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AUTOMATED IRRIGATION SYSTEM USING WIRELESS SENSOR NETWORK AND RFMODULE

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ABSTRACT

Fresh water is the basic need of living organisms on earth. The fresh water is consumed by living beings to be alive including plants and animals. The amount of fresh water available is limited.Also; population has increased as compared to available water and food resources. Agriculture consumes about 85% of the total fresh water quantity available and hence, there is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial & institutional improvements. There are many systems using various techniques to achieve water savings in various agricultural practices. The system using remote access and wireless communication is discussed in this paper. The system explained here is a network of wireless sensors and a wireless base station to process the sensor data to automate the irrigation system. The sensors are soil moisture sensor and soil temperature sensor. The Base station microcontroller is programmed such that if the either soil moisture or temperature parameters cross a predefined threshold level, the irrigation system is automated, i.e. the motor relay that is connected to water pump, switches to ON otherwise OFF.

KEYWORDS: Wireless sensors,soil moisture sensor,Soil temperature sensor,Wireless Base station,sensor data.

INTRODUCTION

The sources of fresh water present on earth are limited.The sources include underground and ground surface sources.These are rivers,lakes,wells etc.The 97% of water on earth is in form of oceans and is saline water.The total fresh water is about only 2.6% & 0.6% avaible for use for living beings.The 2% of fresh water is inaccesible in form of polar ice.Thus, the water present for use to survive on earth is limited.If water is not properly utilized,the coming next generations will have to struggle to survive.Hence it's high time to conserve water implementing different strategies and with help of science and technology the task is easy and fast.

There are number of systems and a lot of research work being done since last decade on the water conservation techniques.Also electronics field has boosted in recent years.Hence we can think for elctronic system to be used in all strategies for water management to save used water.Agriculture is largest user of fresh water so water management is essential in agriculture.The wireless sensor network can be used to save water used for agriculture

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MATERIALS AND METHODS

Block diagram

The figure below is the block diagram of automated irrigation system using wireless sensor network and can be divided into wireless sensor unit and wireless control unit. The block diagram below is separate for wireless sensor unit and wireless control unit.

A .Wireless control/Interface unit

The soil moisture and temperature data from each WSU are received, identified, recorded, and analyzed in the Wireless control unit. The WCU consists of a master microcontroller [ARM 11], a radio modem [RF Module], an RS-232 interface, electronic relays for driving the motor of pump to drive water of the tanks, and power supply, solar panel(optional). The WCU unit must be located up to 100 m line of sight from WSU's placed in the field.The wireless control unit is represented by Raspberry Pi board.The microcontroller ARM 11 on Raspberry pi board is the processor in wireless control unit.The relay RWH-SH112D is used.

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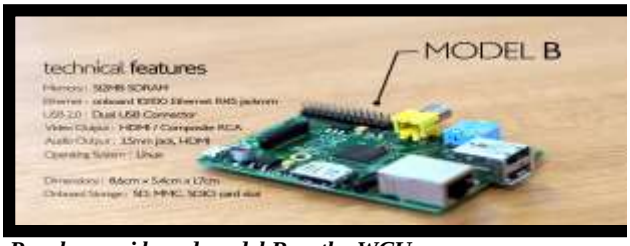
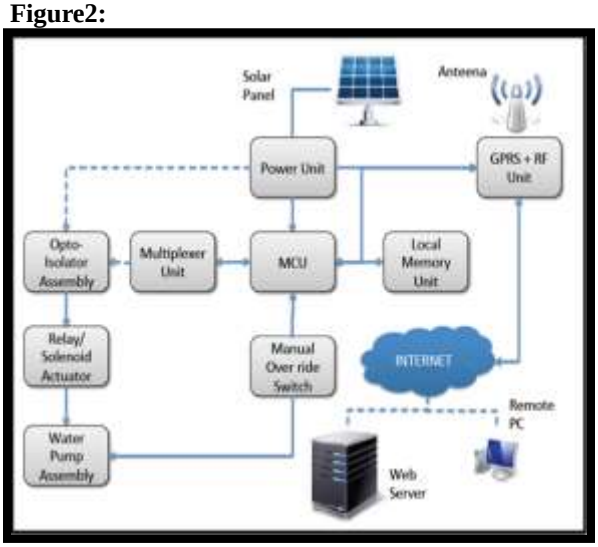
Figure1:



Raspberry pi board model B as the WCU

Figure2:

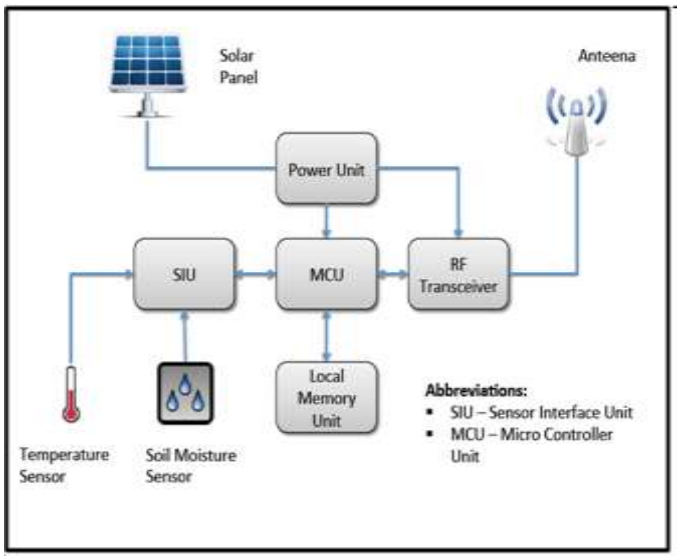


Wireless control unit.

B. Wireless sensor unit

The figure 2 shows block diagram of Wireless sensor unit. The figure shows following blocks viz Temperature sensor and soil moisture sensor, sensor interface unit, microcontroller unit, RF transreciever, power unit. A WSU consists of RF transreciever, sensors, and microcontroller and power sources. Several WSU's can be deployed in – field to configure a distribute sensor network each unit has a PIC16F877A microcontroller, that controls the radio modem [RF2.4GHz RK'1197 serial link] and processes information from soil moisture sensor deployed at the root zone of the crops and temperature sensor to measure temperature . All the components are powered by power supply source.

Figure3:



Wireless sensor unit

C. Algorithm.

[1]Algorithm for microcontroller of Wireless control unit :

1.Power ON the WCU and WSU.

2.Initialize all the peripherals.

3.Display the start screen.

4.Pull sensor data from WSU.

5.If valid sensor data is received than process the information.If the data received is not valid than continue pulling sensor data from WSU.

6.If soil is dry i.e. cross the threshold or temperature is above 25 degrees centigrate,activate motor relay to ON.

7.Check Battery voltage and light intensity conditions ,if low battery conditions and low light conditions display alert message(optional).

[2]Algorithm for microcontroller of wireless sensor unit:

1. Initialize all the peripherals.

2.Start the timer.

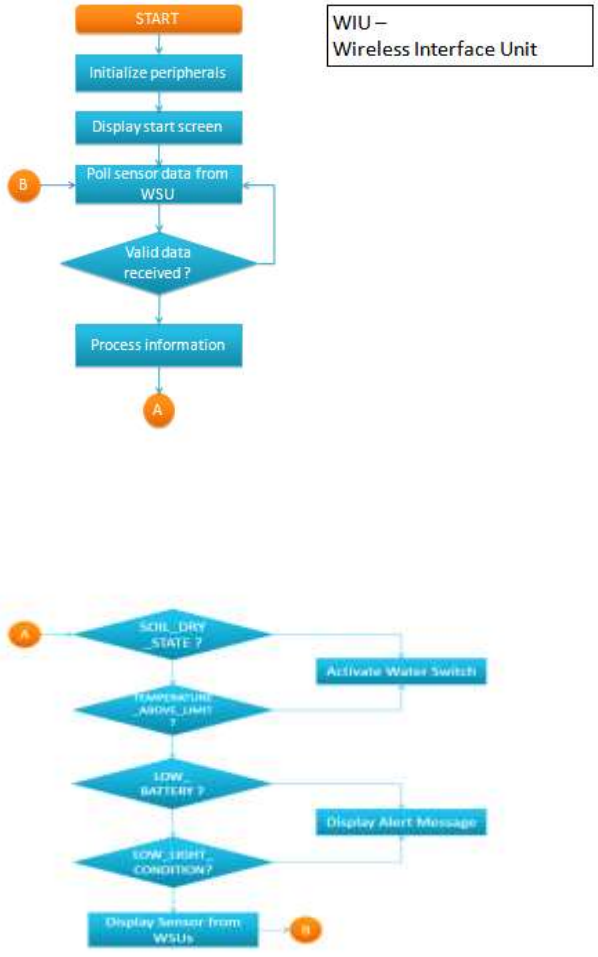
3.Poll the timer flags.

4.If the time is equal to t_measure get the sensor data.If not poll timer flags.

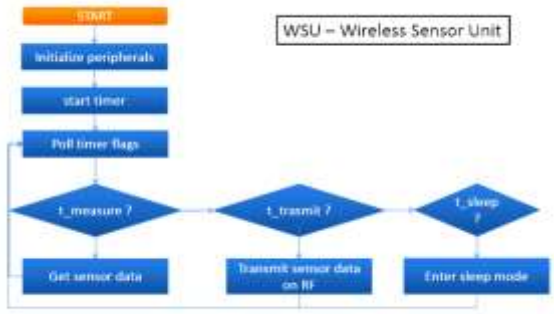
5.If time equals to t_transmitt, transmitt sensor data on RF module to send data to WCU.If sensor data transmission complete, poll the timer flags.

6.If time equals to t_sleep then microcontroller enters sleep mode.At end of sleep time the microcontroller poll for timer flags.

[3] Flow chart of wireless control unit



[4] Flow chart of wireless sensor unit



RESULTS AND DISCUSSION

The ARM processor and PIC microprocessor are programmed according to their functions. The PIC processor at WSU is programmed for sensing data from time to time, transmitting/receiving data over RF module to WCU and sleep mode. ARM Processor at WCU is programmed for processing valid data received from WSU. If the valid data obtained from WSU shows that soil is dry(i.e cross the threshold) then the soil moisture shows output high at its digital output DO and the motor relay switches to ON. If the received valid data from WSU contains temperature is above 25 degrees then the motor relay switches to ON. When the motor relay is ON the LED connected at the output of ARM glows. If the soil is moist the relay of motor is not switched to ON. If the atmospheric temperature is below 25 degree centigrade the motor is not ON.The water is saved using this system. This is because the drip system is automated. The water is supplied to crops when soil is dry. Thus, the crops can save from drying. The automated irrigation system implemented will be feasible and cost effective for optimizing water resources for agricultural production. This irrigation system will allow cultivation in places with water scarcity thereby improving sustainability. The automated irrigation system developed will prove that the use of water can be diminished for a given amount of fresh biomass production.

CONCLUSION

The Wireless Automated Irrigation System aims at providing an efficient irrigation system that reduces/avoids wastage of water/crops due to over

supply of water.This system is capable of detecting the soil moisture across the field and processing the information for appropriate actions. However, it relies on the interfaced (existing) traditional irrigation system (Ex: Drip Irrigation) to form an end-to-end automation.

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REFERENCES

1. W. A. Jury and H. J. Vaux, "The emerging global water crisis: Managing scarcity and conflict between water users," Adv. Agronomy, vol. 95, pp. 1–76, Sep. 2007.
2. 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
3. G. Yuan, Y. Luo, X. Sun, and D. Tang, "Evaluation of a crop water stress index for detecting water stress in winter wheat in the North China Plain," Agricult. Water Manag., vol. 64, no. 1, pp. 29–40, Jan. 2004
4. S. B. Idso, R. D. Jackson, P. J. Pinter, Jr., R. J. Reginato, and J. L. Hatfield, "Normalizing the stress-degree-day parameter for environmental variability," Agricult. Meteorol., vol. 24, pp. 45–55, Jan. 1981.
5. Y. Erdem, L. Arin, T. Erdem, S. Polat, M. Deveci, H. Okursoy, and H. T. Gültas, "Crop water stress index for assessing irrigation scheduling of drip irrigated broccoli (Brassica oleracea L. var. italica)," Agricult. Water Manag., vol. 98, no. 1, pp. 148–156, Dec. 2010.
6. Y. Kim, R. G. Evans, and W. M. Iversen, "Remote sensing and control of an irrigation system using a distributed wireless sensor network," IEEE Trans. Instrum. Meas., vol. 57, no. 7, pp. 1379–1387, Jul. 2008.
7. D. K. Fisher and H. A. Kebede, "A low-cost microcontroller-based system to monitor crop temperature and water status," Comput. Electron. Agricult., vol. 74, no. 1, pp. 168–173, Oct. 2010
8. Y. Kim, J. D. Jabro, and R. G. Evans, "Wireless lysimeters for realtime online soil water monitoring," Irrigation Sci., vol. 29, no. 5, pp. 423–430, Sep. 2011.
9. O. Mirabella and M. Brischetto, "A hybrid wired/wireless networking infrastructure for greenhouse management," IEEE Trans. Instrum. Meas., vol. 60, no. 2, pp. 398–407, Feb. 2011
10. I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, "A survey on sensor networks," IEEE Commun. Mag., vol. 40, no. 8, pp. 104–112, Aug. 2002
11. J. Yick, B. Mukherjee, and D. Ghosal, "Wireless sensor network survey," Comput. Netw., vol. 52, no. 12, pp. 2292–2330, Aug. 2008
12. N. Wang, N. Zhang, and M. Wang, "Wireless sensors in agriculture and food industry—Recent development and future perspective," Comput. Electron. Agricult., vol. 50, no. 1, pp. 1–14, Jan. 2006.
13. D. D. Chaudhary, S. P. Nayse, and L. M. Waghmare, "Application of wireless sensor networks for green house parameters control in precision agriculture," Int. J. Wireless Mobile Netw., vol. 3, no. 1, pp. 140–149, Feb. 2011
14. P. Mariño, F. P. Fontan, M. A. Dominguez, and S. Otero, "An experimental ad-hoc WSN for the instrumentation of biological models," IEEE Trans. Instrum. Meas., vol. 59, no. 11, pp. 2936–2948, Nov. 2010
15. M. Johnson, M. Healy, P. van de Ven, M. J. Hayes, J. Nelson, T. Newe, and E. Lewis, "A comparative review of wireless sensor network mote technologies," in Proc. IEEE Sensors, Oct. 2009, pp. 1439–1442.
16. J. S. Lee, Y. W. Su, and C. C. Shen, "A comparative study of wireless protocols: Bluetooth, UWB, ZigBee, and Wi-Fi," in

Proc. IEEE 33rd Annu. Conf. IECON, Nov. 2007, pp. 46–51
17. W. K. G. Seah, Z. A. Eu, and H.-P. Tan, "Wireless sensor networks powered by ambient energy harvesting (WSN-HEAP)—Survey and challenges," in Proc. 1st Int. Conf. Wireless VITAE, May 2009, pp. 1–5.
18. Y. K. Tan and S. K. Panda, "Self-autonomous wireless sensor nodes with wind energy harvesting for remote sensing of wind-driven wildfire spread," IEEE Trans. Instrum. Meas., vol. 60, no. 4, pp. 1367–1377, Apr. 2011.
19. E. Sardini and M. Serpelloni, "Self-powered wireless sensor for air temperature and velocity measurements with energy harvesting capability," IEEE Trans. Instrum. Meas., vol. 60, no. 5, pp. 1838–1844, May 2011.
20. P. Suriyachai, U. Roedig, and A. Scott, "A survey of MAC protocols for mission-critical applications in wireless sensor networks," Commun. Surveys Tuts., vol. 14, no. 2, pp. 240–264, Apr./Jun. 2012.
21. Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (LR-WPANs), IEEE Standard 802.15.4, 2003
22. 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 Trans. Instrum. Meas., vol. 63, no. 1, pp. 166–176,January 2014.
23. Dargie, W.and Poellabauer, C., " Fundamentals of wireless sensor networks: theory and practice", John Wiley and sons, ISBN 978-0-470-99765-