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Standalone Highway Dual Wind Mill for Power Generation

Dr.S.Deepa[1], T.Keerthana[2], R.Kiruthiga[3], R.Preethicaa[4],N.Balaji[5]

Associate Professor, Dept. of EEE, Panimalar Institute of Technology, Chennai, Tamil Nadu, India[1]

UG Student, Dept. of EEE, Panimalar Institute of Technology, Chennai, Tamil Nadu, India[2,3,4]

Assistant Professor, Dept. of EEE, Panimalar Institute of Technology, Chennai, Tamil Nadu, India[5]

ABSTRACT: The aim of this project is to design a compact Standalone Highway Power Generation System using Dual Wind Mill system. This system can be implemented in general highways, where the automobiles moves at greater speed, produces huge amount of air that are collected and finally energy is supplied for domestic and country purposes. For the purpose of maximum uninterrupted power supply in industries and domestic areas, a DC generator and Power supply line is also connected to the system, but these two works in a priority, only when the demand is not met by the Wind system. This system can be implemented in standalone and grid connected modes.

KEYWORDS: Energy efficiency, economics, distributed energy systems, Renewable energy system

I. INTRODUCTION

Energy in the world basically comes from fossil coals, hydro sources, thermal sources and renewable sources. Renewable sources available are solar, wind, tidal, hydro, biomass and energy from waste. The energy resources solar and wind are periodic, both may not be existing at all times which causes an intermission in the power flow thus reducing the efficiency and reliability in the power. Our wind tunnel test indicates that a scaled-down version of the dual-rotor turbine system may produce up to 60 to 70% more power than a single-rotor system. Premeditated for on-site power generation by profitable, industrial, and residential electric users in remote locations, our model uses wind channel effect to seizure and magnify wind for enhanced production of energy. It is intended that this turbine system will be available in tower-mounted strategy and can capture wind in provinces where it has low speed wind. The successful design should allow cost-effective alteration to an effectiveness scale. These possibility leads to the performance of the dual wind mill [1]. The incorporation of the two wind mill energy sources as one helps us to proliferation the output power of the system as a whole. The important features of this turbine are its dual rotor blade system which is positioned horizontal windward at upwind and downwind locations, its energy train which is mounted horizontally inside the tower with a resourceful induction generator, and its controller and security systems. The mission focuses mainly on the procedure to examine the power flow enactment. The methodical works indicates that a dual-rotor system could extract additional 20-40% power control related to a single rotor system from the similar wind watercourse. The distinguished feature of WTGS is that it consists of two rotor systems placed horizontally at upwind and downwind areas, and a generator fitted vertically inside the tower. In this paper, this new wind turbine generating systems (WTGS) is treated as an inhibited multi-body system. Various pitch control structures provisional on the wind speed and the foremost rotor's rotational speed are executed. A soberly modest model for the load torque is obtained by using the trial data of the doubly fed induction generator (DFIG) espoused in the new Dual Wind Mill. Visual basic Simulink-based hybrid model software is developed and used to forecast and analyze the performance of the Wind Turbine [2, 3]. Wind and solar hybrid power systems are achievement acceptance for stand–alone generation uses, due to the advances in hybrid renewable energy technologies and consequent rise in values of coal products. The economic characteristics of these technologies show sufficient potential to include them in evolving power generation capacity for developing countries [4]. This paper deals with a viability study of a solar and wind hybrid system for thoroughfare energy necessities. The paper designates the modeling of two incipient electricity systems based on renewable energy: solar photovoltaic and wind power. The study presents an debt of combined solar and wind system for thoroughfare energy requirements such as lighting, SOS, announcement, etc., as given in [5]. During the past couple of decades widespread research has been engaged in renewable energy hybrid systems. As a consequence, wind solar hybrid

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energy systems have become more standard and attention of sustainable energy investigation. At contemporary, the technology in this area has been developing very quickly specially in the industrial division producing new apparatus with numerous patent rights. The main aim of this analysis of paper is to re-examine the abstract agendas and mathematical modeling techniques used in hybrid energy systems. Paper presented synopsis of examination and advance determination finished over last ten years and anticipated suggestions for future investigation [6].

The existing system is not efficient. As in the reference paper[7] there are certain drawbacks in the existing system are, the energy resources solar and wind are regular, both may not be available at all times which causes an interruption in the power movement thus sinking the efficiency and consistency in the power. As soon as the sun starts to fall below the horizon at night, photons stop signal to the solar panels and the power drops instantly causing an interruption in power flow. The strength of the wind is not persistent and it varies from zero to tempest force. This income that airstream turbines do not produce the identical volume of electricity all the interval. There will be times after they produce no electricity at altogether. Photovoltaic system are more expensive, so the proposed system encompasses dual wind mill.

In the proposed system, the energy sources such as wind and power supply route are used together, provides an intensification in the systems competence as well as superior balance in energy supplies. The systems are complementary [8]. Greater output can be obtained from the wind turbine during the various seasons which would produce peak outputs. Hybrid energy systems feature lower remnant fuel discharges and produces constant power generation at all times thus being environmental approachable and reducing pollution. It improves the excellence and obtainability of power. The required generating volume of the basic wind energy conversion units can be reduced since the total load is common. Easy to operate and maintain.

II.SYSTEM DESCRIPTION

A. GREEN HOUSE GASES

Undertaking the issues by delivering secure energy to a maintainable low carbon future and taking schedules on unbearable climate and weather change should be the all nation‘s aim. Determined, motivating and encouraged efforts are required in every correction to move forward in the direction of this extremely thought provoking obligation which is not intolerable by 2050. The methods implemented by many energy producing corporations are:

1. To protect energy on the demand side.
2. Efficiency enlargement in the energy production progressions.
3. Spare of fossil fuels with various sources of renewable energy .

They reprises that renewable energy is a core element in the competition against climate change as it is a best energy source to decarbonize the generation of energy and improving the safety of our energy supply. Instead of depending on centralized power sources run on presented fossil fuels, rising application of renewable energy lets the power draw on distributed and limitless sources of energy indigenous to the communities. Maintaining the Reliability of the Specifications

Electricity and heat generation are key suppliers to worldwide emissions of greenhouse gases. In this paper, the premised attention is compensate to renewable energy sources (RESs) for electricity and heat generation and analyses current accommodating and estimates the life cycle analysis GHG emissions from a sort of renewable electricity and heat generation technologies. The renewable electricity and heat generation based on onshore and offshore wind source, hydropower, oceanic thermal technologies (wave power and tidal energy), geothermal, photovoltaic, solar, thermal, biomass, and heat pumps are overcome. The study determines the inconsistency of energies in following Greenhouse Gas emissions for electricity and heat generation. This analysis has revealed that the lowest Greenhouse Gas emissions were connected with offshore wind technologies Greenhouse Gas emissions. Effects compared with Greenhouse Gas estimates by fossil fuel heat and electricity designated that life cycle GHG emissions are relatively higher in predictable sources as compared to renewable sources with the allowance of nuclear-based power electricity generation. In this contemporary study, considering (RESs), waste treatment management and dedicated biomass technologies were originated to potentially have high Greenhouse Gas emissions, selected boundary and the inputs mandatory for their production. The study recognizes supplementary powers associated with renewable electricity and heat technologies, points out the efficiency of life cycle analysis as an instrument for evaluating ecofriendly impacts of renewable energy sources (RESs) and completes with prospects for enhancement in the future.

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B. WIND ENERGY

Wind turbines are mainly divided into two categories. They are the horizontal axis wind turbines (HAWT) and the vertical axis wind turbines (VAWT). Windmills that produce electricity are very eco-friendly. For one thing, they produce no harmful waste products. The natural resource, wind, is already available and cannot be used up. These wind power supply are used for them to work. If there is no wind resource, the blades will not spin and nothing will be produced. Windmills are an inexpensive basis of energy and can create electricity without the harmful effects. Modern wind generator consists of rotor blades, shaft, gear mechanism, control system and a generator. The generator generates electricity through electromagnetic induction. Gear mechanisms are there to control the generator speed. When the wind forces the blades to move, it transfers some of its energy to rotor which connects to the generator. Nevertheless, there are variable speed and constant speed generators.

In addition to the two main categories of VAWT and HAVT, commercially available wind turbines are divided into two groups: fixed speed and variable speed turbines. In the fixed speed wind turbine the electrical generator is connected directly to the national power grid. Therefore, these types of generators operate at constant frequency and speed to maintain the grid balance. Active and reactive power control mechanism is there within the system when they are connected to the grid. The variable speed wind turbine (VSWT) is used to absorb more wind power similar to a saying, 'make hays while the sun shines'. These turbines absorb 10-15% more energy than the fixed speed turbines. Even though it is assumed that fixed speed turbines have less power fluctuations, variable speed turbines produce lower mechanical stress and less power fluctuations.

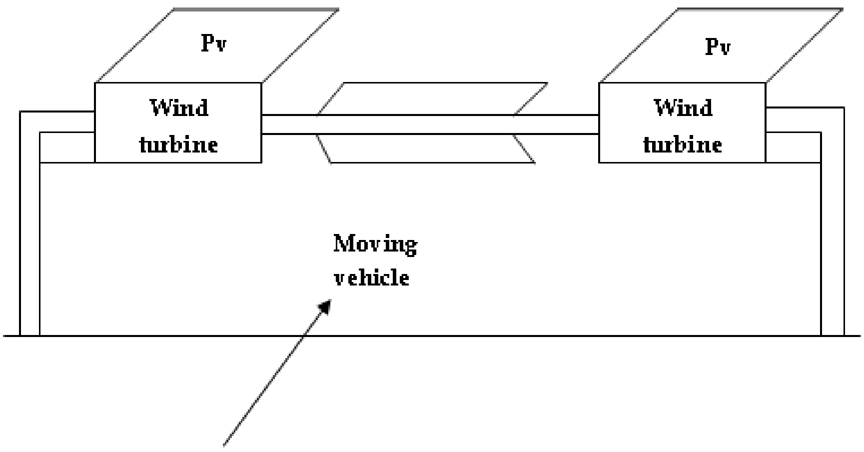

Fig.1. Proposed Design

C. POWER SUPPLY

Every electronic components starting from diode to Intel IC's only work with a DC supply ranging from -+5v to -+12v. We are utilizing the same by cheaply and commonly available energy source of 230v-50Hz and stepping down, rectifying, filtering and regulating the voltage. The transformer of 230v/15-0-15v is used to perform the step down operation where 230v AC appears as 15V AC across the secondary winding. A commonly used circuit for supplying large amounts of DC power is the bridge rectifier with four diodes (4*IN4007) and are used to achieve full wave rectification. Rectifier units are usually capacitors acting as a surge arrester. This capacitor is also called as a decoupling capacitor or a bypassing capacitor. Regulator is connected to the DC output to maintain the voltage within a close tolerant region of the desired output. IC7812 and 7912 is used for providing +12v and –12v DC supply.

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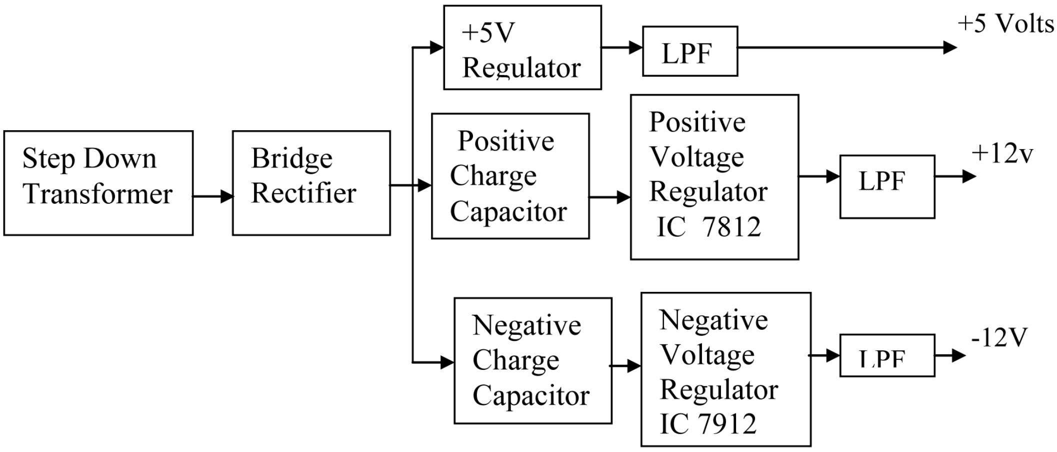

Fig.2.Power Supply Unit Circuit

D. MICROCONTROLLER

The microcontroller which used here is PIC16F877A. The microcontroller has three 8-bit ports, one 6-bit port and one 3-bit port. It also consists of an 8-channel 10-bit ADC. The microcontroller is programmed such that the intensity is sunlight is measured at one point and stored in a register. Then the speed of the wind is monitored. The input and output signals are controlled, monitored and displayed. The multiple charging batteries are monitored.

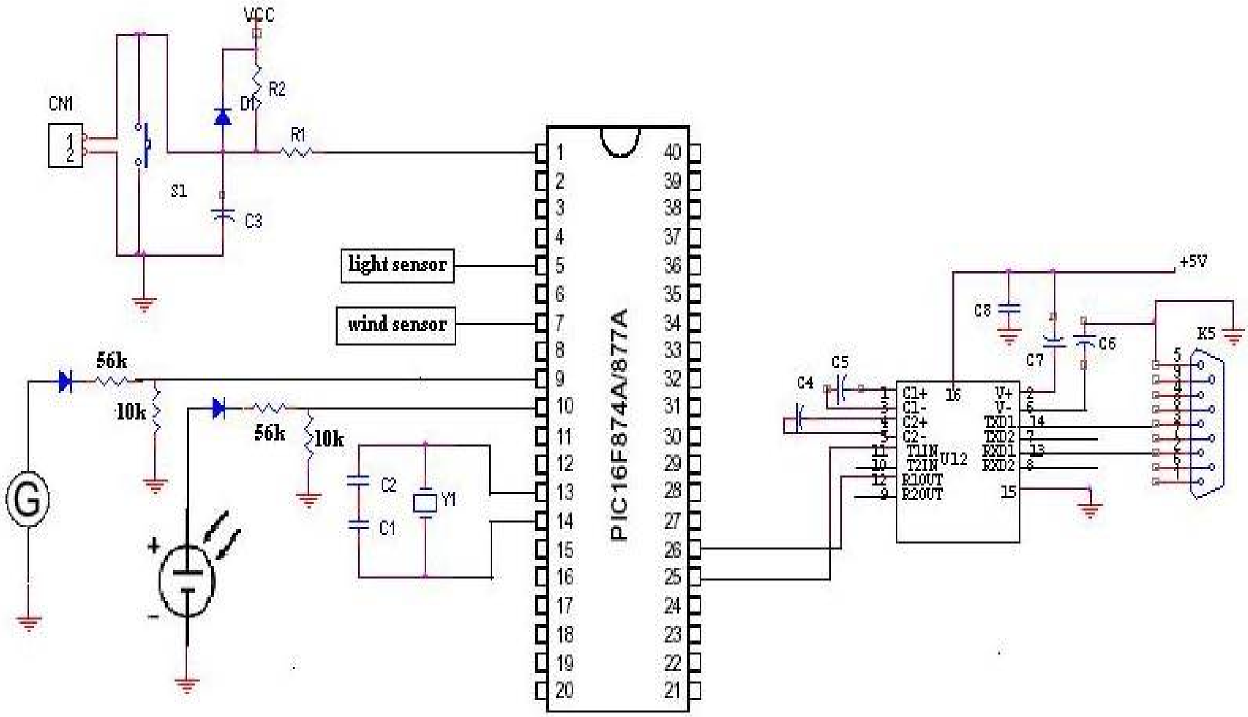

Fig.3. Microcontroller circuit

E. ASTABLE MULTIVIBRATOR

A 555 timer IC is used as an a-stable multi-vibrator. The threshold input is connected to the trigger input pin 2.The resister R1, R2 and capacitor C1 are for timing network, which are used to set the frequency of the oscillator. The capacitor C2 is connected to the control input. At the beginning when the power supply is turned ON, the 555 timer

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IC capacitor C1 is uncharged and the trigger voltage on pin 2 is zero. In this case the output of comparator B is high and the output of comparator A is low, which keeps the base of transistor Q1 low and turns OFF the transistor. C1 starts to charge through R1 and R2. When the capacitor voltage reaches to 1/3, the comparator A switch to its low operating state and when the capacitor voltage reaches to 2/3 the comparator A switch to its high operating state. This RESET the latch and turns ON the transistor Q1 through which the capacitor C1 is discharged. The frequency of the oscillator is given by the following formula.

$$f = \frac{1.44}{(R_1 + R_2)C_1}$$

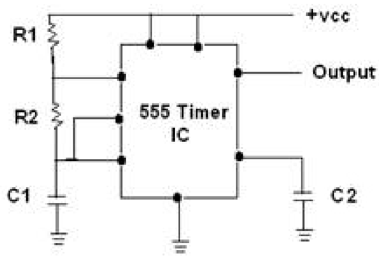

Fig.4. 555 Timer Circuit

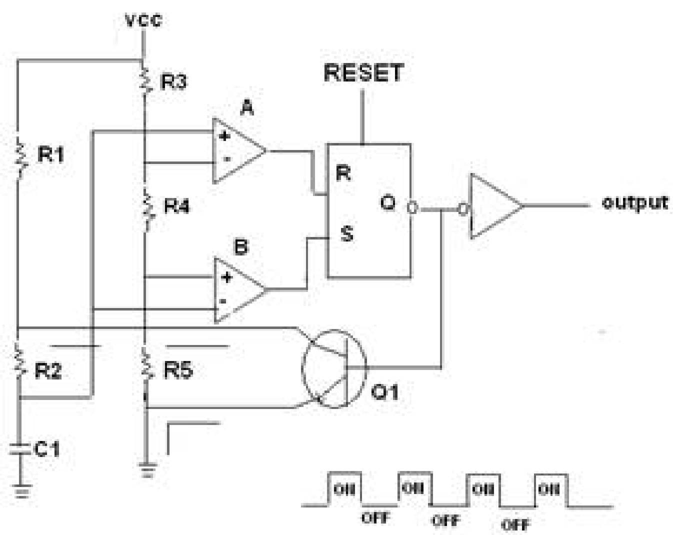

Fig.5. Astable multivibrator

F. SIGNAL CONDITIONING

Signal conditioners are essential to improve field received signals. Signal conditioner job starts from simple amplification to protection. For this circuit input will be 0v to 1000mv and must be amplified to 5volts. When doing amplification this would like to follow below mentioned objectives.

- It must consume very low current from the source.
- It should have greater isolation between input and output.
- Provision to adjust zero value (minimum operating point).
- Provision to operate span (maximum operating point).
- Removing the unwanted frequencies during amplification and from the power source.
- Creating offset and null adjustments which may occur during amplification.
- Offset and null is the one which is available in all OPAMPS.

- To provide good enough current to the subsequent devices with protection.
- Signal conditioner must protect the subsequent devices from hazardous high voltage signals.

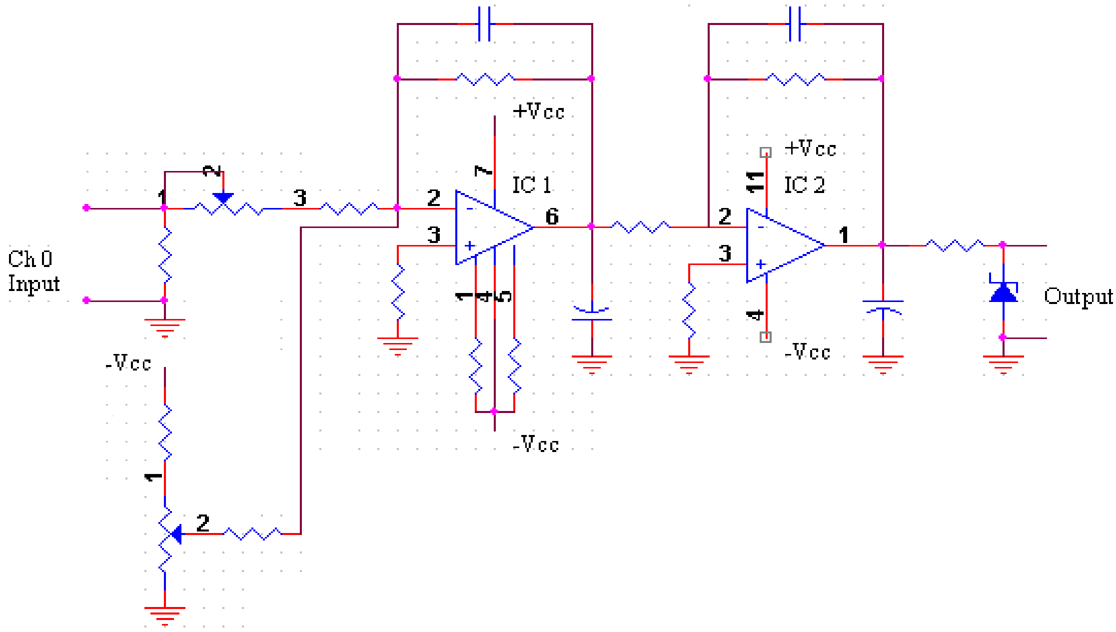

Fig.6. Signal Conditioner Circuit

IV. WIND MILL CIRCUIT

When there is no dump power, the inverter acts only with ac output voltage reference. In case the larger of the outputs from dc overcurrent detection circuit and dc overvoltage detection circuit exceeds the ac output voltage reference, the diode which is related to the error amplifier with the larger output is turned on. Then, dc overcurrent value or dc overvoltage value is added to the ac output voltage reference, in case the output from ac overvoltage detection circuit exceeds the dc input voltage reference, the diode related to the error amplifier is turned on. Then, ac overvoltage value is added to the dc input voltage reference; thus, the inverter act. Specifically, when dump power occurs, the surplus portion flows into the storage battery through the bidirectional inverter.

Charging current flowing into the battery is detected by the current sensor. When the battery current exceeds the charging current reference, the difference is amplified and added to the ac output voltage reference. While, when the battery voltage exceeds the charging voltage reference, the difference is amplified and added to the ac output voltage reference. Thus, as the ac output voltage reference increases, the output voltage of the bidirectional inverter also increases. When the output voltage of the bidirectional inverter increases, the output voltages of Wind Turbine. The inverters increase through reactive power control. If the output voltage becomes greater than the ac output voltage reference, the difference is amplified and added to the dc input voltage reference.

With this, the phase reference as varies, allowing the PLL to control inverter voltage phase. Because the output voltages of the Wind inverters are designed to be controlled by the dc input voltage reference, the ac output voltage decreases as the dc input voltage reference increases. In this way, a feedback loop is formed in the proposed system. Dump power is controlled; and charging current and charging voltage in the storage battery can be stabilized.

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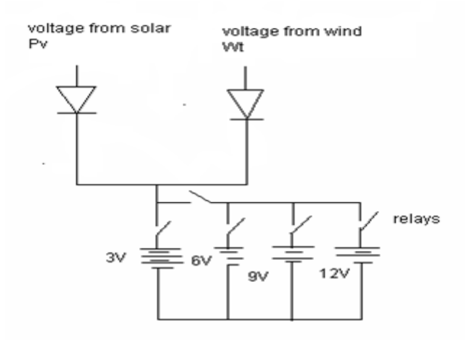

Fig. 7. Multilevel Charging Circuit

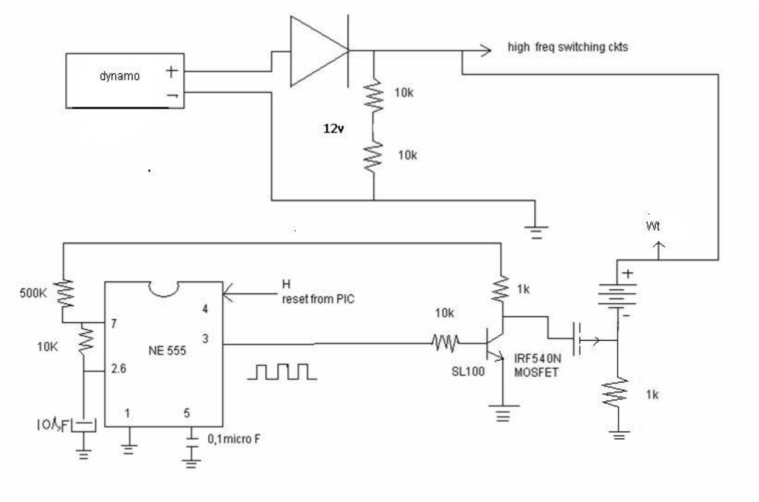

Fig.8. Wind Circuit

V. RESULTS

This paper deals with simulation of stand – alone Wind Turbine Generating System (WTGS) using PMSG. The circuit can be used for two purposes: firstly the output of the inverter can be used to supply ac loads and the output of the rectifier can be used for battery charging applications. The title or heads unless they are unavoidable. The Visual Basic Output is as shown in the figure.9.

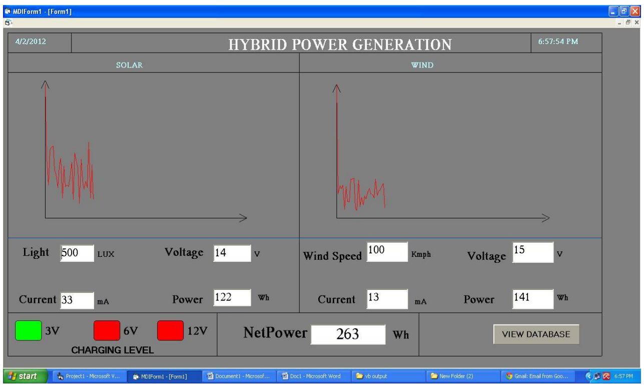

Fig. 9. Visual Basic – Output

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V I. CONCLUSION

This standalone highway dual wind mill power generation is to overcome the disadvantages of the existing model of the wind turbine. The integration of both the two wind power generation as a one will help us to increase the efficiency of the overall system and the power generation can be improved. The interruption of the power flow could be avoided. It is a complementary system and greater output can be obtained from the wind turbine during the winters which would produce their peak outputs. Dual wind mill energy systems feature lower fossil fuel emissions and produces continuous power generation at all times needed thus being environmental friendly and reducing pollution. The required generating capacity of the basic wind energy conversion units can be reduced since the total load is shared. The cost for generating 1KW power is Rs.50,000/-. This is a single time investment and this system is easy to operate and maintain. It improves the quality and availability of power.

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