AERO LEAF WIND TURBINE TREE FOR ELECTRICTY GENERATION

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***Abstract*: Energy from wind is the fastest growing source of electricity in the world. In this project wind energy is used to generate electricity with the help of aero leaves. Several leaf shaped aero leaves are placed in the form of tree, called Wind Tree. Wind Tree uses tiny blades housed in the aero leaves to generate power from wind energy. These wind trees are able to generate power regardless of the wind direction and with minimum wind speed of 7Kmph.In this project we have used tree shaped structure, covered with leaf shaped mini turbines called aeroleaves which are of savonius type turbine and designed to produce the power which will catch the wind from all the directions. All cables and generators are integrated into the leaves and branches. Artificial leaves operate as mini vertical turbines all around the tree. When the wind blows, the leaf turbines rotate and quietly produce the energy. This project concludes that, the power generated from wind tree is environmental friendly, mainly it generates power with least noise and it can be installed at different locations.**

***Keywords*: Aeroleaf, Vertical axis wind turbine, Savonius type**

1. INTRODUCTION

Wind energy has become a competitive contributor in the energy portfolio, and, as a consequence, it has experienced monotonic growth. Future developments are expected to occur in complex topographic and harsh environments due to reduced advantageous sites. Characterization of wind turbines operating in difficult terrains requires significant attention. Particular scenarios include wind turbines operating in forest terrains. There, the interaction of multiple wakes with the canopy can result in turbulent exchange that may modulate the local ecological equilibrium and climate and the performance of large arrays of turbines. Characterization of coherent motions in boundary layer flows developed over forestry, and vegetative canopies, have been of high relevance over past decades due to their impact on mass, momentum, and energy exchange in the mixing process. Proposed by Lu and Willmarth, quadrant analysis has been an instrumental tool to quantify the impact on momentum transfer from coherent motions and has been applied in many related phenomena, including flow over various vegetation canopies. Yue et al. and Poggi et al. showed that rigid canopies exhibit a predominance of sweeps within the canopy that evolves to ejection dominated away from the canopy tip for a range of Reynolds numbers. Field measurements over forest by Arnqvist et al. showed that coherent structures are dominated by large-scale mixing processes; they also found that local upwind and topography heterogeneity in a forest only have a minor effect on the measured wind statistics. Numerical simulations, e.g., and experiments, e.g., have provided substantial insight on the dominant motions induced from the mixing layer in relatively dense canopies. The mixing layer dynamics reduce as the density of canopy decreases and velocity fluctuates. The distinct structure of the turbulence above forest canopies may strongly modulate turbines' performance and wake; its impacts on the performance and unsteady loading, among others, on wind turbines remain as open problems. Numerical and experimental studies have explored this problem and have provided quantitative understanding. A numerical analysis of a wind turbine operating over a forest by Schröttle et al. using large eddy simulations (LESs) showed faster wake recovery and vertical asymmetry in the wake, and forests may enable tighter spacing of wind turbine arrays. However, LESs of forest effects on large wind turbine arrays by Agafonova et al. showed comparatively shorter, but wider, turbine wakes may be induced in forest terrains. They pointed out that stronger mean shear and higher turbulence intensity may reduce turbine life span. Agafonova also noted that turbine arrays placed in a forest incurred a significant power loss as compared to the non-forest case; improper blade pitch of the turbines was determined as a major cause of the reduced power performance. LES investigation by Nebenführ and Davidson showed fatigue load on a wind turbine is larger in the boundary layer developed over a forest. Experimental studies have particularly focused on continuous forested-like fetch and forest edge effects on wind turbine wake, among others. Rodrigo et al. studied the flow over porous foam sections and the effects on wind turbines in a clear-cut and noted a significant increase in turbulence, wind velocity, and wind shear leading to a decrease in energy output. They suggested that the clearance between the turbine rotor and the ground should be at least twice the height of the forest when the wind is perpendicular to the clear-cut axis. If the roles are flipped, however, and a porous windbreak is introduced into a relatively flat 'plains-like' environment, the power gained from a wind turbine increases. Indeed, Tobin and Chamorro found that the porosity of windbreaks plays a significant role in the power output enhancement of a wind turbine but has a minor effect on the power output of a very large wind farm. Odemark and Segalini modeled a forest with cylindrical pins to test different forest densities and the effects of heterogeneous forest structures such as clearings. They also varied the hub height of the wind turbine to study its impact on turbine performance and found minor changes in the maximum power output. This suggests that effects imposed on the wind turbine power output from incoming forest canopy boundary layers are not strongly dependent on the forest's structure. Chougule et al. investigated the wind characteristic and turbine load in forested and agricultural sites. They observed a much higher turbulent kinetic energy (TKE) dissipation rate over forestry landscapes. Another essential consideration can be gleaned from field experiments by Zendehbad et al., who have shown considerable increases in turbulence intensity and aeroelastic tower deflection of wind turbines in a forested fetch as well as a significant energy loss in a forested fetch, as compared to unforested fetch. Overall, forests are one type of terrain

that offers untapped potential for wind energy; likewise, the changes in the local mean shear and turbulence may also induce distinct differences in the transport of scalars in forestry terrains. Despite the substantial progress on characterizing forest boundary layer and induced turbulence and the insights into wind turbine performance, the unsteady interaction between turbine and wake with forest modulated turbulence and the effect of distinct energetic motions in wind turbines are still far from well understood and should be explored in detail to inform optimized operation and extend the life span of the units. Here, we aim to contribute to understanding the flow over forest canopies and wind turbine wake interaction by exploring the turbulence statistics. Such a characterization is needed for, e.g., multi-criteria decision support systems on wind farm site selection within forestry terrains.

2. LITERATURE REVIEW

C. Bhuvaneswari, R. Rajeswari: He was publish the paper that is Idea to Design a Solar Tree Using Nanowire Solar Cells in International Journal of Scientific and Research Publications, Volume 3, Issue 12, December 20131 ISSN 2250-3153,To introduces a new solar technology that emulates how trees convert sunlight into energy. Trees, shrubs and plants use an inherent structural design to expose their leaves, height dense to sunlight for photosynthesis. They do this determines their survival. Based on this we describe the coconut tree growing u to 30m(98 feet) tall, with pinnate leaves 4-6m(1320feet) long to design a solar tree. Pinnate refers to a leaf resembling like a feather having the leaflets on each side of a common axis. It can be either even or odd. By this structured pattern that leaves follow to arrange themselves on a tree. With this arrangement we introduce a new idea to design a solar tree using nanowire solar cell. Nanoparticles exhibit a number of special properties relative to bulk material. A single Nanowire concentrates the sunlight upto 15 times of the normal sunlight intensity. The solar new technology presented in this paper will provides nearly high efficiency. The number of papers and patents published in this area has grown up exponentially over the last 10 years. However at the present, research efforts have largely focused on solar trees. Nanowire can concentrate the sunlight up to 15 times of the normal sunlight intensity and hence the surprising results have the potential for developing a new kind of highly efficient solar cell. This can be used to give a higher concentration efficiency of the sun's energy [1]. Dr. Suwarna Torgal: She is publishing the paper that is Concept of Solar Power Tree in International Advanced Research Journal in Science, Engineering and Technology Vol. 3, Issue 4, April 2016. Demand for energy is increasing with each period, to fulfill the required demand we must have to concentrate on utilizing non-conventional sources of energy. Energy from the Sun is the best alternatives among the renewable energy sources. It is free, inexhaustible, nonpolluting, eco-friendly and continuous source of energy. The paper detailed Solar Power Tree that generate large amount of energy by capturing very small land area throughout the year. Silicon-crystalline Photo-Voltaic (SPV) mounted on tall pole which direct convert solar energy in to electrical energy by means of the photo voltaic effect. In the world, oil is running out and it is estimated that 80% of the world's supply will be consumed in our lifetimes. Coal supplies appear to be very large but this stock is also stock out if rapidly uses. Nuclear power having a dangerous aspect. Thus unconventional energy sources such as geothermal, ocean tides, wind and sun is best option to meet future energy requirements. Cultivable land is the greatest crisis of the earth rather it is already a burning crisis in major countries, the cultivable land is god of the farmers, if used for other than agriculture, it will be unpredictable loss to the society. Therefore Solar Power Tree is very efficient to capture large amount of solar energy by utilizing a very small surface area of valuable land [2].

Deepak M. Patil, Santosh R. Madiwal: He was publish the paper that is Design and Development of Solar Tree For Domestic Applications in International Journal of Engineering Sciences & Research Technology, August 2016 ISSN: 2277-9655, he work Flat or roof top mountings of PV systems require large area or and. Scarcity of land is greatest problem in cities and even in villages in India. Solar Power Tree provides better alternative to flat mounting of PV systems. For domestic lighting and other applications use of Solar Tree is more relevant when PV system is to be used. In this article load or energy requirement of small house in India is estimated to 1.75kWhr/day. All the calculations are done considering solar radiation data at Kolhapur, Maharashtra (16.760). The solar tree concept is very successful to fulfill the increasing energy demand of the people, saving of land, and should be implemented in India to provide electricity without the problem of power cut-off and reduce the dependence on grid power. Daily average energy requirement of the small Indian family is calculated about 3.5kW. Such systems can be mounted on the terrace, in front of the house or near the wall avoiding shading areas. The initial investment cost of the solar tree is also equal to same capacity PV systems as other system components are similar [3]. Mr. A P R Srinivas: He was publishing paper that is Design and Development of a SOLAR TREE in International Journal of Scientific & Engineering Research, Volume 7, Issue 10, October-2016, 1319 ISSN 2229-5518. a new product called, 'solar tree' has been designed to increase the power output by many folds by consuming solar energy. It can be installed on the sides of heavy traffic roadways and on roof top buildings. The tree consists of numerous solar panels connected to one another in series and parallel connections. The solar tree consists of number of branches welded to a stem and each stem has a solar panel mounted on it. It adds up voltage in series and current in parallel connection. The paper calculates the sun earth angles at different times of the day and designs solar tree based on these sun earth angles. The panels are put on the structure in a spiral fashion. It proves to be a useful system to meet the energy demands of the world and to use a given space more efficiently. The present system of roof top solar systems can be replaced by solar tree and the roof top space can be utilized for recreation purposes. The solar tree can be installed on ground also in addition to roof top spaces. So, this solar tree proves to be advantageous in saving space and increasing the power output by many folds. It saves a lot of energy over the years to come. The number of solar trees that could be installed in a given space depends on the wattage needed [4]. Sushma Gupta, Monish Gupta: She is publish the paper that is The Benefits and Applications of Solar Tree with Natural Beauty of Trees in SSRG International Journal of Electrical and Electronics Engineering (SSRG-IJEEE) –EFES April 2015, ISSN: 2348 – 8379. Now a days oil supply is decreasing therefore energy sources are becoming limited throughout the world. In all this Solar Tree proves to be most beneficial source of energy. This paper presents Solar Tree implementation as alternate source of energy in urban cities. A new idea of a solar tree design us in Nano wire solar cell is presented. Nano wires possess high physical light absorption properties which can be improved tremendously Hence we can say that it is a revolutionary urban lighting concept and these technologies lead to the development of high efficiency solar energy. Keywords -- Solar Tree, Renewable Energy, Nanowire, solar cell, Solar Energy. To fulfill the increasing energy

demand of the people, saving of land, the solar tree concept is very successful one and should be implemented in India to provide electricity without the problem of power cut and the extra energy can be provided to the grid. India as the 2nd largest country of the world in the increasing demand of the energy and try to find a way from which efficient and abundant source of energy cab be available. Also a solar botanic tree is a nonconventional source having many advantages of producing electricity as compared to the other sources. It is therefore the responsibility on the shoulders of the youngsters of the earth to think smartly and take the right decision. Everyone should starts as an individual to cooperate with the government to make life favorable for mankind [5].Global scenario of wind energy International Energy Agency (IEA) reported that in 2015 the wind power supplied more new power generation than any other technology. China is a leading nation in wind power installed capacity and has grown rapidly, from 300 MW in 2000 to 188,232 MW last year and today accounts for 35% of the world's total wind power capacity.

Wind power potential in India

The growth of wind energy in India is enormous and proves to be an option to mitigate the challenges to meet electricity demands, environmental pollution, greenhouse gas emission and depleting fossil fuel etc. India has the second largest wind market in Asia after China and fourth amongst the global cumulative installed countries of the world after USA and Germany. During this year, 4148 MW wind projects were commissioned. Wind Energy contributes the major portion of 64.09% of total renewable energy capacity of the country [5]. The Indian government is also focusing on policy development to attract investor in wind energy sector. Recently in October 2015, the Government of India, along with the National Institute of Wind Energy (NIWE) formulated and announced the policy framework for the first offshore wind development in India. National Institute of Wind Energy, formerly known as Centre for Wind Energy Technology (C-WET) located in Chennai serves as a research focal point in the improvement and development in the entire spectrum of the wind energy sector in India [13]. NIWE also coordinate wind energy assessment program and initially estimated 49 GW of wind potential at 50 m hub-height and on further survey, at 80 m hub-height, wind potential grows as much as 102 GW assuming 2% land availability for all states except Himalayan states, North-eastern states and Andaman and Nicobar Islands where 0.5% of land availability was assumed for energy estimation at both heights, however land availability significantly effects the potential in windy area and recently in 2015, using the advanced meso-micro coupled numerical wind flow model, and with the corroboration of almost 1300 actual measurements spread all over India, NIWE announced estimated wind potential at 100 m hub-height i.e. 302 GW assuming actual land availability [13].

Problem Identification:

Due to less land requirement It require less land as compare to traditional PV system. So we require such a plant which can generate maximum energy using minimum land. Main problem is solar panel won't work in dark. Overcome this is very needy. As setup for solar tree is quite costly as compare to rational solar placement so this could be used so wind turbine on same setup. Wind turbines are rarely found in cities though it is also a free energy source of energy.

3. MATERIALS & METHODOLOGY

3.1. Material

- Plastic pipe
- Plastic pipework
- Chlorinated polyvinyl chloride (CPVC)
- Plaster of Parise
- Medium-density fibreboard
- Aluminum Sheet
- Dynamo
- LED
- Resister
- Digital Multimeter
- Zero PCB
- Relay Module With Optocoupler
- LDR Sensor Module
- Battery

3.2 Methodology

- **Solid works:-** Solid Works is a solid modelling computer-aided design (CAD) and computer-aided engineering (CAE) computer program that runs on Microsoft Windows. Solid Works is published by Dassault Systems. According to the publisher, over two million engineers and designers at more than 165,000 companies were using Solid Works as of 2013. Also according to the company, fiscal year 2011–12 revenue for Solid Works totalled $483 million.

- **Modelling technology**: - Solid Works is a solid modeller, and utilizes a parametric feature-based approach to create models and assemblies. The software is written on Para solid-kernel.

  ***Parameters* refer** to constraints whose values determine the shape or geometry of the model or assembly. Parameters can be either numeric parameters, such as line lengths or circle diameters, or geometric parameters, such as tangent, parallel, concentric, horizontal or vertical, etc. Numeric parameters can be associated with each other through the use of relations, which allow them to capture design intent.

Design intent is how the creator of the part wants it to respond to changes and updates. For example, you would want the hole at the top of a beverage can to stay at the top surface, regardless of the height or size of the can. Solid Works allows the user to specify that the hole is a feature on the top surface, and will then honor their design intent no matter what height they later assign to the can.

Features refer to the building blocks of the part. They are the shapes and operations that construct the part. Shape-based features typically begin with a 2D or 3D sketch of shapes such as bosses, holes, slots, etc. This shape is then extruded or cut to add or remove material from the part. Operation-based features are not sketch-based, and include features such as fillets, chamfers, shells, applying draft to the faces of a part, etc.

Building a model in Solid Works usually starts with a 2D sketch (although 3D sketches are available for power users). The sketch consists of geometry such as points, lines, arcs, conics (except the hyperbola), and splines. Dimensions are added to the sketch to define the size and location of the geometry. Relations are used to define attributes such as tangency, parallelism, perpendicularity, and concentricity. The parametric nature of Solid Works means that the dimensions and relations drive the geometry, not the other way around. The dimensions in the sketch can be controlled independently, or by relationships to other parameters inside or outside of the sketch.

In an assembly, the analogy to sketch relations is mates. Just as sketch relations define conditions such as tangency, parallelism, and concentricity with respect to sketch geometry, *assembly mates* define equivalent relations with respect to the individual parts or components, allowing the easy construction of assemblies. Solid Works also includes additional advanced mating features such as gear and cam follower mates, which allow modelled gear assemblies to accurately reproduce the rotational movement of an actual gear train.

Finally, drawings can be created either from parts or assemblies. Views are automatically generated from the solid model, and notes, dimensions and tolerances can then be easily added to the drawing as needed. The drawing module includes most paper sizes and standards (**ANSI, ISO, DIN, GOST, JIS, BSI** and **SAC**).

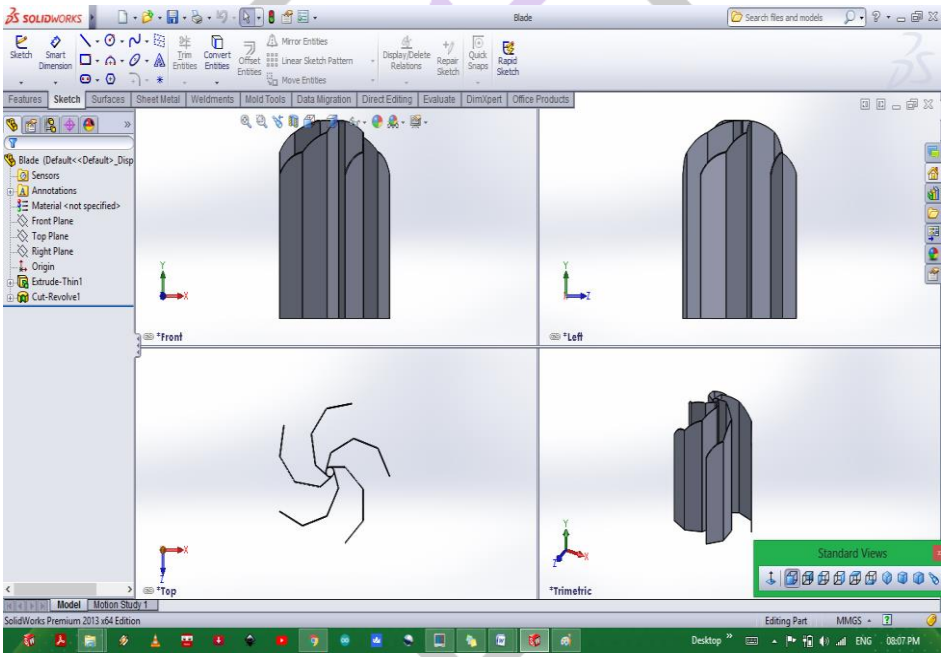


Fig: Leaves

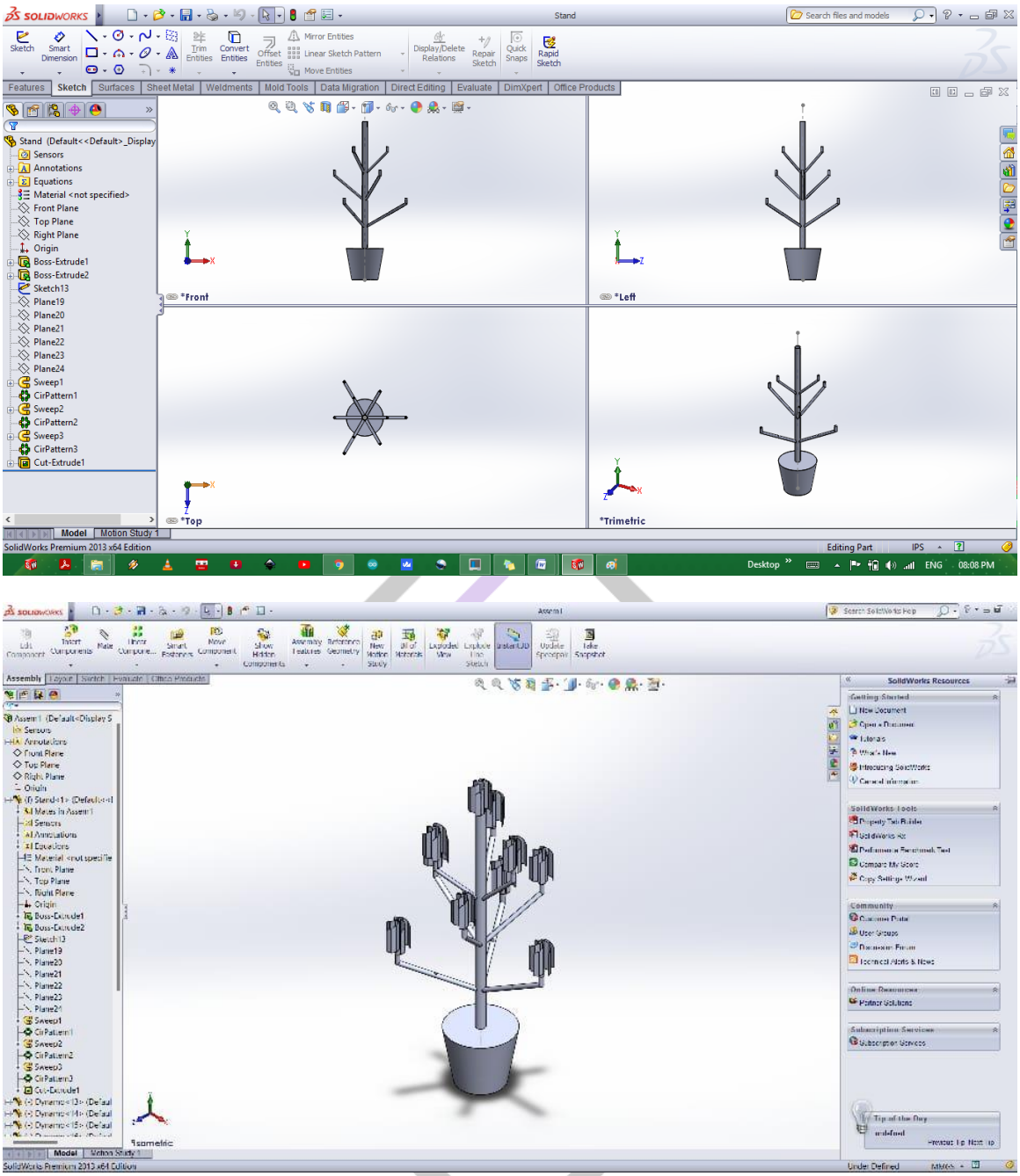
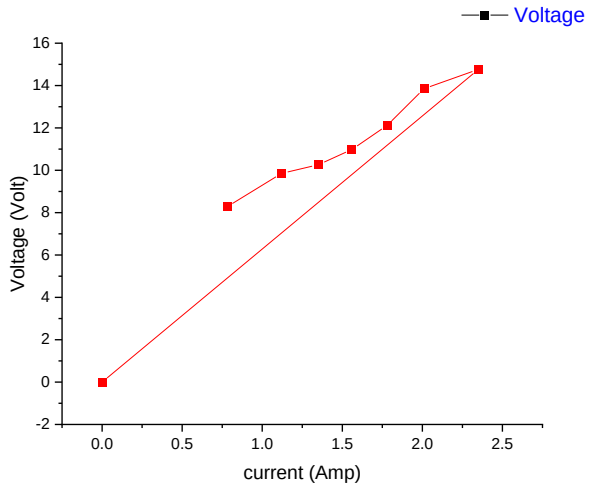


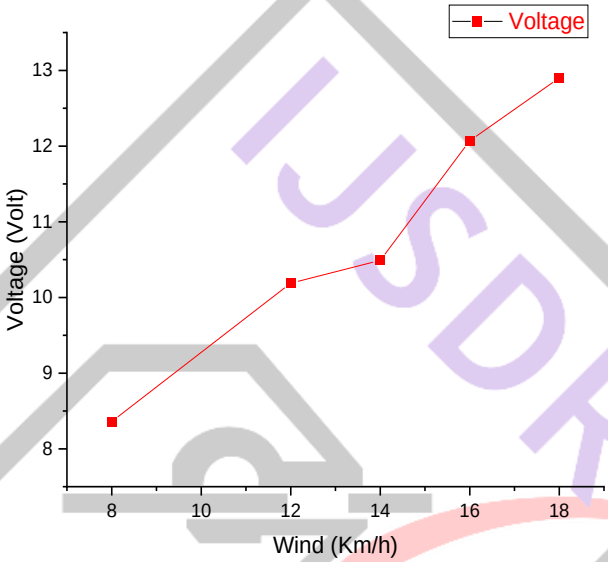
Figure: Tree Structure

4. Result & Discussion

4.1 Performance of Tree

Average voltage (V) = 11.77
Average current (I) = 1.35
Power (P) = VI
P =11.77*1.35
P=15.8895watt





4.2 Estimated Costing

S No.	Materials	Qty.	Cost Per	Total
1	PVC PIPE	5 M	60	300
2	ALUMINIUM SHEET	2 8*8	1500	3000
3	DYNAMO	10	65	650
4	LED	6	5	30
5	WIRE	6 M	6	36
6	ZERO PCB	1	15	15
7	RELAY MODULE	1	75	75
8	LDR SENSOR MODULE	1	150	150
9	BATTERY	2	200	400
			TOTAL	4656

4.3 Future Scope

Wind power is an affordable, efficient and abundant source of domestic electricity. It is pollution free and cost competitive with energy from wind tree plants in many reasons. The paper first deals with the current scenario of the wind energy in India. Wind energy is available without any cost and it does not emit any greenhouse gases. This makes it a great source of energy production for any developing state. The field of wind energy has tremendous scope for innovation, translating to real world applications and tremendous economic opportunity. It is crucially important for India, as our economy continues to evolve. For that we will need greater resources. Clean, sustainable, renewable and equally important, domestic sources of energy are essential to fulfil the potential of India in the coming years and it is certain that wind energy will play a major part in shaping India's future. Wind power has emerged as the biggest source of renewable energy in the world.

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