



Design and fabrication of an Electric Bicycle with Auto Recharging Mechanism

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Abstract: An electric bicycle, also known as an e-bike, is a bicycle that is powered by an electric motor. The design and fabrication of an electric bicycle with an auto-recharging mechanism would involve several steps and considerations. First, the design of the electric motor and battery system would need to be chosen based on the desired power output and range of the e-bike. The motor and battery would need to be integrated into the existing frame of the bicycle, which may require some custom fabrication. Next, the design of the auto-recharging mechanism would need to be developed. This could involve incorporating a generator into the e-bike's drivetrain that charges the battery while the bike is in motion, or using regenerative braking to charge the battery when the bike is slowing down. Once the design is complete, the e-bike would need to be fabricated using appropriate materials and techniques. This would likely involve welding the frame, installing the motor and battery, and connecting all the electrical components. Testing and fine-tuning of the electric bike would be done to make sure everything is working as expected. A computerized control system would be used to manage the various components such as the motor, battery, and regenerative braking system. Finally, safety precautions would be implemented such as a safety key to prevent unauthorized access, short-circuit protection, and overcharge protection. This is a summary of the design and fabrication process for an electric bicycle with an auto-recharging mechanism. The actual process would likely be more complex and would depend on the specific design and materials used.

Key word: DC motor, battery, self-charging, alternating voltage, generator

1. Introduction

Electric bicycles have become increasingly popular over the past few years due to their eco-friendliness, low cost, and easy maintenance. However, one of the main limitations of electric bicycles is the need to periodically recharge the battery, which can be inconvenient for riders. To address this issue, propose the design and fabrication of an electric bicycle with an auto-recharging mechanism that can recharge the battery while the bicycle is in use. The auto-recharging mechanism will be designed to harness the kinetic energy generated by the bicycle while in motion and convert it into electrical energy to recharge the battery. The design will incorporate a generator that will be mounted on the rear wheel of the bicycle. The generator will be connected to the battery through a rectifier, which will convert the AC output of the generator into DC, which is needed to charge the battery.

The generator will be designed to be efficient and lightweight to minimize the added weight on the bicycle. It will be made of high-quality materials that can withstand the wear and tear associated with cycling. The rectifier will be designed to be compact and efficient to minimize energy losses during the conversion process. To ensure that the auto-recharging mechanism is effective, the bicycle will be designed with a lightweight frame that is optimized for speed and maneuverability. The bicycle will also be fitted with high-quality tires that provide good traction and reduce rolling resistance, thereby minimizing the energy needed to propel the bicycle forward. The battery will be designed to have a high capacity and fast charging time to ensure that the bicycle can be used for long distances without the need for frequent recharging.

In addition, the bicycle will be fitted with a display that will show the battery level, distance traveled, speed, and other relevant information. The display will be easy to read and will be positioned in a way that does not interfere with the rider's view of the road. The bicycle will also be fitted with lights that will make it visible at night or in low-light conditions. To ensure that the auto-recharging mechanism is safe and reliable, the bicycle will be designed with safety features such as a robust braking system and a sturdy frame that can withstand the stresses associated with cycling. The auto-recharging mechanism will be tested extensively to ensure that it can recharge the battery effectively without compromising the safety or performance of the bicycle.

Shubham et al. [1] banded about automatic design of the system and also give better knowledge in system integration. This paper also helps us to know further about power transmission system which contain motor, the chain sprockets, flywheel, casing and the hinder wheel. Get know how to do some introductory computation relating to energy transfer through the system and how main factors similar as motor and battery will affect by these computations. Sathya Prakash [2] handed information about difficulties that faced during the relief of internal combustion machine by a battery and electric motor drive in particular transportation electric vehicles. The paper provides the information regarding principles of interspersing current, direct current, motors, speed controls, batteries, relays and battery. Yogesh jadhav et al. [3], handed information regarding Self recharging electric bike and electric- machine controlled bikes. And also helps us understand the conception of battery, fireball as a wind creator, the BLDC machine, regulator, charging frame and sun acquainted board.

Adithya Kumar et al. [4], helped us by giving the information regarding electric power motor and alternator and how they help the rider throughout his trip. The alternator generates electricity which is stored in batteries and these batteries give propulsion power for the motor. It also give information of alteration demanded for electric bike. Robert Cong et al. [5], helped us to see further about the project of E-Bikes and also information descrying lithium- ion battery, the DC- DC boost motor, the solar panel, the motor, and the motor regulator. It'll also practicable to ameliorate them farther by unborn scholars. And also how to make them veritably effective and cost operative. Prof.S.H.Shete et al. [6], provided the information of controller which takes PIC16F72 as a core, introduced some important components and Circuit principle diagram. And also information about controller functions such as over-current protection, under-voltage protection and so on

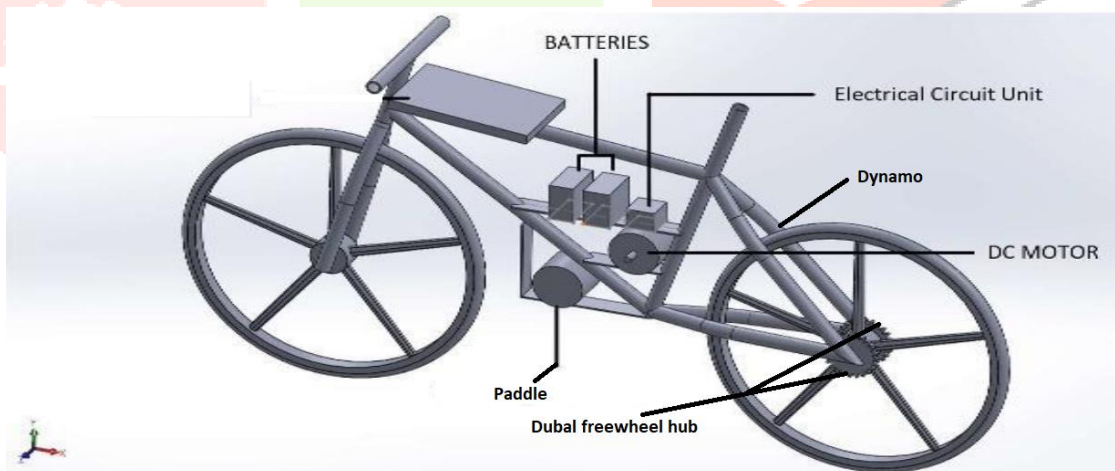
Haw wang at al. [7], in the time published the paper named as "Optimal Planning of Renewable Conceptions for Electric agent charging Position". This paper has examined that electric instruments (EVs) have grown fleetly and are extensively stationed to enable a sustainable transportation system. One of the crucial expostulations is how to optimize the sizing and operation of the charging stations to meet the ever- adding EV demands. Renewable dynamism coffers from solar and wind can give clean authority to meet the EV charging demand. The proffered frame can determine the optimal capacity of renewable dynamism generation, and the optimal scheduling for authority force, in two stages. The appearance patterns and demand biographies of EVs utilizing real-world data to grease a ultrapractical EV request model. Kartik S Mishra et al. [8], in the time 2016 published the paper named as "project and evolution of Solar agent " and has examined that a solar bike is an electric agent that provides that volition by employing solar dynamism to charge the battery and therefore give needed voltage to run the motor. India is blessed with nine months of bright climate therefore conception of solar bike is veritably friendly in India. mongrel bike combines the use of solar dynamism as well as the fireball that runs through pedal to charge the battery to run the bike. Two or further Photovoltaic cells may be exercised to harness solar dynamism to induce voltage to charge the battery. Therefore solar cold-blooded bike can come a veritably vital volition to the fueled machine therefore its manufacturing is essential.

2. Objective

Here are some possible objectives for the design and fabrication of an electric bicycle with auto recharging mechanism:

1. To create an electric bicycle that provides a sustainable and eco-friendly mode of transportation.
2. To develop a system that automatically recharges the electric bike's battery while the rider is pedaling.
3. To design a lightweight and compact electric bike that is easy to maneuver and store.
4. To ensure the electric bike has a long-lasting battery life and efficient power management system.
5. To incorporate safety features such as lights, brakes, and reflectors for safe riding in low-light conditions.
6. To create a comfortable and ergonomic design for the rider, including adjustable handlebars and seat.
7. To minimize the environmental impact of the electric bike's production and disposal.
8. To ensure the electric bike meets all applicable regulations and standards for electric bicycles.
9. To make the electric bike affordable and accessible to a wide range of consumers.
10. To gather feedback from users and make improvements to the design and functionality of the electric bike as needed.

3. Cad model of the bi-cycle



All the designed components and materials such as, bi-cycle, motor, dynamo, dual freewheel, chain sprockets, paddle, etc. were procured separately. Sub-assemblies was fabricated separately and finally all sub-assemblies was assembled as per cad model. The motor was controlled by the throttle.

4. Methodology

Designing the electric bicycle

The first step in designing the electric bicycle is to determine the requirements for the bike, such as the range, speed, and load capacity. Once the requirements are established, a design can be developed that meets those needs. This involves designing the frame, selecting the motor, batteries, and other components, and determining the control system.

Developing the auto-recharging mechanism

The auto-recharging mechanism involves integrating solar panels into the bicycle frame or designing a separate solar panel unit that can be attached to the bike. The solar panels will generate electricity during the day, which will be stored in the bike's

batteries. The mechanism also includes a charging controller that will manage the charging process and ensure that the batteries are not overcharged.

Fabricating the bicycle frame

The next step is to fabricate the bicycle frame using materials that are lightweight and strong, such as aluminum or carbon fiber. The design of the frame should be optimized for aerodynamics and stability.

Installing the motor and batteries

The motor and batteries are installed into the frame, along with the control system that will manage the motor and battery operation. The motor should be selected based on the required power output and the terrain the bike will be used on. The batteries should be selected based on their capacity and the required range of the bike.

Integrating the auto-recharging mechanism

The dynamo and charging controller are integrated into the bike, either as part of the frame or as a separate unit that can be attached to the bike. The dynamo should be positioned to maximize their speed, and the charging controller should be set up to manage the charging process.

Testing and optimizing the bike:

Once the bike is assembled, it should be tested to ensure that it meets the design requirements. This involves testing the motor, battery, and auto-recharging mechanism under different conditions, such as varying terrain and weather conditions. Any issues that are identified should be addressed, and the bike should be optimized for performance and efficiency.

5. Working

Using two sets of batteries for the motor run. Simultaneously after the discharge of one battery second battery will provide the power. And for battery charge, using a dynamo system. Which charges the battery for auto or semi Auto running time. Which provides more mileage. When using bicycles the generated electricity will fluctuate to control this fluctuation using a boost converter. After that, connecting the 4 diodes [5408] and 1 capacitor [4700 μ F,50V] which convert AC to DC for charging the battery. An electric bicycle with an auto-recharging mechanism using a dynamo is an innovative concept that combines the convenience of an electric bike with the sustainability of a human-powered one. The mechanism works by using the rotational energy generated by the bicycle's movement to power a dynamo, which in turn charges the bike's battery. The system includes a dynamo, a rectifier, a regulator, and a rechargeable battery. The dynamo is mounted on the bike's wheel and generates an AC voltage. The rectifier converts the AC voltage into DC, which is then regulated to the appropriate voltage level for the battery. The rechargeable battery stores the energy and powers the electric motor when needed. When the bike is in motion, the dynamo spins, generating electricity. The rectifier converts this electricity into a direct current, which the regulator ensures is at the correct voltage to charge the battery. As a result, the battery charges while the bike is in use, without requiring any external charging sources. This auto-recharging mechanism has numerous benefits. It reduces the need for external charging and can extend the bike's range, making it more convenient to use. Additionally, it promotes sustainable energy usage by harnessing the energy created during regular use. The mechanism also reduces the dependence on external charging infrastructure, making it a practical solution in areas with limited access to power. Overall, an electric bicycle with an auto-recharging mechanism using a dynamo is an innovative concept that combines convenience and sustainability. With its potential to extend the bike's range and promote sustainable energy usage, it is an excellent solution for those looking for a more environmentally friendly mode of transportation.

6. Calculation

Power required accelerating the bicycle from the start $F=m*a$

$$=140*0.611$$

$$F=85.54N$$

$$P=F V$$

V =Average speed

$$V= (V_i + V_f)/2$$

At starting, the velocity V_i will be zero

$$V=V_f/2$$

$$=6.116/2$$

$$=3.055m/s$$

$$P=85.54*3.055= 261.32 \text{ watts}$$

Power required=261.32 watts

Calculation of battery power

Battery connected in series

There are two 12V batteries connected in series each having 15Ah capacity

$$\text{Total watt power}=24*15=360\text{Wh}$$

One watt motor burns 1Wh in one hour. That means,

350 watt motor burns

$$360\text{Wh}=1.02\text{hr} \sim 1\text{hr}$$

Hence from the calculation if the electric bicycle is driven at 22km/hr, it gives a

Mileage of 22km per hour (or) per battery pack.

Calculation of power generation

The generator (or) the reverse DC motor produces

24volts at 3A

In order to charge a 24V battery at 3A

Time taken= $Ah/A=15Ah/3=5hrs$

It takes 5 hours to charge a 24v battery to be fully charged.

Considering the essential factors it would be ideal to choose Lead acid battery over the other Batteries. It is essential for lead acid battery to charge slowly to prevent heat generation.

The motor burns 350 watts in a hour for a battery rating of 350Wh. So at an average speed of 30km/hr 30 kms can be travelled for a single battery pack. While discharging takes place simultaneously battery pack 2 gets charged from the motor 2 at a power rating of 24v and 3A. Though full charging of battery pack 2 cannot be done. More than half of the charge can be generated from the power generated from motor 2. Which can provide more mileage to the e-bike.

7. Results and discussion

An electric bicycle with an auto recharging mechanism is a innovative transportation solution that offers many benefits. The mechanism allows the bicycle to recharge its battery while in use, using kinetic energy generated during pedaling and braking. This can extend the range of the bike and reduce the need for external charging. Additionally, the bike produces zero emissions, making it an environmentally-friendly option for commuting and transportation. The auto recharging mechanism also promotes a healthier lifestyle by encouraging physical activity. Overall, an electric bicycle with an auto recharging mechanism is an efficient, sustainable, and practical solution for modern transportation needs.

8. Conclusion

- It can be seen that all the vehicle companies are changing to electric engines from existing IC engines.
- But the real problem of the electric motors lies in the field of charging the batteries.
- The present study is provide a solution for this existing problem since charging of the battery is done as the vehicle runs.
- It is very much suitable for young, aged people 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 the money.
- 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 frequent news coming about the shortage of fossil fuel. Keeping in mind decide to make self-charging electric Bicycle. It will decrease the dependency of fossil fuel with the help of dynamo, will generate the electricity and run the vehicle. It will be more helpful for the office going people and short distance travel people. The new things are doing in this project before us they provide only 22 km per hour battery capacity. But in this project are providing the 24 to 30 km/h with the help of dual dynamo will generate the electricity to run the vehicle. Using the 2 set of battery. When the front and second wheel is running condition dynamo generate the electricity they charged first set of batter and second set of battery use to run to run the wheel. When the front and second wheel is running condition dynamo generate the electricity they charged second set of batter and first set of battery use to run to run the wheel.

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