Design and Fabrication of Solar Operated Portable Bicycle

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ABSRTACT:-The solar powered self-balancing vehicle is a two wheeled vehicle which uses solar energy stored in battery to run its motor and attain acceleration. It is convenient form of transport without consuming fuels. Self - balancing vehicle is a two wheeled vehicle which balances itself in air vertically with reference to the ground. This vehicle is designed to mirror the process of walking and can be used for inspection purpose in the malls and offices. With solar energy as source of energy self-balancing vehicle technology and related uses of non-motorized transportations, a long term solution is to establish dedicated on-motorized lanes in urban environment, which will promote more energy efficient and environment friendly travel means. In this research solar energy is used as a source of fuel. A D.C motor is driven by solar energy. Solar energy is a natural resource available free of cost and in adequate quantity. The balancing of vehicle is achieved by the weight balance on the platform plate at the static condition and the action of inertia forces in the dynamic state. This vehicle is capable of moving with the speed of 15 Km/hr.

Key Words:- solar vehicle, IC engine, segway, DC Motor, portable,pollution, batteries and vehicle.

INTRODUCTION

In this research, the solar energy is used to run self-balancing vehicle by help of various electric components. Selfbalancing vehicle is the vehicle which balances itself in air with reference to the ground. Self-balancing is achieved by using mechanical components. In pune region the intensity of sunlight is 1013*100 lux. The main objective of "Solar powered self-balancing vehicle" is to reduce the cost and make it high efficient for the use of human being with help of solar energy. To prepare a self-balancing vehicle without using complex and electronics parts such as microcontroller, gyro sensors, etc. For the better performance of the vehicle we need batteries which are charge by solar panels and solar station. Also the vehicle is designed for the inspection and security purpose. The indoor applications of the vehicle is rarely visible to us. Nowadays the individual shopping markets are closing drastically and the concept of big shopping malls is increasing in metro as well as in small cities. So it"s crating the problem of walking from small children to the senior citizens. Hence to reduce the human effort and to making the mirror of walking process the idea of self-balancing vehicle with help of solar energy came into the picture. Solar technologies are an extremely promising renewable resource considering their ever-increasing output efficiencies and ability to be utilized in a variety of locations. The intrinsic qualities of solar energy make it a beneficial utility, especially for developing countries, for many reasons: first, most developing countries are located in regions with optimal access to the sun"s rays.

To avoid the consumption of fuels such as petrol, diesel etc. to drive the vehicle the decision to use solar energy is generated. The increase in the prices of the non-renewable energy sources is making the high impact on the vehicle usage so it is more reliable to use the renewable energy sources. With the commercialization of solar powered selfbalancing vehicle, it is possible to make the better use of solar energy. The self-balancing vehicle is present in the market and has high cost because of various sensors to balance it but in our vehicle the selfbalancing is completely achieved mechanically. The use of five pin throttle enhances the better acceleration of the vehicle whereas the use of solar energy eliminates the cost of fuel. So, to reduce the human effort of walking the large distancesand as it is cost effective, this product is affordable in less price to the society. The speed of selfbalancing vehicle achieved is 20kmph.

BASIC WORKING PRINCIPLE

The basic working principle of solar portable segway. By using solar panel sunlight is directly converted into DC current, collect in lead acid batteries through voltage controller. After that power used to rotate the DC motor with speed controlling action by throttle. Motor gives torque to rear wheel at very good speed. When loaded of vehicle near about 15 to 20 km per hr.
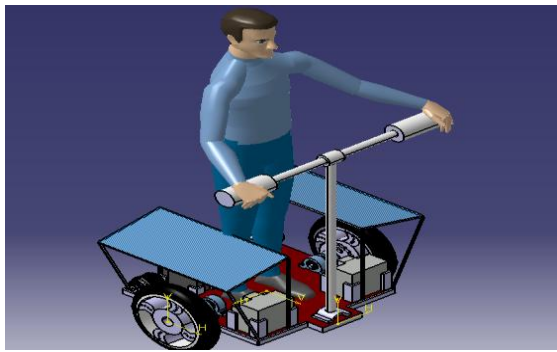
Fig:-3D Catia Model

MATERIAL FUNCTION

Various types of electrical components were used for making the Solar Portable segway. Some of them with average price are mentioned below,

Sr no	Components	Specifications
1	DC Motor (MY1016)	24V 250W
2	Solar panel	80W
3	Battries	(12V 7A)×2
4	Fabricating Materia	Iron pipes metal sheets, Axle, wheels, Bearings, etc

CALCULATIONS

CALCULATIONS FOR ELECTRIC SOLAR VEHICLE

Let us consider the following assumption in Electric Solar Vehicle:

Mass of the Vehicle = 40kg

Speed =30 kmh-1

Slope % = 0.1

Wheel Diameter = 0.45 m

Battery Weight = 5 kg

Average Speed = 25 kmh-1

Range =8 km

CALCULATION FOR ANGULAR VELOCITY OF THE WHEEL

Considering Linear Velocity = 30 kmh-1

Speed = 30 x (5 / 18) ms -1

= 8.3333 ms-1

Diameter of wheel = 0.45 m

Radius = Diameter / 2

= 0.45 / 2 m

=0.225 m

Using the Relation

Linear Velocity = Angular Velocity x Radius Angular Velocity

= Linear Velocity / Radius

= 8.3333 / 0.225

= 37.0368 rad.s-1

From the Relation,

Angular Speed = 2 x π x frequency

Frequency = Angular Speed / (2 x π) RPS

= Angular Speed x 60 / (2 x π) RPM = 37.0368 x 60 / (2 x 22 / 7) RPM

= 353.67 RPM

CALCULATION FOR PEAK TORQUE REQUIRED MOVING THE VEHICLE

Using the formula,

Peak Torque = (Mass of Vehicle + Battery) x Acceleration due to gravity x Wheel Radius x Slope%

= (45) x 9.8 x 0.225 x 0.1 N-m

= 9.9326 N-m

Power Required (Peak) = Torque x Angular Velocity

= 9.9326 x 37.0368 Watt

= 367.8717 Watt

SOLAR CALCULATION

Motor Specification

Power 500W

Operating Voltage 24V

Battery Specification

Voltage 12V

Capacity 14 AH

Quantity 2

Solar Panel Specification

Power 60 W

Open Circuit Voltage 22 V

Short Circuit Current 3.55 A

Voltage at maximum power 18.2 V

Current at maximum power 3.3 A

Quantity 2

Dimension 635 x 670 x 34 mm2

Energy Calculation

Energy consumed by motor in 3 hrs. = Power x Time = 500 x 3

= 1500 WH

Energy produced by solar panel for 3 hrs. = Power x Time

= 60 x 3

= 180 WH

Energy Stored in battery = Capacity x Voltage

= 14 x 24

= 336 WH

Discharging and Charging of Battery

Discharging time (without power loss) = (Capacity x Voltage)/Power of load

= (14 x 24)/500

= 0.672 hrs

= 40.32 minutes

Discharging time (with power loss of about 25%)

= 0.672 x (75/100)

= 0.504 hrs

= 30.24 minutes

Charging time (from 0 to 100% without considering power loss) = Energy Stored in Battery/Power of panel

= 336/60

= 5.6 hours

Charging time (from 0 to 100% considering power loss factor as 2.5)

 = 5.6 x 2.5

=14 hours

Fig :- Model

ADVANTAGES

- Become more productive: more work can be done by using the product versus walking
- Become more recognizable: Riders stand an additional eight inches off the ground, allowing you to be better seen and giving the rider better sight lines, over cars in a parking lot or boxes in a warehouse.
- low operating costs: no need for gas and inexpensive battery charging
- reduce fatigue caused by walking
- a clean, green, eco-friendly machine! (zero emission)

Disadvantages

• Slow as compare to car.

• Does not exactly say how far the Segway will go with riders of different masses.

• Heavy prototype.

• Unlike bicycles, a drained Segway cannot be pedaled home or a charger.

•Expensive .

APPLICATION

• In India we can use this tech. as in:- Office , Colleges having large campus area

• Use to store luggage in traveling.

• Use at tropical areas where normal vehicles can't go.

• Civil construction site and large carpet industries.

• Helps some handicaps and elders.

• Optimal use on airport railway stations, on 30-40kg short distances.

• Easy handling in travelling

CONCLUSION

'Portable Solar segway with Optimized Design' is project to make ecofriendly, zero pollution vehicle option for IC engine motorcycle with affordable price. As this field of automobiles will be explored the problems will get solved. It can easily carry as a bag or ride on it with good speed. It can used to cover short distances and at the same time keep the environment pollution free.By reducing many electronic components and due to addition of mechanical components cost of vehicle is drastically reduced.The attempt to change the existing design of self balancing vehicle was successfully completed. This research was implemented with an idea to find an effective solution to transportation problem. The main objective is to achieve space utilization and minimize the fuel consumption especially for commuting over shortest distance.

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