Design and Implementation of Agricultural System Using Solar Power

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Abstract- From olden days we are using non renewable sources of energy in excess amount for our needs. As minerals like coal etc are exhausting, we have to depend on the renewable sources of energy like solar, wind, etc. Agricultural sector is backbone of Indian economy as population increases demand of water and food also increases. For smaller applications it is better to use renewable energy. Hence forth solar energy is choosed in order to develop agricultural system. It has been found that PV system is the best solution for remote agricultural system and for needs such as water pumping for crops. It presents the details of a solar-powered automated irrigation system that dispenses the exact amount of water required depending on the soil moisture, hence minimizing the waste of water. A network of sensor nodes is used to collect the humidity and temperature of the soil which is transmitted to a remote station.

Index Terms- solar panel, Moisture Sensor,

I. INTRODUCTION

A solar powered pumping system method needs to take proper account of the fact that demand for irrigation system water varies throughout the year. Solar-powered systems are being preferred for use in developing countries instead of other forms of alternative energy because they are extremely durable and can also exhibit long-term economic benefits. Solar powered water pumping systems can be the most appropriate solution for grid-isolated rural locations in poor countries where the levels of solar radiation are extremely high.

The solar PV panels have proven in time their ability to reliably produce sufficient electricity directly from solar radiation to power livestock and solar irrigation systems. Solar water pumps find their use mainly in small scale or community based irrigation fields, as large scale irrigation requires large volumes of water which in turn requires a solar PV array extremely large in size. As the water maybe required only during some parts of the year, a large PV array would provide excess energy which isn't necessarily required, thus making the system in efficient.

Drip irrigation is artificial method of supplying water to the roots of the plant. It is also called micro irrigation. In past few years there is a rapid growth in this system. The user communicates with the centralized unit through SMS. The centralized unit communicates with the system through SMS which will be received by the GSM with the help of the SIM card. The GSM sends this data to ARM7 which continuously receives the data from sensors in some form of codes. After processing, this data is displayed on the LCD. Thus in short whenever the system receives the activation command from the subscriber it checks all the field conditions and gives a detailed feedback to the user and waits for another activation command to start the motor. The motor is controlled by a simple manipulation in the internal structure of the starter.

II. THE MAIN OBJECTIVES

- The project includes implementation of irrigation system using solar energy.
- Solar water pump is made to work with solar energy. The rotatory motion of the motor is converted to electrical energy through generator this electrical energy in term is used to lighten the lamps and to drift the water from canal.
- The project includes the mechanism which facilitates irrigation system by measuring moisture level in soil continuously.

III. METHODOLOGY

System description: Proposed irrigation system consists of two main parts, solar pumping and automatic irrigation part. Solar panel charges the battery through charge controller. From the battery, supply is given to the motor directly in this work. Here the sensing circuit controls the motor. 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.

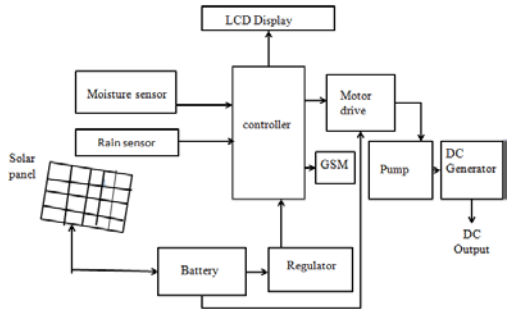
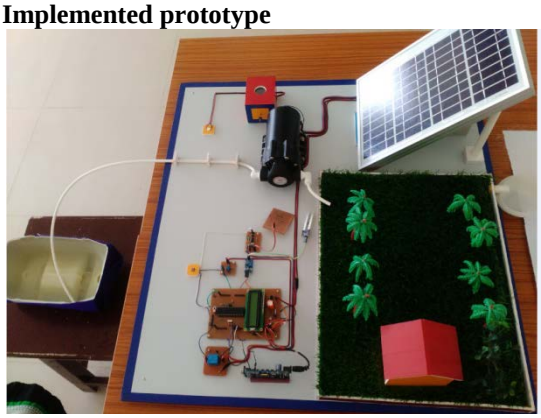


Fig1:Block diagram

Implemented prototype



IV. COMPONENTS USED

- Solar Panel, Charge Controller & Battery
- Power Supply
- Moisture Sensor
- GSM Modem
- Microcontroller
- LCD display
- Generator
- Pump

***A.* Solar Panel, Charge Controller & Battery:** The solar cells that we see are also called photovoltaic (PV) cells, which convert sunlight directly into electricity. A solar panel pumps electricity into a battery that stores it, but the solar panel has no control over how much it does or how the battery receives it. The charge controller (charge regulator) positioned between the solar panel and the battery regulates the voltage and the current and essentially halts charging activity temporally when necessary.

B. Power supply: A 12V dc supply of battery is fed to the 7805 regulators which converts it into regulated 5V DC supply. It is then, distributed to the motor drive. 5V is supplied to the Microcontroller.

C.* Moisture sensor*: The terms humidity and moisture are not interchangeable. Humidity refers to the water content in gases such as in the atmosphere. Moisture is the water content in any solid or liquid. It consists of a connecting probe, which is laid down in the soil. Moisture sensor is used to sense the moisture of the soil and sends the signals to the controller. If the moisture level reaches the below the pre-set value, then the water is sent to the field. These sensors have no moving parts, they are precise, never wear out, do not need calibration, work under many environmental conditions, and are consistent between sensors and readings. Moreover, they are not expensive and quite easy to use.

D. GSM modem: A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network.

E.Microcontroller: Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, and toys. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcntrollers make it economical to digitally control even more devices and processes.

F.Pumps: DC water pumps in general use one-third to one-half the energy of conventional AC (alternating current) pumps. DC pumps are Classed as either displacement or centrifugal, Centrifugal pumps use a spinning impeller that adds energy to the water and pushes into the system,submersible or surface types.

G.LCD Display: It is a combination of two states of matter,the solid and the liquid.LCD uses a liquid crystal to produce a visible image.LCD are super thin technology display screen that are generally used in laptop,tv etc.

H.Generator: It is a device that convert mechanical energy to electrical energy for use in external circuit. The reverse conversion of electrical energy into mechanical energy is done by electric motor. Many motors can be mechanically driven to generate electricity and frequently make acceptable manual generators.

I. Rain sensor: It is consist of base material as mica and in that aluminium wiring has been placed, which senses the rain and sends the notifications to the users through GSM.

V. FUTURE SCOPE

The solar powered automatic irrigation system is going to be very useful in the future. It has various advantages over the other conventional type irrigation system. To demonstrate the functionality and performance of the controller system, the prototype was implemented and tested. This will In future the advances in nano technology, improvements in smart grid and power electronics have major role in implementing solar energy policies. Our government, Research and laboratories, various solar organizations are working hard to make this solar pump set as agriculture and user friendly. Let we have a hope so that in one fine day all farm lands in India are provided with solar pump sets with SMS alert. help to minimize over water in gand crop production cost. The solar powered automatic irrigation system is going to be very useful in the future. It has various advantages over the other conventional type irrigation system. The components required for this type irrigation system is moisture sensors, relays, solenoid valves, and sub-immersible type pump and GSM.

VI. CONCLUSION

Irrigation has been the backbone of human civilization since man has started agriculture. As the generation evolved, man developed many methods of irrigation to supply water to the land. Motor with deep well pump has been utilized for water storage from Dam Lake to pool and motor with centrifugal pump is utilized for the purpose of transferring of water kept in pool to drip irrigation system. Since the increase in price per increase in

unit power output of a photovoltaic system is greater than that for a diesel, gasoline, or electric system, photovoltaic power is more cost competitive when the irrigation system with which it operates has a low total dynamic head. For this reason, photovoltaic power is more cost-competitive when used to power a micro irrigation system as compared to an overhead sprinkler system. Photovoltaic power for irrigation is cost-competitive with traditional energy sources for small, remote applications, if the total system design and Utilisation timing is carefully considered and organised to use the solar energy as efficiently as possible.

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