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POWER HARNESSING HYBRID STREET LIGHT; A CUTTINGEDGE TECHNOLOGY TO INDIA

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Abstract:

As India is the largest populated country with 1.4bn population, walking on the long road of developing nation. the main ideology behind this invention is to Rur-urban Electrification via hybrid system which includes wind and solar energy. Our intention is to design a wind turbine compact enough to be installed on the divider of roads. The electricity generated will be stored in the battery and then given to the load. This project emphasizes on electrification of remote areas with minimum cost where load shading still has to be done to meet street light, and speed breaker panel indicator with demand of urban areas.

Keywords — **Mechanism to generate electricity from street pole, Energy generation, VAWT, High efficiency with simple arrangement.**

1. INTRODUCTION

In the 21st century world, the energy is at outmost importance and can be made as one of the 4th basic needs of human among Air, Water, Food. On the same line to meet the need of such huge populous country the enshrined innovation is water shade movement. Above infographic shows the necessity of electricity. the present study an attempt is made to utilize at low velocity wind below 4m/s for useful power generation using magnetic levitation for vertical axis wind turbine (VAWT). A single large Maglev turbine can give output more than conventional horizontal axis wind turbine (HAWT). The rotor that is designed to harness enough air to rotate the shaft at low and high wind speeds while keeping the centre of mass closer to the base of yielding stability due to Maglev effect. The efficiency of turbine is increased by replacing the conventional bearings by magnets in repulsion; the magnetic levitation helps the turbine to spin at much faster rate as it eliminates the stresses on the shaft of turbine. The major components are placed at the ground level also we provide the steel net around the spiral wind turbine, which ensures the safety of turbine.[1]

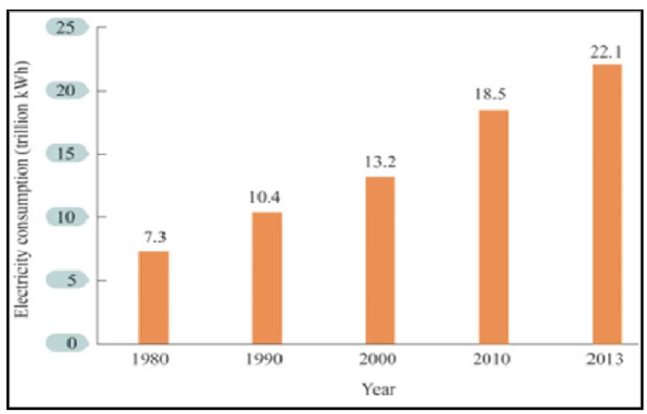


Figure.1.1. Infographic

PROBLEM STATEMENTS

The various catastrophic concern that undertaken are listed below as.

The development of vertical axis wind turbines can be traced back to 300 – 900 A.D. where these were utilized for grain grinding and water pumping processes. VAWTs offer a number of advantages over traditional horizontal-axis wind turbines (HAWTs). They can be packed closer together in wind farms, allowing more in a given space. They are quiet, Omni-directional, and they produce lower forces on the support structure. They do not require as much wind to generate power, thus allowing them to be closer to the ground where wind speed is lower. By being closer to the ground they are easily maintained and can be installed on chimneys and similar tall structures.

In our project we are aim to modify the shape of the rotor or blade of the turbine so that it can rotate at a low altitude with fluctuation in the wind speed. Thus, in this project we aim to carefully design, analyze, fabricate and calculate the performance of a Vertical axis wind turbine to determine problems with these turbines and attempt to suggest some solution to the determined problem. [2]

OBJECTIVES

The objectives of the invention in line with ideological perspective are;

1. To design and build a vertical-axis wind turbine to generate electric power.
2. To meet the high utilisation of wind generates by fast moving vehicles.
3. Effective Use of Divider.
4. To run street lights
5. Change in blade shape allows more rotation of the rotor even at low speed.
6. The helical shape of the blade has a tendency to rotate the rotor even when the wind flows from the different direction.
7. Low-cost power generation

SCOPE

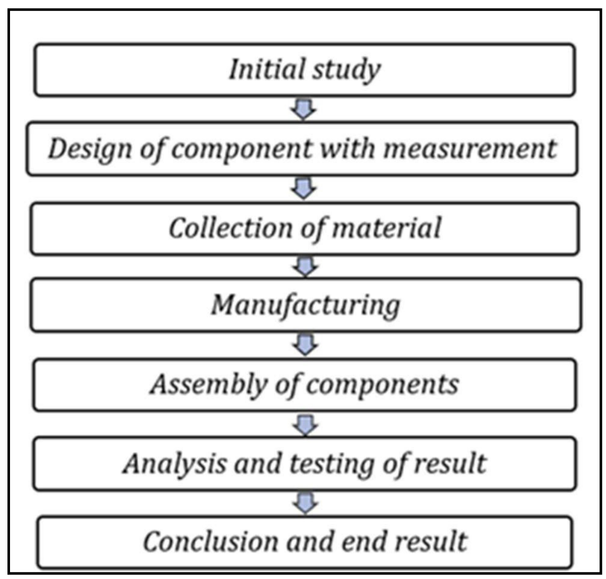
An economical, small scale Vertical Axis Wind Involute Turbine is fabricated using aluminium sheet and mild steel materials etc. From test results of Vertical Axis Wind Turbine over a wide range of wind speeds, it is noted that this turbine produces 40 watts for a wind speed of 3-3.5 m/s and which can be even increased by following measures.

1. Optimizing the design of blades so as to give better aerodynamics.
2. Using a best alternator which produces more voltage for low rpm.
3. Using gear mechanisms to increase rpm for alternator input and hence can have higher power output.
4. Structural fabrication should be more accurate in order to have proper functions of windmill.
5. Using fixed base system to reduce the weight of the whole system. Thus, a small-scale turbine for energy needs can be satisfied with optimized involute shape Vertical Axis Wind Turbine or combination of Darrieus and Savonius type of Vertical Axis Wind Turbine.
6. Can be used to build small powerhouse for small villages.
7. Can be install in all highways and railway station.

METHODOLOGY

Adopted methodology for complete specification of invention is as;

1. Recognition of need.
2. Collection of data.
3. Data analysis.
4. Select the proper method to design the parts.
5. Evaluation.
6. Implementation.
7. Troubleshooting.
8. Result.



Summary of Methodology

2. LITERATURE REVIEW

The literature review of the proposed ideology is as shown below;

Sr. No	Title and year of publication	Name of author	Key findings
1.	Trembling Analysis of Helical Blade VAWT ISSN: 2350-0255	Aravind S., Sougathali S., Ashok pandiyan N., Ganesh karthikeyan	Displacement &stress distribution values of the model at the diff thickness
2.	Design and Fabrication of Vertical Axis Highway Windmill,2014	S.Saravanan, M.Varathar, L.Ayyadurai, S. Palani.	Coupled one more generator to increased its efficiency.
3.	Design, Development, of Small VAWT axis 7% cambered plate 2017	Dr. Manoj H,Dr. Suchita Hirde,Ms. Arshi Khan	a modified rotor for low windy regions

Table.2.1. Summary of literature review

Aravind S. et al; For the three different thickness of helical VAWT were under gone with the modal analysis by sustaining boundary conditions. The main idea of this paper is to find the displacement and stress distribution values of the model at different thickness. From the plots and graphs it was understood that the helical VAWT rotor with thickness 2.5mmhas effective range of frequency compared to other two models. When the helical VAWT rotor with thickness 2.5mmis subjected to time-dependent analysis, it is found that the displacement values of the model with damping effect are lesser than the model without damping effect. In the future scope of this paper grid independent study of this model could be analyzed and this model could be used for designing the purpose of urban applications etc. [3]

S. V. Saravanan et al ; In today's life the demand on electricity is much higher than that of its production the main objective of our project is to produce electricity by using the force of air created by the moving vehicle in highways. In highways the vehicle suffers a lot to travel in night time because of lightning problem. This problem can be overcome by using the VERTICLE AXIS WINDMILL (VAW). This is a new unique method of power generation. In this method the windmill blade is designed in a vertical direction and it is kept at the middle of the highway divider by a series combination. The force in the middle portion is higher than the side of the road. This force will rotate the vertical turbine blade. And this blade is coupled with the generator and this generator will produce electricity. In our method we have coupled one more generator and we have increased its efficiency.[4]

Vilas Warudkar et al Among the different vertical axis wind turbine (VAWT) rotor is a slow running wind machine driven by drag force and has a lower efficiency as compared to lift type machine but it is also inexpensive. The present work is to design and develop a modified rotor for low windy regions, to develop a self-starting and more efficient wind turbine, which can be used domestically; it is portable and easily fabricated with locally available materials. In this work, Plate profile of the rotor was modified by using 7% of cambered plate which is giving higher efficiency. The rotor is designed and fabricated for application in rural areas for generating electricity.[5]

3. PROPOSED MODEL

Premia facilely, the proposed innovative model can be studied in two engineering aspects, basketed as; Construction Aspect and Modus Operandi.
Thoroughly both of them can be elaborated as;

CONSTRUCTION

The MS Pipes options include Equal Pipes from 25 x 25x 3mm to 200 x 200 x 24mm. Further, for delivering superior end performance, these also come tested for mechanical properties that include Tensile Strength, Elongation at gauge length, Yield Stress, Bend Test and others.

The tube is placed on rollers in the machine, and the rotating cut off blade engages the tube, causing it to spin. When downward pressure is applied to the blade, it passes through the wall of the material (rather than traveling through the diameter) and parts the tube wall.[6]

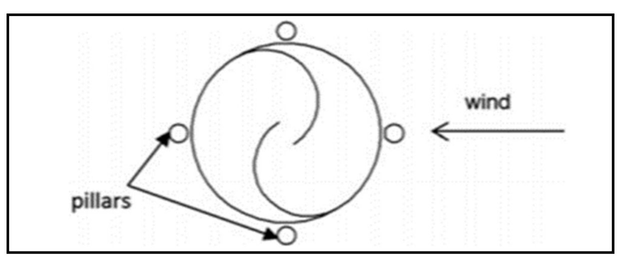


fig.3.1.1. pillar fixation view.

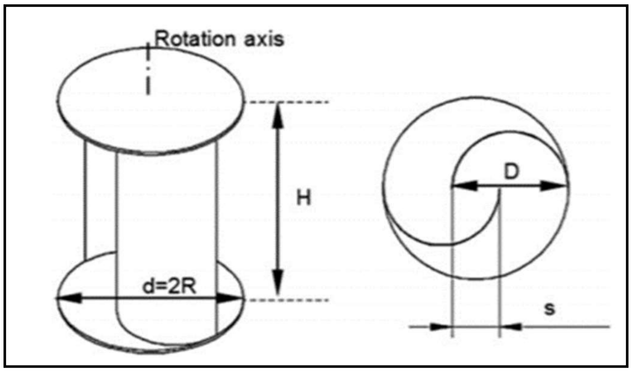


fig.3.1.2. Rotation axis and blade orientation.

By the appropriate measurement and standard assumption, the rotation axis is seted in the well designated direction of wind. The direction so selected and tilted that the more wind can be fetched in. PV solar panel is fixed at the top and battery for the storage of electricity is been installed at the bottom of the poll.

Apart from this small window is covered with the steel net to avoid the accidents and other catastrophic events in near future. The adjoin below figure show the complete assembly evolution from the material parts. This will give complete ideology behind the propsed model. The height topic under construction is kept reserved and left on the individual discretion.

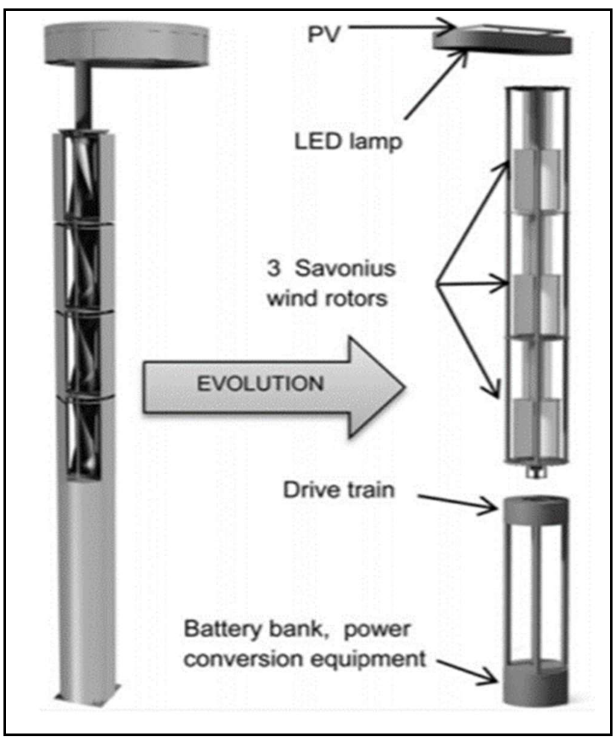


fig.3.1.3. Evolutionary figure of model.

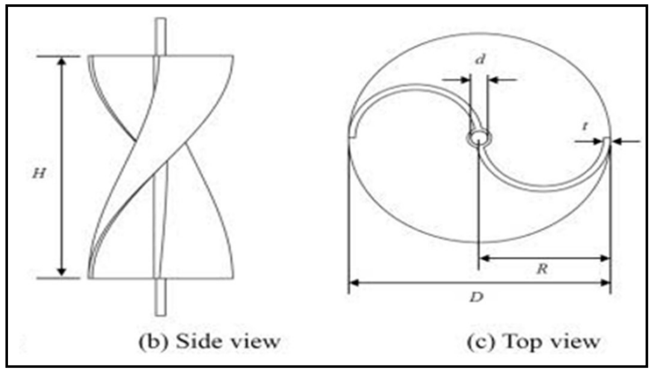


fig.3.1.4. Graphical views.

MODUS OPERANDI

The orientation of the shaft and rotational axis determines the classification of the wind turbines. A turbine with a shaft mounted horizontally parallel to the ground is known as a horizontal axis wind turbine or (HAWT). A vertical axis wind turbine (VAWT) has its shaft normal to the ground. Configurations for shaft and rotor orientation. The two configurations have instantly distinguishable rotor designs, each with its own favourable characteristics. Vertical-axis wind turbines (VAWT) can be divided into two major groups: those that use aerodynamic drag to extract power from the wind and those that use lift. The advantages of the VAWTs are that they can accept the wind from any direction.

This simplifies their design and eliminates the problem imposed by gyroscopic forces on the rotor of a convectional machine as the turbine tracks the wind. The vertical axis of rotation also permits mounting the generator and drive train at ground level. The disadvantages of this type of rotors are that it is quite difficult to control power output by pitching the rotor blades, they are not self – starting and they have low tip-speed ratio. Horizontal – axis wind turbines (HAWT) are convectional wind turbines and unlikely the VAWT are not omnidirectional.

As the wind changes direction, HAWTs must change direction with it. They must have some means for orienting the rotor with respect to the wind. The turbine was subjected under many tests to confirm its performance and operation ranges. After analysing and comparing the results with the analytical data, it was determined that the helical wind turbine could be a viable alternative option for its use to generate cost-competitive energy.

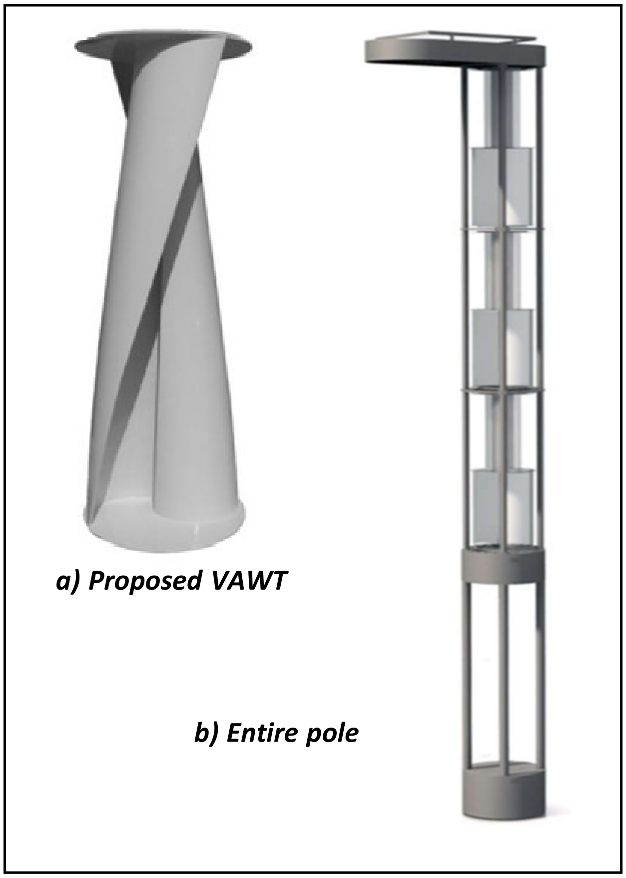
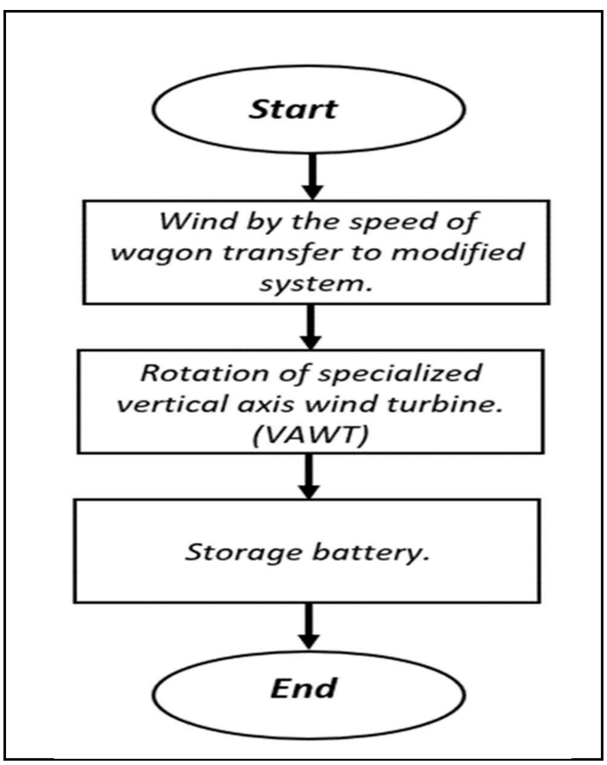


fig.3.2.1.'3-D' lay out of model.

4. EXECUTION FLOWCHART



5. APPLICATIONS

1. Night lamp in street.
2. Home appliances.
3. To lift light loads.
4. Pumping water.
5. Electricity generation.

6. ADVANTAGE

1. Reduces or even eliminates the cost of electricity.
2. Reduces dependence on power companies.
3. Excess electricity produced can be sold back to the power company at a profit.
4. Allows you to tap into the abundance of free renewable wind energy that is literally in-your-face every day.
5. It is good for the environment because windmills produce no polluting exhaust.
6. It helps our country reduce its dependence on foreign oil.
7. Building a windmill can be a family bonding experience that can teach our next generation that everyone can have a significant impact on cutting energy costs while improving our environment.
8. The cost to operate a windmill is very low.
9. The simple design of a wind turbine means low maintenance costs - just install it and forget it.

7. DISADVANTAGE

1. It is weather dependent - no wind equals any electricity
2. There is a dependence on the zoning rules of each community
3. Purchasing commercial pre-build wind turbine systems can be costly and require 8 or more years to pay back the initial investment.

8. CONCLUSION

A helical vertical axis wind turbine was built with the purpose of covering the electricity supply for a household with an average consumption of approximately 1500 kW/h per year. The turbine was subjected under many tests to confirm its performance and operation ranges. After analysing and comparing the results with the analytical data, it was determined that the helical wind turbine could be a viable alternative option for its use to generate cost-competitive energy. Wind power is a clean and inexhaustible source of renewable energy, which has experienced dramatic growth in the last decade. Considering the featured benefits, such as the construction and maintenance costs, turbine size and operation requirements, this rotor mechanism could be a scalable solution, which has a significant expansion potential to address the current renewable energy demands.

9. REFERANCES

1. Ministry of power, https://powermin.gov.in/
2. Ministry new and renewable energy https://mnre.gov.in/
3. Aravind S.1, Sougathali S.2, Ashokpandiyan N.3, Ganeshkarthikeyan K.4 "Trembling Analysis of Helical Blade Vertical Axis Wind Turbine (VAWT)", ISSN: 2350-0255; Volume 1, Number 5; October, 2014 pp. 71-77.
4. Arturo Reza, GuilibaldoTolentino& Miguel Toledo "Construction of a helical vertical axis wind turbine for electricity supply"01 Sep 2015.
5. Becker, W. S. ―Wind Turbine Device.‖ US Patent # 7,132,760 B2. Filed (Jul. 29, 2003).
6. Benesh, A. ―Wind Turbine System Using Twin Savonius-Type Rotors.‖ US Patent # 4,830,570. Filed (Dec. 15, 1987).
7. Bertony, J. ―Vertical Axis Wind Turbine with Twisted Blade or Auxiliary Blade.‖ US Patent Application # 2008/0095631 A1. Filed (Oct. 19, 2005).

