

An Ideal Automatic Solar Beam Concentrator with Sun Tracking System

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Abstract: A microcontroller based Rotating Solar Beam Concentrator is proposed. This system is divided into 3 units. The first unit consists of solar beam concentrator whose function is to concentrate the beam coming from the sun on the solar panel. The second unit consists of microcontroller based sun tracking system which helps to get the positioning of the sun in order to get maximum efficiency and maximum output as it rotates the dish towards the axis of the sun. The last unit consists of an integrated program that helps the user to interact with the information provided by the system.

Keywords— Sun Tracking System; Concentrated Solar Power; Rotating Dish; Solar panel; CPC Collector

I. INTRODUCTION

In today's world, everything needs energy either in form of petroleum product or electricity. Therefore as Petroleum products are limited to nature electricity become the basic need. But through conventional ways, we are not able to generate the amount of electricity to quench the thirst for energy.

Therefore through an idea of Automatic Rotating Solar Beam concentrator (ARSBC), this problem can be solved. Through this system maximum amount of energy could be easily managed and easily able to get the full utilization of solar energy. This system has an interface so that the user is easily able to get information or status about the solar beam concentrator.

The system comprises of the following things:

A. Reflective Beam Concentrator

It is an optical instrument which helps to concentrate the high intensity of light and also reducing the size of an incipient beam. The rays coming from the sun is reflected towards the concentrated area. Thus the concentrated beam produces is having similar to the laser. [1]

B. Solar Tracking System (STS)

This system helps the panel or dish to align towards the axis of the sun. This device changes its orientation throughout the day in order to be the maximum captured. In Photovoltaic (PV), tracking system is used to minimize the angle of

The incidence of the rays in order to accumulate the maximum amount of energy from the sun.

There are two types of the tracking system is used:-

- Single-axis tracking system
- Dual-axis tracking system

Single axis tracking system rotates only on one axis moving back and forth in the single direction

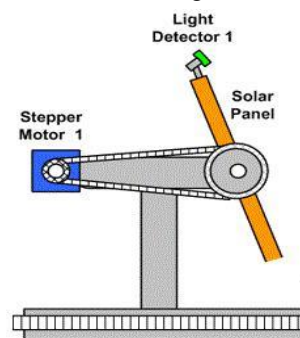


Fig. 1: Working of Single-axis solar tracker

Whereas dual-axis tracking system can align the system towards two axis, horizontally and vertically as the sun moves east to west on every day but it also moves 46 degrees north to south every year. Therefore it helps to get the maximum efficiency as it is faced towards the sun in the whole day. [2].

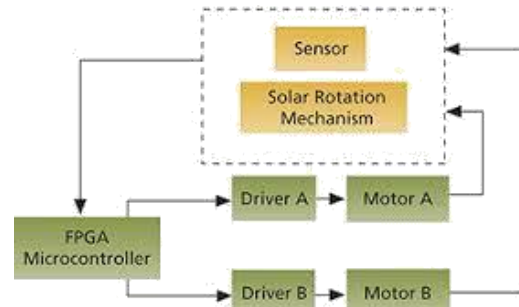


Fig. 2 Working of Dual-axis solar tracker [3]

C. GSM Module

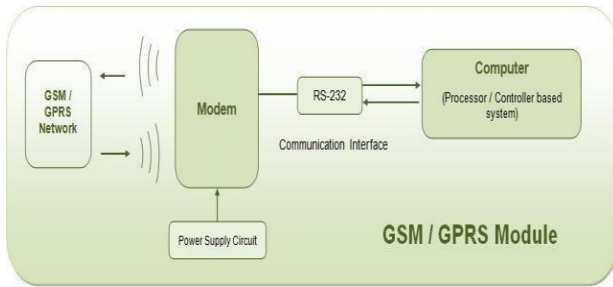


Fig. 2 Working of GSM/GPRS Module [4]

GSM/GPRS module is used to establish a link between the computer with the GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for telecommunication in most of the countries especially mobile. Higher data transmission rate is provided by Global Packet Radio Service (GPRS) as it is an extension of GSM1. GSM/GPRS module consists of a GSM/GPRS modem assembled with power supply circuit and communication interfaces. [5]



Fig. 4 A GSM/GPRS Module [6]

II. RELATED WORK

- A. *Reflective Beam Concentrator*, based upon an optical instrument produces a concentrated beam of light coming from the sun. In this, the incident beam is reflected inwards to a concave conical lens which refracts the parallel high-intensity beam. [1]
- B. *Juanita R. Riccobono* concludes that the method of manufacturing highly efficient solar beam concentrator which helps to reduce the cost of solar power generation.[7]
- C. *Optical Beam Concentrator* provides a concentrated uniform irradiation along the length or circumference of the area used for reflection.[8]
- D. *Abdul-Jabbar N. Khalifa* concludes the effect of two axis sun tracking system based on an electromechanical two-axis tracking system which helps in the alignment of the beam concentrator.[9]
- E. *Microcontroller based Sun Tracking system* which helps the system to align itself towards the axis of the sun, which informs the system about the direction of the sun

using two switches. These switches are placed in east and west side of the reflective dish.[10]

- F. *User Interactive System* helps the user to get up-to-date about the situation and output from the system. It also helps the user to guide and up to date about the maintenance and the service of the system as it is inbuilt with GSM module.

III. PROBLEM FORMULATION

From the above study, it can be observed that the traditional reflective beam concentrator used is not fit for the future enhancement of the use of solar energy.

As there is a lot of dust and gases in the environment which can tarnish the reflective surface of the dish and reduced the efficiency of the beam concentrator. This would result in the low production of solar energy and increase the cost of production.

Also, the solar beam concentrator is static in position. Therefore it is not able to gather more solar radiations coming from the sun. That's why solar grid system is needed and besides using a single concentrator, a whole plant is needed to establish.

The society is not aware of the working and maintenance of the solar panel or beam concentrator, which results in low efficiency provided by the system. There are no means to interact the user or consumer with the system.

IV. OBJECTIVES

- To use less solar panel due to the shortage of pure silicon
- To improve the Reflective beam concentrator by using sun tracking system for alignment.
- To make concentrator movable and make the system more interactive to the user

V. METHODOLOGY

In this system, reflective solar beam concentrator is used as there is a shortage of pure silicon. Most of the scientists are trying to find an alternative way to produce solar energy without using or using less silicon. Therefore this system has the potential to replace the convention way using Automatic Rotating Solar Beam Concentrator.

The system has three units.

The First Unit consists of solar beam concentrator, in which silver mirrored spherical dish is used. Silver mirror is used as it has a high ability to reflect the light radiations and spherical shape is used in order to cover up a large area. These concentrators are designed in such a way to reflect a large amount of heat.

So when the solar beams are concentrated on it, the silver mirrored reflects the beam coming from the sun to the concentrating point. Due to which we are able to get higher efficiency as a comparison to the flat solar panels.

The Third Unit comprises of a user interface system which is in between the user and the beam concentrator. This is one of the main units of the system as it has two objectives. First is to make the user aware of the working and importance of

the solar energy and second to make the system convenient to use.

This could result in increasing the usability of the beam concentrator to gather energy from solar. A user interface system is designed in such a way that it is friendly to the user and as well as the system. This system helps the user to get up-to-date with the system and able to know the energy gathered from the sun. It also alerts the user about the services and malfunctioning of the system. Through this, the user can easily able to get the information of about 30 days as the whole data is stored in the storage devices.

VI. CONCLUSION

The effective utilization of solar energy is an important path because it can deal with the global energy crisis at present and future. For this, the solar panel is used which is made up of silicon. But also there is a shortage of pure silicon in the global market. Therefore reflecting solar beam concentrator is only the way to generate the solar energy more effectively than any other. So the study on improving the efficiency of solar beam concentrator is very necessary. This paper proposed an “Ideal Automatic Rotating Solar Beam Concentrator” in order to enhance the past technology and by some modification make it compatible for the future utilization in an efficient way.

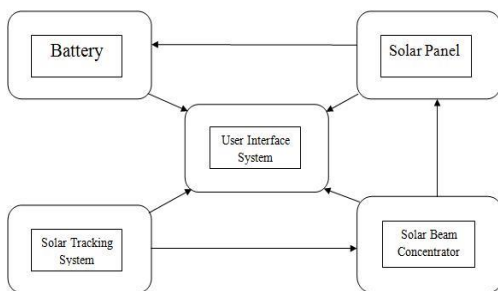


Fig. 4: Methodology Flow Diagram

The Second Unit consists of spherical dish alignment using a microcontroller. The alignment system is installed on the side of the dish. There are two types of sun tracking system. One is single axis and other is a dual axis tracking system. For best and more accuracy and to make the system more efficient dual axis tracking system can be used. In dual axis tracker, 2 switches/sensors are used and these are placed at the outer of the parabolic dish. These two sensors are always trying to align itself in such a way that both the axis of the switches and the sun coincide with each other. The switch system is connected to the microcontroller. So that it becomes easy to manage the whole system. The motors are also connected to the dish. So when the dish is aligned itself using sensors, it gives commands to the microcontroller and through which the motor rotates itself until it gets align itself to the axis of the sun in order to get more reflections from the sun and get higher efficiency.

VII. FUTURE SCOPE

This project will consist of creating a revolution in the uses of solar energy in future. This will save the cost as well as

helps to save the environment by creating a pollution free energy. In future, it will be further extended its usability as an application in other products like satellites, water heating system etc.

[1]

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