

**Solar Powered Wireless Irrigation System**Rucha Deore¹, Nayan Kotwal², Kajal Kunjir³, Prof. V. N. Ghodke⁴*1*Electronics and Telecommunication Engineering, AISSMS IOIT*2*Electronics and Telecommunication Engineering, AISSMS IOIT*3*Electronics and Telecommunication Engineering, AISSMS IOIT*4*Electronics and Telecommunication Engineering, AISSMS IOIT

Abstract —Solar powered wireless irrigation system is perfect solution to the Indian farmer in such energy crisis. Solar power is the best solution for the energy crises and perfect for use in irrigation systems. When the sun is hot Solar Panel will absorb sun rays and will convert solar energy to electrical power which is saved in to batteries. In this project the water quantity present in agricultural soil is detected by soil moisture sensor and water level sensor for detect water level in tank. Based on soil moisture sensor values, the water pump is switched on and off automatically. When moisture level of the soil is dry, the soil moisture sensor will send the signal to Atmega328 to start the pump by using stored solar energy. Same time, ZigBee processes values of sensors from Atmega328 and this values from different sensors (Soil moisture, temperature, humidity and water level), are collected in the PC according to date and time, and periodically updates it for synchronization for graphical user interface (GUI) by using VB software that is visual basic. The sensors values, switching of the pump i.e., on/off are displayed on a 16x2 LCD which is interfaced to the Atmega328.

Keywords-Atmega328, Graphical User Interface (GUI), Humidity sensor, Solar panel, Soil moisture, Temperature and Water level sensor, Wireless sensor network (WSN), Visual basic (VB), ZigBee.

I. INTRODUCTION

Most abundant resource of energy in this world is solar energy. The solar energy is not only a solution to now a day's energy crisis but also an eco friendly form of energy. Solar power generation using photovoltaic cells is an efficient approach. Nowadays solar panels are mostly used for industrial and domestic needs. One of the applications of solar energy is used in irrigation systems for farming. This is a green and eco friendly way for energy generation which serves free energy once an initial investment is made.

The climatic conditions are isotropic and Indian economy is based on agriculture. The main issue is the scarcity of rains and scarcity of land reservoir water. The continuous extraction of underground water is reducing the water level due to which most of land is slowly coming under drought zone. The improper use of water because of which significant amount of water goes waste is the biggest reason of droughts. Generally the farmers irrigate the land at regular time intervals till now which is manually control technique. In this process most of the times consume more water or sometimes the crops get dried, when water reaches late. This scarcity of water can affect the growth rate of the crops and even leads to lighter weight fruits.

Wireless sensor networks are an important penetrating computing technology conquering our environment. The main objective of this project was to design a solar powered WSN for an agricultural environment that is to provide more facility in agriculture field by using Zigbee. Supervising agricultural environment for number of factors such as temperature and humidity, soil moisture along with other factors can be of importance. It is very problematic for farmers to monitor and control the distribution of water in the whole farm or as per the necessity of the crop. Farmers have to undergo large financial losses because of improper irrigation methods. Sensors are necessary for precision agricultural applications. The upgraded irrigation method removes the need for workmanship for flooding irrigation. The proper water management technique plays an important role in the irrigated agricultural cropping systems.

Also as we know many, energy conservation measure projects have been conducted with the aim to reduce energy consumption. The performance energy conservation measure projects in conducting energy saving project are very dependent on measurement and verification activities. These activities include soil moisture survey, temperature and humidity, monitoring and calculation. Energy saving performance is considered under measurement and verification protocols. There are several protocols that are being used for determining energy saving. Therefore, the Visual Basic based Graphical User Interface (GUI) to determine performance of sensor. This is useful to measure and verify the change in temperature and solar panel voltage.

II. LITERATURE SURVEY

- [1] Solar power is absolutely perfect for irrigation systems. Using Solar Panel, the sun energy will converted to electrical power and saves in to batteries. In this paper Light Detecting Resistors (LDR's) are used, which placed on the solar panel for tracking maximum intensity of sunlight. Solar panels are always maintained perpendicular to the sun so that maximum energy is generated. The solar panel is mounted on the stepped motor which rotates as per signal received from microcontroller to track movement according to sun.^[3]
- [2] Mr. JOAQUIN GUTIERREZ developed a system placed in the root zone of the plants that has wireless network of soil-moisture and temperature sensors. It also has a unit that handles sensor data and transmits data to a web application that allowed for data inspection and irrigation. They have developed algorithm, with threshold values of sensors that was programmed into a microcontroller-based on values water quantity is controlled.^[1]
- [3] In this paper a wireless biosignal acquisitions system was designed especially for electrocardiogram (ECG) monitoring. That system also consists of 1) the ECG acquisition node, 2) the protocol for standard IEEE 802.15.4 ZigBee system, and 3) the RF transmitter circuit as a subsystem. They adopted ZigBee protocol for wireless communication to achieve high integration, applicability, and portability. ZigBee based sensor node are now available to suit a variety of applications, such as environment monitoring, precision agriculture, home and building automation, healthcare, traffic management etc.^[2]
- [4] C. A. Cosmas explained proposes a Visual Basic based Graphical User Interface (GUI) to determine energy saving using Option C, the whole facility measurement that is adherence to the International Performance Measurement & Verification Protocol (IPMVP). The GUI was tested using a case study in an office building in Malaysia. Two independent variables have been considered in the analysis, i.e. 1) Cooling Degree Days (CDD) and 2) number of working days in a month. The results showed that the GUI was able to calculate the energy saving as recommended by the IPMVP. This tool was proved very useful for facility owner to calculate how much energy is saved.^[4]

III. SOLAR POWERED WIRELESS IRRIGATION SYSTEM

The solar powered wireless irrigation system here consisted of two components (Fig. 1), transmission section and (Fig. 2) a receiver section, the transmitter that permits the transfer of soil moisture, humidity, water level, solar panel voltage and temperature values, implemented at transmission section which uses ZigBee technology. The receiver receives the values of different sensors and these values are remotely monitored on a PC, through a software Visual Basic and parameters are represented graphically.

A. Transmission section

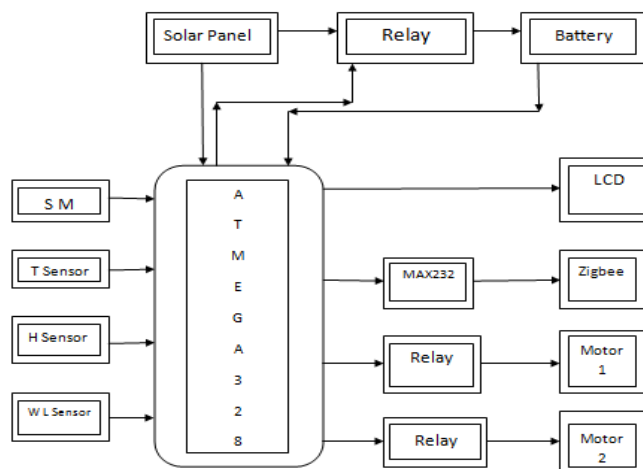


FIG. 1: Block Diagram of Solar Powered Wireless Irrigation System Transmission section

Solar powered wireless irrigation system is to be used for saving electricity and water going wastage. The transmission section comprised of Atmega328, sensors (Temperature, Soil Moisture, Humidity, Water-Level), ZigBee transmitter, motors, LCD display, solar panel and a battery.

In this proposed system Solar panels is used for generating solar energy to charge a battery which is power supply for the

Atmega328 based irrigation system, the use renewable energy helps in saving power.

Acontrolling circuit is used to charge a battery that is when the intensity of sunlight is high the solar panels absorbs the light and stores in the battery, connected to relay circuit. The relay is used as a switch, when the battery is low the relay will be on and charging of battery takes place and similarly if battery is charged then relay will be off, the battery is charged or discharged is displayed on LCD. The voltage of the solar panel is also displayed on LCD.

The battery gives power to the water pump which is inserted inside the well. Then the water is pumped into an overhead tank. Before releasing the water into the field, water is stored temporarily in overhead tank. The motor of the tank is electronically controlled in this system according to soil moisture sensor. The moisture content in the soil is transform into identical voltage using this sensor. This data from sensor is compared with the reference voltage which can be adjusted by famer according to need of different corps and accordingly the amount of water is needed to soil. According to the soil moisture control signal is given to a motor. The motor in turns controls theflow of water. In this system depending upon the need of the water for the crop the water flow is regulated thus, conserving the water by avoiding over flooding of crops.

The water level sensor is used to determine whether the water level in storage tank that is over head tank is sufficient or not for watering the fields. The different water levels in overhead tank is displayed on LCD, and pump motor is turned on.

The humidity sensor and temperature sensor is to be used to regulate the humidity and temperature of surrounding by means of shed as controlled by controller for healthy crop growth.

The data from the sensors are displayed on LCD and the data is transmitted by ZigBee to the receiver section.

B. ReceiverSection



FIG. 2: Block Diagram of Solar Powered Wireless Irrigation System Receiver section

Firstly,the solar panel voltage, soil moisture, temperature, humidity and water level sensor values from transmitter arereceived, identified, recorded, and analyzed in the receiver section. The receiver section consists of a ZigBee modem and a PC. This processed information is send to PC connected to ZigBee modem through Max232 connector where values of all these sensors are displayed according to date and time using Visual Basic software. The information of sensors from the transmission section is received by ZigBee modem and the solar panel voltage and temperature sensors real time data are displayed graphically using GUI using Visual Basic.

IV. APPLICATIONS

1. It can be implemented in modern irrigation system.
2. It may be used in gardens and parks.
3. It works according to the soil conditions.

V. ADVANTAGES

1. A green way for energy production which provides free energy once an initial investment is made and it saves electrical energy.
2. Simple to implement.

VI. RESULT

From the different sensor node, these following results are receiving:

- Atmega328 read the data from different sensors and transmitted the serial data to the PC via ZigBee. The ZigBee works as a transmitter whereas at the PC ZigBee works as a receiver. Figure 3 shows, Atmega328 are interfaced with Soil Moisture sensor, Temperature sensor, Humidity sensor, and Water Level sensor. Atmega328 read the data and transfers to the PC via ZigBee Transceiver.

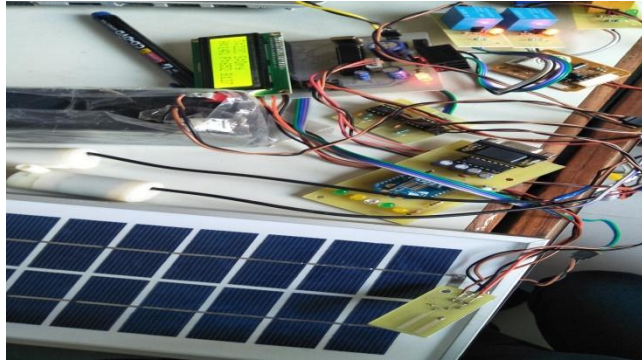


FIG. 3: Hardware of Solar Powered Wireless Irrigation System.

- Visual Basic software is used for creating the GUI and Database. In figs 4 shows Real time data i.e. Temperature sensor and solar panel voltage is represented graphically with respect to time.

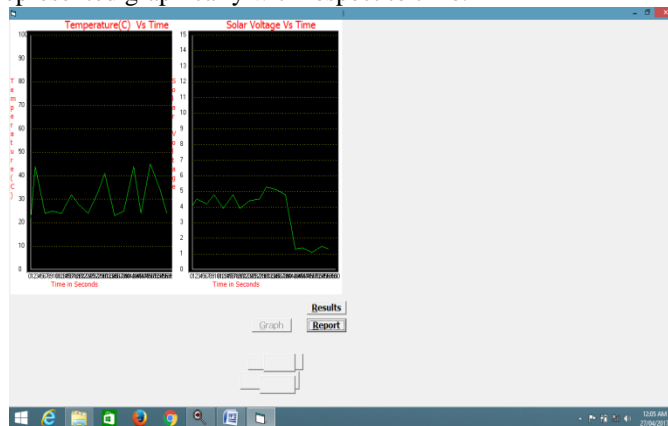


FIG. 4: Graphical Representation of Change in Temperature sensor and Solar Panel Voltage.

- Database is created using VB software. The values of the sensor are stored with date and time in the database. Figure 5 shows, Table of Humidity, Temperature, water level, soil moisture and solar panel voltage real time data with date and time.

Date	Time	Temperature(C)	Solar Panel Voltage	Soil Moisture	Tank Level	Humidity (%)	Battery Voltage
26/04/2017	23:39:24	0035	01.2	Exc.	_FULL_	037	12.
26/04/2017	23:39:27	0047	01.4	Opt.	_FULL_	037	12.
26/04/2017	23:39:31	0042	01.5	Opt.	_FULL_	037	12.
26/04/2017	23:39:35	0023	04.2	Opt.	_FULL_	037	12.
26/04/2017	23:39:39	0024	05.1	Opt.	_FULL_	037	12.
26/04/2017	23:39:42	0024	03.8	Opt.	_FULL_	037	12.
26/04/2017	23:39:46	0051	04.1	Opt.	_FULL_	042	12.
26/04/2017	23:39:50	0023	03.7	Opt.	_FULL_	042	12.
26/04/2017	23:39:53	0053	03.9	Opt.	_FULL_	047	12.
26/04/2017	23:39:57	0023	04.1	Opt.	_FULL_	046	12.
26/04/2017	23:40:01	0036	03.9	DRY.	_FULL_	045	12.
26/04/2017	23:40:04	0043	03.5	DRY.	_EMPTY_	044	12.
26/04/2017	23:40:08	0040	03.7	DRY.	_EMPTY_	042	12.
26/04/2017	23:40:12	0021	03.7	DRY.	_EMPTY_	041	12.
26/04/2017	23:40:15	0052	03.6	Exc.	_EMPTY_	040	12.
26/04/2017	23:40:19	0021	04.4	Opt.	_EMPTY_	040	12.
26/04/2017	23:40:23	0022	01.2	Opt.	_EMPTY_	039	12.
26/04/2017	23:40:26	0024	01.3	Opt.	_EMPTY_	039	12.
26/04/2017	23:40:30	0023	01.2	Opt.	_FULL_	038	12.
26/04/2017	23:40:34	0032	01.1	Opt.	_MIDDLE_	038	12.
26/04/2017	23:40:38	0047	01.4	Opt.	_EMPTY_	038	12.
26/04/2017	23:40:41	0021	01.4	Opt.	_EMPTY_	037	12.

FIG. 5: Database of Solar Powered Wireless Irrigation System.

- Database created using VB software is also saved as a report in the notepad. In Report, the values of the sensor are stored similarly like database. Figure 6 shows, the report.

Date	Time	Temperature(C)	solar voltage	Soil Moisture	Tank Level	Humidity	Battery voltage"
26/04/2017	23:30:52	0022	01.3		DRY.	_FULL_ 037	12."
26/04/2017	23:30:54	0032	01.4		DRY.	_FULL_ 036	12."
26/04/2017	23:30:58	0023	01.4		Exc.	_FULL_ 036	12."
26/04/2017	23:31:02	0035	01.5		Exc.	_FULL_ 036	12."
26/04/2017	23:31:05	0021	04.8		Exc.	_FULL_ 036	12."
26/04/2017	23:31:09	0054	04.2		Exc.	_FULL_ 036	12."
26/04/2017	23:31:13	0021	04.4		Exc.	_FULL_ 036	12."
26/04/2017	23:31:16	0021	03.7		Exc.	_FULL_ 036	12."
26/04/2017	23:31:20	0022	04.5		Exc.	_FULL_ 041	12."
26/04/2017	23:31:24	0033	04.4		Exc.	_FULL_ 047	12."
26/04/2017	23:31:27	0040	04.1		Exc.	_FULL_ 048	12."
26/04/2017	23:31:31	0024	04.3		Opt.	_FULL_ 047	12."
26/04/2017	23:31:35	0034	04.2		DRY.	_FULL_ 046	12."
26/04/2017	23:31:39	0023	01.5		DRY.	_FULL_ 045	12."
26/04/2017	23:31:42	0037	01.5		DRY.	_FULL_ 044	12."
26/04/2017	23:31:46	0022	01.5		DRY.	_FULL_ 043	12."
26/04/2017	23:31:50	0028	01.2		DRY.	_FULL_ 042	12."
26/04/2017	23:31:53	0040	01.3		DRY.	_FULL_ 041	12."
26/04/2017	23:31:57	0035	01.5		DRY.	_FULL_ 040	12."
26/04/2017	23:32:01	0023	01.5		DRY.	_FULL_ 039	12."
26/04/2017	23:32:04	0045	01.3		DRY.	_FULL_ 039	12."
26/04/2017	23:32:08	0024	01.4		DRY.	_FULL_ 039	12."
26/04/2017	23:32:12	0034	01.5		DRY.	MIDDLE 038	12."
26/04/2017	23:32:16	0024	01.4		DRY.	MIDDLE 038	12."

FIG. 5: Report of Solar Powered Wireless Irrigation System.

VII. CONCLUSION

Now a day's water and energy saving methods is main idea in irrigation. We noticed that, in previous irrigation system there is lots of wastage of water, wastage of electricity and large human efforts are needed. All problems discussed above are reduced, by using Solar Powered Wireless Irrigation System. Monitoring the crop field area without human interaction is implemented in real time with the help of Zigbee network which is wireless transmission between sensor and coordinate node. We have successfully designed a monitoring system for farmers that will graphically represent the temperature and panel voltage of the field using VB. The system is power efficient, cost-effective and user friendly. It also makes the job of farmers easier as it is efficient enough to monitor the crop condition and controls the basic parametric of the irrigation system. This system is scalable, as it allows any number of devices to be added with no major changes in its core architecture. Currently, the humidity, water level, soil moisture sensor and temperature sensor has been interfaced successfully with Atmega328. To modernize agriculture with optimum expenditure the present system is model.

VIII. REFERENCES

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