Blade Design, Analysis and Utilisation of Vertical Axis Windmill using Ansys Software for Streetlights

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Abstract

The objective of this project is to generate electric power through the fabrication of savonius wind mill and to regulate the power generated in order to use that power for automatic street light using LDR (Light Dependent Resistor) and USB purpose. Wind turbine is a machine that converts the kinetic energy in wind into mechanical energy. If the mechanical energy is used directly by machinery, such as a pump or grinding stones, the machine is usually called a windmill. The blade is designed with the help of ANSYS software.

Keyword- Savonious Windmill, LDR, Wind Turbine, ANSYS

I. INTRODUCTION

India is one of the nations in the world with fastest growing economy. Today the technology is increased day by day. The technology will be increased on the basis of energy. The energy can be developed in two ways like renewable and non-renewable. Energy demand is increased with usage fossil fuel which increase global warming, air pollution and climate changing will be occur. Depending technology based on energy production energy is produced by renewable or non-renewable energy sources (solar, wind…).due to the shortage of the non-renewable energy resource we want to find some other way to produce energy. This paper based on change renewable energy resource like wind and solar which plays an important role to produce energy. Wind will be the clean energy in the fastest growing source in the world wide. To utilizing the wind energy horizontal type wind mills are used .The horizontal type wind mill arranged with three air foil shaped blades are arranged and the wind comes in to the face and generator will start to rotate due to the movement of the blades and produce electricity. The major issue with this technology is fluctuation and the intensity price of installing wind farm is very high.

The generated energy from wind farm is less than the capital investment. To rectify this problem this paper implements the changing of horizontal base blade into vertical type blade. Using vertical axis wind turbine (VAWT) can achieve wind from all direction. Here we are using ANSYS software to design the blades .ANSYS is a general purpose software, used to simulate interactions of all disciplines of physics, structural, vibration ,fluid dynamics, heat transfer and electromagnetic for engineers. so ANSYS, which enables to simulate tests or working conditions, enables to test in virtual environment before manufacturing prototypes of products. Furthermore, determining and improving weak points, computing life and foreseeing probable problems are possible by 3D simulations in virtual environment. ANSYS can work integrated with other used engineering software on desktop by adding CAD and FEA connection modules. ANSYS can carry out advanced engineering analysis quickly, safely and practically by it is variety of conduct algorithms, time based loading features and nonlinear material models.

ANSYS can import CAD data and also enables to build a geometry with it is pre-processing abilities .Similarly in the same pre- processor, finite element model which is required for computation is generated. After defining loadings and carry outs analysis results can be viewed as numerical and graphical.

II. BLOCK DIAGRAM

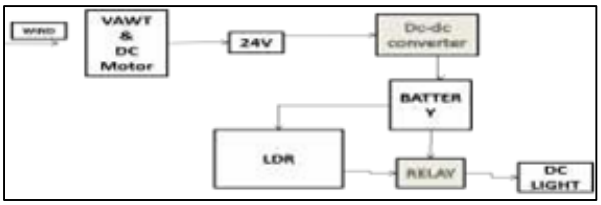

Fig. 1: Block diagram of windmill experiment

Savonious windmill is used to generate wind power from wind energy. The generated wind energy is regulated using voltage regulator. The output of voltage regulator is 5V and this 5V is used to control automatic street light system using LDR and also for USB purpose. In case of excess power generated, the generated energy is stored in the battery so that it can be used later.

The automatic street light system consists of LDR, comparators, resistors, relay and transistors. LDR and USB are connected in parallel so that the output of voltage regulator can be fed to both the devices. Voltage regulator, any electrical or electronic device that maintains the voltage of a power source within acceptable limits. The voltage regulator is needed to keep voltages within the prescribed range that can be tolerated by the electrical equipment using that voltage. In case of excess wind excess amount of power will be generated. So at that time the remaining power after utilising for street light system and USB purpose is stored in the battery. The savonious wind mill with rotational sails have the main rotor shaft running vertically.

Key advantages of this arrangement are that the generator and/or gearbox can be placed at the bottom, near the ground, so the tower doesn't need to support it, and that the turbine doesn't need to be pointed into the wind. Most of the time we see streetlights ON even after sunrise thus wasting lots of energy. Over here we are avoiding the problem by having automatic system which turns on and turns off the street light at given time or when ambient light falls below a specific intensity. There are two blades are used in this project with s-shape. Aluminium is used to make the blade and mild steel is used to make turbine and base. DC alternator is used in this project. Fibre is also an important material for the preparation of the blade.

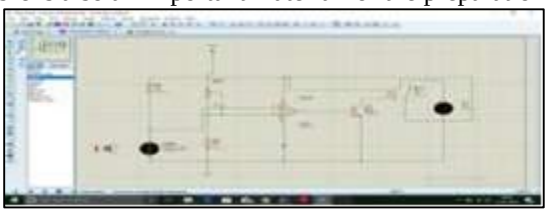

Fig. 2: Simulation of automatic streetlight using LDR

FigII represents automatic street light representation using LDR.LDR is a light dependant resistor. It works based on the presence of the light. To glow streetlight automatically during the night time LDR is mainly using in this project. There should be a reference voltage kept in this and the voltage from the battery fed into the LDR it compares the two voltages and if the presence of light is detected it will not work and on the other hand if the light is not detected relay opens and the street light glow.

Vertical-axis wind turbines (or VAWTs) 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, for example when integrated into buildings. With a vertical axis, the generator and gearbox can be placed near the ground, hence avoiding the need of a tower and improving accessibility for maintenance. . If the height of the rooftop mounted turbine tower is approximately 50% of the building height, this is near the optimum for maximum wind energy and minimum wind turbulence. It should be borne in mind that wind speeds within the built environment.

III. PROPOSED MODEL

In this proposed method the oscillating problem by the horizontal axis windmill can be cleared very easily. In this vertical axis windmill the output can be delivered with the small amount of wind and also it is very useful for the future use. There are two blades are used in this project. The shape of this blades are of S-shape. Aluminium is the material used for the making of the blade.

Fig. 3: Hardware setup of the project

Windmill, device for tapping the energy of the wind by means of sails mounted on a rotating shaft. The sails are mounted at an angle or are given a slight twist so that the force of wind against them is divided into two components, one of which, in the plane of the sails, imparts rotation. Like waterwheels, windmills were among the original prime movers that replaced human beings as a source of power. The use of windmills was increasingly widespread in Europe from the 12th century until the early 19th century. Their slow decline, because of the development of steam power, lasted for a further 100 years. Their rapid demise began following World War I with the development of the internal-combustion engine and the spread of electric power; from that

time on, however, electrical generation by wind power has served as the subject of more and more experiments. The exponential benefits are not only crucial but already evident where wind turbines are used. Increasingly, mainly in developed and developing nations. To finish this guide on windmill sand its natural successors, wind turbines, we highlight some positive effects they have on humankind and the environment.

A. Light Dependant Resistor

An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits.

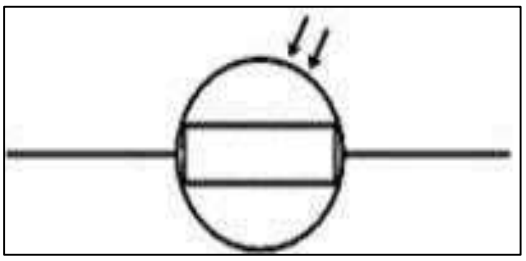

Fig. 4: LDR circuit symbol

The most common type of LDR has a resistance that falls with an increase in the light intensity falling upon the device (as shown in the image above). The resistance of an LDR may typically have the following resistances:

Daylight = 5000Ω

Dark = 20000000Ω

You can therefore see that there is a large variation between these figures. LDRs have a sensitivity that varies with the wavelength of the light applied and are nonlinear devices. They are used in many applications but are sometimes made obsolete by other devices such as photodiodes and phototransistors. Some countries have banned LDRs made of lead or cadmium over environmental safety concerns. Based on the materials used, photo resistors can be divided into two types; intrinsic and extrinsic. Intrinsic photo resistors use undoped materials such as silicon or germanium. Photons that fall on the device excite electrons from the valence band to the conduction band, and the result of this process are more free electrons in the material, which can carry current, and therefore less resistance. Extrinsic photo resistors are made of materials doped with impurities, also called dopants. The dopants create a new energy band above the existing valence band, populated by electrons. These electrons need less energy to make the transition to the conduction band thanks to the smaller energy gap. The result is a device sensitive to different wavelengths of light. Regardless, both types will exhibit a decrease in resistance when illuminated. The higher the light intensity, the larger the resistance drop is. Therefore, the resistance of LDRs is an inverse, nonlinear function of light intensity.

IV. CONCLUSION

This project will provide a competent method for lighting systems and make the whole process of energy saving easierand efficient. With a capability to change the amount of light emitted depending upon the outside condition is no doubt an innovation with many future application apart from the fact that it can also be used in many present day tech such as head lights, street light, parklights, industrial lights and many more. The usage of the smart lighting system will undoubtedly change the world that we see today. In the near future, wind energy will be the most cost effective source of electrical power. In fact, a good case can be made for saying that it already has achieved this status. The actual life cycle cost of fossil fuels is not really known, but it is certainly far more than the current wholesale rates. The eventual depletion of these energy sources will entail rapid escalations in price which averaged over the brief period of their use will result in postponed actual costs that would be unacceptable by present standards. And this doesn't even consider the environmental and political costs of fossil fuels use that are silently and not-so-silently mounting every day. Thus utilizing the wind and solar energy by hybrid power generating technique it can generate more energy with efficient output continuously. By implementing three generators with three setup and placed at the bottom of the proposed system can increase in the output power obtained by placing the wind turbine in top most building. By analysis about the wind blade PVC with aluminum here we found that aluminum will be more weightless and energy production will be higher than compare with the other materials.

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