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Solar Panel Controller and Power Optimization

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Abstract – **This Project involves a microcontroller based solar panel tracking system. By tracking the solar, more and more energy is to be generated as the panel is always perpendicular to the Sun's intensity. Renewable energy is rapidly gaining importance as an energy resource as fossil fuel prices fluctuate. The solar tracker will tend to maximize the amount of power absorbed by Photo Voltaic systems. Development of solar panel tracking system has been ongoing for several years. Now the wheel which is fixed at the base will move the panel from the shaded region to solar illuminated region, by using a sensor to detect high intensity radiation from the sun. It is advantageous to have the solar tracking system tracks the location of the high light intensity region, such that it generates more energy by absorbing the rays which is radiated from the sun. The objective is to design and implement an automatic solar tracking mechanism using embedded system design with minimum cost and reliable structure.**

Keywords— **Solar Tracking System, Solar panel, Microcontroller AT89C51, LDR Sensor, DC Gear motor.**

I. INTRODUCTION

Sun is the essential source of energy. It is the renewable source of energy and it is free of cost. Now a day's fossil fuels are limited. Fossil fuel is costly and they cause lots of pollution as compared to sun energy. As we know that sun energy is free of cost and does not cause any kind of pollution. To avoid this drawback of fossil fuel we use solar energy. Solar energy is becoming an important energy source as petroleum based resources become more expensive. Solar energy is now abundant and solar technology is growing as more and more people put solar energy to work.

Previous type of solar tracking system was fixed system. Solar panel which are used in this systems are only in one way direction. And this system generates low power at the output. As we can see there are many problems that occur in the previous solar system. To overcome these drawbacks solar tracking system is used. Solar tracking system can detect a 180 degree of rotation so panel can generate high power at the output. It can store more energy.

This project use 3 sensors in a three direction to sense the direction of maximum intensity of light. Its sensor will face 30 degree so the total angle that the system can sense is 180 degree.

This system will use AVR microcontroller as a brain to operate this system and servomotor to rotate the solar panel. And the angle/direction of solar panel will be shown on the LCD.

Sun light emits sun rays. Then LDR sensor detects the sun rays. And give the information to AVR microcontroller. Then AVR microcontroller compares the intensity of light. As if the {LDR1 > LDR2} then it rotates to right direction. And if {LDR2>LDR1} then it rotates to left direction. And it gives the command to servomotor. And as per the instructions servomotor moves the panel to left or right. The project output voltage is displayed on the LCD.

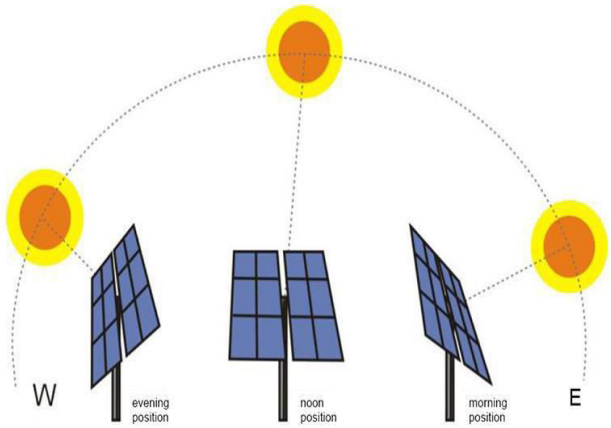

Fig. 1 Solar tracking system

Objective of Project

The main objective of project is to rotate solar panel through the LDR by using servo motor. We have proposed solar panel to control the panel that it should face the sun till it is present in a day.

II. ANALOGY

Table below shows the parameter of solar tracking system & previous type of solar system.

TABLE. 1 COMPARISON OF SOLAR TRACKING SYSTEM AND PREVIOUS TYPE OF SOLAR SYSTEM

Parameter	Solar tracking system	Previous type of solar system
Type of circuit	Simple	complex
Direction of sensor	30 degree from east to west(180 degree total)	45 degree from east or 45 degree from west
Output power	High	Low
Microcontroller Type	AVR (atmega16)	Intel8051

III. SCOPE OF THE PROJECT

This project is focused to design and build the solar tracking system that would be starting point to build realistic solar tracking system move 30 degree each and total movement that is system can do is 180 degree using AVR microcontroller, LDR and using LCD to show the status of the solar panel.

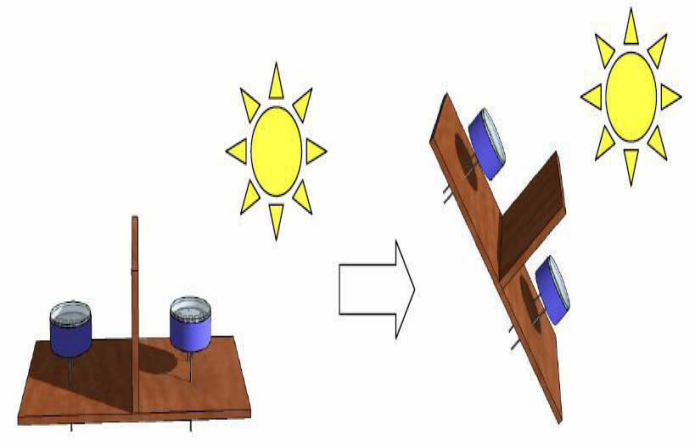

Fig. 2 Sensor response once a shadow is cast on one LDR

IV. PROPOSED WORK

The proposed plan of action of this project is to make a system working on solar energy. This model should effectively be able to track sun position through solar panel. Solar tracking system automatically detects the position of sun and tracks its position in the sky using solar panel when the sun moves from east to west. LDR which is present on the solar tracking system detects the rays of the sun and helps the solar panel to move with sunrays from east to west. This LDR's are placed on the three sides. Right side, left side, and at the middle. Which helps the panel to detect and rotate the panel accurately? Servomotor moves in perfect direction and gives accurate angles for panel to detect. This panel is moved with the help of servomotor. Solar tracking system has capacity to store more electric power than regular solar system. This accurate direction of the panel and voltage of electricity is displayed on the LCD. The system block diagram to be used in this project is as follows.

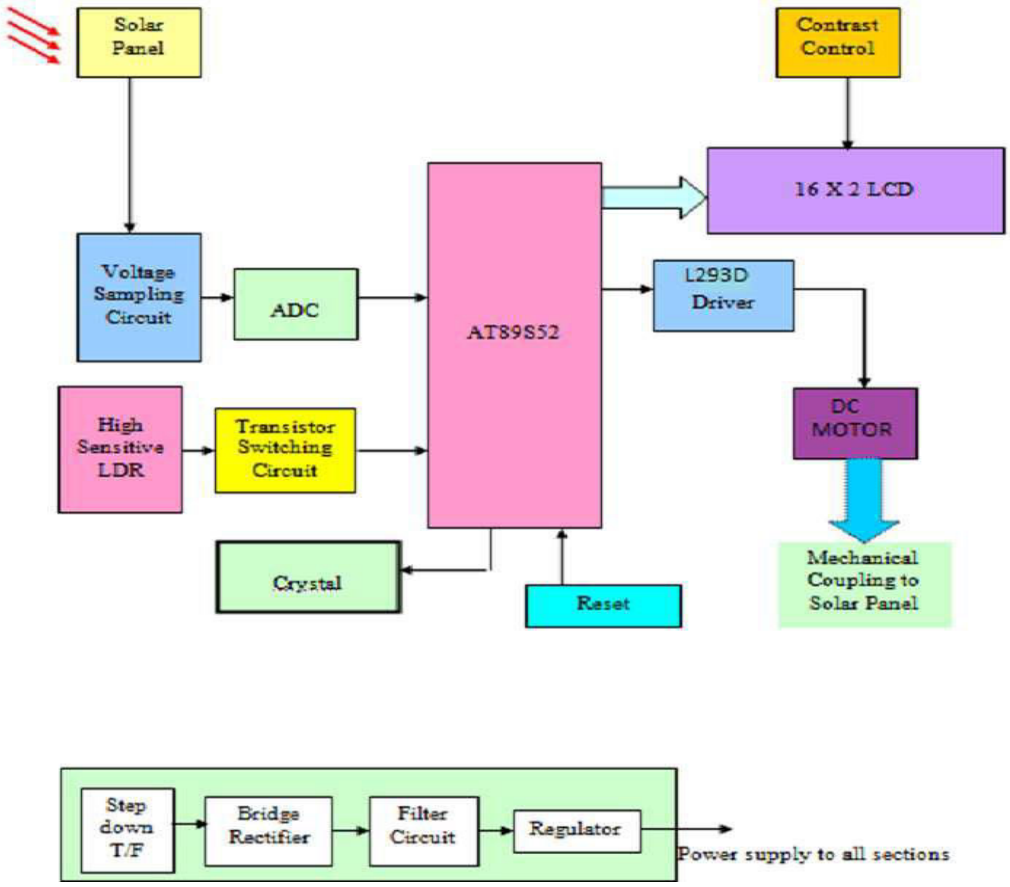

Fig. 3 Solar tracking system

Advantages

- It Reduces Human errors.
- Human power requirements are less.
- It saves more power.
- It requires less time.
- Cost effective and time efficient.
- Installation is easy.
- Consumes less energy and is more efficient.
- Increases the overall efficiency of the system.
- Facilities can operate with little maintenance or intervention after initial setup.

Flowchart

The work flow of the project is as follows

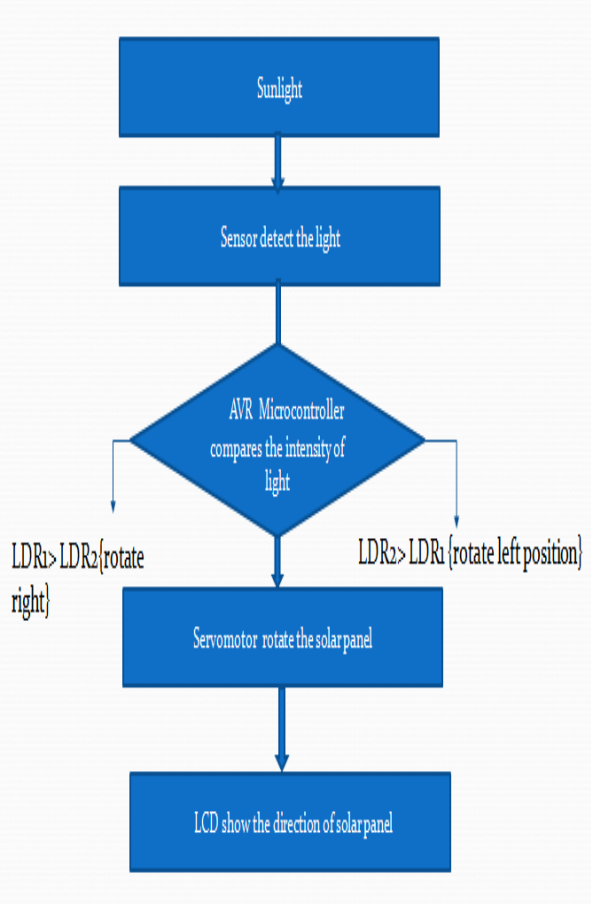

Fig. 4 Flow chart of solar tracking system

Disadvantages

- Solar trackers are slightly more costly than their stationary counterpart
- Trackers are a more complex system than fixed tracking.
- Solar trackers are generally designed for climates with little to no snow making them a more viable solution in warmer climates

Applications

- Used by the solar monitoring stations.
- Used by the people working in mines for monitoring cracks.
- Used by the Process control industry.
- Used by the High voltage labs.
- Used by the Wild life researchers.
- Used in the Distributed control systems& R&D industries.

V. SCOPE OF THE PROJECT

The result for the project was gotten from LDRs for the solar tracking system and the panel that has a fixed position. The results were recorded for four days, recorded and tabulated. The outputs of the LDRs were dependent on the light intensity falling on their surfaces. The LDRs measure the intensity of light and therefore they are a valid indication of the power that gets to the surface of the solar panel. As a result, by measuring the light intensity at a given time, it will be possible to get the difference in efficiency between the tracking panel and the fixed one. The light intensity is directly proportional to the power output of the solar panel. The result was obtained for different days. Getting results from different days was helpful in that it made it possible to compare the various values gotten from different weather conditions.

Hardware Output

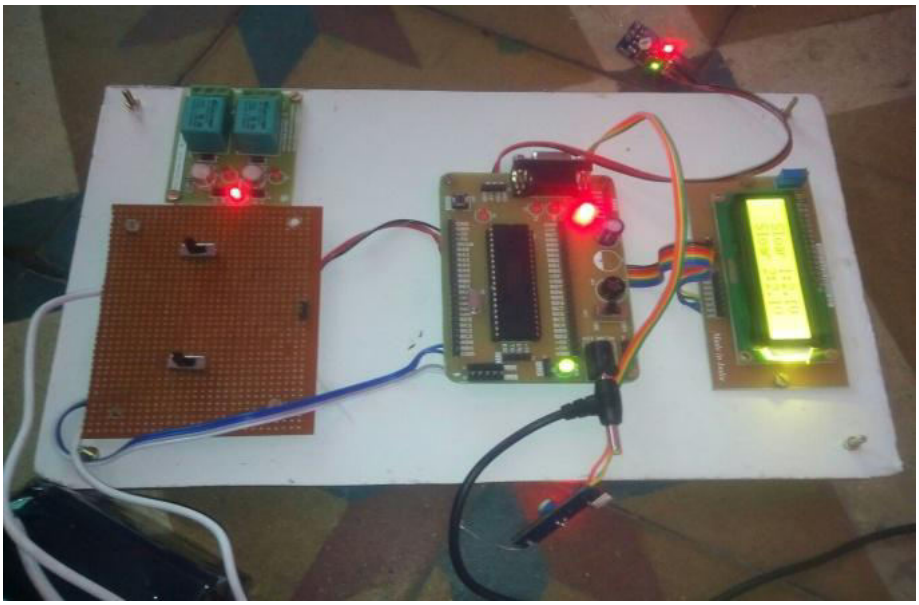

Fig. 5 Hardware output

Fig. 6 Solar Tracking Setup

VI. ANALYSIS

The results for the project were gotten from LDRs for the solar tracking system and the panel that has a fixed position. The results were recorded for four days, recorded and tabulated. The outputs of the LDRs were dependent on the light intensity falling on their surfaces. The LDRs measure the intensity of light and therefore they are a valid indication of the power that gets to the surface of the solar panel. As a result, by measuring the light intensity at a given time, it will be possible to get the difference in efficiency between the tracking panel and the fixed one. The light intensity is directly proportional to the power output of the solar panel. The results were obtained for different days. Getting results from different days was helpful in that it made it possible to compare the various values gotten from different weather conditions. The values obtained were recorded and used to draw graphs to show the LDR readings for Fixed Panel LDR readings for a Tracking Panel. Thus the different readings are noted by table which is following below Table 2 the values obtained were recorded and used to draw graphs to show the relationship between the recorded values following below figure 7.

TABLE. 2 RESULTS FOR CLOUDY MORNING AND SUNNY AFTERNOON

Time	LDR1	LDR2	LDR 12	LDR 22
06:30Hrs	0.196	0.176	1.477	1.487
07:30Hrs	0.249	0.210	1.804	1.839
08:30Hrs	0.225	0.196	2.757	2.933
09:30Hrs	0.723	0.567	3.631	3.783
10:30Hrs	0.733	0.816	3.900	3.798
11:30Hrs	3.211	2.297	3.910	3.969
12:30Hrs	4.888	4.941	4.990	4.990
13:30Hrs	3.803	3.910	4.985	4.990
14:30Hrs	3.456	4.057	4.976	4.985
15:30Hrs	3.930	3.846	4.941	4.892
16:30Hrs	1.999	1.544	4.824	4.594
17:30Hrs	1.090	1.144	3.128	2.981
18:30Hrs	0.718	0.787	0.982	0.968

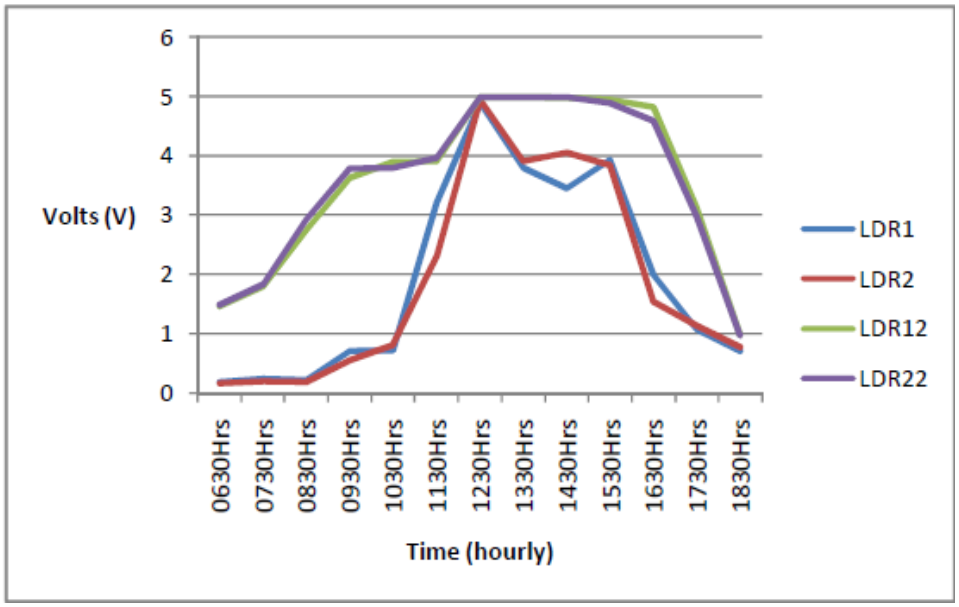

Fig. 7 Relationship between the recorded values

Where,

LDR1 is the photo resistor 1 reading for a solar panel that is fixed.

LDR2 indicates the 2nd photo resistor for a fixed solar panel.

LDR12 indicates the 1st photo resistor reading in the tracking solar panel.

LDR 22 indicates the 2nd photo resistor for a tracking solar panel.

VII. CONCLUSION

Using concept of solar tracking system, the position of sun and keeps vertical contact between solar panel and sunlight. And it is used to increase the efficiency of solar panel.
This project aims to track the sun till the sun is up and generate electricity as per the need.

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