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## Fresnel Lens: A Catalyst for increasing Efficiency of solar panel.

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### Abstract

Now a day most of the energy is generated by Thermal power plant and it is generally seen that the solar as an alternative source for thermal power plant. Solar is the renewable energy source and non-polluting also. But efficiency of solar power plant is about 15-25% only. In this paper we propose a system which increase the efficiency of solar power plant at very cheap cost. This system consists Fresnel lens, servomotor, microcontroller etc. In this way the efficiency of solar plant is increase up to 36%.

**Index Terms:** Fresnel lens, PV Cell, Servo motor, Micro controller, LDR.

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### 1. INTRODUCTION

Energy issues remain an interesting research topic throughout the rate of rise of human population. The solar is the alternative energy source for fossil fuel. There are several natural energy sources available as clean, non-polluting, secure and unlimited alternative energy such as solar energy [1]. In bright weather conditions, the Earth's surface receives about 1000 watts of sun energy per square meter. Less than 30% of the energy is reflected back into space, 47% is converted to heat, 23% is used for all work circulation located above the earth's surface, a fraction of 0.25% is accommodated by wind, waves and currents and there is still a very small 0.025% is stored through the process of photosynthesis in plants that is eventually used in the process of forming coal and petroleum (fossil fuels, photosynthesis that takes millions of years) [2]. The current solar panel efficiency level reaches only about 15-25% of the total solar energy that can be converted to electrical energy. Even to get a high level of efficiency required high quality PV cells and expensive investment costs. This makes people increasingly reluctant to apply PV cell technology as one of renewable alternative energy sources to meet their daily electrical energy needs. For that researchers designed PV cell system by combining Fresnel lens. Fresnel lens can increase and optimize the intensity of sunlight absorbed by PV cells so that its efficiency becomes raised [3]. In the research of Design of Solar Tracker is Based on Microcontroller With LDR Sensor (Light Dependent Resistor), solar tracker design used four LDR sensors to sensing the direction of solar motion. Solar tracker was used to drive PV cells to follow the direction of

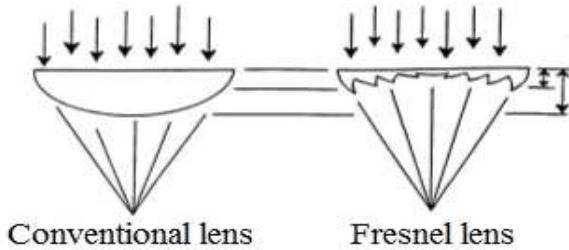
solar motion. The electronic circuit consisted of a PV cells, LDR, Microcontroller, servo motor and most important Fresnel lens [4].

### 2. FRESNEL LENS

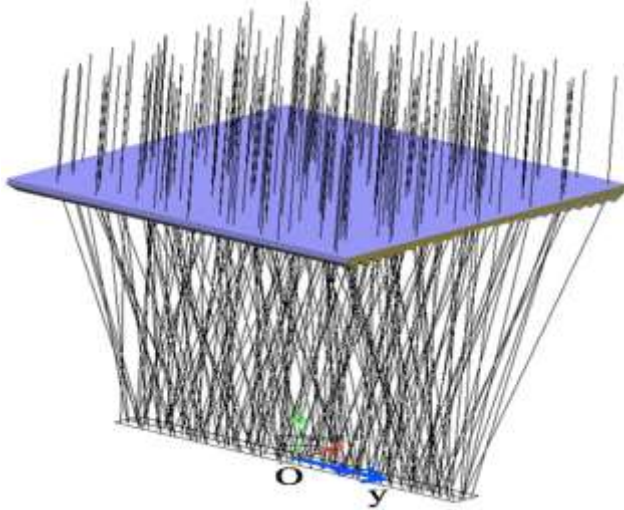
In a lens, the refraction phenomenon is produced in the surface, while the bulk material between the two surfaces doesn't have any influence in the refraction. In 1748 Georges-Louis Leclerc had the idea of reducing lens weight and size acting on the lens surface, but it was a French mathematician and physicist, Augustin-Jean Fresnel, who built, in 1820 the first lighthouse using Leclerc's design.

The Fresnel lens is a flat optical component where the bulk material is eliminated because the surface is made up of many small concentric grooves (Fig. 1). Each groove is approximated by a flat surface that reflects the curvature at that position of the conventional lens, so each groove behaves like an individual prism. There are two basic Fresnel lens configurations: linear (Fig. 2) and circular (Fig. 3). A linear Fresnel lens has linear parallel grooves and the focus is a line. A circular Fresnel lens has circular concentric grooves and the focus is a small circle.

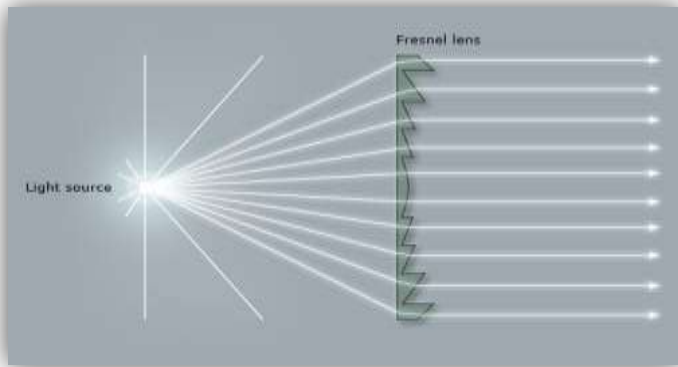
Fresnel lens manufacture processes have developed. First designs were cut and polished in glass. In 1950 they started to be made by pressing hot glass in metal molds, and since the eighties they are made of plastics. Modern plastic Fresnel lens, cheaper and lighter than a conventional lens of the same size, have high optical quality and no spherical aberration.



**Fig.1.** Difference between Conventional lens and Fresnel lens.



**Fig.2.** Linear Fresnel lens.



**Fig.3.** Circular Fresnel lens.

### 3. PROPOSED SYSTEM

Initially the sun rays fall on the solar panel. At that time Light Dependent Resistor (LDR) is set in ON position. The light dependent resistor value increases or decreases according to the intensity of light. At this variation the micro controller makes to rotate the servo motor. The servo motor is attached with the solar panel and hence the panel moves. The optocoupler support the isolation of power circuit and control circuit. Fresnel lens is attached on two sides of the PV cell for increasing the power generation. And further increased power is calculated and compared with the output power of the solar

panel reading without Fresnel. The output power reading with Fresnel lens is greater than the normal solar panel reading.

The heights of the Fresnel lenses were adjusted to make the distances between the Fresnel lenses and solar cells equal to 120 mm, 180 mm, 240 mm, 300 mm, 360 mm, 420 mm, 480 mm and 540 mm. A solar cell without a Fresnel lens was used as the control.

### 4. DESCRIPTION OF COMPONENT

#### 4.1PV Cell (Solar Panel):

A photovoltaic panel is a packaged interconnected assembly of pv cells called as solar panel. PV Cells are integral part of solar-electric systems which is now increasing important as alternative sources of power utility.

#### 4.2 Light Dependent Resistor:

Light dependent resistor also called as a photo resistor. LDR it works based on the variance of resistance value, which under goes to decrease or increasing the incident light intensity.

#### 4.3 Servo Motor:

A servo motor is a linear and rotary actuator that allows for precise control of angular or linear position, velocity and acceleration. For position feedback motor coupled with the sensor.

#### 4.4 Limit Switch:

Limit switch is a switch operated by motion of a machine part. They are used for controlling machinery as in a control system. Limit switch is used for a variety of applications because of its various advantages like ruggedness, ease of installation and reliability of operation.

#### 4.5 Light Sensor:

Photodetectors, also called photosensors, are sensors of light. Light sensors are a device which convert light into current. The light sensor is a passive device.

#### 4.6 Optocoupler:

An optocoupler is an electronic device that interconnects two separate electrical circuits by means of a light sensitive optical interface. Optocoupler also called as opto-isolator.

#### 4.7 Liquid Crystalline Display:

LCD is the technology used for displays on TVs and computer monitors. LCD does not emit light directly, instead using a backlight or reflector to produce images in color or monochrome.

#### 4.8 Microcontroller:

The first microcontroller was the 4-bit Intel 4004 released in 1972, with the Intel 8008. A microcontroller is a small computer on a single integrated circuit. It is used for automatically controlled products and devices such as automobile engine control systems, medical devices, remote controls, office machines.

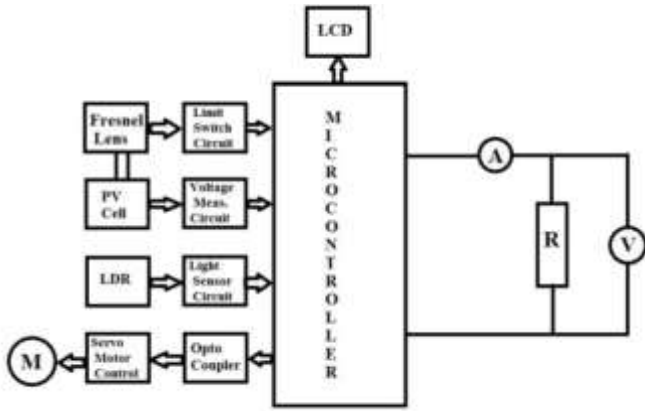


Fig.4: Block Diagram of proposed system.

Time	Current Without Fresnel lens (mA)	Current With Fresnel lens(mA)
08.00 AM	0.42	1.02
09.00 AM	0.55	1.15
10.00 AM	0.75	1.35
11.00 AM	0.81	1.41
12.00 AM	0.92	1.52
01.00 PM	0.95	1.55
02.00 PM	0.88	1.48
03.00 PM	0.76	1.36
04.00 PM	0.42	1.02
05.00 PM	0.23	0.93
06.00 PM	0.08	0.68
<b>Total</b>	<b>6.77</b>	<b>14.37</b>

5. CONTROLLING FLOWCHART.

Table 02: Output current

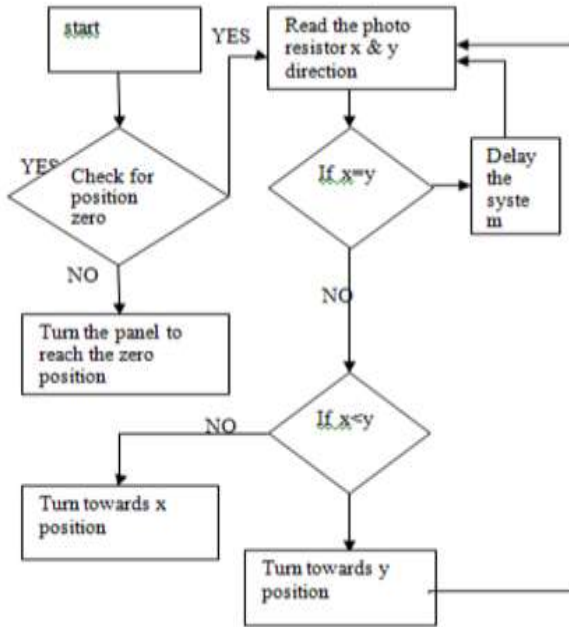


Fig.5. Controlling Flowchart

7. ADVANTAGE

- The lenses are available in small as well as in large size.
- By using these lenses it increase the amount or collection of solar energy.
- The light weight and thin construction of this lenses make them ideal for use in applications
- This lenses has excellent light gathering ability
- Fresnellens are ideal for any application requiring inexpensive, thin and light weight positive lens element.

8. CONCLUSION

This paper based on Fresnel lens which improves the efficiency of PV cell. The controlling is based on the closed loop algorithm, it is designed and implemented with Microcontroller. Experimental work has been carried out carefully. By using this technology maximum current can be obtained from solar panel. Solar trackers are used to orient solar panels, reflectors, lenses towards the sun. Since the sun's position in the sky varies with the seasons and the time of day, trackers are used for tracking the position of sun to maximize energy production. Operating cost, maintenance costs are minimum as compared to the other type of power generation systems. Pollution free atmospheric condition due to the absence of smokes. They have long effective life and are highly reliable. They have a high power efficiency.

6. RESULT:

Commonly the output power, reliability and the cost rate play an important role in the successful product.

Sr. No.	Component Name	Cost
1	Microcontroller	79.00
2	LDR	8.00
3	Servo Motor	742.00
4	Fresnel Lens	825.00
5	LCD	187.00
<b>Total</b>		<b>1841.00</b>

Table01: Cost of Component

## ACKNOWLEDGEMENT

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