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Design and Fabrication of Three Wheeler Electrical Vehicle (for Physically Challenged)

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Abstract: The main aim of the project is to design and fabricate a "Three wheeler electrical vehicle (for physically challenged)".The vehicle should be easily operate by physically challenged people. The vehicle is designed to be propelled by an electric hub motor mounted in the rear wheel and powered by 48V Lithium-ion battery. There can be one "Direct-Drive In-Wheel Motor" to generate the necessary torque per wheel. The main benefits of vehicle are it Eco-friendliness and ease in transportation. This vehicle helps handicapped people for their self-transportation. It is economical in electricity consumption; scooter can be driven comfortably with the help of streamline design of the body.
Keywords: The Wheeler Vehicle (TWV), Electrical Vehicle (EV), Electrical Motor (EM), Lithium-ion battery

I. INTRODUCTION

In an era where energy conservation has become the latest topic of discussion not only among erudite but also among the ordinary responsible denizens, for efficiency along with minimum pollution's has become the benchmark for any new automobile and in the same context "Three wheeler electrical vehicle (for physically challenged) " come as the latest addition. By the name itself it can be inferred that a Three wheeler electrical vehicle is powered by electric batteries. Anyone thinking about the nature and future understands the electric vehicle are attractive compatible. With all concerns on heavy taxes on fuel, and the possibility of further restrictions on greenhouse gas emission, work on alternative power systems for vehicles is very important. We seen that most vehicle only travel with one or two person in it, no matter how small or big the vehicle is. The project title as "Design and fabrication of three wheeler electrical vehicle (Scooty)" is aimed to implement the most efficient and less polluting vehicle. In this project the electric Scooty model whose motion is provided by electric motors. The motion may be provided by wheels by rotary motors, resulting to achieve the better fuel & pollution economy vehicle.

II. PROPOSED WORK METHODOLOGY

1) Design
2) Material Selection
3) Fabrication
4) Assembly
5) Testing
6) Inspection
7) Result

A. Chassis of the Vehicle

The choice of material for the vehicle is the first and most important factor for automotive design. There is variety of materials that can be used in automotive body and chassis. The most important criteria that a material should meet are lightweight, economic effectiveness, safety, recycle ability, and life cycle consideration. Some of these criteria are the result of legislation and regulation.

The material for the frame and chassis is Cast-iron (with coating of carbon + silicon + Manganese + sulfur + Phosphorus). The main factors for selecting material specially for body is wide variety of characteristics such as thermal, chemical and mechanical resistant which are ease for manufacturing and durability.

B. Material Selection

In this project material is use Cast-iron (with coating of carbon + silicon + Manganese + sulfur + Phosphorus).

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C. Properties of Materials

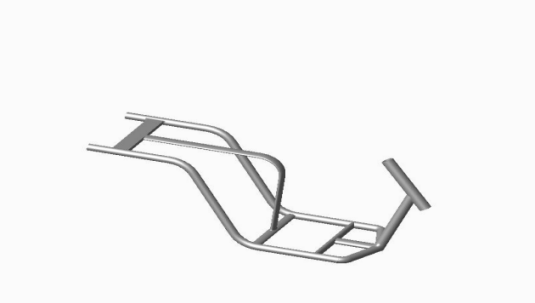
1) Young's modulus: 1.1e+005Mpa
2) Poisson Ratio: 0.28
3) Density: 7.2e-006kg/mm^3

D. Design

Design is the intentional creation of a plan or specification for the construction of an object or system or for the implementation of an activity or process.

1) The Chassis of three wheeler electrical vehicle has been designed

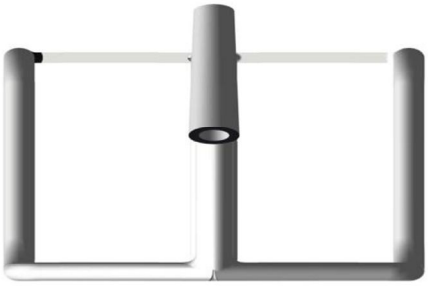
E. 3D Design Of Chassis



Iso View of Chassis

Top View of Chassis

Front View of Chassis



Right Side View of Chassis

F. Chassis Specifications

Table 4.1 Chassis Specification

Specification	Dimensions in mm
Chassis length	1300
Chassis width Front	350
Chassis width Rear	380
Chassis height	350
Pipe Thickness	5
Steering tunnel diameter	40
Pipe diameter	25
Riser member	300
Rear long member	350
Front Long member	350
Horizontal tunnel	300
Material	Cast-iron

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G. Working Principle of Electrical Vehicle

1) In three wheeler electrical vehicle stored power in battery will supply power to rotate Dc motor by converting electrical energy into mechanical energy recharged using grid electricity either from wall socket or an charging unit
2) When the vehicle is ideal there is no electric current being processed so energy is not being used up, the controller acts as regulator controls the amount of power received from battery so the battery does not burn out
3) This battery powers all the electronic device in the vehicle just like battery in fuel vehicle
4) The motor turns transmission and then it turns the wheels
5) By rotating wheels the vehicle can be transferred from one place to other place
6) The speed of the electrical vehicle is less compared to gasoline vehicle because of torque
7) The electric car lacks a tailpipe and gas tank but the overall structure is basically same the electric motor needs no oil, no tune ups an there is no tailpipe emission and it does not need any smog checks
8) Since there is only electrical components it is much easier than other vehicles
9) The power of electric car is less than gasoline car but it has an heavy noise, electric cars are smooth and silent while having
10) There has also been a trend of converting ordinary vehicle into electrical vehicle all you have to do is replace engine with an electric motor and fit in an array of rechargeable batteries

III. FABRICATION AND ASSEMBLY

A. Chassis of the Vehicle

The chassis of the vehicle is made of Cast-iron (with coating of carbon + silicon + Manganese + sulfur + Phosphorus). The section is cut and welded according to the given design dimension.

Chassis of the Vehicle

Wheels Holder

B. Fabrication of Wheels Holder

The plough tool is fabricated using Cast-iron (with coating of carbon + silicon + Manganese + sulfur + Phosphorus) . The part is machined by cutting and grinding operations.

C. Battery Panel Specifications

Voltage: 48V
Current: 20Ah
Power (P) = Voltage (V)*Current (I)
P= 12*20= 480W
Electricity consumption/Full charge: 1.25 units
Charging Time/Full charge: 6 to 8 hours
No. of Battery in a panel = 4 (12V)
Total number of panels = 1

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Battery

Hub Motor

D. Selection of Motor

Selection of motor depends on the power requirement i.e 300W and the mode of driving. Two types of motors are available, mechanically commuted D C motor and Brushless electronically commuted D C motor (BLDC motor). Among these two types, BLDC motor is preferred because it provides noiseless operation , more efficient , gives under voltage and over voltage protection and waterproof.

E. Hub Motor Specification

Voltage: 48V
Capacity:48V,24Ah
Output power: 250W
Type: BLDC hub motor

F. Selection of Tyre

Vehicle tyre specification is a key element in achieving fuel efficiency. Factors that need to be considered include tread, diameter, width, rim size, load indexes, and typical operating speeds.

For Rear Wheel		For Front Wheel	
Rim	:350 mm	Rim	:350 mm
Tyre	:410 mm	Tyre	:410 mm

The rim type is steel and the tube is used in the tyres.

G. Assembled View of Vehicle

The separately fabricated components are assembled in the vehicle frame. The handle system, front wheel and lighting system with accelerator is attached to the front. The hub motor wheel, BLDC controller and wiring+seating system is attached with the backside of the frame. The battery is attached in respective place.

Side View of Assembled Vehicle
(without battery and seat)

Side View of Assembled Vehicle
(with battery and seat)

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IV. RESULT AND DISCUSSION

By this we conclude that Three Wheeler Electrical Vehicle means, Pollution less and Fuel Saving Technology for the Current and Future Vehicles" with even better efficiency & conservation rate are very much on the anvil in today's energy. High Cost/Price is still a big issue to be solved. This problem can only be eliminated by Collaboration between industries and government to lower the barriers costs (such as taxes) on the customer and industries to adopt these Eco-friendly Electrical Vehicle technologies.

Three Wheeler Electrical Vehicle are having a pollution-free and greener environment. Further, with their sleek aerodynamic design and ultra-light materials, these vehicles can achieve speed of approximately 30-40km/h. All in all, one can assured that electric vehicles are the vehicles of the future and will rule the automobile industry until the next generation of eco-friendly and fuel-efficient Vehicles take their place.

At last, the "Three Wheeler Electrical Vehicle (For Physically Challenged)" is fabricated, analyzed different cost factors that influence the running & existing in present market. This Vehicle gives good economical results for overcome from some limitations which are present in ordinary conventional cars. Its existence in present market decreases 90% pollution, saves nearly 349 liters petrol per annum, saves Rs.20,048/- per annum when compared with ordinary conventional Vehicles running cost.

The substitution of electric vehicle for conventional vehicles results in a significant reduction in greenhouse gas emissions. There are also economic benefits. Put simply, because they cost less to run. Finally we are saving the 70% of the fuel usage with that of the energy supplied to vehicle by the batteries. Because of which the pollution be controlled. "So usage of the natural resources in the well defined manner rather than that of the threatening means". Structural and modal analysis is also performed on the chassis of a Three Wheeler Electrical Vehicle with material such as Cast iron and the stress distribution and different types of mode shapes were observed.

A. Battery Panel Specifications

Voltage: 48V
Current: 20Ah
Power (P) = Voltage (V)*Current (I)
P= 12*20= 480W
No. of Battery in a panel = 4 (12V)
Total number of panels = 1

B. Hub Motor Specifications

Voltage: 48V
Power: 350W
Weight: 4.6 Kgs
Motor Diameter: 0.148m
Motor Shaft Diameter: 0.214m
Maximum speed (rpm): 300rpm

C. Torque Calculations

Angular Velocity (ϖ) = (2*∏*N)/60 rad/sec
N= Maximum speed of motor in rpm
Power (P) = Torque (T) * Angular Velocity (ϖ)
ϖ = (2*∏*300)/60= 31.4 rad/sec
P = T * ϖ
350 = T * 31.4T = 350/31.4=11.4 Nm

D. Speed Vs Velocity Calculations

Velocity in km/h (V) = (2 * ∏ * r * N* 60)/1000
V = (2 * ∏ * 0.74 * N * 60)/1000
r = Radius of Motor Shaft= 148/ (2*1000) m = 0.74 m
N = Speed of motor in rpm Values of N = 50, 100, 150, 200, 250, 300 rpm

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V. RESULT AND DISCUSSION

S.No.	Description	Result
01	Speed o the Vehicle	30-35 km/h
02	The distance travelled by the vehicle	45 Km
03	The total current consumed for full charging batteries	6 Units
04	The time taking for full charging of batteries	3 h

VI. CONCLUSION

The journey of electric vehicles right from evolution to present day's implementation has deeply undergone several hindrances. The global concern to curb the hazardous effects of vehicle exhaust and climatic intolerance has transitioned minds of countries to face towards the change from the conventional oil run automobiles.

The shortage and soaring costs of oil, universally, has finally set up a stage for many nations to devise plans for e-vehicle usage. Many on-road conditions and scenarios concerned with e-vehicles are studied and several technical and theoretical remedies have been continuously posted front.

VII. FUTURE WORK

The electric vehicle market continues to expand, with more than two million electric vehicles sold worldwide by early 2017. Automakers continue to make commitments to shift their production to electric drive, and national governments have made ambitious plans to phase out internal combustion vehicles to meet their climate and air quality commitments

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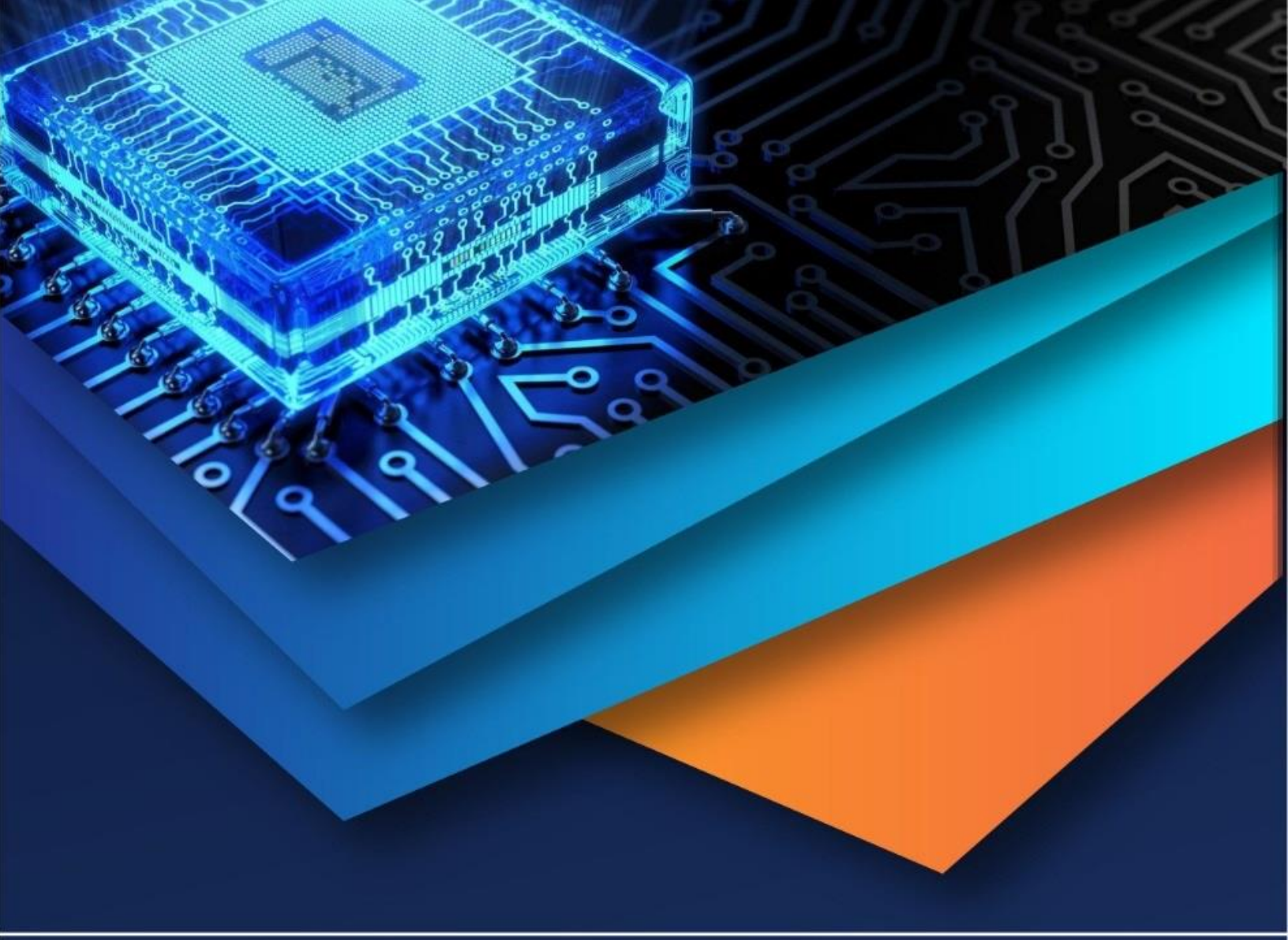

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