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Design and Development of Self Powered Cycle

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Abstract:- In the current situation, a hybrid bicycle powered by solar and dynamo energy could address the significant issues of rising fuel prices, especially the steady increase in petrol costs. Additionally, vehicle pollution in metropolitan and urban areas is continually growing. To tackle these problems, efforts are being made to research alternative energy sources for bicycles. For middle-class individuals, purchasing fossil fuel vehicles can be prohibitively expensive. Considering all these factors, there is an ongoing search for solutions that cater to economically disadvantaged people and address environmental pollution. The solar and dynamo-assisted hybrid bicycle is driven by a direct current motor installed in the front axle housing, operating on electrical energy. Solar panels mounted on the carriage charge the battery, which in turn powers the hub motor. When the bicycle is stationary or parked, the solar panel continues to charge the battery. Additionally, a pair of 48-volt dynamos fixed on the rear wheel charges the battery as the bicycle moves.

Keywords:- *Bicycle, Self-Powered, Solar Powered Bicycle, Dynamo.*

I. INTRODUCTION

In an era marked by technological advancements and a growing emphasis on sustainable living, the self-powered pedal bicycle emerges as a beacon of innovation and ecofriendly transportation. As our world grapples with environmental concerns and seeks alternative modes of commuting, this ingenious concept seamlessly blends the simplicity of traditional pedal power with cutting-edge technology, offering a unique solution to modern mobility challenges. The self-powered pedal bicycle represents a paradigm shift in the way we perceive transportation. Unlike conventional bicycles that rely solely on human pedaling, these innovative two-wheelers incorporate advanced systems to harness and store energy, transforming every pedal stroke into a source of power. This synergy of human effort and technology not only enhances the overall riding experience but also extends the range and versatility of pedal-powered transportation. As concerns about carbon emissions and environmental sustainability reach a critical juncture, the self-powered pedal bicycle stands as a symbol of responsible mobility. By eliminating the need for external power sources, such as electricity or fuel, these bicycles offer a sustainable and ecofriendly alternative for short to moderate-distance commuting. The user becomes both the driver and the power generator, fostering a sense of personal responsibility and connection to the environment.

This introduction sets the stage for a closer exploration of the self-powered pedal bicycle, delving into the technology behind its operation, the environmental benefits it presents, and the potential impact on urban and rural transportation landscapes. As we navigate through the pages that follow, we will unravel the layers of innovation that make these bicycles a compelling solution for the environmentally conscious and those seeking an active, efficient, and sustainable mode of personal transportation.

II. LITERATURE SURVEY

As the use of conventional resources like gasoline and diesel grows, it is critical that we transition to alternative resources like electric bicycles and other resources in order to identify more efficient modes of transportation. An electric bicycle is a modification of the current cycle that uses both electric and, if solar-powered boards are available, solar-based energy, which adds up to increased energy generation. Given its energy efficiency, electric bicycles are more affordable and suitable for all budgets. People of all ages can use it for shorter separation times. The consistent development of electric bicycles is vital, primarily because they do not consume non-renewable energy sources, thereby saving significant amounts of foreign currency. Another key feature is their pollution-free, eco-friendly, and quiet operation. A recent study was conducted at the Sam Higginbottom Institute of Agriculture, Technology & Sciences (SHIATS) in Allahabad, India, to evaluate the feasibility of installing solar panels on the rooftops of various buildings within the campus. A survey was carried out within SHIATS to collect latitude and longitude coordinates for each building included in the study. High-resolution imagery from Google Earth was used to digitize the rooftops of these buildings. Spatially distributed solar radiation maps were generated for the study area, and data was extracted for each building. The potential for installing solar panels on SHIATS's buildings was assessed by analyzing the total solar radiation received by each building. The buildings were then ranked based on the amount of solar radiation they accumulated.

From the perspective of future energy systems, it's crucial to explore innovative methods for electricity transportation and generation, and solar-powered e-bike pools could be a promising solution. E-bikes are significantly more energy-efficient compared to cars, buses, or other heavy transport modes. Research indicates that a solar panel with an area of 0.2-0.8 m² per e-bike is sufficient to meet the initial energy demands of an e-bike pool, depending on simulated system usage (ranging from 3 to 10.8 trips per bike per day). This required area is well within the maximum available area

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of 3-3.8 m² per e-bike, suggesting that achieving energy self-sufficiency on an annual basis is feasible without space constraints. Additionally, employing a larger panel area than 0.2-0.8 m² per e-bike in a grid-connected system would result in net electric energy production. It is advised that systems be designed with grid connectivity in mind, as off-grid options would not fully take advantage of solar radiation. It has been demonstrated that adding a buffer battery to a grid-connected system can increase its percentage of grid-free time from roughly 40% to 80% when each E-bike has two meters of solar panels.

A. Problem Identification

- Cyclists are exposed to the elements, making them susceptible to adverse weather conditions such as rain, snow, or extreme temperatures, which can affect comfort and safety.
- There is no On-Boarding Self Charging System. i.e., Dynamo
- Riding a bicycle requires physical effort, which may not be suitable for everyone, especially those with mobility issues or individuals who need to arrive at their destination without exertion.
- In some regions, there may be a lack of dedicated bike lanes or proper infrastructure, making cycling less convenient and safe compared to other modes of transportation. Maintenance period was very low.
- In some cultures or communities, there may be a perception that cycling is not a practical or prestigious mode of transportation, which can deter individuals from choosing bicycles as their primary means of travel.
- Bicycles may not be a practical mode of transportation in sprawling or geographically challenging environments where long distances need to be covered regularly.
- Bicycles are generally slower than the motorized vehicles.

B. Component Used

- *Bicycle*
- *Solar panel*
- *Dynamo motor*
- *Hub motor*
- *Controller*
- *Battery*

- *Bicycle:*

In this project we used solar and dynamo:

Fig 1: Bicycle

- *Solar Panel*

The head line shows that the bicycle is worked by solar energy. Solar PV cells directly convert the energy from the sun into Electricity by using photovoltaic effect. The photovoltaic effect means the generation of a voltage based on the electrons. Ejected by another light effect called Photoelectric effect. Solar cell works on two different kinds of effects, one is Photoelectric and another one is photovoltaic. In photoelectric effect, electrons are emitted when photon are subjected on solar panels.

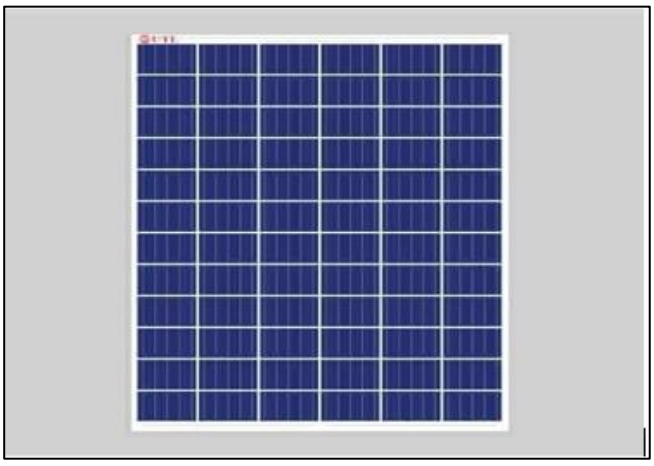

Fig 2: Solar Panel

- *Dynamo Motor*

A commutator is used by a dynamo, an electrical generator, to create direct current. The choice of dynamo depends on the battery and hub motor capacity. We selected 240 volt Dynamos and fixed them to the front wheel of the bicycle using arc welding since we were using a 36 volt battery and a 36 volt hub motor.The dynamo's rotor shaft a fiber teethed wheel that was attached to the front wheel of the bicycle, creating friction and producing electricity that was stored in batteries.

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Fig 3: Dynamo Motor

➢ *Hub Motor*

The most popular kind of motor is a hub drive motor, which is built into the back wheel. Although the latter is more typical, some bicycles even have motors. on actual wheels. A hub drive functions without relying on your bike's gears to directly apply torque to the wheel. Bicycle hub motors require a controller because they cannot run directly on DC power. The controller transforms the DC into a three-phase, variable-frequency AC. This project uses a 36-volt hub motor.

Fig 4: Hub Motor

➢ *Controller*

The primary job of the controller is to process inputs from every component of the bicycle—such as the throttle, battery, speed sensor, display, motor, etc.—and output the appropriate signal. Multiple protections are included in the controller design, including brake, overvoltage, over temperature, overcurrent, and low voltage protection. The project uses a 36-volt controller.

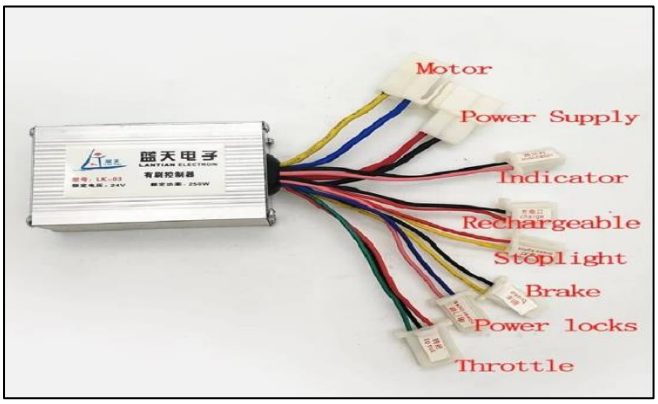

Fig 5: Controller

➢ *Battery*

The solar and dynamo bicycle are using 36v 350w motor to run the Cycle, we are required to supply a voltage of 36 V a rated current of 15.6 A And to make the bicycle run more efficiently for a long duration of time.

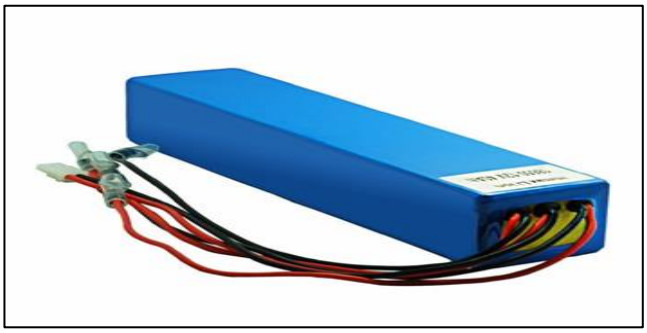

Fig 6: Battery

C. Working

➢ *What is Solar and Dynamo Bicycle?*

The Solar and Dynamo bicycle which is driven with the help of battery where the electric power in the battery is generated from dynamo and solar panels.

➢ *Working Principle:*

It works on the principle that the electromotive force of an A.C. motor which receives electrical energy stored in D.C. battery is converted with the help of D.C. to A.C. converter.

➢ *Operation:*

A solar panel that will be mounted on the bicycle and a dynamo motor that rotates a wheel provide the initial electricity for the device. In order to store this electrical power or energy, direct current must be changed into alternative current in a battery. Thus, when acceleration is applied, this alternate current aids in rotating the sprocket wheel. Bicycles powered by solar and dynamo power can thus be operated.

D. Design Calculation

➢ *Problem Statement*

- Diameter of wheel [D]= 0.45-meter Speed [V] = 10 km/h
- Weight of bicycle [W1] = 40 kg
- Weight of rider [W2] = 60 kg Total weight W = 100 kg

➢ *Power Calculation*

Normal calculation on each tire
N1 = W/2 N= 100/2
N= 50 Kg

Earth gravity act = 9.81
N = 50*9.81
N = 490.5 N

Friction force act on each tire
$F = u * N1\ F = 0.3 * 490.5\ F = 147.15\ N$

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➢ *Torque Requirement*

$T = F * r\ T = 147.15 * 0.225$
T = 33.10 NM

➢ *Speed Calculation*

$w = V/r\ w = 10000/0.225 * 3600\ w = 12.34 rad/sec$
$N = W2 * w/2 * 3.14$
$N = 60 * 12.34/2 * 3.14\ N = 117.82 RPM$

➢ *Power Requirement*

$P = 2 * 3.14 * NT/60$
$P = 2 * 3.14 * 353.7 * 33.10/60\ P = 408\ W$

Selection of a motor 408 W of power is needed to operate the bicycle, and the rider is assisted by solar power. As a result, a 350 W, 48 V standard motor with a lower power rating is chosen.

➢ *Battery Choice*

The battery voltage rating should be 36 V since the chosen motor is 36 V, and the current rating is determined by $P = V * I = I = P/V = 350/36 = 9.72\ Ah$. As a result, 36 V 7.0 Ah in series combination is required to obtain 36 V output.

➢ *Panel Choice*

We make use of two 20 W panels. It takes 40 V to develop the voltage and 20 Watts of time to charge the battery panel. charging duration: 8.4 hours (36*7/40).

➢ *Dynamo Selected*

We have selected 240 Volt motor. so we selected 50W dynamo. Charging time $36 * 7/50 =$ 3.36 hours.

➢ *Result*

- Voltage of motor = 36volt 350 watt
- Rated speed = 10 k mph
- Current rating = 9.72Ah
- Lithium-ion battery = 36 Volt 7.5 Ah
- Power required = 408 W
- Speed in RPM = 117.82 RPM

E. Advantages

- Renewable energy source.
- Reduces the use of fossil fuels.
- Technological development
- Reduces air and noise pollution
- Low maintenance cost
- This can be used even in the absence of sun light
- It has an alternate source of power generation using dynamo
- It is a combination of both non-polluting and cost efficient.

F. Fabricated Model

Fig 7: Photo with Fabricated Model

III. CONCLUSION

- The hybrid bicycle powered by solar and dynamo can be an excellent use of renewable energy sources, helping to cut down on pollution and serving as a helpful tool for rural communities without access to adequate electricity.
- This device can function even in the absence of sunlight because it has a backup power source that uses a dynamo.
- Despite the low efficiency of solar cells and their high cost, it can last for a longer period of time. It is a hybrid of non-polluting and health-maintaining equipment.

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