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RESEARCH ARTICLE

IRRIGATION CONTROL BASED ON SOLAR TRACKING SYSTEM.

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Abstract

The motivation for this project came from the countries where economy is based on agriculture and the climatic conditions lead to lack of rains & scarcity of water. The farmers working in the farm lands are solely dependent on the rains and bore wells for irrigation of the land. Even if the farmland has a water-pump, manual intervention by farmers is required to turn the pump ON/OFF whenever needed. In this paper we tried to minimize this manual intervention by the farmer. In recent times, the farmers have been using irrigation technique through the manual control in which the farmers irrigate the land at regular intervals by turning the water-pump ON/OFF when required. This process sometimes consumes more water and sometimes the water supply to the land is delayed due to which the crops dry out. Therefore in this paper we use sensors to control the turn ON/OFF of the motor. And to achieve maximum the utilization solar energy, solar tracking system model is added.

Introduction:-

Agriculture sector is a major source of income in a country like India. Irrigation is a scientific process of artificially supplying water to the land or soil that is being cultivated. Traditionally in dry regions having no or little rainfall water had to be supplied to the fields either through canals or hand pumps, tube wells. But this method had severe problems such as increase in workload of farm labor and often it lead to problem such as over-irrigation or under irrigation, and leaching of soil. Further there were issues like weeding, lesser yield of crop as an effect of above mentioned problems.

Hence there was a need for a way to test the soil condition before supplying water to the fields. This mechanism would reduce the workload of the farmer and help maintain proper soil conditions for improved and better crop production. Hence with the advance of technology it was possible to design systems that eliminated the direct involvement of the farmer with respect to irrigation of their fields. Irrigation systems can also be automated through information on volumetric water content of soil, using dielectric moisture sensors to control actuators and save water, instead of a pre-determined irrigation schedule at a particular time of the day and with a specific duration. An irrigation controller is used to open a solenoid valve and apply watering to bedding plants (impatiens, petunia, salvia). When the volumetric water content of the substrate drops below a set point.

The project “SOLAR TRACKING SYSTEM” is an attempt to achieve maximum utilization of the solar energy. This is achieved by tracking the movement of the Sun, and keeps charging solar cells below the Sun’s availability zone for maximum time. By this one can get the maximum utilization of the Sun presence.

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Literature Review:-

Yang et al. suggested a multi-functional remote sensing system that embedded RFID technology with that of spectral imaging and environmental sensing in a greenhouse system. Here use of multispectral images system for remote sensing of the canopy of cabbage seedlings. The parameters like Greenhouse temperature, relative humidity, and lighting conditions were analyzed and measured above the crop [4].

Also Yoo et al. obtained the results of real deployment of a WSN IEEE 802.15.4 compliant system that continuously monitor and control the environment in greenhouse systems at where melons and cabbages were being grown [6]. As we included author Baggio deployed a WSN for fighting against phytophtora seamlessly in a potato field. Phytophtora is a fungal disease that purely depends on the climatological conditions. So the used 868/916 MHz motes for measuring humidity and temperature. The objective of the system was to explain when the crop was at risk and know the farmer so that he will treat the plants only when really needed [7]. Speaking literally we have two general types of controllers are used to control irrigation systems they are as follows: one is Open control loop systems and another closed control loop systems. We are defining in an open loop system, in which operator makes the decision on the amount of water that will be supplied only when the irrigation event will occur. So therefore this information is programmed into the microcontroller and the water is applied according to the desired schedule planned. Finally Open loop controllers basically have a clock that is used to start irrigations. The limitations of open loop systems are there: o Inability to respond automatically to altering conditions in the atmospheric conditions. Moreover, they require frequent resetting to achieve high levels of irrigation efficiency [2]. Generally in closed loop systems, the operator develops a common control strategy. In this it is defined, in which control system takes over and makes particular decisions of regarding when to apply water and also how much quantity water to apply. Especially this type of system requires feedback from one or more sensors. In the same way closed loop controllers require data acquisition of certain environmental parameters (like soil moisture, temperature, radiation, wind-speed, etc.) on the other end system parameters (like pressure, flow, etc.). Closed loop controllers have their irrigation decisions based on the sensors that will measure soil moisture, temperature, humidity and evaporation and other climatic data to estimate water requirement of a crop [2]. As depicted in the below block diagram (i.e. Fig 1) we used different types of sensors their functionalities is to send the input data to the 89C51 Microcontroller. Now the microcontroller controls the operation through the commands which were previously written in the program and are used easily by the end user (farmer).

Methodology:-

This model consists of three Modules:-

1. Initially sensor module which is placed on the field monitoring parameters and to irrigate the field properly based on the monitored parameters reading.
2. The monitoring has system has 5 sensors those are conductivity sensors, fire sensors, soil sensors, human or animal detection sensors and ultra-sonic sensors.
3. The conductivity sensor helps in examining whether the water spread all over the field. Soil sensor helps in growing crops suitable at that particular field.
4. Fire sensor is designed to detect presence of fire or flame in the field and water.
5. Human or animal detection sensor senses the entry of human or animal arrival in the field and thereby prevents the damage of crops.
6. All these sensed parameter values are send to farmer via microcontroller through RF transmitter and receiver. The monitored sensor information will be sent to multi-vibrator then it controllers the speed of the motor via interfacing stage then microcontroller will send information to the base station unit via RF transmitter.
7. The RF receiver which is present in base station unit will receive the information which is transmitted from RF transmitter and sense the information to the microcontroller via interfacing stage.
8. The microcontroller will display the respective information on LCD display.
9. The maximum utilization of solar energy is achieved by tracking the movement of the sun and keep charging solar cells below the sun's availability zone for maximum time.
10. The Light Detection Resistor (LDR) is used to sense the orientation of sun and based on the received signal the orientation of the stepper motor will take place at an angle of 45 degree and 180 degree at day and night.

Block Diagram:-

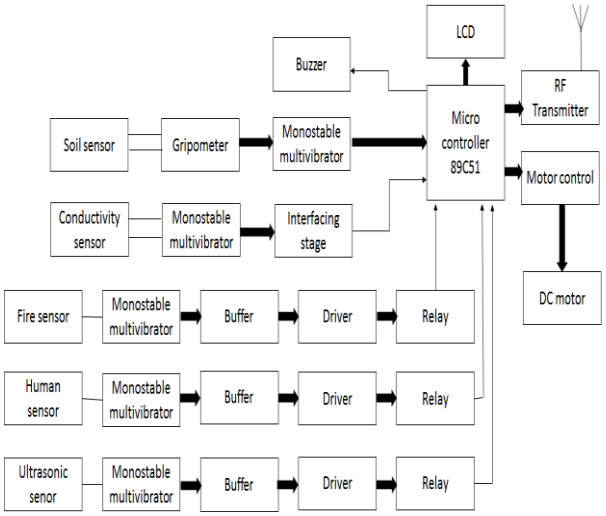

Fig1:- Proposed block diagram of system module.

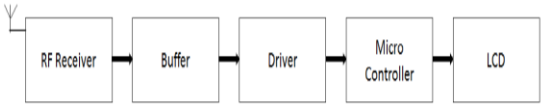

Fig2:- Proposed block diagram of Base station module.

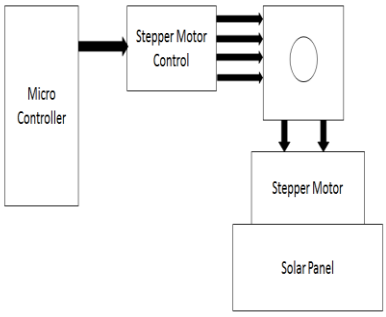

Fig3:- Proposed block diagram Solar tracking module.

Experimental Results:-

Water level is sensed and accordingly field is water. Fire is detected and measures are implemented to switch-off the flame. Intruders are sensed and given danger message to farmer. Soil texture is sensed and crops are cultivated accordingly in the field. Using solar tracking system 60% of efficiency is increased. Overall water resource is efficiently conserved. Every information is sent and displayed using LCD present in the base station and provided to the concerned person.

Conclusion:-

The project is thus carried out using Microcontroller. This project finds application in domestic agricultural field. In civilian domain, this can be used to ensure faithful irrigation of farm field, since we have the option of finding out moisture level of soil in a particular area. Shortage of water globally is also emphasizing the need of systems that not only control the crop irrigation but also provide the intelligent way to provide water to only those places where it is needed and in the required quantity. Thus we conclude that, by using the proposed technique, we get the following advantages - Increasing Irrigation Efficiency, Reducing the Labor cost, Saving water and electricity.

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