International Journal of Core Engineering & Management (ISSN: 2348-9510)
Special Issue, NCETME -2017, St. Johns College of Engineering and Technology, Yemmiganur

NEW TECHNOLOGIES OF SOIL MOISTURE SENSOR IN SOLAR POWERD IRRIGATION FIELD

P.RANA PRATHAP[1], Dr.A.NAGARAJU[2], B.MADHU BABU[3]
1. PG Scholar, Mechanical engineering, JNTUACEA Ananthapuramu,
2. Lecturer, Department of mechanical engineering, JNTUACEA, Ananthapuramu,
3. Lecturer, Department of, Mechanical engineering JNTUACEA Ananthapuramu.
ANANTHAPURAMU (AP), INDIA.
rana4738@gmail.com

Abstract

Now a day's Cost effective on irrigation field is somewhat higher for feticides and needs of craft field. So, the solar power can be the answer for all our energy needs. Solar powered smart irrigation systems are the answer to the low-level water land farmer. This system consists of solar powered water pump along with an automatic water flow control using a moisture sensor with modern technology. It is the proposed solution for the present energy crisis for the low level water lands farmers. This system conserves electricity by reducing the usage of grid power and conserves water by reducing water losses. And improve the soil power by optimum utilization of land and water.

Index terms: Smart irrigation, solar power, solar pump, soil moisture sensor; energy crisis.

I. INTRODUCTION

Mixed farming is a system of farming in which a farmer conducts different types of agricultural practices together. If a farmer cultivates 3 types of crops then there occurs a difficult task in irrigation as individual crop contains different types of water level respectively. In current times, the farmers have been using irrigation system through the labor-intensive control in which the farmers irrigate the land at regular intervals by turning the water-pump on/off when essential. These procedures sometimes consume more water and sometimes the water supply to the land is delayed due to which the crops dry off.. Water shortage deteriorates plants enlargement before visible wilting occurs. In addition to this slow development rate, lighter mass fruit follows water shortage. So, to overcome this problem we have designed the project to ease the farmer. One of the applications of this technology is used in irrigation systems for farming Solar powered irrigation system can be a suitable alternative for farmers in the present state of energy crisis in India. This green way for energy production which provides free energy once an initial investment is made. In this paper we propose an automatic irrigation system using solar power which drives water pumps to pump water from bore well to a tank and the outlet valve of tank is automatically regulated using controller and moisture sensor to control the flow rate of water from the tank to the irrigation field which optimizes the use of water. It consists of Humidity sensor in the soil and is used to control the DC water pump operation. Four light dependent resistances (LDRs) sensors are used to detect the sun position, this information is read and processed by a 16F877A PIC microcontroller to move two stepper motors, used as actuators for the two axes PV solar tracking system, in order to control the azimuth and tilt angles.

II. BACKGROUND INFORMATION

Following are the components

- Solar panel
- Soil moisture sensor
- Micro controller
- Water pump
- Solar tracking
- Light dependent resistor

Solar panel:
The solar cells that we see are also called photovoltaic (PV)cells[6], which as the name implies (photo meaning "light" and voltaic meaning "electricity"),convert sunlight directly into electricity. Module is a group of cells connected electrically [11] and packaged into a connected electrically and packaged into a frame (more commonly known as a solar panel), which can then be grouped into larger solar arrays.

Soil moisture sensor:
A moisture sensor [7] is used to sense the level of moisture content present in the irrigation field. It has a level detection module in which we can set a reference value. This circuit can be used with analog probes that produce a voltage proportional to soil moisture such as VG400 probe shown in Fig. 3. The moisture content [5] of the soil is found by using the soil moisture sensor such as VG400 which produces an equivalent output voltage proportional to the conductivity between the two probes.

Figure 1.soil moisture sensor probe

Micro controller:

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, and toys. By reducing the size and cost compared to a design that uses separate microprocessor, memory, an input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers [2] are common, integrating analog components needed to control Non-digi electronic systems. Some microcontrollers may use four-bit words and operate at clock rate frequencies as low as 4 kHz, for low power consumption (mill watts or microwatts). They will generally have the ability to retain functionality while waiting for an event such as a button press or other interrupt; power consumption while sleeping (CPU clock and most peripherals off) may be just Nano Watts, making many of them well suited for long lasting battery applications. Other microcontrollers may serve performance-critical roles, where they may need to act more like a digital signal processor (DSP), with higher clock speeds and power consumption.

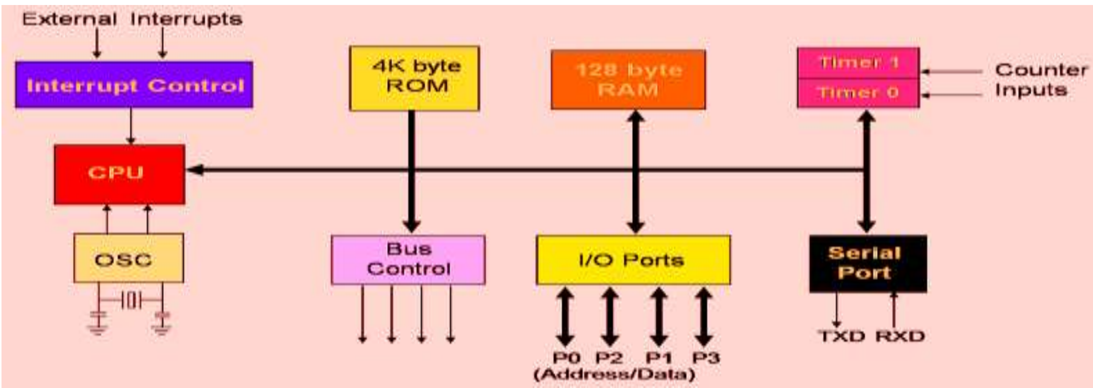

Figure 2.Micro controller

Water pump:

A DC voltage based water pump will also be used in order to supply the water in the field. Since we are dealing with the stored DC power, hence we are going to use a DC power water pump [13].

International Journal of Core Engineering & Management (ISSN: 2348-9510)
Special Issue, NCETME -2017, St. Johns College of Engineering and Technology, Yemmiganur

Solar tracking:

The main objective is to find the maximum sun radiations in order to get maximum charge for the batteries. Electricity can be generated from the sun in several ways. Photovoltaic (PV) has been mainly developed for small and medium-sized applications, from the calculator powered by a single solar cell to the PV power plant. For large -scale generation, concentrating solar thermal power plants have been more common, however new multi Mega Watt PV plants have been built recently. A photovoltaic cell (PV cell) is a specialized semiconductor that converts visible light into direct current (DC). Some PV cells can produce DC electricity from infrared (IR) or ultraviolet (UV) radiation. Photovoltaic cells are an integral part of solar-electric energy systems, which are becoming increasingly important as alternative sources of power utility. Solar cells generate DC electricity from light, which in turn can be used in many applications such as: charging batteries, powering equipment, etc. This solar tracker [1][2] works on the photovoltaic technology.

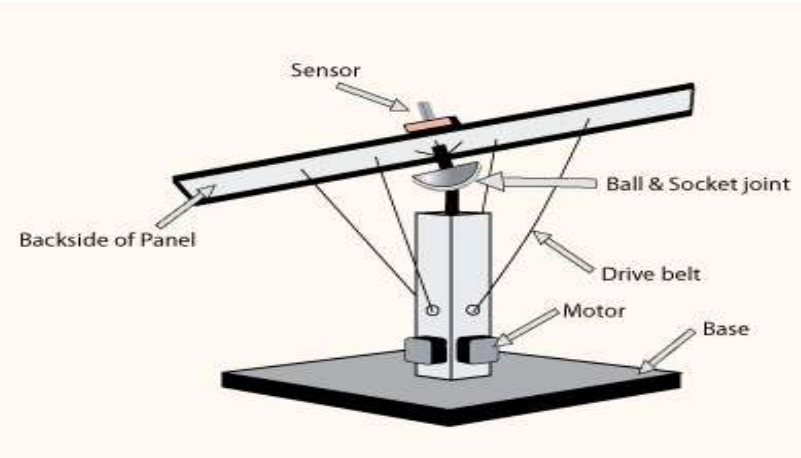

Figure 3 single axis solar tracking

Light dependent resistors:

Light Dependent Resistor is a high-resistance semiconductor. It can be referred to as a photoconductor. If light falling on the device is of the high enough frequency, photons is absorbed by the semiconductor give to bound electrons enough energy band jump into the conduction band. The free electron conducts electricity, thereby lowering in resistance. Hence, Light Dependent Resistors is very useful in the light sensor circuits. LDR is very high-resistance, sometimes as high as 10MΩ, when they are illuminated with the light resistance drops dramatically.

The solar tracker comprises comparator IC LM339 for light detection and a few discrete components. Light-dependent resistors [13] LDR1 through LDR3 are used as a sensors to detect the panel's position relative to the sun. These also provide the signal to the micro controller to moves the solar panel in the sun's direction. LDR1 and LDR3 are fixed at the edges of the solar panel along the X-axis, and LDR2 is fixed at the Centre of solar panel and LDR1 and LDR3.LDR1, 2, and 3 connected to comparators IC LM339 at A1,A2 and A4, respectively. Pre-sets the PR1, PR2 and PR3 are set to get the low comparator IC output at the pins 1, 2 and 14 of comparators IC LM339

International Journal of Core Engineering & Management (ISSN: 2348-9510)
Special Issue, NCETME -2017, St. Johns College of Engineering and Technology, Yemmiganur

A1, A4 and A2, respectively. Comparator is the active low output signal fed to MCU Port Pin P1.0, P1.1and P1.2. Port Pin P1.0, P1.1, and P1.2 Used as a digital Input Port and is pulled up via 10K resistors, LEDs are indicates to LDRDetection operated. LED has a current limiting resistor in series some components can change the resistance value by changes in the amount of light hitting. One type is the Cadmium Sulfide Photocell. (Cd) the more light that hits it, the smaller its resistance value to becomes. They vary according to light sensitivity, size, resistance value etc. Pictured at the left is a typical CDS photocell. Its diameter is 8 mm, 4 mm high, with a cylinder form.

Figure 4.Light dependent resistors

Working of soil moisture sensor:

NormallySoil moisture sensors measure the water content in soil. A soil moisture probe is made up of multiple [8] soil moisture sensors. One common type of soil moisture sensors in commercial use is a Frequency domain sensor such as a capacitance sensor. Another sensor, the neutron moisture gauge, utilizes the moderator properties of water for neutrons [8].

Soil moisture content may be determined via its effect on dielectric constant by measuring the capacitance between two electrodes implanted in the soil. Where soil moisture is predominantly in the form of free water (e.g., in sandy soils), the dielectric constant is directly proportional to the moisture content. The probe is given a frequency excitation to permit measurement of the dielectric constant. The readout from the probe is not linear [9] with water content and is influenced by soil type and soil temperature.

TABLE: 1
Advantages of different soil moisture sensors:

S.no	Sensor type	advantages
1	**Neutron Probe** (Campbell Pacific Nuclear; CPN)	Accurate. Repeatable. Samples a relatively large area. One sensor for all sites& depths.
2	**Time Domain Transmissivity** (Acclima, Gro-Point)	Less expensive ($110/sensor). Easy to log data.
3	**Tensiometers**	Less expensive ($80/sensor)
4	**Granular Matrix Sensors** (Watermark)	Inexpensive ($40/sensor)

III. MAIN RESULT

Irrigation becomes easy, accurate and practical with the same soil sample impossible. Because of the idea above shared and can be implemented in agricultural difficulties of accurately measuring dry soil and water fields in future to promote agriculture to next level. The Volumes, volumetric water contents are not usually output from moisture sensor and level system plays major determined directly. Role in producing the output.

IV. IMPLEMENTATION DETAILS OF THE PROPOSED METHOD

Table reflects the values of impedance offered by sand under different temperature conditions for different amount of water content in it.
The new technologies are needed to meet the present criteria in irrigation field so that, the new technology of elements which are listed above is best suited.implimentation of the solar moisture sensor in the irrigation field is needed in many situation like different situations of lands.(ex: dry lands and wet lands)

International Journal of Core Engineering & Management (ISSN: 2348-9510)
Special Issue, NCETME -2017, St. Johns College of Engineering and Technology, Yemmiganur

Table: 2
Impedance response under different temperature conditions for sand

SL. No	Temp.	Type of material/ sample	Resistance across probe(Ω)
1	10 ° C	a) No sample	>10MΩ
	10 ° C	b) Sand (DRY)	10000Ω
	10 ° C	c) Sand (semi WET)	7100Ω
	10 ° C	d) Sand (dipped in water)	790Ω
2	25 ° C	e) No sample	>10MΩ
	25 ° C	f) Sand (DRY)	12800Ω
	25 ° C	g) Sand (semi WET)	8300Ω
	25 ° C	h) Sand (dipped in water)	810Ω
3	40 ° C	i) No sample	>10MΩ
	40 ° C	j) Sand (DRY)	13900Ω
	40 ° C	k) Sand (semi WET)	9000Ω
	40 ° C	l) Sand (dipped in water)	920Ω
	50 ° C	m) No sample	>10MΩ

International Journal of Core Engineering & Management (ISSN: 2348-9510)
Special Issue, NCETME -2017, St. Johns College of Engineering and Technology, Yemmiganur

4	50 ° C	n) Sand (DRY)	13000Ω
	50 ° C	o) Sand (semi WET)	9100Ω

For the measured values the graph is drawn between resistance versus temperature by taking temperature on X axis and resistance on Y axis and the graph is shown below.

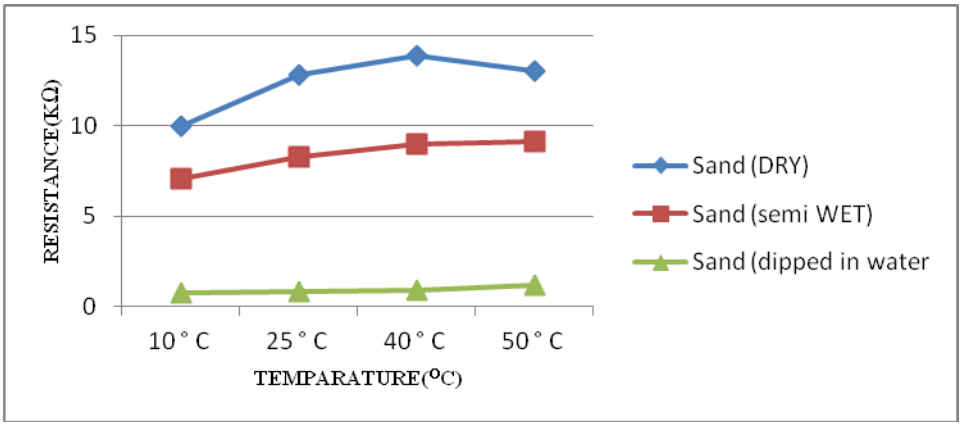

Figure 5: Resistance across probes versus temperature

V. RESULTS

The moisture sensor being developed give an analog value ranging from 0 to 5 V for different moisture levels. Figure shows the output performance of the soil moisture sensor
For soil moisture sensor special sensor is developed which has variable resistance with respect to variation in soil moisture. The sensing units were placed at distances of 10 meters. They were all networked with the smart signal conditioning unit that samples the sensor outputs. The number of plants that remained alive as a result of irrigation approach monitored. The system is very useful for agriculture applications particularly in semi arid areas that are sparsely populated, so that human involvement and intervention is not needed for irrigation purpose

VI. CONCLUSION

The current work aims to develop a smart Irrigation system using soil temperature and moisture sensor. Automation helps in utilization of water for irrigation as per requirement of the crop result in better yield of crop compared to normal practices carried out by farmers. The proposed system enables irrigation of the field only when it is needed and thus serves to conserve water. The automated irrigation system implemented was found to be feasible, reliable, low cost, alternate

International Journal of Core Engineering & Management (ISSN: 2348-9510)
Special Issue, NCETME -2017, St. Johns College of Engineering and Technology, Yemmiganur

source of electric power and automatic control. As the proposed model is automatically controlled it will help farmers to properly irrigate their fields and avoid under-irrigation and over-irrigation. The solar tracking system is a renewable and non-consumable technique. It leads to a pollution free system. The designed system requires minimum maintenance with a practically good level of improvement of system efficiency for the comparative cost of acquisition of systems of similar output capacity.

REFERENCES

[1].OkamBingol, AhmetAltintas, YunusOner, "Microcontroller based solar-tracking system and its implementation", Journal of EngineeringSciences, Vol 2, No. 12, pp. 243-248, 2006.

[2.]]Nasir Ahmed Filfil, DeiaHalbootMohussen andDr.Khamis A. Zidan, "Microcontrollerbased sun path tracking system", Eng. And Tech. Journal , Vol. 29, No. 07, 2011

[3]Klute, A. (ed.), 1986: *Methods of Soil Analysis, Part 1 Physicaland Mineralogical Methods.* American Society of Agronomy,Madison, Wisconsin, United States, 1188 pp..

[4]Knight, J.H., 1992: Sensitivity of time domain reflectometMeasurements to lateral variations in soil water content. *WaterResources Research,* 28, pp. 2345–2352

[5]Jeng-Nan Juang, R. Radharamanan; "Low Cost Soil Moisture System Brad Rodriguez."Moving Forth Part Camel Forth for the 8051".

[6]SatyaPrasanthYalla, B.Ramesh, A.Ramesh "Autonomous Solar Powered Irrigation System International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 ,www.ijera.com Vol. 3, Issue 1, January –February 2013, pp.060-065

[7]Shock, C., E. Feibert, and S. Jaderholm. 2001. A Compari son of Six Soil Moisture Sensors. Available online at:

[8]Evett, S.R., J.A. Tolk, and T.A. Howell. 2003. Sensors for Soil Profile Water Content Measurement: Accuracy, Axial Response and Temperature Dependence. *Geophysical Research Abstracts,* Vol. 5 09944.

[9]Muhammad Ali Mazidi and Janice Gillispe Mazidi, "*The 8051microcontroller and embedded systems*", Pearson education ltd., India, 2007.

[10]6 Ahmad Abu Hanieh, "Solar photovoltaic panels tracking System", Proceedings of the 6th WSEAS international conference on dynamical systems and control, Sousse, Tunisia, 3-6 May 2010, pp 30-37.