Solar Energy Utilization For Speed Controlling Of Dc Motor

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Abstract- *The main aim of conducting this project is to provide solar energy utilization on speed of Dc electric motor.The solar power is the conversion of the energy from the sun to usable electricity.The most common source of solar power utilizes photovoltaic cells to convert sunlight into electricity. Photovoltaics utilize a semi-conductor to absorb the radiation from the sun,When the semiconductor absorbs this radiation it emits electrons,which are harnessed as electricity. Electric motors are an integral part of industrial plants and they are responsible for consuming more than half of all the electrical energy used in the world. In every industry there are processes that require adjustment for normal speed, such adjustments are usually accomplished with variable speed drive and it consists of electrical motor, power converter and controller*

Keywords- DC motor, Rheostat, Voltage Regulator, Photo-Voltaic cell, Rooftop, Battery, Graphical, Solar Panel

I. INTRODUCTION

As we know Electric motors are an integral part of industrial plants and they are responsible for consuming more than half of all the electrical energy used in the world and specifically how to use the solar energy (Renewable energy) for small scale industries purposes with optimum output. Consideration is given as to how this energy is generated and where losses most commonly occur. The solar cells find its application in a wide scale various toys, calculators and watches and so on but if we use it in small and large scale industries then not only it produce a optimum output but also it becomes an environment friendly . Photo-Voltaic cell consists of a p-layer and an n- layer. It is the primary constituent of a photovoltaic cell. When sunlight falls on the p-n layers of the photo-voltaic cell, the photons contained in the sun rays strike the p-n layer and an electric current flows due the generation of electron-hole pairs. This just explains the basic working of a photo-voltaic cell at a glance. Being self-sufficient in its operation the study of solar radiations, being observed in this approach, shows that the solar radiations was low during the initial period of a day. Gradually the radiations reached to the peak and became gradually low afterwards. The battery charging current depended solely on the panel voltage and battery terminal voltage. Photo-Voltaic cell cuts the leading edge of the today's energy focus in an environ-mental friendly way should summarize the content of the paper.

II. COMPONENTS REQUIRED

1. Solar Panel
2. Rechargeable Battery
3. DC Motor

1. SOLAR PANEL

Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells. [1]

2. RECHARGEABLE BATTERY

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved to additionally include devices composed of a single cell. Primary (single-use or "disposable") batteries are used once and discarded; the electrode materials are irreversibly changed during discharge. Common examples are the alkaline battery used for flashlights and a multitude of portable electronic devices. Secondary (rechargeable) batteries can be discharged and recharged multiple times using mains power from a wall socket; the original composition of the electrodes can be restored by reverse current.[2] According to a 2005 estimate, the worldwide battery industry generates US$48 billion in sales each year, with 6% annual growth.[2]

3. DC MOTOR

DC motor is electro-mechanical device that converts electrical energy into mechanical energy that can be used to do many works. It can produce mechanical movement to moving the wheels of the robot. DC motor has two wires, we can say

them positive terminal and negative terminal, when these wires are connected with power supply the shaft rotates there are two inputs and two outputs for each motor.[3],[6]

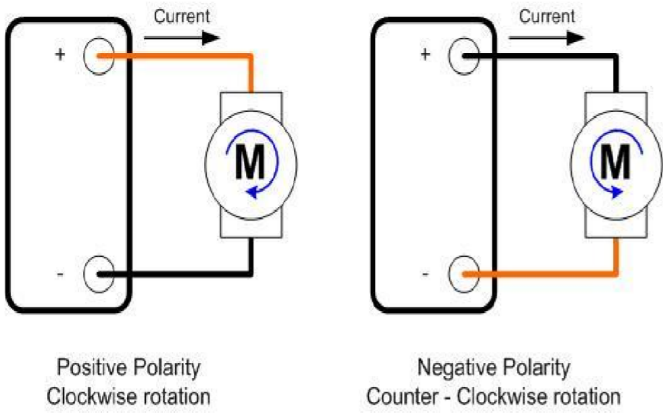

Figure 1. Dc motor rotation

III. WORKING

In this project, Solar panel is used to receive the energy from the sun and stores it in battery through the solar charger circuit. Here solar charger circuit is used to charge Lead Acid or Ni-Cd batteries using the solar energy power. The circuit harvests solar energy to charge a 6 volt 4.5 Ah rechargeable battery for various applications. The charger has voltage and current regulation and over voltage cut-off facilities.The circuit uses a 12 volt solar panel and a variable voltage regulator IC LM 317.The solar panel consists of solar cells each rated at 1.2 volts. Charging current passes through D1 to the voltage regulator IC LM 317. By adjusting its Adjust pin, output voltage and current can be regulated. VR is placed between the adjust pin and ground to provide an output voltage of 9 volts to the battery. Resistor R3 Restrict the charging current and diode D2 prevents discharge of current from the battery.Transistor T1 and Zener diode ZD act as a cut off switch when the battery is full. Normally T1 is off and battery gets charging current. When the terminal voltage of the battery rises above 6.8 volts, Zener conducts and provides base current to T1. It then turns on grounding the output of LM317 to stop charging.

A 12V DC to 220 V AC inverter can also be designed using simple transistors.The circuit can be divided into three parts: oscillator, amplifier and transformer. A 50Hz oscillator is required as the frequency of AC supply is 50Hz.This can be achieved by constructing an Astable multi vibrator which produces a square wave at 50Hz. In the circuit, R1, R2, R3, R4, C1, C2, T2 and T3 form the oscillator. Each transistor produces inverting square waves. The inverting signals from the oscillator are amplified by the Power MOSFETS T1 and T4. These amplified signals are given to the step-up transformer with its center tap connected to 12V DC. This AC current is given to the load , through which we can control the speed of DC motor with the help of PWM technique.

IV. CIRCUIT DIAGRAM

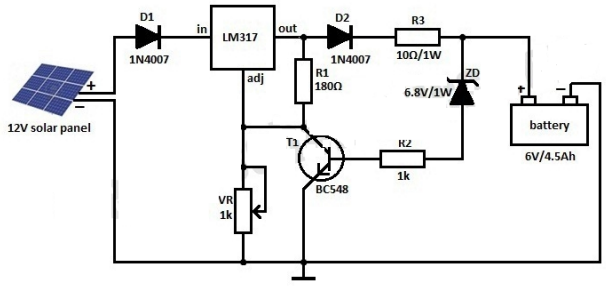

Figure 2. Charging circuit

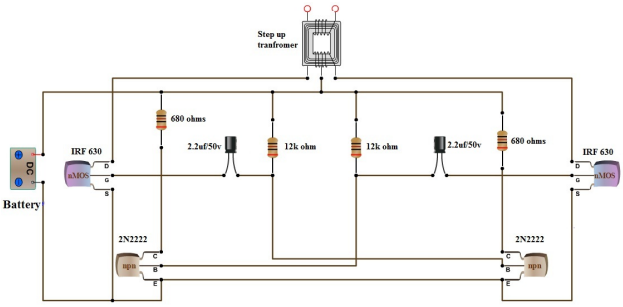

Figure 3. Inverter circuit

V. BLOCK DIAGRAM

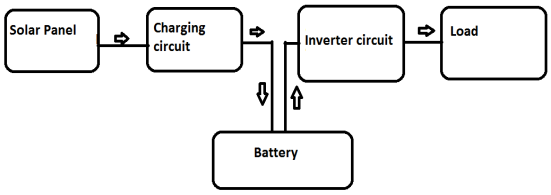

Figure 4. solar enrgy utilisation process

VI. INTERNAL CIRCUIT DIAGRAM

Figure 5. Solar panel

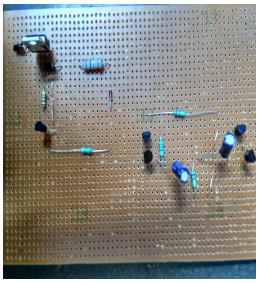

Figure 6. charging & inverter

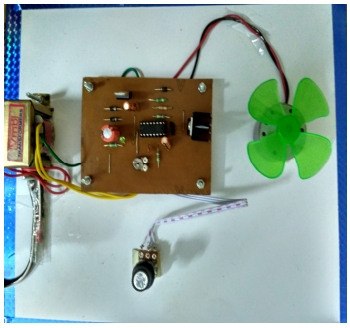

Figure 7. DC motor used as a load

VII. RESULT

In this Project 12v , 5W solar panel is used to absorb the energy from sun and convert it to a DC energy. Which is stored with the help of charging circuit and stores it to a 6 volt 4.5 Ah rechargeable battery this useful energy is provided to Dc Load with the help of Inverter circuit and speed of the DC motor was controlled successfully with the help of PWM Technique.

VIII. FUTURE SCOPE

Presently, solar energy conversion is widely used to generate heat and produce electricity. A comparative study on the world energy consumption released by International Energy Agency (IEA) shows that in 2050, solar array installations will supply around 45% of energy demand in the world. It was found that solar thermal is getting remarkable popularity in industrial applications. Solar thermal is an alternative to generate electricity, process chemicals or even space heating. It can be used in food, non-metallic, textile, building, chemical or even business related industries. On the other hand, solar electricity is wildly applied in telecommunication, agricultural, water desalination and building industry to operate lights, pumps, engines, fans, refrigerators and water heaters.

It is very important to apply solar energy for a wide variety of applications and provide energy solutions by modifying the energy proportion, improving energy stability, increasing energy sustainability, conversion reduction and hence enhance the system efficiency. The present work aimed to study the solar energy systems utilization in industrial applications and looked into the industrial applications which are more compatible to be integrated with solar energy systems.

IX. ADVANTAGE

- Solar energy is environment friendly. When in use, it does not release CO2 and other gases which pollute the air. Hence it is very suitable for India, India being one of the most polluted countries of the world.
- Solar energy can be used for variety of purposes like as heating, drying, cooking or electricity, which is suitable for the rural areas in India. It can also be used in cars, planes, large power boats, satellites, calculators and many more such items, just apt for the urban population.
- Solar power is inexhaustible. In an energy deficient country like India, where power generation is costly, solar energy is the best alternate means of power generation.
- You don’t need a power or gas grid to get solar energy. A solar energy system can be installed anywhere. Solar panels can be easily placed in houses. Hence, it is quite inexpensive compared to other sources of energy.[4]

X. DISADVANTAGE

- We cannot generate energy during the night time with solar energy.
- And, also during day time, the weather may be cloudy or rainy, with little or no sun radiation. Hence, this makes solar energy panels less reliable as a solution.
- Only those areas that receive good amount of sunlight are suitable for producing solar energy.
- Solar panels also require inverters and storage batteries to convert direct electricity to alternating electricity so as to generate electricity. While installing a solar panel is quite cheap, installing other equipment becomes expensive.[7]
- The land space required to install a solar plant with solar panel is quite large and that land space remains occupied for many years all together and cannot be used for other purposes.
- Energy production is quite low compared to other forms of energy.[4]

V. CONCLUSION

By proper setting of solar panel and circuit battery system we conclude that speed of dc motor can be controlled and used for further industrial application in future.

REFERENCES

[1] https://en.wikipedia.org/wiki/Solar_panel#Theory_and_construction

[2] https://en.wikipedia.org/wiki/Battery_(electricity)

[3] https://www.electrical4u.com/working-or-operating-principle-of-dc-motor/

[4] http://www.mapsofindia.com/my-india/india/scope-of-solar-energy-in-india-pros-cons-and-the-future

[5] Electrical Machinery By P.S. Bimbhra

[6] Electrical Engineering By J.B. Gupta

[7] Renewable energy sources and emerging Tecnologies By D.P. Kothari, K.C. Singal, R. Ranjan