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Hybrid Electric Bicycle using PMDC motor controller & pedaling mechanism

Dr.A.Sudhakar[a], B.Nithin sai[b], B.Hema sai keerthana[c], T.Sindhu priya[d], P.Sai krishnamachary[e] 1

[a,b,c,d,e] Department of Electrical and Electronics Engineering, MLR Institute of Technology, Hyderabad – 500043, Telangana, India* Corresponding author. Tel.: +91 9966424587.

E-mail address : ambarapusudhakar@gmail.com

Abstract

An electrical bicycle, likewise called an e-bike is a bike with an incorporated electrical motor which can be utilized for the control of bike. The suggested system will be an add-on to a bike that includes electrical motor, batteries and controller. An e-bike can improve the individual experience of bicycling by decreasing the manual labour. Based upon the analyses from the PMDC electric motor and outcome of the controller the voltage Vs current, Speed Vs current characteristics are outlined depicting the performance of the electric bike. The job therefore objectives to reintroduce the bike with more eco - pleasant and set with good effective functions

Keywords: PMDC motor; PWM Controller; e-bike.

1. Introduction

The electrical bike is a electric helped gadget that's developed to provide bikes .An electro-magnetic energy is provided to the typical bike with the assistance of electric helped gadget. By this, users need energy to run the bicycle is reduced. This electric bicycle reduces the effort of users in different situations such as while climbing a hill road. For this purpose we need to use strong motor and batteries. Batteries place a crucial role in this electric bi-cycles, as batteries with more capacity will help in covering more distance. This works with the help of PMDC Motor, Controller, pedal assist sensor and Batteries.

The Permanent Magnet DC Motor is becoming increasingly popular in sectors such as Electric Bicycles and in other aspects as well. To improve the efficiency and usage of a cycle and converting it into an electric bicycle makes the travelling easier and cheap. It is easy and simple to handle.

The design of the controller includes all the various controls which handle throttle, brakes and a headlight with a horn. This has a special pedal assist mode which helps you to use mechanical peddle which provides the energy required to move a bicycle which supports an extra range and along with speed of the bicycle. This is the biggest feature of the bicycle which helps in controlling the speed.

1.1. Literature survey.

There are many others who worked on this project, but in a different way.

Literature survey explains about Electrical Bike[1] for an evaluation on Mobile Electrical Bike. In this job, DC center electric motor linked to the unusual wheel of bike is utilized. It was moved by the dual electrical motor. For the stopping system a center utilized is used in band brake system where the springtime is packed in this kind of system.

The German Naturalistic Biking Examine - Contrasting the rate of cycle bikers[2] of various e-bikes and traditional bikes. The velocity and rate of orthodox and electrically powered bike are the primarily concentrated subjects. The writers differentiated in

* Corresponding author. Tel.: +91 9966424587.
E-mail address : ambarapusudhakar@gmail.com

between the electrical bikes which will provides arrangement upto 45km/h(As called S-pedelecs) and 25km/h(speed of pedelecs). As the rate limitations of 30km/h can affect particularly on the implementation of rate bikers, under different circumstances the prospective imply rate can be differed.

Design And Fabrication of Dual Chargeable Bicycle[3] is discussed. The writers mentioned about the essential elements and the experiments carried out on e-bike, generators and batteries. Initially a generator is used which is an electromechanical gadget that changes power to electric power in the rotating present style. The DC generator brushes bring a little portion of present, which brings the entire generators outcome. To change AC to DC the rectifiers (diodes connect) are utilized.

Develop Of Electrical Bike With Greater Effectiveness [4]. The enhancement of effectiveness of E-bike is concentrated from this paper. The speed of E-bike has between 40-45 kilometers/human resources at optimal. The effectiveness of E-bike is enhanced by increasing the rate and deliberately the wind resistant form. For enhancing the rate they have made the contrast of power transmission system.

Efficiency Assessment Of Electrical Bikes. The writers talked about the setup and summary of E-bike[5] in this paper. They have categorized the different feasible elements utilized to develop an e-bike[6]. The development of an electrical bike consist of a controller[7] that manages the manage stream of the battery to the electrical engine. This suggests the power offered from the electrical engine which is used to run e-bicycle[8].

2. PMDC MOTOR

In this the DC electric motor is utilized as electric motor is a gadget that transforms electric power into mechanical power. The concept of electric motor in electrical bikes is to produce the turning electromagnetic field by utilizing the electrified coil and act upon the blades squirrel-cage shut aluminum mount to develop the magneto electrical turning torque. The fundamental functioning concept of a DC electric motor is based upon that whenever a conductor is put within a electromagnetic field, there will be mechanical pressure. A Long-term Magnet DC electric motor (PMDC electric motor) is a kind of DC electric motor that utilizes a long-term magnet to produce the electromagnetic field needed for the procedure of a DC electric motor. Therefore long-term magnet DC electric motor is utilized where there's no need to manage the speed of the electric motor (which is typically done by managing the electromagnetic field). Little fractional and sub-fractional KW electric motors are frequently built utilizing a long-term magnet.

This PMDC electric motor is utilized due to the complying with factors:

- The dimension of these electric motors is smaller sized
- These electric motors are less expensive
- These electric motors don't require area windings, and they do not have the copper losses in the area circuit

3. PWM CONTROLLER

The controller of an electrical bike is a digital circuit that not just manages the speed of an electric motor, however likewise manages the electrical brake. This controller utilizes power from batteries and owns it to electric motor.

As its call recommends, pulse size inflection rate manage functions by owning the electric motor with a collection of "ON OFF" pulses and differing the responsibility cycle, the portion of time that the outcome voltage is "ON" compared with when it's "OFF", of the pulses while maintaining the regularity continuous. The power put on the electric motor can be regulated by differing the size of these used pulses and thus differing the typical DC voltage put on the electric motors terminals. By altering or modulating the timing of these pulses the rate of the electric motor can be regulated, i.e., the much longer the pulse is "ON", the much faster the electric motor will turn and also, the much shorter the pulse is "ON" the slower the electric motor will turn. Using pulse size inflection to manage a little electric motor has the benefit because the power loss in the changing transistor is little since the transistor is either completely "ON" or completely "OFF".

Consequently the changing transistor has a lot decreased power dissipation providing it a direct kind of strategy which lead to much far better security. Likewise the amplitude of the electric motor voltage stays continuous so the electric motor is constantly at complete stamina. The outcome is that the electric motor can be turned a lot more gradually without delaying. So, create a pulse size inflection indicate to manage the electric motor. With Astable 555 Oscillator circuit.

4. WORKING

Electric motors transform electrical energy into mechanical energy. PMDC electric motor functions just like the basic functioning concept of dc electric motor. Functions by Fleming’s left hand rule. The controller modulates the quantity of power streaming to the electric motor, which utilizes input to move the preferred quantity of present from the battery into the electric motor.

Pedal-assistant utilize a speed sensing unit, which controls e-assist by spotting the rider's pedaling cadence, or torque sensing units, which feel just what does it cost, torque the biker is placing into the pedals or throttles that permit to utilize the electric motor independent of pedaling. The power is offered to the electric motor and PWM controller with batteries. Front lights, brakes, strangle, horn and secure are linked to controller. Controller carries out manage activity according to the demand of the individual.

By opening the secure, the power provided to electric motor and controller begins .By utilizing the strangle it can be differed, the control of the bike. Electrical brakes will assist to hold the bike by reducing the input provided to the electric motor. Pedal help sensing unit (PAS) is shaped close to the pedal which assistance to enhance the electric motor, in addition to it will create electric

power. Electric power created with pedaling is offered to controller by this the effectiveness of the electric motor will not reduce. The battery degree will be suggested on the leading off the front lights. The PMDC motor is connected to e – bike as shown in Figure 1.

Fig. 1. PMDC motor connected to e - bike.

5. RESULTS

It is understood that by increasing or decreasing the throttle the speed of the bicycle changes. This change in speed of bicycle is due to change of voltage supplied to the motor which is controlled by the controller. So, the readings for voltage Vs current are as mentioned in Table 1.

Table 1. Voltage and current characteristics of e – bike.

Voltage(V)	Current(A)
1	0.38
1.5	0.5
2	0.9
3	1.41
88	0.5
40	0.38

Table 2. Speed and current characteristics of e – bike

Speed(rpm)	Current(A)
290	2.7
230	2.32
170	1.41
130	0.9
88	0.5
40	0.38

The input current of the DC motor is varied in order to obtain the variation of speed with respect to input current as shown in Table 2.

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