International Journal of Research in Advent Technology, Special Issue, ICATESM 2019
E-ISSN: 2321-9637
Available online at www.ijrat.org

Fuzzy Logic Controller for Irrigation Scheduling In Green-House Horticulture

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Abstract- As the soil moisture sensor of the irrigation management system has a nonlinear response and a significant time delay, it may take a considerable amount of man power to get satisfactory results by using a conventional feedback control method. Contrarily, an experienced human operator can often manage the irrigation system proficiently by simply using fingers as the sensors in deciding the timing for irrigation. Since fuzzy logic has the capability to mimic human being in reasoning, it is a good alternative for the conventional control method in this case. Fuzzy control rules are either synthesized through a careful examining of the nature of the irrigation system or instinctively generated during the control process. They can determine when and for how long the plants must be watered. Two sensing mechanisms are used in the system to monitor soil moisture and identify water drainage, respectively, The effectiveness of the fuzzy control system has been verified through experiments both in laboratory and greenhouse.

Index Terms- Decision-Making system, Fuzzy Logic Module, Controller, Internet of Things, Cloud Computing.

1. INTRODUCTION

some of the major problems faced by agricultural scientists and producers, when dealing with decisions aimed at improved crops yield or water usage, is the blurred boundaries between such lexical criteria as established in the technical literature. Besides, many of the percentages used to determine water or fertilizer quantities are found on rules of thumb, which sometimes are obtained from years of experience on particular crops on particular environments. This makes difficult not only to compare or test the performance of any proposed method of irrigation or fertilization in crops on particular environments. This makes difficult not only to compare or test the performance of any proposed method of irrigation or fertilization in anymore thanks to the Internet not many

abstract models are still available that may serve as quick decision tools for users.

2. RELATED WORK

Global evaluation of the effects of agriculture as well as water management adaptations on the water stressed population, Mitigation and Adaptation Strategies for Global Change[1]-Fresh water is the most important resources required for human existence, and ensuring its stable supply is a critical issue for sustainable growth. The effects produced by a general set of agriculture and water management adaptations on the size of the world's watery population were assessed for a specific but consistent scenario on socio-economic development and climatic change during the 21st century. Significant increase in the water-stressed population will occur in regions such as North Africa and the Middle East, India, Other South Asia, China and Southeast Asia. The key adaptation options differ by

region, depending on dominant crops, increase in specific crop demand and so on.[2]"Crop water requirements and irrigation scheduling"-With growing scarcity and growing competition for water, judicious use of water in agricultural sector will be necessary. This means that exact or correct amount as well as correct timing of operation should be adopted. This chapter discusses the detail method for crop, irrigation water necessity and latest concepts of the irrigation planning also strategies involved in irrigation scheduling. Numerous examples are incorporated to understand the procedure to calculate irrigation water requirement and irrigation scheduling too. In addition, techniques for command area evolution are explored along with sample illustrations of designing parameters for command area.[3]Irrigation scheduling - comparison of soil, plant and atmosphere monitoring approaches"- This paper considers relative merits of various alternative approaches about irrigation scheduling for horticultural crops. In particular, the use of conventional soil moisture constant observing is compared with another approaches based on sensing plant responses to water in soil deficits. These latter include direct monitoring of plant water level, the morphometric sensing of stem, leaf or fruit dimensions, the sensing of stomatal closure either by porometry or infrared sensing technologies, or the detection of responses such as xylem cavitations. The potential of infrared sensing technologies and

strategies for their use are also evaluated.[4]"Integrated processing and control of multiple environmental variables through Internet of Things (IoT) using COTS components"- Climate change has already shown its negative impact that has on agricultural activities and food production, particularly because of rainfall deficit or excess, temperature changes. In order to increase the understanding of plant growth in protected crops, Internet of Things (IoT) capabilities were integrated into a greenhouse, thus providing a platform for researchers that allow them to take decisions at the right time about irrigational actions. The designed system consists of electronic circuitry, sensors, mobile communication, actuators and software running in the cloud. The functionality of the system was tested in a cucumber vegetable production in a greenhouse, where the data acquired from environmental variables. [5]"Using IoT resources to enhance the accuracy of over drain measured values in greenhouse horticulture"- Climate change has already shown its negative impact that has on agriculture and food production, particularly because of rainfall deficit or excess, temperature variations and other associated environmental variations not amenable to sufferable agriculture. The designed system consists of electronic circuitry, sensors, mobile communication, actuators and software running in the cloud. The functionality of the system was tested in a cucumber vegetable production in a greenhouse, where the information acquired from environmental variables, substrate constrains, and over drain measurements are sent over the Internet for their remote inspection by researchers. [6]"An Intelligent Irrigation System Based on Wireless Sensor Network and Fuzzy Control"- In accordance to resolve the problems which include loss of soil fertility and waste of water resource in agricultural production, we have designed an intelligent irrigation system build upon wireless sensor networks and fuzzy control. The system mainly consists of wireless sensor networks and the monitoring center. All of the nodes in Monitoring zone, use solar power to collect the informative details of soil moisture, together with the growth data of different crops within different periods. Water content deviation in soil and the changing rate of deviation are taken as input variables of fuzzy controller, and the fuzzy control regular database is established for the fuzzy irrigation control system.

3. PROBLEM STATEMENT

In traditional irrigation systems ,various problems arises due to lack of knowledge about the scheduling. This leads to wastage of water, also affects the environment .recent studies have shown that not only more water supply to crop destroys the irrigation but less water supply to the crop also destroys the irrigational efficiency, so there is a need of proper scheduling. This project mainly focuses on water scheduling in an irrigation system , so as to avoid the water drainage.

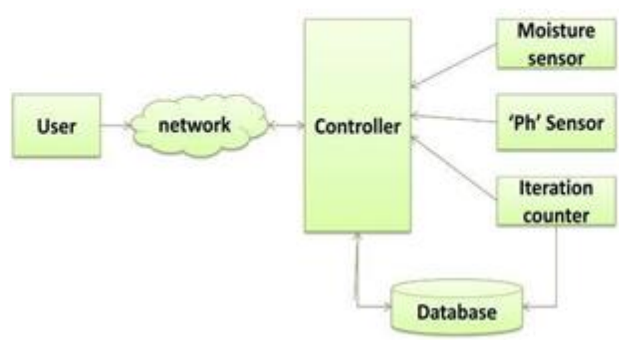
4. METHODOLOGY

An affordable data gathering unit has been shown in where a hardware and software description is made. This system allows for constant measurement of environmental variables (such as ambient temperature, humidity and light potency) as well as substrate moisture, drainage, pH and conductivity. This data is then loaded to the cloud for instant monitoring the processing.[7]The system's performance has been tested both in a controlled greenhouse, and in a microalgae culture, where acquired data from environmental variables, substrate moisture conditions and over drain collection, are sent over the Internet to be processed using data fusion techniques and expert based criteria.[8]Therefore, the means of having information for decision making on, for instance, how to minimize irrigation process frequency, required quantity of water, nutrients and fertilizers during the whole span of growth and production of a crop is available; this, of course, if data is handled with models that are capable of fusing it with human expertise. Here is where the use of FLM to translate lexical common sense rules into numerical values, considering the crop drainage data, may provide researchers and producers with a useful tool for efficiently planning their irrigation scheduling. The next steps were: first, to define which linguistic variables were related to the irrigation process; and second, to establish the necessary fuzzy sets with their related fuzzy rules.[9] In this system we are using an fuzzy logic controller for the scheduling of irrigation to avoid water drainage .We are using different sensors for measuring the moisture in soil also the PH level of soil. For measuring moisture we use soil moisture sensor & for the PH level of soil we are using PH level sensor .This sensors measures values & give it to controller, after this there is also need of iteration counter which gives the water iteration values. After storing all these values to database, user get an output to the web application.

Relevant mathematics associated with the Project :

- Let S is the system to avoid drainage in irrigation system
- S = { I, O, F,, Success, Failure}
- Where,
- I = Input
- I = {values from soil moisture sensor, values from flow sensor, previous water iterations}
  □ = Output
- □ = {prediction for number of future iteration of water to avoid drainage}
- F = {take values from moisture sensor, values from flow sensor, take history of previous iterations, predict future iteration to avoid water drainage}
- Success – Avoided water drainage successfully
- Failure – Problem in hardware

5. SYSTEM ARCHITECTURE



As shown in above fig.1.,system takes the environmental values from moisture sensors, Ph sensors and give that data values as input to the controller. Controller uses the iteration counter for knowledge about previous iterations and evaluates them to produce the informative output using fuzzy logic. At the same time ,these input and output data is stored in database to acknowledge the user about the actions performed via web application over the internet.

6. CONCLUSION

In this system ,fuzzy control rules are synthesize through a careful analysis of irrigation system and environment by using sensors. It helps to evaluate the amount of water required for the crops. It is inherently robust since it does not require precise, noise free inputs and can be programmed to fail safely if a feedback sensor quits or is destroyed. The output control is a smooth control function despite a wide range of input variations In future, it can be made multilingual which will ensure it is not be region restricted also it can be connected with GSM which will give the data in smartphones.It will make farmer digitalized and automatic.

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