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Automatic Solar Tracking System Using AT 89S52 Microcontroller

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A B S T R A C T

Solar energy is one of the trending expanding renewable energy resources now-a-days. Due to revolution of the earth, solar source i.e. sun does not face the panel continuously in a day, hence less electricity is produced. The problem is solved by our system by tracking sun automatically to generate maximum electricity. LDR sensor senses max solar power which is being given to the Microcontroller. Controller then takes the decision according to the algorithm and gives commands to tilt the panel towards the direction of the max energy. The DC Motor (driven through relay) is used to rotate the panel. A Solar Tracker is basically a system into which solar panels tracks the motion of the sun across the sky ensuring the maximum amount electricity generation throughout the day in conjunction with the electronic circuitry. After finding the sunlight, the tracker will try to navigate through the path ensuring the maximum sunlight falling on the panel. It is completely automatic and keeps the panel in front of sun until it is visible. Its active sensors constantly monitor the sunlight and the DC motor rotates the panel towards the direction where the maximum intensity of sunlight. Residential that uses solar power as their alternative power supply; the system is beneficial to them. The main objective of this project is to develop an automatic solar tracking system whereby the system will cause solar panels be aligned with the Sunlight in order to maximize in harvesting solar energy.

Keywords: LDR (Light Dependant Resistor)

1. Introduction

Electricity consumption is used as one of the measuring standard of all developed and developing countries' growth. The electricity demand of developing country like India is increasing year by year. To cope with the increasing demand, use of solar energy is also increasing rapidly. The government is also taking initiatives towards increase of use of solar energy. The solar panels used for this purpose are of standstill type i.e. their position once installed is fixed. Such panels have maximum energy generation at noon time, while at morning or at evening the generation is lowered, because the sun is not perpendicular with the solar plate at these times. Automatic solar tracking system comes with the solution of this problem. The system uses two LDRs. The tracking operation is to be done during day only and during night the system should remain idle. Two LDRs are arranged on the edges of the solar panel such that, one LDR at East edge ant the other at West edge. Depending upon LDR's output the AT89s52 microcontroller takes the decision, whether to rotate panel clockwise or anticlockwise. The microcontroller drives the DC motor through the relays. A transistorized relay driver is used to drive the relays. The solar panel is attached to the shaft of DC motor. When the day is detected by LDR, the tracking starts. At morning the solar panel will be facing towards the east sun. After some time let's say 10:00 AM, the sun moves towards west. At this position the east LDR receives less solar energy than the west LDR. This indicates that to receive the maximum energy the panel has to be rotated towards west, by rotating the DC motor anticlockwise. The process continues till evening, when the sun is at maximum west position.

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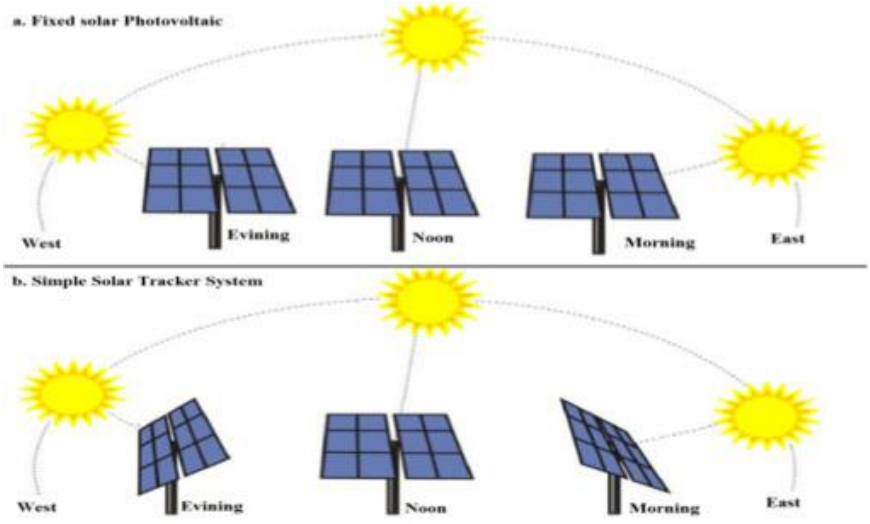


Figure1 Fixed position and tracking type solar panels [1]

Single Axis Tracker: Single axis solar trackers can either have a horizontal or a vertical axis. Generally single axis trackers are one which tracks the sun in horizontal axis i.e. from East to West direction throughout the day. The system is simpler than the dual axis tracker. These trackers are well suited at the sites such as equator, where the deviation of sun can be neglected. The horizontal tracking is generally used in large solar generation projects.

Dual Axis Tracker: The dual axis tracker has the capability to track the sun from East to West during a day, and also vertically due to solar solstice. The dual axis systems are obviously complex one. Dual axis systems are used in small projects like roof top generation. [2]

2. LITERATURE SURVEY

Mayank Kumar Lokhande states in his paper, that the sun tracking solar system model which is a device that follow the movement of the Sun regardless of motor speed. Besides that, it is to improve the overall electricity generation using single axis sun tracking system and also to provide the design for residential use. LDR or light dependent resistor has been chosen as the sensor because LDR is commonly used in sun tracking system. This is because LDR is sensitive to the light. The resistance of LDR will decreases with increasing incident light intensity. For the controller, AT89S52 had been chosen. This ATMEL programming will give the pulse to the driver to move the motor. For the driver, bi-directional DC motor control using relay has been used. The motor controller had been chosen because it can control the motor to rotate clockwise and counter-clockwise easily. DC geared motor also been chosen because it has a hold torque up to 24 kg.cm and low rpm. [3]

According to Nikesh D. Watane**,** Rakesh A. Dafde, the hardware design and implementation of a system that ensures a perpendicular profile of the solar panel with the sun in order to extract maximum energy falling on it renewable energy is rapidly gaining importance as an energy resource as fossil fuel prices fluctuate. The unique feature of the proposed system is that instead of taking the earth as its reference, it takes the sun as a guiding source. Its active sensor constantly monitors the sunlight and rotates the panel towards the direction where the intensity of sunlight is maximum. The light dependent resistor's do the job of sensing the change in the position of the sun which is dealt by the respective change in the solar panel's position by switching on and off the geared motor the control circuit does the job of fetching the input from the sensor and gives command to the motor to run in order to tackle the change in the position of the sun. With the implementation the proposed system the additional energy generated is around 25% to 30% with very less consumption by the system itself. In this paper, an improvement in the hardware design of the existing solar energy collector system has been implemented in order to provide higher efficiency at lower cost. [4]

Ari Sowndarya Rani, Mandeep Dhanda "Analysis and Synthesis of Solar Tracker using Timer Mechanism" presents a system which operates in open loop. Open loop trackers: use no sensing but instead determine the position of the sun through pre-recorded data for a particular site. Her paper deals with open loop tracker in which a timer is used to move the tracker across the sky. Incremental movement throughout the day keeps the solar panel pointing the sun. The mechanism consists of timer which creates mass imbalance, which helps to tilt the panel. [5]

3. BLOCK DIAGRAM

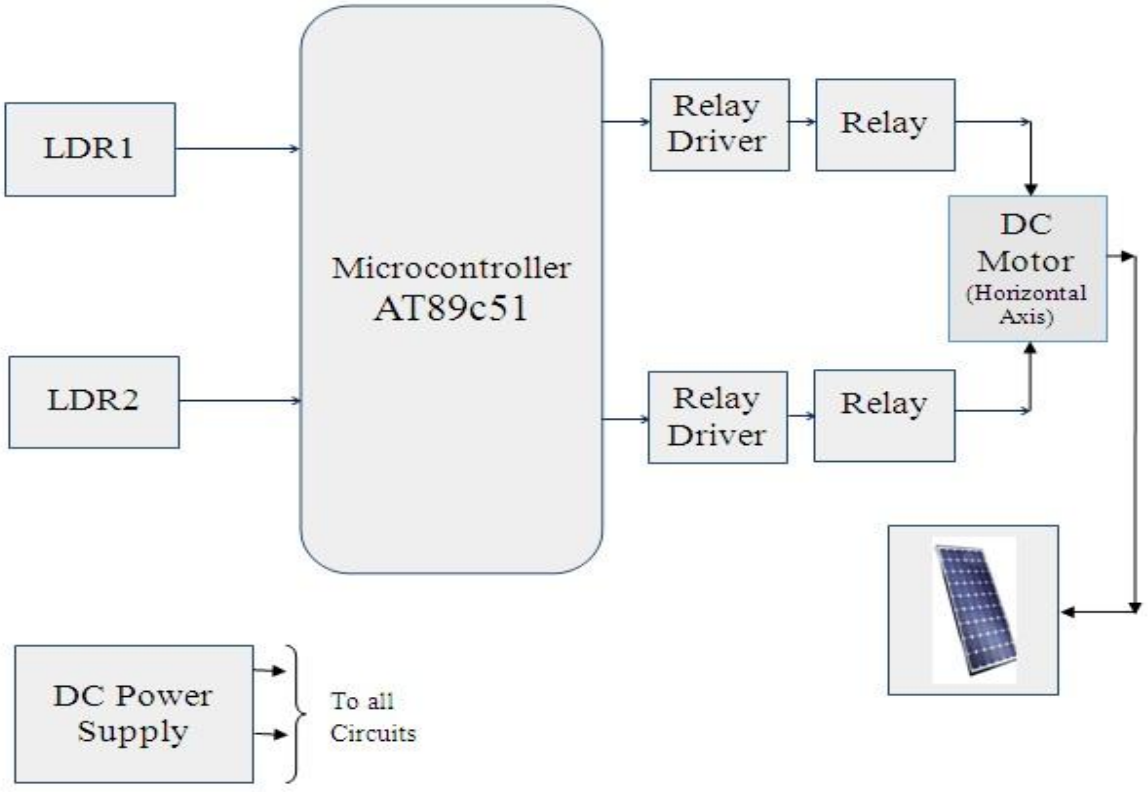
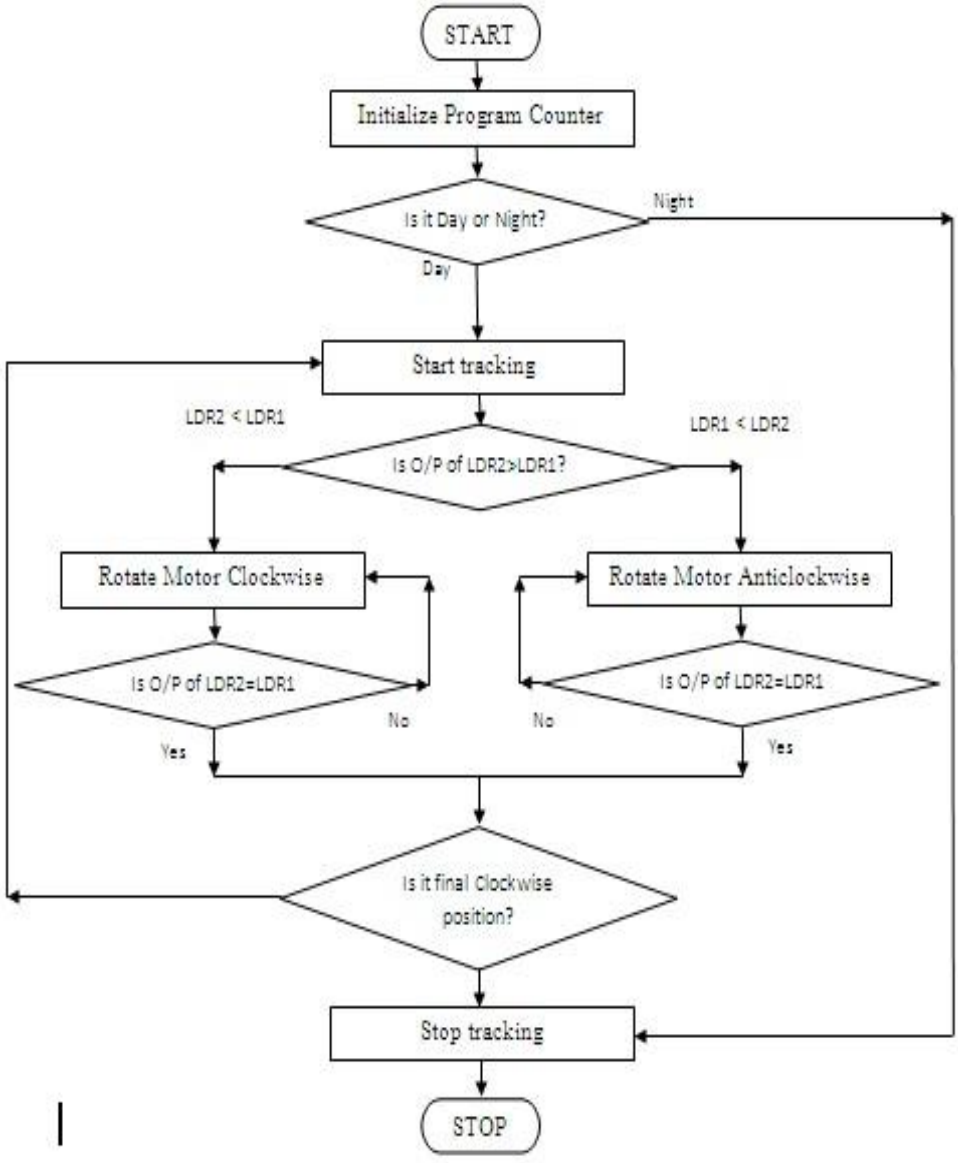


Figure2 Block diagram of Automatic Solar Tracking System using AT 89s52

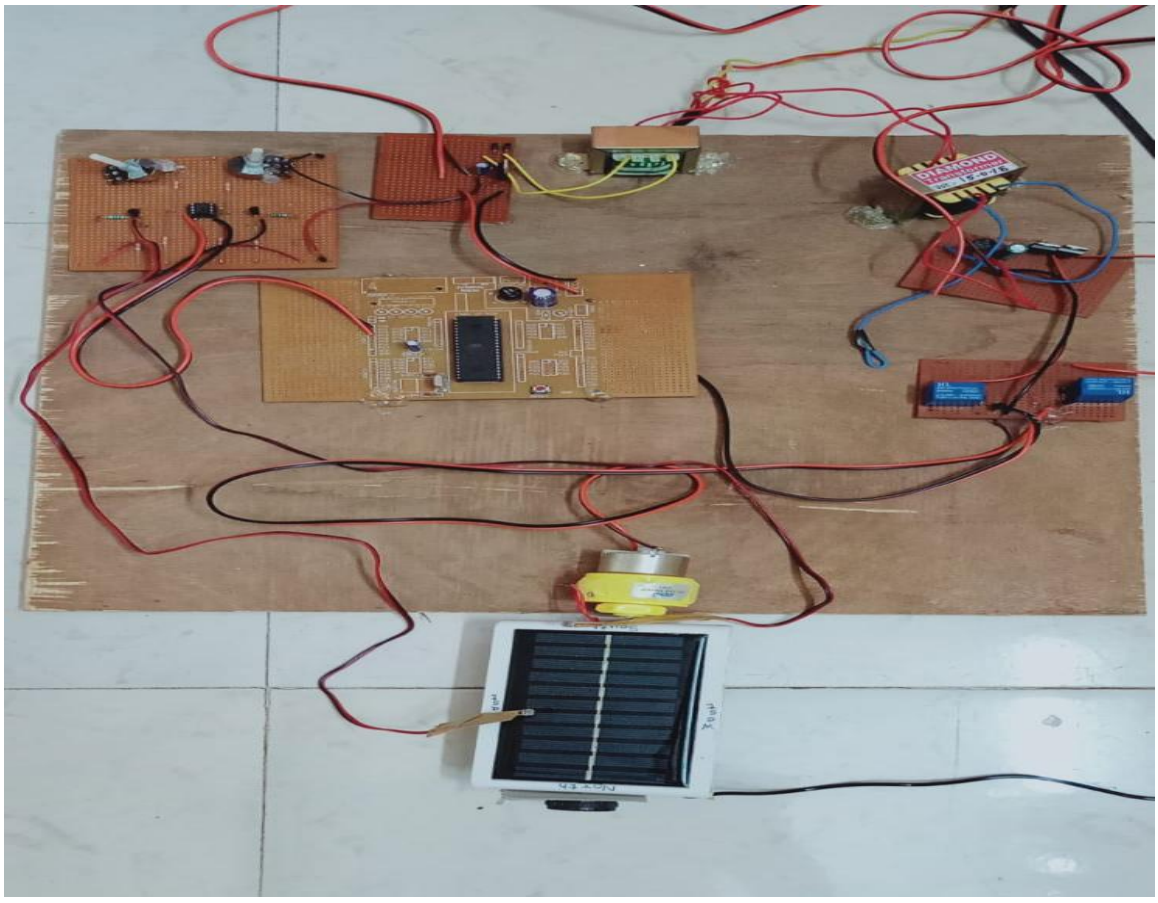
4. Operation of Automatic Solar Tracking System using AT 89s52:

Above figure shows that main block diagram of Automatic Solar Tracker. The two LDR's are used to give triggering signal to microcontroller. The output of the LDRs is analog but the microcontroller needs its inputs in digital form, hence the output of LDRs' is converted to digital using inbuilt ADC. Depending upon the LDR's output, microcontroller decides the rotation action i.e. clockwise or anticlockwise. After morning at time suppose 10:00 AM, the west LDR output will be greater than the output of east LDR. In this situation the microcontroller sends the signal such that the DC motor will rotate the panel in anticlockwise direction. As the sun moves towards the west direction the same situation will occur throughout the day and the panel will be rotated towards west by rotating the DC motor in anticlockwise direction. The microcontroller drives the motor through two relays. For driving the relays only microcontroller is not sufficient, so relay drivers are used here. The two relays are connected in such a way that their combine operation can rotate the motor in clockwise as well as in anticlockwise direction. The motor shaft is mechanically coupled with the solar panel's body. Here for demonstration purpose a DC motor used is of low power. In actual application the motor can be used with higher power ratings. All circuits needs the DC power for their functioning, hence a DC power supply is incorporated in the system. It gives +5 V DC to microcontroller circuit while +12 V to relay and DC motor.

5. Flowchart:


START
Initialize Program Counter
Is it Day or Night?
Night
Day
Start tracking
LDR2 < LDR1
LDR1 < LDR2
Is O/P of LDR2>LDR1?
Rotate Motor Clockwise
Rotate Motor Anticlockwise
Is O/P of LDR2=LDR1
Is O/P of LDR2=LDR1
No
No
Yes
Yes
Is it final Clockwise position?
Stop tracking
STOP

6. Actual Prototype:



7. Advantages:

- Increases the efficiency of solar panel as compared to fixed solar panels the operation isautomatic hence no need of human intervention
- This automatic solar tracker is easy to implement, since its construction is simple.
- System increases the efficiency by 10 to 25 % as compared to stand still solar panels.
- The position is checked again and again within seconds hence continuous tracking is done.
- Once installed the system requires very less maintenance
- With the implementation the proposed system the additional energy generated is around25% to 30% with very less consumption by the system itself.
- The solar panel with the sun in order to extract maximum energy falling on it renewable energy is rapidly gaining importance as an energy resource as fossil fuel prices fluctuate.

Disadvantages:

- The system is complex than simple fixed solar panel system.
- Initial cost is high for the system.
- This system cannot be used in rainy season.

Applications:

- The system finds application at the solar generation plants of various electricity supplying companies.
- The system is applicable at the roof top solar generators.
- It can be used at Hospitals which have incorporated solar system for electricity generation.
- The system can also be used at Industries having solar generation.

8. Conclusion

The proposed system will increase the efficiency of solar panel as compared to stand still solar panel and give maximum power over an increased day period. With use of microcontroller system operates smoothly i.e.no jerks as in mechanical tracker.

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