Agricultural Water Pumping System with Auto Tracking Solar

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***Abstract*— solar energy is an important means of renewable energy resource. Solar tracking urges extreme solar energy to generate out of the solar panel and enables to maintain a profile with the sun rays. The goal of our venture is to increase the amount of usable energy by utilizing a computerized tracking system to capture maximum intensity of the solar rays. This project deals with development of automated water pumping system using solar tracking. The rapidly increasing demand for energy calls a need for substitute for fossil fuels. Renewable energy source exhibits an outstanding figure for producing electricity without any fuel consumption.**

I. INTRODUCTION

Energy plays a major role in the development of the nation. Present day scenario, huge amount of energy is produced using non-renewable energy sources. 85% of energy production is dependent on fossil fuels. The resources of the fuels are limited and its usage is resulting to global warming due to emission of greenhouse gases. To provide a sustainable power production and safe world to the future generation, there is a rapid increase in need of energy from renewable resources like solar, wind, geothermal and ocean tidal wave. Solar radiations are converted into electrical energy by solar panels. Solar panel constitutes of semiconductor materials. Major component used in the making of solar panel is Silicon, which is 24.5% efficient. 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 undertaking is expected to develop a programmed water system framework which controls the draw engine ON/OFF on detecting water level sensors. 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 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 Resource of water is indispensable for satisfying daily human need 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. 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 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 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.

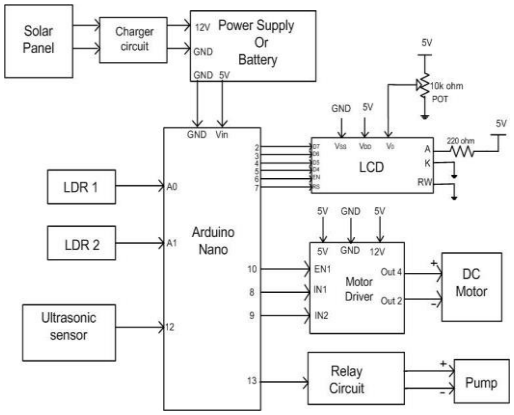

Fig.1

Configuration of Agricultural Water Pumping System with Auto Tracking Solar

II. SOLAR TRACKING SYSTEM

Deciding the specification of the PV panel depends on the need of water tank, followed by rating of pump and battery. Single axis tracking is done using LDR controlled by Arduino Uno board and the panel is rotated accordingly which is driven by stepper motor using the driver L298N. The I-V and P-V characteristics and other parameters of solar panel is then obtained. Constant voltage which is obtained from the panel is made to store in the rechargeable battery for future application i.e Pumping system. Hence the automated water pumping system with relay protection is developed.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.

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
Amax	18Volts
Imax	0.56Amps
Vic	21.6Volts
SC	0.64Amps
Rechargeable Battery	12Volts
Dimension	280*54*22
Weight	1.5kg

The solar energy is extracted from the solar panel such that maximum energy is captured and made to store in the rechargeable type of battery. This work makes use of a 12V, 4.5Ah lead acid battery. The battery maintenance is required for better performance. If the battery is overcharged, it might get heated up and if the battery is over discharged.

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.

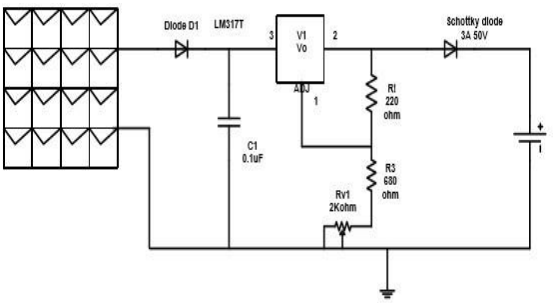

Figure 2: Circuit diagram of Solar Charger circuits

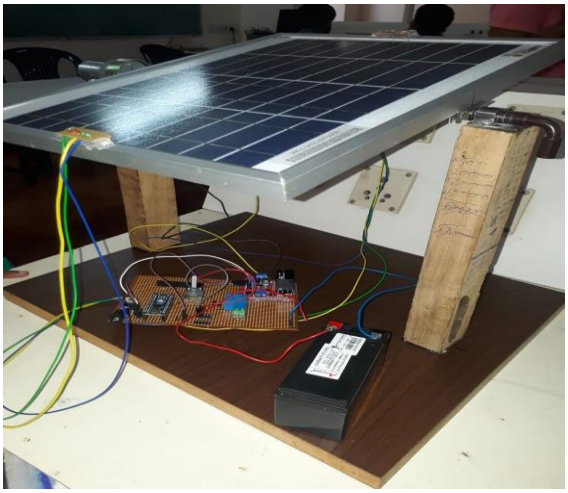

Figure 3: Solar Tracking Unit

Solar panel Characteristic

The electrical power generated by solar panel depends on the intensity of the solar isolation. The amount of solar energy that passes through the atmosphere and strikes a given area on the earth over specific time varies with latitude seasons and the weather which is known as 'insulation' (incident solar radiation). Due to the variation in the intensity of the sun rays during the day and variations in the length of the day, the power generated by the solar panel also varies. The current voltage characteristic of the solar module provides useful information.

Working of proposed system

Figure 6: Solar Tracking and Automated Water Pumping Unit

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 through the solar charger circuit and then towards the battery. Meanwhile the ultrasonic sensor which is situated on the water tank keeps sensing the water levels and sends the message through LCD display. Once the sensor detects that the water level is low then the water pump is turned on with the relay protection circuit, powered from the lead acid battery which was storing the solar energy. Once the water level in the tank reaches its maximum point the sensor senses and then turns off the pump automatically.

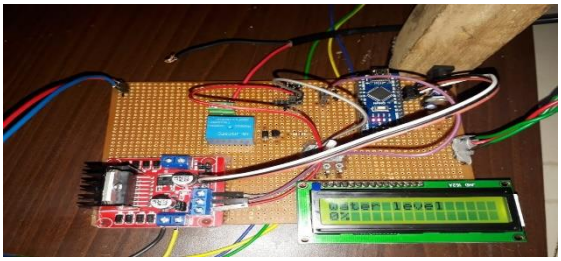

Figure 7: LCD display showing the water level

III. RESULT AND CONCLUSION

In this project 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. The production of solar energy by tracking increases its efficiency there by making it more useful. Solar energy is eco-friendly, widely available.

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