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Design of EV Wheel for Bicycle

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Abstract: The Era of the eco-friendly technologies is emerging rapidly; bicycles are the most dependent modes of transportation. The environmental factors and the increase in fuel price make it clear that it is far better to use a bicycle over a motor vehicle for traveling. This project 'Design and implementation of Electric Bicycle with battery monitoring system and speed control mechanism, is designed to provide two modes of travel, such as a power- on-demand mode for long distances and pedaling mode for short distances. This electric bicycle is provided with ease to switch between these two modes of operation. The electric vehicle depends on the battery for energy. Provision for monitoring the state of charge of the battery using lot techniques is provided in the project. The speed controlling mechanism enables the user to ride the electric bicycle in different ranges of speed IOT based speed monitoring system is provided. The monitored values of battery state of charge and the speed are displayed so that the rider gets the information about the status of the battery and the speed. Each circuit is designed separately and assembled to form an electric bicycle which can make the long distance cycling easier with many user-friendly features.

Keywords: Electric bicycle, Speed Controlling, Speed Monitoring, Battery Monitoring.

I. INTRODUCTION

The electric bicycle is an electrical-assisted device that is designed to deliver the electromagnetic momentums to a present bicycle therefore relieving the user of producing the energy essential to run the bicycle. It contains a strong motor and enough battery power that just needs charging to help in hill climbing, generate greater motoring speeds and provide completely free electric transportation. Electric vehicles price more and perform poorer than their gasoline counterparts. An Electric bicycle would, however offer other solid benefits that are overlooked by the marketplace. These include the intense reduction in oil consumption that its widespread use would bring about. Much less oil would be needed because only a tiny proportion of electricity is generated from oil. The further major non-market benefit would be lower greenhouse gas emissions. Drives for electric bicycles are required to produce a variety of different pairs of torque and speed, and of rate of change of torque at a given speed. The aim is that mainly because gasoline cars have promoted from a century of intensive development; electric cars have been virtually overlooked for several years. The single biggest advantage of electric bicycle is that it is cost operative as it mainly only entails building cost as running cost would only require the charging of the battery. The market for electric motor power bicycles has been growing fast during the last years. Such electric bicycles can be used for a large variety of purposes, including serving as a vehicle for police or law enforcers, a guide bike during races, and for leisurely rides and commuting. Common issues such as high cost and weight can be addressed by custom-designed bicycles for given contexts. The electric bicycle is a project that can promote both cleaner technology as well as a lesser dependence on oil.

II. OBJECTIVES

1. Performance analysis of BLDC motor for EV wheel.
2. Implementation of battery and controller.

III. SCOPE OF THE PROJECT

1. Easy control and reliable operations.
2. The functionally of developed Electric bicycle can be further enhanced by implementing DC-DC converter
3. Experiment on conditional of EV wheel

IV. METHODOLOGY

The e-bicycle has been developed by incorporating the BLDC hub motor through hall sensor feedback. Instead of PAS(pedal assistant sensor), PWM controller is used. The BLDC motor gets the position of the controller. The controller gets the variable voltage from the motor. The variable voltage with the help of battery connected to the controller.

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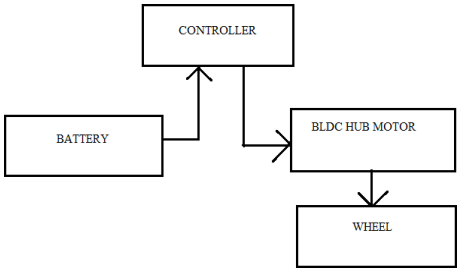

HARDWARE COMPONENTS:

SL NO	COMPONENTS	SPECIFICATION	QUANTITY
1	BLDC Motor	12 V 100W	1
2	Battery	12 V	1
3	Controller	12 V 30W	1

Table 1

1. Motor Type: Hub Motor (front or rear) or Mid-Drive Motor Power Rating: Typically between 250W to 750W, depending on the desired speed and torque. Voltage: Matching the battery voltage, commonly 36V or 48V.

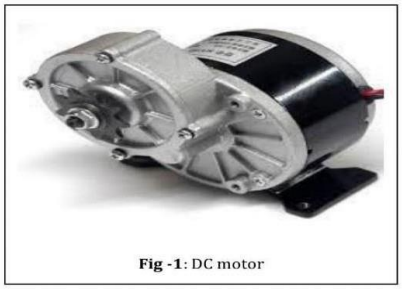

Fig -1: DC motor

2. Battery Type: Lithium-Ion Capacity: Measured in Watt-hours (Wh), typically ranging from 250Wh to 750Wh for e-bikes.
Voltage: Common voltages include 36V and 48V. Battery Management System (BMS): Ensures safe chargingand discharging of the battery.

Fig 2: Battery

3. Controller Function: Manages power flow between the battery and motor, controlling speed and torque. Features: May include regenerative braking, pedal-assist levels, and throttle control.

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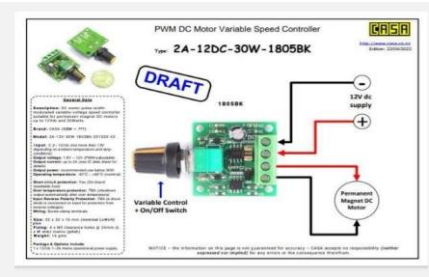

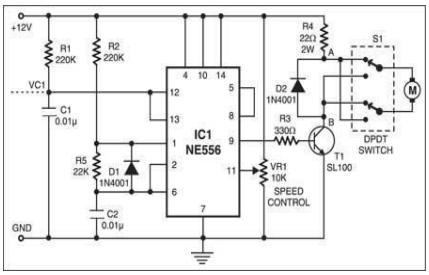

Fig 3: Controller

MERITS:

The main advantage of rear wheel electric bicycle hubs is that they provide greater power and torque to the bike, allowing for faster acceleration and more efficient hill climbing.

Improved Traction: Advanced designs can incorporate materials and tread patterns that enhance grip and stability,which is crucial for the performance of electric bicycles.

Enhanced Efficiency: Specialized wheels can be optimized to reduce rolling resistance, improving overall energy efficiency and extending battery life.

Integration of Components: Wheels can be designed to integrate components like hub motors, making for a cleanerand more efficient system that simplifies installation and maintenance .

Better Heat Dissipation: Custom designs can include features to improve heat dissipation, particularly important inhigh-performance scenarios where braking and motor use generate significant heat.

DEMERITS:

The disadvantage is that they can be more difficult to maintain and repair than front wheel hubs due to their complexity.

Cost: Advanced wheel designs, especially those incorporating high-tech materials or integrated components, can be expensive, potentially raising the overall cost of the bicycle.

Complexity: Specialized wheels might require more intricate maintenance or repairs, which can be a barrier for some users and might limit repair options.

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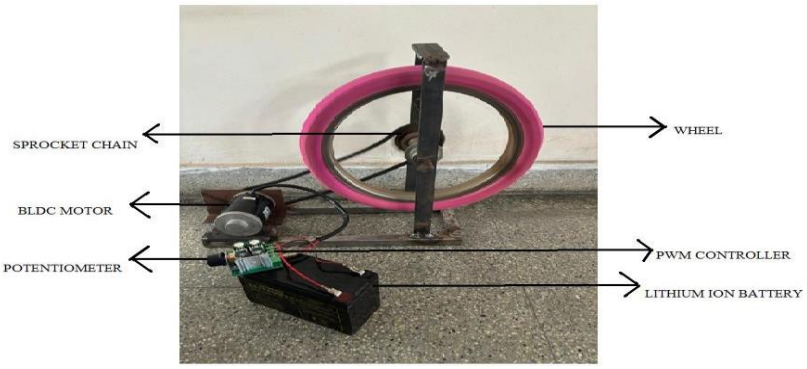

WORKING MODEL:

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Fig 4: Working model

The 12V lithium ion battery is used. The battery supplies the power to the PWM controller. Controller manages power between the battery and the motor, controlling speed and torque ,its capacity is up to 12V dc and 30watts. The BLDC motor of capacity 12V 100W deliver precisely the desired torque and the rotation speed. The speed of wheel is controlled at different voltages.

EXPECTED OUTCOME:

The conversion is a anticipated to significantly enhance the bicycles performance, providing increased speed. Speed control of EV wheel for bicycle id designed.

Various speed of different voltages is measured.

The conversion is anticipated to significantly enhance the bicycle's performance, providing increased speed, extended range, and improved climbing ability.

Thereby making cycling more efficient and enjoyable.

The user experience is expected to be enhanced with intuitive controls, reduced physical strain, and customizable settings to suit individual preferences.

Environmentally, the adoption of an EV bicycle promotes sustainable transportation, reduces carbon emissions. contributes to noise reduction in urban areas.

Additionally, the conversion fosters social inclusivity by making cycling accessible to a broader demographic.

While also serving as an educational and technical project for hands-on learning and innovation in electric vehicle technology. Economically, the conversion offers cost-effectiveness compared to purchasing a new e bike, along with lower maintenance costs and retained portability.

V. CONCLUSION

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This project brought together several components and ideas to achieve a common goal: to prove that it is possible to build a bicycle with 3 separate charging sources. We put a lot of time into this bicycle to make sure that it was performing the best it possibly could. Now that the project as a whole is finished, we hand it over to future generations to design and improve each component. Possibly future projects may include:

1) Design of the motor controller: The current motor controller is a very nice size and weight, but the connections that itprovides are not as stable and protected as it can be. Limiting the amount of wiring and connections may also be desired.

2) Construction of a separate hub motor: There are many levels to the design of the 48V, 1000W hub motor in order to have it so compact in size. The new hub motor can be placed on the front wheel of the bicycle or it can just be used to compare the speeds and efficiencies to the current motor on the bicycle.

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