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Design, Testing & Performance analysis of Electric Bike

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ABSTRACT

The main aim of this paper is to present the idea of design EBIKE with minimum cost as well as should have high efficiency. Electric bike which will be driven with the help of battery and thus provide required voltage to the BLDC motor. Electric vehicles make use of BLDC motors as the propulsion method.
Keywords: BLDC motor, Controller, Battery, Bicycle.

I. INTRODUCTION

Transportation involves the combustion of fossil fuels to produce energy translated into motion. Pollution is created from incomplete carbon reactions, unburned hydrocarbons or other elements present in the fuel or air during combustion. Combustion also produces carbon dioxide, the primary greenhouse gas. The share of fossil fuel used in the transport sector varies widely from region to region and city to city. A number of factors can be identified as influencing the amount of emissions attributable to the transport sector, and an effective strategy will need to consider all these factors. They include the amount that vehicles are used in a given country or metropolitan area; the age of the vehicle fleet and the technology used within it; the extent to which vehicles are properly maintained; the availability of appropriate fuels and the extent to which they are used properly; and Atmospheric, climatological and topological conditions.

Electric vehicles make use of BLDC motors as the propulsion method. Due to the fact that BLDC motors do not have brushes, they present some advantages over the DC brushed motors, from which we remember:

(1) Longer life span,
(2) Lower EMI (Electromagnetic interference) radiation, (3) Noiseless operation,
(4) Greater torque to motor size ratio.

Due to the geometry of the windings in the motor, the BEMF (back electro-motive force) generated by the motor when in generator mode can be of two types: (1) trapezoidal and (2) sinusoidal. The latter can be of interest if the driven motor does not have Hall position sensors, and facilitates the calculation of the motor's rotor absolute angle.

Global warming is a major concern all around and to save Mother Earth, there are several policies, promises and pledges. With the ever increasing emission of greenhouse gases, there is an increased fear of pollution. With modern technology and innovation, transportation and communication have undergone a paradigm shift.
The most necessary requirements of an electric vehicle are reduced design effort, lower cost, less depreciation, and optimization of the volume and weight needed by the traction drive system.

II. METHODS AND MATERIAL

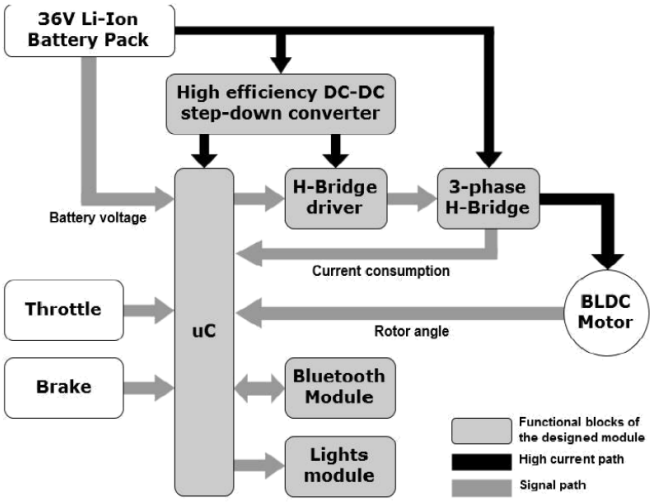

Figure 1: Block diagram of the designed e-bike electric system

Figure 2: E-BIKE photo.

The microcontroller receives information about the motor position (rotor angle), via signals generated by three Hall effect sensors contained within the motor. Using this data, the microcontroller uses a simple commutation table and switches the six power MOSFET transistors which drive the BLDC motor. Internet-based literature (images only) suggests that BLDC controllers used in commercial e-Bikes contain linear power supplies. This is a main issue regarding power efficiency, due to the significant power loss as heat in the internal power supply. One of the improvements this design brings is the use of a DC-DC step down converter, which greatly lowers the power consumption of the module and reduces the ambient temperature in the case of the module. The latter is an important issue, considering the fact that the electronics on an e-Bike must be housed in a water-proof enclosure. The user of the e-Bike receives relevant data (e.g. instantaneous speed, battery state of charge) from the motor controller via Bluetooth protocol and can view the data on a GUI (graphical user interface), i.e. on a smartphone. By using a Bluetooth transmitter instead of a graphical display, the power consumption is further more reduced.

Calculation of Motor Torque

Pedal length: 22cm i.e. 0.22m
Weight of human 60 to 90 KG(weight 1Kg=9.81N)
Initial force in range between (15-20 Kg) and running condition very less force
Formula for Torque:
T =F*D (Distance)
T =20*9.81*0.22
=43.16 NM (At initial)
We required 43NM Torque at initial but very less for running condition
If we consider W =15 KG
Then, T =32 NM

BATTERY

The 36-V, 4.8 AH battery is selected with the following performance specification:
Voltage: 36 V
173 Wh
Maximum continuous discharge current: 9.3 A

Operating temperature:- 20C -60C
Charging time: 1.5hrs

Total Weight:

Bicycle assembly	15
Motor	03
Battery & Controller	1.2
Cyclist	80
Total weight	99.2

III. RESULTS AND DISCUSSION

In Simulation Motor Takes Current 4 to 5 Amp. Motor is geared having ratio 1:4.42 and max. speed up to 22 kmph. So According to calculation bike will go 22-25 km in single charge.

IV. CONCLUSION

With the increasing consumption of natural resources of petrol, diesel it is necessary to shift our way towards alternate resources like the Electric bike and others because it is necessary to identify new way of transport. Electric bike is a modification of the existing cycle by using electric energy and solar energy if solar panels are provided, that would sum up to increase in energy production.

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