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Vertical Axis Wind Turbine with Inverter

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Abstract

One of the major issues in this fast-moving world is to meet the demand for energy in the most economical and environment-friendly way. This research focused on designing a Vertical axis wind turbine (VAWT) that gives a solution that is comparatively a cheap alternative to renewable energy. When there is enough wind to rotate the windmill, magnetic coupling between the rotating and stationary coils causes the windmill to produce energy. The work demonstrates a vertical rotating prototype of the windmill. The wind turbine can charge up to a 12V battery. The advantage of this design is that it works without any consumption of fossil fuel and works efficiently inappropriate weather conditions with- out being closely monitored and the battery charges automatically without any harmful emissions or drawbacks. The work presented in this paper is an example of how natural resources like wind energy can be used efficiently to produce electricity.

Keywords: *Arduino uno, Invertor, Renewable energy system, vertical axis wind turbine, Battery*

I. INTRODUCTION

Wind power has emerged as one of the most cost-effective renewable energy sources in recent years. Wind turbines that generate power nowadays use tried-and-true technology and offer a reliable and sustainable energy supply. The first known wind turbine created for electricity production is built by inventor Charles Brush to provide electricity for his mansion in Ohio. A wind turbine is a device that converts wind's kinetic energy into electrical energy. The costs of producing wind energy have reduced by 80 percent since the last century. Today, wind energy is regarded as the least expensive renewable energy source. On the market today, wind turbines are useful. Vertical-Axis wind turbines happen to be the most popular and widely coveted turbines. It is also more practical, reliable and cost effective, it also has the best longevity and durability features. Therefore, we will be able to use efficiently over a long haul.

1.1 Literature Review

Today, wind energy is thought to be the most affordable type of renewable energy. Currently available wind turbines serve a purpose. Their analysis indicates that the vertical axis wind turbine can be able to attain the air from all the direction and produces the power of 1 kilowatt for a movement of 25 m/s. D.A.nikam et al. analysed that the generation of electricity is affected by the geometry and orientation of the blade in the wind turbine .He analysed the blade plays critical role in the performance and energy production of the turbine. Altab hossain et al. analysed that the power production will increases when the velocity is high. Parth Rathod et al. study of a combined vertical axis wind turbine review. The experiment is conducted to increase the power production and efficiency of a wind turbine. The outcome suggests that a turbine's efficiency is always dependent on the wind speed and weather. Piyush Gulve et al. analysed the design and construction of vertical axis wind turbine. He conclude that the vertical axis wind turbine is more efficient than horizontal axis wind turbine because it requires compact room for making the same amount of electricity while making less noise.

1.2 Problem definition

The electricity we get today in our homes is generated from nuclear energy or any other atmosphere destroying ways. For both large-scale and small-scale and distributed power generation applications, wind power is a desirable and alternative energy source. One of the most important advantages of wind energy is that it is modular and scalable. A wind turbine is a machine that transforms wind's kinetic energy into electrical power. The main rotor shaft of a vertical axis wind turbine (VAWT), which can take wind from any direction, is one form of wind turbine. The primary objective of this research is to design and model a small-scale VAWT, which can be used to meet the power for low demand applications.

1.2.1 Need and Scope of the Project

The most significant subject in the world right now is renewable energy. The world's fossil fuel supplies have been shown to be quickly depleting. Wind energy has been proven as a promising renewable option. Institutions, residences, and enterprises can all use the electricity generated by wind turbines. Nowadays, horizontal axis wind turbines (HAWTs) are the most familiar type in use. But vertical axis wind turbines (VAWTs) have several benefits, such as it can capture wind from any direction because its shaft is vertical. In rural locations where grid energy cannot be deployed owing to a lack of infrastructure, such systems can be a more practical choice. Moreover, in an interruption or a breakdown of the grid, a vertical axis wind turbine could act as a backup. In un-electrified areas, basic electric energy needs are usually obtained by batteries, which are charged by grid electricity available in city centres. Therefore, vertical axis wind turbines could play an important role as an alternative and cost-effective source of battery charging.

1.3 Design Methodology

1.3.1 System Design

A windmill uses blades to transform wind energy into rotational energy. The blades of a windmill are aerodynamically optimized to make the most of the energy in the wind and turn it into rotational energy making the blades spin around. The windmill is designed with a number of variations in the blade and the windmill designed for this research work has 4 blades. Through a gearbox that in turn turns the shafts, these blades are linked to a generator, which transforms mechanical energy from the blades' spinning into electrical energy. Once the electricity is produced and is ready to enter the local grid, it may then be used to power devices. For storage of power, we will require an inverter which stores the electricity converted by the turbine. When there is insufficient wind required for the windmill, the circuit will be made to switch power from the inverter to the load, this creates an unlimited amount of sustainable energy. According to the wind circumstances the blade twists or shreds the wind. It is well known that proper shaping of the blades of a windmill and the proper alignment of the physical axis of that mill in fences to a large extent, the efficiency of the said mechanical converter to convert the 'raw' wind power to a considerable value of rotational energy ordered by the blades of the mill.

1.3.2 Block diagram and Circuit diagram

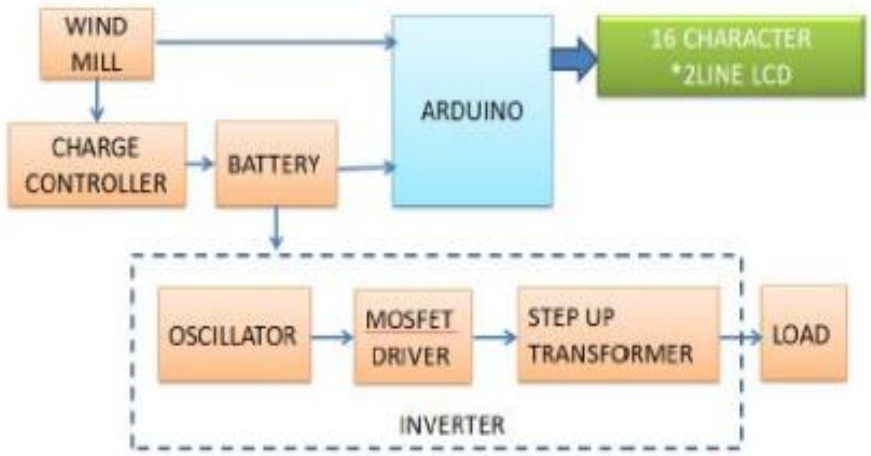

Figure 3.1: Block diagram of VAWT system

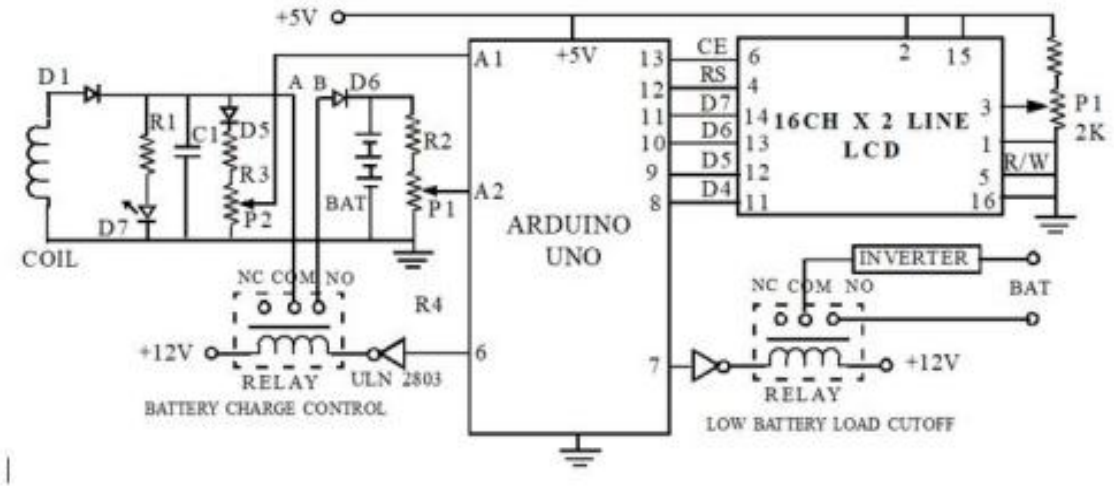

Figure 3.2: Arduino board circuit diagram

1.3.3 System Working

When system starts, If WIFI is connected to system then it will read vibrations, Temperature Humidity, Moisture of soil from the sensor If WIFI is not connected then, it will show device is offline in blynk application. The Blynk app will produce an alarm and send a warning and letter to the department if readings from all sensors are beyond the predetermined range. If not, it will send the blynk application continuous data. When a landslide occurs and an alarm is created, the department is notified, and the department sends a bridge to the area to restore transportation. The bridge sensor detects movement, if movement is not detected it will return to the initial process, if movement is detected then the bridge will be open and after delay time is over it will automatically close.

II RESULT AND DISCUSSION

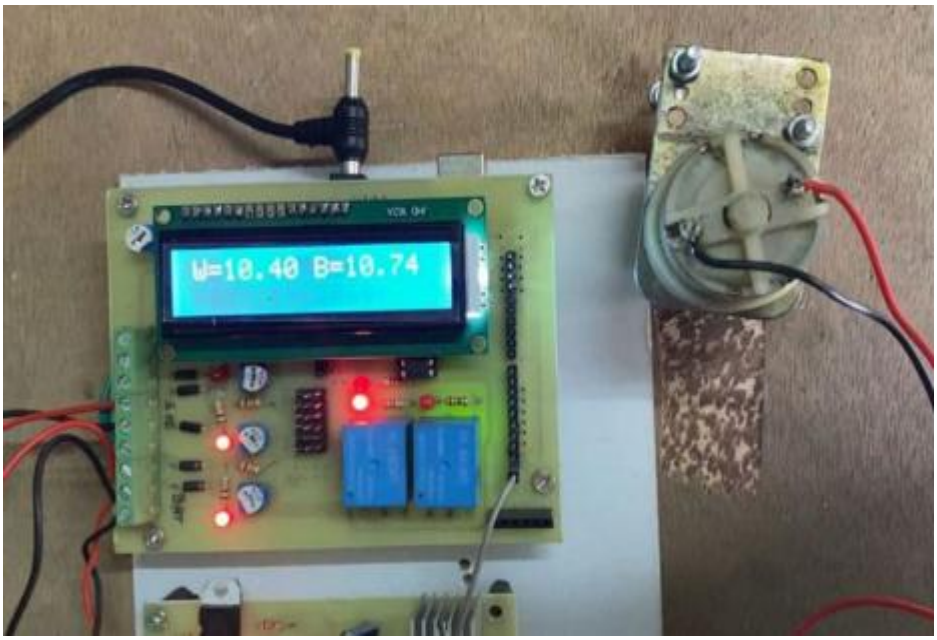

Figure 7.1: Wind and battery voltages displayed on LCD

Aim of project is to charge battery with wind turbine and run inverter on it, while doing this we want to take care of battery and show different information on lcd. Battery must be charge when wind turbine is generating power and battery needs charging , when wind turbine voltage is greater than battery and battery id not full charge charging relay 31 Title of the project is kept on. When battery is discharge its voltage level gets decrease. when battery voltage is less than 9v load (inverter) must be disconnect to prevent battery from deep discharge . Initially we are showing welcome massages on display. Then input /output ports are configured. Reading wind turbine voltage and showing on display. Reading battery voltage and comparing with turbine voltage if it is greater, charging relay is made on. If turbine voltage is less than battery, charging relay is kept off. Respective massage is shown on LCD. Now we will take decision of making load relay on or off. If battery voltage is too low it means below 9v for 12 v battery it means battery is discharge and if it further used it will get flat and while charging it will need more current for charging due to voltage difference between battery and battery charger voltage.

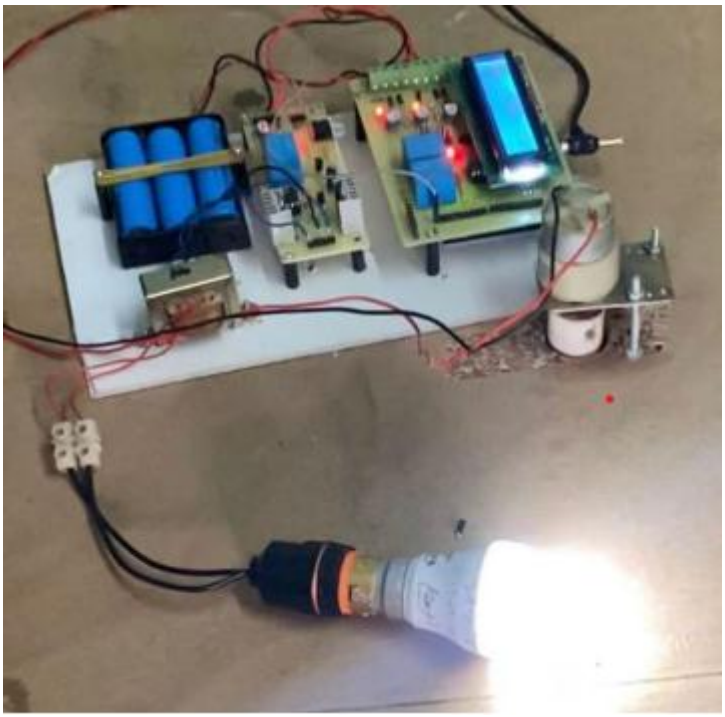

Figure 7.2: We are getting our inverter output

III.CONCLUSION

Vertical axis wind turbine has economically feasible energy solution for isolated areas missing from combined grid systems. Design of wind turbine rotor blades plays an important role in performance evaluation and extraction of energy from turbine. Vertical axis wind turbine placed in a location where moderate wind is available and by optimizing blade parameters, design specifications higher power generation can be achieved. For remote areas, the designed vertical axis wind turbine will be serving as good feasible energy generation unit.

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