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An Optimized Equipment for Measurement of Soil Parameters and Conservation of Water in Agricultural Fields

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ABSTRACT: Nowadays agricultural field is facing lots of problems due to lack of water resources. In order to protect agricultural field and for helping the farmers by overcoming their difficulties this equipment for conserving water has been suggested. The main aim is to automatically control the water flow to the agricultural field by sensing various parameters in the soil and also to optimize water flow with the intelligence of surrounding weather conditions. Based on the sensor values the water flow in the agricultural field has been controlled with the help of a PIC microcontroller along with the driver circuit. In addition to this, Rain detection sensor is also used to sense the weather condition and by this way also the further flow of water has been controlled. The pump is controlled automatically using the sensed values and it has been intimated to the farmer for their references through GSM.

KEYWORDS: Automation; wireless Sensors; Environmental Indicators; Water resources; GSM, PIC Microcontroller.

I. INTRODUCTION

Agriculture is the backbone of all developed countries. It uses 85% of available freshwater resources all inclusive, and this proportion will go on to be dominant in water utilization because of population increase and increased food demand. Nowadays agricultural field is facing lots of problems. There is an urgent need to create strategies based on discipline and knowledge for sustainable use of water, including technical, agronomic, managerial, and institutional improvement. There are many systems to achieve water savings in various crops, from basic ones to more technologically advanced ones. [1, 4, 5, 7, 10]

Zigbee have restrictions for certification, memory size, bandwidth size and the replacement with Zigbee compliant appliances is costly. It is less secured than a typical 802.11 wireless network. The main disadvantages of ZigBee include short range, low complexity, and low data speed. [4]

There were several kinds of irrigation such as flood irrigation, drip irrigation, etc. Flood irrigation comes under the conventional type irrigation and it produces 40% to 60% efficiency as water wastage is high here. So drip irrigation was found which produces 90% efficiency. In drip irrigation, the water flows as drop by drop to each root zone and hence the water has been used in an efficient manner. And this is the advanced irrigation method used everywhere. Also there is another type of irrigation called fertigation where the fertilizer is used properly and taken enough amount of fertilizer by the root zone through this irrigation method.

In another system, monitoring of water status for a plant was done and irrigation list is done on the basis of canopy temperature distribution of the plant. In accumulation, various systems have been developed to schedule irrigation of crops and optimize water. Irrigation systems can also be programmed all the way through information on volumetric water content of soil, using dielectric moisture sensors which manage actuators and save water. [10]

The latest smartphone irrigation sensors require Wi-Fi connection and in each part of the land a zigbee module should be placed compulsorily to run the system. The same zigbee module acts as a wireless node. The image processing requires high resolution mobile camera which should be placed inside the field and an irrigation application should be installed in it which makes the system more expensive. [1]

For the development of agricultural field, a huge number of sensors are used to increase the productivity. For the major replacement of image processing the sensors can be used and in turn it reduces the cost. [3]

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To water the plants when the volumetric water content of the substrate drops below a set point and to open a solenoid valve an irrigation controller is used. An alternative parameter to determine crop irrigation needs is estimating ET. ET is affected by various weather parameters, including solar radiation, temperature, humidity, air stream speed, and crop factor, such as period of development, range and plant density, management elements, earth properties, pest, and control of disease. Systems which works on ET have been developed that allow water savings of up to 42%on time-based irrigation schedule. In Florida, automated switching tensiometers have been used in combination with ET which is calculated from weather data to manage automatic irrigation schemes for papaya plants instead of using fixed programmed ones. ET-based irrigation methods and water status of the soil resulted in additional sustainable practice compared with set planned irrigation because of the lesser water volumes applied. [11, 13]

The robots designed for the agricultural development will be much more costly. Usage of many electric motor increases the work load of the controller and also the consumption of power. On the other hand the image processing techniques requires a high resolution camera and also it requires a PC or laptop. There are many chances for the robot to struck in the wet soil so, continuous monitoring of robot should be done. [2]

II. RELATED WORK

A. PROGRAMMED IRRIGATION SCHEME USING A WIRELESS SENSOR NETWORK AND GPRS UNIT

To optimize water use for agricultural crops an irrigation system was developed. It consists of a distributed wireless network of soil-dampness and temperature sensors which was placed in the root zone of the plants. In accumulation, a gateway block handles sensor information, activates actuators and sends data to a web application. A procedure was developed with threshold values of temperature and soil dampness that was programmed into a microcontroller-based opening to control the quantity of water. The scheme was driven by photovoltaic panels and had a duplex communication link based on a cellular-Internet interface which allows irrigation scheduling and data inspection to be encoded through a web page. [5, 8]

The CMOS and RISC combination has their advantage that low power consumption resulting in a very small chip size and it has a lesser pin count. Another advantage is that of CMOS has immunity to noise than additional fabrication techniques. There were many kinds of PIC series like 16F877, 16F877A, etc. FLASH etc. are used among them FLASH is the most newly developed. Technology that is used in PIC16F877 is a flash one and also the data is retained even when the power is switched off. It is easy to program also. [5, 8]

The automatic arrangement was verified in a sage crop field for 130 days and water savings of about 80% compared with customary irrigation practices of the agricultural area were attained. Successfully three replicas of the automatic system were used in other places for 18 months. The system is useful for water limited geographical isolated areas because of its energy independence and low cost. The automatic irrigation scheme implemented was found to be cost effective and feasible to optimize water resources for agricultural production. [5, 8]

B. DESIGN OF CLEVER OBSERVATION ANDCONTROL METHOD OF AQUACULTURE USING WIRELESS SENSORS NETWORK

A clever observation and control method of aquaculture based on wireless sensor networks are designed to adopt BP neural networks. It uses wireless sensor nodes to sense an array of water quality parameters which is sent to the on-site monitoring host computer through sink node. The control unit consists of decoupling neural network and fuzzy controller without using the necessity of environmental model identification. Remote data collection is done by remote monitoring and control computer using GPRS wireless communication technology. [6, 9]

Since 1980s, the aquaculture is filing in china, which has been progressively altered d from the usual extensive fanning to factory computerization and digitization. In order to improve the level of industrialized aquaculture, more number of control systems and modern aquaculture equipments were developed by china. Though, these systems and devices are expensive and the running cost is high, it is very difficult to support popularization in the domestic and at the same time, in some forced environment the application of wired communication is costly and more difficult. [6, 9]

C. SOIL DAMPNESS RECOVERY IN THE HEIHE RIVER BASIN BASED ON THE ACTUAL THERMAL INERTIA SCHEME

In the early 1970's a talented approach for land surface soil dampness retrieval is recognized by remotely sensed thermal inertia method. In order to calculate approximately the land surface soil dampness in dry regions, thermal inertia model was formulated to calculate the land surface soil dampness in dry regions which is based on the approximated energy budget equation and heat conduction equation at the terrestrial surface using the land surface temperature and reflectance calculated by the moderate resolution imaging spectroradiometer. Based on the thermal

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inertia model the soil thermal inertia of Heihe River Basin (HRB) was recovered. Moreover, by using a thermal inertia-soil dampness model along with secondary data such as bulk density and soil texture, land surface soil dampness was estimated. Therefore, by using the observations made at three automatic weather station (AWS) the results were verified experimentally. [7]

The soil wetness is one of the most significant hydrological state variable which plays a major role in understanding the energy budgets and land surface water. The Heihe River Basin (HRB) is considered as the second largest inland river basin which is located in the northwest of China, the water scarcity an obstruction to the public growth of the region. The upstream district of the HRB is considered as one of the main rural areas. [7]

III. PROPOSED ALGORITHM

In this module the temperature sensor, humidity sensor, moisture sensor, LDR sensor and rain detection sensor are the five sensors connected to port A pins of PIC microcontroller. All the sensors sense the values and display the values in LCD. If the sensed values went beyond the threshold value which has been set in the program by various analysis then the message will be sent to the user through GSM modem. To all the sensors 5V supply is given and to relay 12V supply is given since it takes more amps and the relay is connected to the 12V DC pump. Using keypad the mobile number can be set and reset based on the user need. The 10 seconds have been allotted for entering the new number if needed.

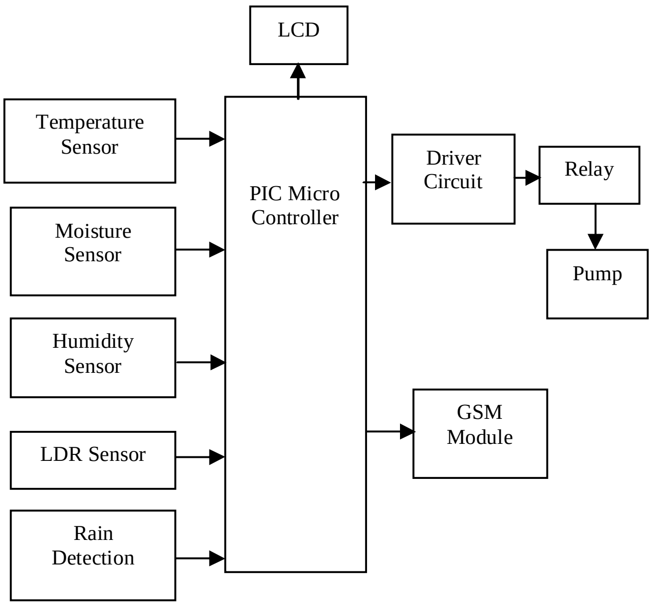

Fig.1. Block Diagram

The 230V supply is given to the three transformers and the required amount of voltage can been drawn related to the various components. Pump operation depends on the temperature range and if the temperature range is beyond the threshold limit then the pump is in ON state. The pump will be automatically switched ON and OFF by the relay circuit and the relay circuit is connected to the driver circuit which helps to switch the voltage.

IV. EXPERIMENTAL RESULTS

PIC 16F877Ais used in this project. PIC is used to interface the various components and set the command based on the requirements of the design. Proteus and MPLAB are used for the simulation purpose. By using these two software a schematic layout for the automated irrigation system is developed. Figure shows the schematic layout of the Automated Irrigation System using GSM Module and WSN. Figure 2 describes the entire components and connections

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made with various sensors, LCD, GSM modem, transformers, power supply circuits and keypad. Figure 3 implies the title "AUTOMATIC IRRIGATION METHOD USING GSM" in the LCD which is connected to the PIC microcontroller. Figure 4 displays the temperature, humidity, moisture, light intensity and rain detection sensor range. Figure 5 shows the message which is send to the user using GSM modem. If the sensed value goes beyond the threshold limit then the message will be sent to the user as shown in the above figure 5.

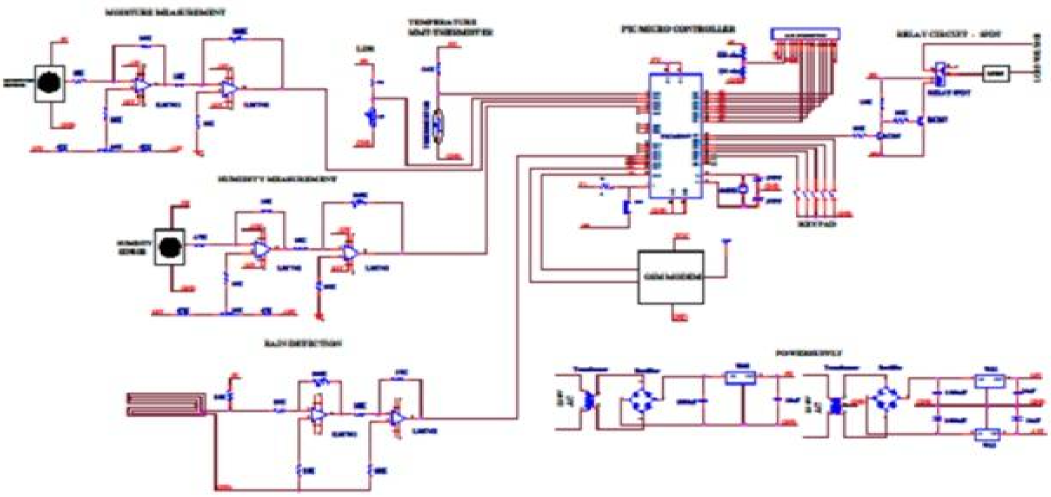

Fig.1 Circuit Diagram for Automated Irrigation System using GSM Module and WSN

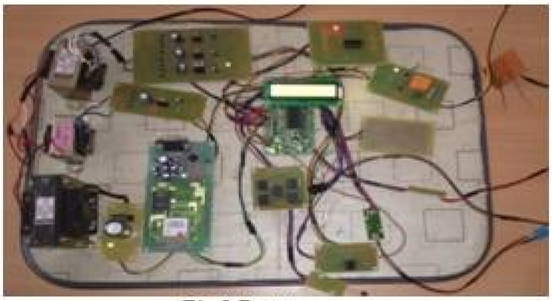

Fig.2.Prototype

Fig.3. LCD Display

Fig.4. Displaying various parameters

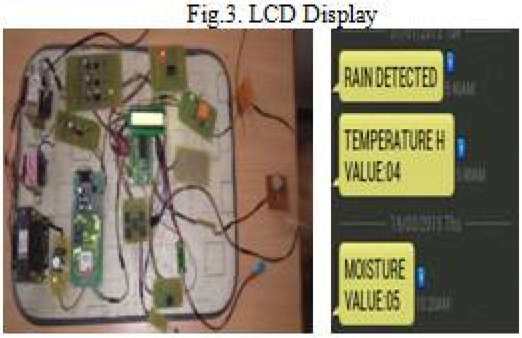

Fig.5. Message received from the working model

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Table 1 shows the analysis of day time, noon time and night time in a day. In these parameters such as temperature, light intensity, moisture content and humidity are measured and those results were tabulated.

Types of Sensors	Day Time	Noon Time	Night Time
Temperature	28^{o}c	33^{o}c	30^{o}c
Humidity	61	55	69
Moisture	220	170	210
Light Intensity	187	230	166

Table 1 Overall Analysis

V. CONCLUSION AND FUTURE WORK

In this paper, a variety of sensors like light intensity sensor, temperature sensor, humidity sensor, moisture sensor and rain detection sensor values have been estimated and displayed in the LCD. Certain limits have been set in microcontroller for all the sensors. If the sensed values go beyond the certain limit the message will be sent to the user through the GSM modem. The sensed value by temperature sensor crosses its threshold limit, and then the pump automatically comes to ON position. Later this technology can be extended to get much more efficient result for various fields. This method can be implemented in diverse fields such as medical, industries etc. In industry this technology has been widely used to find the temperature range as this sensor is an important parameter.

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BIOGRAPHY

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