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Development of Arduino Based Solar Tracking System to Increase Efficiency of Solar Panel

A. M. Pawar[2], A. A. Langote[1], J. D. Deshpande[2] and S. N. Patil[2]
[1]Department of Electronics S.B.E.S College of Science Aurangabad
[2]Department of Electronics Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati (MS), India.

Abstract: Now days, to meet demand of energy sources, renewable energy sources like wind, solar energy is considered. Therefore, considering the limitation of fossil fuels use of green renewable energy sources is very important. Solar energy is one of the most important energy sources. Most of solar panel fixed single axis hence impossible to capture maximum sun radiation in all direction. Therefore, getting maximum energy from sun, position of solar panel is very important to track sun radiations maintain perpendicular to solar panel. To overcome this problem, Microcontroller based system is suitable solution. Therefore, Arduino based embedded system design to track suns position and convert maximum sun radiation to electrical power. The position of sun detected using LDR module. The solar panel fallows the sun radiation by motor movement. The detail regarding the design and results discussed in this paper.

Keyword: Renewable energy source, Arduino, embedded system, LDR

I. Introduction:

Recently, it is found that significant development happened in the electronics fields for various sectors. Such as, biomedical applications, Automobile sectors, chemical industries, agriculture applications, food processing and storage application etc. Now a day, electronics technology is help full for use of renewable energy sources like wind, solar, biomass. Solar energy is one of most effective renewable energy source [1]. Therefore, many people residential in smart city uses electrical solar system for energy generation at their society and house. Because, of solar energy providing unlimited electricity, heat energy and souse of green energy technology. However, use of solar panel in fix position affects the efficiency of solar panel. To getting maximum power from solar panel it is necessary to place solar panel to capture maximum sun radiation. The sun tracking system is better solution to trap the solar energy in all possible directions. In general single axis solar panel, tracking intensity is only one direction. Therefore, in case of track the sun radiation perpendicular to solar panel maximum possible time to enhance better energy. This happens in case of maximum solar energy tracking system using electronic system which senses the light intensity and moves solar panel in direction of sun. Thus, it increase the output potential as well efficiency as compare to single axis system [2]. The detail regarding solar panel, reflection rays from sun, solar panel position is discussed in Langote et al [3]. They describe the review of Sun's position tracking system for increase the solar power efficiency. It is also found that, various microcontrollers like AVR, PIC, ARM families are available for design sophisticated embedded system [4-5]. However, to minimize cost, design requirement, low power, portable instrument Microcontroller plays significant roll [6-7]. Therefore, based on Arduino a smart embedded system is design to produce maximum power efficiency during whole day by tracking suns positions.

II. Hardware Design:

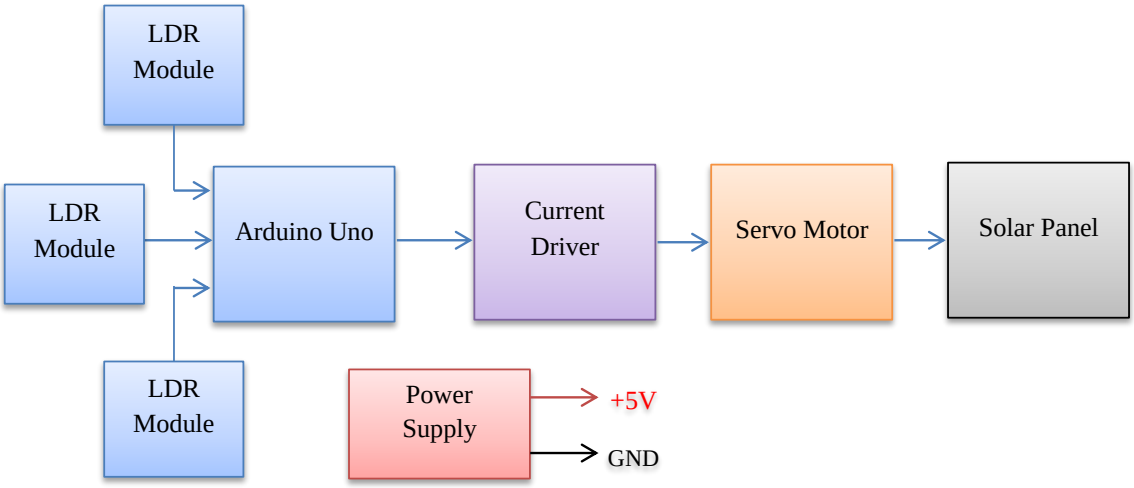

Figure 1: Block Diagram

Figure 2: Experimental Set up

The Arduino based smart solar tracking system is design and shown in terms of block diagram in figure 1. The block diagram consist of LDR sensing unit as a input for Sun's direction tracking followed by Controlling unit Arduino which provide on-chip analog to digital conversion facility. The output of Arduino provide current driver to drive the motor precisely. Instead of LDR we can use photo diode also for light intensity detection. In present system three LDR module is deploy for detection of sun's position. Arduino always compare three LDR module voltage and drive the motor for same direction of LDR which provide higher potential. Therefore, solar panel always place in direction of sun to get maximum sun radiation. Hence automatically solar panel provide maximum output during whole day which definitely essential for increasing efficiency of solar panel [8].

III. Software:

The essential software called as firmware design in Arduino Integrated Development Environment (IDE) to upload program and communicate with Arduino Board and it is open source software. Using the available library we can easily write embedded c code for dedicated application. The voltage level from three LDR red from input side and put up the decision making condition for servo motor controlling. Sufficient amount of delay provided through firmware to provide stable output.

IV. Experimental Work:

The Sun position tracking system is successfully design and shown in figure 2. We create a setup of checking maximum light intensity obtain by three LDR module by moving light source from one direction to opposite. During experiment it is found that when we consider light source in East direction LDR 1 module getting 1.57V while LDR 2 module 1.12V and LDR Module 3 is 0.56Volt. The light source move from East to West direction voltage of LDR Module 1 decrease and LDR module 2 and 3 increases. Considering voltage levels obtained from LDR modules solar panel follow the light source and maintain perpendicular to source of light. Therefore, only one LDR produce maximum output potential which suitable for make decision for controlling solar panel using software. After successfully testing the system in lab it is implemented outside and it work satisfactorily.

V. Conclusion:

The present embedded system is practicable and more efficient method for maximizing the energy received from sun and tracking of sun position in housing society, small area and size panel implementation. For more size and weight solar panel require a more RPM motor to rotate the shaft and panel. The importance of tracking is increase efficiency and sustainability to give better output as compare to single axis solar panel tracking system. Hardware design successfully along with firmware and implement successfully for sun position tracking. The system is suitable and easily implemented for small society, small size panel place in personal power generation.

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References:

[1] Yogesh N., "Solar Tracking System For Optimal Power Generation", International Research Journal of Education and Technology, IRJEdT 02 (03) July-2021,49-51.
[2] A.R. Amelia1, Y.M. Irwan2 , I. Safwati , W.Z. Leow, M.H. Mat and Mohd Shukor Abdul Rahim, S. Md. Esa, "Technologies of solar tracking systems: A review", 1st International Symposium on Engineering and Technology (ISETech) 2019 , IOP Conf. Series: Materials Science and Engineering 767 (2020) 1-10
[3] A. Langote, A. M. Pawar, J. D. Deshpande and S. N. Patil, "Review of Sun's Position Tracking System to Increase Efficiency of Solar Panel", Journal of Emerging Technologies and Innovative Research (JETIR), 9 (4) April 2022, 800-804
[4] Reshmi Banerjee, "Solar Tracking System", International Journal of Scientific and Research Publications, Volume 5, Issue 3, March 2015,1-7
[5] A. M. Pawar, J. D. Deshpande and S. N. Patil, "Development of Smart Electronics System for Realization Smart Home", imanager's journal on Digital Signal Processing, Vol 8, Issue 1 Jan.-June 2020,16-27
[6] Gauri S. Pardikar, Anitya I. Dongre, Maheshvari R. Lokhande, Prathmesh S. Tak, Prof. Vikramsingh R. Parihar, "Solar Power Tracking Device Using Embedded Systems", International Journal of Creative Research Thoughts (IJCRT), 9 (7) July2021, 388-401
[7] Zhang, Shun and TiechaoWang, "Maximum power point Tracking control of Solar Power generation systems." Informative and cybernetics for computational Social Systems (ICCSS). 3rd International Conference on . IEEE, 2016.
[8] Mousazadeh, Hossein, et al." A review of principle and sum tracking methods for maximizing solar systems output." Renewable and Sustainable Energy Reviews 13.8(2009):1800-1818.

BIOGRAPHIES

Mr. Arjun A. Langote presently working as Assistant Professor at Department of Electronics S.B.E.S College of Science, Aurangabad. He completed his M.Sc. from Tuljaram Chaturchand College (Autonomous) Pune, Maharashtra, India in 2021. He published one review paper in International Journal.

Dr. Aparna M. Pawar Presently, she is working as Assistant Professor at Tuljaram Chaturchand College, Baramati. Dist. Pune (India). She completed his Ph.D. from Solapur University, Solapur, Maharashtra, India. Her area of research is Embedded technology, Wireless Sensor Network and Instrumentation designing for high tech agriculture. She awarded with best paper presentation award at Research Festival, five times. She presented 33 research papers in National level conferences. She published 24 papers in International Journal.

Prof. Dr. J. D. Deshpande is currently working as Head in the Department of Electronics at Tuljaram Chaturchand College, Pune, Maharashtra, India. He completed his Ph.D. from Pune University, Pune, Maharashtra, India. He has published many papers in International and National Journals. His areas of research are Embedded Technology and Sensor Development.

Dr. Suhas N. Patil Presently, he is working as Assistant Professor at Tuljaram Chaturchand College, Baramati. Dist. Pune (India). He completed his Ph.D. from Solapur University, Solapur, Maharashtra, India. His area of research is the development of smart sensor module, Embedded technology, Wireless Sensor Network and Instrumentation designing. He awarded with best paper presentation award at Research Festival, four times. He presented 37 research papers in National level conferences. He published 28 papers in International Journal.