

Solar Powered Automatic Irrigation System using Soil Moisture Sensor”

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Abstract – Water is a critical input into agriculture in nearly all aspects having a determining effect on the eventual yield. Good seeds and fertilizers fail to achieve their full potential if plants are not optimally watered. In spite of water scarcity farmers also face electrical crisis due to increased demand for electrical energy with the growing population. solar powered auto irrigation system gives the solution for the above problem by using the soil moisture sensor based on solar power. Solar energy is best way for the irrigation purpose to overcome energy crisis problem. The solar panel will extract energy from the sun and convert into electrical energy which is stored in the battery. Automatic irrigation using solar power can be efficiently used for the proper management of irrigation. Proper irrigation increases fertility rate of field and can get maximum production of crops by increasing yields and the quality of the crop by improved management of water during critical plant growth stages. The benefit of solar based automatic irrigation using soil moisture is the field gets continuous water and plants grows fast. The proper management of water helps to get rid of problem from water scarcity. If automated system is not working then pump can be also operated manually. The manual operation can be done through the manual switching system. Another benefit of the manual operation is we can also use the pump to supply the water. The soil moisture sensor measures the soil resistivity or volumetric moisture contain of soil in terms of voltage.

1. INTRODUCTION

For the development of country agriculture plays vital role. Most of the land in world are cultivated land but they are not able to utilize properly due to lack of proper knowledge or due to scarcity of water. Lot of lands have to depend on monsoon rain and due to unfavourable season, crops are late grown or dried. Due to intermittent nature of rain, farmers have to invest on water, which ultimately increase the cost of production. As we know there is lack of proper market for agricultural products, high investment during production is not feasible. In some places there is no problem of water scarcity, but due to mismanagement of water crops are dying and due to over floods production rate of the crops or fertility of land decreases. Solar based automatic irrigation, using soil moisture sensor helps to maintain proper water supply at equal interval of time, which will get rid of the problem of water scarcity and over use of water through automatic system. For the fulfilment of water problem many technologies have made lots of methods and types of irrigation systems. But in today's

world the demand for fossil fuel is high and as they are non-renewable, it is preferable to use renewable energy sources. For the problem of energy crisis and load shedding, solar energy is the best way. Hence solar based irrigation system is suitable.

In this system automatic irrigation is done by sensing the soil moisture placed in field. He moisture sensor measures the volumetric moisture content or soil resistivity present in the soil. If the moisture content in soil is less or soil is dry then pump will run and supply the water. Here controlling action is taken care by microcontroller and hence controller is heart of this system. In case of failure in automatic system the pump can also be operated manually through switch which will not stop the irrigation system but only thing is farmer presence is required.

2. LITERATURE SURVEY

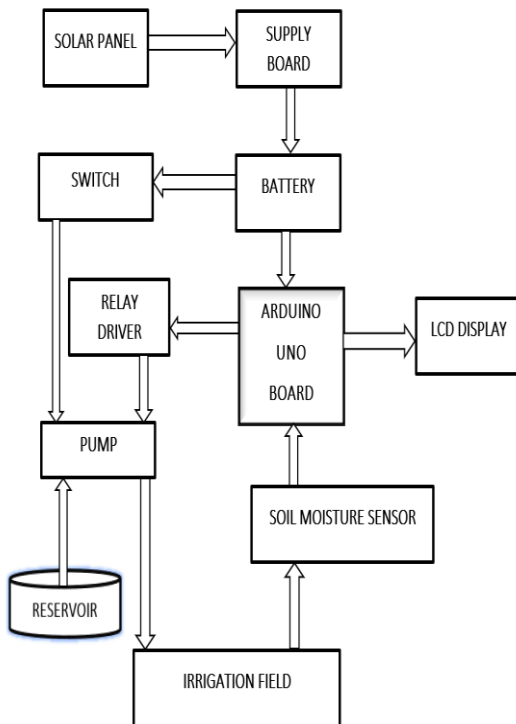
In early years, electricity is available only to a specific section of affluent society. The advancement in technology over time encouraged meeting the demands of common people in all parts of the world. The history of electricity meter is well connected involving research from past. The general usage of electricity in the early 1870's is only confined to telegraphs and arc lamps. With the invention of the electric bulb by Thomas Elva Edison, the power energy market became widely opened to the public in year 1879. Eventually, the progressive development in metering technology leads in enlightening the year 1888. Eventually, the progressive development in metering technology leads in enlightening the lives of many common people.

3. PROBLEM DEFINITION

There is scarcity of water and electricity for farmers. There was no proper methodology for the proper utilization of available resources. And farmers also need to water the crops manually depending on the moisture content of the soil. This project helps farmers to utilise the solar energy which is freely available and automatically provide water to the crops when required by sensing the moisture content in the soil there by utilising the water to a great extent. But there are chances of failure of automation system due to environmental conditions. Hence along with automatic system manual operation also should be there. Manual system will supply the water if any short circuit occurs in automation system. Irrigation system should not disturb to get target productivity so, by switching the manual switch we can irrigate the field. The pump installed for the irrigation,

only can irrigate the field where sensor is placed. Rather than no use, also by installing manual switch we can use pump to supply water for other purpose. If the battery is down and also solar system is not charging the battery, then system will not work, for smooth working of system adopter or main supply is needed. Hence multiple sources for power supply are proposed.

4. BLOCK DIAGRAM



5. METHODOLOGY

The whole system can be understood by looking at the block diagram. The solar panel will convert the solar energy into electrical energy and charging unit stores the electrical energy in the battery. The whole system, automation system as well as irrigation system is connected to the battery. The microcontroller controls and regulates all the parts of automation system. The LCD display, relay drive and soil moisture sensor placed in the field are connected to microcontroller through microcontroller board. The relay drive after the microcontroller is connected with power supply and pump and also connection is made in between power supply and pump through a switch for manual operation.

6. COMPONENTS REQUIRED

- Solar panel (PV-cell)
- Power supply board
- Battery

- ARDUNIO
- Soil Moisture Sensor
- LCD Display
- Relay Driver
- Pump
- Solar panel (PV-cell):

Solar panels harness the sun's energy in the form of light and convert the energy into electricity. Although the average consumer might associate solar panels with residential rooftop assemblies, solar panels are available for a wide range of applications, including powering individual gadgets, electronic devices and vehicle batteries. The smallest unit of a solar panel is the solar cell, also called a photovoltaic, or PV cell; it's the individual PV cell that turns sunlight into electricity. Individual cells arranged in a group are called a "module" or panel; a collection of two or more panels is called an array. According to the National Renewable Energy holds approximately 40 cells and the average residential array consists of 10 to 20 panels.

- Power supply board:

It is used for connection of negative and positive terminal of system where power supply is connected with three suppliers; solar panel, battery and main supply (adopter). Here solar panel is also connected with battery for charging purpose but while working with adaptor battery will not charge. For that connections are done through diode which prevents from back flow of charge and also switch the system.

- Battery:

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smart phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. Historically the term "battery" specifically referred to a device composed of multiple cells however the usage has evolved additionally to include devices composed of a single cell. The battery used is 12v dc battery which stores the charge and operates the system when required.

- **Arduino**

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without working too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

- **Soil Moisture Sensor**

Soil moisture sensor is used to measure the soil resistivity or volumetric water content of soil in terms of threshold. When sensor is placed in field, it measures the moisture or water level content in it. It gives a digital output of 5V when moisture level is high and 0V when the moisture level is low in the soil.

The sensor includes a potentiometer to set the desired moisture threshold. When the sensor measures moisture, it is compared by comparator LM393 with the set threshold. If compared value is more than the set value then, the digital output goes high and an LED indicates the glow. When the moisture in the soil is less than the set threshold, the output remains low and LED remains off. The digital output is sent to connected micro controller to sense status of field. The sensor also outputs an analog output which can be connected to the ADC of a micro controller to get the exact moisture level in the soil. This type of soil moisture sensor are easily available in market and easy to use and also low cost.

- **LCD Display:**

LCD (Liquid Crystal Display) screen is an electronic display module and finds a wide range of applications. A 16x2 LCD display is a very basic module and is very commonly used in various devices and circuits. Here display is used to indicate the condition of soil either it is dry or wet and also the status of pump when it is OFF or ON.

- **Relay Driver:**

A relay is an electro-magnetic switch which is useful to use a low voltage circuit to switch on and off a load connected to the mains supply. Here relay driver is used to

switch ON and OFF the pump on the demand of field. The relay driver is controlled by Arduino.

- **Pump:**

Pump is a device which moves the fluids by means of mechanical action. Pumps operate by some mechanism and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines or wind turbine, and come in many sizes, from microscopic for use in medical applications to large industrial pumps. Mechanical pumps serve in a wide range of applications such as pumping water from well, irrigations, pumping fuel, operating cooling tower.

The pump used in irrigation is self-priming centrifugal electrical pump. This type of pump is completely dipped into reservoir or bore well for pumping purpose. The pump moves the fluid from the reservoir and supply to the desired field. The distance of pumping depends on the head of pump used. The pump used in this model is 5V DC pump with head of 0.5 m.

SOFTWARE

Arduino Software (IDE) Compiler

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

7. CONCLUSION

Hence by implementing the automatic irrigation system, proper irrigation is done which maximizes the productivity of crops. The scarcity or deficiency of water in field is controlled and regular irrigation is done. By implementing manual switching, we use the pump to supply water. The pump is also used for filling the tank and used during cultivation of land. Besides, it helps to operate the irrigation system if any short circuit or failure occurs in automation system. The solar panel used here helps to overcome the energy crisis problem and a diode is used as an alternative subsidy for damage of battery or for cloudy days, where the battery is not charged sufficiently, our idea works successfully.

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