# Vertical Axis Laviating, Frictionless Windmill

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***Abstract-Wind energy is one of the non-conventional forms of energy and it is available in affluence. Electricity can be generated with the help of vertical axis wind turbine. This focusses on magnetic levitation of wind turbine for power generation magnetic levitation (MAGLEV) is a method by which an object is suspended without any support with the help of strong magnetic field. Vertically oriented blades of the wind turbine are suspended in the air above the base by using neodymium magnet which produce magnetic force to lift up the plates. By the principal of magnetic levitation, the friction is less in wind turbine. The system requires wind for operation and does not require the efficient output for power generation as compare to other wind turbine.***

***Keywords- Wind energy, Vertical axis wind turbine, Magnetic levitation (MAGLEV), Neodymium magnet.***

## I.INTRODUCTION

Wind Power Technology has played a significant role in power production since decades. It is the cheapest available energy resource. Wind Power has become essential to use and can now be considered as a valuable supplement to conventional energy sources. Use of non-renewable sources is not sustainable because they take billions of years for formation. Example: According to BP, 53 years of oil left at current production rate. So, these non-renewable sources, not only are in short supply but also extremely harmful to the environment. For centuries farmers have used windmills to harness the wind for benefit of mankind. Wind Turbine converts kinetic energy of wind into mechanical power. Mechanical power can be used for specific tasks such as grinding grain or pumping water. Generator helps to convert mechanical power to electricity.

The project dwells on implementation of a vertical axis wind turbine for the generation by using magnetic levitation. Maglev Wind Turbine was first presented at the Wind Power Asia Exhibition in Beijing 2007. India was the first country in Asia to develop wind power on a commercial scale. In July 2015, India had installed 23,588 MW and is one of the countries in the world with most wind power on line. Currently, wind power has become commercially viable in India and the fact that 99 per cent of the investments in wind power are made by the private sector is a good indicator that wind power is made by the private sector is a good indicator that wind power can successfully compete with order sources of energy. The Wind Turbine is suspended without any support with the help of strong magnetic field, so it has less friction while rotating which is one of the merits of this wind Turbine. This Maglev Wind Turbine give more efficient output than any other horizontal axis wind turbine.

1. Renewable Energy:

Wind power is the use of wind energy to generate useful work. Historically, wind power was used by sails, windmills and wind pumps, but today it is mostly used to generate electricity. This article deals only with wind power for electricity generation. Today, wind power is generated almost completely with wind turbines, generally grouped into wind farms and connected to the electrical grid.

Fig. 0.1

2. Principle of magnetic levitation (Maglev) :

Magnetic levitation is a method by which an object is suspended without any support with the help of the strong magnetic field. The repulsive force of magnets used for reduction of effect of gravitational force significantly. Magnetic force is used for reducing of gravitational force and to lift up the objects in air. By this technique implementation of this vertical axis wind turbine is used for having negligible friction.

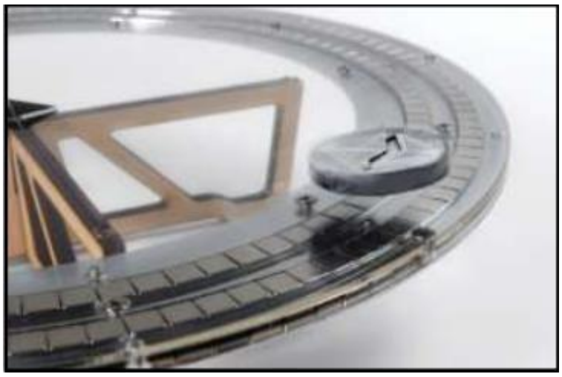

Fig.0.2

## II. REQUIREMENT SPECIFICATION

1. Neodymium magnets Power of 1 Tesla- ring type magnet
2. Dynamo A small generator which gives desired output
3. Shafts Made up of Aluminum and in prototype it is made up of pen cover
4. Base foundation- Made up of PVC pipe
5. Support structure PVC sheet and pen covers.
6. Synchronous motor

1. Neodymium magnets:

Neodymium magnets are used in some of the world’s largest wind turbines because they are strong, can produce a magnetic field without an external power source, and are used to attach equipment to the steel tower walls. Neodymium magnets are made of neodymium, iron, and boron, and are the strongest type of commercially available permanent magnet. They are placed around the rotor, which is turned by the wind’s energy, and create a magnetic field that generates electricity. The stronger the magnets, the more electricity can be produced.

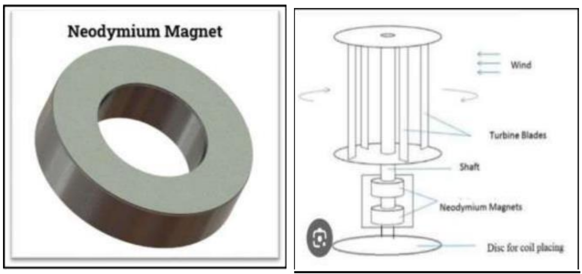


Fig. 0.3

2. Dynamo:

A device that makes direct current electric power using electromagnetism. It is also known as a generator; however, the term generator normally refers to an “alternator” which creates alternating current power.

3. Shafts:

Vertical axis wind turbines (VAWTs) are a unique type of power-generating technology with an axis of rotation that is perpendicular to the ground. The main rotor shaft is arranged vertically so that it captures wind from any direction. The blades on this type of wind turbine look more like poles on a carousel than spokes on a wheel.

4. Synchronous motor:

Permanent magnet synchronous generators (PMSGs) are a popular choice for small wind turbine kits because they are reliable and efficient. PMSGs use permanent magnets in their rotor, which eliminates the need for an external power source to create a magnetic field. A direct driven cable wound PMSG can be used in a straight bladed vertical axis wind turbine. A low-power PMSG can be used in low- power wind plants for vessels (ships, yachts) and stationary prosumers power installation

## III. CONSTRUCTION

The implementation of this project consists of heavy base on which a shaft is punched centrally. Two plates are used i.e. upper and lower plate which is mounted on shaft. Upper plate having 24 small magnets which are attached in round shape which is placed alternatively north south systematically and one neodymium ring magnet which is mounted centrally on the bottom face. Lower plate is fixed on the base. There are 12 coils of copper are attached to it. Each coil has 280 turns and they are connected in series. Turbine is mounted on the upper plate. When the turbine rotates by the wind sources, upper plate also rotates.

## IV. WORKING

By the principle of Maglev, the vertically oriented blades of wind turbine suspended in air above the base by permanent magnets which produces magnetic force to lift up the blades. This system does not require ball bearing. When wind as a source impact on the turbine blades, the turbine rotates by which upper plate also rotates. Due to rotation of the plate flux generates due to set up and cuts the magnetic field. Since EMF is generated in the coil. There are two wires extended from the coal which is in series for external connection for use power.

## V. TESTING

The Levitating Frictionless Vertical Windmill has been tested for magnetic levitation. The EN0005 blade profile has been able to produce energy at wind speeds as low as 2 m/s, which is not typical of a Darrieus turbine. The turbine has also been tested for its ability to generate electricity, which is produced by an axial flux permanent magnet AC generator. The output of this generator is converted to DC using a three-phase bridge rectifier, which was also self constructed. The turbine is designed to reduce friction, allowing the wind turbine to start rotating at lower wind speeds. The levitated generator design without bearings and gears provides an almost frictionless flow of energy, minimizing noise and friction losses. The gentle running of fewer moving components also guarantees minimal material wear, which reduces the maintenance cost.

| Sr. no. | Speed of the turbine (in RPM) | Output voltage (in volt) | Power in wattt |
|---|---|---|---|
| 1. | 25 | 1.72 | 0.51 |
| 2. | 50 | 3.49 | 4.59 |
| 3. | 75 | 5.26 | 15.65 |
| 4. | 100 | 7.0 | 37.2 |
| 5. | 200 | 8.4 | 64 |

## VI. DESIGN INTRODUCTION

1. Darrius type

The Darrius wind turbine is a type of vertical axis wind turbine (VAWT) that uses curved aero foil blades mounted on a rotating shaft or generate electricity It’s also known as an eggbeater turbine.

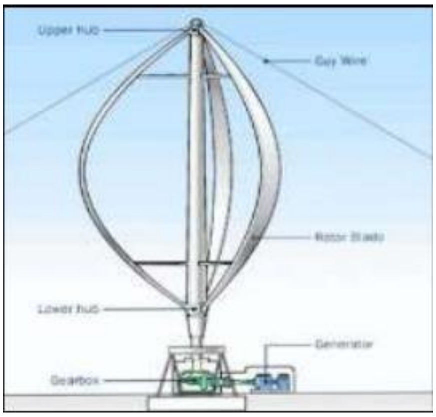


Fig. 0.4

2. Savonius type

Savonius wind turbines have blades built around the vertical shaft in a helix form, which looks like DNA. Savonius type of VAWT can be considered as a self-starting device.

Fig. 0.5

3. H Rotor type

Vertical axis wind turbine (VAWT) with straight blades. VAWTs are small turbines with an axis of rotation that is perpendicular to the ground, which means they can operate independently of wind direction.

Fig. 0.6

4. Maglev type

A maglev vertical axis wind turbine (MVAWT) uses permanent magnets instead of bearings, which reduces friction and allows the turbine to rotate at low wind speeds.

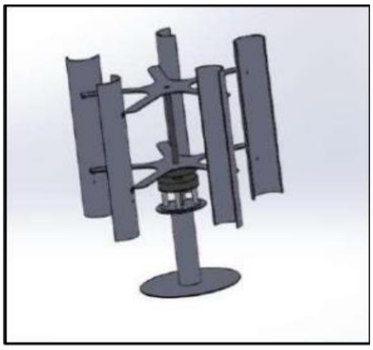

Fig. 0.7

Proposed system:

Magnetic Levitating Frictionless Vertical Windmill: A Sustainable Innovation:

Vertical axis wind turbines (VAWTs) are small wind turbines with an axis of rotation perpendicular to the ground. They can operate independently of wind direction, which is useful in urban areas where wind direction changes quickly. VAWTs have several advantages over horizontal wind turbines. Vertical axis wind turbines have the main rotor shaft arranged vertically. Key advantages of this arrangement are that the turbine does not need to be pointed into the wind to be effective. This is an advantage on sites where the wind direction is highly variable.

1. Magnetic Levitation: Neodymium magnets are employed to create a frictionless bearing system. Unlike traditional ball bearings, which introduce internal friction, this magnetic levitation system allows the wind turbine blades to rotate smoothly without resistance.
2. Low Wind Speed Operation: The magnetic levitating wind turbine can start generating power even at low wind speeds (as low as 1.5 meters per second). This advantage stems from the negligible friction achieved through magnetic levitation.
3. Reduced Operational Costs: By eliminating the need for ball bearings and minimizing maintenance requirements, this innovative design reduces operational costs by approximately 50% compared to traditional wind turbines.
4. High Wind Speed Tolerance: Unlike conventional turbines, which may struggle in strong winds, the maglev wind turbine can operate efficiently even in winds exceeding 40 meters per second.

## VII. FUTURE SCOPE

Magnetically levitated vertical axis (MVAWT) wind turbines have the potential to be more efficient, require less maintenance, and have a longer lifespan than traditional wind turbines. The turbines use rare earth magnets instead of electromagnets, so they don't need electricity to run. The friction between the turbine blades and the base can maximize power output. MVAWTs can operate in winds exceeding 40 m/s, and can use winds with starting speeds as low as 1.5 meters per second. They could increase generation capacity by 20% over conventional wind turbines and decrease operational costs by 50%.

ACTUAL VEIW OF THE PROJECT

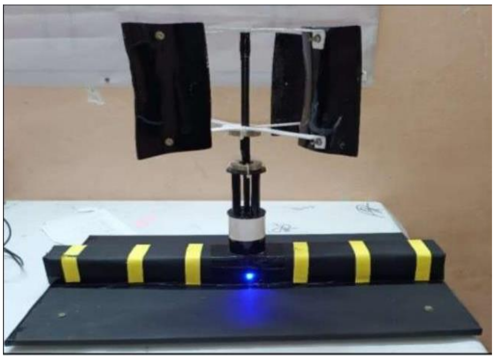

Fig.0.8

## VIII. CONCLUSION

Magnetic levitation for wind power generators, represent a very promising future for wind power generation. Maglev wind turbines will require lower wind velocity for start-up and also they show better performance at lower wind velocities. The wind turbine rotors and stator levitated properly using permanent magnets which allowed for a smooth rotation with negligible friction. At moderate wind speeds the power output of the generator satisfied the specifications needed to supply the LED load.

The introduced of magnetic levitation To the VHWT increases the efficiency and reduced the vibration with by 30% compared to that of the turbine without mechanical bearing. However the in the current work the drawback of the cogging and effect of magnetic pull is not considered as our major purpose is to introduce the concept and to demonstrate the implications of using magnetic levitation concepts in the vertical axis wind technology.

## IX. RESULT OF PROJECT

To find output of wind turbine, generator was connected to multimeter were readings observed was 0.49 mA. Generator output was connected to a rechargeable battery when sufficient voltage is available, it starts charging battery while there is no load acting. LED bulb of 5 watt was connected with inverter circuit, when battery is removed from charging.


Fig.0.9

Fig -0.9 shows multimeter reading, where dial is set for voltage indication with red wire as positive connection and black wire as negative connection (common).

## X. REFERENCES

[1] Vishal D Dhareppagol, Maheshwari M Konagutti, "Regenedyne Maglev Wind Power Generation", "International Journal of Electrical, Electronics

and Data Communication", ISSN: 2320-2084 Volume- 1, Issue- 6, pp.51-55, 2015.

[2] Shubham Patil, Pratik Kumbhar, Oslaniya Siddharth, Patil Rohit, C.S.Wagle, "Magnetic Vertical Axis Wind Turbine", "International Scientific Conference", "International Research Journal of Engineering and Technology (IRJET)", CONECT 2017, Volume: 04, Issue: 05, pp.2543-2547, May-2017.

[3] Andrea Alaimo, Antonio Esposito, Antonio Messineo, Calogero Orlando and Davide Tumino, "3D CFD Analysis of a Vertical Axis Wind Turbine", Energies, ISSN 1996-1073, 2015.

[4] Rosario Nobile, Maria Vahdati, Janet F .Barlow, Anthony Mewburn-Crook, "Unsteady flow simulation of a vertical axis augmented wind turbine: A twodimensional study", Journal of Wind Engineering and Industrial Aerodynamics", Science Direct, 2014.

[5] N. Dibakara Reddy, Surender Singh, N. Tejeshwar Reddy, "CFD Analysis On A Savonius Rotor Wind Turbine Made Using Mild Steel Material", "International Journal Of Mechanical And Production Engineering", ISSN: 2320-2092, Volume4, Issue-4, pp.86-89, Apr.-2016.

[6] International Journal of Innovative Research in Science, Engineering and Technology Vol. 7, Issue 4, April 2018

[7] https://nevonprojects.com/levitating-frictionless-vertical- windmill/

[8] www.alternative-energy-tutorials.com