SOLAR POWER IRRIGATION USING WIRELESS SENSORS

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ABSTRACT

The objective of this briefing is to present an overview of the Solar power Irrigation System with Wireless Sensors. Our project involves presenting a model which will carry out irrigation process with automatic control, being powered by solar power. Solar powered irrigation system is the answer to the problems of Indian farmer. This system conserves electricity by reducing the use of grid power and conserves water by reducing water losses. In this paper, we propose a model of irrigation system powered by solar panels which drives pumps to pump water from the river to the tank, where it is stored. With the help of an outlet valve, regulated with using controller and moisture sensor, water is sent from the tank to the irrigation field where it is then sprinkled. A solar panel of required specifications is mounted near the pump set. Then, using a control circuit, it is used to charge a battery. From the battery using a converter circuit it gives power to the pump.

Keyword: - *Solar panel, Soil moisture sensor, Irrigation system, Solar pump, Microcontroller, Water level sensors, Humidity Sensors, etc…*

1. INTRODUCTION

The solar energy is the most abundant source of energy in the world. It's not only an answer to today's energy crisis but also an environmental friendly form of energy. The continuous increasing demand of food requires the rapid improvement in food production technology. In a country like India, where the economy is mainly based on agriculture and the climatic conditions are isotropic, still we are not able to make full use of agricultural resources. The main reason is the lack of rains & scarcity of land reservoir water. It is common to use diesel to power generators in agricultural operations. While these systems can provide power where needed there are some significant drawbacks, including:

• Fuel has to be transported to the generator's location, which may be quite a distance over some challenging roads and landscape.

• Their noise and fumes can disturb livestock.

• Fuel costs add up, and spills can contaminate the land.

• Generators require a significant amount of maintenance and, like all mechanical systems; they break down and need replacement parts that are not always available.

There are also major disadvantages in using propane or bottled gas to heat water for pen cleaning or in crop processing applications, to heat air for crop drying, including transportation to the location where you need the heat, costs of fuel and safety issues. For many agricultural needs, the alternative is solar energy.

There is an urgent need for a system that makes the agricultural process easier and burden free from the farmer's side. With the recent advancement of technology it has become necessary to increase the annual crop production output entirely agro-centric economy. The ability to conserve the natural resources as well as giving a splendid boost to the production of the crops is one of the main aims of incorporating such technology into the agricultural domain of the country. To save farmers effort, water and time. Irrigation management is a complex decision making process to determine when and how much water to apply to a growing crop to meet specific management objectives. If the farmer is far from the agricultural land he will not be noticed of current conditions. So, efficient water management plays an important role in the Irrigated agricultural cropping systems.

Day by day, the fields of electronics are blooming and have caused great impact on human beings. The project which is to be implemented is an automated irrigation method and has a huge scope for future development. The project can be extended to greenhouses where manual supervision is far and few in between. The principle can be extended to create fully automated gardens and farmlands. Combined with the principle of rain water harvesting, it could lead to huge water savings if applied in the right manner. In agricultural lands with severe shortage of rainfall, this model can be successfully applied to achieve great results with most types of soil.

By developing a Smart Wireless Sensor and by using upcoming techniques a farmer can increase his profit by solving different problems that are faced by the farmer in his routine life.

1.1 The Proposed Solution

We propose a model of irrigation system powered by solar panels which drives pumps to pump water from the river to the tank, where it is stored. With the help of an outlet valve, regulated with using controller and moisture sensor, water is sent from the tank to the irrigation field where it is then sprinkled. A solar panel of required specifications is mounted near the pump set. 4 LDRs are fitted onto the stand of the solar panel. These LDRs are connected to the microcontroller, which enables it to change the position of the solar panel in the direction of maximum sunlight to get maximum power. The submersible pump in the tank is used to pump water into the irrigation field. This pump is also connected to microcontroller which receives data from the moisture sensor about the moisture of the field. Judging on the moisture of the field, the pump is run for a specific time in order to optimize use of water. The solar panel is connected to a boost converter circuit which then leads to the battery. This circuit enables a regulated constant supply of current to the battery irrespective of the amount of sunlight being received by the solar panel. This battery then is used in order to run the submersible pump. This battery also runs the *Arduino- programmed* microcontroller which is used to regulate the working of pump, positioning of solar panel (based on LDRs) and the functioning of the moisture sensor.

2. LITERATURE SURVEY

PV cells are used as energy adopters from the sun which converts the solar energy into dc electric energy. This dc electric energy is stored in the battery. The supply from the battery is then regulated to the microcontroller and LCD display which runs on 5v dc. A relay is an electrically operated switch which creates a lever and changes the switch contacts. A small modification is proposed that the solar panel is directly connected to the battery via the converter circuit. This converter circuit converts the solar energy to electrical energy and provides maximum efficiency. Due to lack of electricity and mismanagement, in the manual control irrigation system many crops are dry or flooded with water. Farmers usually control the electric motors observing the soil, crop and weather conditions by visiting the sites. A sensor is sensing the moisture content of soil and accordingly switches the pump motor on and off. If soil is dry, the pump motor will pump the water till the field is wet which is constantly monitored by the microcontroller. There are many advantages of this system as the farmer does not have to visit his farms to operate the pump. This also results in optimal use of water in the field which leads to reduction in water wastage.

3. METHODOLOGY

In the solar pumping system photovoltaic cells are use as the energy adopter from the sun which converts the solar energy into dc electric supply. Solar panel charges the battery through charge controller. From the battery, supply is given to the motor directly in this work. The sensors used are soil moisture sensor, temperature & humidity sensor.
The sensor detects the values of soil moisture, temperature & humidity at different points in the field. Microcontroller according to pre-set value compares the measured values. Based on the error between the pre-set and measured values, motor ON/OFF condition is controlled. If the microcontroller gives the signal that moisture continuity is less or the soil is dry then this signal is given to the relay which is use as a switch or starter of the pump. After getting the signal the relay get operate and pump is started.

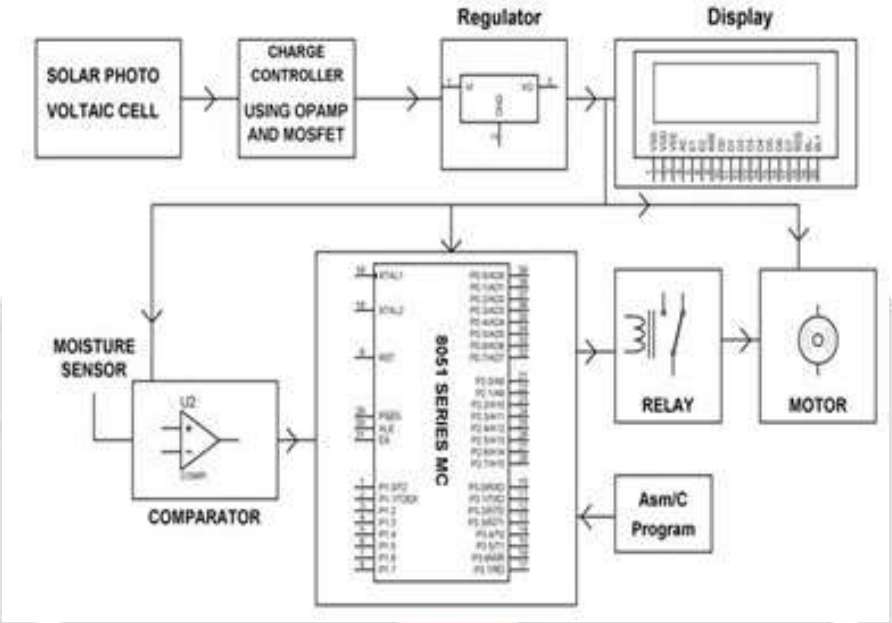

Fig -1: Block Diagram

3.1 Microcontroller

The ATMEGA8 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in system programmable Flash memory. The device is manufactured using Atmel's high-density non volatile memory technology and is compatible with the industry standard 80C51 instruction set and pin out.

3.2 Water Level Sensors

Level sensors detect the level of liquids and other fluids and fluidized solids, including slurries, granular materials, and powder that exhibit an upper free surface. Substances that flow become essentially horizontal in their containers (or other physical boundaries) because of gravity whereas most bulk solids pile at an angle of repose to a peak. The substance to be measured can be inside a container or can be in its natural form (e.g., a river or a lake). The level measurement can be either continuous or point values.

3.3 Humidity Sensors

A humidity sensor senses, measures and regularly reports the relative humidity in the air. It measures both moisture and air temperature. Relative humidity, expressed as a percent, is the ratio of actual moisture in the air to the highest amount of moisture air at that temperature can hold. The warmer the air is, the more moisture it can hold, so relative humidity changes with fluctuations in temperature. Humidity sensors detect the relative humidity of the immediate environments in which they are placed. They measure both the moisture and temperature in the air and express relative humidity as a percentage of the ratio of moisture in the air to the maximum amount that can be held in the

air at the current temperature. As air becomes hotter, it holds more moisture, so the relative humidity changes with the temperature.

3.4 Soil Moisture Sensors

Although soil water status can be determined by direct (soil sampling) and indirect (soil moisture sensing) methods, direct methods of monitoring soil moisture are not commonly used for irrigation scheduling because they are intrusive and labor intensive and cannot provide immediate feedback. Soil moisture probes can be permanently installed at representative points in an agricultural field to provide repeated moisture readings over time that can be used for irrigation management. This group of sensors estimate soil water content by measuring the soil bulk permittivity (or dielectric constant) that determines the velocity of an electromagnetic wave or pulse through the soil. Measuring soil moisture is very important in agriculture to help farmer for managing the irrigation system. Soil moisture sensor is one who solves this. This sensor measures the content of water.

3.5 Solar Panel

Solar panels absorb the sunlight as a source of energy to generate electricity or heat. Photovoltaic modules use light energy from the Sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells. The structural member of a module can either be the top layer or the back layer. Cells must also be protected from mechanical damage and moisture. Most modules are rigid, but semi-flexible ones are available, based on thin-film cells. The cells must be connected electrically in series, one to another. Externally, most of photovoltaic modules use MC4 connectors' type to facilitate easy weatherproof connections to the rest of the system. Modules electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired current capability. The conducting wires that take the current off the modules may contain silver, copper or other non-magnetic conductive transition metals. Bypass diodes may be incorporated or used externally, in case of partial module shading, to maximize the output of module sections still illuminated.

3.6 Arduino Software (IDE)

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino board. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students with or without a background in electronics and programming. Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a message - and turn it into an output - activating a motor, turning on an LED, publishing something online and many more. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

4. CONCLUSIONS

The primary applications for this project are for farmers and gardeners who do not have enough time to water their crops/plants. It also covers those farmers who are wasteful of water during irrigation. As water supplies become scarce and polluted, there is a need to irrigate more efficiently in order to minimize water use and chemical leaching. Recent advances in soil water sensing make the commercial use of this technology possible to automate irrigation management for vegetable production. However, research indicates that different sensors types perform under all conditions with no negative impact on crop yields with reductions in water use range as high as 70% compared to traditional practices. The main advantage of using solar energy comes with its simplicity. The fact that it can be used anywhere is a massive boost for solar community. It is safest system and no manpower is required. The system helps the farmer or gardener to work when irrigation is taking place, as only the area between the plants are wet. It also reduces soil erosion and at a time when people are urging for reduction in usage of fuels keeping pollution in mind, the solar energy system comes as a blessing in disguise.

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