

NON CONVENTIONAL POWER GENERATION BY WIND ENERGY PRODUCED BY FAST MOVING TRAINS USING AXIAL TURBINES

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Abstract - Recent scenario reveals the imbalance in power generation and power demand in many of the countries. we need different ways of power generation using renewable energy sources like solar energy, wind energy, Tidal energy, Geo thermal energy etc. Wind energy is considered the fastest growing clean energy source however; it is limited by variable natural wind. In our project we have come up with the idea of producing non-conventional power generation using Axial wind turbine to recapture wind energy from moving trains on railway tracks. However railway tracks can provide a required considerable amount of wind to drive a turbine due to movement of trains. Apart from this the produced energy and setup is smartly monitored using various sensors like IR Sensor, Gas Sensor, GPS Sensor to detect blade damage, smoke detection and fault location and parameters like wind speed, R.P.M, Voltage, Current are monitored over IoT. Additionally storage system for power generated is provided to reduce fluctuation and maintain constant power source.

Key Words: Axial wind turbine, IR Sensor, Gas Sensor, GPS Sensor, Storage system, IoT

1. INTRODUCTION

On Railways, trains moves faster. Moving trains on the tracks create wind turbulence. When a trains moves on tracks, it disturbs the wind present over that tracks. Trains creates low wind pressure field and big vertex behind it while moving. The wind disturbed by the trains intend to cover that space created by the moving trains and creates huge wind turbulence at Railway tracks. The direction of the wind turbulence is always moving along the trains to the centre of low pressure field. Turbulence presents at the Railway tracks along with normal breeze creates a strong wind effect near the Railway tracks. This wind effect can be easily feel by any one on the tracks side. Wind turbulence at the Railway tracks is directly depends upon size and speed of the automobile (train) along with the frequency.

1.1 PROCESS

Energy is derived by the use of required generator that are attached to the turbines, which the conversion takes place.

The turbine is almost 7 feet in height designed in a manner which exerted air is also used for power generation. The turbine shaft is than connected to the secondary rotor shaft. The amount of energy derived is stimulated in to various parameters such as, wind speed, voltage, current, power derived, power saved etc. The turbine blade swifts with respect to generator and the calculations is done.

2. CONSTRUCTION

Combination of two different turbines enhances the efficiency of power generation in road side application. Different materials are used to manufacture both the turbines. The selection of material is based on the availability, reliability

A. Designing of H type rotor:

Component used: Wooden airfoils, wooden cross shaped wood, Nut bolts, L shaped Aluminium connectors

- Dimension of airfoil : 90*1*7cm
- Dimension of turbine (l*b*h) : 100*100*90cm

B. Designing of Savonius:

Component used: Aluminium sheet, L-shaped connectors

- Height of turbine : 60cm (2 ft)
- Overlap Space : 5cm
- Ratio of Bend and Straight Blade : 2:1 (30cm:15cm)

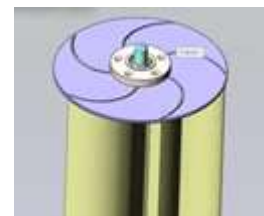


Fig -1: Axle

Darrius turbine is not self started, so to make it to start at low wind speed an external model is used along with it. They are very suitable to generate power at high wind velocity due to its structure and lift force but these turbines have limited rotational speed due to its heavy structure at high wind.

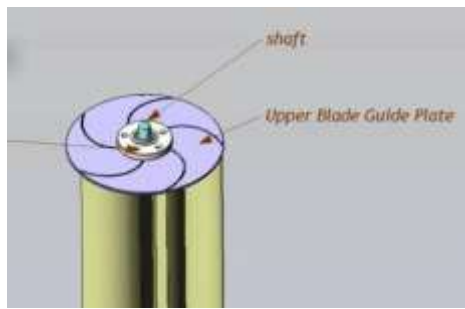


Fig -2: Base of the shaft

Two different wind turbine structures are combined with each other to form hybrid turbine. This hybrid turbine has capability to generate high initial torque and high rotational speed for low and high wind velocity respectively. A DC generator can be used as a DC motor without any constructional changes and vice versa is also possible. Thus, a DC generator or a motor can be broadly termed as a DC machine.

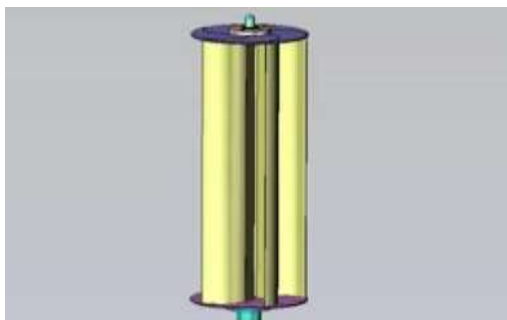


Fig -3: VAWT design

2. WORKING

Smart Wind power is the conversion of wind energy into useful form of energy such as electric energy by using wind turbines in the middle or either sides of the Railway tracks to generate electricity. Wind power is an alternate to fossil fuels which is plentiful, renewable widely distributed .clean energy produces no green house gases during its operation and requires little land. So, we suggest that the energy can be harnessed in Railway tracks or by placing the smart wind turbine in the either side of the tracks. The smart wind turbine rotates more effectively because of the wind power generated in the tracks due to large number of trains passing at very high speed. The smart wind turbine consists of the shaft which is mounted on the blades and the bottom end is connected to the generator. When the wind power increases certainly the number of rotations gets increased. Additionally, Smart monitoring system equipped with IoT is used to detect blade damage, monitor amount of power generated and stored, indicate exact fault location using various sensors. So the implementation and monitoring can be made easier.

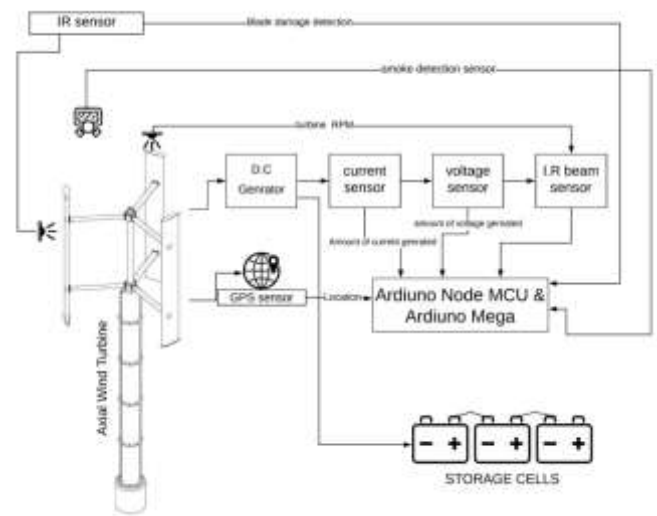


Fig -4: Block Diagram

4. COMPONENTS USED

Hardware Components:

- Arduino Node MCU Controller
- Arduino Mega controller
- Vertical Axis Turbine
- Voltage and current sensor
- IR beam sensor
- Accelerometer
- D.C Generator
- GPS Sensor
- Transformer & Storage cells

Software :

- Embedded C
- Arduino IDE
- Thingspeak

BACKGROUND AND RELATED WORK

In this proposed system, a high end design of vertical axis wind turbine is installed and required cabling is attached for power system. The DC generator which performs energy conversion is installed to the shaft of the turbine. Controller Atmel AT mega 328 is connected to the voltage, current, and high beam RPM sensors. Node MCU is used transmit data over IoT platform to monitor various parameters using WI-FI. The LCD display is fitted to indicate the power generated and stored in the transformer at field level.GPS Module NEO-6M is used to determine the location of fault and indicate the exact location using IoT on any soft device like mobile phones. Simultaneously the wind speed is also measured in order to compensate the generation and rpm of the shaft. The wind speed is measured using Zephyrus wind lite meter on any soft device. The generated parameters voltage,

current, rpm, location of fault, power generated can be viewed and monitored on any device using Mindsphere IoT open platform software and they can also be viewed in graphical form by serial plotter of the IDE software. Cabling is given to the series of turbines so that it produces maximum energy to and meet out the demand of residential and commercial needs.

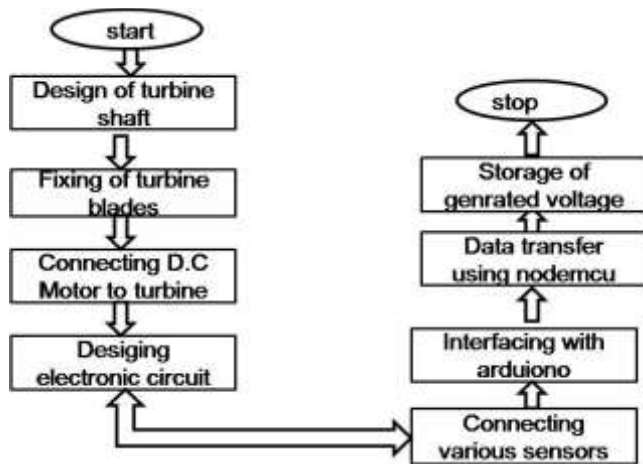


Fig -5: Flow chart

3. RESULTS AND OUTPUT

This H type VAWT model is tested on Railway tracks and analyzed in real world environment. Output of the system is measured as the power generated by tracks side wind turbine. Voltage is the key parameters for battery charging purpose so the chart given for power generation for specific time with shows its values in volts. 24V, 240rpm, 9Amp parameters are Generated using this turbine. Voltage level generated by HSWT on 10th March 2019 is shown. Result shows us during peak time when frequency of trains per hour is more, power generation is also increases to its peak for a single unit. This system can generate energy during no movement time with the help of generalize breeze. With the help of grid cluster network and facility the HSWT can make a significant impact on street lightning or blackout problems in Railways.

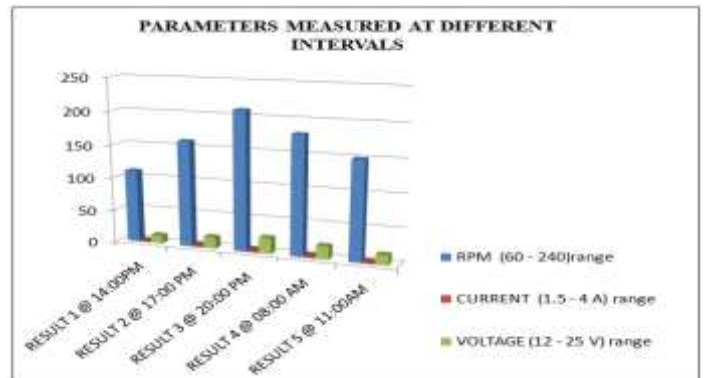
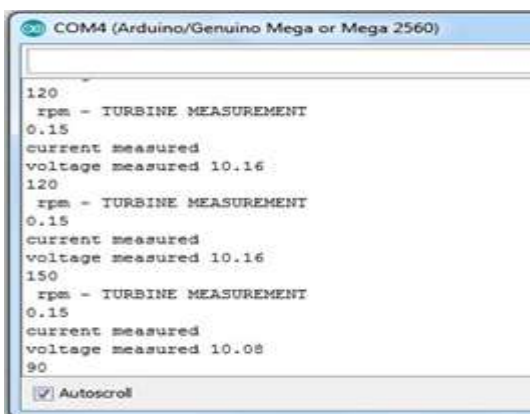


Fig -6: Analysis of derived parameters at different intervals

3. CONCLUSION

Wind is a cost effective, green, renewable energy resource for power generation. Tracks side application of wind turbine with improved efficiency can help us to reduce a gap between demand and supply of power. An efficient hybrid wind turbine is designed to be used in track side application for energy generation. This turbine is specially designed to generate energy by utilization of natural wind and wind turbulence created by the moving trains on the tracks. Winds from all the direction are utilized by this turbine. This turbine is self-starting, easy to installation, low in cost, easy to monitor and suitable for both high and low wind speed.

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