Fabrication of Solar Augmented Automatic Water Level Sensing and Water Pumping System for Irrigation

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Abstract:

Agriculture is a very unpredictable occupation in the world. The yield depends on a complex combination of a lot of factors like irrigation, climate, fertility of soil, and freedom from pests. Thus, the farmer has to take care of a lot of factors simultaneously. The proposed system aims to help the farmer focus on other aspects of agriculture, by automating the entire process of irrigation. Automation has created a bigger hype in the electronics. The major reason for this hype is automation provides greater advantages like accuracy, energy conversation, reliability and more over the automated systems do not require any human attention. The system uses sensors to sense the moisture content from soil at the field. Using the sensed parameters, this system switches the irrigation water pump through switches like relays. The purpose of the proposed model is to make an automated water pump control system to the irrigation fields. This system is capable of sensing the water content in the soil and takes the intelligent decision of switching ON/OFF the water pump depending on the water level present. Also, solar energy is used to power up the circuit. This system also provides provision for storing solar energy, which can be used during nights to switch ON the water pump.

Index terms:
Solar panel, Inverter circuit, Electro magnetic relay, soil moisture sensor, battery.

I.INTRODUCTION:

Highly interaction in human machine in daily lives has made user interaction progressively very important. Expansion of sensor based advanced technology sophisticated human force and stress along with power conservation with automation system.

Power conservation, which has become a major challenge for the users and that, is the driving idea behind our project. Power conservation system can be successfully designed only when it is interfaced with automation system. This kind of power conservation systems finds their vast application in the IT companies, banking sectors, Public organizations, and large-scale industrial sectors.

Here large number of High voltage as well as low voltage devices is employed to fulfill different consumer as well as the employ needs. In this kind of scenario there is a need to replace the switches and other fuses with relays and circuit breakers to design systems, which are capable of switching very high voltage devices and also low voltage devices.

Automation is the most frequently spelled term in the field of electronics and electrical. The hunger for automation brought many revolutions in the existing technologies. One among the technologies, which had greater developments, is the sensor based alerting technology and applications designing. These had greater importance than any other technologies due its user-friendly nature. In nowadays, we must make use of various high-tech tools and equipments to get our jobs done and make our life comfortable

And the sensor is the inseparable part of human lives today.The energy conversation is very important in the current scenario and should be done to a maximum extent where ever it is possible. Irrigation of a field is releasing the amount of water required by the crops depending on the amount of water that can be absorbed by the soil. It also depends on the climatic factors, the most important of them being – air temperature and soil moisture.

**Fig-1: Image of the proposed model**

II. RELATED WORK:

The idea behind the proposed system is to design an automatic irrigation water pump control to the overhead tanks in irrigation fields, in apartments etc. This system is capable of sensing the water level in the tank and takes the intelligent decision of switching ON/OFF the water pump depending on the water level present. The growth of crops involves a lot of factors and these factors have to be monitored very carefully for their healthy growth. But, precisely, there are three important things which are needed for the growth of a crop

• Soil: A crop is cannot be grown in any soil and a soil is not suitable to all crops. A particular crop can grow only on certain types of soil.

• Water: Only freshwater can be used to irrigate the crops. Salt water cannot be used to water the crops. Agriculture requires withdrawal from freshwater resources. Agriculture is a major draw on water from aquifers.

• Sunlight and climate: Climate has the potential to affect agriculture through changes in temperature, rainfall (timing and quantity), CO_2, sunlight and the interaction of these elements.

Water is one of the most important factors for the growth of crops. Irrigation of the field takes care of this factor. Sunlight and climate change are natural factors and cannot be controlled. Soil in a particular field remains the same for a long period of time. Thus, irrigation is a factor of agriculture that is in the control

of the human being and by effectively managing the process of irrigation, the healthy growth of the crops can be ensured to some extent. The presented paper discussed about water its precious usage in the scarce resources required for food production in the world. Attention should be taken to utilize this resource efficiently. Selection of an appropriate Agriculture Solar powered method of irrigation based on crop and soil type is a prerequisite for efficient utilization of water.
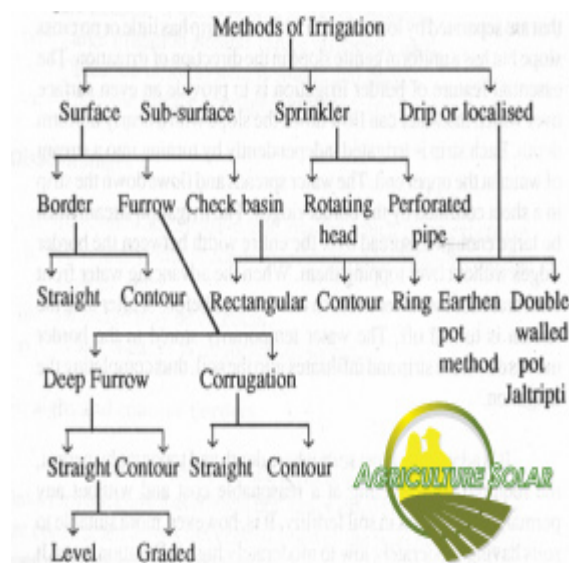
Fig-2: Figure of the water usages in the agricultural fields

Characteristics of an efficient Agriculture Solar method of irrigation, factors affecting the suitability of irrigation method systems and cultural practices for increasing water use efficiency are also highlighted. Methods of Irrigation are probably one of the oldest technologies around with many different irrigation methods systems been invented. Since the dawn of time humans have always been in search of more efficient and effective ways to deliver adequate water to their crops. Before processed food came into existence growing one's own food was vital and without proper irrigation methods one was reduced to filling buckets of water for the crops manually. With approximately 60% of the earth's fresh water being used to irrigate crops it is not reasonable to assume that all the farmers in the world grab their buckets and do watering of crops. Although that method of irrigation was the lifeline of the farm decades ago it is not only wasteful but also not practical. Today with the constantly evolving Agriculture Solar technology farmers are no longer slaves to the manual grind of having to carry water.

There are actually two popular Agriculture Solar irrigation methods that are being used today. The first is the Agriculture Solar drip irrigation method and the other is the Agriculture Solar spray irrigation method. Each method has its advantages and with proper customization contributes greatly to the conservation of water through near complete elimination of excessive spillage and water waste.

III. HARDWARE DESIGN OF PROPOSED SYSTEM:

In this paper we presented an advanced Solar Augmented Automatic Water Level Sensing and Water Pumping system for Irrigation.
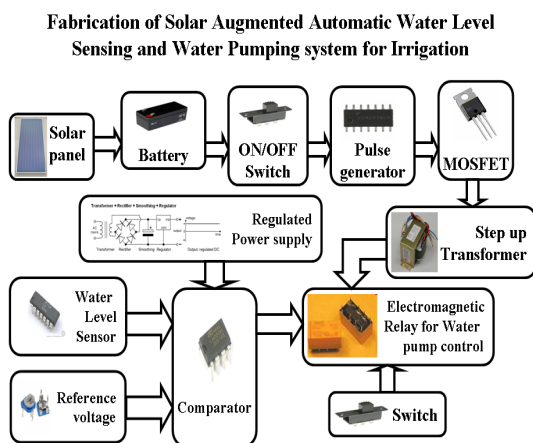

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Fig-3: Block Diagram of the Proposed Model

The proposed working model of the system consists of two sections mentioned below-

(i) Water level sensing and controlling water pump
(ii) Solar based power generation with inverter design

The controlling section consists of water level sensor, comparator, relay, switch, and regulated power supply unit. The system makes use of a comparator. The output from water level sensor detecting probes sensor is fed to comparator. The comparator will continuously compare output from probes and reference voltage and generates logic low or high. The output generated from comparator is used to drive a water pump through an electronic switch Relay.

a. LM324 Water level sensor:

The LM324 series consists of four independent, high gains; internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits which now can be more easily implemented in single power supply systems. For example, the LM124 series can be directly operated off of the standard +5V power supply voltage which is used in digital systems and will easily provide the required interface electronics without requiring the additional ±15V power supplies.

b. LM358 comparator:

The LM358 is a great, easy-to-use dual-channel opamp. Opamps have so many applications we figured we should probably carry at least one in a DIP package. LM358 applications include transducer amplifiers, DC gain blocks and all the conventional opamp circuits. If you're looking for a good, standard opamp the LM358 should fill most of your needs. It can handle a supply of 3-32VDC and source up to 20mA per channel. This opamp is great if you need to operate two individual opamps from a single power supply and Comes in an 8-pin DIP package.

c. Relay:

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism, but other operating principles are also used. Relays find applications where it is necessary to control a circuit by a low-power signal, or where several circuits must be controlled by one signal. The relay has a wire connecting the armature to the yoke. This ensures continuity of the circuit between the moving contacts on the armature, and the circuit track on the printed circuit board (PCB) via the yoke, which is soldered to the PCB.
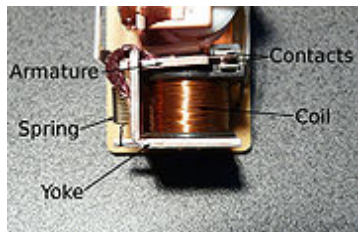
Fig-4: Image of internal structure of Relay

The power generation section consists of Solar panel, MOSFETS, IC 4047 pulse generator, Step-up transformer.

d.Solar panel:

The solar cells are also called photovoltaic (PV) cells, which as the name implies (photo meaning "light" and voltaic meaning "electricity"), convert sunlight directly into electricity. A module is a group of cells connected electrically and packaged into a frame which can then be grouped into larger solar arrays. A solar cell or photovoltaic cell is a device that converts solar energy into electricity by the photovoltaic effect.

e.MOSFETS:

The metal–oxide–semiconductor field-effect transistor (MOSFET, MOS-FET, or MOS FET) is a transistor used for amplifying or switching electronic signals. Although the MOSFET is a four-terminal device with source (S), gate (G), drain (D), and body (B) terminals, the body (or substrate) of the MOSFET often is connected to the source terminal, making it a three-terminal device like other field-effect transistors. The MOSFET is by far the most common transistor in both digital and analog circuits, though the bipolar junction transistor was at one time much more common.

f.IC4047 Pulse generator:

The CD4047B is capable of operating in either the monostable or astable mode. It requires an external capacitor (between pins 1 and 3) and an external resistor (between pins 2 and 3) to determine the output pulse with in the monostable mode, and the output frequency in the astable mode. Stable operation is enabled by a high level on the astable input or low level on the astable input.

The output frequency (at 50% duty cycle) at Q and Q outputs is determined by the timing components. A frequency twice that of Q is available at the Oscillator Output; a 50% duty cycle is not guaranteed. Monostable operation is obtained when the device is triggered by LOW-to-HIGH transition at + trigger input orHIGH-to-LOW transition at – trigger input. The device can be retriggered by applying a simultaneous LOW-to-HIGH transition to both the + trigger and retrigger inputs. A high level on Reset input resets the outputs Q to LOW, Q to HIGH.

g.Step-up Transformer:

In case of step up transformer, primary windings are every less compared to secondary winding.Because of having more turns secondary winding accepts more energy, and it releases more voltage at the output side. . The alternating current flowing in the primary produces a magnetic field in the core, which then induces current flow in the secondary winding circuit. A primary objective of current transformer design is to ensure that the primary and secondary circuits are efficiently coupled, so that the secondary current bears an accurate relationship to the primary current.

IV.CONCLUSION:

The existed model of "Fabrication of Solar Augmented Automatic Water Level Sensing and Water Pumping system for Irrigation" was designed such that an automated water pump control system is capable of sensing the water level in the soil and takes the intelligent decision of switching ON/OFF the water pump depending on the water level present. The system also, solar energy is used to power up the circuit. The project makes use of a solar plate. The solar energy obtained is stored to a battery and is fed to pulse generator and in turn to a MOSFET which is capable of generating ON/OFF pulses of different frequencies.

This is fed to a step up transformer to generate a low voltage AC. This AC is fed to electrical device like water pump for pumping water to the irrigation fields. This system also provides provision for storing solar energy, which can be used during nights to ON the water pump. This system can be used to control the water pump even at over head tanks in apartments, house holds etc.

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