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Remote Workspace Management System for Irrigation Fields

Bindu B[1], MuthuVangaliappan T[2], Sarma S[3], Santhosh S M[4], Prashanth R[5]

Assistant Prof., Department of Robotics and Automation Engineering, PSG College of Technology, Coimbatore, India [1]

Student, Department of Robotics and Automation Engineering, PSG College of Technology, Coimbatore, India [2,3,4,5]

Abstract:In a country like India, whose economy is mainly based on agriculture and the climatic conditions which are isotropic, we are still not able to make full use of agricultural re-sources. The main reason is scarcity of water. Another very important reason of this is due to un-planned use of water as a result of which a significant amount of water goes into waste. In the modern irrigation systems, the most significant advantage is that water is supplied near the root zone of the plants. But the modern day drip irrigation systems had not been automated. The problem incurred was the inability to adopt labour for just switching on/off the valves and one more problem unnoticed was closing of valves since it was a huge area. So, a low cost automation that is user friendly for uneducated farmers was required to handle the system. This situated can be improved if we use automatic controller based closed circuits of Mini-sprinkler irrigation system in which the irrigation will take place only when there will be intense requirement of water. The valves can be easily automated by using controllers and solenoids. Automating farm or nursery irrigation allows farmers to supply the right amount of water at the right time, regardless of the availability of labour to turn valves on and off. So, the implementation with a low cost processor will be able to sense the moisture content of the soil level and irrigate the crops. Use of wireless module and communication system like Zigbee would solve the problem of expensive cabling involved. An alarm or any signal would indicate if the connection between the sensors and the control system is lost to intimate the user so as to troubleshoot the problem. Effective programming would further improve the case.

Keywords: Automation, Drip Irrigation, Real Time Monitoring, Wireless Sensor Network.

I. INTRODUCTION

Farmers using automation equipment are able to reduce runoff from over watering saturated soils, avoid irrigating at the wrong time of day, which will improve crop performance by ensuring adequate water and nutrients when needed. Thus we can get "More Crop per Drop of Water". Automatic Closed circuits of Mini-sprinkler irrigation system is a valuable tool for accurate soil moisture control in highly specialized greenhouse vegetable production and it is a simple, precise method for irrigation. It also helps in time saving, removal of human error in adjusting available soil moisture levels and to maximize their net profits. The entire automation work can be divided in two sections, first is to study the basic components of irrigation system thoroughly and then to design and implement the control circuitry. Management plays an important role in the irrigated agricultural cropping systems. The demand for new water saving techniques in irrigation is increasing rapidly right now. In order to produce "more crop per drop", growers in (semi) arid regions currently explore irrigation technique [1]. In the modern drip irrigation systems, the most significant advantage is that water is supplied near the root zone of the plants drip by drip due to which a large quantity of water is saved, at the present era, the farmers have been using irrigation technique in India through the manual control in which the farmers irrigate the land at the regular intervals. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried. This problem can be perfectly rectified if farmers use automated intelligent wireless drip irrigation system by using linear Programming [2].

II. NEED FOR REMOTE WORKSPACE MANAGEMENT SYSTEM

Drip irrigation, also known as trickle irrigation or micro irrigation or localized irrigation, is an irrigation method that saves water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, Irrigation is an artificial application of water to the soil. An irrigation system is a system that delivers water to an area where water is needed but not normally present in the required amounts. Generally, it is used for agriculture and landscaping purposes. The effectiveness of the irrigation is determined by a number of different factors, including the type of irrigation system and the conditions at its time ofuse. Additionally, irrigation also has other uses in crop production, which include protecting plants against frost, suppressing weed growing in gain fields and helping in preventing soil consideration. In contrast, agriculture that relies only on direct rainfall is referred to Rain fed farming.

A. Suitable Slopes

Drip irrigation is adaptable to any farmable slope. Normally the crop would be planted along contour lines and the water supply pipes (laterals) would be laid along the contour also. This is done to minimize changes in emitter discharge as a result of land elevation changes.

B. Suitable Crops

Drip irrigation is most suitable for row crops (vegetables, soft fruit), tree and vine crops where one or more emitters can be provided for each plant. Generally only high value crops are considered because of the high capital costs of installing a drip system.

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C. Suitable Soils

Drip irrigation is suitable for most soils. On clay soils water must be applied slowly to avoid surface water ponding and runoff. On sandy soils higher emitter discharge rates will be needed to ensure adequate lateral wetting of the soil.

D. Suitable Irrigation Water

One of the main problems with drip irrigation is blockage of the emitters. All emitters have very small waterways ranging from 0.2-2.0 mm in diameter and these can become blocked if the water is not clean. Thus it is essential for irrigation water to be free of sediments. If this is not so then filtration of the irrigation water will be needed. Blockage may also occur if the water contains algae, fertilizer deposits and dissolved chemicals which precipitate such as calcium and iron. Filtration may remove some of the materials but the problem may be complex to solve and requires an experienced engineer or consultation with the equipment dealer. Drip irrigation is particularly suitable for water of poor quality (saline water). Dripping water to individual plants also means that the method can be very efficient in water use. For this reason it is most suitable when water is scarce.

E. Types of Irrigation

Surface irrigation, Localized irrigation (Drip, mini sprinkler, bubbler, etc.), Closed circuits of Mini-sprinkler irrigation system and Sprinkler irrigation.

Closed circuits of Mini-sprinkler irrigation system also known as Mini-sprinkler irrigation system is an sprinkler irrigation method which minimizes the use of water and fertilizer by allowing water to Mini- sprinkler slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, and emitter.

III. LIMITATION OF EXISTING AUTOMATED DRIP IRRIGATION SYSTEM

There are many existing automated drip irrigation systems available in market today. We can gone through few among them, where we figured it out the most major concern is the cost especially when it is implemented by Indian Farmers. The other concern is the knowledge of farmers for operating the automated systems with various control functions that is available in today's existing automated systems. Since it has several inputs that make the operation more complicated and several indicators and outputs that again make it complicated for the farmers to understand. The basic knowledge level of farmers has to be taken in account which existing automated systems lags behind as shown in Fig.1.

The other concern is attaining more specific data values in host computer that is readily available in today's systems, but it can't host in an Online Server basis at a very low cost level. Since, It may be useful for the community purpose, for instance – In order to monitor the correct working of the process and to note down the required water capacity to have a good maintenances of the various crops at the several soil beds available in a College garden by the officials for making their work easy instead of going on the field every time and checking whether everything is alright or not. So this can be hosting in Intra College Domain so that any authority can have a check at it from the place where they are, that makes their time more efficient. Thus there is a possibility to design a system.

Limitations of existing automated drip irrigation where the sensor data values could be collected by networking techniques and hosted on to the online server with a user friendly domain interface.The other concern is the current system employ irrigating technique based on Volume or

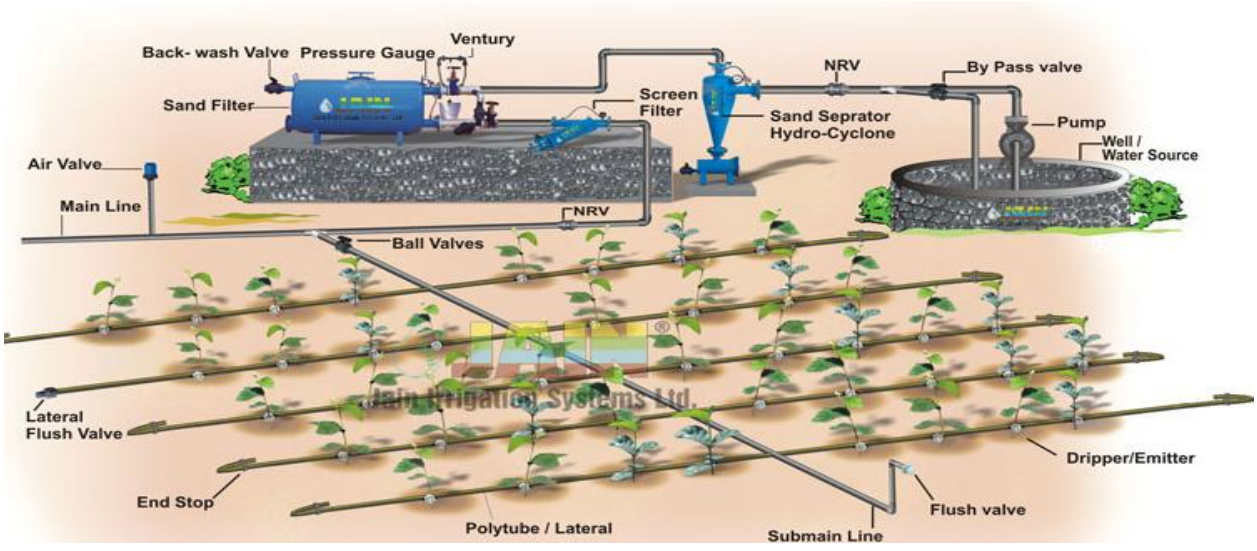

Fig. 1 Existing Drip Irrigation System

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Time parameter which causes problem in case of severe changes in natural climatic conditions. It makes user un-aware of when he goes to out of station when such incident happens. Thus there is again a clear possibility of sensing the current temperature, humidity parameter and irrigating accordingly that ensure farmers can conserve more water and reduce death of crops under such unbiased conditions. There are systems that employ sensing techniques with the on field parameters and irrigating accordingly, but they lack semi – auto operation techniques that can enable you switch between volume based control, time based control and fully automatic control. Since it is efficient depending up on the situations, thus for instance in case of user being available in his same place as that of the cultivation field then he need not switch to fully automatic and can save more energy but operating it under semi-automatic control that is Time based or Volume based Control.

IV. AUTOMATED WIRELESS DRIP IRRIGATION USING ZIGBEE MODULE

Temperature,light. It operates on only one condition at a time like if we using soil moisture sensor to control automated drip irrigation then whenever soil moisture level is get decrease then & then only it direct the valve to change its position from OFF to ON, and if soil moisture level is go t the proper pre-settled level at that time system is get OFF automatically. Here it is not going to check availability of water and requirement of water. But my system is going to check that and on that basis it is get operated. For that purpose I'musing linear programming approach in order to do proper use of available water all the available crops in the field where our system is get implemented to get maximum profit and also with the help of linear programming we easily identify available water and required water for the crops.

V. SYSTEM ARCHITECTURE

A. Sensors

Sensor Sense the different physical parameters like light, pH value of soil, temperature and humidity and converts these sense data into electrical signals (either voltage or current).

B. Signal Array

It is collection of various sensors basically it took input from sensor and fed that data as an input for the signal conditioning.

C. Signal Conditioning

It is very essential. Generally the signal obtained from sensors are weak hence we uses signal conditioning in order to keep signal in to its original state. That means it works as like amplifier.

D. ADC(Analog to Digital Converter)

It converts analog signal into digital signal and fed that digital signal to the micro controller as an input.

E. Local Area Network

A local area network (LAN) is a computer network that interconnects computers within a limited area such as a home, school, computer laboratory, or office building, using network media. The defining characteristics of LANs, in contrast to wide area networks (WANs), include their smaller geographic area, and non-inclusion of leased telecommunication lines.

ARCNET, Token Ring and other technology standards have been used in the past, but Ethernet over twisted pair cabling, and Wi-Fi are the two most common technologies currently used to build LANs.

F. Sensor Unit

The SU acquires data given by the ADC, and the data sent to BSU. Value of ADC input which comes from the sensor is stored in a 10-bit register. Different type of sensors can be added easily for future developments.

G. PC(Personal Computer / Server)

Basically for Data Acquisition as well as logging purpose we are going to use personal. The graphical visualization displays 3D Graphs generated from sensor values located across the field.

H. Wi-Fi Router

It is used to establish a wide bandwidth network of sending signals to several wireless devise inside the much defined range of the zone limit of the Wi-Fi router. It is very helpful in case of the several adverse climatic conditions like storms, winds, rain and bad climatic lighting since it has no impact in transmitting signals through aerial medium.

I. Valve Unit

A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports as shown in Fig 2. Multiple solenoid valves can be placed together on a manifold. Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design. Besides the plunger-type actuator which is used most frequently, pivoted-armature actuators and rocker actuators are also used.

There are many valve design variations. Ordinary valves can have many ports and fluid paths. A 2-way valve, for example, has 2 ports; if the valve is open, then the two ports are connected and fluid may flow between the ports; if the valve is closed, then ports are isolated. If the valve is open when the solenoid is not energized, then the valve is termed normally open (N.O.). Similarly, if the valve is closed when the solenoid is not energized, then the valve is termed normallyclosed. There are also 3-way and more complicated designs. A 3-way valve has 3 ports; it connects one port to either of the two other ports (typically a supply port and an exhaust port).

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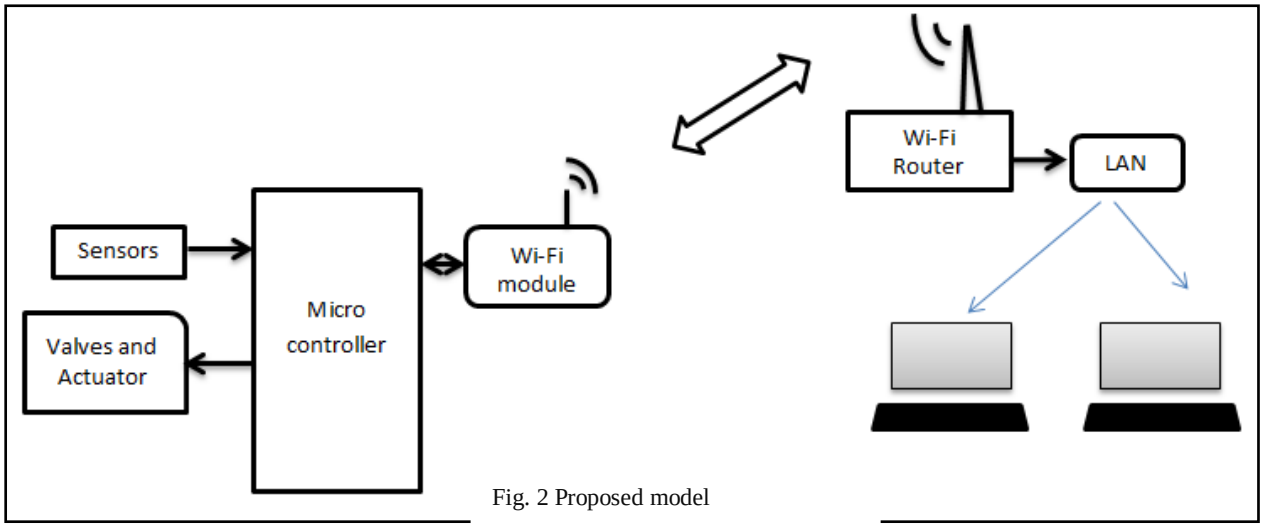

Fig. 2 Proposed model

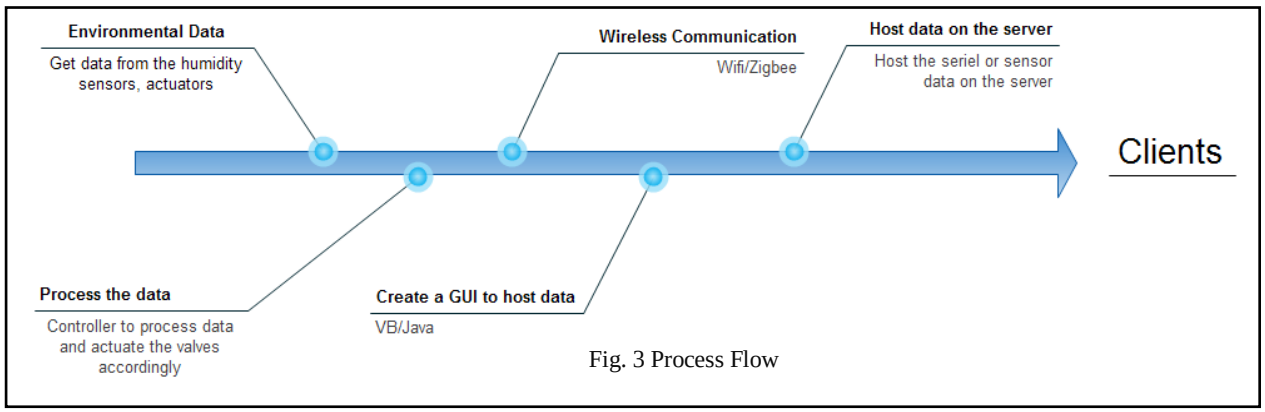

Fig. 3 Process Flow

VI. PROCESS FLOW

A wireless sensor network (WSN) for drip irrigation shown in Fig.3 consists of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

Wireless sensor networks (WSN) have recently been proposed for a large range of applications in home and industrial automation. It consists of many tiny nodes, which have several sensors and a radio interface that depends on the IEEE 802.15.4 standard that supports large number of embedded devices in one network. WSN can be used for many applications such as environment monitoring, medical applications, robotic systems and home and industrial automation.

VII. ACQUIRING AND HOSTING THE HUMIDITY SENSOR DATA ON SERVER

The internet is a versatile, convenient and efficient means of communication in the 21st century. Protocols such as Transfer Control Protocol/Internet Protocol (TCP/IP), User Datagram Protocol (UDP), Dynamic Host Configuration Protocol (DHCP) and Internet Control Message Protocol (ICMP) form the backbone of internet communications a large bulk of which consists of Hyper Text Transfer Protocol (HTTP) traffic for the World Wide Web. A HTTP or web server is a server process running at a web site which sends out web pages in response to HTTP requests from remote browsers. While high performance Onboard processors or 32 bit desktop computers are used for serving websites, much smaller and cheaper 8 or 16 bit microcontrollers, though not as powerful in terms of processing power, can do the job as well. This report details the workings of the embedded web server built for the project.

A suitable micro-controller (An onboard processor), both being versatile and adequate in terms of capability is necessary to accomplish the task. Building a HTTP server involved implementing several protocols, namely, UDP, TCP/IP, DHCP and Address Resolution Protocol (ARP). Testing also involves the implementation of ICMP. The micro-controller which has facilities for Ethernet and Cloud applications, either directly or through an Ethernet

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module will be sufficient. A RJ45 Ethernet jack was used to connect the Ethernet controller to a router. The web server was implemented with no problems and worked.
The server was able to send a DHCP request for an IP address from a router and served the required webpage on the browser when the IP address of the web server was entered. While the TCP stack is not fully RFC compliant, it is adequate for the purposes of this project. The webpage itself was stored in the flash memory of the micro-controller but future improvements could include adding an external EEPROM to support larger web pages.

VIII. CONCLUSION

The Automated Wireless Drip Irrigation System Using Zig bee Module proves to be a real time feedback control system which monitors and controls all the activities of drip irrigation system efficiently as well as it helps us for to do the efficient water management in order to get more profit with less cost. Using this system, one can save manpower, as well as water to improve productivity and ultimately the profit. In future if you modify it properly then this system can also supply agricultural chemicals like calcium, sodium, ammonium, and zinc to the field along with Fertilizers by adding new sensors and valves.
Also it is possible to registered farmer to download drip control timings from agricultural universities website and also for various cycles and timing control.

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