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POWER GENERATION USING WINDMILL USING MOVEMENT OF VEHICLES IN HIGHWAYS

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Abstract - *This project deals with the generation of electrical energy using windmills mounted on the median of the highways. As we know that wind energy is produced to a certain amount during vehicle movement due to the difference in pressure created by them in both the sides of highways. The energy produced can be harnessed in an efficient manner using Vertical Axis Wind Turbine. The VAWT is installed in the median of the roads in such a way the wind would act tangentially on the blades in opposite direction of the turbine thus effectively harnessing the wind energy from either sides of the median. Electrical energy is generated by a generator coupled to the turbine. The generated energy is stored in battery during day time. This energy is supplied to street lights during night time through DC-DC converter and inverter.*

***Key Words*: Vertical Axis Wind Turbine, DC-DC converter, Single Phase Inverter, MOSFET, Microcontroller.**

1. INTRODUCTION

1.1 Problem Statement

Wind energy is the quickest growing supply of fresh energy worldwide. The most downside is that the fluctuation with the supply of wind. The wind energy is good throughout some seasons and poor throughout some other seasons. This makes the power generation using windmills somewhat tedious. Hence another approach is made by mounting the windmills in the median of highways. There is an enormous supply of wind energy in highways because of the movement of vehicles. The main aim of this project is to use this energy in economical approach and promote power generation from renewable energy resources.

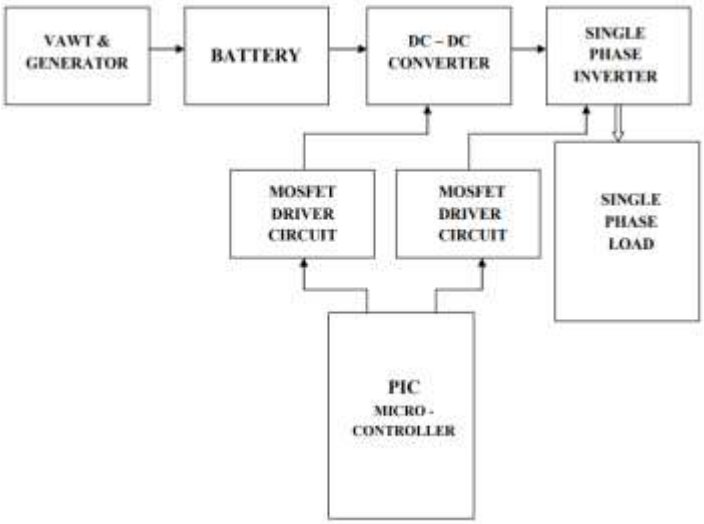
1.2 Objectives

- To generate power from Wind energy – Renewable energy in highways.
- To store the excess generated energy for further use.
- To use the sufficient wind energy source in highways in an optimized way.
- To incorporate more renewable energy to the power system.

2. PROPOSED SYSTEM

2.1 Block Diagram

The overall block diagram of the power generation using windmills from vehicle movement in highways.



2.2 Configuration of the System

The system structure represents the connection of the individual components.

2.2.1 Hardware Components

- VAWT
- Dc generator
- Battery
- Dc – dc converter
- Inverter
- Pic microcontroller
- MOSFET driver circuit
- Single phase load (light)

2.2.2 Softwares Used

- MPLAB IDE compiler
- Proteus 8

2.3 Description of Components

2.3.1 VAWT

In this project vertical axis wind turbine is used. The VAWT is placed in the median of the highway. The turbine used here is made up of aluminum sheets. Aluminum is used here since it is very light compared to other materials and free to run even at low wind speeds. The turbine consists of 3 blades, disc at the top and bottom for support and shaft at the middle. The height of the blades is approximately 2 feet.

2.3.2 Generator

The Permanent magnet DC generator is utilized here. The Permanent Magnet DC Generator can be considered as an independently energized DC brushed generator with a consistent attractive transition. These PMDC generators comprise of a stator having lasting magnets, for example, Neodymium to create an extremely solid stator field transition rather than wound curls and a commutator associated through brushes to an injury armature as regular generators. The principle favorable position of PMDC over different kinds of DC generator is that this generator reacts to changes in wind speed rapidly in light of the fact that it has similarly more grounded stator field is constantly present and furthermore it kept up as consistent. PMDC generators are lighter and productive than the customary loop type generators. It is coupled to the pole of the turbine. The voltage rating is 12V and the speed is 600 – 800 rpm. The evaluated power is 200W.

2.3.3 Battery

A 12V battery is utilized for putting away the DC yield from the generator. A battery is a gadget that changes over compound vitality straightforwardly to electrical vitality. It comprises of various electrochemical cells. Each electrochemical cell comprises of two half cells along a conductive medium called electrolyte which consist of anions and cations. Along these lines the vitality delivered is put away in the battery through electrochemical procedures and can be utilized for additional applications.

2.3.4 MOSFET - IRF840

The N-Channel upgrade mode silicon entryway power field impact transistor is a power driven MOSFET intended to remain the same as a predefined level of voltage in the breakdown torrential slide method of activity. The force MOSFETs are used in applications like exchanging controllers, exchanging converters, engine drivers and hand-off drivers requiring rapid and low door drive power.

2.3.5 DC to DC Converter

DC to DC converter is utilized in electronic components which are provided with power from batteries fundamentally. Such electronic components require voltage level not the same as that provided by the battery or an outer stock (some of the time higher or lower than the stockpile voltage). Changed DC to DC converters offer a strategy to expand voltage from an in part brought down battery voltage in this way sparing space as opposed to utilizing different batteries to get something very similar. Here DC to DC converter utilizing MOSFET gadget is utilized to help the DC yield from battery. At that point this is passed on into the single stage inverter.

2.3.6 Single Phase Inverter

Inverters convert DC capacity to AC power with wanted yield voltage and recurrence. In a large portion of the inverters, both are required to be controlled. This change can be accomplished either by transistors or by MOSFET. For low and medium force yields, MOSFET switches are obviously utilized. The fundamental distinction between an inverter and an oscillator is that the inverters produce huge measure of AC power as a rule at low frequencies where as an oscillator creates little AC power at high frequencies. Here PWM strategy is utilized to give entryway heartbeats to both DC to DC converter and Inverter.

2.3.7 PIC16F877A Microcontroller

Right now based microcontroller is utilized. PIC microcontroller is the main RISC based microcontroller created in CMOS. The primary preferred position of CMOS and RISC blend is low force utilization and it has insusceptibility to commotion than other manufacture methods. It has an Operating pace of DC - 20 MHz. The capacity scope of PIC microcontroller is up-to 8K x 14 expressions of Flash Program Memory, 368 x 8 bytes of Data Memory and 256 x 8 bytes of EEPROM information memory.

2.3.8 MOSFET Driver Circuit

MOSFET Driver circuit comprises of Opto–coupler, ebb and flow boosting area and force segment. Opto-coupler area is to disengage the components in a circuit here the force electronic gadgets and the microcontroller. Current boosting segment is to intensify the signs from PIC to the relating gadgets. Force segment is to manage the yield from the current boosting area into required voltage and recurrence.

2.4 Methodology

The Vertical axis wind turbine is placed in the median of the highways. Vehicles pass on both the sides of the highway road in counter directions. Due to the atmospheric wind and vehicular movement in opposite directions a tangential force is exerted on the blades. This results in rotation of the vertical axis wind turbine. A permanent magnet DC generator is coupled with the turbine through a shaft. Once the Vertical

axis turbine starts rotating, the PMDC generator will start rotating. The speed of generator is approximately 600 – 800 rpm. The output voltage generated is approximately 12V.

This output DC voltage is stored in a 12 V – 1.2 Ah Battery. The output power from the battery is regulated and boosted by a DC to DC converter. The DC chopper used here is constructed using IRF840 MOSFET semiconductor switches. The PWM signals are generated by PIC microcontroller and given to the converter through a MOSFET driver circuit.

The boosted DC voltage from the chopper circuit is then passed to the single phase inverter. Inverter converts the DC to AC output voltage. The inverter used here is full-wave bridge type is used here. The inverter is also constructed by using MOSFET switches. The PWM signals is generated by using PIC microcontroller and given to the inverter through a MOSFET driver circuit.

The output Single phase AC voltage is finally given to the single phase load (Here incandescent lamp). Therefore the renewable wind energy is used to power the streetlights present in the highways.

Fig -1: Photograph of the VAWT

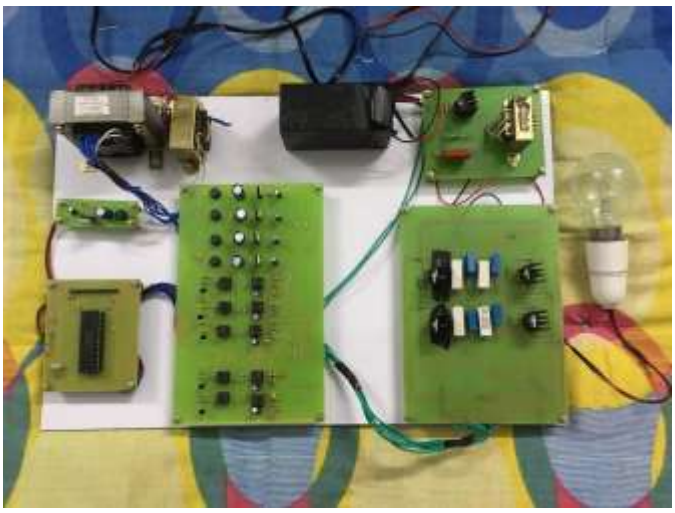


Fig -2: Power electronics part–DC to DC converter, Inverter, MOSFET driver circuit

3. IMPLEMENTATION OF THE PROJECT

3.1 Calculations

Speed

Speed of air in highways = 4.5m/s

Approximate speed of vehicles in highways = 70km/hr = 19.5m/s

Total speed = 25m/s

Turbine speed = angular velocity/0.1047

Angular velocity = wind velocity/radius of turbine = 83.33 radian/s

Turbine speed = 800rpm

Input Power of Wind Turbine (PI)

Pi = ½ * ρ * a * v

A – Area of turbine = d*h = 0.9m²

P – Air density = 1.093 kg/m²

V – Wind velocity = 25m/s

Therefore, Pi = 7685.15 W

Output Power of Wind Turbine (PO)

Po = Gear ratio*pi

Po = 0.1*7685.15

Therefore,

Po = 768.515w

4. RESULT

Speed of the turbine = 50

RPM Speed of the generator = 50 rpm

Output voltage from generator = 12 V Output voltage from Battery = 12 V

Output voltage from DC to DC converter = 65 V

Output voltage from inverter = 20 V (AC)

Wattage of lamp = 40 W

5. CONCLUSION

Thus the project will act as an effective method for harnessing the renewable wind source available on the median of highways. The wind energy produced due to the moving vehicles in the highways is converted to electrical energy by the wind turbine and is stored in a battery for other appliances such as street light, traffic signals, etc. The main advantage of this design is it is sustainable as well as environmental friendly. If long high speed express highways are installed with this type of turbines a valuable amount of electrical energy can be produced to solve the issue of energy crisis to a large extend.

6. FUTURE SCOPE

- This project can be implemented in a large scale and excess energy produced can be transmitted to the grid.
- This system can be combined with a solar panel for higher energy production.
- The excess energy can also be given to the buildings near bythe highways.

7. APPLICATION

Generally batteries are provided with battery chargers. But regulation and filtering of DC voltage is not possible in battery chargers. Battery chargers with these functions are called Battery eliminators. The power from these batteries is not only used for street light and traffic signals but also for other appliances.

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