Electricity Generation Using Rooftop Ventilator

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Abstract- This paper presents small power generation through R.T.V (Rooftop ventilator) considering development of new micro generation of system using renewable energy sources i.e. wind energy. Wind energy does not cause any pollution therefore there is large scope for technological development in electricity generation through wind energy. The proposed system uses the industrial rooftop ventilator connected with small generator through shaft and gear mechanism. The mechanical energy of RTV which has been already installed for ventilation purpose can be used for driving the generator. The system is monitored by microcontroller and can be controlled by various controlling devices to obtain desired output. The generated electricity can either be consumed or can be stored into the batteries.

Keywords- R.T.V, Generator

I. INTRODUCTION

Considering the current scenario of energy crisis and rapid degradation of nonrenewable energy sources there is great demand for technological development in renewable energy sources. Micro power generation system can play a significant role in coming days. India is the tropical zone there is high humidity and warm weather present throughout the year. The day time temperature is more which is also responsible for increase in room temperature in workshops and industries therefore there is need of ventilation which is overcome by RTV.RTV does not require electrical energy that is why this technology is installed on the roof of workshop largely. The mechanical energy of ventilator can be converted into electrical energy.

The capital and installation cost of renewable energy source such as wind turbine and solar power plant high, on other hand power generation using RTV require low capital cost because ventilators has already been installed on the roof for ventilation purpose. This reduces capital cost significantly. In this system we are going to build small power generation system for converting mechanical energy of RTV into electrical energy. The energy provided by this system is used for the AC and DC load usage such as mobile and battery charger.

System have the following components:

a) Rooftop ventilator
b) DC generator
c) Voltage regulator
d) Inverter Circuit
e) 8-bit AVR microcontroller
f) LCD module
g) Relay module
h) Battery

a) Rooftop ventilator

Wind turbine ventilators are exactly as the name implies, they are ventilator which are powered by the wind to create the effective ventilation for different industries. Turbine ventilators are round metal vents with fins in them even just a little bit of wind can be just enough for turbo ventilator to rotate. The mechanics involved in the air movement is very simple. The hot air inside the shed tends to rise up. When turbine rotates, they suck the warm air out through the vent, thereby, bringing out drop in temperature in the shed and allow supply of fresh air through doors and windows.

The ventilator used in this system is of 5-7 inch in inner diameter, made from molded cast aluminium body with bearing ring press fitting.

Fig. 1: Rooftop ventilator

The rooftop ventilator further connected with the gear and shaft mechanism. The gear used with the generation gear ratio 1:150 which drives the shaft.

b) DC Generator

A generator is machine that converts mechanical energy into electrical energy by using principle of magnetic induction. In this system we are going to use dc generator a dynamo which is connected with gear assembly. The rpm decides the current induced in coil which generates the voltage. The output voltage is directly proportional to rpm.

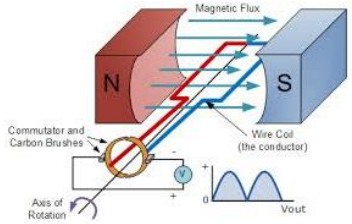

Fig. 2: DC generator

c) Voltage regulator

In this system it is very necessary to maintain the voltage at desired level to work system satisfactorily but system consist of DC generator which does not produce constant output but produces a pulsating dc, to maintain the desired voltage level the voltage regulator is used. LM78XX is used in this system which provides constant voltage which does not require any external components and it is compact.

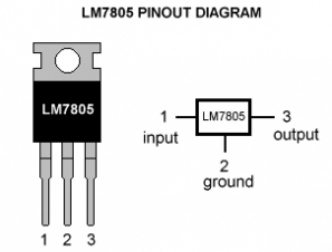

Fig. 3: Voltage Regulator

d) AVR 8-bit Microcontroller:(ARDINO)

In this system we have used 8-bit Atmega 128 microcontroller. This microcontroller is used to sense the generated voltage and to display it on LCD module ATmega 128 characteristics: 128 kb program memory on chip, 4 kb on-chip SRAM data memory, 7 I/O ports.

Fig. 4: AVR microcontrllor

e) Inverter circuit

In this system we are going to use the low power inverter circuit using the CD4047. Battery gets charge whenever the supply is available by using the constant volt charger, this stored energy can further used for the ac load. So there is need of inverter arises. This circuit is mainly used for the resistive load as we are using the bulb as load. The circuit diagram for the inverter is shown below fig.

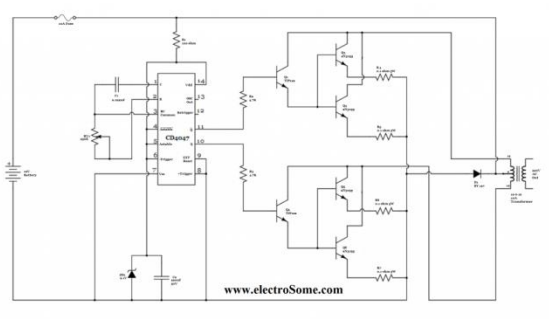

Fig. 5: Inverter circuit

f) LCD module

This is simple 16X2 LCD module used to display speed of wind turbine i.e. rpm and voltage generated. This LCD module is interfaced with the microcontroller which provides the data to be displayed on the panel of LCD. The data displayed on the LCD screen can used for the analysis purpose of the system.

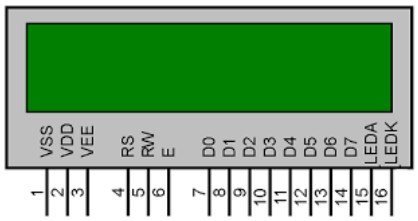

Fig. 6: LCD module

g) Battery

Battery is very essential component of our system which is used to store the generated energy. The lead-acid batteries we are going to use in this system due to their good features. Battery used in this system is 12V and 7.5Ah rating which will store the electricity generated. This battery have a long life span and have low self discharge. Battery will provide the 12 DC voltage at the output.

Fig.7: Battery

h) Relay module

Relay module is used in this system to protect the microcontroller from its above rated voltage. It is electrically operated switch which protects the circuit. The 5V and 10A relay module is used in our system for the protection purpose.

Fig. 8: Relay module

II. SYSTEM DEVELOPMENT AND WORKING

The system consist of the various components described above mounted on the metallic frame with the ventilator mounted on the top of it. Which further connect with the gear and shaft mechanism to drive the dynamo assembly. The electricity generated pass through the voltage regulator to the battery charger. The AVR controller sense the voltage generated and rpm which gets displayed on the LCD. The generated electricity used by dc and ac load. The block diagram for whole system is shown below,

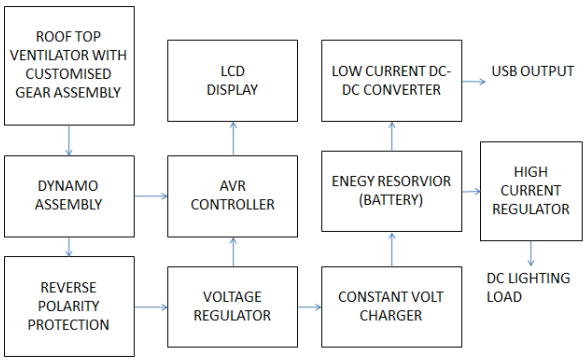

Fig.9: Block diagram

III. SYSTEM PERFORMANCE

The main objective of the rooftop ventilator is to provide the ventilation to the room and secondary the electricity generation. The generation is achieved by dc generator and it is pass through the reverse polarity circuit in case to avoid the back flow of power. The voltage regulator gives the constant voltage to the battery charger. The inverter is used to convert DC to AC for the AC load.

There are many rooftop ventilator are available in the market with different size and variable no of blade and its arrangement. The spinning ventilator is connected with a mechanism to transfer mechanical power to generator. The performance of the dc generator is relay on the varying wind speed. The different modes of operation can be used depending on wind turbine configuration. Fixed speed and variable speed operation. Fixed speed operation is simple so having low cost, but it does not provide optimal efficiency. In case of variable operation, maximum efficiency is obtained the system is controlled to maximize the power extracted from the wind.

Result analysis:

Sr.no	Speed(rpm)	Voltage(V)
1	300	12
2	282	10
3	200	9
4	175	7
5	170	5

The above result shows that the generated voltage is directly proportional to the wind sped.

IV. CONCLUSION

The system manages to generate the power from ventilator and to produce the micro generation system. The system also manages to charge battery efficiently. The electricity generated is directly proportional to the speed of wind.

V. REFERENCES

[1]. International Journal of Advanced Research in Electronics and Communication Engineering(IJARECE) Volume 5, Issue 4, April 2016

[2]. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 4, Issue 10, October 2015

[3]. Sirichai Dangeama,"An electric generator driven by a roof ventilator, "Energy Procedia 9 (2011) 147 – 158

[4]. Jason Lien, Noor Ahmed, "Indoor Air Quality Measurement with the Installation of a Rooftop Turbine Ventilator ,"Journal of Environmental Protection, 2012, 3, 1498-1508 http://dx.doi.org/10.4236/jep.2012.311166 Published Online November

[5]. Mazran Ismail& Abdul Malek Abdul Rahman, "Rooftop Turbine Ventilator: A Review and Update,"www.ccsenet.org/jsd Journal of Sustainable Development Vol. 5, No. 5; May 2012,

[6]. Y. Ting, H. Gunawan, A. Sugondo, K. L. Hsu and J. T. Teng, "Analysis and Design of Roof Turbine Ventilator for Wind Energy Harvest"