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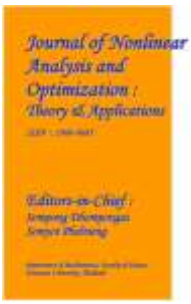

MODELLING AND DESIGNING OF E BIKE USING SOLAR PANLES

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Abstract:
The rider of an E-bike has the option to rely solely on the motor, pedal while using the motor simultaneously, or pedal only, akin to a conventional bicycle. It's essential that the installation of photovoltaic (P.V.) panels on the electric bicycle does not compromise riding comfort. The idea behind solar energy integration is to equip the bicycle with a high-torque motor powered by solar energy absorbed through portable solar panels. This energy can directly power the motor if it meets requirements; otherwise, a battery serves as backup. During periods of inactivity, such as daytime, the solar panel charges the battery, enhancing the bike's efficiency. This is where electric bicycles shine, offering a green, health-conscious, and swift mode of transportation. Beyond these benefits, electric bicycles can even generate electric power through regenerative pedal power mode. The versatility of an Electric Bicycle extends to various uses. Our goal is to create an Electric Bicycle available at the most affordable rate compared to market prices.

Keywords:
Lithium-ion batteries, battery packs, solar Panels, Frames, etc.

I.INTRODCUTION

One of the most essential need for human survival on Earth is energy. To meet our needs, we must rely on energy in one way or another. Fossil fuel energy is one type of this kind of energy. These forms of energy are used by humans to produce electricity, power cars, and other things. However, the primary drawback of fossil fuels is their exhaustibility and lack of environmental friendliness. In order to address these issues with fossil fuels, we must consider alternative energy sources. Increased fuel consumption, worsening traffic situations, rising car exhaust emissions, air pollution, and a decline in quality of life are all direct results of increased mobility. In addition to being an affordable, eco-friendly, and fair means of transportation for short trips, cycling has the potential to address the issue of urban mobility. Numerous cities have made an effort to encourage riding, especially by introducing bike sharing. Since batteries are the energy source for electric motorcycles, a battery charger system that runs on solar energy is necessary. The primary motivation for the search for and modification of e-bikes is to address the problem of pollution caused by the steadily increasing number of cars in metropolitan areas. Scooters, mopeds, and motorbikes are not reasonable purchases for members of all social classes. The best course of action would therefore be to combine the two problems and provide a cheap, environmentally friendly option. Brushless DC motor (hub motor), throttle (accelerator), battery storage (11.1 V - 20A), chain drive, if required, frame, and other standard bicycle elements are typical components of an e-bike. According to how they operate, an electric bicycle is made up of two parts: pedal assist and power on demand. Power-on-demand throttles, which are typically handlebar mounted and also found on regular scooters and motorcycles, are used to turn on the motor Additionally, a roof that has solar panels installed on it might provide both weather protection and electric energy by covering the E-bike station. Rechargeable batteries powering an E-bike have a top speed of 25 to 45 kmph. As a result, you will arrive at your destination more quickly and in better condition than with a typical cycle. An e-bike, or electric and power-assisted bike, is one

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of the bicycle industry's newest and fastest-growing technology. The electric motor on this bicycle propels you forward. Thus, you can ride it with less effort than you would a regular bicycle.

II.COMPONENTS

A. Solar Panel

A p-n junction diode is the semiconductor used in a photovoltaic or solar cell. Many semiconductor materials are used to make solar cells, but silicon (Si) is one of the most extensively available (due to cost) materials on the market. When energy and heat are present, silicon functions as a conductor and an insulator at low temperatures. An upper layer of n-type silicon and a lower layer of p-type silicon combine to make a silicon solar cell (Figure 1). An electric current will form at this point as the electrons are released. The energy of the sun strikes the unbound electrons in both levels as it enters the cell. Electrons will flow from the n-type layer to the p-type layer as a result of the layers' opposing charges, but the p-n junction's electric field stops this from happening. Electrons in the n-type layer have an exit route to the p-type layer thanks to the presence of an external circuit. An external circuit is provided by the extremely thin wire that runs along the top of the n-type layer, and the electrons that flow through this circuit ultimately produce an electric current. Two varieties of crystalline silicon solar cells exist: the first is called monocrystalline (c-Si), and it is composed of single-crystalline silicon that is created when silicon atoms fuse together to form a long, hexagon-shaped structure. Monocrystalline technology may now be produced with thicknesses of up to 200 microns. Figure 2a shows how the surface looks blackish, and efficiency values can approach 22-24%. Polycrystalline/multi-crystalline (poly-Si) is the second type. These are created by gently cooling silicon after it has been melted in a ceramic furnace to create a mixed silicon substance that will be visible on the silicon layer.

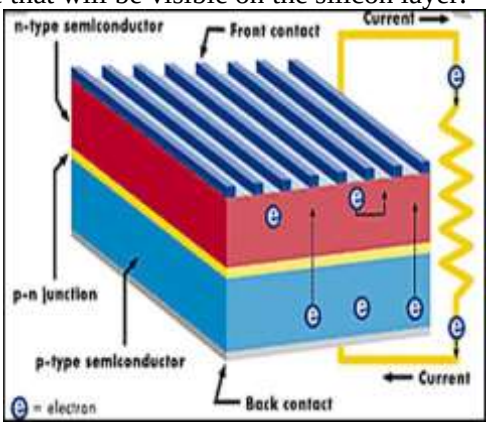

Figure 1: The p-n junction single-crystalline silicon wafer scheme

Figure 2: Solar Classification a) monocrystalline, b) polycrystalline, c) flexible.

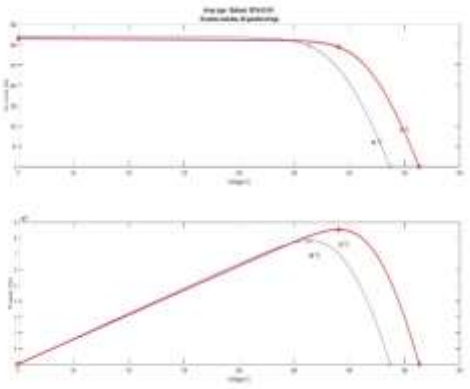

Figure 3: Characteristics of PV

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B. Converter:

A DC-DC boost converter is essential to maximizing solar energy consumption and guaranteeing effective power supply to the bike's electrical components in a solar electric bike that uses a bicycle. The boost converter is significant for the following main reasons:

1. Voltage Regulation: The voltage levels produced by solar panels change based on temperature and sunshine intensity. The output voltage is stabilized and kept within the ideal range by a DC-DC boost converter, which powers the bike's electrical system or charges its battery.
2. Cell Charging: The voltage from the solar panel is increased by the boost converter to meet the voltage needed to charge the bike's battery. It controls the charging process to keep the battery from being overcharged and damaged, hence prolonging its life.
3. Efficiency Optimization: In order to power electrical loads or charge batteries effectively, solar panels frequently operate at voltages lower than what is necessary. The boost converter maximizes the overall efficiency of the solar electric bike system by raising the voltage to the required level while reducing energy losses.
4. Variable Load Support: When powering different electrical components on the bike, including lights, motors, or electronic devices, a boost converter's adjustable output voltage comes in handy. It guarantees that the right voltage level is applied to every component for optimum performance.
5. Energy Harvesting: The boost converter helps to optimize the quantity of solar energy that is captured and used by the bike's electrical system by effectively increasing the voltage from the solar panel. This is especially crucial for increasing the bike's range and lowering dependency on conventional charging techniques or grid power.
6. tiny Design: Since boost converters are usually lightweight and tiny, they can be integrated into the little area on a bicycle. Their compact form factor guarantees minimum impact on the bike's overall weight and aerodynamics, and also facilitates simple installation. Therefore, in order to control voltage, maximize energy efficiency, make battery charging easier, and handle a variety of electrical loads, a DC-DC boost converter is a necessary component of a solar electric bike. It makes efficient use of solar energy possible and improves the bike's sustainability, performance, and range.

A DC-DC boost converter raises a DC input's voltage to produce a greater DC output. It quickly turns the input voltage on and off by using an inductor and a semiconductor switch, usually a MOSFET. An increased output voltage is the outcome of this process, which stores energy in the magnetic field of the inductor during the on phase and releases it during the off phase. A feedback control loop regulates the output voltage, while protective mechanisms and efficiency measures guarantee dependable and safe operation. Boost converters are widely utilized in many different applications, including power supply, renewable energy systems, and portable electronics, that call for voltage step-up.

Figure 4: DC-DC Boost Converter

D. Electric motor

The hub has a typical Dc motor. The rotor is located outside of the stator, and the permanent magnets are put inside of it. Once the stator is installed on the axle and attached, the hub will rotate due to the alternating current provided by the batteries. Hub motors provide a lot of torque at low speeds very effectively without the need for sockets, mounts, or drive chains. They are very trustworthy since they have a long lifespan. The main advantage of brushless DC machines is their ability to deliver broad, stable power speed ranges. The hub motor is one type of DC motor that uses electromagnetic force to turn a wheel. They have magnets inside of one part of them and covered in cables that transport the electricity from the battery. When electricity runs through the stator's electromagnets in a circular pattern, the permanent magnets on the rotor are drawn to and repelled from them, which causes the rotor to spin. The shaft transforms into the axle and ceases to revolve as the rotor continues to spin, rotating the motor as a whole. This generates torque strong enough to spin the front or rear wheel.

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Figure 5: Permanent magnet DC motor.

E. FRAME

An electric bike also needs a somewhat altered frame. The major portion of the frame, which bears your weight, is typically composed of lightweight aluminium alloy. The lighter the frame, the lighter the bike will be overall and the longer it will go before needing to be recharged. Additionally, the spokes on the wheel need to be more robust than the flimsy spokes on a conventional bicycle. This is because the spokes could bend or buckle if they were made of regular, lightweight spokes. Instead, the electric motor in the hub spins the wheel with a lot of turning force, or torque.Fig5 shows the frame work of the Implemented system.

Figure6: Framework of E Bicycle

F. Brakes

There are electric bikes that promise to use a clever technique known as regenerative braking. The electric motor in the hub is turned in reverse and the batteries begin to charge when you pedal the bicycle or move downhill. Regenerative braking works far better on an electric bicycle than it does on an electric automobile or train. An electric bike never gains (or loses) nearly as much kinetic energy during starts and stops as a train or car since it has far less mass and velocity. To fully charge the batteries, you would need to travel down a very long list of hills, which is typically not feasible. And why would you pedal the wheels just to get the battery charged? It would have been better if you had started with a regular bicycle.

III.SYSTEM DESCRIPTION

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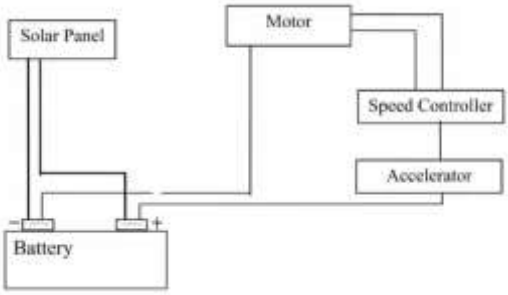

Figure 7: Schematic Diagram of E Bicycle

IV. METHODOLOGY

Fig7 shows the Schematic Diagram of the E-Bicycle, as we all know it Consists of a Solar Panel Mounted on the Top of the Cycle with the Help of a Frame and is Connected to Battery with the Help of a Converter in Between, these Dc Supply Units are Connected to the Motor which is Connected to the Wheels and Accelerator connected to the Handle in order to Increase or Decrease the Speed of the Vehicle. The final outcome is as below:

Figure 8: final outcome of the project

Specifications of the Proposed systems are shown in the Tables below

Table 1: Battery Specification

S.No.	Parameter	Rating
1.	Voltage	24V
2.	Current	10A
3.	Capacity	10Ah
4.	Input voltage	29.4v
5.	Output voltage	25.9v to 29.4v
6.	Output current	20A
7.	Charge current	5A
8.	Discharge current	20A/40A
9.	Weight	1.55kg

Table 2: Controller Specifications

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S.No.	Parameter	Rating
1.	Voltage	24v
2.	Power	250w
3.	Current	21A
4.	Under voltage	20A
5.	Throttle	1-4v

Table 3: Motor Specifications

S.No.	Parameter	Rating
1.	Voltage	24/36v
2.	Speed	3000 rpm
3.	Rated power	250w
4.	Item weight	3kg
5.	Dimensions	8.5*4.5*8.5 cm
6.	No load current	<=2A
7.	No load speed	3850 rpm
8.	Rated torque	0.8Nm
9.	Rated speed	3000 rpm
10.	Rated current	<=13.4 /9 A
11.	Motor efficiency	>=78%

V.ADVANTAGES AND DISADVANTAGES OF E BICYCLE

A. Advantages:

Improved experience while riding Electric aid, which e-bikes offer, can boost speed and lessen physical strain. E-bikes force you to engage your shoulders, arms, and legs, which can improve your physical fitness. Your smartphone can be connected to an e-bike in order to track maps and fitness objectives.

B. Disadvantages:

Expensive: The cost of purchasing and maintaining an e-bike can be higher than that of a standard bicycle.
Heavier: Because of their extra parts and stronger construction, e-bikes weigh more than regular bicycles.
sophisticated components: Specialized, sophisticated parts make up e-bikes.
Legal status: In certain areas, the legal position of e-bikes can be unclear.
Battery life: E-bikes are only appropriate for short trips and have a limited battery life.
Maintenance and repairs: Immediate attention is needed for problems with the motor, sensor, display, battery, or other parts.
Safety: Long charging durations and inefficiency are two drawbacks of wired charging systems. Additionally, there is a chance of electrocution, particularly in damp areas.

VI. CONCLUSION

The project was completed with impressive work in the automotive department. Having two wheels makes sense because you don't have to spend a lot of money on fuel. The project is expected to lower the concern's expenses. The project is set up to complete all required tasks in the least amount of time possible. As a result, pollution is manageable. An existing bicycle is modified and powered by solar energy to become a solar assisted bicycle. It works well on mud, asphalt, and cement roads in both urban and rural areas. This bicycle is more affordable, easier to assemble, and suitable for a wide range of short-distance riders, including postmen, college students, schoolchildren, and office workers. It meets the needs of the economically disadvantaged sector of society and is very suitable for persons of all ages and disabilities. It is available for free use all year round.

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