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# Small Power Generation Vertical Axis Wind Turbine (VAWT) System

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## ABSTRACT

**This article presents a small power generation capacity vertical axis wind turbine for rural application. A vertical axis wind turbine (VAWT) is designed and developed to generate a power of maximum 40 Watts which is best suitable for lightings in rural areas. Currently, Vertical Axis Wind Turbine is more commonly employed for the standalone and high power generation applications. Proposed VAWT system consist of three blades (PVC material is used), low friction bearings for vertical axis support, gear train (to achieve desired speed ratio), dynamos for conversion of mechanical energy to electrical energy. Most of the components are used here to have a low weight so that it can be transported easily and is handy unit. Theoretical calculations show a power generation will be approximately 40 Watts and experimentally we have achieved a power generation of 35 Watts which is close to theory results. Generated power further can be used for lighting purpose in rural area and it is portable can be easily transported to desired location whenever needed.**

***Keywords*— Wind power, power generation, repulsion, VAWT.**

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## I. INTRODUCTION

Wind is generally one of the natural power source which is economical and available in excess quantity .It is form of solar energy which can be used easily to generate electricity. There is enough wind globally to satisfy much of our energy requirements, if it could be harvested effectively on a large scale. Wind energy is a viable option to complement other types of pollution-free generation. Wind turbine technologies have evolved over centuries from traditional wind mills to the sleek and robust turbines we know today. It has become one of the reliable source for major industry since last. 20 years. The general trend of installing wind farm on the location, with adequate wind speed, is becoming increasingly rare. The current trend tends to implement wind farms off shore or to provide wind turbine on high rise building which would ultimately lead to development of inner-city wind power application and such trend would ultimately lead to avoid the transmission loss as the energy will be utilized were it will be produced. Nowadays we here charge our mobile phone in any of desired phone socket, but there are also the people who have to illuminate their homes with kerosene lamp, students which can't study when daylight extinct vegetable that cannot be stored in freezes On the other hand there are also the people who despite of having electricity still have load shading problem or electric cut off. Furthermore, there are the places which don't have electricity access, these are generally poorest and isolated rural areas of developing countries. May be free turbine design that anyone of the generally used commonly available workshop material could build, would make difference in living condition of such people. Vertical axis wind turbine are suitable were such intension is desired. Currently, if we see horizontal axis wind turbines (HAWT) dominate the wind energy market due to their large size and high power generation characteristics. However, vertical axis wind turbines (VAWT) have merit of producing a lot of power, and offer many advantages. Vertical axis wind turbines (VAWTs), can be as efficient as current horizontal axis systems, might be the practical, simpler and significantly cheaper to build and maintain, than those of the

horizontal axis wind turbines (HAWTs). They also have other advantages, such as they are always facing the wind, which might make them a competent player in our quest for cheaper, cleaner renewable sources of electricity. VAWT produced in early days incorporated bearing support, but friction vibration and noise are problem which are accompanied by such structure .Therefore to avoid such problems Magnetic bearings which have low torque/friction and vibration dampening properties will be an effective solution indeed. The space requirement of such turbine is also less and requires little if any maintenance

## II. OBJECTIVES

- To design a small scale, cheaper Vertical Axis Wind turbine (VAWT) which can be installed in small areas such as balconies of houses, terrace etc.
- To design it in such a way that, it can generate enough energy to take part load of households electricity requirement.

## III.METHODOLOGY

The basic working principle of a wind turbine is that when the air moves quickly, in the form of wind, the kinetic energy is captured by the turbine blades. The blades, rotate and spin the shaft that leads from the hub of the rotor to a generator and electricity is produced. The high speed shaft then drives the generator to produce electricity. The low speed shaft of wind turbine is connected to shaft of high speed drives through gears to increase their rotational speed during operation. Using the effects of magnetic repulsion, semicircular shaped wind turbine blades will be fitted on a rod for stability during rotation and suspended on magnets as a replacement for ball bearings which are normally used on conventional wind turbines.

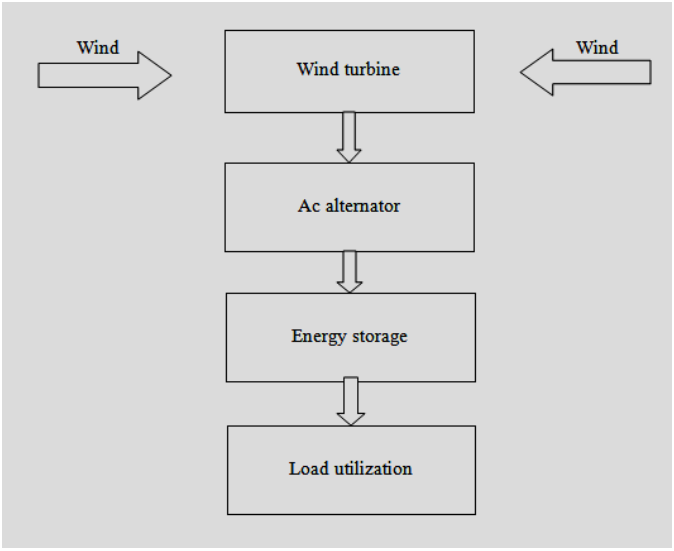


Fig.1 Block diagram of wind power generation.

## IV.MODELLING

Figure gives an idea of MAGNETIC LEVITATED WIND TURBINE. As stated above, it operates on the repulsion property of permanent magnets. Using a pair of permanent magnets like neodymium magnets and substantial support magnetic levitation can easily be experienced. By placing these two magnets on top of each other with like polarities facing each other, the magnetic repulsion will be strong enough to keep both magnets at a certain distance way from each other. The force then created as a result of this repulsion can be further utilized for suspension purposes and is strong enough to balance the weight of an object depending on the threshold of the magnets. Power will then be generated with an axial flux generator, which incorporates the use of permanent magnets and a set of coils[6].

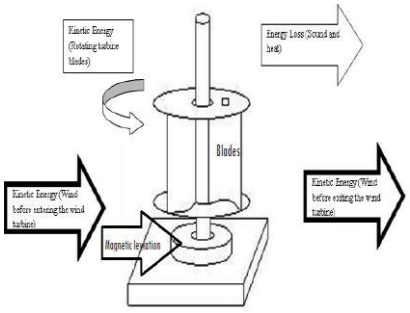


Fig.2 Working model of maglev wind turbine.

## V.CHOICE OF NUMBER OF BLADES

The choice of the number of blades of a wind rotor is critical to its construction as well as operation. Usually the greater number of blades is known to create turbulence in the system, and a lesser number won't be capable enough to capture optimum wind energy. Hence the no of blades to installed should be determined by considering both of these constraints[6].

## VI.MAGNET SELECTION

Some factors need to be assessed in choosing the permanent magnet selection that would be best to implement the maglev portion of the design. Understanding the characteristics of magnet materials and the different assortment of sizes, shapes and materials is bit critical. There are generally four classes of commercialized magnets used today which are based on their material composition each having their own magnetic properties. The four different classes are Alnico, Ceramic, Samarium Cobalt and Boron neodymium Iron also known Nd-Fe-B. Nd-Fe-B is the most recent addition to this list of material and at room temperature gives the highest properties of all magnetic material[8]

## VII. AN ELECTRICAL DYNAMOS

The dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current through Faraday's law of induction. 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. The motion of the wire within the magnetic field causes the field to push on the electrons in the metal, creating an electric current in the wire. 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.

## VIII.CAD MODEL

The modeling of the project is performed in catiaV5. The entire stage is assembled considering the proper axis alignments and surface constraints. The arrangement of different component, in the system is done as shown in the model below.

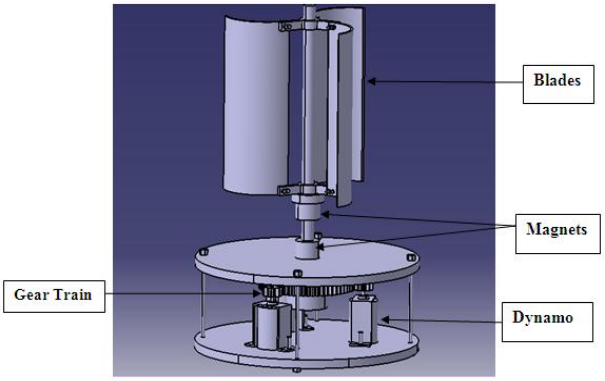


Fig. 3. CAD model of system in CATIA V5

## IX. EXPECTED OUTCOMES

- As have designed vertical axis wind turbine for small scale purpose, it is expected for lightening in the rural areas.
- Stored energy in generator is utilized to light the bulbs ranging from 5 to 40 watt bulbs.

Further it can also be used for charging small devices like mobile phone

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