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Hybrid Power Generation System using Wind Energy and Solar Energy

Bhagwat A. Bhagat[1], Rohit R. Bhondve[2], Amol V. Maske[3], Sachin V. Ravate[4], Ganesh Karpe[5]
[1,2,3,4]*Student, Dept. of Mechanical Engg., PCET's Nutan Maharashtra Inst. of Engg. and Tech., Talegaon, India*
[5]*Asst. Prof., Dept. of Mechanical Engg., PCET's Nutan Maharashtra Inst. of Engg. and Tech., Talegaon, India*

***Abstract*: Now a day's electricity is most needed facility for the human being. All the conventional energy resources are depleting day by day. So we have to shift from conventional to non-conventional energy resources. In this the combination of two energy resources is takes place i.e. wind and solar energy. This process reviles the sustainable energy resources without damaging the nature. We can give uninterrupted power by using hybrid energy system. Basically this system involves the integration of two energy system that will give continuous power. Solar panels are used for converting solar energy and wind turbines are used for converting wind energy into electricity. This electrical power can utilize for various purpose. Generation of electricity will be takes place at affordable cost. This paper deals with the generation of electricity by using two sources combine which leads to generate electricity with affordable cost without damaging the nature balance.**

***Keywords*: Design, Fabrication, solar energy, Wind energy, windmill.**

1. Introduction

Electricity is most needed for our day to day life. There are two ways of electricity generation either by conventional energy resources or by non-conventional energy resources. Electrical energy demand increases in word so to fulfill demand we have to generate electrical energy. Now a day's electrical energy is generated by the conventional energy resources like coal, diesel, and nuclear etc. The main drawback of these sources is that it produces waste like ash in coal power plant, nuclear waste in nuclear power plant and taking care of this wastage is very costly. And it also damages he nature. The nuclear waste is very harmful to human being also. The conventional energy resources are depleting day by day. Soon it will be completely vanishes from the earth so we have to find another way to generate electricity. The new source should be reliable, pollution free and economical. The non-conventional energy resources should be good alternative energy resources for the conventional energy resources. There are many non-conventional energy resources like geothermal, tidal, wind; solar etc. the tidal energy has drawbacks like it can only implemented on sea shores. While geothermal energy needs very lager step to extract heat from earth. Solar and wind are easily available in all condition. The non-conventional energy resources like solar, wind can be good alternative source. Solar energy has drawback that it could not produce electrical energy in rainy and cloudy season so we need to overcome this drawback we can use two energy resources so that any one of source fails other source will keep generating the electricity. And in good weather condition we can use both sources combine.

2. Problem statement

1. As we can see, there are many problems that occur in the previous type of solar tracking system. The problem that we can see here is the solar panel that is use is only in one-way direction. Because of this problem, the power that can be generated is low.
2. The second problem is the price for the solar tracking system is very expensive for the family that use more power than usual because they need to install more than one solar panel to produce enough power. So, this project is to fix the problem that occurs here. This solar tracking system can detect a 180 degree of rotation. So, the solar panel that can be generating here is very high compare to when the solar panel can only stay in one direction. So, the families don't have to install more than one solar panel to generate enough power. One solar panel is enough to produce a lot of power.

3. Objectives

- In Remote areas implementing power systems units at each apartment.
- Multistoried buildings, Homes, schools.
- Street lightings covering a large area.
- Off grid applications, solar water heaters.
- Electric kettles solar vehicles, Traffic signaling

4. Project scope

This project is focused to design and build the prototype of solar tracking system that would be starting point to build.

The realistic solar tracking system. Therefore, this prototype will cover the scope as followed.

- Move 180° movement that this system.
- Using Arduino.
- Using DC motor.
- Using Light Dependent Resistor (LDR) or Photo

resistor as a sensor.

5. Types of renewable energy

A. *Hybrid system*

Hybrid energy system is the combination of two energy sources for giving power to the load. In other word it can defined as "Energy system which is fabricated or designed to extract power by using two energy sources is called as the hybrid energy system." Hybrid energy system has good reliability, efficiency, less emission, and lower cost.

B. *Solar system*

Solar energy is that energy which is gets by the radiation of the sun. Solar energy is present on the earth continuously and in abundant manner. Solar energy is freely available. It doesn't produce any gases that mean it is pollution free. It has greater efficiency than other energy sources. It only need initial investment. It has long life span and has lower emission.

C. *Wind power system*

Wind energy is the energy which is extracted from wind. For extraction we use wind mill. Ii is renewable energy sources. The wind energy needless cost for generation of electricity. Maintenance cost is also less for wind energy system. Wind energy is present almost 24 hours of the day. It has less emission. Initial cost is also less of the system. Generation of electricity from wind is depend upon the speed of wind flowing.

6. Conceptual diagram

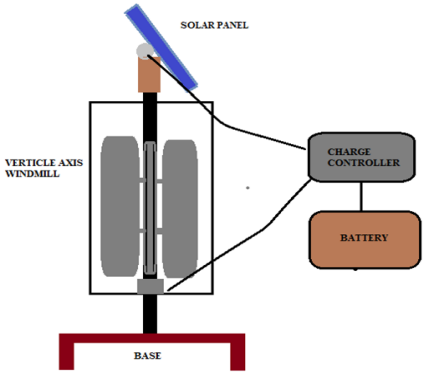

Fig. 1. Conceptual diagram

7. Components of the system

1. Solar Panel
2. Windmill
3. Arduino
4. Charge Controller
5. DC generator
6. Gear arrangement

8. Solar tracking

A. *Working principle of the tracker*

Fig. shown here is the tracking device in out prototype. It is the one which follows the sun's movement throughout the day and provides uninterrupted reflection to the solar panel. The sun rays will fall on the solar panel in two ways, which is, they will fall directly on the solar panel and also the reflector will reflect the incident rays on the solar panel. Suppose at the time of sun rise the sun is in extreme east the reflector will align itself in some position by which the incident rays will fall on the solar panel. Now when the earth rotates and the sun gets shifted from its earlier position the reflection of the incident rays will also change. Thus as a result the light will fall on the sensors kept on each side of the solar panel. The tracking circuit is so designed that when reflection falls on say the sensor attached to the right of the panel, the tracker will move towards the left, and vice-versa. Similar is the case when the reflection falls on the sensor attached at the top of the panel, circuit will make the tracker to move downwards. We here have tried to bring two simple principles together. One being, the normal principle of incidence and reflection on which our tracker works.

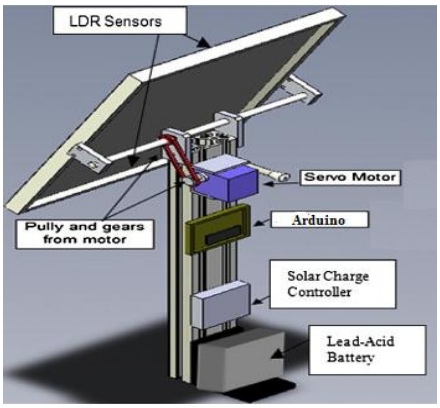

Fig. 2. Solar tracking

9. Design of components

Design calculation of the VAWT is done by considering the speed of the air impacting blades of the turbine it starts rotating, blades connected to generator that generates the power. The power is used for some useful work.

A. *Design of blade*

The blade is designed in semicircular shape so as one blade passes another blade comes in the position of first. 3 blades are used so as to use of maximum utilization of wind from air and moving vehicle.

A= d*h
d= diameter of the rotor (m)
h= height of the blades (m)
So area= (0.75*0.4)
= 0.3 sq. m.

This height and diameter is chosen due to restriction of use of more rotor diameter due to available of less space to install on highway. In the project three blades with vertical shaft are used, it has a height & width of 750mm & 400mm respectively. The angle between two blades is 120 degree. The material used

for the blade is PVC pipe.

Fig. 3. Blade of the system

B. Design of Shaft

While designing the shaft it should be properly fitted to blade. The shaft has diameter of 12 mm so as to easily fix.

10. Theoretical power calculation

The wind mill works on principle of converting kinetic energy of the wind in to mechanical energy. The K. E of any particle is equal to the one half of its mass times the square of its velocity, or ½ mv^2.

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Kinetic energy, K.E. =½ mv_2. …….. (1)

Where, m = mass, v = velocity, Density ρ of air,

Mass = ρ AV ……. (2)

Substituting eqn (2) in eqn (1) we got,

K E = ½ ρ AV3 watts, ρ = density of air (1.225 kg/m3)

Available wind power Pa = (½ ρ π D^2 V^3)/4

P = 1/8 ρ π D^2 V^3

TRAIL 1

FOR VELOCITY 4.5 m/s

Pa = (½ ρ π D^2 V^3)/4

Pa = (½*1.225*π*0.4*0.4 *4.5^3)/4

Pa = 7.1watt

TRAIL 2

FOR VELOCITY 5.5m/s

Pa = (½ ρ π D^2 V^3)/4

Pa = (½*1.225*π*0.4*0.4 *5.5^3)/4

Pa = 15.1watt

TRAIL 3

FOR VELOCITY 7.5m/s

Pa = (½ ρ π D^2 V^3)/4

Pa = (½*1.225*π*0.4*0.4 *$7.5^3$4

Pa = 33 watt

TRAIL 4

FOR VELOCITY 10m/s

Pa = (½ ρ π D^2 V^3)/4

Pa = (½*1.225*π*0.4*0.4 *10^3)/4

Pa = 77 watt

Table 1
Testing and result

S. No.	Wind speed m/s	Speed of shaft	Voltage
1	2 to 3	109 to 121	3.9
2	3 to 4	189 to 201	4.8
3	4 to 5	271 to 320	6.2
4	5 to 6	328 to 353	8.8
5	6 to 7	390 to 396	9.2
6	7 to 8	400 to 409	12

11. Battery and Solar Panel Calculation

Power (watts) = volts * amps

In order to charge the 12V, 7A battery, various solar panels having different power range is available.

Table 2
Battery and solar panel

Capacity	Time required for charging (hours)
For 6 W	14 hrs.
For 10 W	8.4 hrs.
For 20 W	4.2 hrs.

- Your 10W solar panel puts out about 10Watts/12Volts = 0.83Amperes under optimum conditions.
  Assuming that you have optimum conditions for approx. 6Hours per day, the charge delivered will be 0.83A * 6H = 5AH per day.
  Your battery is not rated at 7A, but 7AH (Ampere Hours). If you run it completely dead, the charge time will be 7AH /0.83A = 8.4Hours.

Hence, it will be advisable to use 10 W. solar panel which can fully charge the 12 V, 7A battery in 8 hours.

Solar panel selected = 10 W solar panel

A. Applications

- Islanded system (remote areas)
- Hybrid vehicle (fuel less)
- Industrial power saver
- Distributed power generation

B. Advantages

- Green, environment friendly
- Efficiency improvement
- Higher output power
- Economical benefits

12. Conclusion

Obviously, a complete hybrid power system of this nature may be too expensive and too labor intensive for many Industrial Technology Departments. However, many of the same benefits could be gleaned from having some subset of the system, for example a PV panel, batteries, and an inverter, or even just a PV panel and a DC motor. The enhancements to instruction, especially in making electrical power measurements more physical, intuitive, and real world are substantial and the costs and labor involved in some adaptation of the ideas in this paper to a smaller scale setup are reasonable.

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