Solar Powered Water Management System Using Smart Card

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Abstract: With rapid development of economy and urban growth, water shortage and resource pollution is now a serious problem for urban water supply in many cities. At same time, with enlargement of urban areas and increase of sealing areas results in reduction of green spaces, new road and building construction etc., runoffs of rainwater increase greatly. Networked, smarts systems will help make enhanced use of energy, avoid superfluous and water losses and lessen the consumption of resources. In addition to automation and drive technology, this paper introduce solar powered drinking water supply management using RFID technology. In this paper RFID technology is used to manage the supply of water to the people, if the RFID card is placed near to the RFID reader, LCD displays the details regarding that card holder. According to the details, the DC Motor will pump the water and the message will be sent to the card holder regarding the water consumed

Keywords: LDR, MPPT, Ardino Nano board,Smart card.

1. Introduction

Energy plays a major role in the evolution of the country. Present day scenario, immense quantity of power is produced using non-renewable power sources. 85% of power production is dependent on fossil fuels [1]. The resources of the combustible are finite and its usage is resulting to global warming due to emission of conservatory gases. To provide a sustainable power production and safe world to the future generation, there is a rapid increase in need of vitality from renewable resources like solar, wind, geothermal and ocean tidal wave [2]. Solar radiations are converted into electrical energy by solar panels. Solar panel constitutes of solid state conductor substance. Major component used in the making of solar panel is Silicon, which is 24.5% efficient.[3].

To have the maximum utilization of the amount of intensity captured it is essential to use the tracking system and hence to maintain accuracy and precession. The control circuit for solar tracker is done by Arduino Uno board. This is programmed to detect sunlight using LDR and actuate the stepper motor to position the solar panel where it can receive maximum sunlight. Stepper motor is controllable, energy efficient, steady and have high tracking accuracy and suffers little environmental affect. The water pump is attached to the battery. Since the pump works on DC power supply, it is directly attached to the battery. The water pumping system also consists of water level sensors used to detect water levels for automatic turn on and off of the water pump. This helps in the automation of water pumping systems in hospitals, factories, schools, public places etc. hence reducing manpower also maintaining the adequate usage of the resources[4] [5].

Solar based power is a rule progressively used worldwide as an inexhaustible wellspring of vitality. India has tremendous undiscovered sun powered off-frame work openings. This paper gives data about advancement methodology of an installed framework for off grid water system frame work [7]. Resource of water is indispensible for satisfying daily human needs varying, from agriculture to energy production. The demand of water for irrigation purpose is still an issue to be solved in developing countries, mainly rural areas with energy crisis and environmental pollution created mostly by the use of fossil fuel, this problem has unfolded a solution using solar photovoltaic water pumping system. Solar photovoltaic water pumping system has become so popular not only in the agriculture sector but also for drinking water and micro irrigation applications [8].

Abundant water supply in remote locations is required to ensure the grazing evenly. Water pumping is most accepted and admired application of solar energy in developing countries such as India. The proposed system is reliable, simple and requires less maintenance [9]. Many villages in India use fossil fuel based water pumping system for irrigation due to a shortage of electricity. Fossil fuel causes great damage to the environment as they release harmful greenhouse gases. In this research work, we propose a solar energy based automated water pumping system is implemented to these villagers in terms of cost and profit. In addition, this can save a lot of water and is environment- friendly [10]. Increase in cell efficiency, maximizing the power output and employing a tracking system with solar panel are the three major ways to increase the overall efficiency.

To develop single axis solar tracking system which captures maximum intensity from the sun rays efficiently store the generated energy in the battery for the future application to develop automated water pumping system

which helps to save water and minimize man power. Overall objective is to build a power conserving, less use of manpower, resource conserving project for the sustainable development and to help the mankind save time.

2. Solar Tracking System

The proposed system mainly consists of two parts, solar tracking and water pumping system. The first part of the system, the solar tracking system consists of LDR, stepper motor and solar panel. These LDR's are connected to the two ends of the solar panel. Based on the intensity of light falling on the LDR the arduino will decide the direction of rotation of stepper motor. Stepper motor is in turn connected to the panel. Thus arduino controls the rotation of both stepper motor and solar panel The second part of the project namely the water pumping system consists of water level sensors, DC motor and battery. The water level sensor is used to control and detect water level in the tank. The solar energy is stored and it is collected in battery. The absorbed power is then sent to the motor which runs the pump.

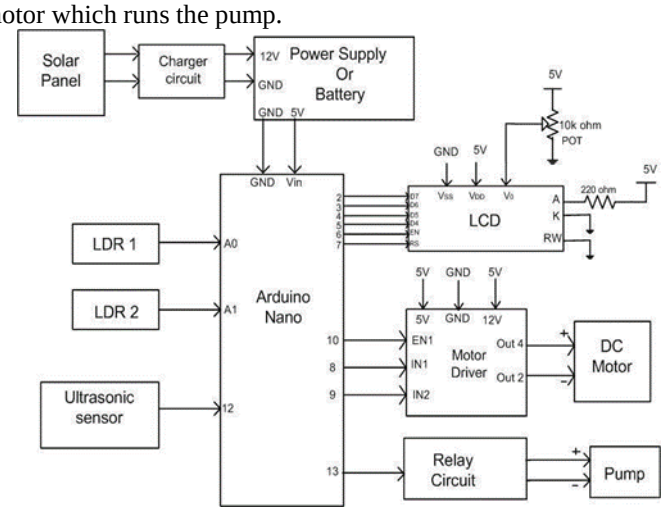

Figure 1: Configuration of Solar Tracking and Water Pumping System

Solar Panel

Solar panel mainly consists of numerous photovoltaic (PV) cells which is combined to form a module. These PV cells are made up of semiconductor material namely silicon that is usually connected in series or parallel to get additive voltage or current. The solar panel is basically a P-N junction, when sunlight falls on the PV cell; the electrons gain energy and jumps out of the atom hence leading to the flow of electricity.

Table 1: Solar panel specification

Parameter	**Value**
Maximum Power	10 W
Vmax	18Volts
Imax	0.56Amps
Voc	21.6Volts
Vsc	0.64Amps
Rechargeable Battery	12Volts
Dimension	280*54*22
Weight	1.5kg

Solar Charging Circuit

This circuit is mainly used to maintain constant DC voltage obtaining from solar panel. This provides protection from over charging and over discharging of the battery life cycle of the battery eventually decreases. To maintain the battery life and to have better performance, battery should never be overcharged or over discharged.

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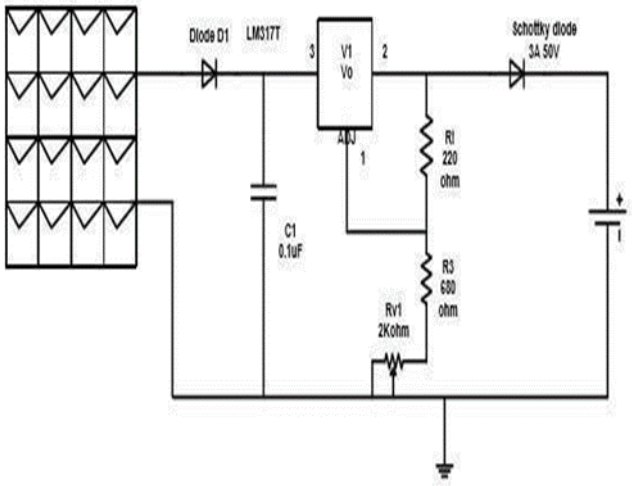


Figure 2: Circuit diagram of Solar Charger circuits

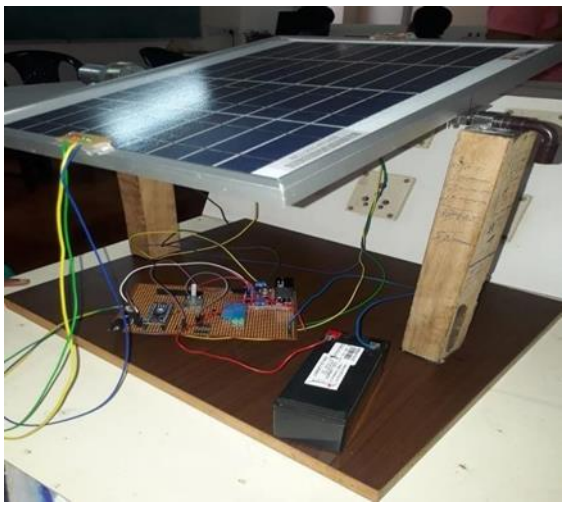


Figure 3: Solar Tracking Unit

Solar panel Characteristic

The current voltage characteristic of the solar module provides useful information. The parameters obtained from the I-V curve include short circuit current 'Isc', open circuit voltage Voc, maximum current Imax, and maximum voltage Vmax at the maximum power point Pmax.

Solar panel characterization is done by connecting the solar panel in series with the ammeter followed by a rheostat and voltmeter connected across the rheostat. The resistance is varied and corresponding solar panel voltage and current are recorded, the I-V curve plotted for a 10W solar panel is shown in the below figure 4.

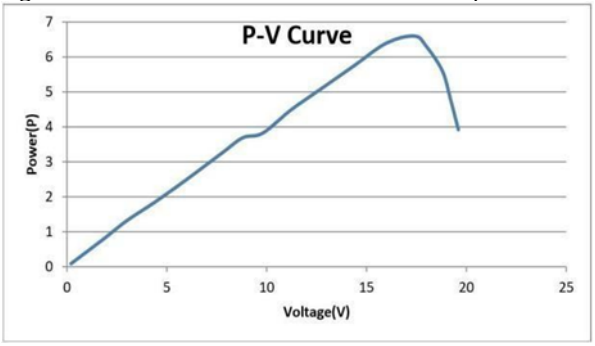


Figure 4: I-V Characteristics of solar panel

The IV curve for the solar panel is plotted during the peak time of the day say approx 2pm. The graph is plotted by taking voltage along x-axis and current along y-axis. The graph having the maximum current of 0.4A obtained at voltage of 10V.

Figure5. IV curve

This graph is obtained by taking solar panel voltage along x- axis and power (obtained by multiplying voltage and current at each point) along y-axis .It can be seen that the maximum power of 6.61W is obtained at voltage

17.4V and current 0.38A. From the above graph it can be inferred that thesolar isolation is not constant throughout the day and the power generated varies accordingly, therefore, there is a need to store the electrical energy generated by the solar panel during maximum productivity. To achieve this battery is used as, renewable energy along with batteries allows stand- alone operations and therefore the batteries are now a standard component of solar power system.

Figure 6:Solar Tracking and water pumping unit

RFID-Technology:

RFID identification (RFID) is term is used to explain a method that transmits the identity the object wirelessly using radio waves. RFID technology is assembled with the most general Automatic Identification (Auto ID) technologies.

An RFID system consists of two separate components: a tag and a reader.

The tag contains an antenna linked to a small microchipthat contains as much as two kilobytes of information. The readers or scanner functions much like a bar code scanner. However, while a bar code scanner utilizes a laser light to scan the bar code, an RFID scanner uses electromagnetic waves. To deliver these waves, the scanner uses an antenna that transmits a signal contacting the tags antenna

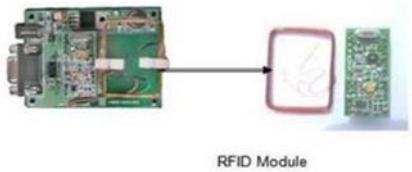
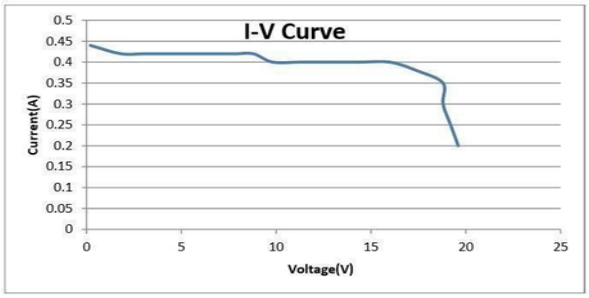


Figure 7 : RFID module



3. Design of Proposed Systems

When the solar panel is exposed to sunlight, the LDR sensors are activated through arduino code and then the LDR senses the intensity of the sunlight and then decide whether the LDR1 or LDR2 is receiving maximum sunlight. And followed by the rotation of the solar panel through the DC motor driven by motor driver L298N in the direction of the maximum intensity.

Once the solar energy is obtained it is made to store in the lead acid battery for the future scope and for the protection of the battery the power trapped by the panel is made to pass

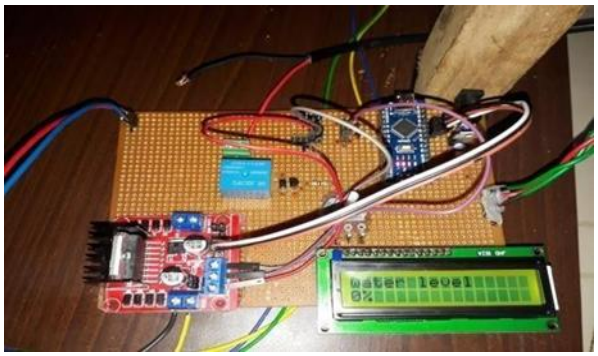


Figure 8: LCD display showing the water level

4. Result And Conclusion

In this paper the single axis solar tracking system is successfully implemented. The constant DC voltage of 12V is obtained with help of solar charger circuit. The energy obtained from the panel is stored into the rechargeable battery of 4.5Ah. The charge controller circuit prevents over charging and over discharging of the battery. Later implemented automation of water pumping system which senses the water level in the tank and automatically turns on and off the pump, based on the water sensed in the tank which is programmed using Arduino Uno. This paper aims at reducing wastage of drinking water and providing purified water to the village people. An RFID Reader can access the data of the card holder from a family . The RFID Reader is capable of reading 40 tags per second. This results in reduction of waste of drinking water ,cost of electricity by utilize the renewable energy source and provide a purified drinking water to the village people

References

1. J.Rizik and Y.Chaiko ,"Solar tracking system : More efficient Use of solar panels"-2008
2. M.Reyasudin basir khan,"Solar Tracking System Utilizing Pyranometer For optimal Photovoltaic Module Positioning"- 2012
3. Jeng -Nan Jung and R.Radharamanan,'Design of a solar tracking system for Renewable energy'-2014
4. M. Ouada, M.S. Meridjet and N. Talbi,'Optimization Photovoltaic Pumping System Based BLDC Using Fuzzy Logic MPPT Control', International Renewable and Sustainable Energy Conference (IRSEC), pp.27- 31, 7-9 March 2013.
5. Neha Yadav, Manju Gupta, K. Sudhakar. “Energy assessment of floating photovoltaic system”, International Conference on Electrical Power and Energy Systems (ICEPES) 2016, pp.264 – 269.
6. Yashar Ghiassi-Farrokhfal, Fiodar Kazhamiaka, Catherine Rosenberg, Srinivasan Keshav. “Optimal Design of Solar PV Farms With Storage”, IEEE of Solar PV Farms With Storage”, IEEE With Storage”, IEEE
7. Y.J.Zuo “survivable RFID system : Issues ,challenges,and techniques” IEEE Trans .Syst ., Man, Cybern. C, Appl.Rev.,vol. 40, no. 4, pp.406-418 2010
8. H.H.Bi and D.K.Lin “RFID –enabled discovery of supply networks”,IEEE
9. Trans.Eng.Manag.,vol.56,no.1,pp.129-141 2009
10. J.D. porter and D.S.Kim “An RFID- enabled road pricing system for transportation”,IEEE Syst. J.,vol .2,no. 2,pp 248-257 2008
11. K.Finkenzeller RFID Handbook : Fundamentals and application in contactless smart card and identification,2003 : Wiley.