ADVANCED ELECTRICAL BICYCLE

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ABSTRACT

In a modern world human beings needs to travel from one place to another place. There are various ways of travelling. The way of travel must be easy to operate and availability must be there. Conventional sources like petrol, diesel is limited in stock and considering the Pollution, there is a need to search the alternative fuel for transportation. A bicycle is a good option for transportation among all and now a day's becoming a popular. Limitation of bicycle is that it needs an effort in order to overcome frictional torque and pedaling. In this project, the new idea of converting conventional geared bicycle into electrical bicycle is discussed. Electrical bicycle is found to be a very effective tool for transportation. It has a advantage that it runs on electrical energy as well as conventional way of pedaling whenever required bicycle can be operated on electricity by using battery and when battery ends it can be run by pedal. The Design performance and future scopes and electric bicycle is discussed in this project.

Keyword: *- Bicycle, Fuel, Battery,*

1. 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. [1] In this context, new alternatives to the existing internal combustion engines are mandatory. So, vehicles with electric propulsion seem to be an interesting alternative.[2] 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 [3]. The solution proposes the combination of two sources of energy, batteries and super capacitors, and two DC-DC converters. On board, batteries and super capacitors store the energy [4].

Anyway, the proposed topology considers that fuel cells should be used in two ways: replacing the set of batteries or to charge the batteries and the super capacitors 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 [5]. As it is well known, this type of operation decreases strongly the autonomy of the vehicles for individual use [6]. The continuous and random operation of electrical vehicles requires and claims for systems improving the autonomy and the performance of the available ones [7]. In this situation, a solution to improve the battery behavior 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 [8]. In this case, the load is supplied by the complementary energy source avoiding, at least, deep discharges of the battery [9]. The adopted solution uses super capacitors, which drive the peaks of power required by the load [10].

1.1 Problem Statement: There are several problems that occur during up grades a conventional electric powered bicycle to so large Powered Electrical Bicycle. The specifications of photo voltaic (PV) plane is must be sufficient to generate the electric motor same as conventional electric powered bicycle. The suitable connection of solar cells, rechargeable battery and DC electric motor with bicycle needed to make sure this project accomplish with more optimum energy use. The electric motor must to support the weight and size of the bicycle, size of solar panel and condition of the road surface.

1.2 Project Background: A method of upgrades a conventional electric powered bicycle over to Solar Powered Electrical Bicycle that is powered by an electric motor which gets its supply from Photovoltaic (PV) panels. The PV panels must be mounted and installed at the bicycle without compromising riding comfort ability. The

method employs a small electric motor that are easily connected and separated for ease of transport. A solar collector is connected to the rechargeable batteries for collecting solar energy and converting such energy to Electrical power that is delivered to the rechargeable batteries for recharging thereof. A rechargeable battery s operable connected to DC motor for providing electrical power to drive the motor.

1.3 What is Electric Bike? The Electric bike is a bike which is driven with the help of battery which is coupled to electric motor.

1.4 COMPONENTS OF E – BIKE: The Electric bike consists of following components viz, DC motor, Frame, Platform, Battery, Drive etc.

a) Dc motor: The motor is having 250 watt.
Capacity with maximum 2100 rpm.
Its specifications are as follows:
Current Rating: 7.5amp
Voltage Rating: 24 Volts
Cooling: Air – Cooled Bearing: Single row ball.

Fig.1.1 DC Motor

b) Frame: The Frame is made up of M.S. along with some additional light weight components. The frame is designed to sustain the weight of the person driving the unit, the weight of load to be conveyed and also to hold the accessories like motor. Also it should be design to bear and overcome the stresses which may arise able to due to different driving and braking torques and impact loading across the obstacles. It is drilled and tapped enough to hold the support plates.

Fig.1.2 Frame

c) Platform: The Platform is designed with robust base so that it can hold the load along with the weight of the driving person uniformly. It is fabricated from Mild Steel at a specific angle in cross section and welded with a sheet of metal of specific thickness. The platform‘s alignment is kept horizontal irrespective whether it is loaded or unloaded and this is directly bolted and welded to the frame.

d) Battery: The battery also acts as a condenser in a way that it stores the electric energy produced by the generator due to electrochemical transformation and supply it on demand. Battery is also known as an accumulator of electric charge. This happens usually while starting the system.

e) Digital Speedometer: This digital speedometer displays the speed of the vehicle in kmph. An opaque disc is mounted on the spindle attached to the front wheel of the vehicle. The disc has ten equidistant holes on its periphery. On one side of the disc an infrared LED is fixed and on the opposite side of the disc, in line with the IR LED, a phototransistor is mounted. IC LM324 is wired as a comparator. When a hole appears between the IR LED and phototransistor, the phototransistor conducts. Hence the voltage at collector of the phototransistor and inverting input of LM324 go _low', and thus output of LM324 becomes logic _high'.

Fig. 1.3. Speedometer

2) METHODOLOGY: To achieve the above stated objectives, the following methodologies are to be used. i) A mathematical vehicle model will be developed and MATLAB simulation will be carried out for evaluation of power and energy requirements for a plug-in hybrid electric two-wheeler for different driving cycles.

ii) A simple control strategy has to be developed for Indian city driving conditions with less fuel consumption for reducing emissions.

iii) A conventional two-wheeler will be converted into a plug-in hybrid electric two wheeler by retrofitting a hub motor in the front wheel.

iv) Experiments will be carried out on engine and electric hub motor to estimate the power and torque requirements for various operating conditions.

v) A detailed investigation will be carried out to estimate the battery energy and power requirements for various conditions.

vi) A cost benefit analysis will be carried out to estimate the battery pack cost and its payback period. Vii) An assessment of annual petroleum saving and greenhouse gas emission reduction from the two-wheeler segment in India in the next decade will be carried out using a simple emission model.

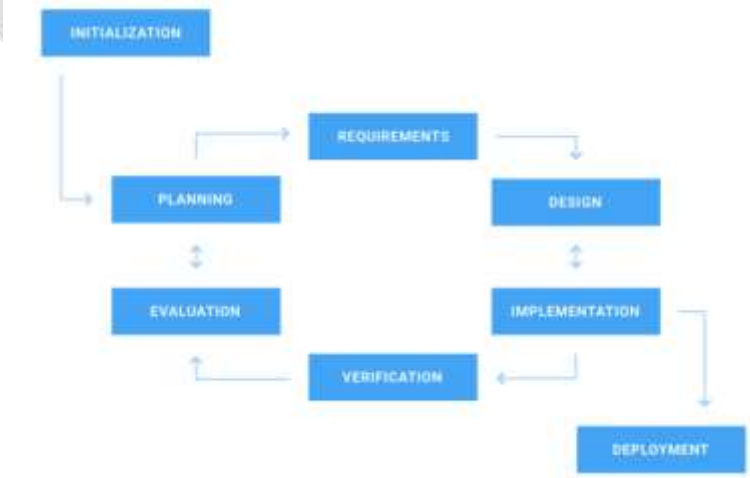

Fig. 1.4 Methodology of implementing Electric bicycle

3) Design of motor:

Here we have used permanent magnet self-generating motor with 250 watt power and 2100rpm. The motor runs on 24volts and 7.5amps power source. This motor can reach a peak current during starting equal to 15 amps.

P = 2 x 3.14 x N x T /60
250 = 2 x 3.14 x 2100 x T /60
T = 1.13 N m = 1136 N-mm
Reduction in chain drive R chain = 66/11 = 6:1
Torque at wheel shaft = T x R chain = 1136 x 6 = 6820 N mm
Speed of wheel shaft = 2100 /6 = 350 rpm.

4) Shaft design:

T = 36000 N mm
T = 3.14 / 16 x σs x d3
Fs allowable = 80 N/mm2
6820 =3.14 x σs x d3 /16
σs = 34.73 N/mm2
Material = C 45 (mild steel)
σ ut = 320 N/mm2 ---------- PSG design data book.
Factor of safety = 2 σt = σb = σ ut/ fos = 320/2 = 160 N/mm2
σs = 0.5 σt = 0.5 x 160 = 80 N/mm2
σs is less then allowable so our shaft design is safe

5) Design of Sprocket and Chain for Electric Bike:

We know,
TRANSMISSION RATIO = Z2 / Z1 = 66/11 = 6
For the above transmission ratio number of teeth on pinion and the number of teeth sprocket is in the range of 21 to 10, so we have to select number of teeth on pinion sprocket as 11 teeth.
So, Z1 = 11 teeth
SELECTION OF PITCH OF SPROCKET:
The pitch is decided on the basis of RPM of sprocket.
RPM of pinion sprocket is variable in normal condition it is = 2100 rpm
For this rpm value we select pitch of sprocket as 6.35mm from table.
P = 6.35mm

6) CALCULATION OF MINIMUM CENTER DISTANCE BETWEEN SPROCKETS:

THE TRANSMISSION RATIO = Z2 / Z1 = 66/11 = 6 which is less than 7
Dia. of small sprocket,
Periphery = π × dia. Of sprocket
11 × 6.25 = π × D
D = 11 × 6.25 / π
D = 21.8 mm Dia. of sprocket,
Periphery = π × dia. Of sprocket 66 × 6.25 = π × D
D = 66 × 6.25/ π D = 131.3 mm.
So from table, referred from PSG Design Data book
The minimum center distance between the two sprocket = C‘ + (80 to 150 mm)
Where C‘ = Dc1 + Dc2 2 C‘ = 131.3 + 21.8 2 C‘ = 76.5 mm.
MINIMUM CENTER DISTANCE = 76.5 + (30 to 150 mm)
MINIMUM CENTER DISTANCE = 170 mm

7) WORKING: An electric bike at its core is a regular push bike. They just rely on extra components that work together to allow it to operate; electric motor, battery, the sensor and the electric display. All of our electric bikes use pedal assist; this is where the motor is only activated when the pedals are already in motion. This allows the rider to still get a workout, but with an added boost to make their ride easier.

1. Motor: There are different placements for an electric bike motor; each has its benefits; front hub, rear hub and mid-drive motor. You can find out more about each of these motors on our specific motors page. The main aim of the motor is to control torque. The more advanced the electric motor, the more torque it offers. The more torque you have, the more power you can get out of the bike.

2. Battery: The battery on an electric bike can be located in varying places on the bike, often dependant on frame type and size. Each battery make, model and type means that they will need to charge for different times, an average charging time is five to six hours. Charging your battery is easy, just like a mobile phone you plug it into the wall. We have plenty more information on electric bike batteries for you to read too.

8) RESULT AND APPLICATION: This section presents and analyses the survey results. It starts with descriptive statistics on e-bike usage and user characteristics. After that, a Generalized Linear Model is built to predict future e-bike adoption. To further analyses the influencing factors of travel mode choices and understand the transport system transition, a Binomial Generalized Linear Model is established. Following a back-to-back test of electric cars, electric motorcycles and an electric bicycle this week, the Environmental Transport Association (ETA) concluded that the bicycle offered the best application of the technology. Yannick Read of the ETA said: ―In terms of price, range and usability the bicycle is the most practical option for those who want the benefits of an electric vehicle today.‖ Electric vehicles of every description are currently in development, from aircraft to jet skis, but batteries remain expensive, heavy and troublesome to charge without widespread charging points. Bicycles are easy to convert to electric power and light enough to be carried into a house to be re-charged. Furthermore, the electrically-assisted bicycle is the ultimate hybrid; if the battery runs flat, the rider can switch to leg power in an instant.

9) CONCLUSION AND FUTURE SCOPE: The issues associated with electric bicycles may be addressed by custom-designed drives that are most efficient over a given operating cycle. These include city bicycles, hill bicycles, distance bicycles, and speedy bicycles. The results of the studies listed here can serve as a platform to improve electric bicycle performance if new drive systems are designed around key parameters that will result in improvement of the system performance. Furthermore, they can be used for comparison of existing drives in a systematical, comprehensive, and technical way. Bicycle use is known to be healthy, efficient, and environmentally friendly and in some localities is even faster than driving (either due to traffic conditions, or the distance of available parking spaces from origin and destination respectively). Unfortunately, bicycle adoption rates are not high in many places, due to various barriers and perceived barriers to more widespread use.

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