

Solar Powered Irrigation System

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Abstract— In this paper the irrigation systems to support people who are involved in agriculture in terms of effective utilization of natural resources like solar energy and water resource is reviewed. Various irrigation systems based on Internet of Things, solar power, sensors and embedded controller are discussed. By using smart irrigation system people can overcome from the problems of scarcity of electricity and water wastage.

Keywords: IOT, Sensors, Microcontroller and Irrigation system

I. INTRODUCTION

In India, Agriculture is the major sector in terms of water consumption. As the population increases water consumption and water wastage also increases. In order to avoid this efficient automated irrigation system is required which is based on Internet of Things [1]. In rural areas there is scarcity of electricity, this can be overcome by using solar energy. Solar energy is used to generate electrical energy using solar panel. Solar panel produces the DC electricity. Solar panel contains photovoltaic (PV) cells which converts light energy into electric energy [2].

Measuring soil moisture is important for agricultural applications to help farmers to manage their irrigations system more efficiently. The soil moisture sensor is basically used to measure the volumetric water content in soil. When the water level is low in the field the motor starts automatically to pump and vice versa [3]. The system can be automated using Microcontroller.

Microcontroller accepts the signals from the sensors and provides the commands to do the respective work [4].

II. EXISTING METHODS

A. Solar Powered based irrigation system

The scarcity of electricity is one of the big issues in agricultural field. This problem can be overcome by making use of solar energy which is renewable energy and abundant in nature. The electric energy is generated by solar energy using solar panels. This electrical energy is used to power the submersible pump to pump and store the water. Solar panels consists of PV (photovoltaic cells) cells which converts light energy into electrical energy. These PV cells are also known as solar cells [2].

The system is driven by using sufficient amount of power which generated by solar energy. The Solar tracker system in such a way that it tracks the movement of the sun in bi directional movement. The power obtained by solar tracking is almost constant over a period of time when compared with the output obtained by panel without tracking [5].

Due to scarcity of electricity fossil fuel-based water pumping system is used for irrigation purpose. The

alternative to the fossil fuel water pumping system is the automatic solar energy water pumping system.

This system contains the solar panel to convert solar energy to electrical energy. This energy can be used in two ways either directly or stored in external battery [6].

B. Sensor Based Irrigation System

The temperature sensor and soil moisture sensors are used for irrigation system to avoid the water wastage. The moisture content in the soil is detected by using soil moisture sensor. When moisture content is low and the temperature is high then the water flow will be high and vice versa [1].

The moisture sensor and pH sensor is used in the irrigation system where moisture level is measured by using moisture sensor and the pH value is measured by pH sensor in the soil[2]. The Moisture sensor, Humidity, Temperature sensor and ultrasonic sensor are used to sense the data like Moisture content, humidity and temperature level in the soil and water level of reservoir [4].

C. Microcontroller Based Irrigation System

The Microcontrollers are used to automate the irrigation system. The whole system can be controlled by the microcontroller. The main heart of the irrigation system is microcontroller. The sensors sends the signals to the microcontroller Based on this signals microcontroller gives the commands to do the particular function.

A PIC Microcontroller is used to control the whole system moisture sensor detects the level of moisture in soil if moisture level is decreased PIC microcontroller sends a command to switch ON the pump. A PIC Microcontroller accepts the signals from the sensors and gives the commands to the submersible pump which is used to pump and store the water. The water will be supplied to the crops by drip irrigation technique using microcontroller [2].

Embedded controller is used for the watering operation automatically. Here KL25Z embedded microcontroller is used. The soil moisture is placed in the field when the moisture level in the soil is less controller gives signal to display which makes switch ON. The ON/OFF status of motor is indicated using LED. This ON/OFF message is displayed by using LCD. Hence in this system the overflow of water reduced in the field [3].

Atmega328p Arduino microcontroller is used to automate the system. The operation of motor is based on moisture content in the soil and temperature present in the atmosphere. Motor operates to maintain soil moisture content within minimum and maximum moisture threshold value [8].

D. IoT Based Irrigation System

An IoT based irrigation system that drives by fuzzy logic. The system contains Mamdani fuzzy controller which is designed and implemented using MATLAB. Here fuzzy

rules are applied to control the flow of water from the pump and produce irrigation in proper time and frequency. The ZigBee based wireless network is applied widely in the system for real time applications [1]. A smart irrigation system monitoring and control features is designed and implemented by using Internet of Things.

The ESP8266 is the main controller of the system. then it will cut off the pumping. ESP8266 is used to connect the system to internet it supports WIFI connection and cloud is integrated so that it can connect to an Android phone.

All the real time value can be fetched and displayed on the application. SSIS is the Android app developed in this system. The SSIS is an efficient and cost-effective alternative to the manual irrigation system [9].

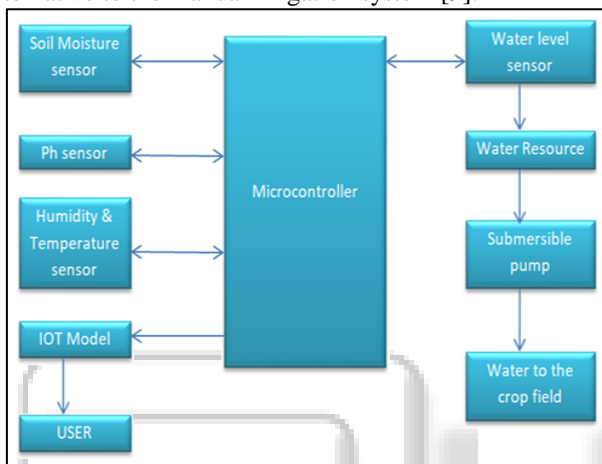


Fig. 1: Block diagram of Microcontroller and Sensor Irrigation system.

The above figure shows the block diagram of Microcontroller and Sensor irrigation system. The whole system is automated by Microcontroller. Soil moisture sensor is basically used to measure the volumetric water content in the soil. If the moisture content in the soil is low it sends the signal to microcontroller. The pH sensor is used to measure pH content in the soil. Humidity sensor is used to measure the moisture and air temperature. Microcontroller accepts the signal from the sensor and it sends the commands to the submersible pump to pump the water from water resource. The water level sensor is used to indicate the water level in tank.

III. CONCLUSION

The proposed system is helps the formers to use the solar power to drive the system and it reduces the dependency of power supply from grid. It saves the electrical power by using solar energy. The system will be completely automated and there will be no wastage of water. The efficient irrigation system has developed based on level of moisture in the soil. This is the user-friendly irrigation system that provides real time information to the user by using IoT technology.

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