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Vertical Axis Wind Turbine with Solar Tracking

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Abstract: ***Wind energy is one of the non-conventional forms of energy and it is available in humungous amount. Vertical Axis Wind Turbine (VAWT) can generate electricity. This projects aims of utilizing this wind energy in most effective manner to get the maximum electric output, and therefore we selected highways and railways as our installation site where we can take the advantage of the moving vehicles and trains on both the sides of the road and platform respectively. This model will also be augmented with solar tracking panel at the top of it which assist in generating more energy together or in the absence of other. In the name of advancement we will also be using this model as a weather station with the help of different sensors such temperature, humidity etc. This all will come with the features of real time data logging and IOT. This project will be cost effective and efficient in terms of output. So that the government can think over this project and can implement this type of vertical axis wind turbine on highways and railways at efficient cost.***

Keywords: Vertical Axis Wind Turbine, VAWT, Solar Tracking. Weather sensor and data logging

I. INTRODUCTION

In today's race every country is competing with the other over the dominance of the world. And the leader of this race can be judged according to factors such as 1) Resources 2) Energy. Putting lights on these two we can say that this race is far from over because of lacking resources and most importantly energy. The main reason or culprit is nothing but the over population. In demographics, the world population is the total number of humans currently living, and was estimated to have reached 7.6 billion people as of May 2018[1]. This carnage of population is consuming so much of energy stored within earth rapidly every second. Considering this never ending need of energy and appallingly increasing people's standard of living conventional energy sources are far less than enough. It has been stated by various scientist and geology experts that after not more the 50 years there will be crisis of energy. Every country will wage war against each other for the rights of conventional energy sources. So now we are facing a superior necessity to utilise the non-conventional energy resources effectively.

Wind and Solar energies are two most prominent sources of non-conventional energy. They are available in never ending amount and possess humongous and tremendous amount of energy. The wind turbine and the solar panel are the instruments or gadgets that can produce power or electricity for wind energy and solar energy respectively.

In our model we are uniting these two particular modules together so that it can produce power effectively. Vertical Axis Wind Turbine is the predecessor of traditional horizontal axis wind turbine which can capture the flowing wind effectively, resulting into more efficient power generation. Also solar tracking unit is the advancement into the normal solar panel. We are planning to plant this model on the highways and railways so that the wind turbine will get enough wind supply generated from the high speed of moving vehicles and train from both sides. We are planning to augment this model with temperature and humidity sensors with can collect the weather report near accurately. The collected result can be stored in the SD card and also using wi-fi module (IoT).

II. RELATED WORK

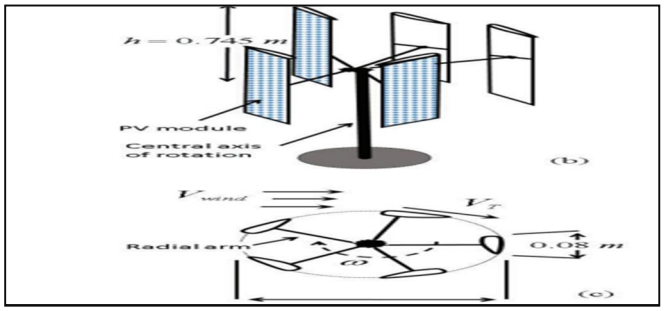

Fig.1 PV module of vawt[4]

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Figure 3 shows the PV modules are integrated with the H-type VAWT which has five blades of a height h 0.745m and a width of 0.08m. The diameter of the rotor is d 0.56m. The wind has a speed of in m/s which rotates the shaft with a speed in RPM at a rotation frequency in rad/s of 60 2S Z N and the resulting turbine speed in m/s will be 2 d VT Z . The PV modules used are very lightweight and the dimensions match that of the blades such that the aerodynamics of the wind turbine are not affected.
The vertical-axis wind turbine used in Figure 3 has a maximum power 75W . It consists of five blades of height h 0.745mand has a rotor diameter d 0.560m resulting in a projected turbine area 2 A hu d 0.417m Where Cp is the aerodynamic power coefficient, 3 U 1.225kg / m is the air density, and Vwind is the wind speed.

A. Concern Parameters

1) Solar Cell Efficiency: It is the Portion of energy which is coming from sunlight that are converted into electricity and also Efficiency of the solar cell can be defined as,

Efficiency = max power output / (incident intensity) × (area of device)[3]……(a)

Also, Efficiency = (V × I) / (Insolation × A)[3] .....(b)

Where ,V is the voltage of solar cell in Volt , I is the Current.

2) Power of Vertical axis wind[5]: The total power of wind is equal to the kinetic energy of that wind. This kinetic energy of wind is used to spin the shaft which is already connected to the generator and produces electricity power . It can be given as,

$$P=(1 \times m \times v^2)/2$$[3] .....(c)

Where,

P =total power of wind ,

m = rate of flow of mass of air in kg/s ,

v =velocity of wind in m/s.

3) Efficiency[6]: Ideal efficiency is defined as ratio of maximum power obtained to the total power which are obtained .

$\eta = (power)_{max} / (power)_{total}$[3] ……..…(d)

Ideal Efficiency of wind Turbine is around 45 % but in coal power station there will be around 85 % of energy are converted into electricity.

4) Tip speed ratio[7]: It is define as ratio of the speed of tip of blade to the speed of free stream of wind.

λ= speed of tip of blade / speed of free stream of wind .....(e)

III.DESIGN AND IMPLEMENTATION

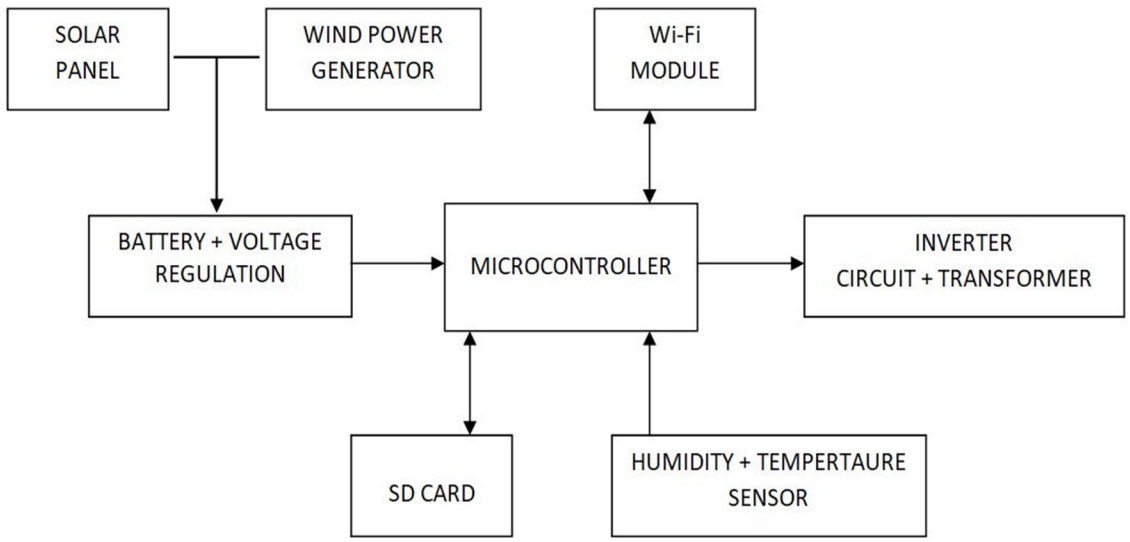

Fig 2. Block Diagram

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1) The block diagram can be divided into three sections; power generators, a microcontroller unit and sensors and data storing.
2) First part which is a power generation section comprises of wind power generator with solar tracking system, battery with voltage regulator, inverter and transformer circuit.
3) The energy generated through wind turbine and solar panel is stored into a battery using voltage regulator.
4) Some of this power is used for different applications through inverter circuit and transformers.
5) The main section is microcontroller which is at the heart of the device; controlling all the functions by giving them priority as programmed.
6) The other augmented section is consist of various sensors such as temperature sensor, humidity sensor etc. with a wifi module which is can be used real time data connection, storing and logging.
7) The Data collected by these sensors can also be collected in SD card.

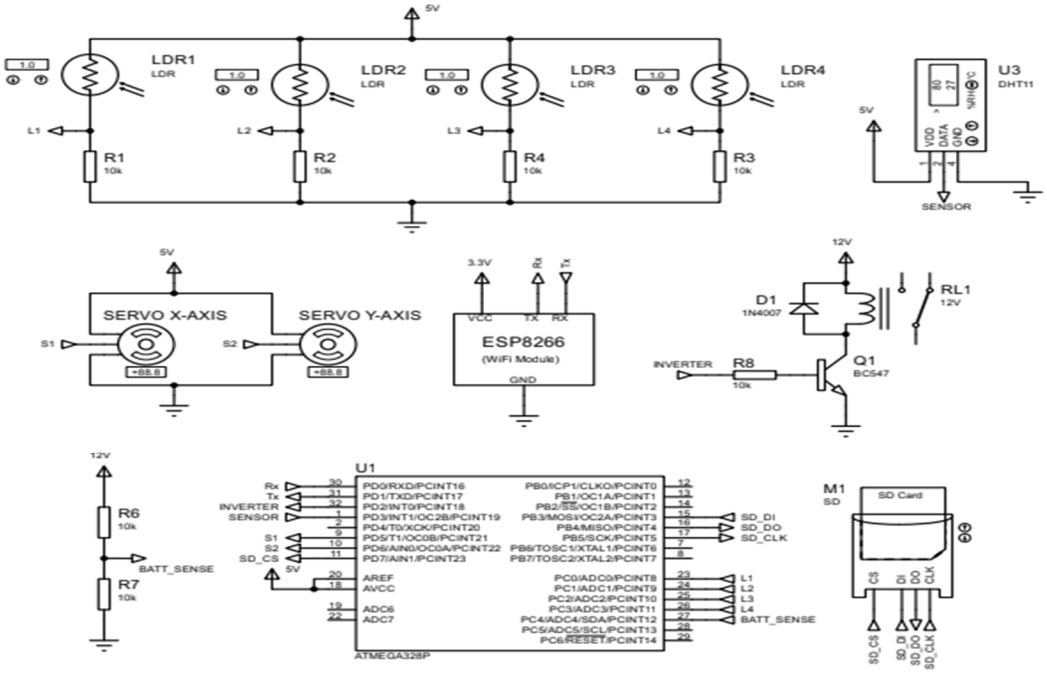

Fig. 3(a) Circuit Model

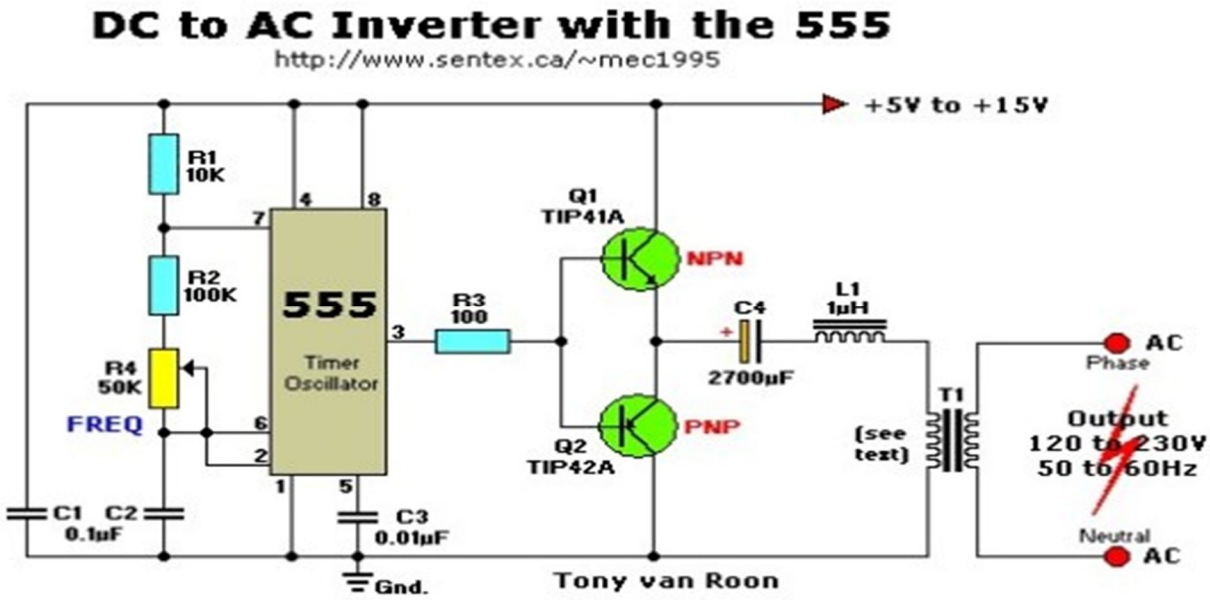

Fig. 3(b) Inverter Circuit [1]

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IV. CONCLUSION

A. The device can store energy efficiently generated through wind and solar energy.

B. The sensors can collect data and stored in the SD card or data logging can be done on real time basis.

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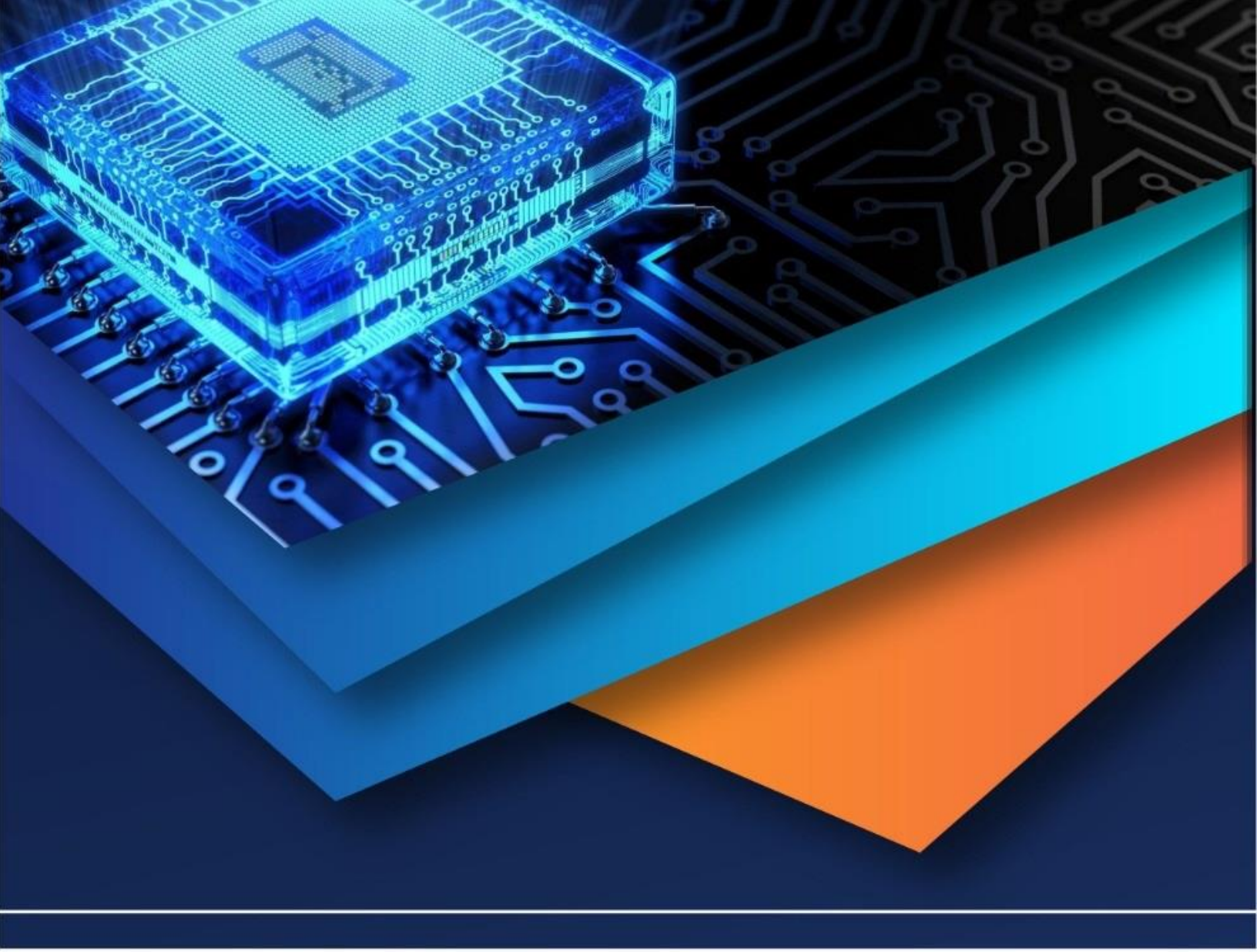

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