Power Generation Using Wind turbine with a vertical axis

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Abstract-
The wind is an unconventional form of energy that is rea dily available.The use of vertical axis wind turbines can be used to generate electricity. We chose the highway as the location so that we could optimise the driving of the automobiles on both sides of the road. Our goal is to harness this wind power to get the greatest outcomes and the most electricity possible. In the present study, a turbine for the guide is designed and constructed using a s emicircular blade attached to the disk attached to the shaft. Then the shaft is connected to the pulley with the help of bearings and then it is connected to the alternator that provides the power. The electricity produced is stored in batteries and can be use d for lighting, lighting or telephone reception. The government can choose the project this way and install inexpensive vertical axis wind turbines on the highway.

1. INTRODUCTION

Energy plays an crucial role in our daily life. Without power, it is impossible for men in this world. It is very important to consider the future needs of renewable energy [1]. Some rene wable products are environmentally friendly, non-renewable resources that cause pollution when used. Some renewable energy sources such as geothermal, biomass, solar and wind are most used.Wind energy is one of the largest energy sources. The main problem with this technology is the change in ventilation. Curre nt windmill designs cannot be used in our environment due to their large construction and high cost. It is not very sensitive to all wind directions, but some auxiliary equipment needs to bedirected to the turbine to move downwind. Perfection in design and execution has been achieved and is still being developing.

The major thing which mattersin the traditional way is increase cost of design, transportation, installation, and maintenance.

1.1 Problem Statement

Because Wind turbines with a vertical axis are usually mounted on theground, they cannot take advantage of the higher wind speeds t ypically found at higher altitudes. Therefore, less wind power is available in ground-based vertical axis wind turbines. One solution is to install turbines on roofs and highways.Vertical axis wind turbines generally have low rotation. This is one of the reasons vertical axis wind turbines are less efficient. Due to the rotor design, all the blades of a vertical axis rotor donot become airborne at the same time. So we use curved teeth to do well. A generator directly connected to a turbine is neededto convert mechanical energy into electricity. We can increase the speed of the gearbox by connecting it to the generator.

1.2 Objectives

The main goal is to increase the energy used by vehicles on theroad. Most of the wind is not used to power wind turbines with a vertical axis that harness the kinetic energy of the wind to generate electricity. Different turbulence levels cause greater changes in wind speed and direction. Vertical axis wind turbines (VAWTs) can capture the turbulent winds that present in urban contexts, in contrast to traditional horizontal axis wind turbines (HAWTs). Efforts are being made to develop vertical axis wind turbines with high efficiency. Our goal is to create a simple to use, built-in ball,

halfcut PVC pipe, etc. To design and manufacture wind turbines. This wind turbine is best placed to capture the maxim um wind power from all directions, taking into account the cost and safety of the system. The system can be used in many wa-ys to generate large amounts of useful electricity.

2 LITERATURE SURVEY

N. VENKATA SUBBAIAH, M.L. S DEVA KUMAR "PowerGeneration Using Highway Vertical Axis Windmills" Volume5, 4 December 2017, Designed to provide alternative electricityy for emergency lighting. Electric generators use conventionalelectronic transformers to use wind energy to convert alternating current into direct current (DC).The system generates by utilizing the wind energy generated by the wind turbines in a non-uniform way to generate electricity.

. SAURABH ARUN KULKARNI and BIRAJDAR Mr. " Wind turbines with a vertical axis for use on highways " Impe rial Journal of Interdisciplinary Research Volume 2 Issue 10 2016 It shows that the focus on renewable energy production h as increased in recent years with the increasing pollution of th e environment and the demands of depletion of fossil fuels. M any renewable energy sources include biomass, solar energy, geothermal energy, hydroelectric power and wind power.

BHADANE PRATIK.S, RATHOD SNEHA.A, "Vertical Axis Road Windmill Using Magnetic Levitation", Vol 02, Issue 05 2017. It is argued that the world has a huge amount of wind energy that can be used to generate electricity. Wind energy extr action technology has special features that allow use for desig n.Existing scientific methods are now used to make stronger, lighter and more efficient turbines. In the last few years, the an nual power of the turbines has increased significantly, the wei ght of the turbines and the noise they emit have decreased. Th e Indian Renewable Energy Development Agency (IREDA) a nd the wind industry are working together to deliver these imp rovements through various research and development initiativ es.

YOUNG,TAELEE,HEECHANG LIM "Numerical Study of Aerodynamic Performance of Darrieus Type Vertical Axis Win d Turbine" Vol. 4, 2011. The characteristics and performance of a Darrieus type vertical axis wind turbine with NACA blad ed blades were investigated. The efficiency of the Darrieus turbine can be characterized by power and energy. Many parame ters related to blade design such as beam length, helix angle, pitch angle and rotor diameter affect the performance of the ge nerator.

DEVENDRAPA .M. K, Chandan.S. "Power Development Using Low Cost Vertical Axis Wind Turbines [VAWT]" Vol. 7 number 15 2017. Prototypes of Savonius-type vertical axis wind turbines (VAWT) were built using sim ple materials such as ball-bearing bicycle front wheels, half-cut PVC pipes, wooden roots, and more. The VAWT is put at the centre of the highway with traffic on both sides of the medium speed wind, which increases its kinetic energy and fo rces the turbine blades to rotate clockwise. This drives the rot or connected to the DC generator that generates electricity. Efforts to generate electricity at low cost. This is electricity, s mart highway, telephone booth, street lighting, etc. can be use d in many applications

NIRANJANA SJ "Power Generation by Vertical Axis Wind Turbine" International Journal of Emerging Research in Management &Technology ISSN: 2278-9359Volume-4, Issue-7 presented that there is a straightforward principle at work in wind turbines. The primary shaft, which spins a generator to produce electricity, is attached to the rotor. A wind charger is a wind turbine that is used to charge batteries. The generator generates energy as the wind rotates the blades, which spin a shaft. They can be positioned closer to areas with lower wind speeds because they don't require much wind to produce electricity

3 WIND TURBINE WITH A VERTICAL AXIS

Vertical axis wind turbines, or VAWTs for short, are more attr active and more suitable for use in cities and towns where there is less need for wind currents. This makes VAWT a better choi ce for floor mounting and/or mounting on buildings and roofs, avoiding the installation of higher horizontal turbine structures. Additionally, this type of wind turbine is omnidirectional, mea ning it doesn't have to point the blades into the incoming wind as normally designed. Then there is no hard yawn or tail fin to make sure the VAWT is always facing the right direction. Partly due to their simple, low- friction vertical blade design, vertical axis turbines have relativeeely they can operate under low wind speeds around buildings and infrastructure, not in terms of wind characteristics or direction.Another advantage of vertical axis wind turbines is that they can be placed close to the site of use, thereby reducing the load on an existing infrastructure, reducing environmental conc erns while promoting sustainability. The vertical axis wind turbine differs from conventional wind turbi nes in that its main axis is perpendicular to the ground. Their c onfiguration makes them ideal for both rural and urban environments, giving homeowners the opportunity to offset rising ener gy bills and protect the environment. Also, they do not need th e head position of conventional horizontal axis turbines. A Ver tical Axis Wind Turbine (VAWTS) is a wind turbine in which the main rotor axis is mounted vertically. This configuration has the benefit of allowing the generator and gearbox to be placed close to the ground without requiring the VAWTS to face the wind

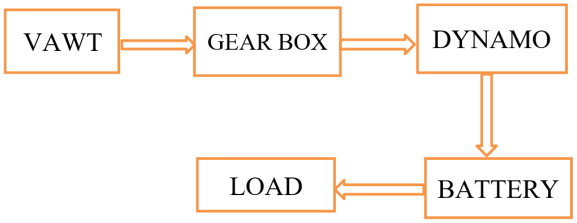

Figure 3.1: Block diagram

3.1 Working of Wind turbine

All wind turbines operate basically the same with minor chang es based on size and configuration. The wind turns the blade, w hich turns the shaft connected to the generator, which produces electricity. Essentially, the rotor takes the kinetic energy of the wind and converts it into electricity. turbines operate on a simple principle. The working principle of awind turbine is simple. The

Three blades that resemble propellers rotate around the rotor due to wind force. The smallest turbines are used in applications such as power for boats or caravans, or to charge batteries that power warning signs. Smaller sized turbines can serve as a small addition to the local electricity supply, while selling unused electricity back to the electricity supplier over the grid. A significant source of renewable energy, wind farms are vast collections of turbines that are used by several nations to wean themselves off of fossil fuels. A wind turbine operates similarly to a fan, to put it simply. Wind turbines use the wind to produce power rather than consume electricity, like a fan. The generator's blade, which is coupled to the wind-driven shaft that revolves to produce energy, is altered by the wind. Since they don't require a lot of wind to generate electricity, they can be placed closer to the area with the strongest winds.

3.2 Major components Of VAWT

In a vertical axis wind turbine, the tower or support structure t hat supports the rotor, gearbox, generator and ancillary equip ment has two or more rotor blades that capture the wind power. A mechanical gearbox is used to increase the speed of the gen erator or alternator. The wind turbine is connected to the Load via cables.

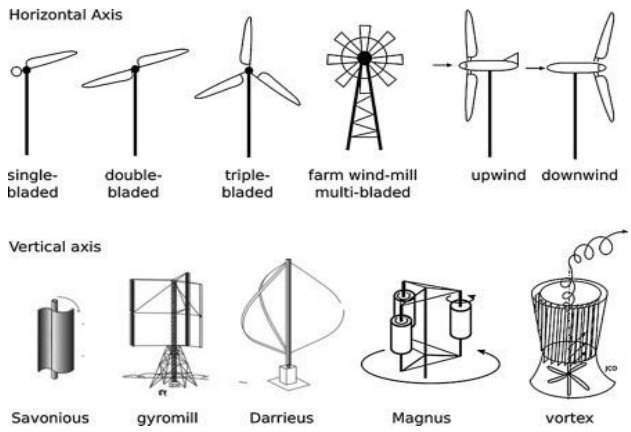

Figure 3.2: Different types of Wind turbines

Components of vertical axis wind turbine are:

I. Shaft

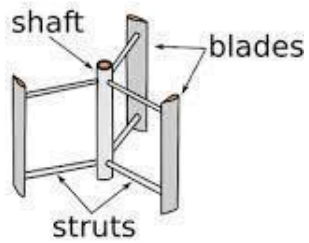

Figure 3.3: Shaft

The shaft is partially rotated by the turbine blades. which is co nnected to a generator in the main building

II Bearing

The purpose of ball bearings is to reduce friction and support r adial and axial loads. It does this by using at least two matche s to fit and deliver the load from the product. In many applications, one bearing is fixed and the other is attached to the assembly

Figure 3.4: Bearing

III Turbine blade

Many iterations were made on the design of the turbine blade,resulting in a unique design for the blade. As seen in the pictur e, the wing is made of galvanized sheet. The hole is drilled in t he middle and at the vertical end to make suitable arrangement s to fix it with the rest of the turbine. The blade design plays animportant role in the smooth operation of the turbine. Therefor e, care should be taken while forming teeth.It should be designed with priority to get the best performance from the turbine.

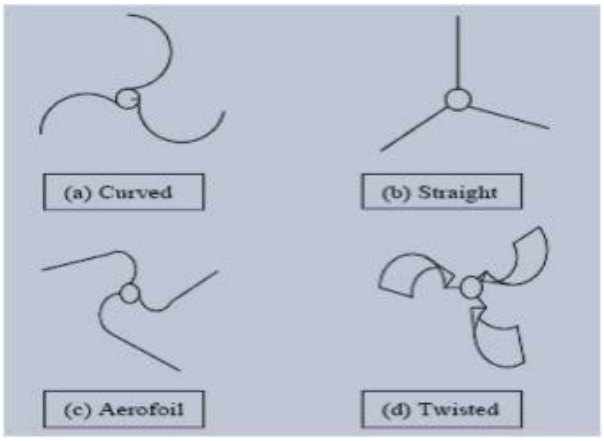

Figure 3.5: Turbine blade

IV Blade Section

Blade selection is one of the most important steps in wind turbi ne design. The turbine's shaft receives rotational energy from the blades, which transform kinetic energy from the wind.. Vertical axis wind turbine s are mainly of two types.

- Drag machines
- lift machines

The tractor moves slower than the wind, is less efficient, and while selfstarting, the lift is faster than the blade wind speed, which is a better result in terms of power, they bounce but they do n't. self march. Wind power generated by moving vehicles will not be stable as there may be periods of idleness when there is no traffic and the

turbine must be stopped and started frequent
y. Therefore, self-starting performance is a major disadvantage of wind turbines Two or three threads are standard, but four is chosen as it solves some issues with vibration, noise and starting. Also, when four blades are used, at least one blade will always be in contact with the air.

V Battery

A battery is an electrical power with one or more electrical cells with external connections used to drive electrical appliances. When using batteries, the positive pole is the negative pole, an d the negative pole is the negative pole. The negative terminal is the source of electrons that will flow from the external circuitto the positive terminal. When the battery is connected to an external electrical source, the redox reaction converts high-energyproducts

Low energy products, and the difference in free energy is export ed as electrical power.

Different types of battery used are

- Lead Acid
- Nickel cadmium
- Lithium ion

Figure 3.6: Battery

VI Dynamo

A generator is an electrical machine that uses an electric moto r to generate direct current. The dynamo was the first generator capable of supplying electricity to industry, and the generators that followed formed the basis for many other electrical transformers, including product changeovers and changeovers. Motor Generator uses a coil and magnetic field to convert the rotation of the machine into alternating current via Faraday's l aw of induction. An electrical machine has a fixed structure called a stator and a series of rotating windings called a stator th at provides rotation with a constant magnetic field called an ar mature. Due to Faraday's law of induction, the strength of a m etal in a magnetic field creates an electromotive force that rep els electrons in the metal, creating a current in the metal.In small machines the permanent position can be maintained by one or more permanent magnets; Large machines have a constant field supplied by one or more electromagnets, often called field coils.

Figure 3.7: Dynamo

VII Gear Box

Gearboxes are used to transfer energy from one electrical source to another and can be found in cars

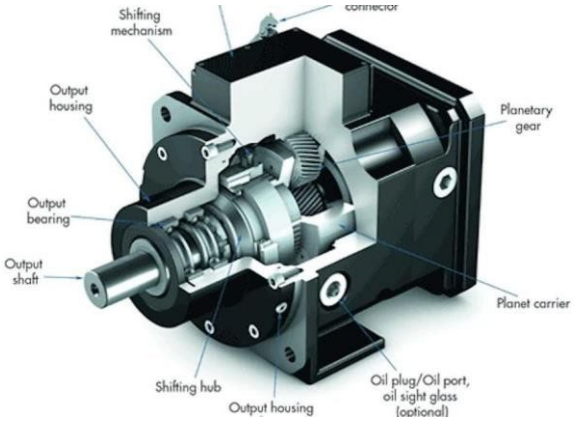

Figure 3.8: Gear Box

VIII. LED

For our project, we're using LED as the load. When current is carried through a semiconductor, a light-emitting diode (LED) emits light. Photons are produced as a result of the recombination of semiconductor electrons with electron vacancies. The energy required for electrons to overcome the semiconductor's band gap determines the colour of the light (as well as the energy of the photon). When different semiconductors or semiconductor materials are coated with light-emitting phosphor, white light is produced.

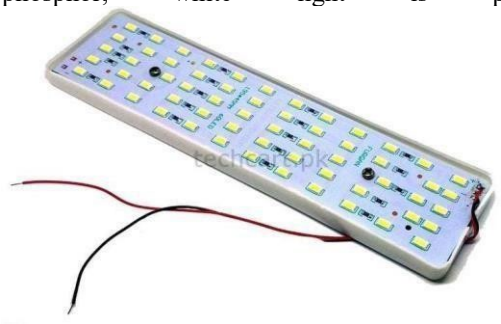

Figure 3.9: LED

3.1 CLASSIFICATION OF VAWTS

The blades transform wind energy into potential energy in

- Savonius wind turbine
- Darrieus wind mill
- Girro mill wind turbine

1. Savonius wind turbine

The Savonius turbine is a simple turbine. Aerodynamically it is a device with two or three buckets. Looking at the rotor from a bove, a machine with two buckets may look like the letter "S"in cross section. The barrel has less resistance while moving against the wind than when going with it because of its curvature. The Savonius turbine also rotates as a result of the difference.

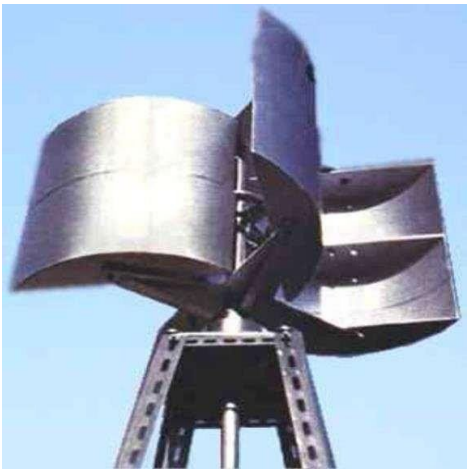

Figure 3.10: Savonius wind turbine

1. **Darrieus wind turbine**

Figure 3.11: Darrieus wind turbine

A Darrieus wind turbine is a vertical axis wind turbine (VAW T) designed to use the power of the wind to generate electricity . A turbine has many curved aerodynamic blades mounted ona rotating shaft or shaft. The curvature of the blade allows the blade to be under tension only at high rotational speeds. Thereare many similar wind turbines that use straight blades. The design of this turbine was patented by the French aeronautical engineer Georges Jean Marie Darrieus; The patent was filed onOctober 1, 1926.Girro mill wind turbine

2. **Girro mill wind turbine**

In order to generate more wind power, gyro mills are vertical axis wind turbines with straight blades. For one half of the turn, each piece offers a positive angle of attack, and for the other half, a negative angle. The VAWT's gyroscopic rotor, which functions like an anemometer cup, is its most basic design. This design was aadopted because it had to reduce the wind speed. Gyroscopic ro tors are rotating machines with three faces. Experiments were performed on four frame gyro rotors and their relative rotations were analyzed. Experiments were made with curved, straight and twisted tooth shapes

Figure 3.12: Girro mill wind turbine

4 ADVANTAGES

1. **Omnidirectional Natural of the Rotor**

Wind entering vertical axis wind turbines is sucked in by the rotor blades from all directions. Horizontal axis wind turbines, on the other hand, must point in the direction of the wind in order to work. They use the yaw mechanism to place the rotors where they will catch the wind. Vertical axis wind turbines may produce energy even under some conditions, such as strong, turbulent gusts, because of its unique operating mechanism. Mountainous and coastal regions are also favorable to them.

2. **Closer Spacing**

A basic rule for horizontal axis wind turbine generating plants is to situate the turbines 5 diameters and about 10 diameters downwind. This is done in order to prevent airflow obstruction and reduce wind speed from one turbine to the next, which would decrease the power output of nearby turbines. Vertical axis wind turbines can be placed in wind farms closer together than horizontal axis wind turbines. This is due to the fact that in choppy weather, vertical axis wind turbines perform effectively. They typically range in diameter from 4 to 6 diameters, and because of their close proximity to one another, the wind farm is able to capture more energy per square metre.

3. **Lower Starting Wind Speed**

Initial wind speeds are lower for vertical axis wind turbines than for horizontal models. An ideal wind speed to start a vertical axis wind turbine is between 2 and 3 m/s. Due to this, vertical axis wind turbines can still produce power when the incoming wind is only moderately strong. Although less electricity is produced from low wind speed, it is better than having wind turbines that cannot h arvest wind energy.

4. Lower Environmental Harm

Most small vertical axis wind turbines offer several advantages such as being environmentally friendly. The rotor blades of wind turbine with a vertical axis do not cast large, continuous shadows because they are built tightly around the shaft. The teeth are also more easily seen by birds and other flying animals, reducing the animal's risk of dying. In addition, vertical axis wind turbines work with less noise, so they do not affect people in settlements.

5. Easier Installation and Maintenance

Vertical axis wind turbines are small and therefore easy to transport, install and maintain. For example, all parts of the turbinecan be transported in a truck and have 6 meters of storage space. Because key components such as generators are built close t o the ground, operators do not have to climb high to access tur bine components.

6. Less Restricted Installation

Another advantage of their size the ability of vertical axis wind turbines to utilize more space than other types. Although local regulations vary, most state governments in Germany approve the installation of wind turbines shorter than 50 meters.

7. Striking Representation

The modern geometric design of the vertical axis wind turbineallows it to operate elegantly and create a smooth view. Their looks perfectly complement homes, schools and parks. By usi ng wind energy, they also directly address the positive value of the organization or community that has a positive outlook.

5 DISADVANTAGES

1. Component Wear-down

Vertical axis wind turbines are usually placed on the ground a nd in crowded places where they encounter more problems an d vibrations. When working, not only does the blade need to be stronger, but the bearings of the rotor and mast also need to be stronger. In previous models, the blade was easier to bend or break. For others, it may require more maintenance, which increases costs.

2. Less Efficiency

It is known that vertical axis wind turbines are less efficient than horizontal axis wind turbine. This is primarily because of the design and functionality of them. On average, horizontal axis wind turbines are 40% to 50% efficient, meaning that the turbine can convert 40% to 50% of the kinetic energy it receives into fire. Savonius VAWTs average 10% to 17%, while Darrieus VAWTsreach 30% to 40%. However, under favorable conditions, a Savonius wind turbine can still generate enough electricity to support two typical households for a year. It is known that Wind turbine with a vertical axis are less efficient than horizontal axis win d turbines. This is mainly due to their design and functionality

. Wind turbines with a horizontal axis are typically 40% to 50% efficient, meaning that the turbine can convert 40% to 50% of the kinetic energy it receives into fire. On the other hand, Savonius vertical axis wind turbines average 30% to 40%, and Darrieus the range of vertical axis wind turbines 10% to 17%.

6. APPLICATION

There are numerous advantages to using vertical axis wind turbines. other uses besides power generation. From the perspective of energy conversion, wind energy can to be changed to electricity and electricity.

- Remote areas can be powered for home use.
- Powering streetlights and highways.
- Connecting VAWT to mains, for example ON GRID.
- VAWT powered engines and watercraft.

7 FUTURE SCOPE

Fixing the solar panel to the vertical axis will increase the effic iency of the wind turbine, and fixing more turbines in series or parallel will provide more efficiency. Wind power can be fully utilized when the estimation of wind turbine blade blows is mi inmixed. This is possible if the wind turbine blades contain holes that close when it pushes and open when it blows differently. The test set is situated at ground level, and it can be tested at various heights.

8 CONCLUSION

Using this technology, entire highways can be illuminated wit hout using renewable energy. Also, this method can generate a lot of electricity if used for all roads in the country. It also h as programs for many scholarships. By boosting the number It's useful more energy and light, thus reducing the accident percentage by at least. Electric generators use conventional elect ronic transformers to use wind energy to convert alternating current into direct current (DC).The system generates electricity using the wind energy produced by installing a wind turbine. The airfoil must be chosen carefully to minimize loss and maximise power. Because wind energy is not stable, wind turbines will operate intermittently and produce varying amounts of electricity; The product should be designed so that it goes down. Blade design plays an important role in turbine and power extraction. To encourage the use of VAWT, problems with various installation, it to. Problems such as poor self- starting, low starting power, small power and poor integration must be overcome. Assuming the turbine is placed in an area with moderate wind and bad blades and a good design, vertical axis wind turbine can achieve high power generation and opera te as electricity generators in remote areas.

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