Sun Tracking Solar Panel

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Abstract - This project employs a solar panel mounted to a time-programmed stepper motor to track the sun so that maximum sun light is made incident upon the panel at any given time of the day. This is better compared to the light sensing method that may not be accurate always – for example, during cloudy days. With the impending scarcity of non-renewable resources, people are considering to use alternate sources of energy. Barring all the other available resources, the solar energy is the most abundant and it is comparatively easy to convert into electrical energy. The usage of solar panel to convert Sun energy into electrical energy is very popular, but due to the transition of sun from east to west, the fixed solar panel may not be able to generate optimum energy. The proposed system solves this problem by an arrangement for the solar panel to track the Sun. This tracking movement is achieved by coupling a stepper motor to the solar panel such that the panel maintains its face always perpendicular to the sun to generate maximum energy. This is achieved by using a programmed microcontroller to deliver stepped pulses in periodical time intervals for 12 hours for the stepper motor to rotate the mounted panel in one direction and then return to the start point for next day light as desired. The Arduino controller used in this project is from the Arduino family. The Stepper motor is driven by an interfacing IC as the controller is not capable of handling the power requirements of the stepper motor. Furthermore, this project can be enhanced by using an RTC (Real Time Clock) to follow the sun. This helps in maintaining the required position of the panel even if the power is interrupted for some time.

Keywords - Solar Panel, Stepper motor, Programmed Microcontroller, Real Time clock, 89C51.

I. INTRODUCTION

In this article we are going to make a Sun Tracking Solar Panel using Arduino, in which we will use two LDRs (Light dependent resistor) to sense the light and a servo motor to automatically rotate the solar panel in the direction of the sun light. Advantage of this project is that Solar panel will always follow the sun light will always face towards the sun to get charge all the time and can provide the supply the maximum power. The prototype is very easy to build. Below you will find the complete description of how it works and how the prototype is made.

II. COMPONENTS AND METHODS

- Servo Motor (sg90)
- Solar panel
- Arduino Uno
- LDR's X 2 (Light Dependent Resistor)
- 10K resistors X 2
- Battery (6 to 12V)

III. RESULTS AND DISCUSSION

In this project, LDR's are working as light detectors. Before we go into detail, we will have to understand how the LDR's work. LDR (Light Dependent Resistor) also known as photo resistor is the light sensitive device. Its resistance decrease when the light falls on it and that's why it is frequently used in Dark or Light Detector Circuit. Check the various circuits based on LDR here.

The two LDR's are placed at the two sides of solar panel and the Servo Motor is used to rotate the solar panel. The servo will move the solar panel towards the LDR whose resistance will be low, mean towards the LDR on which light is falling, that way it will keep following the light. And if there is same amount of light falling on both the LDR, then servo will not rotate. The servo will try to move the solar panel in the position where both LDR's will have the same resistance means where same amount of light will fall on both the resistors and if resistance of one of the LDR will change then it rotates towards lower resistance LDR. Check the Demonstration Video at the end of this Article.

IV. RESULTS AND DISCUSSION

To make the prototype, you will have to follow the below steps:

Step 1:

First of all, take a small piece of cardboard and make a hole at one end. We will insert the screw in it to fix it with the servo later on.

Step 2:

Now fix two small pieces of cardboard with each other in a V shape with help of glue or hot gun and place solar panel on it.

Step 3:

Then attach the bottom side of the V shape to the other end of small piece of cardboard in which you made a hole in first step.

Step 4:

Now insert the screw in the hole you made on card board and insert it through the hole into the servo. The screw comes with the servo motor when you buy it.

Step 5:

Now place the servo on another piece of cardboard. The size of the cardboard should be larger enough so that you can place a Arduino Uno, a breadboard and a battery on it.

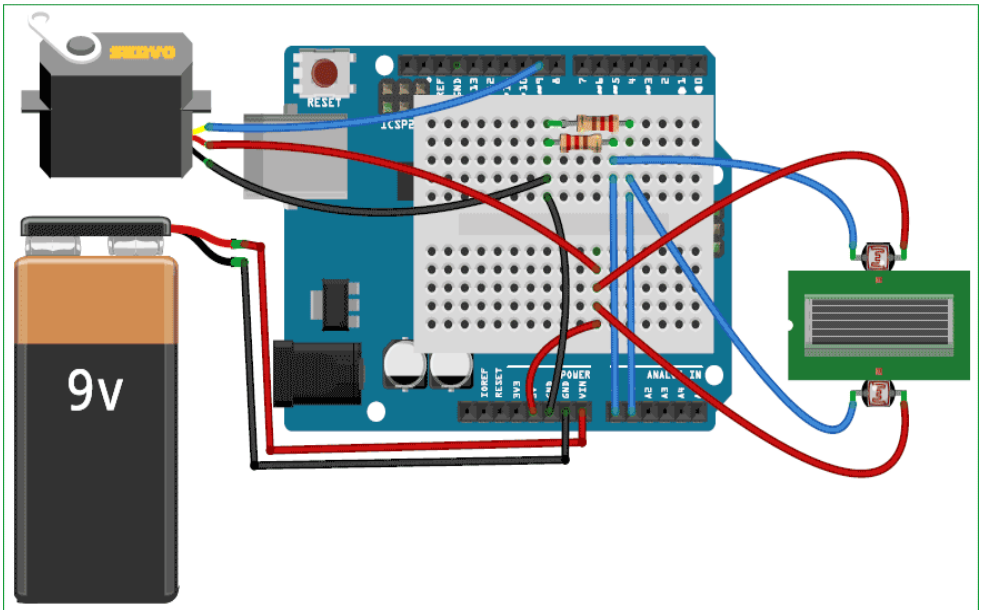
Step 6:

Attach the LDRs on the two sides of the solar panel with the help of glue. Make sure you have soldered the wires with the legs of the LDR's. You will have to connect these with the resistors later on.

Step 7:

Now place the Arduino, battery and the breadboard on the cardboard and make the connection as described in the Circuit diagram and Explanation section below. The final prototype is shown below.

In this Arduino Solar Panel Tracker, Arduino is powered by the 9V battery and all the other parts are powered by the Arduino. Arduino recommended input voltage is from 7 to 12 volts but you can power it within the range of 6 to 20 volts which is the limit. Try to power it within the recommended input voltage. So connect the positive wire of the battery to the Vin of the Arduino and the negative wire of the battery to the ground of the Arduino.



Next connect the servo to the Arduino. Connect the positive wire of the servo to the 5V of Arduino and ground wire to the ground of the Arduino and then connect the signal wire of Servo to the digital pin 9 of Arduino. The servo will help in moving the solar panel.

Now connect the LDRs to the Arduino. Connect one end of the LDR to the one end of the 10k resistor and also connect this end to the A0 of the Arduino and connect the other end of that resistor to the ground and connect the other end of LDR to the 5V. Similarly, connect the one end of second LDR to the one end of other 10k resistor and also connect that end to the A1 of Arduino and connect the other end of that resistor to ground and connect the other end of LDR to 5V of Arduino.

V. CONCLUSION

In this project, the sun tracking system is developed based on 89C51 microcontroller. The microcontroller 89C51 based circuit is used in this system with a minimum number of components and the use of stepper motors enables accurate tracking of the sun. It has been shown that the sun tracking systems can collect maximum energy than a fixed panel system collects and high efficiency is achieved through this tracker, it can be said that the proposed sun tracking system is a feasible method of maximizing the light energy received from sun. This is an efficient tracking system for solar energy collection.

REFERENCES

[1] Mayank Kumar Lokhande - Automatic Solar Tracking System

[2] A.V.Sudhakara Reddy, M. Ramasekhara Reddy, M. Vijaya Kumar "Stability Improvement During Damping of Low Frequency Oscillations with Fuzzy Logic Controller", International Journal of Engineering Research and Applications (IJERA), Vol.2, No.5, pp.1560-1565, September 2012.

[3] G.Sathya, Fathima Shameema S, Jyothi MolSebastian, Jemsya K S"Automatic Rescue System for Ambulance and Authoritative Vehicles, Vol.2 - Issue 4 April

[4] B Bhargava Reddy, D Sivakrishna and A V Sudhakara Reddy "Modelling and Analysis of Wind Power Generation Using PID Controller", International Journal For Scientific Research & Development (IJSRD), Vol.1, No.9, pp.2045-2049, November 2013.

[5] A. V. Sudhakara Reddy, Prof. M. Damodar Reddy, "Optimization of Distribution Network Reconfiguration Using Dragonfly Algorithm", Journal of Electrical Engineering, Vol.16, No.4, No.30, pp.273-282, ISSN:1582-1594, March 2017.

[6] Ganiyu R. A., Arulogun O. T., Okediran O. O. " Development Of A Microcontroller-Based Traffic Light System For Road Intersection Control" International Journal Of Scientific & Technology Research Volume 3, Issue 5, May 2014 (2002).

[7] A. V. Sudhakara Reddy, M. Damodar Reddy andY. V. Krishna Reddy "Feeder Reconfiguration of Distribution Systems for Loss Reduction and Emissions Reduction using MVO Algorithm", Majlesi Journal of Electrical Engineering,Vol.12, No.2, pp.1-8, June 2018.

[8] A. V. Sudhakara Reddy, Dr. M. Damodar Reddy, M. Satish Kumar Reddy "Network Reconfiguration of Distribution Systems for Loss Reduction using GWO algorithm", International Journal of Electrical and Computer Engineering (IJECE), Vol.7, No.6, pp.3226-3234, December 2017.

[9] S.Bharathi, A.V.Sudhakara Reddy, Dr.M.Damodar Reddy, "Optimal Placement of UPFC and SVC using Moth-Flame Optimization Algorithm", International Journal of Soft Computing and Artificial Intelligence, ISSN: 2321-4046, Vol.5, No.1, pp.41-45, May2017.

[10] A. V. Sudhakara Reddy and Dr. M. Damodar Reddy "Application of Whale Optimization Algorithm for Distribution feeder reconfiguration", i-manager's Journal on Electrical Engineering, Vol.11, No.3, pp.17-24, Jan-Mar 2018.

[11] Kalyani S, A. V. Sudhakara Reddy and N. Vara Prasad "Optimal Placement of Capacitors in Distribution Systems for Emission Reduction Using Ant Lion Optimization Algorithm", International Journal of Current Advanced Research, Vol.7, No.11, pp.16339-16343, 2018.

[12] Y V Krishna Reddy, M. Damodar Reddy and A. V. Sudhakara Reddy "Flower Pollination Algorithm for Solving Economic Dispatch with Prohibited Operating Zones and Ramp Rate Limit Constraints", Journal of Emerging Technologies and Innovative Research (JETIR), Vol.5, Iss.10, pp.498-505, 2018.

[13] A. V. Sudhakara Reddy, N.Rajeswaran and D. Raja Reddy "Application of modified ALO to economic load dispatch for coal fired stations", International Journal of Recent Technology and Engineering (IJRTE), Vol.8, No.2, pp.2147-2152, 2019.

[14] Y V Krishna Reddy, M. Damodar Reddy and A. V. Sudhakara Reddy "Flower Pollination Algorithm to Solve Dynamic Economic Loading of Units with Practical Constraints", International Journal of Recent Technology and Engineering (IJRTE), Vol.8, No.3, pp.535-542, 2019.

[15] Y. Praveen Kumar Reddy, N. Vara Prasad and A. V. Sudhakara Reddy "A Power Sensor Tag with Interference Reduction for Electricity Monitoring of Two-Wire Household Appliances", Journal of Research in Science, Technology, Engineering and Management (JoRSTEM), Vol.6, No.1, pp.31-35, Mar 2020.

[16] B. Bhargava Reddy, P. Nagarjuna and A. V. Sudhakara Reddy "Traffic Signal Control Using Lab View", Journal of Research in Science, Technology, Engineering and Management (JoRSTEM), Vol.6, No.1, pp.1-4, Mar 2020.