Generation of Electricity Using Wind Energy on Traction System

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Abstract- *This paper discusses the generation of electricity through wind on rail tracks and its methodology. Today the electricity is most important facility for human beings. In this project combination of wind turbine and dynamo on railway track is used to generate electricity.This process is Free from any kind of Pollution which is obtained by the existing energy generation systems. So It is eco-friendly solution as well. In this paper we are proposing a system of wind turbine with dynamo to convert wind energy generated due to motion of train into Electricity. This will be generated by installing wind turbines on railway tracksby replacing the alternate sleepers, so the wind generated by running train can be used to rotate the blades of wind turbine and due to which power generated and this generated power can be stored in batteries and used for signaling purposes.*

Keywords- Introduction, Related work, wind power, Operation, Working, Calculations, Advantages, Disadvantages, References, Conclusion.

I. INTRODUCTION

Wind power is the form of renewable energy which is extract from the wind. This is possible by using wind turbines. The wind energy required Minimum cost for generation of electricity. As well as Maintenance Money is also less for wind energy system. In proposed system we are making use of wind turbines and dynamo's which are placed in between tracks. These wind turbines are enclosed which replaces alternate sleeper. When train moves at high speed a gust of wind is produced along a train which is waste energy, this gust of wind is used to rotate the wind turbine. In order to achieve better mechanical efficiency we are using vertical axis aerodynamic shaped turbine blades over conventional blades.
The proposed system is useful in providing electricity to remote locations where electricity is not easily available for signaling and other purposes. The energy generated can be stored in batteries or directly transmitted for signaling system. The output of wind generator is variable so in order to get constant output voltage we are using charge controller circuit which also blocks reverse power flow. If train traffic on route is good then sufficient amount of power can be generated.

II. RELATED WORK

The main concern is to use the renewable sources of energy as much as possible. The system is basically a utilization scheme for the wind energy produced which get wasted. As seen day by day population is increasing at a rapid rate, it is very essential to concentrate towards these ideas. This system works on the traction system.

Nowadays seeing the current scenario, the use of railways is increasing day by day. Utilization of energy through this idea would be very beneficial in future time. This will have immense effect on upcoming metros, and bullet trains. As they will have a greater speed, they can produce a large amount of wind energy and we can get a good output voltage.In this we are going to install the turbine in between the sleepers so that they can be rotated through produced wind energy and can help to turn mechanical to electrical energy.

III. OPERATION

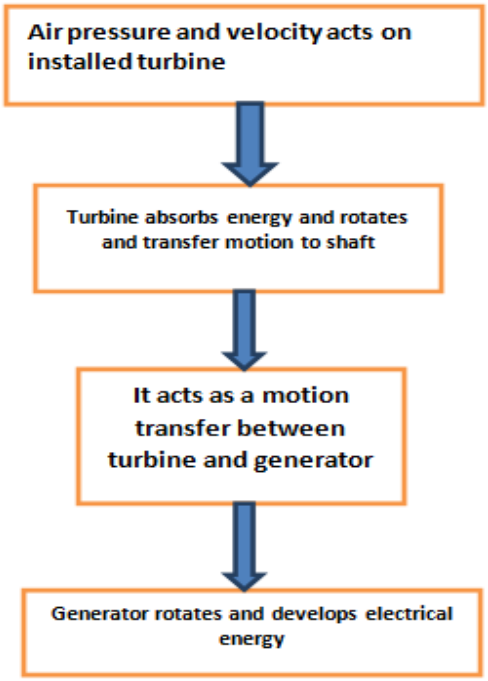

Fig 1:- Flow chart layout

The proposed system is a hybrid system for generation of electricity using wind as a primary input. This mechanism consists of some important blocks to complete this process. They are as:-

i. Wind turbine
ii. Charge controller
iii. Dynamo
iv. Inverter

i. Wind turbine

Wind turbine is equipment which extracts kinetic energy of wind due to its motion and rotates the wind generator with the help of its blades. Vertical axis wind turbine and horizontal axis wind are two basic types of wind turbine. In our system we are using vertical axis wind turbine and the blades are of aerodynamic shaped. The wind generator generates the power which is not constant.It is varying due to changes in speed. So this varying power we cannot use for the load.so for that we have to store in battery and then provide it to the load.

ii. Charge controller

Basic function of charge controller is that it charges battery and also supplies power to the load as per the need of load. The main function is that it variesthe power as per the requirement of the load. And it also adds both the power from battery as well as dynamo so that the requirement of the load can be fulfilled and when generator is not generating the power the already stored power in the battery is used for fulfil the load demand.

iii. Dynamo

A simple device used to convert the attained mechanical energy to electrical energy. This works when fast moving trains capture air currents by which it rotates, As turbine rotates the shaft joined to it rotates and the dynamo comes into action by which mechanical energy is converted to electrical. It is one of the major parts of generation.

Also we can decide variable dynamos depending on the speed of the moving train on tracks.

iv. Inverter

Inverter converts direct current into alternating current. As some of the loads are works on the alternate current supply. If we give direct current supply to the devices which works on alternating current than it will completely damage the device. For that we use inverters.

IV. WORKING

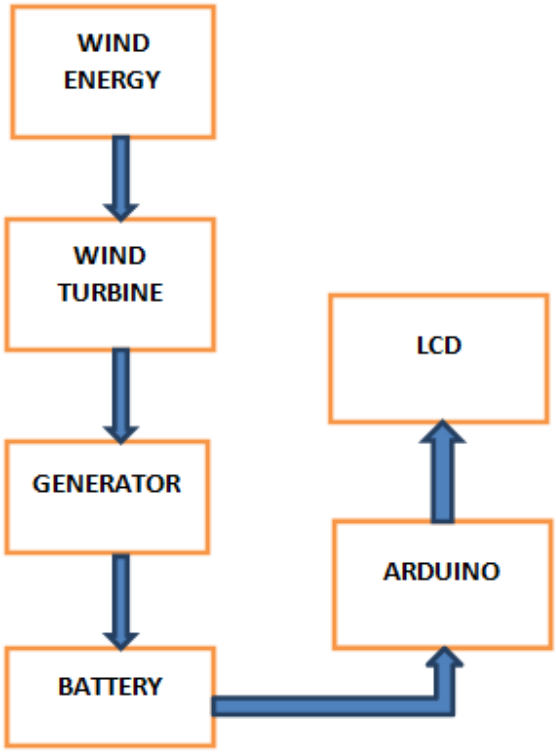

Fig 2:- Flow of project

The system simply works with the motion of trains. We are installing turbines in between the railway tracks by replacing sleepers with the wind turbines. When a running train at a certain speed passed by the turbine, the wind produced due to its motion will tend the turbine to rotate. Due to its rotation mechanical energy will be produced which will be linked through a dynamo with certain suitable rating with the help of a shaft. This mechanism will give us the generated mechanical energy into electrical energy .this will be linked to a Arduino will display the generated voltage. This can be then given to a battery or different loads for different uses.

• Calculations of mechanical power:-

According toBet'z principle,

Max power that is possible to extract,

P(mech)= 16/27 ρ*L*H*V3

Where,

ρ=density of air in kg/m3
H=height of blades of turbine in m
L=length of blades in m
V=velocity of wind in m/s

Considering train speed to be approx. 80 km/hr and tracks distance of a standard gauge if 1.435 m,

We are considering length of blade as 1m and width as 0.15m.

• Generator size:-

kwh= cf*gs*8760

Where,

kwh= annual energy production
cf= capacity factor (efficiency)
gs=Generator size (rated power) kW
8760# of hours in a year

V. ADVANTAGES

- Power generation is due to simple motion of trains.
- No need of fuel input.
- No pollution along with the output.
- Generation is through renewable sources of energy.
- Maintenance will be less.
- Safe operation.
- Generation is through waste wind energy.

VI. DISADVANTAGES

- High initial investment.
- Output is in marginal volts, until and unless sufficient turbines are installed.
- Payback period will be large.
- Proper attention at the installation process is mandatory.

VII. CONCLUSION

Wind power generation system using railway track is good and effective solution for power generation. It is applicable to some places where we can't reach easily. So power could be generated just to sustain extra transmission and generation costs. There are approximately 14,500 trains running daily. Indian Railway (IR) has about 63,208 routes Km of track. This method would be capable to generate 1,481,000 megawatt (MW) of power in India alone. It certainly has a high initial investment but also has a good life span. Overall it good and reliable system.

REFERENCES

[1] "Generation of electricity using wind energy produced due to motion of trains" by Shivank Joshi.
[2] Control Strategy for Optimal Compromise Between Trip Time and Energy Consumption in a High-Speed Railway Hee-Soo Hwang.