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Solar Powered Smart Irrigation System

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Abstract: *Agriculture is a very important sector, and plays a key role in the economic development of the country. In the field of agriculture, use of proper method of irrigation is important. The paper represent development of an automatic irrigation system which switches the pump motor ON/OFF on sensing the moisture content of the soil. The advantage of using this method is to reduce human intervention and still ensure proper irrigation. The prototype system is based on the use of Programmable logic controller which is programmed to receive the input signal as varying moisture condition of the soil through the sensing arrangement and operates the pump.*

Key words- *PLC, Solar Panel, SMPS, Moisture Sensor, Battery, DC Pump.*

INTRODUCTION

Water is a precious resource. We use thousands of cubic meters of purified water to maintain the parks and green areas in cities and towns. Water availability is a critical variable for every economic activity, including agriculture and industry, the energy sector and public use.

In agricultural system, farmers rely on controllers with a fixed schedule to operate the irrigation systems. These controllers are usually programmed to satisfy the peak water need, and end up wasting a lot of water on cold or cloudy days. Farmers with drip and sprinkler systems also use fixed schedule irrigation programmers and thus end up wasting large amounts of water in cold days and at the beginning of the growing season when the crop water needs are minimum. Since irrigation process has been converted as a complex process because of less manpower is available for low paid jobs like these.

The purpose of this work is to develop automated irrigation systems that use a single climate criterion to adapt daily irrigation depths to plant needs, by using PLC and sensing devices. This work intends to develop a cost-effective irrigation controller that is adaptive to daily climate conditions, without the need for expensive sensors and costly weather-stations. It is also reliable and easily accessible in order to work under harsh outdoor conditions without the need for supervision or regular monitoring. From time to time a technician may manually adjust the watering schedule, but such adjustments are usually only made a few times during the year, and are based upon the technicians. These changes to the watering schedule are typically insufficient to achieve efficient watering. An automation of irrigation system is needed to overtake these problems which apply water to the fields based on the water requirements of the plants or crops.

For example, Wheat, Paddy, Sugarcane crops moisture content of soil is detected and irrigated automatically. Automatic irrigation system is used to optimize the usage of water by reducing wastage and reduces the human work. The energy needed to the water pump and controlling system is given by solar panel. Solar panels which are small grid that can be produce excess energy. By using solar energy reduces the energy crisis problem. The system requires minimal maintenance and attention because they are self-starting. This system demonstrates the feasibility and application of using solar PV to provide energy for the pumping requirements for sprinkler irrigation.

HARDWARE IMPLEMENTATION:

1) COMPONENTS AND RATINGS:

The various components used in development of automatic solar powered irrigation system one listed in table.

Sr. No .	Name of Components	Specifications

1.	Solar Panel	• Wattage (W) : 10 • Voltage at Max Power, Vmp (V) : 17.8 • Current at Max Power, Imp (A) : 0.57 • Open Circuit Voltage, Voc (V) : 21.8 • Short Circuit Current, Isc (A) : 0.61 • Product Dimensions (L*W*H) : 340x280x22
2.	Soil Moisture Sensor	• Range : 0 to 45% volumetric water content • in soil (capable of 0 to 100% VWC • with alternate calibration) • Accuracy : ±4% typical • Power : 3 mA @ 5VDC • Operating temperature : –40oC to +60oC • Dimensions : 8.9 cm × 1.8 cm × 0.7 cm (active • sensor length 5 cm)
3.	DC Pump	• Working Voltage : 4v- 12V • Working Current : 0.8A • Motor Diameter : 27mm • Water Pump length : 52mm • Drain Hole : 4mm • Weight : 70g
4.	Battery	• Nominal voltage : 6V • Rated Cap : 1.3 AH Aprrox. • Weight : 0.30kg • Terminal standard : F3- TAB 187A • Operational temperature : Charge 00 C (320 F) – 400 C (1040 F) • Discharge -200 C (-40 F) – 500 C (1220 F) • Storage -200 C (-40 F) – 400 C (1040 F) • Capacity 250 (770F) : 20 hour rate (0.065A) 1.3AH • Capacity affected by temperature :
		400C (1040F) 103% • Constant voltage charge : Cycle Initial charging current >0.39A • 7.2 V – 7.5 V at 250C (770F) • Maximum discharge current : 19.5 A
5.	Relay	• Voltage : 24 –30 Volts • Pull-in voltage : 16 Volts • Drop-out voltage : 2.4 –10 Volts • Life cycles : 250,000 • Max Amps NO : 30 • Max Amps NC : 10 • Coil resistance : 255 +_ 15 Ohm
6.	PLC	• Input Voltage :24 V DC • Permissible range: 10.8 to 28.8V DC • Power consumption : 20 to 75 mA • Voltage failure buffering : typ. 5 ms • Power loss : 04 to 1.8 W

2) HARDWARE ARRANGEMENT:

Schematic arrangement of the components used for irrigation system is as shown in figure.1.

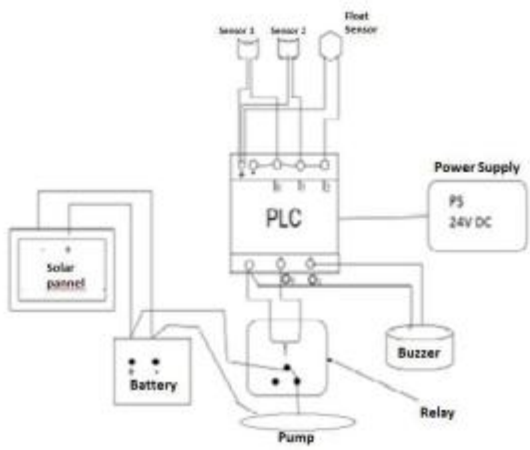

Fig.1. Schematic Diagram

WORKING:

Fig. shows circuit diagram for Auto Irrigation system using PLC and SCADA. The proposed system derives power from sunlight through photo-voltaic cells. Hence, the system cannot depend on availability of supply.

Fig 2. Picture representation

In this proposed model by using sunlight energy, battery is charged which power the irrigation pump. The circuit comprises of soil moisture sensor inserted in the soil to sense whether the soil is wet or dry. Wet soil will be more conductive than dry soil. The soil sensing arrangement module has a comparator in it. The voltage from the prongs and the predefined voltage are compared and the output of the comparator is high only when the soil condition is dry. This output from the soil sensing arrangement is given as the input to the PLC.

When the moisture level of the soil is low then the sensor detects the soil condition and gives condition to the relay unit connected to the pump. It will ON in dry condition and switch off the pump when the soil is in wet condition i.e. when the moisture content in the soil is minimum 20%.

Irrigation becomes easy and accurate, with the automated and solar power operated pump system and can be implemented in agricultural fields for more efficient irrigation. By means of this system, we can control the amount of water released from the reservoir. This control system monitors and controls all the activities of drip irrigation system efficiently and economically. Using this system, manpower can be saved, as well as with this system the productivity is improved and ultimately the pro.For example, Wheat, Paddy, Sugarcane crops moisture content of soil is detected and irrigated automatically. Automatic irrigation system is used to optimize the usage of water by reducing wastage and reduces the human work. The energy needed to the water pump and controlling system is given by solar panel. Solar panels which are small grid that can be produce excess energy. By using solar energy reduces the energy crisis problem. The system requires minimal maintenance and attention because they are self-starting. This system demonstrates the feasibility and application of using solar PV to provide energy for the pumping requirements for sprinkler irrigation.fit is achieved.

CONCLUSION:

Implementation of the proposed system is beneficial for the farmers . Energy crisis is a problem in rural area therefore this is also useful to the proposed prototype based on solar. The availability of water in the soil is indicated by the sensors and accordingly the pump can be turned ON/OFF. Even though this system requires more investment but it solves more irrigation problem after long run of this system.

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