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HIGHWAY POWER GENERATION

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Abstract - *This paper focuses on use of air on highway divider with the help vertical axis wind turbine. When the vehicle passed on the highway it produces a considerable amount of air due to its speed. This air tangentially strikes on the blade of the vertical axis wind turbine and its makes a rotation of the turbine in only one direction. The solar system is used to generate electrical energy and also installed in a way that it diverts the vehicle air towards the turbine. The generator with the gear mechanism is connected to the shaft of the vertical axis wind turbine to generate electricity. The electrical output of vertical axis turbine and the solar system is stored in a battery. This stored energy which can be further used for street lighting, toll gates, etc.*

Key Words: **Arduino board, power supply, LCD, solar plate, turbines.**.

1. INTRODUCTION

In a day to day life, the demand for the electricity is much higher than the production of electrical energy. One of the major problems ever since the natural resources are going to finish one day Solar and wind both are renewable energy sources. Solar energy available begins of day and the wind energy is maximum on the highway due to the speed of the vehicle. The motivation of this project contributes the global trend toward clean energy. The main motive behind this project is to design a vertical axis wind turbine which effectively uses the wind energy generated by the vehicle speed on the highway. So the maximum wind energy can be extracted by the vertical axis wind turbine as compared to the horizontal axis wind turbine. We have designed modified savonius vertical axis wind turbine which is more efficient than old savonius design. in modified vertical axis turbine we twisted the blade of the turbine to gain maximum spin on low pressure of the wind, we also try to achieve less vibration at gear moment .This turbine works under all the environmental condition and cyclone also. This design of the blade enables the turbine to rotate in clockwise and anticlockwise directions. The arrangement of solar plats is in such a way that they divert the vehicle air towards the turbine for effective use of vehicle air. The solar system generates the electrical energy by sun radiation in day mode and from vehicle headlight during night mode the generated electrical energy we can use street lighting, toll gates etc.

2. METHODOLOGY

The block diagram and circuit diagram for that project is as follow

2.1 BLOCK-DIAGRAM

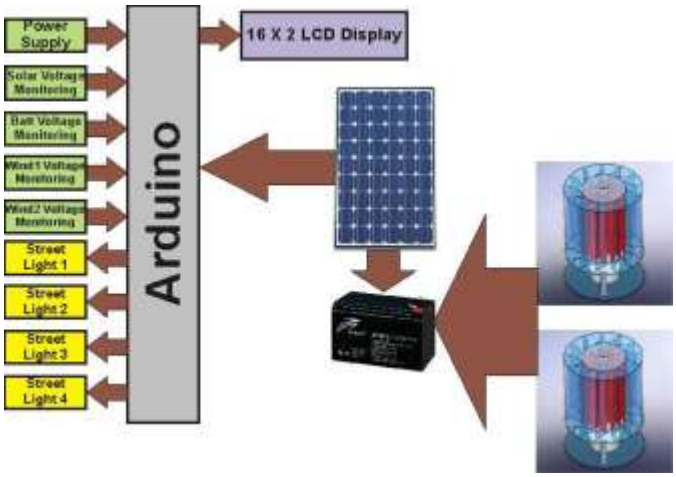

Fig.1: Block diagram of highway power generation

The above diagram shows the complete architecture of the proposed system. This system consists of an Arduino microcontroller as shown in the diagram. This microcontroller is used to collect the data and control the working of the system as per the requirement. The system requires power for its operation. This power is provided by power supply unit to the components in the system. This power supply unit is designed to provide regulated 5v or 12v power supply as per the requirement of the components in the system. The power supply unit consists of a step down transformer, diodes, regulator IC 7805, capacitor filter etc. In this system two maglev wind turbines are used for the power generation. This wind turbine is used to generate the electricity with the aid of the wind present in the environment. The power generated by these turbines will be stored in a battery for further use. To store the power we have used a battery in the system. The system is designed in such a way that if the turbines are not able to generate the power due to the lack of wind the solar power will be used to charge the battery to provide the power to the connected load. For this purpose we have used solar panel to generate energy from the sunlight and charge the battery as shown in the diagram. 4 street lamps are connected as load to the system. This system is also designed to monitor the voltage of the battery, solar and each turbine. The monitoring is done by using a voltage divider circuit. This voltage monitoring circuit measures the voltage and provides the data to the Arduino controller. A 16*2 LCD display is also interfaced with the microcontroller. This display is used to display the generated energy and the monitored voltage.

This display contains 2 lines and is able to display 16 characters on each line. This is an alphanumeric display, interfaced in 4 bit mode with the microcontroller.

2.2 CIRCUIT DIAGRAM

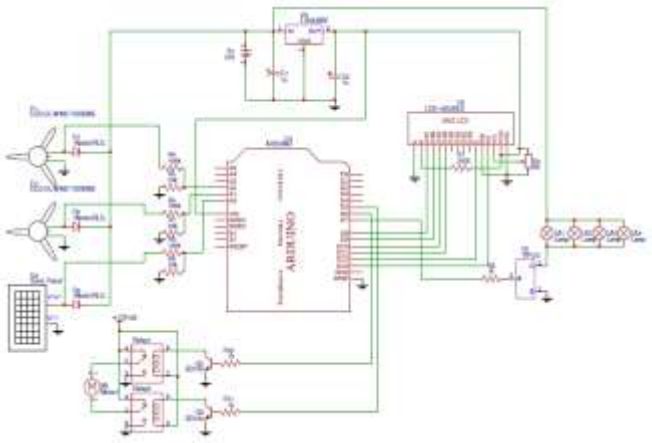

Fig. 2: Circuit diagram of highway power generation

The system consists of Arduino microcontroller. It is used as the brain of this project. The function of this section is to collect the measured data from the voltage monitoring circuit which provides the voltage of two turbines, voltage of battery as well as solar. The microcontroller and circuit components require power for their operation. For the fulfilment of this power requirement of the system a 12v battery followed by a voltage regulator IC LM7805 is used. This regulator IC provides regulated 5V supply to the microcontroller and to the required circuit components. The system uses vertical axis wind turbines for the power generation. These two turbines are interfaced in the system as shown in the above circuit diagram of the system. The power generated by the turbines will be stored in the battery used in the system. The voltages of the turbines are to be measured for the monitoring purpose. For this purpose we have designed voltage divider circuit and connected to the pin A1 and A2 of the Arduino board as shown in the above circuit diagram. The power output of the turbines is provided to the battery for storage purpose. The system also consists of solar panel to charge the battery in case of failure of wind turbine power generation. This solar panel generates power from the sunlight and stores the power in the battery. This stored power is then used for the street lamps connected in the system. The voltage of this solar is also monitored for the protection purpose. The voltage is measured by the voltage divider circuit and the output of this divider circuit is provided to the Arduino to the pin A0 of the Arduino board. In this system LDR is used to monitor the direction of maximum solar energy. When the sun light falls on the LDR it will put the solar panel in same direction to obtain maximum energy. But if there is no sun light on the LDR it will turn the solar panel with the help of the gear motor in the direction of the sun. All this process is controlled by the microcontroller. The system continuously monitors the battery voltage and the solar panel voltage through the voltage divider circuit made up off resistor and LDR circuit. In this circuit when sun light present on the LDR the resistance of LDR will be low and supply is grounded that is voltage will be 0v. But when there is no sun light on this LDR circuit, the resistance of the LDR will become high and thus output voltage will be equal to 5v. In this way the circuit continuously monitors the voltage of the panel. The system is also equipped with a 16*2 LCD display for displaying all the monitored parameters by the system. The parameters measured by the system are displayed on this LCD display which is interfaced with the microcontroller in 4 bit mode. In 4-bit mode, only four data pins of LCD are connected to the controller. This mode, thus, saves four pins of the controller unlike 8-bit mode. In 4-bit mode only 4 bit data is send to LCD. Since 8-bit microcontrollers contains data in 8-bit form so we divide our data in to two nibbles (1 nibble=4-bits). First higher 4-bits (nibble) are send to LCD and then the lower 4-bits (nibble). Only D4, D5, D6, D7 data pins of LCD are used in 4-bit mode. D1, D2, D3, D4 are left empty. D4 is our least significant bit and D7 is highest significant bit. Interfacing LCD with Arduino microcontroller is simple. Port-B first 4 bits (PB2, PB3, PB4, PB5) of microcontroller are used to send 4-bit data and commands to LCD. These four Pins (PB2, PB3, PB4, PB5) are Connected to four data pins of 16x2 LCD (D4, D5, D6, D7).Port-C0 pin no 23 is connected to RS pin of LCD. Port-B0 pin no 14 is connected to EN (Enable) pin of 16x2 LCD. A vertical axis wind turbine is interfaced as shown in the circuit diagram. A wind turbine basically draws the kinetic energy from the wind and converts this power to electrical energy by means of a generator. Its operability is dependent on key components of the turbine and its response to the wind based on how it is built. This electrical energy is stored into a battery connected with the turbine as shown in the figure. With this turbine, the blades receive the wind and are caused to lift and rotate. Depending on the wind speed the controller will start up or shut off the turbine. If wind speeds are right between 8 to 16 miles per hour, the turbine would start to operate but will shut down if speeds exceed about 55 miles per hour. This is a preventative measure because at very high winds the turbine could be damaged. The anemometer on the turbine calculates this wind speed and sends the information to the controller. The VAWTs usually do not have anemometers because they are usually used for low speed and small scale applications. The moving vehicle on highway may be all types such as small or heavy vehicles. Whenever vehicle moves on both side of the highway divider then some pressurized air is produced due to the speed of vehicle. This pressurized air is strike on the blade of vertical axis wind turbine and turbine makes a rotation. The shaft of the vertical axis wind turbine is connected to generator with the help of gear mechanism. The generated electricity is an alternating quantity; the output of the generator is rectified by rectifier and stored in the battery. The solar system is mounted on besides of the vertical axis wind turbine, the function of the solar system not only generate the electricity but also provides the constant air flow towards the blade of

vertical axis wind turbine. Here the Kinetic Energy from wind force produced due to the fast moving vehicles from both lanes, forces the wind turbine to rotate in clockwise direction with certain rpm. This in turn forces the alternator to rotate in same clockwise direction with 10 times faster than the turbine speed, thus generating electricity which is stored in 12 volt battery. This energy can be multiplied by implementing a series of wind turbines. The stored energy can be utilized for smart highway lightening system. Also the system measures the turbine voltage with the help of voltage divider circuit and provides the measured output to the Arduino. This method is used for the protection of the battery and other circuit components. The solar power generation is also designed in this system in case the turbine power failed due to the lack of wind speed.

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