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A New Fangled Highway Wind Power Generation

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Abstract- In present scenario, the efficient way of utilizing energy resources is the biggest challenge to overcome the energy demand. Wind power has sufficient potential to compensate the demand in energy sector. The fact says that, in India the utilization of renewable energy sources is only 13.4%. Outstanding renewable sources are not appropriately used. In this discernment, there is a necessity to improve the effective way of utilizing wind energy sources. The proposed idea is to consume the wind potential from fast moving vehicle in national highways and also increase the efficiency of the turbine by enhancing the wind flow through turbine blades. The introduced idea is capable of generating electricity which is two times greater than the existing vertical axis wind turbines. This novel technique maximizes the wind to electrical energy conversion ratio and over comes the pressure imbalance on the existing blade designs. Magnetic levitated Vertical axis wind turbine is placed in centre of the roads that would be driven by the moving air generated by the passing traffic. The magnetic levitation technique is used in this system to rotate the turbine in low headed wind speed. It is believed that introduced idea will bring a revolution in maximizing the utilization of wind energy.
Keywords: Wind, Vertical Axis Wind Turbine, Magnetic levitation, Generator, Charge controller, Battery.

I. INTRODUCTION

The wind energy is the fastest growing source of renewable energy. This is mainly due to the increase in fossil fuel utilization. The need of wind energy is expected to increase dramatically over the next few years according to data from the global wind energy council. A major issue with this technology is fluctuation in the source of wind. The terms wind energy or wind power describes the process by which the wind is used to generate electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks to rotate a generator can convert this mechanical power into electricity. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity. The use of maglev technique in the vertical axis wind turbine is to reduce the friction loss and increase the rotating speed of the wind turbine in low wind speed. Maglev vertical axis wind turbine is perfectly suitable for installing in center of the roads that would be driven by the moving air generated by the passing traffic. So we can achieve continuous rotation of turbine which coupled with generator to produce electricity.

II. BRIEF HISTORY OF EXSISTING TECHNOLOGY

The vertical axis wind turbine is used lesser than horizontal axis wind turbine. This is due to variation of wind direction and its speed. The vertical axis wind turbine is used to generate power from the wind potential which is produced at national highways by crossing fast moving of vehicles. If the wind is properly directed towards the wind turbine blades, optimum electricity could be generated. The speed of the wind stream varies with vehicle speed and shape of vehicles. The turbine only rotates when a vehicle crossed across them and it remains rest until vehicles not crossed. In this perspective, there is no incessant rotation in turbine at low headed wind.

III. LITERATURE SURVEY

Example of Suresh Mashyal system [1] wind patterns produced by vehicles on both sides of the highway. Using the collected data, a wind turbine is designed to be placed on the medians of the highway. Although one turbine may not provide adequate power generation, a collective of turbines on a long strip of highway has potential to generate a large amount of energy that can be used to power streetlights, other public amenities or even generate profits by selling the power back to the grid.

Example of Mithun Raj K K system [2] Vertical axis wind turbine can be installed on the median of the roads so that the wind from both sides of the median will act tangentially in opposite direction on both sides of the turbine thereby increasing effective wind speed acting on the turbine. This wind flow will depend on the velocity of the vehicle, size of the vehicle and intensity of the traffic. The kinetic energy of the wind is converted into rotational energy using vertical axis wind turbine which is either coupled directly or through gear. Rotational energy from the turbine is converted into electrical energy by the permanent magnet synchronous generator

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whose output is fed to an IGBT based chopper. Since the wind speed is not constant, the output of the generator will be varying frequently. Chopper regulates the output of the generator and charges the battery. Stored energy in the battery can be used to light LED based street lights using an LED driver circuit.

Example of Sushant N. Malave system [3] Highways can provide a required considerable amount of wind to drive a turbine due to high vehicle traffic. This energy is unused. Extensive research on wind patterns is required to determine the average velocity of the wind created by oncoming vehicles. The wind turbines will be placed on the medians therefore fluid flow from both sides of the highway will be considered in the design. Using all of the collected data, existing streetlights on the medians can be fitted with these wind turbines. Additionally, since the wind source will fluctuate, a storage system for the power generated will be designed to distribute and maintain a constant source of power.

Example of Minu John system [4] Magnetic levitation, maglev, or magnetic suspension is a method by which an object is suspended with no support other than magnetic fields. Magnetic pressure is used to counteract the effects of the gravitational and any other accelerations. The principal advantage of a maglev windmill from a conventional one is, as the rotor is floating in the air due to levitation, mechanical friction is totally eliminated. That makes the rotation possible in very low wind speeds. Maglev wind turbines have several advantages over conventional wind turbines. For instance, they're able to use winds with starting speeds as low as 1.5 meters per second (m/s). Also, they could operate in winds exceeding 40 m/s. The wind turbine rotor levitated properly using permanent magnets, which allowed for a smooth rotation with negligible friction.

IV. BACKGROUND OF THE PROPOSED DESIGN

To get continuous power generation, the vertical axis wind turbine is effectively rotated. To achieve this, magnetic levitation technique is used. The magnetic levitation reduces the limitations and losses in the wind turbine i.e., bearing friction losses. So that the starting wind speed is reduced; due to this we can generate electricity even at low wind speed. The magnetic levitation which setups the magnetic flux by permanent magnets in the rotor at the turbine. By placing magnets with same poles cause some repulsion force. This repulsive force is used to rotate the rotor continuously. When wind flows across the maglev turbine the speed of the rotation is increases due to magnetic levitation. The wind blade drives rotor of the turbine which coupled with the generator. The generator generates power which is stepped up and stored in battery. Then stored energy is used for street light and small grids.

V. BLOCK DIAGRAM

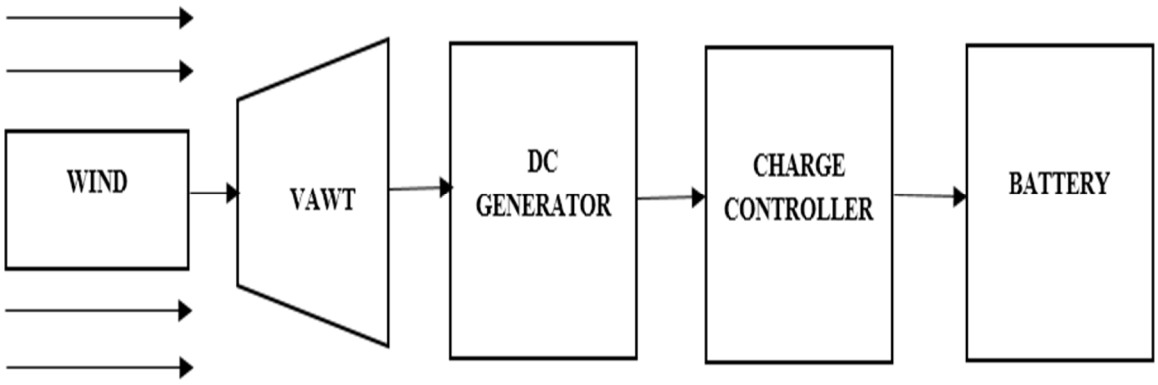

Fig .1 Block diagram of the prototype.

This Block Diagram shows that, while the wind is blow, it rotates the turbine and generates the electricity. The kinetic energy is converted into mechanical energy. In this the turbine is connected to the DC Generator which converts the mechanical energy into electrical energy. Then the DC generator is connected to the charge controller which is used for proper charging of battery. From that battery we can use the power for our various purposes.

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VI. PROPOSED DESIGN

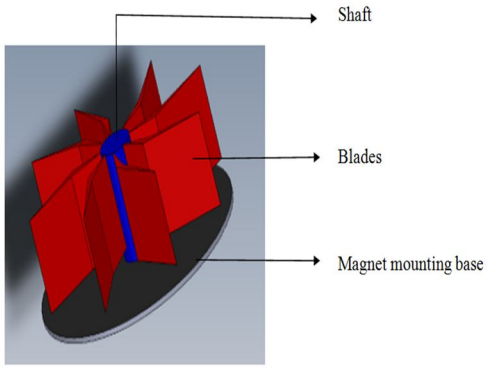


Fig.2 Isometric view of the design

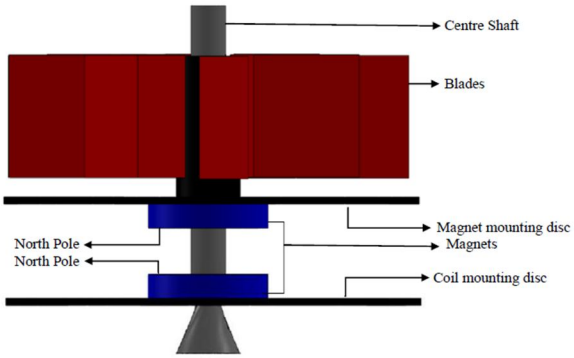


Fig.3 Front view of the design

Hardware used in the proposed design and its detailed description is given below.

Maglev Wind Turbine
Neodymium magnets
Generator
Battery

A. Maglev Wind Turbine

The vertically oriented blades of the wind turbine are suspended in the air above the base of the machine by using permanent magnet which produces magnetic force to lift up the blades. This system does not require the electricity to operate because no electromagnets are involved. Since the turbine blades are suspended by magnetic force produce by the permanent magnet, there is no need of ball bearing to retain the blades. This allows the friction between the blades and ball bearing can be reduced significantly and thus, minimizes the energy loss. This also helps reduce maintenance costs and increases the life span of the generator.

B. Neodymium Magnets

Neodymium magnets are powerful permanent magnets composed of the elements neodymium, boron and iron. It is developed in 1982 by General Motors and Sumitomo Special Metals. Neodymium Magnets are the strongest type of permanent magnet .It is also known as NdFeB, NIB or Neo magnet. It is most widely used type of rare-earth magnet. These magnets have the highest known energy product for their mass. Neodymium magnets are graded according to their maximum energy product, which relates to the magnetic flux output per unit volume. Neodymium magnets have higher remanence, much higher coercivity and lower Curie temperature than other types. Neodymium is alloyed with terbium and dysprosium in order to preserve its magnetic properties at high temperatures. One of the most appealing characteristics of neodymium magnets is their relatively low cost

C. Generator

The basic understanding of a generator is that it converts mechanical energy to electrical energy. Generators are utilized extensively in various applications and for the most part have similarities that exist between these applications. Over the years, alternating current has been the common choice of power supply. AC is popular because the voltage can be easily stepped up or stepped down using a transformer. Due to the inherent properties of a transformer, DC voltage cannot be altered using this type of equipment. Transformers operate due to a changing magnetic field in which the change in magnetic flux induces a current. With the AC flux generator design, its operability is based on permanent magnet alternators where the concept of magnets and magnetic fields are the dominant factors in this form of generator functioning. These generators have air gap surface parallel to the rotating axis and the air gap generates magnetic fluxes perpendicular to the axis.

D. Charge Controller

A charge controller, sometimes referred to as a *battery charger*. The primary function of a charge controller is to prevent overcharging of the batteries. Most also include a low voltage disconnect that prevents over-discharging batteries. There are essentially two types of controllers: Shunt and Series. A shunt controller bypasses current around fully charged batteries and through a power transistor or resistance heater where excess power is converted into heat. Shunt controllers are simple and inexpensive, but are only designed for very small systems. Series controllers stop the flow of current by opening the circuit between the battery and the PV array. Series controllers may be single-stage or pulse type. Single-stage controllers are small and inexpensive and have a greater load handling capacity than shunt-type controllers. Pulse controllers and a type of shunt controller referred to as a multi-stage controller (e.g. three-stage controller) have routines that optimize battery charging rates to extend battery life. Most charge controllers are now three-stage controllers. These chargers have dramatically improved battery life.

E. Battery

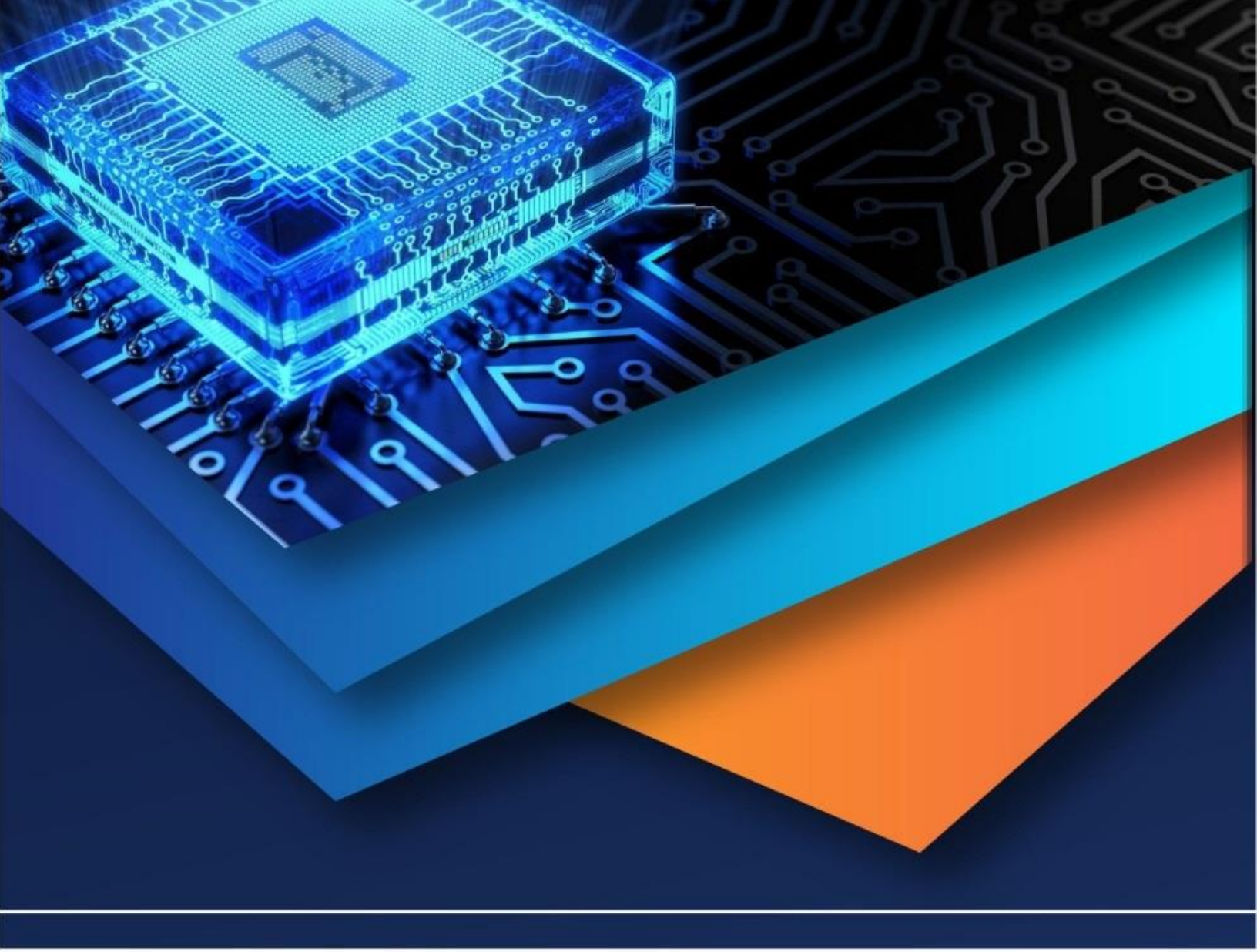
The generated power can be stored in battery for streetlight and the most commonly used batteries are lead-acid and nickel-cadmium batteries. Lithium-ion and nickel-hydride batteries are also used, but to a much lesser extent. Undoubtedly, it is the lead-acid battery especially sealed maintenance free version, which is most popular on account of its low cost and simple charging process.

VII. CONCLUSION

The proposed Vertical Wind Turbine is designed for the highest possible efficiency and wind energy utilization. The development of the vertical axis wind turbine in India has made significant progress during last 10 years. Recently, due to incremental rate of environment concern, wind energy development has experienced a significant of interest and considerable attention all over the world. Due to its simple construction and low maintenance cost, VAWTs can be effectively used for generation of electricity in India.

REFERENCES

[1] Suresh Mashyal, “Design and Analysis of Highway Windmill Electric Generation”, American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 p-ISSN: 2320-0936 Volume-03, Issue-07, pp-28-32, 2014.
[2] Mithun Raj K K, “Design and Simulation of a Vertical Axis Wind Turbine for Highway Wind Power Generation”, International Journal of Electrical and Electronics Engineers, ISSN- 2321-2055 (E), IJEEE, Volume 07, Issue 01, Jan- June 2015.
[3] Sushant N. Malave, ” Highway Wind Turbine”, International Journal of Mechanical Engineering and Research.ISSN No. 2249-0019, Volume 3, Number 5 (2013), pp. 529-534.
[4] Minu John, “Maglev Windmill”, International Journal of Research in Engineering and Technology, eISSN: 2319-1163 | pISSN: 2321-7308.
[5] Dinesh N Nagarkarand, ”Wind Power Plant Using Magnetic Levitation Wind Turbine”, International-Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue1, July 2013.
[6] Vishal D Dhareppgoal, “Regenedyne Maglev Wind Power Generation”, SARC-IRAJ International Conference, 16th June 2013, Pune, India, ISBN: 978-81-92747-8-3.
[7] Ali Zarkesh, “Developing a new application for wind generators in highways”, In Computational Intelligence, Communication Systems and Networks (CICSyN), 2013 Fifth International Conference on, pages 279–282. IEEE, 2013.
[8] Batista, “J. P. S. New blade profile for Darrieus wind turbines capable to self-start”, Renewable Power Generation (RPG 2011), IET Conference on. IET, 2011.



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