
e) Rider is safe while taking sharp turn on the road cause possibility of skidding or falling of bike is almost negligible.
f) Normal people can take experience of off road biking.

X.APPLICATION

a) It is used for on road as well as Off Road Driving.
b) Can be suited for Handicapped People.
c) Can be used in rainy season.
d) Well suited for hilly areas.
e) It can replace army bikes to do patrolling on borders where roads have irregular geometries.

XI.CONCLUSION

In study we have seen that the tilting action is highly sensitive to weight distribution. It will be important and challenging to design the vehicle such that all components coordinate to produce the desired tilting effect. This

mechanism can negate the forces coming on the vehicle at high speeds. This will produce anti skidding effect in the vehicle by which handicapped people can also enjoy the ride of bike. This bike will be more comfortable, stable as compared to conventional bikes.

i. The total weight of the vehicle is found to be 140 kg which is 35 kg more than normal motorbikes; it helps to improve proper controlling of vehicle and increase stability.

ii. The turn radius is 1.50 m which helps the quad to take sharp turns and increase comfort level of riders on road or off road.

iii. The track width of vehicle is 1320.8 mm, the broad track helps to maintain the Centre mass of the vehicle within the wheels when taking sharp turns.

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