Solar AC Power Generator with Arduino Control Circuit

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ABSTRACT

We all know that sun provides a never ending source of energy. This energy is called as solar energy and it comes under the category of Renewable energy resources. Renewable energy resources are clean and non- polluting energy resources. Non-Renewable energy resources like the fossil fuels, oil, natural gas, coal and nuclear energy are not that much sustainable because they all take longer time for formation. Hence we expect more renewable energy resources and the device associated with these resources. The demand for solar cells or PV cells is increasing day by day. Solar cells convert solar energy into electrical energy. We can use this electrical energy according to our purpose of interest. The electrical power we obtained can be either in the DC or AC form. The output of Solar cells is strictly DC. From previous researches, it is seen that we can directly produce AC power from solar cells without any use of inverter by simply arranging the solar cells in a circular pattern over a spinning disc and alternately exposing them. Although it eliminates the cost of the inverter, the major problem arises in controlling the speed of this spinning disk. The type of material for making the circular arrangement also plays an important role in better efficiency. The voltage and power obtained from the previous researches are also less. In this paper, we modify the arrangement with proper speed controlling circuit by using Arduino in our circuit. The voltage and power obtained from this arrangement are more and hence efficiency is increased. The sine wave obtained is also of less distortion.

Keywords: *Solar Cells, Arduino, AC power, DC Motor.*

1. INTRODUCTION

Two American scientists Thomas Edison and Nikola Tesla carried out their invention utilizing DC power and AC power. Thomas Edison's invention generated and utilized DC power and Nikola Tesla's invention used his newly discovered AC power. Tesla's AC utilization was emphasized more as it was having Better efficiency. After certain years Jason Oliver carried out the invention of generating AC power from solar energy. Jason Oliver used the array of Solar cells. Solar cells convert' solar power into DC electrical power. According to researcher Jason Oliver, if an array of solar cells are arranged in the circular pattern on the rotating spinning disc and if they are alternately exposed to sunlight, it produces Ac power. The rotating spinning disc rotates with the help of DC motor. From this invention and all other researches associated with it, the speed of the rotating disc is fixed and hence we cannot vary the frequency properly. The material used for constructing the base was expensive and bulky. The efficiency and result were also less. In our paper, we modify these prototype scheme by providing a proper controlling circuit and using the less expensive material for constructing the prototype base. Voltage and power are increased in our prototype and hence efficiency. We have used Arduino UNO (ATMEGA328) in controlling circuit and MDF sheet for constructing the base.

Identified Problems in Previous Systems
- Existing systems are inverter based.
- Complex circuitry is required.
- Previous systems do not provide fixed frequency due to distortion.
- Weight of the system
- Material required for the system is another issue.

2. PROTOTYPE MODEL DESIGN AND DIMENSIONS

Model designing has been one of the difficult tasks. The main motive of designing this model was to achieve stability so that a balance can be maintained when the model is placed/installed at particular site or location.

2.1 Use of MDF board

In our prototype, Medium density fiber wood (MDF) is used. MDF is generally denser than plywood. It is made up of separated fibers but can be used as a building material similar in application to plywood. It is stronger and much denser than particle board. MDF board have many Advantages. It is less expensive and it has a stable dimension too. It helps us for gaining better efficiency.

Figure -1: MDF Boards

2.2 Dimensions in cm

- Square Model : 44cm x 44cm
- Square Model box width: 8 cm
- Solar cell slot: 6.5 cm
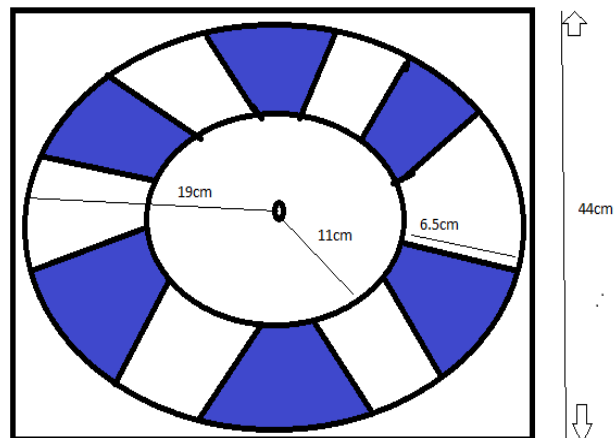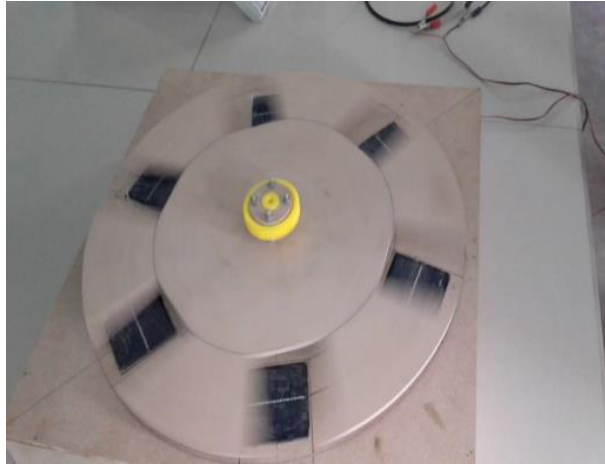- Large disc : 19 cm in radius
- Small disc : 11 cm in radius
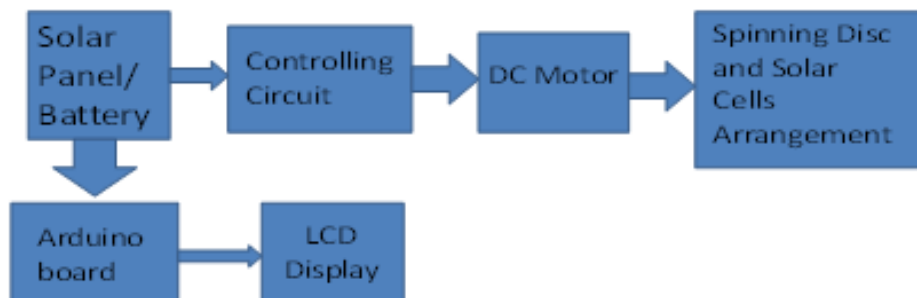

Figure-2: Rough Model with Dimensions

Figure-3: Actual constructed Model

3. BLOCK DIAGRAM OF SOLAR AC POWER GENERATOR WITH ARDUINO CONTROL CIRCUIT

The block diagram is shown in Figure-4 below consists of six blocks:

- Solar Panel/Battery
- ARDUINO board
- LCD
- Controlling circuit of DC motor
- DC motor
- Spinning disc and solar cells beneath it

Figure-4: Block Diagram

3.1 Explanation Of Block Diagram and Working Of Prototype System

Solar Panel serves as the supply to the system. We cannot predict whether the solar panel will produce sufficient torque to drive the DC motor. Hence, we use a battery for a temporary storage. This battery gets charged with the help of solar panel. The battery or panel will excite our controlling circuit. The arduino board and LCD are directly associated with controlling circuit. The DC motor will rotate the spinning disc according to our Arduino programmed in the desire frequency levels. The solar cells beneath the spinning disc are then alternately exposed to sunlight producing AC power.
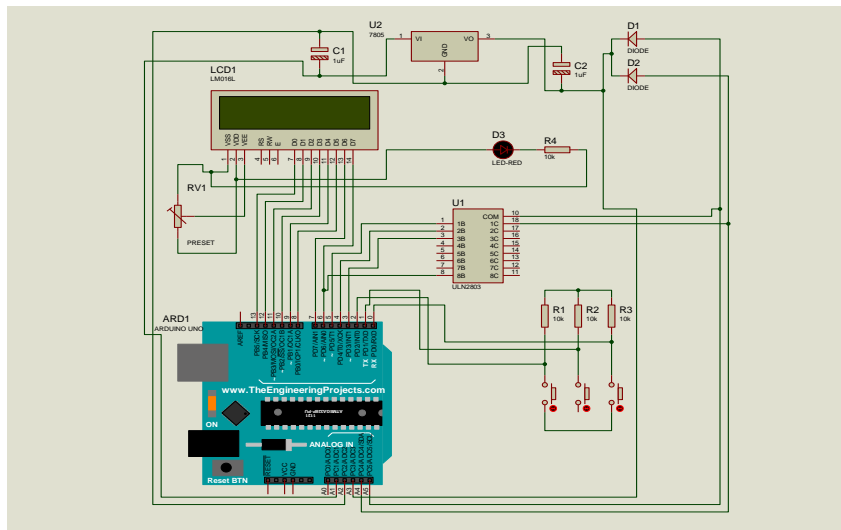
4. ARDUINO CONTROL CIRCUIT FOR DC MOTOR

Controlling circuit is one of the important parts of our research. The speed of the DC motor can be varied with the help of this circuit. The frequency of the system depends upon the speed of DC motor. The circuit consists of

- Arduino UNO
- ULN 2803
- Voltage Regulator 7805
- LCD

Controlling circuit can be excited by using the separate solar panel. We cannot predict the torque that will be required to run the DC motor hence we use the battery as a backup. The battery will be charge by using solar panels. Arduino UNO used in the circuit can be programmed according to the user or manufacturer.

ULN 2803 is the current driver IC used in our circuit. For maintaining the proper voltage, voltage regulator IC 7805 is used. The LCD will simply display the levels of frequency according to the program. There are certain switches on this controlling circuit. By pressing the switches, we can change the speed of the motor to 3 levels that are fast, medium and low.

**Figure -5: Arduino Controlled Circuit for Dc Motor**

5. RESULTS

Based on the different evaluation parameter like frequency, output voltage, output power, and noise, following results are obtained .A sine wave of less distortion was observed on the CRO screen. The prototype can drive the load up to 3watts.

Table-1: Result Analysis

Parameters	Expected Values	Obtained Values
Minimum Output voltage	2 v	1.4v
Maximum Output voltage	7.9 v	7.8v
Maximum Output current	0.7 A	0.6A
Maximum Output Power	2.5-3 Watt	2.5 watt
Maximum Frequency	50 Hz	42-47 Hz
Noise (%)	---	20%

Figure-6: Maximum Output Voltage Obtained
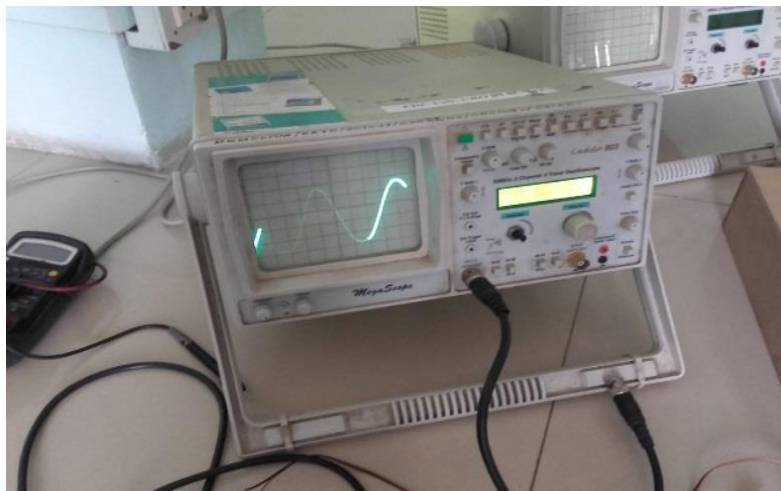
Figure-7: Prototype Testing on CRO

6. CONCLUSION

The idea of using solar energy to produce AC power is an emerging idea. It can reduce the use of non-renewable resources and also it does not pollute the environment. The concept is eco-friendly. Many generators make the use of inverter.The previous prototype of Solar AC power generator has fixed frequency and bulky and heavy material were used for their construction. By using a proper controlling circuit like implanting Arduino or any other supplement, we can achieve better efficiency for Solar AC power Generator. The large solar panels and Wedge pattern can be used in near future for generating Large AC power from solar energy.

7. REFERENCES

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BIOGRAPHY

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Mr. Syed Faiz is a student of Sipna College Of Engineering and Technology, Amravati. He is pursuing the Master's degree in Digital Electronics Engineering from Sant Gadge Baba Amravati University. His areas of interests are Linear Integrated Circuits & Digital Integrated Circuits.