MJRET
Open Access
Multidisciplinary Journal of Research in Engineering and Technology
Journal homepage: www.mjret.in
ISSN:2348 - 6953

SURVEY ON WEB BASED INTELLIGENT IRRIGATION SYSTEM IN WIRELESS SESNSOR NETWORK

Prashant B. Yahide, Prof. S.A.Jain, Prof. Manish Giri
Department of Computer Engineering,
MIT Academy of Engineering, Alandi Pune,
India
prashantyahide@gmail.com, sajain@comp.maepune.ac.in,
mbgiri@comp.maepune.ac.in

Abstract: *Irrigation is need of farmer to save water resource which is essential and need to use in minimum quantity because it is not free forever to use and not conversational resource. In drip irrigation water is given to root of plants to save water and stop land infertility and nutrition count. In irrigation farmer have to keep time table for irrigation which changes as per crop, soil and weather. Web based intelligent drip irrigation system is one and only solution to water management and precision agriculture. In web based system we can control water supply using solenoid valve. This whole system is micro control based and can be operated from remote location through web based so there is no need to concern about irrigation timing as per crop or soil condition. Sensor is used to take sensor reading of soil like soil moisture, temperature, air moisture and light micro controller take decision control by user (farmer). Web based intelligent irrigation system helps a farmer to take decision on water management in farm and there is no need to maintain irrigation time table .Irrigation time table can be fetch and map from agriculture university or government web site as per soil and crop type. It gives maximum profit from minimum cost.*

Keywords: *Wireless Sensor Network (WSN), Internet, Automation, Irrigation, web application.*

1. INTRODUCTION

In agriculture water is important factor. Agriculture sector uses maximum water in world. Indian economy mainly based on agriculture field and water is vanishing day by day due to

its immense use. Irrigation is one solution to this problem because in drip irrigation water is supplied to root zone of crop. Irrigation saves a large amount of water. But still in irrigation sometimes water is over supplied or less supplied to crop and irrigation time table should be maintained which is not easy for farmer. Manual irrigation is the traditional method in world for water supply in agriculture farm. So it is hard to take decision to save water and get maximum profit from field. Sensors and sensor networks are making Hugh progress in agriculture field [1][2]. For sensor based agriculture and networks, varieties of terminologies now in use like Precision Agriculture (PA), site specific crop monitoring, automated irrigation system, GPS based agriculture etc. [3]. Sensors are used to collect data from environment like soil moisture, temperature, air direction, air speed, etc. Actuators are control units as per situation occurred [4][5]. Different communication technology has been developed for communication between network and its element. Zigbee, WIFI, Bluetooth, Wibree are communication technology used in sensor network. Zigbee is preferred over other technology due to low cost and less power consumption [6]. Web based intelligent irrigation system is solution for this problem. It is automated and micro controlled based can be control from remote location [7]. It takes decision on sensor value of agriculture farm. Wireless sensor Network is back bone of whole system. Sensor node, master node, Base station and server are elements of WSN application.

2. NEED OF THE PROJECT

This paper defines the internet driven intelligent and completely automated water management system. The software and hardware combined together provide a very advanced control over the currently implemented manual system. The implementation involves use of water management system using a microcontroller based board. PC based software is used to interface the board and control the valve on/off timings. The software is capable of downloading the on/off timings for drips from websites hosted by agricultural universities. Farmers can get instant assistance from universities to change the drip on/off timings based on current climate, soil condition, fertilizers used, etc. The microcontroller based unit can operate in standalone mode since and only needs to be connected shortly to the PC in order to download the new valve on/off timings. A software module will also be designed for agricultural universities to upload the drip on/off timings for particular farm layout.

3. LITERATURE SURVEY

A) Automated Irrigation System Using a Wireless Sensor Network and GPRS Module.

Automated Irrigation system using WSN and GPRS Module having only main goal is that optimize use of water for agriculture crops. This system is composed of distributed wireless sensor network with soil moisture and temperature sensor in WSN. Gateway units are used to transfer data from sensor unit to base station, send command to actuator for irrigation control and mange data of sensor unit. Algorithm used in system for controlling water quantity as per requirement and condition of field. It is programmed in micro controller and it sends command through actuator to control water quantity through valve unit. Whole system is powered by photovoltaic panels. Communication is duplex take place through cellular network. Web application mange the irrigation through continues monitoring and irrigation scheduling programming. It can be done through web pages. System with three replicas of automated irrigation system can save 90% water as compare to traditional irrigation method.

METHODOLOGY: System is micro-controller base. WSN is use for automated irrigation purpose to save water. Automated irrigation system powered by photovoltaic panel. Live readings are taken by soil moisture sensor and soil temperature sensor. Sensor node contains soil moisture sensor, temperature sensor, microcontroller unit and transceiver. Data accusation receive from sensor and given to gateway through microcontroller and this communication of node and gateway take place through Xbee WPAN IEEE 802.15.4. Communication system from gateway to remote location (web page) is duplex link of cellular internet. It uses GPRS protocol. Internet connection allows data inspection of current soil moisture and temperature value and there graphical representation is simple to take decision. Web pages programmed the micro controller as per requirement of crop for water. Irrigation scheduling can be done as per crop and season. Components of Automated irrigation system are wireless sensor unit, wireless information unit. WSN uses Zigbee as transceiver. GPRS module is used for data transmission to web page. Entire system is powered by photovoltaic panel so it can be use in remote place where electricity is not available. GPRS module help to connect with web application and hence irrigation decision can be done from any remote location. Geospatial data can be map to web page so decision taking becomes easy for user. Maintenance is time consuming and hard because network is spread over large geographical area.

LIMITATION: Automated irrigation system uses only two parameters of soil like soil moisture and temperature other parameters humidity, light, air moisture, soil ph value not taken for decision making. This system works on soil moisture and temperature sensor threshold value. It just shows the soil condition and system take decision on threshold value these are previously sated. Sometime system irrigate farm with more or less water not as per crop requirement. Maximum profit scenario is not considered as per crops type and available water.

B) A Crop Monitoring System Based on Wireless Sensor Network.

Wireless sensor network crop monitoring application is useful to farmer for precision agriculture. The application monitors the whole farm from remote location using IOT (Internet of Things). Application works on sensor network and two types of nodes. Energy saving algorithm is used in node to save energy. Tree based protocol is used for data collection from node to base station. System having two nodes sensor node which collect all environmental and soil parameters value soil moisture, temperature, air, humidity, light, etc and second node consist of cam to capture images and monitor crops.

METHODOLOGY: Crop monitoring application consists of two sensor node image sensor and environment parameter collector. These two sensors collect the information about crops. Image sensor collect crop growth, height and second sensor node collect data about humidity, soil condition, etc and this information is collected at base station and then get transfer to internet (web application). Data analysis is get done at server side. Communication is duplex GPRS/CDMA type. RF transceiver is used for communication purpose between to nodes. This application was deployed in Beijing, Henan and Shandong Province for experimentation purpose and temperature, humidity and images of crop data are collected from these location. Application is for agriculture informationization. IOT make it possible.

LIMITATIONS: Environmental changes not consider for sensor reading. System user is not able to program application. There is no controlling system for application.

C) Automatic Drip Irrigation System using Wireless Sensor Network and Data Mining Algorithm

Data mining algorithm are used to take decisions on drip irrigation system. Automated drip irrigation system having WSN placed in all over farm and different type of sensors like soil moisture sensor, wind direction, wind speed, soil temperature gives reading to control station and base station. WSN uses ad hoc network which gives self configuration and flexibility. Sensor data is given to base station and data is received using zigbee. Data processing is done at base station for decision making. Data mining algorithm is used to take decision on data from sensor to drip. All observation are remotely monitor through web application.

METHODOLOGY: Data mining Naïve Bayes algorithm is used for decision making on data set which is real time feed from field sensor. Algorithm check probability of each attribute. Drip irrigation on and off decision are made. Previous data set of agriculture is provided to take decision. All data of field is given to web application for observation.

LIMITATIONS: Data change as per geological and soil condition system does not work suitably. This system works on Naïve Bayes algorithm for irrigation control. Algorithm works on previous data set for decision making if any attribute is not frequent result is zero. It is

difficult to take decision on atmospheric changes. Web application is used for only observation purpose.

D) Wireless lysimeters for real-time online soil water monitoring

Drainage water readings in soil make effective use of water management. In this system Passive capillary wick-type lysimeters (PCAPs) were used to monitor water flux in root zone of crop. It is web based real time online wireless lysimeter system to monitor drainage water using distributed wireless sensor network. Drainage water use two tipping bucket lysimeter to monitor soil water contain using two soil moisture sensor installed on lysimeter. Weather station measures micrometeorological field condition in WSN. All sensor data is periodically get transferred to base station and from base station all data goes to internet. Communication between sensor and base station take place through Bluetooth. This system makes water management proper and save water from perfect drainage water readings. Web application provides remote login access to user.

LIMITATIONS: Web application is for remote monitoring of agriculture field. User cannot control water management for web application. Bluetooth is costly than zigbee. Zigbee communication is low cost and less power consuming than Bluetooth. Weather station is separated from WSN. To minimize the network overhead it should be included in WSN.

E) Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network

Distributed wireless sensor network is site specific field for site control. Site specific field attribute are measured for soil irrigation decision. In site specific system minimum number of sensors measure most impacting factor of soil like water holding capacity, soil electric conductivity. Water holding capacity causes more impact on crop yield. Soil electric conductivity (ECa) is sense by base station unit to take irrigation decision. Linear move irrigation system is used for in field sensor based variable rate irrigation. It is machine which supply water to field powered by electrical generator. Two motors for water supply and one cart motor part are consisted in this machine. Variable rate Sprinkler control the irrigation as per requirement. Variable rate sprinkler is part of liner irrigation system and control by micro controller program. In field sensing and weather station main components are Data logging, wireless data communication, power management.

METHODOLOGY: Data logging: Five sensing and one weather station log the field data to data logger. Volumetric contains of water in soil and water holding capacity data is sent to data logger. RS232 protocol is used for serial communication to transfer data.

Wireless Data communication: Bluetooth make possible wireless communication between master and slave node in filed. GPS tells about sprinkler position where irrigation control needed.

Power management: Standby mode and active mode save power of network so these are essential in this system. Power supply is mainly from solar panel. Linear irrigation system is powered by electrical generator.

LIMITATION: Bluetooth device work for small area so not much scalable. Short range bluetooth works on line of sight. LoS is drawback of bluetooth. Linear irrigation system with variable rate sprinkler consumes more power.

F) Automated Intelligent Wireless Drip Irrigation Using Linear Programming

Current automated drip irrigation system work on one condition at time like soil moisture, temperature, air direction, soil ph value. If system is working on soil moisture condition then threshold value is for decision of irrigation. Other parameter not consider for irrigation. Water availability and weather condition are also important to save water and get maximum profit.

METHODOLOGY: Automated intelligent wireless drip irrigation system uses linear programming to get maximum profit from available water and crop water requirement. This system calculates water requirement of different crop, available water and maximum profit scenario for different crop field. Decision support system helps to take decision of irrigation for different crop field.

LIMITATION: System use linear programming for maximum profit on defined resources. It causes problem where constrain and objectives are not define. In real time situation object and constrain are not predefined then this system cannot be used.

G) Wireless sensor network with irrigation valve control

Wireless sensor network with valve control unit is developed with actuator hardware and software. Irrigation is control by actuator. Web application is used for manual control and schedule irrigation timing. Water meter indicate the requirement of water. Node unit contain soil moisture sensor and actuator. Two way communications take place from actuator to node and base station. Packet with control commands are sent between node and actuator. Actuator control solenoid valve depending upon water meter value and scheduling timing for water supply.

LIMITATIONS: Packet loss between node and actuator communication degrade performance of system. Power requirement for actuator and node unit is high. Water requirement for different crop is different also depends on other factor like soil type, temperature, etc. This system measures only soil moisture parameter to take irrigation decision.

H) Wireless sensor network infrastructure for agriculture.

Existing wireless sensor networks that monitor agriculture infrastructure measures different soil parameter and environment conditions. This WSN is composed of node with software and hardware units. Nodes manage and monitor farm parameter for precision agriculture purpose. Node has control unit which control sensors and communicate with base station. Atmega and ARM are frequently used as control unit. Zigbee, Bluetooth, wifi used for transceiver in WSN. Nodes in WSN send information to base station for decision purpose. Wireless underground sensor network is deployed underground. Network sensor components work underground at specific depth. Wireless communications take place between networks. Network report soil value, volumetric water contains, landscape movement, earthquakes and volcano information. Limitation of above two network infrastructures solve by hybrid sensor network. It is a combination of wireless sensor network and wireless underground sensor network. Hybrid sensor network combine advantages of these two infrastructure system. When WSN is out off line of sight WUSN collect the information from node. Mobile information collected by terrestrial WSN.

LIMITATIONS: Path loss and low data rate is the problem in hybrid WSN.

4. PREVIOUS WORK ON AUTOMATED DRIP IRRIGATION SYSTEM

In current automated water management system we cannot take decision at that instance by taking different attribute of agriculture soil. Current automated irrigation system only works on one parameter at one time. Soil have different attribute like soil ph, soil moisture and temperature etc. If system working on soil moisture parameter and pre settled threshold violates then it comes in picture. Soil moisture is below threshold value then water valve is open for water supply and after proper water supply if it goes above threshold value water valve is get close. Existing system does not concern about available water in reservoir and requirement of water to particular crop. So system does not have decision power. It only works on one condition at one time.

5. LIMITATION OF AUTOMATED DRIP IRRIGATION SYSTEM

In Current automated water management Irrigation system it is not possible to operate it on decisions, it just operated only on single soil attribute like soil moisture, soil ph, temperature, humidity and light. It operates one condition at a time. System is not web base to control the overall water management system through user from any location and take decision at that instance.

6. PROPOSED SYSTEM

Water management system is microcontroller based and web application is used for monitor and control the water management system from remote location. Whole system is in WSN infrastructure. Water management is done through sensor reading from farm. Web application provide easy monitor and control mechanism to farmer. Graph generated in web application make easy analysis.

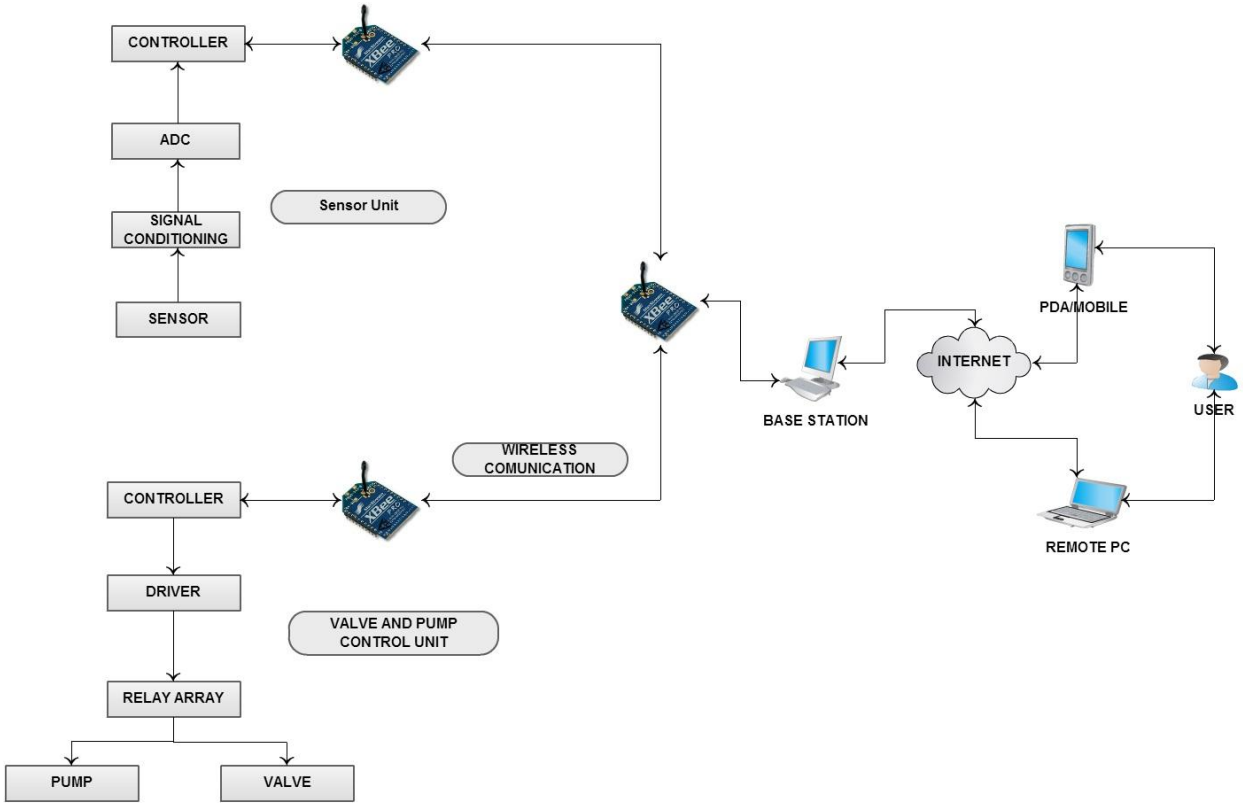

Fig1. System Architecture Diagram

Sensors (Light, Temperature, PH_Value, Moisture): Sensor sense the different physical parameters like soil ph-value, soil moisture, temperature and humidity.

Micro-Controllers: It is heart of system, means it control all operation of system.

ADC (Analog to Digital): It convert analog signal to digital signal and fed this digital signal to microcontroller.

Signal Array: It take sensor data as input and give this data as input to signal conditioning.
Signal conditioning: It work as amplifier .It convert weak signal of sensor in its Original state.

Darlington Driver: It is control unit it control fan motor valve etc. It works as per decision.

Valve: Valve can be Solenoid valve work as per soil moisture threshold value and operate by Darlington driver.

Base station: It is master unit to control valve and take data from all sensor node which are at the end.

Server: It collects data from all WSN network and take decision if threshold cross of any sensor unit. Irrigation timing can be synch from server for water management purpose.

Web application: It collect data from server of agriculture field where WSN network application is deployed. Web application provide graphical interface to user and graph of sensor data value is generated so it is easy to understand for user to analyze and take decision. Web application help to store data and maintain irrigation time table. User can download irrigation timing from Agriculture University.

7. ADVANTAGES:

- Simple to design and install
- Increase productivity and reduces water consumption in agriculture field.
- Less manpower is required
- Reduce soil erosion and nutrient leaching.
- Use of web application provide remote controlling to farm for water resource management.
- It helps to maximize profit.

8. DISADVANTAGES (LIMITATIONS):

- Internet access requires.
- Require frequent maintenance for efficient operation.
- Factors like weather conditions are not taken into consideration.

9.CONCLUSION & FUTURE SCOPE

Irrigation is today's need to save the water in which potential using of WSN and micro controller, actuators is very high. A review of several solution and efforts has been presented in automated irrigation field. The major concerns are develop decision support system with

WSN infrastructure is difficult. Proposed system gives automation to irrigation for agriculture field decision support system act with network infrastructure. The web based Automated Wireless Drip Irrigation provides a real time feedback control system which monitors and controls all the activities of drip irrigation system efficiently. Using this system, one can save water, manpower as well as energy in order to improve productivity and ultimately the profit. This system can also supply fertilizer and the other agricultural chemicals like calcium, sodium, ammonium, zinc to the field with adding new sensors and valves. Also it is possible to registered farmer to download drip control timings from agricultural universities website control own drip irrigation system according to university and weather condition of that particular geographical area.

ACKNOWLEDGMENT

I express true sense of gratitude towards my project guide Prof. Shitalkumar A. Jain and Manish Giri Asst. Prof. of computer engineering department for their invaluable co-operation and guidance that they helping me for my project study. I like to thank them once again for inspiring me and providing me all the lab facilities, which made this survey work very convenient and easy. I would also like to express my appreciation and thanks Prof. Uma Nagaraj Head of Computer Engineering Department and principal Dr. Y. J. Bhalerao and all my friends who knowingly or unknowingly have assisted me throughout my hard work**.**

REFERENCES

[1]. N.Wang, N. Zhang, M.Wang, "Wireless sensors in agriculture and food industry recent development and future perspective", Computers and Electronics in Agriculture 50 (1) (2006) 1–14.

[2]. L. Ruiz-Garcia, L. Lunadei, P. Barreiro, I. Robla, "A review of wireless sensor technologies and applications in agriculture and food industry: state of the art and current trends", Sensors 9 (6) (2009) 4728–4750.

[3]. A. Srinivasan, "Handbook of Precision Agriculture: Principles and Applications", CRC, 2006.

[4]. I.F. Akyildiz, W. Su, Y. Sankarasubramaniam, E. Cayirci, "A survey on sensor networks", IEEE Communications Magazine 40 (8) (2002) 102–114.

[5]. B.N.Schilit, M.M. Theimer, "Disseminating active map information to mobile hosts", IEEE Networks 8 (5) (1994)22–32.

[6]. Aqeel-ur-Rehman, A.Z. Abbasi, Z.A. Shaikh, "Building a smart university using RFID technology", 2008 International Conference on Computer Science and Software Engineering (CSSE 2008), Wuhan, China, 2008, pp. 641–644.

[7]. Y. Kim, R.G. Evans "Software design for wireless sensor-based site-specific irrigation" Computers and Electronics in Agriculture Elsevier 21 January 2009.

[8]. Joaquín Gutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel Ángel Porta-Gándara "Automated Irrigation System Using a Wireless Sensor Network and GPRS Module" IEEE TRANSACTIONS ON

[9]. Zhao Liqiang, Yin Shouyi, Liu Leibo, Zhang Zhen, Wei Shaojun "A Crop Monitoring System Based on Wireless Sensor Network" 1878-0296 © 2011 Elsevier Ltd.

[10]. Ms. Jyotsna Raut , Prof. V. B. Shere "Automatic Drip Irrigation System using Wireless Sensor Network and Data Mining Algorithm" International Journal of Electronics Communication and Computer Engineering Volume 5, Issue (4) July, Technovision-2014, ISSN 2249–071X.
INSTRUMENTATION AND MEASUREMENT, VOL. 63, NO. 1, JANUARY 2014.

[11]. Y. Kim, J. D. Jabro, R. G. Evans "Wireless lysimeters for real-time online soil water monitoring" 13 September 2010 / Accepted: 18 November 2010 / Published online: 15 December 2010_ Springer-Verlag (outside the USA) 2010.

[12]. Y. Kim, R. G. Evans, and W. M. Iversen, "Remote sens, and control of an irrigation system using a distributed 57, wireless sensor network," IEEE Trans. Instrum. Meas., vol. no. 7, pp.1379–1387, Jul. 2008.

[13]. Manish Giri, Dnyaneshwar Natha Wavhal,"Automated Intelligent Wireless Drip Irrigation Using Linear Programming" International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)Volume 2, Issue 1, January 2013.

[14]. Robert W. Coates, Michael J. Delwiche, Alan Broad, Mark Holler "Wireless sensor network with irrigation valve control" 0168-1699/$ - see front matter _ 2013 Elsevier B.V.

[15]. Xiaoqing Yu, Pute Wu, Wenting Han, Zenglin Zhang "Wireless sensor network infrastructure for agriculture" Computer Standards & Interfaces 35 (2013) 59–64 Elsevier.

[16]. Ali AL-HAMDI, Ahmed Monjurul HASAN, Muhammad "WSN-based Support for Irrigation Efficiency Improvements in Arab Countries"

[17]. R. Jaichandran, Dr. A. Anthony Irudhayaraj, Trisha Sinha "Prototype for Automatic Controlling and Remote Accessing of Irrigation Motor" International Journal of Innovative Research in Computer and Communication Engineering Vol. 1, Issue 4, June 2013.

[18]. X. Wang, W. Yang, A. Wheaton, N. Cooley, and B. Moran, "Efficient registration of optical and IR images for automatic plant water stress assessment," Comput. Electron. Agricult, vol. 74, no. 2, pp. 230–237, Nov. 2010.