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Power Generation on High Way by Using Vertical Axis Wind Turbine with Solar System

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ABSTRACT: Energy is an important aspect in our every day's life. The resources we use are limited whereas the population consuming the same is increasing day by day. Therefore there is a need of finding a way to establish a relationship between a natural resources and growing population. In this context wind energy play the vital role in maintaining the relationship between human being and an energy requirement. Wind energy is free of cost and available with ease. Tapping of wind energy is essential for the conservation of other nonrenewable resources. Wind energy has been harnessed for centuries but it has only emerged as a major part of our energy solution quite recently and this project focus on utilizing wind energy by using vertical axis wind turbine. This energy is available in highways; these highways can provide a considerable amount of wind energy to recapture this wind from vehicles while in moving. In the objective of the project, in the present work, vertical axis wind turbine (VAWT) is designed and fabricated as per the specification, the VAWT blades are designed with shape, with less weight and more stiffness, the assembled VAWT is mounted on the highways of a divider, so that the air velocity obtained from the moving vehicle is sufficient enough to cut the turbine blades, VAWT is a special purpose wind mill, this are designed in such a way that the vehicle moving on both the sides of highway are capable to cut the blades of VAWT, the blades are connected to the shaft intern connected to the generator, it generates the power at maximum speed of the generator is 750 rpm, if the generator rotates with full speed it gives an output of 12 volts. This power developed by the VAWT is stored in battery, the power is used for road lamps and many different application some useful application. The solar system is used to generate electrical energy and also installed in a way that it diverts the vehicle air towards the turbine. The generator with the gear mechanism is connected to the shaft of the vertical axis wind turbine to generate electricity. The electrical output of vertical axis turbine and the solar system is stored in a battery. This stored energy which can be further used for street lighting, toll gates, etc.

KEYWORDS: vertical axis design, renewable energy source, battery system, solar plates, Highway medium

I. INTRODUCTION

In a day to day life, the demand for the electricity is much higher than the production of electrical energy. One of the major problem is ever since the natural resources are going to finish one day. The fossil fuel major role in production global warming, a greenhouse gas, etc. currently 68 percent of the electrical energy produced by the thermal power plant and remaining 22 percent included hydropower plant, nuclear power plant, gas power plant and as we realized the fossil fuel is finished in one day. Solar and wind both are renewable energy sources. Solar energy available begins of day and the wind energy is maximum on the highway due to the speed of the vehicle. The motivation of this project contributes the global trend toward clean energy. The main motive behind this project is to design a vertical axis wind turbine which effectively uses the wind energy generated by the vehicle speed on the highway. So the maximum wind energy can be extracted by the vertical axis wind turbine as compared to the horizontal axis wind turbine. We have designed modified savonius vertical axis wind turbine which is more efficient than old savonius design. in modified vertical axis turbine we twisted the blade of the turbine to gain maximum spin on low pressure of the wind, we also try to achieve less vibration at gear moment .This turbine works under all the environmental condition and cyclone also. This design of the blade enables the turbine to rotate in clockwise and anticlockwise directions. The arrangement of solar plats is in such a way that they divert the vehicle air towards the turbine for effective use of vehicle air. The solar system generates the electrical energy by sun radiation in day mode and from vehicle head light during night mode the generated electrical energy we can use street lighting, toll gates etc.

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II. PROPOSED MODEL AND NOTATIONS

2.1 NOTATIONS

- PWM PULSE WIDTH MOSUKATION
- MPPT MAXIMUM POWER POINT TRACKING
- LED LIGHT EMITING DIODE
- HAWT HORIZONTAL AXIS WIND TURBINE
- VAWT VERTICAL AXIS WIND TURBINE

2.2 PROPOSED MODEL

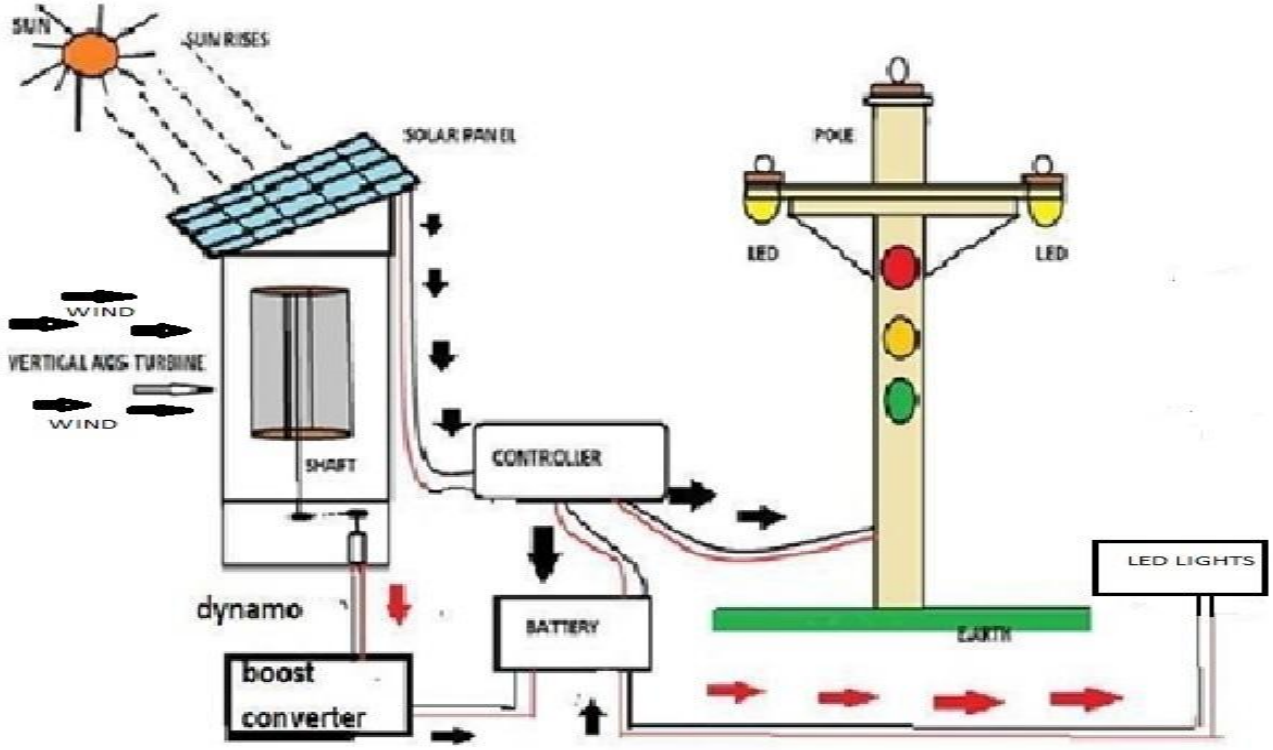

Fig 1 Block diagram of proposed model

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III. EXPLANATION OF BLOCK DIAGRAM

3.1 VERTICAL AXIS WIND TURBINE

Vertical Axis Wind Turbines are designed to be economical and practical, as well as quiet and efficient. They are great for use in residential areas whereas the HAWT is best for use at a business location. There are two different styles of vertical wind turbines out there. One is the Savonius rotor, and the second is the Darrieus model. The first model looks like a 55 gallon drum that is been cut in half with the halves placed onto a rotating shaft. The second model is smaller and looks much like an egg beater. Most of the wind turbines being used today are the Savonius models.

3.2 SOLAR CHARGE CONTROLLER

A solar charge controller manages the power going into the battery bank from the solar array. It ensures that the deep cycle batteries are not overcharged during the day and that the power doesn't run backwards to the solar panels overnight and drains the batteries. Some charge controllers are available with additional capabilities; like lighting and load control, but managing the power is its primary job solar charge controller is available in two different

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technologies, PWM and MPPT. How they perform in a system is very different from each other. An MPPT charge controller is more expensive than a PWM charge controller, and it is often worth it to pay the extra money.

Fig 2 Solar charge controller

Fig 3 Boost converter

3.3 BOOST CONVERTER

A boost converter (step-up converter) is a DC-to-DC power converter that steps up voltage (while stepping down current) from its input (supply) to its output (load). It is a class of switched-mode power supply (SMPS) containing at least two semiconductors (a diode and a transistor) and at least one energy storage element: a capacitor, inductor, or the two in combination. To reduce voltage ripple, filters made of capacitors (sometimes in combination with inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter).

3.4 SOLAR PANEL

Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity. A photovoltaic (PV) module is a packaged, connected assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications.

Fig 4 Solar panel

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3.5 BATTERY

A rechargeable battery, storage battery, secondary cell, or accumulator is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use.

Fig 5 Battery

3.6 DYNAMO

The dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current through Faraday's law. A dynamo machine consists of a stationary structure, called the stator, which provides a constant magnetic field, and a set of rotating windings called the armature which turn within that field. On small machines the constant magnetic field may be provided by one or more permanent magnets; larger machines have the constant magnetic field provided by one or more electromagnets, which are usually called field coils. The commutator was needed to produce direct current. When a loop of wire rotates in a magnetic field, the potential induced in it reverses with each half turn, generating an alternating current. However, in the early days of electric experimentation, alternating current generally had no known use. The few uses for electricity, such as electroplating, used direct current provided by messy liquid batteries. Dynamos were invented as a replacement for batteries. The commutator is a set of contacts mounted on the machine's shaft, which reverses the connection of the windings to the external circuit when the potential reverses, so instead of alternating current, a pulsing direct current is produced.

Fig 6 Dynamo

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IV. WORKING PRINCIPLE

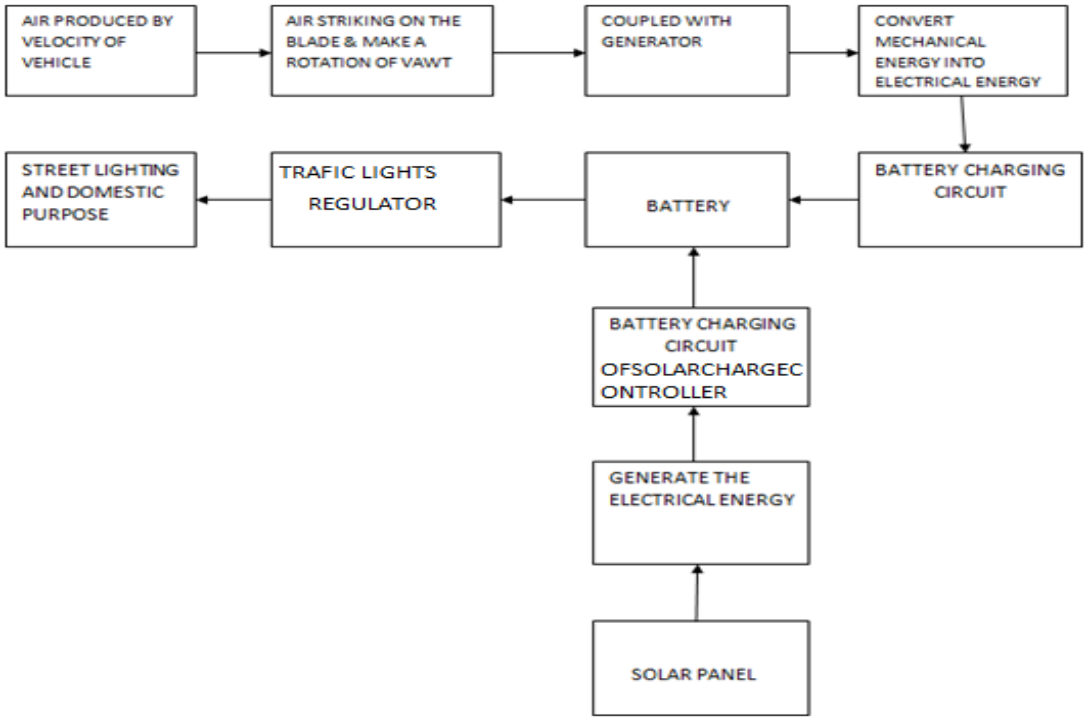

Fig. 7 Block diagram of working principle.

Fig 8 Turbine blades and shaft and bearings

The moving vehicle on highway may be all types such as small or heavy vehicles. Whenever vehicle moves on both side of the highway divider then some pressurized air is produced due to the speed of vehicle. This pressurized air is strike on the blade of vertical axis wind turbine and turbine makes a rotation. The shaft of the vertical axis wind turbine is connected to dynamo with the help of pulley mechanism. The generated electricity is an direct electric quantity; the output of the dynamo is given to voltage regulator and stored in the battery. The solar system is mounted on top of the vertical axis wind turbine, the function of the solar system not only generate the electricity but also provides the constant air flow towards the blade of vertical axis wind turbine. The position of solar plates is in inclined nature at an angle 45 degree. A solar cell or photovoltaic cell is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is the physical and chemical phenomenon. It is photoelectric cell, defined as a device whose electrical parameter such as current, voltage or resistance varies when exposed light. Solar cells are the building blocks of photovoltaic modules. The generated electricity is stored in the battery. And total accumulated power given to loads such as street lights and traffic lights.

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V. MEASUREMENTS

5.1. BLADE SPECIFICATIONS

Blade length : 33.5 inches
Blade width : 7 inches
Blade thickness : 0.1mm
Blade angle : 30 degrees

5.2. OVERALL MEASUREMENTS

Tower height : 46 inches

Shaft height : 43 inches

Shaft weight : 1.0kg

Shaft diameter : 1 inch

Pulley inner diameter : 7.283 inches

Pulley outer diameter : 8.283 inches

Dynamo pulley inner diameter : 0.64inches

Dynamo pulley outer diameter : 5 mm
Ball bearing : 1 inch inside
Dynamo : 12V, 775rpm, brush type

Total Area of Blades =diameter*height
=38.1*85.09
=3,241.929 cm
=0.32385 m^2

VI. RESULT AND DISCUSSION

SPEED OF TURBINE(RPM)	OUTPUT OF DYNAMO(VOLTS)
0	0
28	2.5V
43	5.54V
80	11.84

Table 1 Turbine speed and output

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In the tale 1, fig 9, it shows result of the speed of turbine in resolutions per minute and output of dynamo in volts that is for the wind speed (in terms of no of rotations of turbine) we get the corresponding dynamo output.

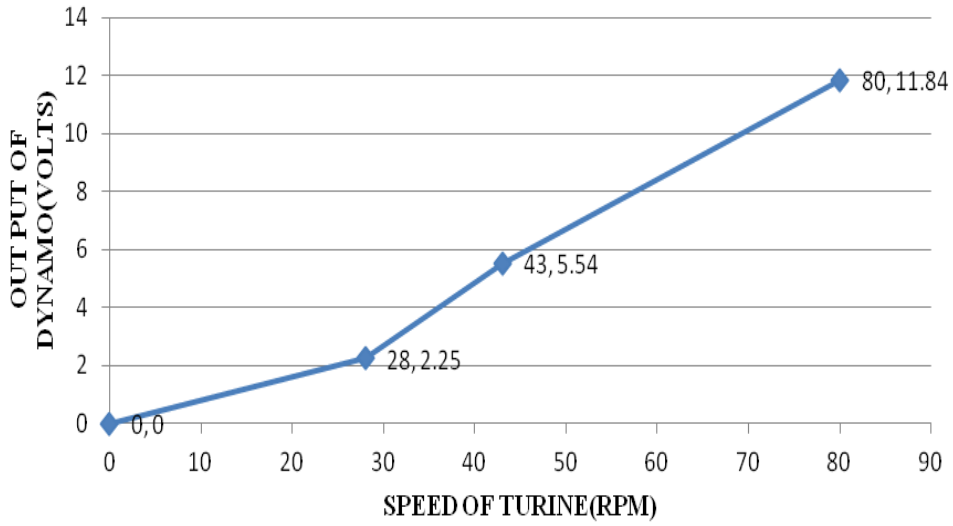

Fig. 9 Graph on output of dynamo Vs speed of turbine

VII. OVERALL VIEW OF THE PROJECT

Fig 10. Overall view of the proposed work model

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VIII. CONCLUSION

This system is environmental friendly. The working model of our project is combine energy source with solar system and vertical axis wind turbine system which is a good and effective solution for power generation, basically this system involves the combination of two energy system, suppose anyone source fails to generate another source will keep generating the electricity and will give the continuous power to the load. The renewable energy sources such as solar and wind energy are used to generate the electricity.

FUTURE SCOPE

A more efficient Wind turbine can be developed using the following measures:

1. Optimizing the design of blades so as to give better aerodynamics.
2. Using a more efficient alternator which produces more voltage for low rpm.
3. Using gear mechanisms to increase rpm for alternator input and hence canhave higher power output from the alternator.
4. Structural fabrication should be more accurate in order to have proper functions of windmill.
5. This turbine can also be fixed near high speed railway tracks inorder to get more energy output.

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