

POWER GENERATION WITH VERTICAL AXIS WIND TURBINE USING IOT

Alfiya Siddiqui¹, Mrunali Gajbhiye², Prachi Sawarkar³, Rajat Thakare⁴, Vaishali Samrit⁵,
Vaishnavi Thote⁶

*UG Scholar, Prof. Surbhi Shrivastav⁶, Assistant Professor Dept. of Electrical Engineering,
JIT, Nagpur, Maharashtra, India*

Abstract

Renewable energy sources are seen as next generation source of energy for meeting rising energy demands. This paper focuses on use of air to generate electricity with the help of vertical axis wind turbine using IOT. Vertical axis turbine is capable of extracting power from wind regardless of the direction of flow and capable to extract energy in day and night time. The power generation with vertical axis wind turbine using IOT will be beneficial in future aspects, The VAWT (Vertical Axis Wind Turbine) are more profitable in nature, it has much better self-starting characters and better conversion efficiency at lower flow speed. The IOT (Internet of Things) is used to provide the alert if any type of fault occurs in generation and IOT is also take action regarding to that fault. This paper deals with uninterrupted power generation by using VAWT and IOT.

Keywords: *Vertical axis wind turbine design, renewable energy source, battery system, IOT rectifier, inverter.*

INTRODUCTION

In a day to day life, the demand for the electricity is much higher than the production of electrical energy. One of the major problems ever seen the natural resources are going to finish one day. The fossil fuel major role in production global warming, a greenhouse gas, etc. By burning of fossil such as coal, oil and gas for energy produce co cause increase in global temperatures, rising sea levels and threats to entire ecosystems. This means we need to adopt those forms of energy that do not produce co2. Hence the renewable energy source is better for power production such as air. The installation cost of renewable energy source is must less than non-renewable. The motivation of this project contributes the global trend towards clean energy.

The main motive behind this project is to design a vertical axis wind turbine which effectively uses the wind energy and provide uninterrupted power supply to the appliances using IOT. So the maximum wind energy can be extracted by the vertical axis wind turbine as compared to the horizontal axis wind turbine. The generator electrical energy we can use for home appliances, for monitoring use, for boat/marine use, for streetlighting etc.

LITERATURE SURVEY

➤ **Darrieus Vertical Wind Turbine**

The first aerodynamic vertical axis wind turbine was developed by Georges Darrieus in France and first patented in 1927. Its principle of operation depends on the fact that its blade speed is a multiple of the wind speed, resulting in an apparent wind throughout the whole revolution coming in as a head wind with only a limited variation in angle. From the prospective blade, the rotational movement of the blade generates a head wind that combines with the actual wind to form the apparent wind. If the angle of attack of this apparent wind on the blade is larger than zero, the lift force has a forward component that propels the turbine. An angle of attack between zero and 20 degrees requires a sufficiently high blade speed.

A Darrieus turbine can't self starting; it needs to be brought to a sufficiently high blade speed by external means.



Fig 1 .Darrieus Vertical Wind Turbine

➤ **Impulse Savories VAWT**

The savories turbine is a vertical axis machine which uses a rotor that was introduced by Finnish engineer S. J. Savonius in 1922. In its simplest form it is essentially two cups or half drum fixed to a central shaft in opposing direction. Each cup or drum catches the wind and so turns the shaft, bringing the opposing cup or drum into the flow of the wind. This cup or drum then repeats the process, so causing the shaft to rotate further and completing a full rotation. This process continues all the time wind blows and turning of the shaft is used to drive a pump or small generator. These types of windmills are also commonly used for wind speed instrument such as the anemometer. Modern savories machine have evolved into fluted bladed device, which have a higher efficiency and less vibration than the older twin cup or drum machine.

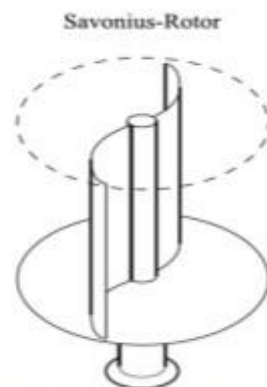


Fig.2 Savonius type of VAWT.

➤ **Variable Geometry Vertical Axis Wind Turbine**

P. J. Musgrove in 1975 led a research project at reading University in the UK whose purpose was to attempt to rationalize the geometry of the blades by straightening out of the blades of a Darrieus type wind turbine. This led to design of straight blade vertical axis wind turbine designated as the H rotor blade configuration. At the time it was thought that simple H blade configuration could, at high wind speeds, over speed and become unstable. It was thus proposed that reefing mechanism be incorporated into the machine design thus allowing the blades to be feathered in high winds. These machine earlier machines with feathering blades were known as Variable Geometry Vertical Axis Wind Turbines.



Fig 3. Variable Geometry Vertical Axis Wind Turbine

OBJECTIVE OF PROJECT

The main objective of our project is to use the maximum amount of wind energy and provide pre-protection power supply as well as fault alert using IOT. The unused considerable amount of pressurised air used to drive the vertical axis wind turbine from which the kinetic energy of turbine is converted into electrical energy using 3 phase generator. The main aim of this project to reduce the pollution produced during of fossil fuel. The generator energy by VAWT AC generator are converted into DC by rectifier control by IOT. The generator energy stored in a battery and this stored energy which can be used for AC appliances by using inverter, can be used for street lighting, for board , tall gates highway etc. In future to provide the charging node to the electrical vehicle.

METHODOLOGY

❖ Vertical Axis Wind Turbine

The vertical axis wind turbine is used to convert the kinetic energy into mechanical energy. The light weight blade materials (Nylon fibre) are used for making the vertical axis wind turbine. The height of blade 600 mm and quantity of blades is 5 pieces. The whole turbine is assembling with a collar, pole support and blades which is fitted by nut bolts. It is made automatically wind direction adjustment to achieve the unidirectional motion.

Turbine Specification

Height of blade = 600mm

Wheel diameter = 900

Safe wind speed = 45m/s

Starting wind speed = 2m/s

Operating temperature = 40c to 80c

Wind direction adjustment = Automatically



❖ Generator Design

Stator

In generator mechanism, 4 coils are used as a stator. The coils are connected in series to achieve desirable voltage from each coil. When the rotor is rotated across winding then the EMF induced on it. The generated EMF is an alternating quantity [1].

Coils Specification

Winding Conductor Gauge = 35

Turns of each coil= 2200 turns

Number of coil= 4

Output voltage= 60-85 volts (Depending on speed of rotation)



Fig. 5 Coils

Rotor

In generator mechanism, a rotor is consisting with permanent magnet placed around the stator. The shape of this permanent magnet is a square . When a rotor is rotated it produced a rotating magnetic

field which link with the stator coil and generate EMF in stator coil. The type of magnet used for rotor circuit is neodymium strong magnet.

Specification of Permanent Magnet

Neodymium strong magnet= 4 (square magnet)

Plating= Nickel + copper

Size= 25mm*25mm*12mm

Battery

A valve regulated lead acid battery sometimes called sealed lead-acid (SLA), gel cell, or maintenance free battery.

. Due to their construction, the Gel and Absorbent Glass Mat types of VRLA can be mounted in any orientation, and do not require constant maintenance. They are widely used in large electrical devices, off-grid power systems and similar roles, where large amounts of storage are needed at a lower cost than other low-maintenance technologies like lithium-ion.

Specification of Battery

Voltage Range= 12 Volt.

Current Range= 12 Ah.

Valve regulated sealed lead acid rechargeable battery.

Inverter

In 1980, Toshriba invented the inverter. The inverter is converts DC to AC . An inventor converts the DC electricity from sources such as batteries or fuel cells to AC electricity. The electricity can be at any required voltage in particular it can operate AC equipment designed for mains operation.

Inverter Specification

Start up input voltage- 12 volt DC

Output voltage-220 volt AC

Ampere voltage-6amp

Power factor-6.8

Output power-100watt

Overload protection-yes

Battery can be connected- 12volt 7apm to 12volt 200amp battery



❖ 3 Phase Rectifier

A 3 phase rectifier is a device which converts a 3 phase AC voltage at the input to a DC voltage at the output

Rectifier specification

Start up input voltage- 220 volt AC

Output Voltage-12 volt DC

IOT

The Internet Of Things (IoT) is a system of interrelated computing devices mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

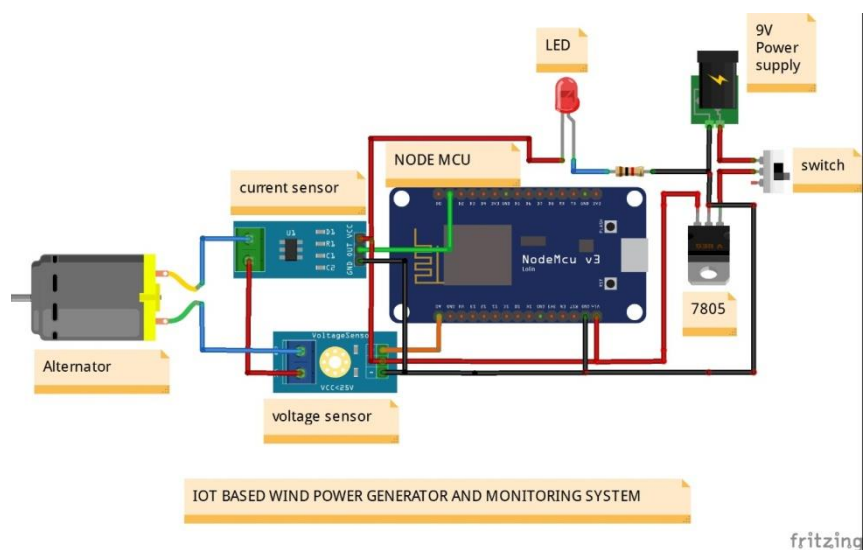
Working:-

An IoT system consists of sensor/devices which “talk” to the cloud through some kind of connectivity. Once the data gets to the cloud, software processes it and then might decide to perform an action, such as sending an alert or automatically adjusting the sensor/devices without the need for the user.

A complete IoT system integrates four distinct components: sensor/devices, connectivity, data processing, and a user interface. Below I will briefly explain each component and what it does.

1) Sensors/Devices

First, sensor or devices collect data from their environment. This could be as simple as a temperature reading or as complex as a full video feed.



2) Connectivity

Next, that data is sent to the cloud (what’s the cloud?), but it needs a way to get there! The sensors/devices can be connected to the cloud through a variety of methods including: cellular, satellite, WiFi, Bluetooth, low-power wide-area networks (LPWAN), or connecting directly to the internet via Ethernet.

3) Data Processing

Once the data gets to the cloud, software performs some kind of processing on it.

4) User Interface

Next, the information is made useful to the end-user in some way. This could be via an alert to the user (email, text, notification, etc). for example, a text alert when the temperature is too high in the company's cold storage.

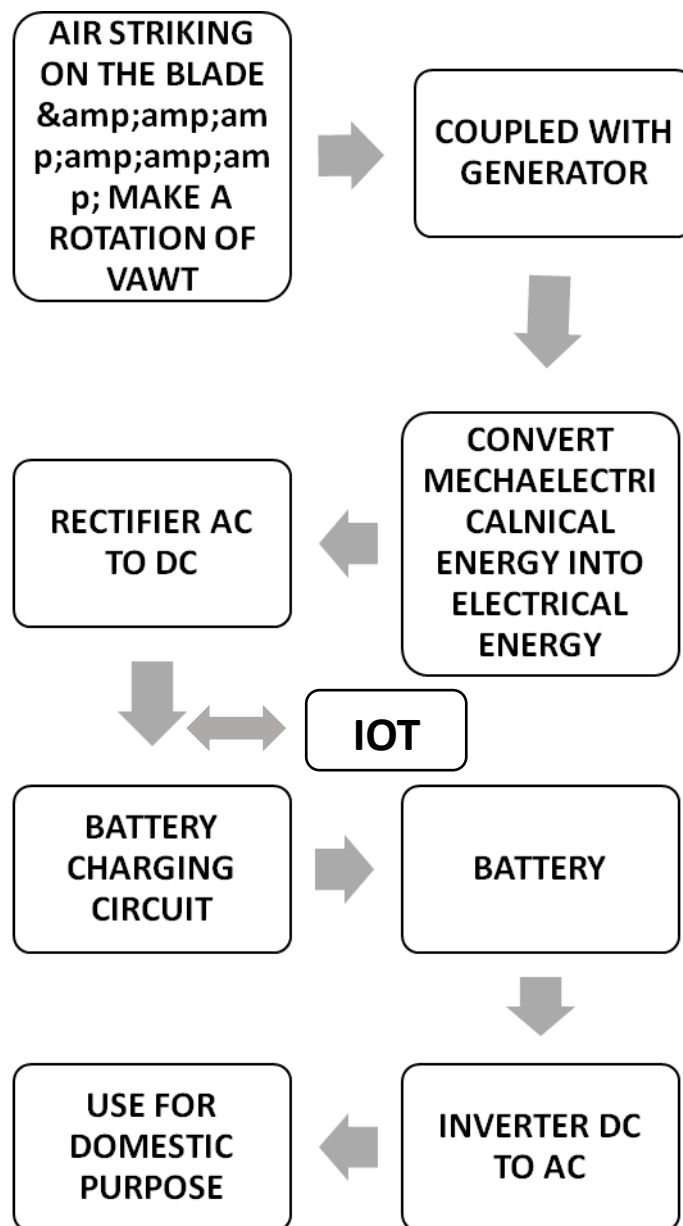


Fig. 6 Block Diagram

WORKING PRINCIPLE

When the pressurized air is strike on the blade of vertical axis wind turbine and turbine makes a rotation. The shaft of the vertical axis wind turbine is connected to the 3-phase AC synchronous generator with the help of gear mechanism. The generated electricity in an alternating quantity. The output of the generator is rectified by rectifier and converted into DC. The dc power is stored in the battery. The inverter is provided which convert DC power into AC power. This AC power we can use in our home appliances. Which is maximum available in AC parameter. Between rectifier and battery IOT control is provided which give alert when any faults occur in system. And send a sms to the operator.

CONCLUSION

This system is environmentally friendly. The working model of our project is combination of wind energy source with IOT control. Cost effective, green energy source for power generation can help to reduce power requirement. An efficient hybrid wind turbine is designed to be use in road side application for energy generation.

This turbine is specially designed for road side applications which generate energy by utilization of natural wind and wind turbulence. A IOT operated effective charge controller has been developed. Charge controller charge battery from generated voltage and utilize this energy for later use. The presented system is cost effective, ready to use and user-friendly system which used to serve specifically in highway lightning system.

It is very useful in the areas which have heavy traffic on road without congestion. With the help of public aids, this system can be used to facilitate many houses and home and will be very handy for implementation.

If we implement this method surely we can shift our country into a new dimension that is we need not depend upon any other country for electricity. Energy independence is the ability of a country or region to meet all its own energy needs.

REFERENCES

1. Mithun K K and Ashok S “Wind Turbine for Highway Wind Power Generation” IJEEE, Volume 07, Issue 01, Jan- June 2015.
2. Dhiraj Varma and AjitabhPateriya “VAWT and Solar Panel Combine System Based Generation of Electricity through Highway” IJRISSE, Vol.3, 2017. pp: 137-140.
3. S.Selvam, Edison Prabhu .K, Bharath Kumar M.R, & Andrew Mathew Dominic “Solar and Wind Hybrid power generation system for Street lights at Highways” International Journal of Science, Engineering and Technology Research (IJSETR), Volume 3, Issue 3, March 2014.
4. Scheurich, Frank, and Richard E. Brown “Modelling the aerodynamics of vertical axis wind turbines in steady wind conditions” Wind Energy 16.1 (2013): 91-107.
5. Shweta Singh, Sarita Singh and Priyank Srivastava “Vertical Axis Wind Turbine for Generation of Electricity through Highway Windmill” S-JPSET: Vol. 7, Issue 2, ISSN: 2229-7111
6. Krishnaprasanth.B ,Akshaya.P.R , Mr.Manivannan.L, Ms.Dhivya.N “A New Fangled Highway Wind Power Generation” International Journal for Research in Applied Science & Engineering Technology (IJRASET) Volume 4 Issue I, January 2016.