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Dual Axis Solar Tracker Using Arduino Uno

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Abstract:-The variation in sun availability occurs daily because of day night cycle and also seasonally because of the earth's orbit around the sun. Population of the world is getting increased rapidly day by day and the demand for energy is increasing appropriately. During the recent decades, the main sources of energy such as the Oil and coal are expected to end up from the world. This ends up in a serious problem for providing the world with the most affordable and reliable source of energy. All the people in the world need the renewable energy resources which is inexhaustible. In this paper we propose dual axis solar tracker by which it is possible to conserve full amount of power by the solar panel by receiving the high intensity sun light using Arduino board.

Keywords—*Dual axis solar tracker, Arduino board, LDR Sensors, Servo motor, Charge controller, Auto load change over, Voltage divider.*

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I. INTRODUCTION

Solar energy is a very large, inexhaustible source of energy. The power from the sun intercepted by the earth is approximately 1.8*1011MW. The earth is not static to receive entire energy from sun but dynamic. There are two types of movement of earth one is earth rotation and earth revolution. Earth's rotation is the rotation of the planet Earth around its own axis. The Earth rotates towards the East. One rotation completes in 23 hours, 56 minutes and 4 seconds. The other motion of Earth is around the Sun, called as Revolution of the Earth. Earth completes one complete revolution around the Sun in 365 days, 5 hours, 45 minutes and 46 seconds. Sunlight has two components, the "direct beam" that carries about 90% of the solar energy and the "diffuse sunlight". There are many renewable sources of energy like hydro energy source, wind energy source, solar energy source etc. There are region where we find more tides, there are regions where we find more wind and there are regions where we find hydro energy. But sun is the only source we find it everywhere. The radiations emitted by sun during both the case i.e. earth's rotation and earth's revolution is tracked by the dual axis solar tracker.

II. BLOCK DIAGRAM

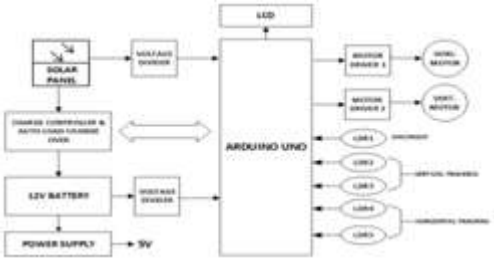


Fig (1):- Block diagram

Light-dependent resistors are connected at the four side of the solar panel to capture maximum light energy. LDR is a resistor which works on photoconductivity. The resistance of an LDR is extremely high. When illuminated the light resistances will drop dramatically and the main controller receives an analog input from the LDR The internal analog-to-digital converter (ADC) compares the solar panel sensor voltage. The analog input from the light sensor goes into the ADC port of the μC and the digital signal is then fed to motor drivers which drive the horizontal and vertical motor.

The solar panel tracks the radiation and fed to battery. The 12V battery goes to 7805 voltage regulator from where the output 5V is spreads to all logic circuitry.

The charge controller and auto load change over is connected between solar panel- battery and battery-load respectively to safe guard the battery,

The charge controller avoids the battery to get bulged with over charging and auto load change over avoids the over draining of charges from the battery due to excess usage from load.

III. CIRCUIT DIAGRAM

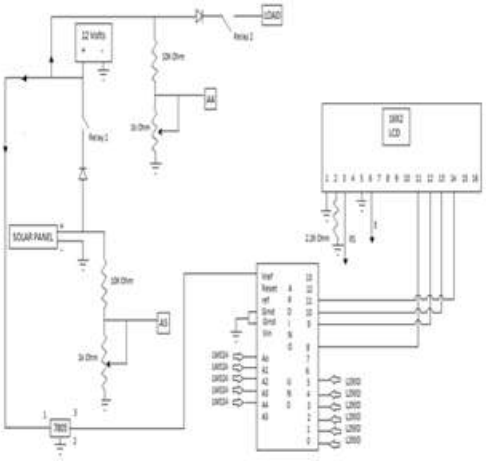


Fig (2): Circuit diagram

Figure 2 shows the circuit diagram of dual axis solar tracker. LDR'S are placed across the four sides of panel which are connected to analog inputs of Arduino UNO through LM324, this compares the voltage set. The analog signals are converted into digital and passed to pin L293D which takes the input from Arduino UNO and controls the horizontal and vertical motor connected across pin 3, 6 and 11, 14 respectively.

Also the connection of voltage divider in between solar panel and battey, and also to the pins A4 and A5 .

The motion of motor whether to rotate clockwise or anti-clock wise is controlled by driver as shown in figure 3. DC gear motor with speed of 10rpm is used to rotate the panel weighing 1.75kgs.

The supply voltage from battery is regulated to 5V using voltage regulator 7805.

Two relays are used to avoid over charging and over draining of battery. Over charge controller and auto load change over is connected across solar panel and load respectively.

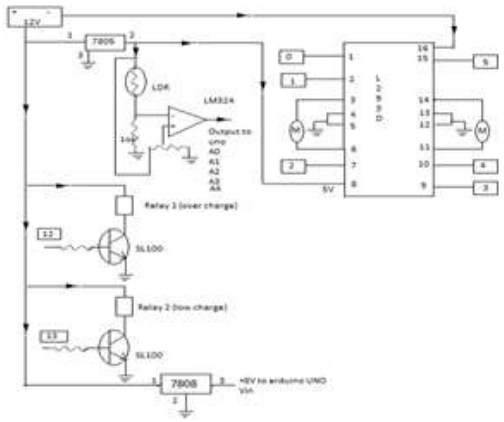


Fig (3):-LDR and motor circuit diagram

IV. SKETCH LANGUAGE

The Integrated Development Environment(IDE) is a special program running on our computer that allows to write sketches for the Arduino board which is simple language modeled after the Processing language. When you press the button The magic happens that uploads the sketch to the board the code written is translated into the C language, and is passed to the AVR-GCC compiler, an important piece of open source software that makes the final translation into the language understood by the microcontroller. This last step is quite important, because it's where Arduino makes your life simple by hiding away possible ways complexities of programming microcontrollers.

The programming cycle on Arduino is basically as follows:

- Plug the board into a USB port on your computer.
- Write a sketch language that will bring the board to life.
- Upload this sketch language to the board through the USB connection and wait for few seconds for the board to restart.

The board executes the sketch that you wrote.

V. COMPARISION BETWEEN FIXED SOLAR TRACKER AND DUAL AXIS SOLAR TRACKER

Figure 4 and 5 shows the voltage drawn by the solar panel with and without tracking and power generated with and without tracking respectively. The maximum generation on power is between 12 to 2pm.

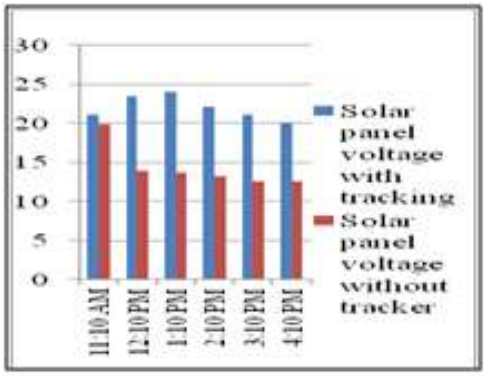
Figure 6 shows the graphical representation of voltage drawn from solar panel. Increase in power in a month using dual axis solar tracker is about 159 Watt.

Time	Voltage without tracking	Voltage with tracking
11:10 AM	19.82V	21.05V
12:10 PM	13.87V	23.50V
1:10 PM	13.67V	24.01V
2:10 PM	13.19V	22.06V
3:10 PM	12.60V	21.10V
4:10 PM	12.60V	20.06V

Fig (4):-Voltage without tracking system and with tracking system

Time	Power generated with tracking	Power generated without Tacking
11:10 AM	14.73Watt	13.87Watt
12:10 PM	16.45Watt	9.70Watt
1:10 PM	16.80 Watt	9.56Watt
2:10 PM	15.44Watt	9.23Watt
3:10 PM	14.77Watt	8.82Watt
4:10 PM	14.04Watt	8.82Watt

Fig (5):-Power with tracking system and without tracking system



Fig(6):-Voltage without tracking system and with tracking

VI. EXPERIMENTAL SETUP

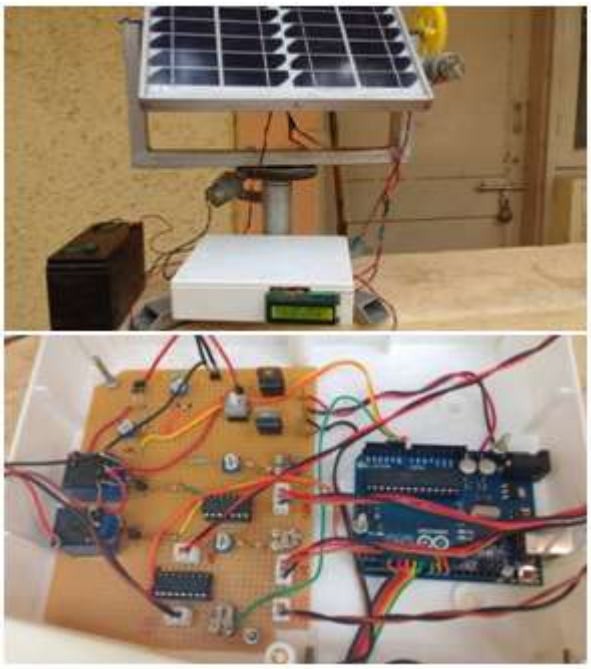


Fig (7):-Experimental set up

The Figure (7) shows the experimental set up of dual axis solar tracker. The motor drivers help the solar panel to rotate in horizontal and vertical direction which helps to track high intensity of radiation.

The LCD displays the voltage generated with the help of dual axis solar tracker. The charge is stored in a 12V lead acid battery. Also one LDR is used to track the presence of day/night. If sun radiations doesn't fall over the LDR, the rotation of the tracker stops.

VII. CONCLUSION

This article presents a smart dual- axis solar tracker. The ARDUINO UNO is used to develop the proposed smart solar tracking model. from the results obtained, it can be concluded that the system will react at its best because of maximum voltage is tracked about 25% to 30% as compared with a traditional fixed PV system. And the generated power is increased about 30% which is much better than fixed PV panel system. In order to get the maximum output of motor speed, the system is able to track the maximum light intensity of the sun.

DC gear motor has been used for movement of the panel for focusing on tracking of sun intensity. There is no fuel cost involved but the initial expenditure on the equipment is usually high, and the maintenance cost is low.

This proposed technique is ecofriendly, environmentally, widely and wisely can be used.

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