



SOLAR POWERED SENSOR BASE IRRIGATION SYSTEM

| | |
|----------------------------|--|
| K. P. Singh | Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, U. P., India |
| Vikas Singh | Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, U. P., India |
| Sanif Ansar | Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, U. P., India |
| Shubham Dutt Sharma | Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, U. P., India |

ABSTRACT

This review throws light on development procedure of an embedded system for solar based Off-Grid irrigation system. Solar power is absolutely perfect for use with irrigation systems. Using Solar Panel, the sun energy will be converted to electrical power and saved in batteries. When the sun is rising and shining, the solar panel will absorb the energy of the sun and the energy will be kept in the battery. Light Detecting Resistors (LDR's) are placed on the solar panel which helps in tracking maximum intensity of sunlight. For generation of maximum energy, it is important to maintain solar panels face always perpendicular to the sun. This tracking movement of the panel is achieved by mounting the solar panel on the stepped motor. This stepped motor rotates the mounted panel as per signal received from the programmed microcontroller. The microcontroller used in this project is from AVR family. Soil moisture sensor is placed inside soil to sense the moisture conditions of the soil. [1] Based on moisture sensor values, the water pump is switched on and off automatically. When moisture level of the soil reaches to low, the soil moisture sensor sends the signal to microcontroller to start the pump by using stored solar energy. Same time, using GSM technique microcontroller sends message to farmers mobile about pump status. The microcontroller completes the above job as it receives signals from the soil moisture sensors, and these signals function as per program stored in ROM of the microcontroller. The LDR's values, soil moisture values, condition of the pump i.e., on/off are displayed on a 16x2 LCD which is interfaced to the microcontroller.

KEYWORDS : Solar panel, Light Dependent Resistors (LDR's), Soil moisture sensor, AVR microcontroller.

1. INTRODUCTION

In India, agriculture plays a very important role to development of country as our economy mainly based on it. India ranks second worldwide in farm output. The most important factor for the agriculture is timely and ample supply of water. But due to uncertain [4] rainfall and water scarcity in land reservoirs, we are not able to make proper use of agricultural resources. Also unplanned use of water results in wasting of water on large proportion. With the increase in agricultural activity and competitive demand from different sectors, it has become important to economize on the use of water. We can optimize use of water by adopting sensor base irrigation system. There are different irrigation systems used nowadays to reduce dependency of rain. Due to the lack of electricity and mismanagement, in the manual control irrigation system many times crops are dry or flooded with water. So to avoid this problem sensor base irrigation system is used. In manual system, farmers usually control the electric motors observing the soil, crop and weather conditions by visiting the sites. Soil moisture sensor base irrigation system ensures proper moisture level in the soil for growing plants in all season. [8] In this system, sensor senses the moisture content of soil and accordingly switches the pump motor on or off. Soil moisture sensor finds the soil condition whether the soil is wet or dry. If soil is dry the pump motor will pump the water till the field is wet which is continuously monitored by the microcontroller. The main advantage of soil moisture sensor is to ensure accurate measurements and farmer doesn't have to visit his farm to operate the pump. Same time, using GSM technique microcontroller sends message on farmers mobile about pump status. For operation of sensor base irrigation system, pump motor requires energy for pumping. In day to day life there is increasing demand for energy but there is continuous reduction in existing sources of fossils and fuels. According to the survey conducted by the Bureau of Electrical Energy in India in 2011, there are around 18 million agricultural pump sets and around 0.5 million new connections per year are installed with average capacity 5HP. Total annual consumption in agriculture sector is 131.96 billion KWh (19%

of total electricity consumption). So, solar power is only an answer to today's energy crisis. It is perfect source of energy in the world as it is environment friendly and its unlimited availability. In fact the amount of the Sun's energy that reaches the Earth every minute is greater than the energy that the world's population.

2. OBJECTIVES OF STUDY

1. To develop solar panel tracking system.
2. To develop sensor base irrigation system based on soil moisture.

3. PROBLEM DEFINITION

Nowadays, even though irrigation systems are used in agricultural field to reduce dependency of rain, most of them are either regulated manually or having time based automation. In these types of system water is applied to field on the basis of fixed intervals which required high manpower for monitoring and also it reduces the field efficiency. In addition, this fixed interval operation leads to over irrigation than the actual plant requirement and under irrigation when plants [5] required more water in their peak periods. Retardation of crop growth rate, late flowering and reduction of the yield are the major events caused due to water deficiency. Moreover, over irrigation in the root zones leads to ill health of the root zones and vegetation, additional cost for farmer, wasting of water and time wastage. Also salinity of the soil can be increased by continuous supply of excess water. For operation of irrigation system, electricity is required. So use of solar energy for power generation is essential to tackle current energy crisis. One of the major weaknesses of the fixed panel solar system is that due to rotation of the sun, it is not able to extract maximum energy from the sun.

4. PROPOSED METHODOLOGY

In the proposed system single axis solar tracking system is used for the irrigation along with GSM. [2] Four LDR's are placed on solar panels helps to track maximum intensity of sunlight and thus helps

to collect more electricity. Produced electricity is stored in DC battery which is used to pump the water for irrigation system. The analog values from LDR sensors and soil moisture sensor are converted in to digital values by using ADC Converter. The digital values then provided to AVR Microcontroller as an input. Microcontroller is interfaced with DC Pump, LCD, and GSM Module. When moisture content of soil will low, pump will start automatically and farmers can get the information on his mobile through GSM module.

5. ADVANTAGES

The main advantages of this proposed system are as follows.

1. By using soil moisture sensors in the field, this system provides water for plants according to the crop water requirement and operates according to the soil moisture condition of the root zone of the plant. This leads to saving of water by avoiding excess irrigation.
2. The system has designed to operate using solar energy; hence it could be used for the areas where the electricity is not available. Further, use of this renewable energy does not affected by the energy crisis. This renewable energy produces little or no waste products such as carbon dioxide or other chemical pollutants, so it has minimum impact on environment.
3. The proposed system controls amount of water use for irrigation in the agricultural fields. Thus it reduces excessive pressure on farmers to pay additional water tariff on water. In addition to this controlled irrigation also save additional cost for water pumping, reduces the conveyance and distribution losses in the field level. Moreover, energy consumption on water pumps could be reduced by efficient water allocation based on the crop water requirement.
4. This solar powered automated irrigation system does not require man power for operation. This intelligent system can detect the soil moisture conditions and perform automatically based on pre-defined moisture conditions.
5. This system reduces run off from over watering saturated soils, avoid irrigating at the wrong time of the day, which will improve crop performance by ensuring adequate water and nutrient balancing. Further, it prevents Salinity of agricultural lands which cause for poor productivity and land degradation.
6. In addition, this system helps in time saving, removal of human error in adjusting available soil moisture level and to maximize their net profit.
7. By using solar tracking system as compared to fixed panels, energy output is increased.
8. Proposed system makes easy to adopt advanced crop systems and technologies, those are complex and are difficult to operate manually.

6. APPLICATIONS

By implementing proposed system, there are various benefits to both government as well as farmers. For the government solution to energy crisis and water shortage is proposed.

Main application of the proposed system is for irrigation of agriculture fields. Even we can apply this system in agriculture research stations, greenhouses where high precision soil moisture control is required. Use of solar energy in the proposed system allows us to use this system in remote areas where electricity is not available.

7. CONCLUSIONS

In this paper, a solar powered sensor base automated irrigation model is proposed. We designed this model considering low cost, reliability, alternate source of electric power and automatic control. As the proposed model is automatically controlled, it will help the farmers to properly irrigate their fields. The model always ensures the sufficient level of water in the soil. Thus, this system avoids over irrigation, under irrigation, top soil erosion and reduce the wastage of water. Solar power provides sufficient amount of power to drive the system. To overcome the necessity of electricity and ease the irrigation system for our farmers, the propose model can be a

suitable alternative.

8. REFERENCES

- [1] Alsayid B, Jallad J, Dradi M and Al-Qasem O, 'Automatic Irrigation System with PV Solar Tracking', *International Journal of Latest Trends in Computing*, Volume 4, Number 4, December 2013.
- [2] Anuraj A and Gandhi R, 'Solar Tracking System Using Stepper Motor', *International Journal of Electronic and Electrical Engineering*, Volume 7, Number 6: 561-566, 2014.
- [3] Fule C and Awachat P, 'Design and Implementation of Real Time Irrigation System using a Wireless Sensor Network', *International Journal of Advance Research in Computer Science and Management Studies*, Volume 2, Issue 1, January 2014.
- [4] Gutiérrez J, Villa-Medina J F, Nieto-Garibay A and Porta-Gándara M A, 'Automated Irrigation System Using a Wireless Sensor Network and GPRS Module', *IEEE Transactions on Instrumentation and Measurement*, 2013.
- [5] Harishankar S, Kumar R, Sudharsan K P, Vignesh U and Viveknath T, 'Solar Powered Smart Irrigation System', *Advance in Electronic and Electric Engineering*, Volume 4, Number 4: 341-346, 2014.
- [6] Khan T, Tanzil S M, Rahman R and Alam S M, 'Design and Construction of an Automatic Solar Tracking System', *IEEE 6th International Conference on Electrical and Computer Engineering ICECE 18-20*, 2010.
- [7] Luthra S K, Kaledhonkar M J, Singh O P and Tyagi N K, 'Design and development of an auto irrigation System', *Elsevier Science B. V. - Agricultural Water Management*, Volume 33: 169-181, 1997.
- [8] Mane A, Arif S M, Shaikh S and Shaikh S, 'Solar Panel Tracking System for GSM Based Agriculture System', *International Journal of Engineering and Advanced Technology (IJEAT)*, Volume 2, Issue 5, June 2013.
- [9] Sanjukumar and Krishnaiah RV, 'Advance Technique for Soil Moisture Content Based Automatic Motor Pumping for Agriculture Land Purpose', *International Journal of VLSI and Embedded Systems - IJVES*, Volume 4, Article 09149, September 2013.
- [10] Seal B, Shirke O, Shewale S, Sirsikar A and Hankare P, 'Solar Based Automatic Irrigation System', *International Journal of Research in Advent Technology*, Volume 2, Number 4, April 2014.