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DESIGN AND FABRICATION OF SWINCAR WHICH IS OPERATED WITH PENDULUM MECHANISM

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ABSTRACT: Now a days the usage of IC Engine like (Petrol, Diesel, Gas etc.) are increasing day by day. Due to the usage of IC Engines very harmful gases emitted while burning of fossil fuels. Due to this harmful gases ozone layer has been Depleting day by day. In major populated countries like India, china, America etc. the air pollution has been increasing very rapidly. And the fuels that are found in earth crust are decreasing. So, the government of India has decided to stop the manufacturing of IC Engine due to the problems and to start the production of electric vehicle. The electric vehicle are pollution free vehicles and run by means of battery power. But the EV cannot travel for a long distance, and does not move smoothly in uneven roads, hills, slopes etc. to overcome all the problems we plan to Design and Fabrication of swincar which is operated with pendulum mechanism. The main aim of over project is develop an EV which is used to travel smoothly on uneven roads, hills, slopes etc.. and by arranging regenerative braking system the battery can charge continuously while in moving . the Design of swincar is done by NX12 and CATIA V5 R19 and the fabrication is completed by means of various fabrication techniques.

Key words: IC Engine, Electric Vehicle, Fabrication techniques.

INTRODUCTION

The depleting reserves of fossil fuel made the engineers and scientists to look for renewable energy sources. In addition, the environmental decay due to the combustion of fuel is alarming and justifies the design of Eco-friendly systems. India is spending large amount of foreign exchange to import crude oil even though we have abundant resource of renewable energy source like solar, battery, wind etc. If we utilize renewable energy source for local conveyance, a large amount of currency can be saved and we also ensure pollution free environment and contribute to nation's economy. The main reason to identify the need of finding and modifying Swincar E-spider is to overcome the issues of the pollution because of vehicles in metro towns and urban zones is swelling uninterruptedly. Considering the all class of society it is not reasonable for all to purchase (petrol, diesel) cars. So, combing issues environmental progress supporting and economical affordable alternative would be the best solution.

In the swincar the motor is activated by a pedal with power-on-demand, by pedaling the electric motor can be controlled with pedal-assist. The pedal-assist augments the efforts of the rider when they are pedal. The e-spider is also known as pedicels have a sensor to identify the pedalling force, the pedalling speed, or both. Disabling the motor is the brake sensing action. The main purpose of this research is to review the current situation and effectiveness of electric car researched by various researchers. In order to approach this purpose, following objectives are specified

1. To maximize the speed and efficiency.
2. To optimize the cost

CATIA DESIGN

CATIA is a (computer aided three-dimensional interactive application) is a multi-platform computer sided design (CAD)/computer aided manufacturing (CAM). CATIA enables the creation of 3D parts, from 3D sketches, sheet metal, composites molded, forged or tooling parts up to the definition of mechanical assemblies. The software provides advanced technologies for mechanical surfacing & BIW. It provides tools to complete product definition, including functional tolerances as well a kinematics definition. CATIA provides a wide range of applications for tooling design, for both generic tooling and model and die.

Commonly referred to as 3d product life cycle management software suit, CATIA supports multiple stages of product development from conceptualization design (CAD), manufacturing (CAM), engineering (CAE), CATIA facilitates collaborative engineering across disciplines, including surfacing and shape design, mechanical engineering, equipment and system engineering.

The design of Swincar is completed by using CATIA V5 R19 software. By using these software's we design several parts of this machine and finally assembled these parts.

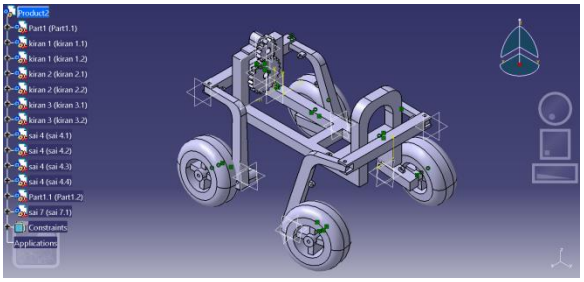


Fig 1.1 Design of swincar in CATIA

FABRICATION OF SWINCAR

The fabrication of swincar is fabricated by means of different fabrication techniques like welding, milling, shaping, cutting, drilling grinding etc.. and the main components which are used in fabrication of swincar is

1. Wheel hub motor
2. Batterys
3. Frame
4. Wheels
5. Suspension
6. Controller
7. Steering system

WHEEL HUB MOTOR

The wheel hub motor is also called as wheels motor, wheel hub drive, hub motor or in wheel motor. The wheel hub motor is an electric motor that is incorporated into the hub of a wheel and drives it directly.

MECHANISM:

Hub motor electromagnetic field are supplied to the stationary windings of the motor. The outer part of the motor follows, or tries to follow, those fields, turning the attached wheel. In a brushes motor, energy is transferred by brushes contacting the shaft of the motor. Energy is transferred by brushless motor electronically, eliminating physical contact between stationary and moving parts. Although brushless motor technology is more expensive, most are more efficient and longer-lasting than brushed motor system.

Electric motor has their greatest torque at start up, making them ideal for vehicles as they need the most torque at start up too. The idea of "revving up" so common with internal combustion engine is unnecessary with electric motors. Their greatest torque occurs as the rotor first begins to turn, with is why electric motor do not require a transmission. A gear-down arrangement may be needed, but unlike in a transmission normally paired with a combustion engine, no shifting is needed for electric motor. The power required to run the hub motor used is 48V. The load carrying capacity of the motor is 250Kg and the type of motor used is a DC motor. The size of the hub motor is 10×3inch.

SPECIFICATIONS OF MOTOR

> Power	300w
> Capacity	48v
> Length	10inch
> Shaft diameter	6mm
> Voltage	48v
> Weight RPM 2.5	
> Max power	72RPM

> OC Voltage 45W 24A
> S.C Voltage 4.8A

MOTOR NOTATIONS

d = diameter of the cycle rim in meters.
r= radius of cycle rim in meters.
m = Angular velocity of cycle shaft.
N Speed of cycle wheel in RPM
v= Linear velocity of the cycle in Kmph
Normal reaction of the road on each tyre in Newtons u-Coefficient of friction = 0.3
E-Frictional force between tyre and road in Newton's.
T=Torque developed on the shaft due to frictional force in Newton-meters.
p-Power required to ride the cycle in Watts.
time required to charge the battery by A-C Supply in hours

Motor calculations

Since the total vehicle weight is equal to 200 kg. the Normal reaction acting on each tyre is equal to (50 x 9.81) Newton cach.
Friction force acting on the tyre
F=u NI
F=0.3 x 490.5
F= 147.15 N

Torque required

T=Fxr
T=147.15 x 0.25
T= 36.78 Nm

Speed calculations

Co =v +r,
o = (10 x 1000) + (0.25 x 3600),
c = 11. 11 Rad/sec
N = (60 x o) + (2n)
N= (60 x 11.11)+ (2)
N=106 rpm

Power calculations

P =(2NT) + 60
P = (2x 106 x 36.78) + 60
P = 408.2 W

BATTERY

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smart phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device.

When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. Historically the term "battery specifically referred to a device composed of multiple cells; however, the usage has evolved additionally to include devices composed of a single cell.

Performance Characteristics

Nominal Voltage		12V
Number of cell	6	
Design Life		5 years

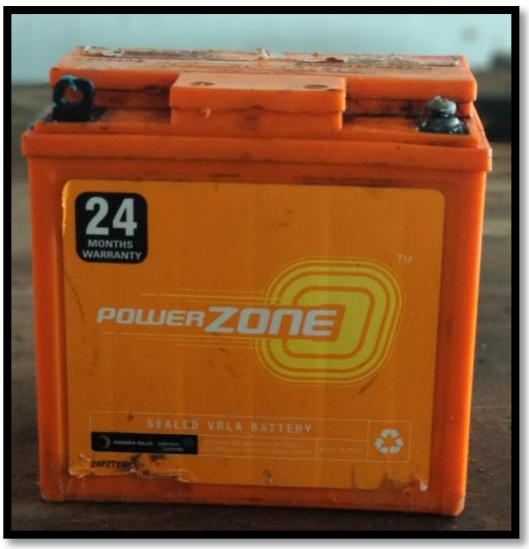


Fig 4.2. Battery

Nominal Capacity

20 hour rate	(0.35A, 10.5V) 7Ah
10 hour rate	(0.68A, 10.5V) 6.8Ah
5 hour rate	(1.13A, 10.5V) 5.65Ah
1 hour rate	(4.56A, 9.6V) 4.56Ah

Self-Discharge 3% of capacity declined per month at 20°C (average)

Operating Temperature Range

Discharge	20~60°C
Charge	10~60°C
Storage	20~60°C Max.
Discharge Current	77°F(25°C) 105A(5s)
Short Circuit Current	350A

FRAME

Frame is made up of ms cast iron square box according to the dimension of the Design. The frame is used for supporting and it can carry up to a load of 200kg. the length of the frame is 4mt, width of te frame is 1mt, front side height of the frame is mt and the rare side height of the frame is 2mt.

Fig 4.3. Frame

WHEELS

A wheel is a circular block of a hard and durable material at whose centre has been circular hole through which is placed an axle bearing about which the wheel rotates when a moment is applied by gravity or torque to the wheel about its axis, thereby making together one of six simple machines. When placed vertically under a load-bearing platform or case, the wheel turning on the horizontal axle makes it possible to transport heavy loads; when placed horizontally, the wheel turning on its vertical axle makes it possible to control the spinning motion used to shape materials (e.g. a potter's wheel); when mounted on a column connected to a rudder or a chassis mounted on other wheels, one can control the direction of vessel or vehicle (e.g. a ship's wheel or steering wheel); when connected to a crank, the wheel produces or transmits energy. The size of the wheel is 10×3inches.

SUSPENSION

Hydraulic suspension is a type of automotive suspension that controls the vertical movement of the wheels relative to the chassis or vehicle body with an onboard system, rather than in passive suspension where the movement is being determined entirely by the road surface. Active suspensions can be generally divided into two classes: pure active suspensions, and adaptive/semi-active suspensions. While adaptive suspensions only vary shock absorber firmness to match changing road or dynamic conditions, active suspensions use some type of actuator to raise and lower the chassis independently at each wheel. These technologies allow car manufacturers to achieve a greater degree of ride quality and car handling by keeping the tires perpendicular to the road

in corners, allowing better traction (engineering) and control. An onboard computer detects body movement from sensors throughout the vehicle and using data calculated by opportune control techniques. controls the action of the active and semi-active suspensions. The system virtually eliminates body roll and pitch variation in many driving situations including cornering, accelerating, and braking.

Fig.5.8. Hydraulic suspension

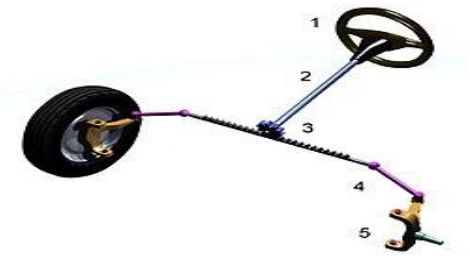
CONTROLLER

A motor controller is a device or group of devices that serves to govern in some predetermined manner the performance of an electric motor. A motor controller might include a manual or automatic means for starting and stopping the motor, selecting forward or reverse rotation, selecting and regulating the speed, regulating or limiting the torque, and protecting against overloads and electrical faults.The simplest case is a switch to connect a motor to a power source, such as in small appliances or power tools. The switch may be manually operated or may be a relay or contactor connected to some form of sensor to automatically start and stop the motor. The switch may have several positions to select different connections of the motor. This may allow reduced-voltage starting of the motor, reversing control or selection of multiple speeds. Overload and over current protection may be omitted in very small motor controllers, which rely on the supplying circuit to have over current protection. Small motors may have built-in overload devices to automatically open the circuit on overload. Larger motors have a protective overload relay or temperature sensing relay included in the controller and fuses or circuit breakers for over current protection. An automatic motor controller may also include limit switches or other devices to protect the driven machinery.

More complex motor controllers may be used to accurately control the speed and torque of the connected motor (or motors) and may be part of closed loop control systems for precise positioning of a driven machine.

STEERING SYSTEM

Steering is the collection of components, linkages, etc. which allows any vehicle (car, motorcycle, bicycle) to follow the desired course. An exception is the case of rail transport by which rail tracks combined together with railroad switches (and also known as 'points' in British English) provide the steering function. The primary purpose of the steering system is to allow the driver to guide the vehicle. A rack and pinion is a type of linear actuator that comprises a circular gear (the pinion) engaging a linear gear (the rack), which operate to translate rotational motion into linear motion. Driving the pinion into rotation causes the rack to be driven linearly. Driving the rack linearly will cause the pinion to be driven into a rotation.



WORKING OF SWINCAR

The swincar will work on the principle of pendulum mechanism. In this project the

battery converts the chemical energy into electric energy. The energy stored in battery in the form of electrical energy by means of an inverter. The electrical energy passed to the motor by means of a voltage regulator or controller.

When the electrical energy passes to motor it leads to move the swincar in the forward direction.

OPERATIONS

1. Firstly, the hub motor was connected to rear wheel of right side, which is fitted through nut and bolts on articulated legs.
2. The fabrication was carried out keeping in mind the maximum load the motor will be able to withstand.
3. Edge grinding was done to provide smooth surface finishing on freewheel and Articulated legs.All the fabricated parts were assembled
4. The throttle is powered by batteries which are fitted on the pedal. pedal gets powered through battery and sends signal/output to the hub motor the battery can be charged by means of electricity
5. The electrical energy stored in a lead acid battery with the help of converter. The lead acid battery cells supply the power to voltage regulator & voltage regulator regulates the voltage to 24v.
    - The regulated voltage supplies to the hub motor with 8A.
    - By using accelerator and brakes, the motor gets speed up and stops.

The hub motor rotates with the speed of 22kmph.

RESULTS AND DISCUSSIONS

RESULT

DISCUSSIONS

To make swincar project we follow this steps

The first step is choose an electric vehicle and find the problems faced by it. The second step is to choose a problem. The third step is to visit to industry. The fourth step is to analyze the problem and their solution.

The fifth step is to selection of design of machine. The sixth step is to find which mechanism is to suitable in lowest cost. The seventh step is to find all components we require in proper dimension. The eight step is to start fabrication. The ninth step is to make proper balance sheet of work done. The last step is the testing of machine.

CONCLUSION

- Is going to be a cheap alterative for the commuter. Most people on their to work, go less than 40km. Its cleaner and you never have to buy gas or change the oil. Thus, leading to a pollution free environment.
- This car is cheaper, simpler in construction & can be widely used for short distance travelling especially by school children, college students, office goers, villagers, postman etc. It is very much suitable for young, aged, handicap people and caters the need of economically poor class of society.
- The most important feature of this vehicle is that it does not consume valuable fossil fuels thereby saving cores of foreign currencies. It is eco-friendly & pollution free, as it does not have any emissions.

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