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FABRICATION AND DESIGN OF VERTICAL AXIS WIND TURBINE

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Abstract:
The aim of this **project is to utilize** wind energy in **the best possible way for maximu m energy, so we chose the highway as the installation location** to get **a good effect f rom** the **vehicles** moving on both sides of the road. In the **current study, the** turbine is **designed** and **built according to** the specifications, the blades used are **semicircular** a nd are **attached to the disk** connected to the **shaft. Then the shaft** is connected to the **t raction through bearings** and **the** pulley is connected to the **alternator that produces electricity.** The **electricity produced** is stored in **batteries** and can **later** be used for **li ghting, signaling** or **searching.** In this **project,** a small **prototype was produced** for te sting **purposes. The most important** project **is to produce at the lowest** cost so that th e **state** can **evaluate** this project and **use** vertical axis wind **turbines** on **the highway** at low cost.

Keywords: Vertical axis wind turbine, design, fabrication.

I. INTRODUCTION

Electricity plays and vital role for development of the country, so the production of electricity is one of the main aims of the country. About 68% of the production of electric energy is based on thermal power plant, where fossil fuels, coals, diesel are used for power generation and which is very less available and this fuels also creates pollution, greenhouse effect and global warming. Therefore power generation with the help of non-conventional resource such as wind is increasing day by day and this type of power generation is very clean and safe. The wind turbines are basically of two types 1) Horizontal axis wind turbine (HAWT). 2) Vertical axis wind turbine (VAWT). HAWT has successfully evolved in making of electricity from wind. However, recently working on VAWT has also been started due to its additional advantage over HAWT such as it does not require yaw mechanism because it can produce power independent of wind direction. VAWT can be produced at low cost then HAWT and also affordable maintenance cost.

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II. OBJECTIVES

The main objective is to utilize the maximum amount of wind energy from the automobiles running on the highways. The unused and considerable amount of wind is used to drive the vertical axis wind turbine, which will use the kinetic energy of the wind to produce the electrical energy. Increased turbulence levels yield greater fluctuations in wind speed and direction. Unlike traditional horizontal axis wind turbine (HAWT), vertical axis wind turbine effectively captures turbulent winds which are typical in urban settings. An effort is made to fabricate a vertical axis wind mill of higher output capacity. Our aim is to design and fabricate the wind turbine using easily available, low cost raw materials like wheels of cycle with inbuilt ball bearing, half cut PVC pipes, etc. This wind turbine is made to capture the maximum of wind energy in any direction by placing it at optimum place and by considering both the cost and safety of the system. This system can be used in huge number to generate the huge amount of useful electrical energy. This energy can be stored and transferred to nearest rural places where we can fulfil the demand of electricity. The thought of design directs us to look into the various aspects such as manufacturing, noise, cost which leads us to our additional aim of Analyzing the system to overcome the usual technical glitches. The project brief involves the design of a smallscale wind turbine that can be easily mass produced and fitted on every highway median to aid electricity consumption.

III. USED MATERIALS

Sr. No.	Components	Material
1	Blades	MS CRC
2	Shaft	MS Bright
3	Bearings	UCM 204
4	Frame	MS Angle
5	Blade Support	MS Flat

IV. COMPONENTS

This work requires lots of parameter to be taken into account, like the speed of the wind impacting on the blades when turbine get start rotating. Turbine required an open area preferably high mounting area available on rooftop. For the support, body design is done in that way so it can absorb maximum vibration which produced by turbine.

Bearing Design

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Many bearings also facilitate the desired motion as much as possible, such as by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.

B.Blade

A wind turbine is a device that converts the wind's kinetic energy into electrical energy. The blade is designed in semi-circular shape so as one blade passes another blade comes in the position of first. 8 blades are used so as to use of maximum utilization of wind from air and moving vehicle. The material used for the is (AL) The material has "22grades"thickness

C. Frame Design

Main role of frame in turbine is to support the turbine. We want to make economical model so we used material like mild steel. Which is also used for making street light poles. This material can also absorb vibration better than other material. We coloured so duration of material is increase.

D. Gearbox

A gearbox in a wind turbine is mainly used to enhance the rotating speed from a low sped shaft to a high-speed shaft connecting through an electrical generator. Gears within the gearbox of a wind turbine are subjected to severe cyclic loading because of uneven wind loads that are stochastic within the environment.

E. Shaft

A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power.[1] The various members such as pulleys and gears are mounted on it.

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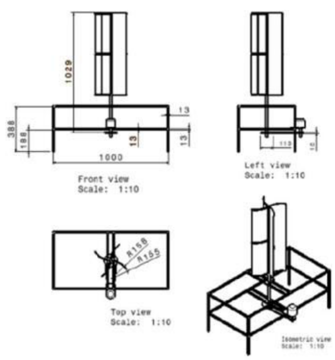
A drive shaft, driveshaft, driving shaft, propeller shaft (prop shaft) is a mechanical component for transmitting torque and rotation, usually used to connect other components of a drive train that cannot be connected directly because of distance or the need to allow for relative movement between them.

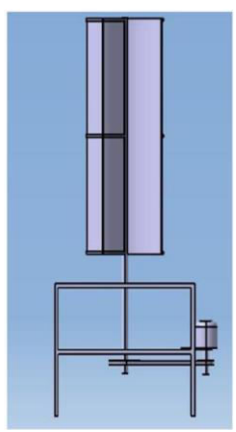
V. VARIOUS OPERATIONS INVOLVED IN FABRICATION PROCESS

- Welding
- Cutting
- Rolling
- Drilling
- Turning
- Mig-Welding

VI. CAD MODEL



Side View of Assembly



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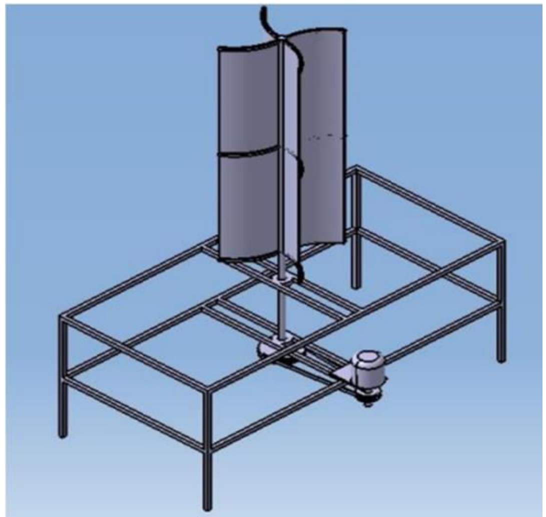

Full Assembly

VII. CALCULATIONS

The wind mill works on principle of converting kinetic energy of the wind in to mechanical energy. The k.E. of any particle is equal to the one half of its mass times the square of its velocity, or ½ mv2.

K.E. =½ mv2. .... (1)

K.E = kinetic energy m = mass

v = velocity,

M is equal to Volume multiplied by its density ρ of air, Mass = ρ AV (2)

Substituting eqn (2) in eqn (1) We had got,

K E = ½ ρ AV3 watts

ρ = density of air (1.225 kg/m3) A = l*b(Sq.m)

D = diameter of the blade A = l*b

A = 0.3 Sq.

Available wind power Pa = (½ ρ π D2 V3)/4 P = 1/8 ρ π D2 V3

TRAIL 1

FOR VELOCITY 4.5m/s

Pa = (½ ρ π D2 V3)/4

Pa = (½*1.225*π*0.4*0.4 *4.53)/4 Pa = 7.1watt

TRAIL 2

FOR VELOCITY 5.5m/s

Pa = (½ ρ π D2 V3)/4

Pa = (½*1.225*π*0.4*0.4 *5.53)/4 Pa = 15.1watt

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TRAIL 3

FOR VELOCITY 7.5m/s

Pa = (½ ρ π D2 V3)/4

Pa = (½*1.225*π*0.4*0.4 *7.53)/4Pa = 33 watt

TRAIL 4

FOR VELOCITY 10m/s

Pa = (½ ρ π D2 V3)/4

Pa = (½*1.225*π*0.4*0.4 *103)/4Pa = 77watt

VIII. TESTING AND RESULT

Sr no.	Wind Speed in m/s	Speed of Shaft	Volt age
1	2 to 3	109 to 121	3.9
2	3 to 4	189 to 201	4.8
3	4 to 5	271 to 320	6.2
4	5 to 6	382 to 353	8.8
5	6 to 7	390 to 396	9.2
6	7 to 8	400 to 409	12

IX. CONCLUSION

The VAWT is designed and fabricated in such a way that the it can able to capture wind from all the direction, power developed from the project is 28W for a speed of 6.1m/s, the efficiency of VAWT can be increase by changing the size and shape of the blade, the theoretical and experimental result is varying because in theoretical calculation we consider the wind is hitting all the eight turbine blades, practically it is not. Our work and the results obtained are very encouraged that vertical axis wind energy conversion are plausible and potentially very contribute to the production of the clean renewable electricity from the wind even under low ideal sitting conditions. With the idea on highway, it will power up street lights. In most cities, highways are a faster route for daily commute and in need of constant light makes this a very efficient way to produce natural energy.

X. FUTURE SCOPE

India is the home of 1.25 billon people i.e. 17.5% of the total world population, which makes it second most populous country in world. India has the second fastest growing economy of the world. India's substantial and sustained economic growth over the years is placing enormous demand on its energy resources.

The VAWT technology is sliding into the use in small generating installations, especially in urban environments that currently have winds that are not exploited. There are studies about the omnidirectional-guide-vane which make power, speed and torque increase markedly in these sorts of environments.

Employing Wind VAWT in power generation system can be the solution at many locations since the cost of this system is considered to be lower than the use of both individual technologies.

In the design field of turbine geometry, it seems to the helical arrangement of the blades, as has been verified by simulation using numerical methods, the helical increases the power coefficient in comparison with the straight arrangement of the blades increasing from 33% to 42% under the same operating conditions.

Due to the high cost and risk involved in the physical realization of a model to be submitted to the testing necessary to meet the various operating parameters as well as how changes in the environment and morphology evidence bearing on this, numerous studies have been devoted, through computer programs and various calculation methodologies, to try to improve the performance and efficiency of VAWT, and this will continue until noticeable results are achieved and someone bets by the use of technology.

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