HUMAN AND SOLAR HYBRID ENERGY GENERATION

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ABSTRACT

It is known that the supply of fossil fuel is less and limited and their utilization as energy source causes environment degradation and environmental pollution due to unfinished ignition. In addition to this, as world population increases will result in increasing in a demand of energy sources, so it is need to replacement of fossil fuels with renewable source of energy. Power generation by Renewable system is now used for generation of clean power. We made the paper to generate electricity by using human energy as well as solar energy.

In this paper, we convert mechanical energy of bicycle pedal in hybrid with solar energy in to electrical energy that can be stored in battery which is used for drive various electrical appliances. The main advantage of this paper is one can generate electricity by own self and use it for own purpose.

In this paper bicycle wheel is coupled with generator, due to rotation of wheel by pedal the generator will produce electricity. In parallel solar panel also convert sun energy in to electrical energy. This energy can be stored in battery which is used when we needed.

Key words: bicycle, generator, solar panel, regenerative.

1. INTRODUCTION
Kartik Mishra et al used in [1] a DC hub motor to run a bicycle in static arrangement. They have placed a motor in front or rear axel. They have used solar and dynamo arrangement to run hub motor. B.Venkataramana et al [2] produced electricity by rotating motor shaft using bicycle pedal. However in this arrangement when bicycle is in ideal condition then electricity cannot be produced.

This paper emphasizes on the idea of finding out the efficient use of the human muscle power as a non-conventional source of power which are wasted while people in the gym are exercising to lose their extra body energy or while doing cycling as a transportation purpose in villages or cities. Due to the shortage of electricity, many of people are living without electricity. This is because of some limitation of government like shortage of land, drought, less amount of fund to build power plant etc. The electrification of remote areas and villages is still a challenging issue.

In this paper we proposed a hybrid scheme for power generation using solar energy and/or human energy. We have used a PMDC motor on the bicycle itself so bicycle can be movable. To overcome the difficulties associated with motor placement in wheel itself we used a belt to drive a motor shaft. we used battery charge controller, which prevents overcharging and may protect against overvoltage in battery. It is also prevents completely draining battery or perform controlled discharge, depending on the battery. The main advantage of this paper is one can generate electricity by own self and use it for own purpose. And also it is used in regenerative mode also. In regenerative mode supply from battery rotates the motor which helps the wheel to run a bicycle. In this paper bicycle wheel is coupled with generator, and generator shaft is rotate with rotation of wheel. In parallel solar panel also convert sun energy in to electrical energy.

2. METHODS OF GENERATING ELECTRICITY
There are many methods [3] for transforming other forms of energy into electrical energy like,

- Static electricity:- electricity can be produce from the physical separation and transport of charge.
- (Examples: tribo electric effect and lightning)
- Electromagnetic induction:- in this method electrical generator or alternator converts mechanical energy into electrical energy. It is based on Faraday's law.
- Electrochemistry:- in this method direct transformation of chemical energy into electrical energy occurred. (Examples: battery, fuel cell).
- Photoelectric effect:- in this method solar or sun energy is converted in to electrical energy. (Examples: solar cells in solar panel).
- Thermoelectric effect:- in this method direct conversion of temperature difference in to electrical energy occurred. (Examples: thermopiles, and thermocouples).
3. COMPONENTS

3.1. Bicycle

- A bicycle is also called as cycle or bike. It is a pedal driven, human powered vehicle.
- Bicycle is used for many purposes in our day to day life. Bicycle’s discovery has had an
  giant effect on the world both in terms of culture and advancing modern industrial
  methods. The Bicycle is prime need of transportation in many villages.

3.2. PMDC Motor

In every DC motor, armature rotates inside a magnetic field and will work on following
principle.

For Construction of DC motor it is require producing magnetic field. The magnetic field
produced by magnet. This can be electromagnet or permanent magnet.

If permanent magnet is used to create magnetic field in a DC motor, it is called as
permanent magnet DC (PMDC) motor.

PMDC motor used in automobiles, washer, and air conditioner.

In this type of motor magnetic field strength is fixed so, it cannot controlled by field
control method.

The poles of motor are made of permanent magnet. It consists of stator and armature.
Stators are made of steel cylinder and magnet mounted in inner side of cylinder.

When conductor which is carrying a current is placed in a magnetic field, conductor will
experienced a mechanical force and direction of force govern by Fleming’s left hand rule.

Armature rotates in the direction of force.

Mechanical force F = B I L

Where B = magnetic field strength in tesla
I = current in conductor
L = length of conductor

Each conductor experiences a force and which will result in production of torque, which
tends to rotate armature.

3.3. Battery Charge Controller

- The charge controller limits the rate at which electric current is added to or drawn from
  batteries.
- It prevents overcharging and may protect against overvoltage in battery. Over charging
  can reduce battery efficiency and also battery performance or life spans.
- It is also prevent completely draining a battery, or perform controlled discharge,
  depending on the battery, to protect battery life.
Figure 1 Solar charge Controller circuit

Figure 2 simulation of Solar charge Controller circuit

- Above figure shows the multisim simulation of solar charge controller. In which we have used a LM324 IC, zener diode 5.1V, diode 1N4007, transistor BC548, LED, capacitor 1000uF, resistor, pot 47K and relay 12V/10A.

- Solar panel output is followed by the capacitor which removes AC ripple. The non inverting terminal of IC is connected to a zener diode and 1K resistor. Which makes a reference voltage of 5.1V. and its inverting terminal is monitor battery level.

- Now comparison between battery voltage and reference voltage will be done.

- If the value of battery voltage is lower than threshold value, then output of comparator will be positive. Then transistor is turned ON.

- When it goes reverses, output is low and so, transistor will be turned OFF and supply will be cutoff.

3.4. Solar Panel

- A Solar panel is made up of solar cells that can be used as a component of a larger photovoltaic system in order to generate and also supply electrical energy.
Human and Solar Hybrid Energy Generation

- Solar cells use sun energy to generate electrical energy through the photovoltaic effect. Most of the modules use wafer-based crystalline silicon cells made up of cadmium, silicon or telluride. solar cells must be protected from mechanical damage and moisture or dust.
- When the electrical connections are done in series to produce a desired output voltage as the voltage adds up and/or can be connected in parallel to provide a desired current capability because current adds up in parallel connection. The conducting wires that take the current off the modules may be made up of silver (Ag), copper (Cu) or other non-magnetic conductive metals.

4. DESIGN OF BICYCLE GENERATOR

4.1. Block Diagram

![Figure 3 Block Diagram](image)

4.2. Hardware Required

- Bicycle
- Generator
- Solar panel
- Combined box
- Charge controller
- Battery
- Belt
- Stand
- pulley
4.3. Actual Model

First of all, we take bicycle and modified it such that we fit a extra ring at back wheel of bicycle. We used PMDC motor as generator and it is fitted on bicycle.

We used co-ring as belt to connect motor and back ring. As we run the bicycle motor will rotate with rotation of back wheel and produced DC voltage which is used to charge the battery. The production of voltage depends on what speed the motor will rotate.

For continuous and more generation of energy we also hybrid solar with our model. Hence in this way we also charge the battery by using solar power.

To protect the battery from overcharge we made charge controller circuit for solar and motor.

We can use this stored power of battery to run DC bulb, charge the mobile and laptop also by providing inverter circuit we can run various electrical equipments.

When generated electricity being surplus then we can provide this energy to the generator so it acts as a motor and run in a regenerative mode. which helps the bicycle to rotate the wheel.

In this project we used following rating of components.

4.4. Ratings

PMDC MOTOR:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>24V DC</td>
</tr>
<tr>
<td>Power</td>
<td>100 W</td>
</tr>
<tr>
<td>RPM</td>
<td>3000 rpm</td>
</tr>
</tbody>
</table>

BATTERY:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12V</td>
</tr>
<tr>
<td>AH rating</td>
<td>7.2AH</td>
</tr>
</tbody>
</table>

SOLAR PANEL:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>30.5V</td>
</tr>
<tr>
<td>Power</td>
<td>20W</td>
</tr>
</tbody>
</table>
5. CALCULATION

- Average power generated by normal person in 2 hours is approximately 220W to 320W.
  
  \[ \text{Power}(P) = \text{voltage}(V) \times \text{current}(I) \]
  
  If battery of 12v, 7.2 Ah
  
  \[ P = (12) \times (7.2) = 86.4W \]
  
- Assume 90% efficiency of battery
  
  Hence, \[ P = 0.90 \times 86.4 = 77.76W \]

6. RESULTS AND DISCUSSION

The production of electricity from bicycle generator is depends upon the speed and time duration of peddling the bicycle. We get uninterrupted electricity during day time by connecting solar panel parallel to bicycle generator. This model is also used in regenerative mode. By providing supply to the generator then it works as a motor, which helps the bicycle wheel to rotate.

7. CONCLUSION

In many villages there is a problem of frequently power cut so, we can increase the availability of electricity using this scheme. Nowadays people are very conscious about their health so they are going to gym for exercise. This scheme also used for exercise purpose and by doing cycling electricity can be produced. In villages bicycle is a main mode of transportation so, we can produce electricity as a side product, which is economical too. In this scheme we are producing electricity by renewable energy so, pollution due to fossil fuel will be decrease. By using this arrangement one can produce electricity by own self. So, electricity bill can be reduced. This scheme can be implemented in rural area where main mode of transportation is bicycle and occurred very shortage of electricity. This modal use in regenerative mode also. By providing supply to the generator it works as a motor, which helps the bicycle wheel to rotate.
REFERENCE


