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Solar Powered Smart Irrigation System

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Abstract – Agricultural sector is backbone of Indian economy as population increases demand of water also increases. Usually lots of water wastage takes place in the land, due to improper method of irrigation. A solar-based smart irrigation system enables user to monitor the relative soil moisture at many different location throughout the field to more precisely scheduled irrigation cycle. By using solar energy, we can save the electrical energy. The sensing system is based on feedback control mechanism with microcontroller unit depending upon the varied requirement of different crops we can irrigate our field.

Keywords **-** Field sensors, Microcontroller, Smart Irrigation, Solar power.

INTRODUCTION-

Solar energy is widely available energy source in the world. Solar power is not only good by the view of the economy but also it is environment friendly form of the energy. Now days this energy is used in street light and in other domestic loads. In today's life due to advance technology's the cost of solar panel decreases, that will help to use solar energy in various sectors. One of the applications of solar energy is in irrigation system. In India there is major problem of energy, therefore solar energy is best solution for Indian farmer.

The continuously extraction of water from earth is resultant into decrease in water level from earth so that lot of land comes slowly in the un-irrigated zone, another reason of this is due to unplanned irrigation. Also now-a-day's population increases rapidly so demand of food also increases which doesn't get balance between demand and supply of food. To maintain this production of food should increase. Present work offers a simpler and economical solution to this problem.

LITERATURE REVIEW-

Concept of smart irrigation: The old irrigation methods are sprinklers and flood type system. In these methods, the consumption of water is in large amount. In the case of slopes in the field large amount of water moves downwards. Thus, the remaining part of field remains un-irrigated. Large amount of water goes waste in these methods. Such problem could be overcome by this work which uses sensors with microcontroller, hence 50% water saving is achieved. Use of solar panel makes this green way of energy saving. [1]According to the survey conducted by the Bureau of Electrical Energy, in India in 2011 there are around 18 million agricultural pump

sets and around 0.5 million new connections per year are installed with average capacity of 5HP. Total annual consumption in agriculture sector is 131.96 billion KWh. (19% of total electricity consumption) [2]

METHODOLOGY-

System Description: Proposed irrigation system consists of two 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. [2]

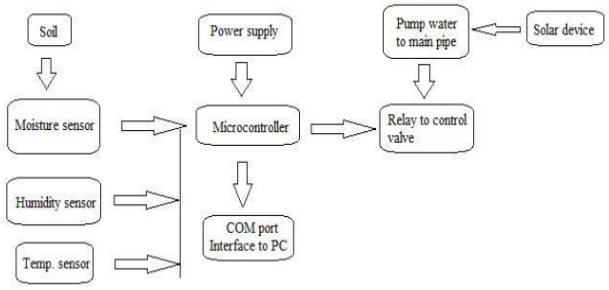


Fig.1. Block diagram of solar powered irrigation system

Figure 1 shows the block diagram indicating the main parts of solar powered irrigation system. 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. [3]

Components used:

- Solar Panel, Charge Controller & Battery
- Power Supply
- Moisture, Temperature & Humidity Sensor
- Relay
- Microcontroller
- LCD display

A. Solar Panel, Charge Controller & Battery

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. Solar panels are connected through an Array Combiner.

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 all the driver and relay circuits. 5V is supplied to the microcontroller and to all ICs used in the system.

C. Soil Moisture, Temperature & Humidity sensor

The health of a plant is influenced by many factors, one of the most important being the ready availability of moisture in the soil. Vegetation and crops always depend more on the moisture available at root level than on precipitation occurrence. The moisture sensor monitors the moisture content of the soil. It consists of a connecting probe, which is laid down in the soil. It 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.

Using the DHT 11 sensor, monitoring of the temperature & Humidity at regular intervals, is done. When it exceeds the particular temperature, the circuit sends the signals to the microcontroller. Based on the error signal error, the decision of turning the motor ON/OFF takes place. [4, 5]

D. Relay

Relay is also an electrically operated device which consists of operating coil, two contacts of NC and NO which is elaborated as Normally Closed and Normally Open contacts. When there is no supply to the coil there is no change in the contact position. When supply is given to the coil, the contact NO closes and NC opens. It is unchanged until the coil is in energized condition. [6]

E. Microcontroller- (ATMEGA8)

ATMEGA8 is a robust, 8 bit microcontroller that suits for such outdoor applications. There are 32×8 general-purpose registers having fully static operation. It contains 28-pin package. The feature of ATMEGA8 is 5/2 EPROM data memory. It contains Three ports namely port B, port C & port D. port B have 8-bit bi-directional I/O pins. Ports C have 7-bit bi-directional I/O pins. Ports D have 8-bit bi-directional I/O pins.[6]

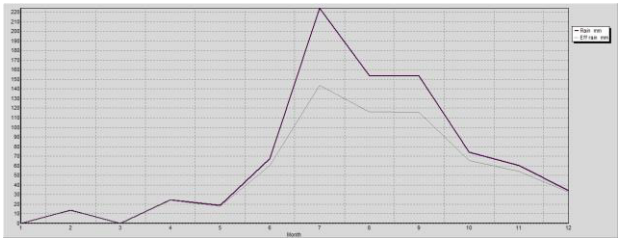
F. LCD

The standard liquid display used in this work is HD44780U. It is 16×2 Display i.e. 16 Characters per 2 lines. The LCD displays the motor ON/OFF state and displays the quantity of moisture, humidity, temperature.

I. Result And discussions

It is observed that, in India, during the month June-October session high rainfall takes place and during April to June and December to February, the rainfall is moderate.

Fig.2. Rainfall and Effective rainfall during the cultivation period



So most of the need of irrigation is during month December-February and April-June, but due to lack of water, amount of water for cannot be maintained in field, so there is need for saving the water and manpower. This scenario is implemented in this work considering following cases.

Motor ON/OFF Conditions

A. Initial stage- Irrigation ON

Case 1 – In this, we take the values from field sensor like soil moisture, temperature & humidity. If the input values are abnormal then motor starts.

Case 2 – When the temperature, humidity and moisture are normal during this case, the pre-set value and field sensors value are equal so motor will automatically turn off.

Case 3 – Either from temperature moisture and humidity is abnormal. In this case, if any one of the field sensor remains abnormal then pre-set value will not match with field sensor value, so motor will remains ON.

CONCLUSION-

At present, water saving technology is key point in irrigation. We observed that, in old irrigation system there is lots of water wastage, energy conservation and required large man power. By using Solar Powered Smart Irrigation System, all problems discussed above are minimized. The present system is model to modernize agriculture with optimum expenditure.

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