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WORKING DESIGN OFVERTICLE AXIS WIND TURBINE WITH ROAD POWER GENERATION

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ABSTRACT

Now adaysthe requirement of electricity is much higher than its generation,hence the main the objective of our project is to produce electricity in low cost with no effect onenvironment. The Electricity is Produce by using the force of air created by the moving vehicle in highways.A considerable amount of wind energy is produced due to the pressure difference created by the moving vehicles on the highways. This wind energy can be used for the production of electrical energy with the help of vertical axis wind turbinesThis is a new unique method of power generation in low cost .We use arrangement vertical axis blade for power generation called as turbine for power generation. These turbines install on middle on highway so that the wind from both sides of the median will proceed tangentially in opposite direction on both sides of the turbine thereby increasing effective wind speed acting on the turbine.The wind power harnessed through this method can be used for street lighting, traffic signal lighting, toll gates etc.

Keywords: - Blades, Generation, Turbine, , Vehicle, vertical axis, Wind energy

I. INTRODUCTION

In 20th century there was big problem of insufficient storage or supply of electricity, so there is need of developmentof different sources for generation of electricity, with the help of renewable energy sources , in low cost also .overcome such problems absorption of more renewable sources such as sunlight, wind and biomass is essential in the current century. Energy is very much essential for development of any nation Currently, more than 65% of electrical energy is produced biothermal power plants where fossil fuels are used. As we realize that fossil fuels are going to be worn out we're trying to develop other means of power generation. Wind energy is an easy source to produce electricity

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As shown these type of turbine is not install on highway, Because there is not generation of electricity in higher amount. Because of the shape of the blades of turbine no restriction for thrust or air exerted by the vehicles running on highway. So Main aim of our project is to produce more amount of electricity with the help of thrust or air exerted by vehicles on highway in low cost

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1.1 Important terms

A) Impact Wind Energy

B) Anemometer

Impact pressure thrust depends on different factors as follows:-

a) The intensity/frequency of the vehicles traffic.

b) The size of the automobiles.

c) The speed of the automobiles.

d) Distance between the harnessing system &vehicles.

e) Angle of Impact.

f) Velocity of natural wind.

1.2 Objective of Project

1. In corporation of more renewable energy to the power system.
2. Design of a new method of generation of electricity using the wind energy generated by the moving vehicles on the highways.
3. Development Stand-alone system for providing the power to the highways.
4. Provide Charging Port for Electric Cars

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II DATA COLLECTION

2.1 Wind speed and electricity Production

Sr .No.	Velocity of wind	Efficiency
1	**5 m/s**	**32%**
2	**8 m/s**	**62%**
3	**11 m/s**	**92%**

2.2 Reason for Selecting VAWT Over HAWT

Sr. No.	Particulars	VAWT	HAWT
1	Tower Sway	Small	Large
3	Self Starting	No	Yes
4	Overall Formation	Simple	Complex
5	Generator Location	On Ground	Not on Ground
6	Height from Ground	Small	Large
7	Blade Operation Space	Small	Large
8	Noise Produced	Less	Relatively Large
9	Wind Direction	Independent	Dependant
10	Obstruction for Birds	Less	High
11	Ideal Efficiency	More than 70%	50-60%

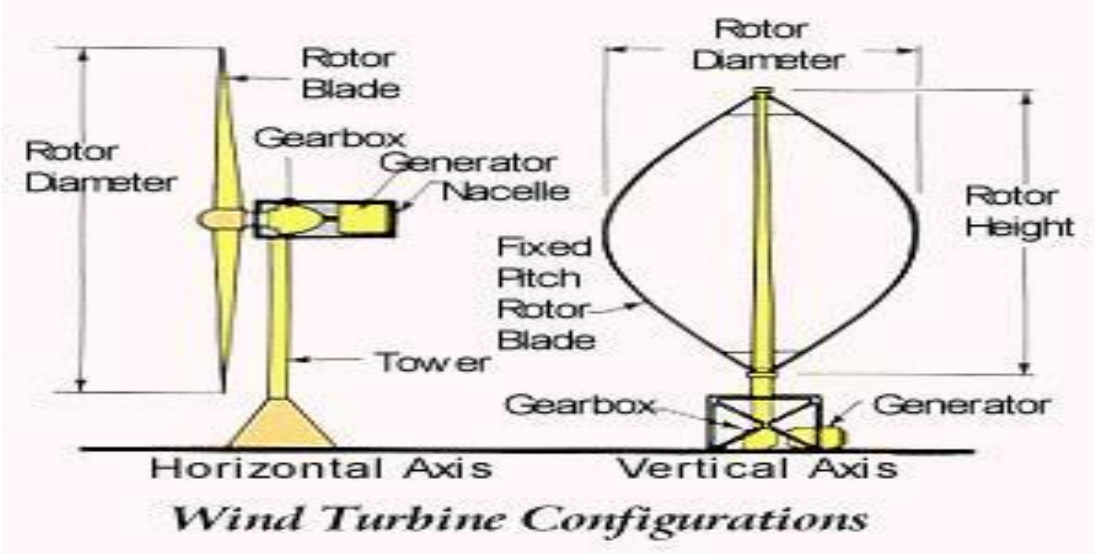
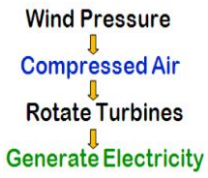


Figure Shows VAWT V/S VAWT

2.2 Velocity of Impact Air at Different height from road surface w.r.t. various vehicles

Sr. No	Types of Vehicles	Height of Anemo-meter from Road Level(cm)	Distance between Anemometer & vehicles(cm)	Velocity of Impact Wind Energy(m/sec)
1	6-wheel truck	40	25	3.4
2	10-wheel truck	40	25	4.6
3	12-wheel truck	40	35	2.9
1	6-wheel truck	60	30	5.7
2	10-wheel truck	60	20	6.9
3	12-wheel truck	60	20	5.4
1	6-wheel truck	80	35	6
2	10-wheel truck	80	25	6.7
3	12-wheel truck	80	20	3.1
1	6-wheel truck	100	20	8.7
2	10-wheel truck	100	20	7
3	12-wheel truck	100	20	4.8

III WORKING PRINCIPLE



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1. Capturing of wind induced by moving vehicles
2. Routing the induced wind in the direction of the wind turbine
3. Converting the energy of the wind into Mechanical energy by using wind turbine
4. Converting that Mechanical energy into electrical energy by using a generating device

IV DESING METROLOGY

Proper design of turbine is very important for proper working of whole set up with the higher efficiency

4.1 Parameters Consider While Designing VAWT

- Speed
- Start up Speed
- Cut in Speed
- Voltage regulation
- Battery Bank Voltage
- Inefficiency
- Blade Material
- Diameter
- Number of blades
- Tip speed Ratio(TPR)
- Taper
- Pitch and Twist
- Bearings

A. Speed of wind

Speed of air is the very important parameter**.** Because in windmill we are using the wind as a raw material for the power production .this bakes the axis rotate and this axis is coupled with a dc generator and makes its also rotate and produce electricity.

B. Height of turbine

When we select the height of turbine very high then these is no effect of air or thrust created by the air When we select the height of turbine too short then the turbine not should rotates properly. So the height of turbine should be accurate, hence it is also important parameter

C. Shape of the blade

Blade selection is one of the major step in the design of a wind turbine. Blades convert kinetic energy from thewind into rotational energy in the turbine shaft.The blades are themost difficult part of the design because they must be propelled by wind in any direction.This necessitates that the blades are curved and angled so that as much surface area isuncovered to the wind flow of air from oncoming vehicles as possible. The blades must also belightweight. The central column design is relatively simple. It is a hollow tube whereon theblades will be attached. It should be large enough to accommodate the width of streetlights

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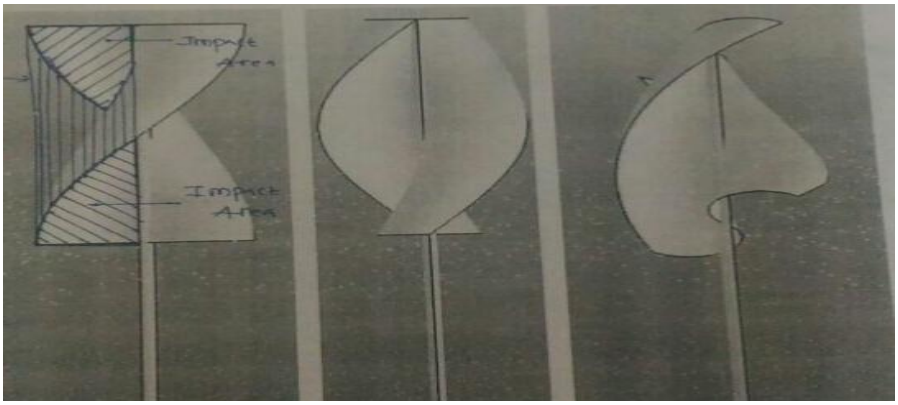

Various design selected for turbine

D. Aerodynamic Shape

This aerodynamic concept shows the forces and velocities cutting in a turbine The resultant velocity vector, W‟ is given

by W'=U'+(-w'*r')

Where,

U‟-undistributed upstream air velocity

(-w‟*r‟)-velocity vector of advancing blade.

$$\alpha = \tan^{-1}\left(\frac{\sin\theta}{\cos\theta+\gamma}\right)$$

Here,

$$\gamma = \frac{\omega R}{U}$$

W, and the blade cords, the resultant air speed flow and the angle of attack are calculated as follows:

$$W=U\sqrt{(1+2\gamma cos\theta+\gamma^2)}$$

The blade turbine must place according to aerodynamic concept. All the variables related to this model definitely varies according to the environment in which it is going to be installed

E .Blade Design

Blade convert kinetic energy of air from fast moving vehicle into rotational energy by the turbine shaft. The rotary motion of shaft is convert into electric energy with the help of PMDC (Permanent Magnet DC) motor and electricity store in battery.Wind energy generated by moving vehicles may not be continuous as there may be idle time with no vehicle traffic and the turbine may need to stop and start frequently. Therefore, start by itself property is one of the important parameter in case of highway wind turbines.

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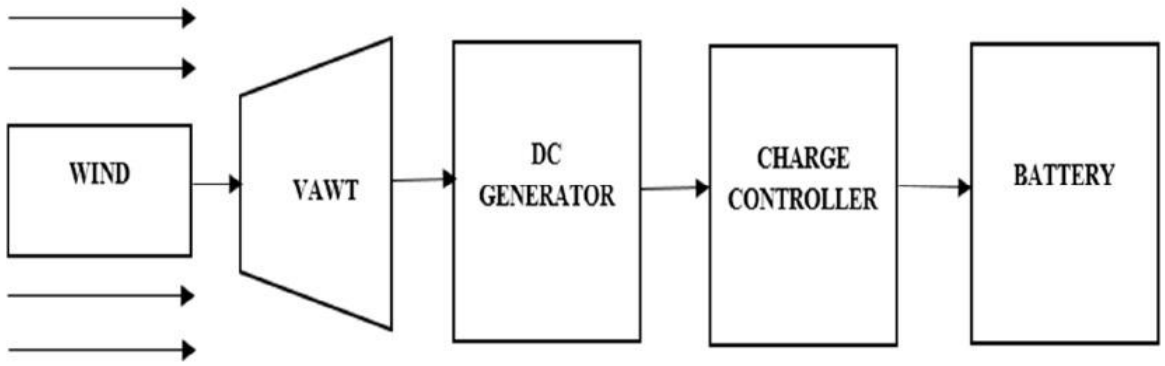
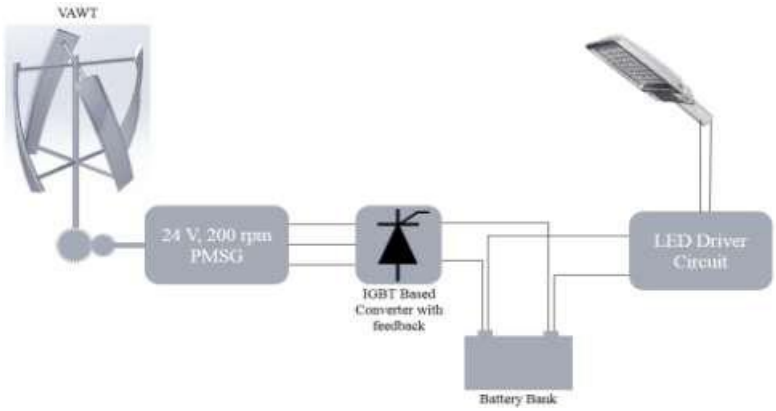
For high efficiency, we used FRP (Fabric Reinforce Plastic) material, so that blade has minimum weight of blade. Shape of bladeis made helical, so it will trap maximum amount of high velocity air & will give high rotation to the turbine shaft. To obtain high rotary motion, the extreme end of blade having high weight. This will help to develop centrifugal force will help in maximum output.

V WORKING CONCEPT

5.1 Block Diagram



5.2 Working Of VAWT



The Working of VAWT is divide into 3 steps

Step 1 .

In the first step the High velocity wind and middle part of the highway will Strikes wind turbine blades and make a rotation in it The wind turbine blade will rotate at clockwise direction even when the vehicle move in any of the side of the highway .because the arrangement of the wind turbine blades are in that manner.

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Step 2

The vertical axis highway wind mill the wind blade turbine is attachedwith the two generators. One is in the top and theother one is at the bottom of the wind turbine blades. when the turbine blade rotate the attached generators will generate electricity in both way

Step 3

Thus, the mechanical energy is converted into electrical energy by using PMDC Motor and this produced power is stored in the battery and is utilize for street light, charging port for electric vehicle, traffic signals and many applications.

VI COMPONENT DETAILS

1. Alternator :- The alternators or generators are the heart of the windmill and it must be properly sized to match your swept area and to produce right type of power to match your application. The unit requirements to make higher voltages at lesser rpm, otherwise it is not suited for wind power use, even motors can also be used a generators. In this vertical axis highway windmill we are using two dc generators coupled with the wind blade turbine.

a) **start up speed:** This wind speed at which the rotors starts turning. It should spin smoothly and easily when you turn it by hand, and keep rotating for few seconds. Designs that „cog" from magnetic force or that use gears orpulley to increase shaft speed will be poor at start up. A good design can start spinning in 5 mph winds cut in at 7 mph.

b) **Inefficiency:** Every generator has a certain speed at which it runs most effectively. But since the wind is continuous varies, we must try to design to happy medium. As the wind speed increases , the untreated power coming into the generator from the wind becomes more than the generator can effectively Use, and it gets more and more electricity . This power is wasted as heat in the stator coils.

VII ADVANTAGES

1. The energy create is environmental pollution free and does not cause any damage to environment.
2. Till now the energy which is waste can be utilized in developmental work.
3. Installation and maintenance charge is no much high.
4. There is no damage to birds and animals.
5. Can be used to produce energy free electricity.
6. Can be use to pump water and develop a well maintained irrigation system.

VIII CONCLUSION

The wind energy generated by the moving vehicles on highways can be utilized to generate electrical energy which can be stored in a battery and used for purposes like street lighting, Electric Car charging etc. This design concept is

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meant to be sustainable and environmentally friendly. If these types of turbines can be installed on long high speed express highways like golden quadrilateral, a considerable amount of electrical energy can be generated, which can solve the issue of energy crisis to a large extend.

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