International Journal of Research (IJR)
e-ISSN: 2348-6848, p- ISSN: 2348-795X Volume 2, Issue 4, April 2015
Available at http://internationaljournalofresearch.org

Design of A Solar Tracking Renewable Energy

Abhijeet Kumar Singh[1] ; Bablu Kumar[2] ; B. Karthik[3]

[1,2] UG students, Dept. Of Electronics and Communication Engineering, Bharath University, India

[3] Asst. Proffessor, Dept. of Electronics and Communication Engineering, Bharath University, India

ABSTRACT:-

Here a solar tracking for renewable energy has been designed to consume as much energy from the sun, store it in the battery and convert it in alternating current. It is used normally in homes as an additional source or power. The system is designed to respond to the temperature in the shortest amount of time.

The Light Dependent Resistor (LDR) 1 senses the change in the sun's position and gives signal to the control circuit in order to tackle the change in the position of the solar panel. The control circuit gives signal to run the motor in forward direction. LDR 2 detects the sun set and gives signal to the control circuit to run the motor in reverse direction until the proxy switch gets activated. The position of the panel will be displayed in LCD at which LDR is absorbing the energy from the sun.

KEYWORDS:-

Solar tracking system; renewable energy; light dependent resistor (LDR); liquid crystal display(LCD)

INTRODUCTION:-

Energies like coal, gas, nuclear are non renewable and would eventually be depleted one day, so the purpose of the project is to harness solar energy as it is renewable energy, on average the earth surface receives about 600 W/m^2 of solar energy. It is estimated that solar energy will be the largest source of electricity by the end of the year 2050.

The systems main purpose is to efficiently harness solar energy and convert it into alternating current as it would be useful in using common household appliances. This project also provides green solution of non polluting environment. Using the LDR the user could monitor the real time information about the system.

People who live in rural areas cannot afford the cost of electrical energy because of the rising price of the energy and fossil fuels. So, solar energy would be the abundant source of energy for the people living in both rural and urban areas as people living in urban areas are keen in finding an alternative source of energy.

MATERIALS AND METHODS:-

PROPOSED SYSTEM:-

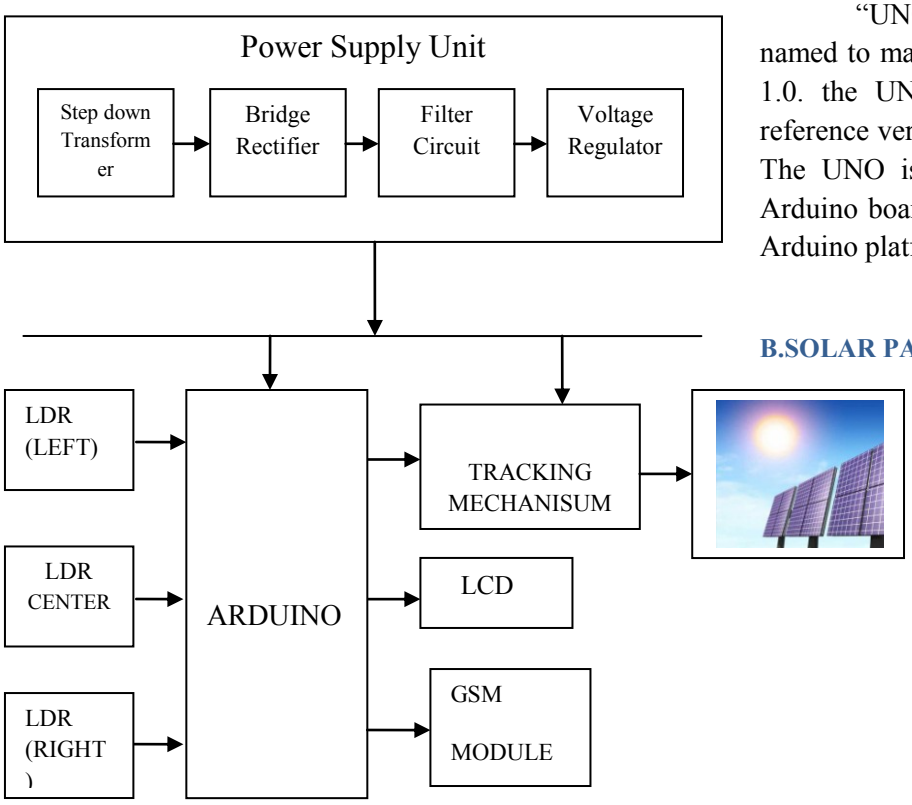
This projects presents the hardware design and implementation of a system that ensures a perpendicular profile of the solar panel with the sun in order to extract maximum energy falling on it. Renewable energy is rapidly gaining importance as an energy resource as fossil fuel prices Fluctuate. The unique feature of the proposed system is that instead of taking the earth as its reference, it takes the sun as a guiding source. Its active sensors constantly monitor the sunlight and rotate the panel towards the direction where the intensity of sunlight is maximum .

International Journal of Research
International Journal of Research (IJR)
e-ISSN: 2348-6848, p- ISSN: 2348-795X Volume 2, Issue 4, April 2015
Available at http://internationaljournalofresearch.org

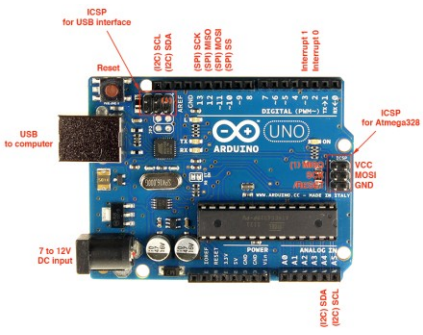
ADVANTAGES

- Automatic Maximum tracking
- Maximum power output compare other technique
- Efficient tracking System And Accuracy.

BLOCK DIAGRAM:-



A. ARDUINO UNO



The arduino uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins of which 6 can be used as PWM outputs, 6 analog inputs, a 16 Mhz ceramic resonator, a USB connection, a powerjack, an ICSP header, and a reset button . it containseverything needed to support the microcontroller. Simply connect it to a computer with a USB cable or power it with a AC-DC adapter or battery to get started.

"UNO" means one in Italian and is named to mark the upcoming release of arduino 1.0. the UNO and version 1.0 will be the reference versions of Arduino , moving forward. The UNO is the latest in the series of USB Arduino boards, and the reference model of the Arduino platform.

B.SOLAR PANEL

Solar panel refers to either a photovoltaic module, a hot water panel, or to a set of photovoltaic modules electrically connected or mounted on a supporting structure. A PV module is a packaged connected assembly of solar cells. It can be used as a component of a larger photovoltaic system to generate and supply electricity to commercial or residential applications. A module is rated by its DC output power under standard test conditions and ranges from 100 to 320 watts. A photovoltaic system typically includes a panel or somtimes a battery, an inverter, a solar tracker and an interconnection wiring.

International Journal of Research
International Journal of Research (IJR)
e-ISSN: 2348-6848, p- ISSN: 2348-795X Volume 2, Issue 4, April 2015
Available at http://internationaljournalofresearch.org

C.LIGHT DEPENDENT RESISTOR

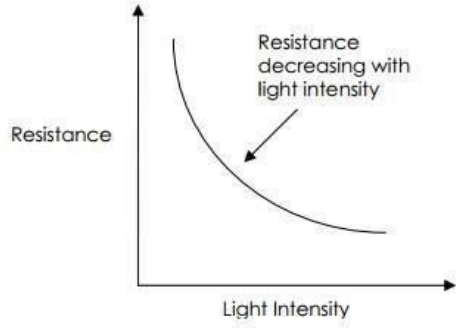
An LDR is a component that has a variable resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits.

The common type of LDR has a resistance that falls with an increase in the light intensity falling upon the device. The resistance of an LDR may typically have the following resistance

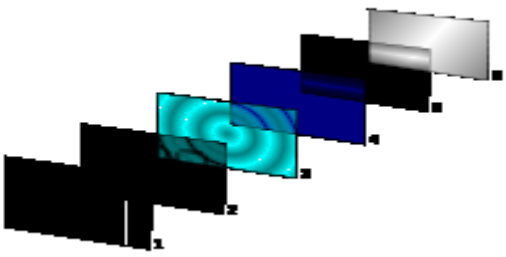
Daylight = 5000 ohms

Dark = 20000000 ohms

Typical LDR resistance VS light intensity graph



D. LIQUID CRYSTAL DISPLAY



A "**liquid crystal display**" is a flat panel display, electronic display, or video display that uses the modulating properties of liquid crystals. Liquid crystals do not emit light directly.

The LCD screen is more energy efficient and can be disposed of more safety than a CRT. Its low electrical power consumption enables it to be used in battery-powered electronic equipment . it is an electronically modulated optical device made up of any number f segments filled with a liquid crystals and arrayed in front of a light source or reflector to produce images in colour or monochrome.

In the figure each plate has its own work :-

1.Polarizing filter film with a vertical axis to polarize light as it enters.

2.Glass substrate with ITO electrodes. The shape of the electrodes will determine the shapes that will appear when the LCD is turned on.

3.Twisted nematic liquid crystal.

4. Glass substrate with common electrode film with horizontal ridges to line up with the horizontal filter.

5. Polarizing filter film with a horizontal axis to block/pass light.

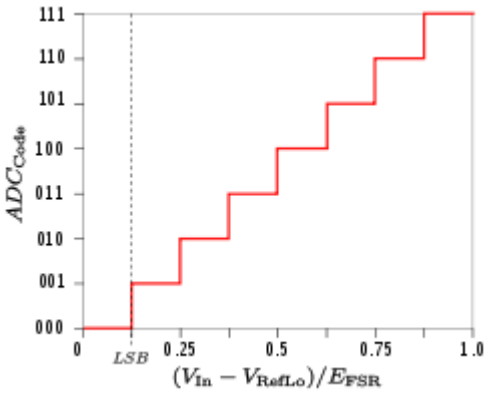
6. Reflective surface to send light back to viewer.

E. ANALOG–TO-DIGITAL CONVERTER

An analog-to-digital converter is a device that converts a continuous physical quantity to a digital number that represents the quantity's amplitude.

International Journal of Research
International Journal of Research (IJR)
e-ISSN: 2348-6848, p- ISSN: 2348-795X Volume 2, Issue 4, April 2015
Available at http://internationaljournalofresearch.org

The conversion involves quantization of input so it necessary introduces a small amount of error . Instead of doing a single conversion , an ADC often performs the conversions periodically the result is a sequence of digital values that has been converted from a continuous-time and continuous-amplitude analog signal to a discrete-time and discrete-amplitude discrete signal.



An 8-level ADC coding scheme

F. POWER SUPPLY UNIT

1.BRIDGE RECTIFIER

A **bridge rectifier** is an arrangement of four or more diodes in a bridge circuit configuration which provides the same output polarity for either input polarity. It is used for converting an alternating current input into a direct full-wave rectification from a two wire ac input, therefore resulting in lower weight and cost when compared to a rectifier with a 3-wire input from a center-tapped secondary winding.

2. VOLTAGE REGULATOR

A **voltage regulator** is designed to automatically maintain a constant voltage level. A voltage regulator may be as simple as a "feed-forward" design or may include negative feedback control feedback control loops. It may use an electrochemical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.

3. STEP DOWN TRANSFORMER

A **step down transformer** is one whose secondary voltage is less than primary voltage. it is designed to reduce the voltage from the primary winding to the secondary winding. This kind of transformer steps down the the voltage applied to it.

As a step-down unit, the transformer converts high-voltage, low-current power to low-voltage, high-current power. The larger-gauge wire used in the secondary winding is necessary due to the increase in the current. The primary winding which doesn't have to conduct as much current, may be made of smaller gauge wire.

4. FILTER CIRCUIT

To remove the AC components or filter them out in a rectifier circuit, a "**filter circuit"** is used. Therefore, a filter circuit is a device to remove the AC components of the rectified output but allows the DC components to reach the load. A filter circuit is generally a combination of inductor(L), and capacitor(C) called LC filter circuit. A capacitor allows AC only and a inductor allows DC only to pass. So a suitable LC network can effectively filter out the AC components from rectified wave.

A filter circuit consists of passive circuit elements i.e, inductors, capacitors, resistors and their combination. The filter action depends upon the electrical properties of passive circuit elements.

G. TRACKING MECHANISM

The smart sun tracking mechanism described in this paper is designed and constructed to enable the solar receptor to track the sun for 1200 hour angle (roughly from 8am to 4pm) and the spinning axis of the solar receptor and lens are kept perpendicular to the equatorial plane. The solar receptor and the focusing lens arrangement

are mounted on the same shaft such that a constant angular difference exists between the normal of the solar receptor and the lens arrangement. This angular difference is to provide enough time for SMA actuator to get actuated by the sun and for it to cool in still air.

At the start of the day, the solar receptor is in a position such that the solar receptor normal is approximately normal to the sun at 8am. When the sun moves away from the solar receptor and approaches the maximum value of the angular deviation, the rays begin to get focused towards the SMA spring by the lenses. The focused rays start heating the SMA spring causing it to contract. This action pulls the cable connected to the SMA spring, causing the cable to rotate the pulley A. This rotation sets in motion a series of rotational movements by pulleys, B, C and D and the beveled gears, culminating in the movement of the solar receptor, which gets tilted forward such that it faces the sun.

As indicated earlier, the stroke of the SMA is controlled by the tapered stopper to restrict the tilt in such way that the solar receptor gets correctly aligned towards the sun's rays. This tilt would simultaneously cause the lens platform also to move away, since both the lens platform and the solar receptor are mounted on the same shaft, such that the sun rays are not any more focused on the SMA spring. In the absence of any heating, the SMA spring would start to cool and elongate due to the pull exerted by the weight attached to the wheel C. The wheel D will also try to rotate back, but would be prevented from doing so by the ratchet pawl mechanism that would arrest such movement, allowing only wheel C to rotate, preventing the reverse rotation of the solar receptor. As regards the SMA actuator it would have been restored to its initial status and would be once again ready to execute the actuation cycle when the sun again reaches the maximum of the angular deviation mentioned earlier.

At the end of the day, after 1200 rotation of the sun, the lever clutch arrangement restores the solar receptor back to the initial position i.e. to the position of the solar receptor at the time of the first actuation of the day.

H. RESULTS AND DISCUSIONS

The student team has designed and built a solar tracking system that fulfils the requirements of a low cost but efficient solar energy system. The design costs less than five hundred dollars for assembly and less than three-hundred dollars for the motors.

Among three design alternatives, design I proved to be the best. It has the lowest power consumption, which is crucial to the system because the maximum amount of output power was needed. It accomplishes flexibility in handling the necessary tracking by allowing a minimum of 45 degrees east to west and north to south rotation.

The key aspects of the product are that it is affordable, efficient, stand-alone, relatively easy to transport, and ready to use. The system is also designed to be autonomous so that the user does not have to do a lot of configuring once the system is set up. The design weighs less than 100 lbs, and consists of wheels for added portability.

The cost effect system built is functional and is kept in the Energy Systems Lab at MUSE. Series of tests will be conducted on the system at the end of the Spring Semester 2014. The solar tracking system will be available for data collection and be used as demonstration equipment for Electrical and Computer Engineering students at MUSE in the near future.

I.REFERENCES

[1] What is U.S. Electricity Generation by Energy Source? - FAQ - U.S. Energy Information Administration (EIA). (n.d.). *U.S. Energy Information Administration (EIA)*.

Retrieved August 29, 2013, http://www.eia.gov/tools/faqs/faq.cfm?id=427&t=3

[2] Kothari, D. P., and Nagrath, I. J. Modern Power System Analysis (3rd ed.). New Delhi: Tata McGraw-Hill Pub. Co., 2003.

[3] Chandler, Nathan. "How Does Solar Power Help the Environment?" 29 August 2012. HowStuffWorks.com. <http://science.howstuffworks.com/environmental/energy/solar-power-help environment.htm> 29 August 2013.

[4] Solar Technologies | Photovoltaic Solar Panels | Thin Film Solar Panels |Solar Thermal. (n.d.). *Solar Panels, Photovoltaic Systems, Solar Solutions for Home, Business & Utility-Scale — SunPower*. Retrieved August 29, 2013, http://us.sunpowercorp.com/solar-resources/how solar-works/solar-technologies/

[5] Watson, A., Giudice, L., Lisell, L., Doris, L., and Watson, S. B., "*Solar Ready: An Overview of Implementation Practices*". *Contract* Volume: 303 (2012-01-01) ISSN: 1530-6224

[6] Kelly-Detwiler, Peter. "As Solar Panel Efficiencies Keep Improving, It's

Time To Adopt Some New Metrics." *Forbes*. Forbes Magazine, 16 July 2013. Web. 15 Sept. 2013. <http://www.forbes.com/sites/peterdetwiler/2013/07/16/as-solar-panel-efficiencies-keep-improving-its-time-to adopt-some-new-metrics/>.

[7] "The Kyocera KD135GX-LPU 135 Watt Solar Panel's New Technology Allows for End Mounting under 2400 Pa(50 Psf) and Traditional Mounting under 5400 Pa (113 Psf)." *Kyocera KD135SX-LPU 135 Watt Solar Module*. N.p., n.d. Web. 11 Oct. 2013. <http://www.wholesalesolar.com/products.folder/module-folder/kyocera/KD135GXLPU.html>

[8] "Solar Angle Calculator." *Solar Electricity Handbook*. N.p., n.d. Web. 25 Sept. 2013. <http://solarelectricityhandbook.com/solar-anglecalculator.html>.

[9] Koutroulis, E., Kalaitzakis, K., Voulgaris, N.C., "Development of a Microcontroller-based, Photovoltaic Maximum Power Point Tracking Control System," *Power Electronics, IEEE Transactions on* , vol.16, no.1, pp.46,54, Jan 2001

[10] "Rolling Resistance." *Rolling Resistance*. N.p., n.d. Web. 5 Sept. 2013. <http://www.engineeringtoolbox.com/rolling-friction-resistance-d_1303.html>.

[11] "Tracking Systems Vital to Solar Success." Web. 26 Sept. 2013. http://solarenergy.net/News/4080902-tracking-systems-vital-to-solar-success/

[12] Dumas, M., Ingende, G., Tention, K., and Thompson, M., "Real-Time Intelligent Solar Energy System," Preliminary Design Review, Mercer University School of Engineering, Macon, GA USA, December 2013