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SOLAR ELECTRIC BICYCLE

Raghuraddi S Sangalad

Department of Mechanical Engineering, R.T.E. Society's Rural Engineering college Hulkoti, Gadag, Karnataka, India-282205, Email : raghu9164114464@gmail.com

ABSTRACT

Solar Electrical Bicycle (SEB) has attracted considerable attention because of the necessity developing alternative methods to generate energy for bicycle. The parallel control problem involves the determination of the time profiles of the power flows from solar panel and electric motor. This is also referred to as the power split between the conventional and the electric sources. The objective of SEB control is in fact to find out the sequence of optimal power splits at each instant of time minimizes the man power over a given driving schedule. Big obstacles to control a design are the model complexity and the necessity from before knowledge of torque and velocity profiles. The Solar powered electric bicycle system that involves three different ways of charging battery: Solar power, Dynamo, Electric energy. The aim of the Solar Electrical Bicycle to save human energy and utilization of conventional energy source like solar energy. For this we need bicycle, motor, dynamo, battery, solar panel, other connecting equipment. In this an overview of SEB is presented.

INTRODUCTION

In the modern societies, the increasing needs of mobility means sometimes increasing the number of vehicles circulating. Ambient concerns, as for instance local pollutant emissions for the atmosphere, influence also, in nowadays, the technical decisions related with all kind of vehicles. In this context, new alternatives to the existing internal combustion engines are mandatory. So, vehicles with electric propulsion seem to be an interesting alternative.

The invention of internal combustion engine is one of the greatest inventions of mankind. The conventional vehicles with ICE provide a good performance and long operating range. However, they have caused and continue to cause serious problems for poor fuel economy, environment pollution and human life. Reducing fuel consumption and emissions is one of the most important goals of modern design. The Solarisation of a convectional combustion engine vehicle with an advanced electric motor drive may greatly enhance the overall efficiency and achieve higher fuel with reduced emissions.

Starting from this context, this research describes a solution that was developed and studied to be applied in electric vehicles of individual use as bicycles. The solution proposes the combination of three sources of energy, batteries, dynamo and solar panel. On board, batteries store the energy. Anyway, the proposed topology considers that fuel cells should be used in two ways: replacing the set of batteries or to charge the battery.

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As it is well known, in the typical electric traction systems the batteries drive the high currents and in the worst situation drive the current peaks demanded by the load. As it is well known, this type of operation decreases strongly the autonomy of the vehicles for individual use. In this situation, a solution to improve the battery behaviours and its time life is to replace temporarily the battery by another power source or, as in the developed solution, to supply the system using other power source when undesired and transient situations occur in this case, the load is supplied by complementary energy source avoiding, at least, deep discharges of the battery.

The term "Solar" usually implies that more than one energy source. There are many types of bicycle in the world such as normal bicycle that people need to paddle for it to move, motorized bicycle that uses fuel as its prime power and electric bicycle that can only be sufficient for an hour. Because of some weaknesses in the existence system, the idea of a solar bicycle came in mind. The idea is to make the bicycle last longer and can be automatically recharge when the bicycle is not in use by the renewable solar energy. The concept of the solar energy is that a high torque motor will be put on the bicycle which will be generated by the solar energy. The solar energy will be absorbed by the portable solar panel to generate the power. The power that had been absorbed by the panel can be used directly by the motor if the power matches the power requirement. If not, the motor will use the power from a battery. When the bicycle was not in use during the day, the solar panel will charge the battery. The system will make bicycle to operate more efficiently. Rechargeable battery is used with long life for charging. The Solar bicycle is a project that can promote both cleaner technology as well as a lesser dependence on oil. It will run on clean electric power with the ability to recharge the battery 3 separate ways: through the 230 V AC wall source, by solar-cell generative power and by dynamo which is attached to bicycle wheel.

STATEMENT OF THEPROBLEM

With increasing in air pollution in urban areas and scarcity of fuels Electric Bikes is in great demand but it is not used by most of the people because of lack of awareness. Thus, the purpose of the study is to study the awareness level of consumers towards E-Bikes and also the perception of the users. Thus, by creating awareness we can enhance the sales of Electric Bikes.

OBJECTIVES OF THE PROPOSEDPROJECT

- To assess the annual saving of gasoline and reduction of CO2.
- Save natural resources.
- Fuel option.
- Utilization of renewable source of energy.

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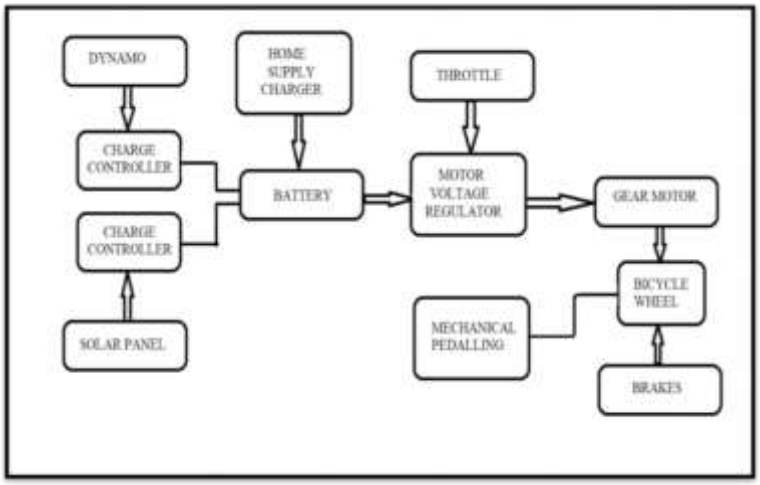
METHODOLOGY

The methodology used in constructing the Solar Bicycle has been illustrated as a block diagram in figure 1. The main aim of the project was to ensure efficient operation of the Solar Bicycle by meeting the drive requirements. Considering legal limits on the speed of electric bicycles, the maximum speed of the Solar Bicycle was considered to be 18kmph. Since regeneration is involved, determining the type of components to be used, given the constraints of weight and size became more crucial. The main components required for this project are listed below.

- BLDC Motor
- Battery
- Solar Panel
- Throttle
- Frame
- Controller kit

4.1 BLOCKDIAGRAM



WORKING

The principle parts of Solar Electric Bicycle (HEB) are battery and motor. Here we are charging the battery by three methods those are solar panel, dynamo and electric energy. From these source batteries will charge through charge controller which protects the battery from over charging and life battery is saved. Once the battery is charged the power will give to motor. The supply from battery to motor is regulated through voltage regulator is that Throttle so that the rider can control the speed of the bicycle. Rider may also use pedal if there is necessary.

DESIGN ANDCALCULATION

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The battery and motor required for Solar Bicycle has been chosen assuming that the external forces such as wind drag, rolling resistance of tires, etc. has been neglected. The focus is more on energy conversion between kinetic/potential and electrical energy. To accelerate the Solar Bicycle from cold start, sufficient torque needs to be provided and hence a sufficient amount of current needs to be drawn by the motor. If the terrain is flat, there is no potential energy which would have caused the motor to deliver a counter torque to oppose the force of gravity. We therefore look at only the kinetic energy required for acceleration. The energy relationships have been provided by equations below.

Calculation:

The force required for driving a bicycle is calculated below. Total=F rolling +F gradient + F aerodynamic drag

Where, F
total=Total
force

F rolling= force due to rolling resistance F
gradient =force due to Gradient resistance

F aerodynamic drag= force due to aerodynamic drag

F total is the total attractive force that the output of motor must overcome, in order to move the bicycle.

A. ROLLING RESISTANCE

Rolling resistance is the resistance offered to the bicycle due to the contact of tires with road. The formula for calculating force due to rolling resistance is given by equation

F rolling=Crr* Tw *g

Where,

Crr=coefficient of rolling resistance=0.05

Tw=Mass in kg=100kg

g=acceleration due to gravity=9.81m/s^2

Total weight=Total weight of cycle+Total weight of person

=40+60

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Tw =100kg

Frolling=0.05*100*9.81=5

N

Power required to overcome the rolling resistance of 5N

Prolling= Frolling*18/3600=25W

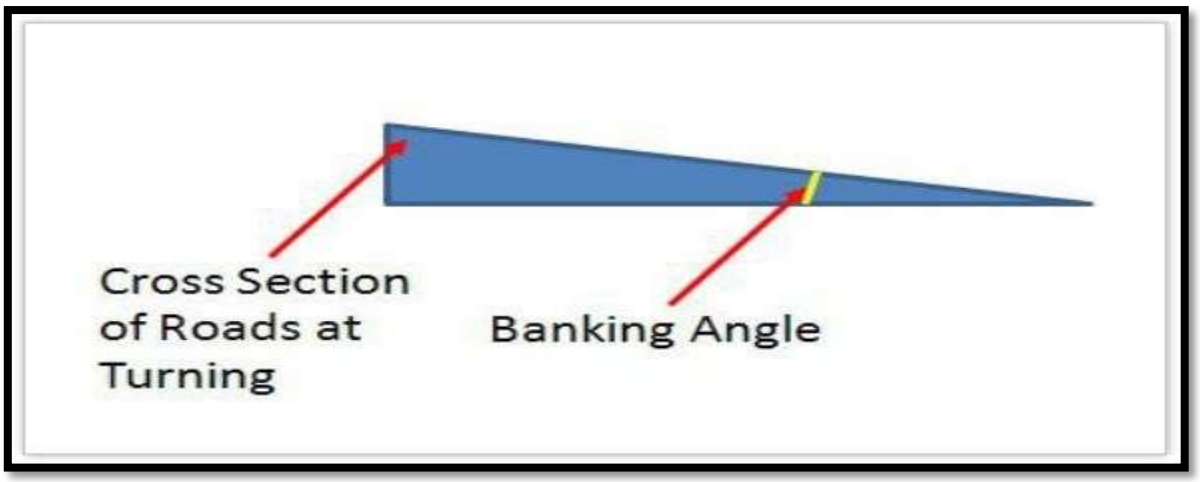
B. GRADIENTRESISTANCE

Gradient resistance of the bicycle is the resistance offered to the bicycle while climbing a hill or flyover or while travelling in downward slope. The angle between the ground and slope of the path is represented as α, which is shown. Angle between the ground and slope of a path. The formula for calculating the gradient resistance is given by equation

F gradient resistance = ±M*g*sin (α)

In this illustration, let us consider the electric Automator runs on a flat road. Therefore, the angle α= Banking angle = 5

F gradient = 100*9.81*sin(5)=85N



C. AERODYNAMICDRAG

Aerodynamic drag is the resistive force offered due to viscous force acting on the bicycle. It is largely determined by the shape of the bicycle.

Let us consider power required to overcome aerodynamic drag and other resistive forces to be around 100W.

Therefore, the total tractive power required to move the bicycle is Ptotal=25+85+100=210W=250WApproximate.

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Choice of motor:

Considering a motor of 250W of 24V
P=250W, V=24V

I=P/
V
I=2
50/
24
I=1
0.41
A

Operating current=I=10.41A

Choice of Battery

Running time(h)=battery capacity (Ah)/operating current(A)
Running time(h)=1.5Hr

Where, operating current=10.41A

Battery capacity (Ah)=running time(h)*operating current(A)

=1.5*10.41 =15A

EXPECTED OUTCOME

Here in this Solar Electric Bicycle, we are charging the battery by three methods those are solar panel, dynamo and electric energy. It is suitable for both city and country roads, that are made of cement, asphalt, or mud. This bicycle is cheaper, simpler in construction & can be widely used for short distance travelling especially by school children, college students, office workers, villagers, postmen etc. It is very much suitable for young, aged, and caters the need of economically poor class of society. The most important feature of this bicycle 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. Moreover, it is noiseless and can be recharged with the AC adapter in case of emergency and cloudy weather. The operating cost per kilometre is minimal. It can be driven by manual pedalling in case of any problem with the solar system. It has fewer components, can be easily mounted or dismounted,

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comparatively needs less maintenance. From a future energy system perspective, it is important to identify new ways of transport and generation of electricity.

CONCLUSION

Today in the world fuel prices rises day by day and the pollution is also increasing. To control this pollution and to save the petroleum product and bio product this project is design and developed. This system requires high initial cost but it gives the sufficient output energy with low maintenance.

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