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A Review on Power generation methods using Roof Top Ventilator

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Abstract— This paper describes about the modified roof ventilator that can generate electricity after reviewing the techniques developed by various researchers. The new modification of the roof ventilator system is by adding the extra fins to help it to spin faster and more efficient. This system is suitable to use for the low speed wind places through Optimum design of the system. The system consists of DC generator, roof ventilator, solar charger, batteries and LED bulb. This paper is aimed to discuss the methods and techniques to generate electricity by roof top ventilators with suitable modifications. Roof top ventilator running with the principle of natural convection is used to drive the dynamo shaft. The revolution of the ventilator is used to operate an alternator to generate electrical power. By revolution of the ventilator the alternator starts to rotate in the ratio of 1:15. So, that the power produced is directly proportional to the speed of the ventilator. The small setup boost converter is used to step up the voltage.

Keywords— Wind power; Ventilator; Voltage regulation; Renewable Energy; Power Generation

I. INTRODUCTION

In recent days, the awareness on the energy conservation is rapidly increased as a result of global warming. Maintaining the better working environment is another concern. The roof top ventilator based power generation is the solution for the above said issues. In industry the ventilation is bought at higher cost. The roof top ventilator is developed to operate at use of natural resources.

II. VARIOUS DEVICES FOR VENTILATION SOLUTION

2.1. Ventilation based on natural convection – Just maintaining a cavity in the top of the roof allows the hot air to escape from the space. By natural the air raised up whenever its temperature is increased. And permitting the fresh air to enter the working space through the door and windows.

2.2. Wind cowling – the cross sectional surface similar to airplane wings is made available in the roof, which allows the hot air to flow out of the building. This method is one the ways of ventilation using the natural convection.

2.3. Ventilation using Turbine – these are operates as a drag devices which removes the hot air as a result of rotation of vertical blades. This is based on the forced convection.

2.4. Ventilation using solar energy – It is similar to above said method but the power required for rotating the turbine blades are using the solar energy. The power from the solar PV panel is used to drive the motor.

2.5. Ventilation using pressure difference - This is also works with the principle of natural convention but with the pressure difference.

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The pressure between the atmosphere pressure and pressure inside the working space

III. REVIEWS IN THE FIELD OF POWER GENERATION FROM ROOF TOP VENTILATOR

3.1. Electricity generator driven by a roof ventilator [1]: Dangeam developed a model by installing three phase synchronous generator into the roof ventilator. The AC current is developed in the three phase stator winding is rectified in to DC voltage and charged in to the 12V 5A lead-acid battery. The author studies the working of this model under two different conditions such as with motor driven and with natural air driven. Further the author design and installs the generator. The maximum voltage in raised up to 8V and 28mA at 49 rpm.

3.2. I.Daut et al.[2] modifies the roof top ventilator by adding extra fins to spin faster and to improve efficiency. Here AC generator is coupled so that the system charges the 12 Vdc batteries.

3.3. Hybrid Ventilators and Analysis [3][4]: Ahamed developed an experimental setup to test various ventilation devices at the University of New South Wales and to improve the performances of such devices. Based on such analysis Standards are developed and discussed by the author.

3.4. Ming Chun Hsieh et al. [5] presents a paper on the new type of rooftop ventilator turbine motivated by a coreless stator AFPM (Axial Flux Permanent Magnet) generator to develop power.

3.5. Magnetic Levitation Rooftop Turbine [6]: Kaewtip et al. develops prototype with an objective to reduce the self starting speed. This is achieved by installing the magnetic levitation system to carry the weight of the turbine body followed with the adjusting of rotor and stator for power generation. The test is conducted by varying the wind speed and obtained a self start at 0.4 m/s wind speed.

3.6. Wind and Ventilation Turbine(WVT) Generator [7]: Anthony Lloyd et al. develop the concept by conducting the experiment in the model designed and fabricated by his own. The author claims that this concept is not practical in business world after performing the economic and feasibility study.

3.7. Application of Roof ventilator for Electricity generation [8]: Torasa et al. developed a model for power generation from roof top ventilator by mounting a DC generator inside the ventilator geared to the central shaft. The Maximum output obtained from this model generates a voltage of 14.32 v and current upto 220 mA which glows the LED lamp.

3.8. Turbo Ventilator [9]: Ganesh K.Jadhav et al. developed a model to improve the ventilation by installing a fan inside the ventilator and propeller system geared to the inside drive. The power required to drive the fan is supplied using the Solar PV panel. Further the authors conducts several trail under different condition followed with three dimensional analyses.

3.9. Akshay.S.Zagade et al.[10] conducts a review and prepared a detail comparison on different methods on generating power from

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roof top ventilator. These methods include Axial Flux Permanent Magner (AFPM), Permanent Magner Synchronous Generator (PMSG), AC-Generator and AC Synchronous Generator coupled with Roof top ventilator for power generation.

IV. MECHANISM

Roof top ventilator running with the principle if natural convection which is further used to rotate the alternator shaft. The system is containing the combination of the DC alternator, Batteries, Roof ventilator and Booster circuits.

Usually the ventilator will be installed in the top of the roof for removing the hot air inside the working space. The main principle of roof top ventilator is the conversion of wind energy into mechanical energy. The wind energy is obtained as a result of pressure difference between the atmosphere and pressure inside the working area. As a result of human and machine work inside the working area the pressure and temperature of the space increases. Further the temperature of air increases the pressure of air. The pressurised air is tends to move out of the space through the gaps in the ventilator. The air flows through the curved path of the ventilator which rotates the drum. The revolution of drum is based on the pressure difference and air flow across the ventilator. The ventilator doesn't have any blades for conversion of wind energy into mechanical energy. The profile in the outer surface of drum aids in the revolution of ventilator. Thereby removing the hot air inside the space and brings the fresh through the windows. The alternator is used to generate the DC Power as in Figure 2. The mechanical energy is extracted from the roof ventilator from its exterior surface. The alternator shaft diameter is 40 millimetres which is simply supported on the larger surface of the ventilator. The ratio is in the range of 1: 15 such that the speed of the alternator is fifteen times higher than the speed of the ventilator. The booster converter is used to step up the voltage in order to power the utility as in Figure 3.

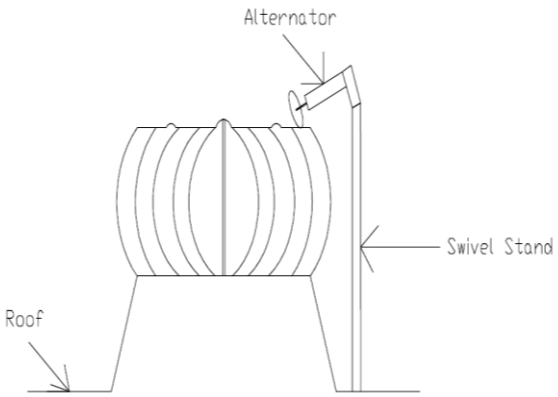

Figure 1. Block Diagram of Modified Roof Top Ventilator

Figure 2. Roof Top ventilator with DC generator

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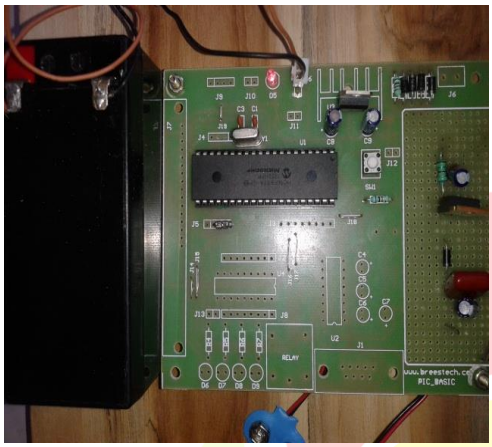

Figure 3. DC Step-up converter

V. RESULTS

The results are at wind speed 0.5 m/s the voltage produced in the range of 0.2 to 0.3 V. At 2 m/s the voltage is 3.5V. And at 5 m/s the DC step-up converter is used and the maximum voltage obtained in the range of 14.32 V and electric current to 220 mA.

VI. CONCLUSION

It is concluded that the output voltage increased with the increase in wind speed. This method is developed to produce clean energy along with providing a better working space with proper ventilation. This research is mainly to prove the concept of power generation using Roof Top Ventilator whereas failed to serve the entire energy demand compared to efforts incurred. The maximum voltage produced is sufficient to light the LED.

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