

A REVIEW ON “HYBRID BICYCLE”

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ABSTRACT

The Hybrid Electric Bicycle is an innovative transportation solution designed to reduce dependence on traditional fuel sources and promote sustainability. It combines three charging methods to power an electric hub motor that drives the front wheel: solar power, regenerative braking, and a 220VAC wall outlet. By integrating these methods, the hybrid bicycle harnesses renewable energy and enhances its performance. A lightweight hub motor is mounted on the front wheel, improving the bicycle's efficiency and handling. The regenerative braking system captures energy from pedalling (human energy) and braking, converting it into electricity to recharge the lithium-ion battery. Additionally, solar panels installed on the bicycle collect sunlight and convert it into power, further charging the battery when the bicycle is not in use. These combined energy sources—solar power, regenerative braking, and wall outlet charging allow the hybrid bicycle to travel longer distances with less reliance on external power. This system significantly extends the bicycle's range and provides an eco-friendly way to recharge while cycling. By incorporating renewable energy and innovative technology, the Hybrid Electric Bicycle offers a sustainable, energy-efficient alternative to conventional transportation. This approach not only reduces environmental impact but also contributes to the development of cleaner, more sustainable transportation solutions. The hybrid bicycle represents a practical step forward in eco-friendly travel, helping to address global energy consumption and environmental challenges.

Keywords: Solar power, Regenerative charging, Wall charging, DC-DC boost converter, Hub motor

INTRODUCTION

With the increasing number of automobiles, the demand for petroleum products has reached its peak, presenting a significant challenge for the future. These petroleum products are non-renewable, and their depletion could pose severe risks to the environment and the economy. As a result, there is an urgent need to explore alternative energy sources. The price of crude oil has risen substantially in recent years, and there is no indication of a reversal in this trend. This has raised concerns about the long-term sustainability of petroleum as a primary energy source.

Moreover, the focus on environmental protection has gained significant momentum globally, leading to the rise of cleaner, renewable energy alternatives. One of the solutions gaining traction is the development of hybrid vehicles, where more than one energy source is utilized to power the vehicle. Hybrid bicycles are an example of such innovation, combining electric power with renewable energy sources like solar power. These bicycles are designed to run on clean electric power, reducing dependence on fossil fuels. A key feature of hybrid bicycles is their ability to recharge the battery in multiple ways,

which includes charging through a wall socket, using energy generated by the pedals while riding, and harnessing solar energy through solar cells. The concept of hybrid bicycles, particularly solar-powered ones, has emerged as a promising solution to address both energy consumption and environmental concerns. The idea is to enhance the existing bicycle system by making it more efficient and sustainable. Traditional bicycles rely solely on human effort to pedal, while motorized bicycles use fuel as their primary source of power, and electric bicycles are limited by their battery life, typically only lasting for about an hour. The solar bicycle overcomes these limitations by integrating a high-torque motor powered by solar energy. A portable solar panel is used to capture solar energy, which is then converted into electricity. This energy can either directly power the motor or charge a battery if the solar power output does not match the motor's needs. When the bicycle is not in use, the solar panel continues to charge the battery, ensuring that the bicycle remains operational with minimal reliance on external electricity sources. Additionally, a dynamo attached to the bicycle wheel can generate power while riding, further contributing to the recharging process. The hybrid bicycle not only promotes cleaner technology but also contributes to reducing the dependence on oil, offering a more sustainable and energy-efficient mode of transportation. By harnessing multiple sources of renewable energy, including solar power, pedal power, and electric charging, the hybrid bicycle represents an innovative solution to the growing concerns over fossil fuel consumption and environmental degradation. As such, it has the potential to play a significant role in the

transition toward a cleaner, more sustainable future.

COMPONENTS OF HYBRID BICYCLE

Brush Type PMDC Motor

A Brush Type Permanent Magnet DC (PMDC) motor uses permanent magnets to create a magnetic field, eliminating the need for field windings. It has a commutator and brushes that deliver current to the armature, allowing the motor to rotate. This type of motor offers simplicity, reliability, and low maintenance due to the absence of external field excitation. Brush Type PMDC motors are commonly used in applications like electric bicycles, small appliances, and toys. However, the brushes can wear out over time, requiring periodic maintenance or replacement. In this project 12v, 80W brush type permanent magnet dc motor is used which is shown in the fig 2.

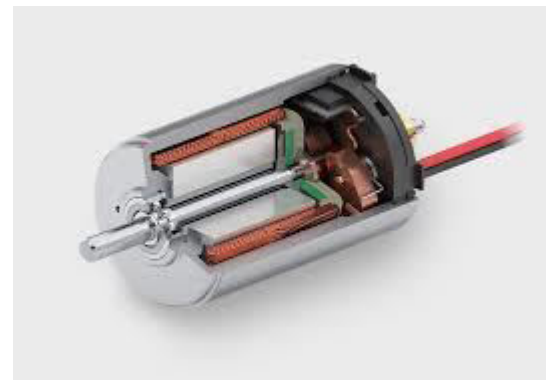


Fig. No	Volta ge	Curre nt	Powe r
2:	12V	3Am	36wat
PMD C motor load		p	ts

Full 12V 7Am 84wat
load p ts

Life span 25 years

Solar Panel

A solar panel is a device that converts sunlight into electrical energy through the photovoltaic effect. It is made up of multiple solar cells, usually made from silicon, which absorb sunlight and generate electricity. The electrical energy produced is typically in the form of direct current (DC). Solar panels are widely used for renewable energy generation in homes, businesses, and vehicles, offering a clean and sustainable power source. They are efficient, low-maintenance, and help reduce reliance on fossil fuels, contributing to environmental protection.



PV) panel. Parameter	Value
Rated max power	12W
Open circuit voltage	21.6V
Short circuit current	0.66 Amp
Rated voltage	17.6 V
Rated current	0.59 Amp

Charge Controller



It is important to control the voltage from the solar panel before sending it to the battery. A charge controller is a device that helps manage this by converting the incoming voltage to a stable, higher voltage suitable for the battery. It ensures that the voltage delivered to the battery remains consistent and within safe limits, preventing overcharging or damage to the battery. The charge controller adjusts the power from the solar panel, ensuring efficient charging, even when sunlight or power output varies. This helps maintain the battery's health and improves the overall performance of the solar-powered system.



Voltage Regulator



A dynamo is a device that makes electricity. It works by using a part called a commutator. In a bicycle, the dynamo is attached to the front wheel, and the commutator is connected to the wheel. When the bike moves, the wheel turns the dynamo, which generates electricity.

Throttle

This solar electric bike thumb throttle is simple to use and perfect for people who want to keep their original handlebar grip. It's usually found on bikes with twist gear systems, but it can also be

Figure 5 shows a typical voltage regulator, which controls the voltage level based on what is needed. In this project, the voltage regulator works like a switch to choose different voltage levels. We use two voltage levels, and the regulator can be adjusted to set the correct one.

used on bikes that have thumb gear systems. A "thumb throttle" is a device that controls how fast the motor of the bike goes, and it's really just a personal choice depending on what type of bike you have.

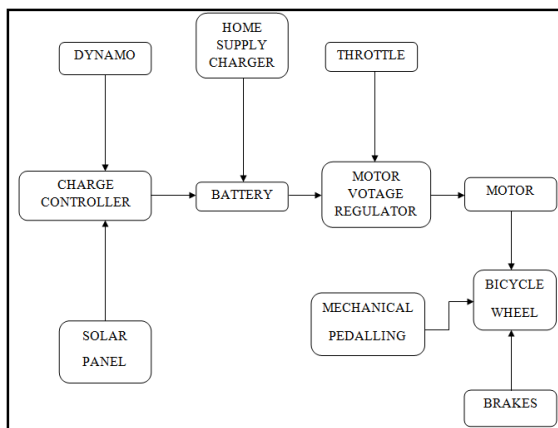
Working Principle

The block diagram of the hybrid bicycle, shown in Fig. 1, illustrates a system where a DC motor is mounted on the middle shaft of the bicycle and powered by a battery. The solar panel is placed on the carriage of the bicycle and generates 12V power when sunlight hits it. The generated power is sent to a charge controller, which regulates the voltage. Additionally, a dynamo is attached to the side shaft of the bicycle, positioned in such a way that its shaft touches the back wheel tires. As the wheel spins, the dynamo shaft turns and generates 12V power. This power is also

connected to the charge controller. When the bicycle is not in use during the day, the solar panel charges the battery using the sunlight. Since sunlight intensity and wheel speed can vary, the output voltage from both the solar panel and the dynamo also fluctuates. The charge controller ensures that the voltage remains constant at 12V, allowing the battery to charge effectively. The energy generated from these sources works alongside the power provided by the rider through pedalling. This means that the rider has the option to either use the motor entirely or pedal the bicycle as in a

traditional, non-electric bicycle. The hybrid bicycle provides an efficient combination of renewable energy sources, including solar and mechanical energy, to help extend battery life and improve overall performance. The charge controller is key in managing these varying power inputs, ensuring the battery is always charged properly without overcharging or

undercharging. This system makes the hybrid bicycle a great option for reducing reliance on traditional charging methods, offering an eco-friendly and energy-efficient way to ride. Moreover, the rider can enjoy the flexibility of choosing between motor assistance or pedal power based on their preference or the available energy.



Advantages

- Solar energy is eco-friendly, producing no toxic fumes or contributing to global warming.
- Solar cells work independently, charging constantly and reducing charging time with a high AC voltage charger.
- They last for at least 20 years with minimal maintenance.
- Maintenance costs are low.
- You can pedal normally when not using power assist.
- The detachable battery can be charged indoors.
- The thumb throttle is easy to use and puts less strain on your hands.
- Solar panels keep charging the battery for continuous use.
- The overall cost is low.

Disadvantages

- As energy demand increases, the prices of the motor, battery, and solar panel also go up.
- Sunlight isn't always available, especially at night, and it varies depending on your location.
- Solar cells and dynamos might not provide enough power, so they can't be the main source of charging.
- The system isn't very energy-efficient due to friction in the chains and wheels.

Applications

- Hybrid bicycles are a great alternative to petrol vehicles in cities, as they're small and can avoid traffic.
- They're suitable for young, elderly, and disabled people for short trips.



- Any regular bicycle can be turned into a hybrid electric bike.
- Small hybrid bikes can also be used by kids.

CONCLUSION

This project is all about making bike riding easier and saving energy. The solar electric bicycle uses sunlight to charge its battery through a solar panel. The battery then powers an electric motor in the wheel, which helps reduce effort when pedalling, especially on hills. If there's no sunlight, the bike can be charged using regular electricity.

The hybrid bike works in both sunny and cloudy weather. It's designed with a minimal extra weight and an integrated control system that adjusts based on the rider's decisions. The bike also uses a microcontroller to make it more efficient than typical hybrid bikes, with features like regenerative motor control and feedback systems that help improve performance.

Future Scope

In this project, the hybrid powered electric bicycle uses solar energy, which is a sustainable and renewable resource. In the future, wind energy could also be utilized by adding a small wind turbine in a suitable location, making the bike even more eco-friendly and efficient.

Further modifications could include making the bike accessible to physically disabled people by adding features like special seating or easier controls. Digitalizing the bicycle could also enhance the user experience by adding indicators,

advanced sensors, a digital display, and a navigation system for better control and safety.

Additionally, implementing a gear variation system would improve the bike's performance by increasing torque and allowing better speed control, making it more versatile and adaptable to different riding conditions. These upgrades would make the hybrid bike more user-friendly, sustainable, and adaptable to future needs.

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