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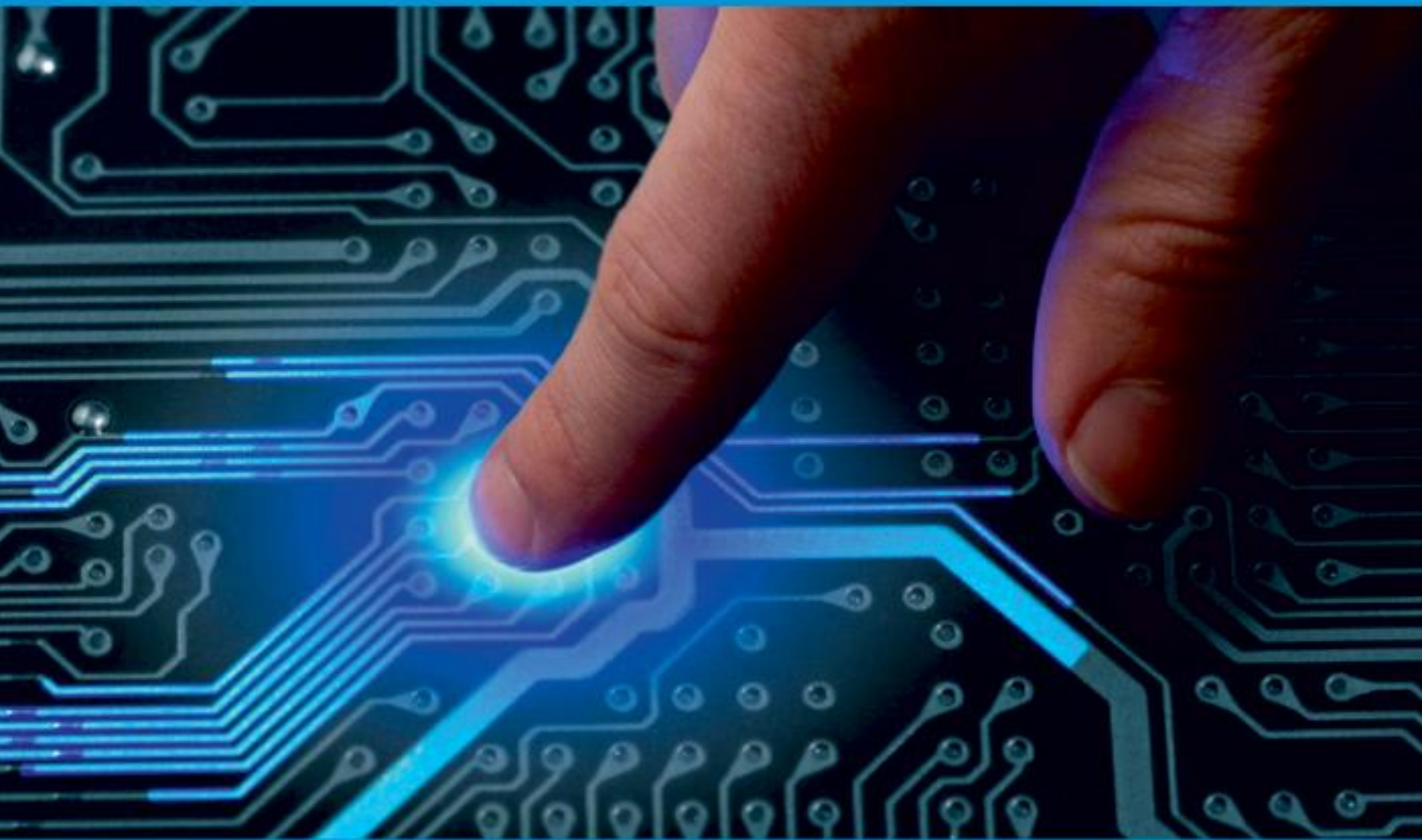

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Arduino Based Solar Tracking Systems for Energy Improvement of PV Solar Pannel

Mrs.Uma.B[1] , Vignesh.R[2], Nandhu.T[3], Thilak.N[4], Jeson prabhu.P[5]

Assistant Professor, Department of Electronics and Communication Engineering, Adhiyamaan College of Engineering, Krishnagiri District, Tamil Nadu, India [1],

U.G Scholars, Department of Electronics and Communication Engineering, Adhiyamaan College of Engineering, Krishnagiri District, Tamil Nadu, India. [2, 3, 4,5]

ABSTRACT: Solar energy is a clean, easily accessible and abundantly available alternative energy source nature.Getting solar energy from nature is very beneficial for power generation. Using a fixed Photovoltaic panels extract maximum energy only during 12 noon to 2 PM in Nigeria which results in less energy efficiency. Therefore, the need to improve the energy efficiency of PV solar panel through building a solar tracking system cannot be over-emphasized. Photovoltaic panels must be perpendicular with the sun in order to get maximum energy. The methodology employed in this work includes the implementation of an Arduino based solar tracking system. Light Dependent Resistors (LDRs) are used to sense the intensity of sunlight and hence the PV solar panel is adjusted accordingly to track maximum energy. The mechanism uses servo motor to control the movement of the solar panel. The microcontroller is used to control the servo motor based on signals received from the LDRs. The result of this work has clearly shown that the tracking solar panel produces more energy compared to a fixed pane

KEYWORDS: - Solar Energy, Arduino, Tracking, Microcontroller, LDR

I.INTRODUCTION

Nigeria is among the tropical countries that fall between4 degrees and 13 degrees and enjoys sunshine of 6.25 hrs daily. Presently, public electricity covers only 40% of Nigerian homes and this is not still on a consistent basis. Due to lack of constant power supply in Nigeria, people have started embracing the culture of generating their own power supply. The use of fossil fuels as a means of generating electricity has become expensive making cost of living very high, especially in the rural part of the country. Also the use of fossil fuel has brought about pollution to the environment which in turn is not safe for our health. It releases carbon dioxide which causes the greenhouse effect. This brings about the deforestation of land and also the pollution of air and water. Solar energy is gotten solely from the sun and as a result does not emit carbon dioxide which prevents the green-house effect. The development of solar energy in Nigeria has the potential to create jobs. Employment in renewable energy industry would reduce occupational hazards especially when compared to coal mining and the extraction of oil. Nowadays solar energy is becoming one of the most reliable source of energy as a result of its surplus and environmental friendly [1].According to reference [2]a system that tracks the sun will be able to know the position of the sun in a manner that is not linear. The operation of this system should be controlled independently[3]. Maximum energy is produced by a solar PV panel when it is positioned at right angle to the sun. Therefore, the aim of this research is to develop an Arduino based solar tracking for energy improvement of solar PV panel.

II. RELATED WORKS

Studies have shown that the angle of light affects a solar panel’s power output. A solar panel that is exactly perpendicular to the Sun produces more power than a solar panel that is not perpendicular. Small angles from perpendicular have a smaller effect on power output than larger angles. In addition, Sun angle changes north to south seasonally and east to west daily. As a result, although tracking east to west is important, north to south tracking has a less-significant impact..

III.EXISTING METHOD

The new approach for *STSs* proposed in this work is based on the use of computer vision techniques to carry out the Sun tracking task, furthermore the proposed system enables computing some key variables related to this. Particularly,

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the new approach makes use of computer vision techniques related to object detection with region proposal techniques based on deep learning by means of convolutional neural networks (*CNN*). In this work the implementation of the approach in a real system is analyzed and discussed..

IV.PROPOSED SYSTEM

In this work, a new approach for Sun tracking systems is presented. Due to the current system limitations regarding costs and operational problems, a new approach based on low cost, computer vision open hardware and deep learning has been developed. The preliminary tests carried out successfully in Platform solar de Almeria (PSA), reveal the great potential and show the new approach as a good alternative to traditional systems. The proposed approach can provide key variables for the Sun tracking system control like cloud movements prediction, block and shadow detection, atmospheric attenuation or measures of concentrated solar radiation, which can improve the control strategies of the system and therefore the system performance.

V.BLOCK DIAGRAM

In this work, a new approach for Sun tracking systems is presented. Due to the current system limitations regarding costs and operational problems, a new approach based on low cost, computer vision open hardware and deep learning has been developed. The preliminary tests carried out successfully in Plataforma solar de Almeria (PSA), reveal the great potential and show the new approach as a good alternative to traditional systems. The proposed approach can provide key variables for the Sun tracking system control like cloud movements prediction, block and shadow detection, atmospheric attenuation or measures of concentrated solar radiation, which can improve the control strategies of the system and therefore the system performanc

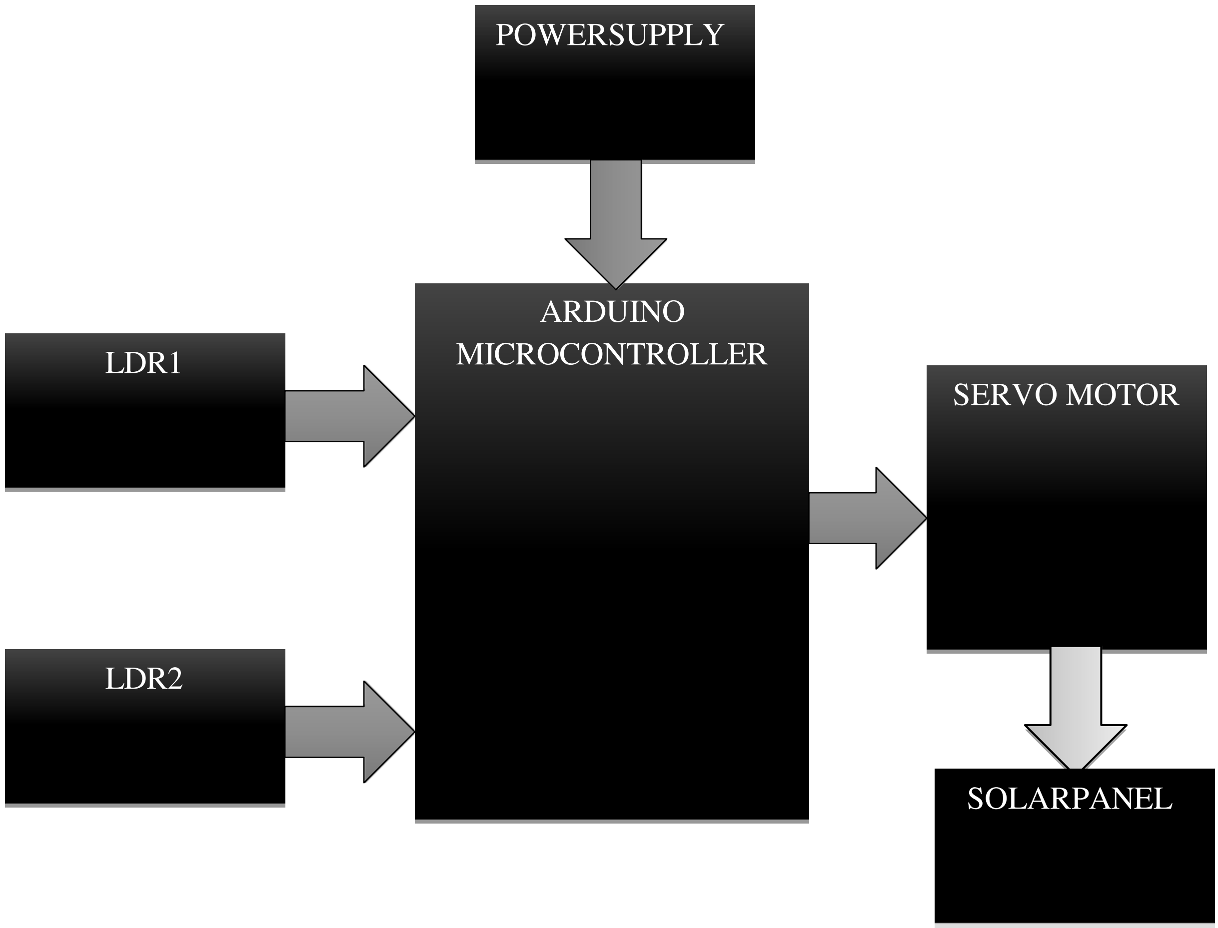

Figure: Solar tracking system Block Diagram

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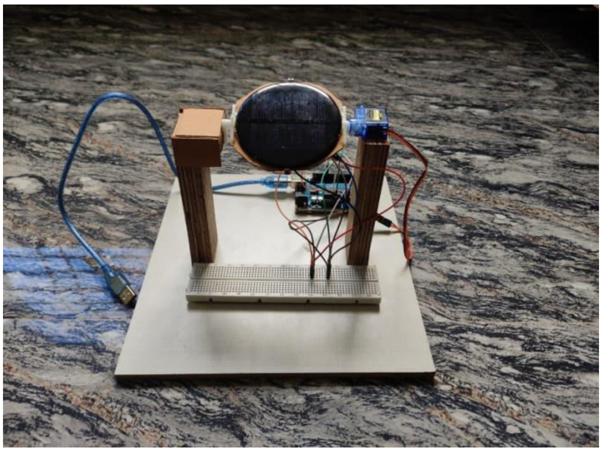
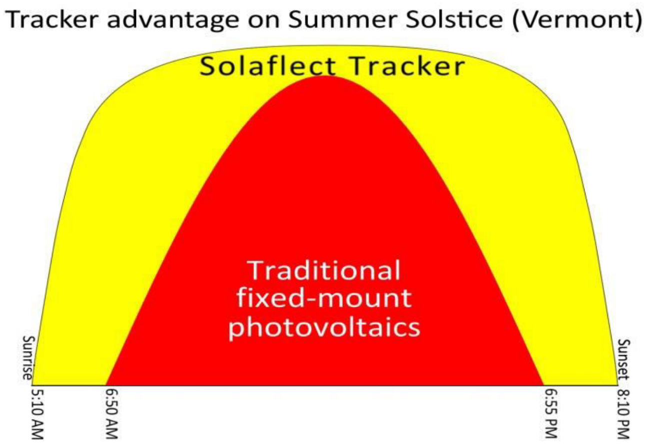
The block diagram of the developed closed-loop solar tracking system in illustrated in Figure 1. describing the composition and interconnection of the system For the closed-loop tracking approach the solar tracking problem is how to cause the PV panel location (output) to follow the sunlight location (input) as closely as possible. The sensor-based feedback controller consists of the LDR sensor, differential amplifier, and comparator in the tracking operation, the LDR sensor measures the sunlight intensity as a reference input signal. The unbalance in voltages generated by the LDR sensor is amplified and then generates a feedback error voltage The error voltage is proportional to the difference between the sunlight location and the PV panel location At this time the comparator compares the error voltage with a specified threshold (tolerance) If the comparator output goes high state, the motor driver and a relay are activated so as to rotate the dual-axis (azimuth and elevation) tracking motor and bring the PV panel to face the Sun. Accordingly, the feedback controller performs the vital functions. PV panel and sunlight are constantly monitored and send a differential control signal to drive the PV panel until the error voltage to less than a pre-specified threshold value

VI. EXPERIMENTAL RESULTS

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. Arduino has a serial that communicates on digital pins 0 and 1 as well as with the computer through a USB. If these functions are thus used, pins 0 and 1 can be used for digital input or output. Arduino environment's built in serial monitor can be used to communicate with the NodeMcu board. To collect the results, a code was written that made it possible to collect data from the LDRs after every one hour.





Time (Hrs)	Without Tracking			With Tracking		
	Voltage (V)	Current (A)	Power (W)	Voltage (V)	Current (A)	Power (W)
9 am	5.5	0.11	0.605	12.2	0.23	2.8
10 am	9	0.19	1.71	13.5	0.25	3.4
11 am	10.5	0.2	2.1	14	0.28	3.92
12 pm	12.5	0.28	3.5	14	0.3	4.2
1 pm	14	0.32	4.49	15	0.3	4.5
2 pm	13.5	0.3	4.05	14	0.3	4.2
3 pm	11	0.26	2.86	13	0.26	3.38
4 pm	8	0.16	1.28	10	0.25	2.5
5 pm	6	0.12	0.72	7	0.2	1.4
6 pm	2.5	0.05	0.125	5	0.1	0.5

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VII. FUTURE SCOPE

The goals of this project were a purposely kept within what was believed to be attainable within the allotted timeline. As such, many advance improvements can be made up of initial design of solar tracker. It is felt this design represents a functioning scale model which could be replicated for a much larger scale. following recommendation are provided as ideas for future expansion for this project. The Solar Futures Study finds that solar energy could power about 14% of transportation end uses by 2050. Solar PV couples well to electric vehicle (EV) charging: Both use direct-current electricity, which avoids efficiency losses in conversion to alternating-current electricity—a much as 26% lost, in some cases.

VIII. CONCLUSION

A solar panel tracking system was designed and implemented. The aim of the solar panel tracking system is to track the positon of the sun for better efficiency of the solar panel has shown in the experimentalresults. This work can be executed on an industrial scale which be beneficial to developing countries like Nigeria and Sub-Sahara Africa countries. Our recommendation for future works is to consider the use of more sensitive and efficientsensors whichconsume less power and whichare also cost effective. This would increase the efficiency while reducing cost.

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BIOGRAPHY

Mrs.Uma.B
Assistant Professor,
Electronics and Communication Engineering Department,
Adhiyamaan college of Engineering,
Hosur

Vignesh.R,
Electronics and Communication Engineering Department,
Adhiyamaan college of Engineering,
Hosur

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Nandhu.T,
Electronics and Communication Engineering Department,
Adhiyamaan college of Engineering,
Hosur

Thilak.N,
Electronics and Communication Engineering Department,
Adhiyamaan college of Engineering,
Hosur

Jeson prabhu.P,
Electronics and Communication Engineering Department,
Adhiyamaan college of Engineering,
Hosur

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