UGC Approved Journal

IJIREEICE

ISSN (Online) 2321 – 2004
ISSN (Print) 2321 – 5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

ISO 3297:2007 Certified

Vol. 5, Issue 9, September 2017

A Review on Automatic Soil Water Controller for Different Crops in a Field

Khyati Solanki[1], K Uma[2]

Research Scholar, Dept. of Electronics Engineering, BIT, Durg, C.G., India[1]

Associate Professor, Dept. of Electronics Engineering, BIT, Durg, C.G., India[2]

Abstract: The efficient use of water in agriculture is one of the most important agricultural challenges that modern technologies are helping to achieve. In a country like India where people in huge number are engaged in agriculture, proper and precise irrigation system can lead to much better productivity. This paper presents a system capable of controlling an irrigation system autonomously. By acquiring soil moisture and temperature data, the system is capable to deliver proper quantity of water at the most different periods of crop growth, through the usage of a Programmable Logic Controller (PLC), optimizing the water supply. This project includes selecting field area as well the crop type in selected field.

Keywords: Soil moisture, PLC, Automatic irrigation, Temperature.

I. INTRODUCTION

The efficient use of water in agriculture is one of the most vital agricultural challenges that modern technologies are helping to achieve [1]. Agriculture is one of the main source of Indians livelihood. It also has a major impact on economy of the country. A major quantity of water is used for irrigation system and therefore 85% of available fresh water resources are used for yielding agricultural crops. Availability of water and its consumption is showing an inverse trend and it will further become adverse in the coming centuries. This is due to increase in population which has further added to the increase in demand for food. Agriculture is the main source of food production. There is need of an hour to use current technologies for implementing a method by which there can be a limited consumption of water [2]. One such system is designed in this project. Although smart irrigation has been developed but so far no solution is obtained to measure accurate and précised flow of water along with availability of data over website. This project will help in irrigating a particular crop with exact amount of water required by it. The further advancement in this project is that it provides the farmer to select a particular crop type out of the options provided. Along that the area of the field can also be selected. So that a single module can be used in various crops irrigation. Also, it will help the most to the farmers who are engaged in mixed cropping and will also promote mixed and other such cropping patterns.

II. LITERATURE SURVEY

The literature describes various progressions that have already been achieved and also the various advancements that are possible in the field of smart irrigation system. It gives the knowledge of various technologies used. A brief description of various processes and technologies used by various authors is given below:
H. Navarro-Hellín proposed an automatic Smart Irrigation Decision Support System, SIDSS, which manages irrigation in agriculture. The paper proposes an automated decision support system to manage the irrigation on a certain crop field, based on both climatic and soil variables provided by weather stations and soil sensors. The system estimated the weekly irrigations needs of a plantation, on the basis of both soil measurements and climatic variables gathered by several autonomous nodes deployed in field. This enabled a closed loop control scheme to adapt the decision support system to local perturbations and estimation errors. Two machine learning techniques, PLSR and ANFIS, were proposed as reasoning engine of our SIDSS. Their approach was validated on three commercial plantations of citrus trees located in the South-East of Spain. Performance was tested against decisions taken by a human expert.

Rashmi Jain proposed a method where sensors were placed and based on that water is supplied to the field and intimated to the farmer using software application. Wireless sensor networks, also called as wireless sensors and actor network, were distributed spatially autonomous sensors to monitor physical or environmental conditions as temperature, pressure sound, moisture etc. and it co-operatively passed these data via network to the main location. WSN was built of few to several thousand nodes, where each node was connected to sensors each sensor network node had typically several parts: a radio transceiver with an internal/external antenna, a microcontroller, an electronic circuit for interfacing with sensors and an energy source such as battery. Microcontroller transmitted the data's using RF module. This project offered stable remote access to field conditions and real-time control and monitoring of the variable-rate irrigation controller. The main purpose of this project was to monitor the paddy crop field in a wireless manner. The temperature, moisture and water level in the well using temperature, humidity and flow sensor respectively were sensed. The analog value from the sensors was converted to digital format by the ADC. The AT-mega controller controlled the output from the ADC.

Imene Yahyaoui is his paper has discussed an autonomous off-grid system for irrigation in semi- arid areas. In this research, the energy and water management for a photovoltaic water pumping installation used for irrigating tomatoes was developed by integrating fuzzy logic inside the control system. This management system first evaluated the water volume needed by tomatoes during the vegetative cycle considering a detailed model for the tomatoes evapotranspiration and irrigation frequency, following the site and crops characteristics. Based on this and the energy availability a control algorithm decided the switching of the relays which connect the main plant components (panels, batteries and water pumps). The control algorithm fulfilled the objectives by considering criteria related to the water volume needed to irrigate the crops, to the safe operation of the batteries and the continuous operating of the pump. The algorithm was tested in two cases study:during normal operation and during faults related with water losses.

Darshana Chaware The proposed a paper whose objective was to develop sensor based automated irrigation system to reduce water requirement and increase the productivity of orange orchard in Vidarbha region. The system was best suited for places where water is scarce and had to be used in limited quantity. Also, third world countries can afford this simple and low cost solution for irrigation and obtain good yield on crops According to her need for irrigation can be determined in several ways that do not require knowledge of evapotranspiration (ET) rates. One way is to observe crop indicators such as change of color or leaf angle, but this information may appear too late to avoid reduction in the crop yield or quality. Other similar methods of scheduling include determination of the plant water stress, soil moisture status, or soil water potential..

F. Rodriguez has the main objective to provide the necessary tools to apply the modeling and control techniques of continuous processes which have been studied in the corresponding didactic unit to a virtual plant, and their integration with in a sequential process. He has proposed a hardware-software architecture for control engineering education and a case study regarding greenhouse irrigation has been implemented.
Such control enables the agricultural engineering students to design the irrigation control system. The control strategy is implemented on the PLC which interacts with the virtual process by carrying out the necessary actions in order to control the appropriate variables of the process.

In this paper by D. Canone, a method that uses an advance-infiltration model based on four field measurements and the soil particle size distribution is proposed to estimate border-irrigation efficiencies. This method was applied to fifteen irrigation events and the application, storage and distribution efficiencies were estimated. The advance-infiltration model was validated against soil moisture measurements. The field-scale saturated hydraulic conductivity was estimated by model fitting to the measured depth of water infiltration. The sensitivity of the modeled irrigation efficiency to the operational surface irrigation parameters was evaluated by simulating seven irrigation scenarios based on field-collected data.

Hak-Jin Kim tried to develop an autonomous irrigation controller for Korean greenhouse cultivation in which various control logics for irrigation could be programmed. Specific objectives were to 1) develop an autonomous irrigation controller consisting of an 8-bit micro-control unit (MCU) and a 12-bit analog digital (AD) converter that could control irrigation events based on either a variable keeping a pause time method or a required water estimation method, and 2) perform a field evaluation conducted in tomato-growing greenhouses in order to investigate the effectiveness of using the autonomous irrigation controller for greenhouse cultivation in Korea.

Liu Xin developed a set of irrigation system controller with automatic regulation on plant moisture, nutrients. Its controlling core of the system is S7-300 PLC which is created by Siemens company. Measurement of the content of soil water and nitrogen (N), phosphorus (P), potassium (K) and other nutrient through the soil moisture sensor and ion sensitive electrode and input into system, use PID proportional integral control algorithm to control the system, and export digital control signal to directly control the water irrigation system in opening or closing electromagnetic valve, implement accuracy controlling for water and fertilizer, in order to ensure the plant growth in the best environment.

R.Vagulabranan has proposed an automated irrigation project that comes into play on Arduino board ATmega 328 micro-controller, and is programmed to collect the input signal of changeable moisture circumstances of the earth via moisture detecting system. The author has used the principle of change in value of electricity with change in soil moisture.

Nungleppam Monoranjan Singh describes the design and development of low cost USB Data Acquisition System (DAS) for the measurement of physical parameters. Physical parameters such as temperature, humidity, light intensity etc., which are generally slowly varying signals are sensed by respective sensors or integrated sensors and converted into voltages. The DAS is designed using PIC18F4550 microcontroller, communicating with Personal Computer (PC) through USB (Universal Serial Bus). The designed DAS has been tested with the application program developed in Visual Basic, which allows online monitoring in graphical as well as numerical display.

III. CONCLUSION

Agriculture is important part of Indian's livelihood and hence irrigation. At present farmers use irrigation technique through the manual control, in which farmers have to irrigate at regular intervals. This process consumes more water resulting in water wastage. Moreover in dry areas where there is inadequate rainfall, irrigation becomes difficult. Hence we require an automatic system that will precisely monitor and control the water requirements in the field. Installing Smart irrigation system saves time and ensures judicious usage of water. Along this system will encourage farmers to adopt mixed cropping, inter cropping, there by resulting in increased yield.

ACKNOWLEDGEMENT

I would like to give my sincere gratitude to my guide **Prof. K Uma** madam for her guidance and support for completion of this work.

REFERENCES

[1] H. Navarro-Hellín , J. Martínez-del-Rincon, R. Domingo-Miguel, F. Soto-Valles, R. Torres-Sánchez, 2016, A decision support system for managing irrigation in agriculture, Computers and Electronics in Agriculture 124 (2016) 121–131. Elsevier

[2] Rashmi Jain, Shaunak Kulkarni, Ahtesham Shaikh, Akash Sood, 2016,Automatic Irrigation System For Agriculture Field Using Wireless Sensor Network (Wsn), International Research Journal of Engineering and Technology (IRJET) , Volume: 03, Issue: 04. IRJET

[3] Imene Yahyaoui, Fernando Tadeo, Marcello Vieira Segatto, 2016, Energy and water management for drip-irrigation of tomatoes in asemi- arid district, Agricultural Water Management,Volume 183, Elsevier

[4] Darshana Chaware, ma. Ashwini Raut, Ms. Mrunal Parse, Ms. Aniruddha Koparkar, 2015, Sensor Based Automated Irrigation System, International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 4, Issue 05, May-2015.

[5] F. Rodr´ıguez _ M. Castilla _ J. A. S´anchez _ A. Pawlowski, 2015, Semi-virtual Plant for the Modelling, Control and Supervision of batch-processes. An example of a greenhouse irrigation system, IFAC-Papers Online 48-29 (2015) 123–128, Elsevier

[6] D. Canone, M. Previati, I. Bevilacqua, L. Salvai, S. Ferraris, 2015, Field measurements based model for surface irrigation efficiency assessment, Agricultural Water Management 156 (2015) 30–42, Elsevier

[7] Hak-Jin Kim , Dong Hoon Lee , Sung Wook Ahn, Won Kyung Kim , Seung Oh Hur ,Jin Yong Choi , Sun-Ok Chung, 2015, Design and testing of an autonomous irrigation controller for precision water management of greenhouse crops, Engineering in Agriculture, Environment, Volume 8, Issue 4, 2015, Elsevier.

[8] Liu xin ,Lu Guang,Yu Ming, 2012, Design on the Precise Regulating Control System for Moisture and Nutrient of Plants Based on PLC, Physics Procedia 33 (2012) 429 – 436, Elsevier

[9] R.Vagulabranan, M.Karthikeyan, V.Sasikala, 2016, Automatic Irrigation System on Sensing Soil Moisture Content, International Research Journal of Engineering and Technology (IRJET) -0072 -0056, Volume: 03, Issue: 03.

[10] Nungleppam Monoranjan Singh, Kanak Chandra Sarma, Nungleppam Gopil Singh, 2012, Design and Development of Low Cost Multi-Channel USB Data Acquisition System for the Measurement of Physical Parameters, Nungleppam Monoranjan Singh (0975 – 888) Volume 48– No.18, June 2012

[11] "An Introduction to Soil Moisture Concepts." [Online]. Available: http://hydrogold.org/education.soil_moisture_concepts.html.