

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال تعالى :

{ وَلَوْ أَنَّمَا فِي الْأَرْضِ مِنْ شَجَرَةٍ أَقْلَامٌ وَالْبَحْرُ يَمُدُّهُ مِنْ بَعْدِهِ سَبْعَةُ أَبْحُرٍ مَا نَفِدَتْ كَلِمَاتُ
اللَّهِ إِنَّ اللَّهَ عَزِيزٌ حَكِيمٌ }

صدق الله العظيم

[لقمان: 27]

Dedication

To my beloved parent

ACKNOWLEDGMENT

“The man Who never thanks men never thank his creator “

With a deep sense of gratitude, I wish to express my sincere thanks to those who made this work possible, Dr/FathElrahman Ismael Khalifa Ahmed of Sudan University of Science &Technology for all his guiding efforts and eyes opening advises, for all friends and my family members for their hart prayers and patience, my work college for their support and encouraging.

Abstract

Solar Energy is the most essential and prerequisite resource of sustainable energy due to its abundance and sustainability. One of the ways to convert this energy into electricity is *Photovoltage cells* PV. The main factor in this conversion is the angle of sunlight that faces the PV cells and due to the movement of the sun; the output of the system varies through the day and the solution will be tracking the sun through the day. The Solar tracking mobility platform plays a crucial role in the development of solar energy applications in order to maintain high levels of power output. In this project an automated solar tracker has been designed to keep the PV panels perpendicular to the incoming sunlight through the day according to the user choice (Dual-Axis, One-Axis, Annual). The system was simulated using Proteus program, the PV panel was fabricated as a way to measure the solar radiation, (the photovoltaic panel output power, voltage and current). The surrounding temperature was also measured to find the effect of the local environment temperature on the PV performance and efficiency. In order to achieve the tracking *fourlight dependent resistors* LDR was implemented to determine the sun position and using Atmega32 microprocessor to drive two stepper motors as the movement object. A simple GUI windows was designed using Matlab to visualize the measured and to control the operation in the proteus as well as making the user experiment easier and joyful.

المستخلص

الطاقة الشمسية تعتبر احدي اهم نوع من انواع الطاقات البديلة نسبة لوفرتها و استدامتها، الخلايا الشمسية هي واحدة من اهم طرق تحويل الطاقة الشمسية الي طاقة كهربائية حيث تلعب زاوية سقوط الاشعة الشمسية علي الخلية دورا مهما في عملية التحويل ، الامر الذي يجعل خرج الخلية متغيراً خلال اليوم و الحل هو إستخدام أنظمة تعقب الشمس . في هذا المشروع تم تصميم نظام تعقب للشمس مؤتمت يعتمد علي خيار المستخدم (تعقب في المحورين ، تعقب في محور واحد ، تعقب سنوي). تمت محاكاة النظام باستخدام برنامج البروتوس ، اولا تم تصميم خلية شمسية لعدم توفرها في البرنامج ولاغراض قياس الاشعاع الشمسي ، القدرة المنتجة بواسطة الخلية ، التيار و الفولتية التي توفرها الخلية. تم قياس درجات الحرارة اثناء التشغيل لمعرفة تأثير الشمس المحلية علي اداء و كفاءة الخلية . لتحقيق عملية التتبع تم إستخدام المقاومات المعتمدة علي الضوء كحساسات لتحديد موضع الشمس لتتم معالجتها باستخدام المعالج المايكروبي اتميجا 32 لقيادة محركين من نوع الخطوة كعنصر حركة. تم تصميم واجهة مستخدم بسيطة باستخدام برنامج الماتلاب لعرض كل القيم المقاسة بواسطة النظام و للتحكم في عمليات النظام بالاضافة لجعل التجربة سهلة و ممتعة بالنسبة للمستخدم.

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List of Abbreviations

AC	Alternative current.
ADC	analog to digital converter .
CdS	Cadmium Sulfide light sensitive resistors.
DAST	Dual Axis Solar Tracker
DC	Direct Current.
FPGA	field programmable gate array.
GND	Ground
GUI	graphical User Interface.
GUIDE	graphical user interface development environment
Imp	Optimum operating current.
INH	inhibit control
Isc	Short-circuit current.
I-V	Current-voltage characteristics of a the PV module.
LCD	Liquid crystal display.
LDR	light dependent resistors.
LED	Light Emitted Diode.
NC	Not Connected
MPPT	Maximum Power Point Tracking
PC	Personal computer.
Pmax	Maximum Power.
PV	Photovoltaic.
SYNC	Synchronize
TTL	Transistor Transistor Logic.
Vmp	Optimum operating Voltage.
Voc	Open-circuit Voltage.
Vref	Reference volt
VS	Supply Voltage

List of Symbols

α	The angle between the sun's position and the horizontal plane of the earth's surface.
β	The angle between a vertical plane containing the solar disk and a line running to the south.
Θ	The angle of the sunlight to the normal is the angle of incidence.
I	Sunlight constant intensity.
W	The solar cell generated power.
A	Ampere.
V	Volt.
A'	Limiting conversion factor in the panel design.
mHz	Mill-Hertz.
C	Celsius.
μA	Micro-Ameper.
T	Temperature