International Journal of Pure and Applied Mathematics
Volume 118 No. 24 2018
ISSN: 1314-3395 (on-line version)
url: http://www.acadpubl.eu/hub/
Special Issue

http://www.acadpubl.eu/hub/

Wireless Irrigation and Monitoring system using Zigbee and IoT

Pratiksha K. Deore(Author)[1], Dr. Urmila Patil (Guide)[2],
Electronics and Telecommunication Engineering
Dr. D.Y.Patil Institute of Engineering and Technology
Pimpri, Pune, India
deorepk@gmail.com [1], Urmilaapatil76@gmail.com [2]

May 29, 2018

Abstract

This paper presents wireless irrigation and monitoring system was enunciate to improve the usage of water for the agricultural crops. We design the system using temperature sensor and soil moisture sensor with help of these sensors prepare distributed wireless sensor network. In addition with the sensors we use the zigbee to transfer the data of information to main microcontroller to measure the sensor values and used the valves to irrigate the plot according to the schedules are assigned. The system gets started when the measured values are reached to threshold value then automatically plot gets irrigate or we can assign the schedules in system as per the schedules system get work. We newly add the dry run circuit in wireless irrigation system to protect the water motor from damage. Using the wireless irrigation system we decrease the manual efforts and reduce the water usage with low power consumption that means it save electricity.

***Key Words*:**Wireless Irrigation, Automatic, IoT, Dry run circuit.

1 INTROUDCTION

India is mostly agricultural country and hence its economy is based on agriculture. We need clean water resources for farming but now a days usage of clean water is increases as per the citizenry enlargement and increased meal requirement. Due to environmental changes in climate, we look forward to that clean water resources will be downgrade in future time. With above challenges, we have to use water very efficiently but it the most important consequence in terms of lower the value and increase the quality of crop. Due to these conditions we motivate to design the wireless irrigation system. This system is very cost effective and achievable for reducing clean water resources for farming production, with the help of this system we can demonstrate that the use of water will be reduced for the various type of crop production. The wireless irrigation system can allow us to use necessary amount of water to crop. In this system we used distributed wireless network of soil moisture sensor and temperature sensors fixed in to the ground area of farm for testing the moisture of soil and temperature. The main controller units controls the sensor information, initiates valves and exchange the data through zigbee and transmit to web server. The some threshold values we have to define for temperature and soil moisture sensor according to that programmed into a microcontroller of main control unit. The system has dry run circuit using this circuit we can control the water motor from damage.

In previous Irrigation systems scheduling of water is accomplished by observing the soil moisture and status of temperature sensor and water with help of drip irrigation using the automation controller system is sandy soil. In this system real time feedback control system is used for observing and controlled activities of drip irrigation. This system uses the valves as actuators to provide the correct amount of water at the time when crop requires hence we no need of labour to turn ON/OFF the motor [1]. In remote sensing and control irrigation system used in-field sensing stations and weather station in this paper we designed the communication between traditional irrigation system and electronic controllable system for commanding on irrigation sprinklers [2]. In this paper we design the system using hybrid framework both the wired and wireless networks are used and wireless modules are placed in the green

house and its elasticity is mandatory and wired modules are used in outdoor location as an actuator [3].

In the Environmental monitoring we analyze the parameters of sensor networks it contains the temperature, soil moisture, water content, pressure, humidity and floods, forest fire like disaster controlling and it is continuously verifying by the system to monitor the conditions [4]. Using this system we help us to define the how to control the pollution using wireless sensor network hence the Introduce the concept of tube; it is mean by wireless sensor network platform this plan is developed and implement to control the pollution at an emergency spot [5]. The some systems are developed using the additional smart logic using this logic we can implement the most advanced and efficient irrigation system and using this fuzzy logic methodology we get the very accurate result, hence it increases the chances of accuracy and facilitate in decision making using the decision support system [6]. The intelligent smart irrigation system we use for open farm area or larger distant plan houses. With the help of this we utilize the temperature monitoring in compost production will be smoothly implemented [7]. In this paper a web based wireless lysimeter network system with the details of integrated system design and observation of experimental results during the whole growth season of crop. It used the Bluetooth, lysimeter and web server provides actual time monitoring and calculation of drainage water and in-field weather data on internet [8].the system is using for monitor the crop temperature and water status, it is constructed for monitoring the conditions of crop by means of soil moisture , soil, air and covering the measurement of temperature in irrigation field[9].

In this paper we design the monitoring system using microcontrollers, wireless sensor network with zigbee and IoT as it is used for transfer the data on web server. The main objective of this paper is to reduce the water consumption, electricity and manual efforts of farmers. The system consist the nodes which placed into the root zone of crop, nodes contains the soil moisture sensor, temperature sensor, aurdino uno and zigbee to transfer the information worked as transceiver; these values of sensors are transmitting to main controllers receiver of the system to analyze the measurements. The mail controller of monitoring system is allows to automatic activation of irrigation when the threshold values of temperature sensor

and soil moisture senor are achieved. We used the zigbee(IEEE 802.15.4 WPAN) to communicate between sensor nodes and microcontroller through data receiver. The receiver is duplex in mode and using for Internet interfacing using General packet radio service (GPRS) Protocol; it provides the data service in 2G and 3G formats.

2 MOTIVATION

As we are interested in Embedded Electronics based projects and there are many advantages of the embedded system as well. We are motivated for doing this project because it is due to electricity load shedding in India. Farmers have to irrigate his farms at any time whatever the night or day so farmers unable to utilize their own time as it consumes more time and electricity for irrigate the farm because all the operations are manually it also the waste of water.

Keep in mind all effort from farmer and all the problems we are developing the wireless irrigation and monitoring system which allows farmers to schedule the farm cultivation according to save electricity and reduce the water consumption.

3 PROBLEM STATEMENT

The basic challenges are occur in automatic irrigation system is huge model size, high cost, less orderliness and difficult to achieve security parameters and huge model size increases the maintenance cost. To overcome these challenges we used the wireless irrigation system using the zigbee and IoT, Hence the introduced system has numerous adaptability by using of Wi-Fi technology to interconnect the distributed sensor nodes, hence we have to use the GSM to operate the system automatic from anywhere like mobile device.

Now a days water consumption level increases due to population , food demand and industrial applications hence we have to minimize and control the usage of water the wireless irrigation system is very useful to achieved reduction of water and low power consumption because it works automatically when we require.

4 METHODOLOGY

Proposed System

In this wireless irrigation system we design the two units

A. Wireless Sensor node Unit(WSU)

B. Wireless Information Unit(WIU)

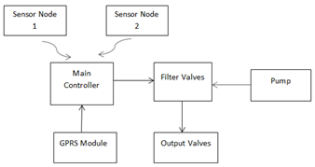


Fig.1. Wireless Information Unit

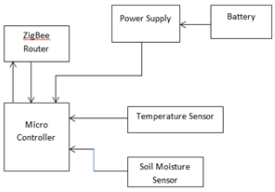


Fig.2. Wireless Sensor Node Unit

Hardware and Software Requirement:

1. Cortex M4(M451LC3AE)
2. Aurdino Uno
3. Temperature Sensor (LM35)
4. Soil Moisture Sensor
5. LCD display (16*4)
6. Keypad or PS2 Keyboard
7. Zigbee S2C Pro
8. AC Water Motor
9. Valves

10. SIM900

11. Thing speak server

Wireless Irrigation System

The wireless irrigation system consist of two units one is wireless sensor node unit and wireless information unit. The main monitoring system itself is called wireless information unit and sensor nodes which are placed at ground level of plant with zigbee for transmit the measured values to information unit. The wireless information unit is the section which worked as receiver and receives the sensor data from the wireless sensor node unit.

A. Wireless Sensor node Unit

The sensor nodes having the temperature as well as soil moisture sensor. These sensors will help to create real time temperature and soil moisture of the soil. We use Aurdino uno for the sensor node. Aurdino uno will read the temperature and soil moisture and create time information. The values send it to main controller and for decision making and displaying on LCD panel. These nodes placed some long distance from main controller hence we use zigbee S2C pro of digi. It having operation band of 2.4GHz.

B. Wireless Information Unit

The information unit is heart of the system. The main controller having the filter, output relay system, Zigbee coordinator, dry run circuit LCD and keyboard. Zigbee coordinator will receive the data from sensor nodes having temperature and soil moisture information. From this information main controller will take the decision of irrigation of the farm. In this system we divided the whole farm in to plots, according to each plot sensor data, the main controller take the decision to irrigate the plot, Once the valves and sensor cross the threshold values.

The wireless irrigation and monitoring system gives the flexibility to farmer that they can set the schedule according to their knowledge of weather or as per their requirement. The user can schedule the irrigation by using the PS2 keyboard. Our system allows them to schedule irrigation with 4 different schedules. In schedule farmer can set the start time plot number and the duration of the plot to be irrigate. The schedule can apply between start date and end date of the schedule even the farmer having flexibility to select day wise schedule in between start and end date. The

schedule can also skip in run time. The data or sensor nodes will be update on the server. By using GPRS module so the farmer can remotely monitor the status of his farm.

Cortex M4 Processor

It supports DSC and FPU and it features high performance up to 72 MHz and built-in 256/128/72/40 KB Flash ROM. It has 32/16 KB SRAM, with high-resolution 144 MHz and low dynamic power, delivering leading system energy efficiency due to integrated software controlled sleep modes. Extensive clock gating and optional state retention.

Temperature Sensor

The temperature sensor used to measure the temperature at the location is LM35. This series are precision integrated circuit temperature sensors and its output voltage is linearly proportional to the Celsius.

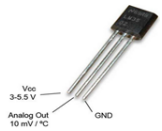


Fig.3. Temperature Sensor

Soil Moisture Sensor

These sensors are made up for measure the water content in soil. Soil moisture probe is design with the multiple soil moisture sensors. Measuring soil moisture is important for agricultural applications to help farmers manage their irrigation systems more efficiently. Knowing the exact soil moisture conditions on their fields, not only are farmers able to generally use less water to grow a crop, they are also able to increase yields and the quality of the crop by improved management of soil moisture during critical plant growth stages

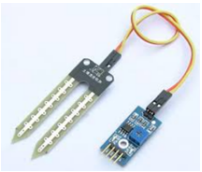


Fig.4. Soil Moisture Sensor

Aurdino Uno

It consist of an ATmega328 8-bit AVR microcontroller and with varying amounts of flash memory, pins, and features. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB), hence Aurdino Uno is very beneficial to design the sensor nodes.

Zigbee S2C Pro

It increases the transmit power and data protocol which allows to create distributed networks based on the ZigBee. These modules allow a very reliable and simple communication between microcontrollers and it worked within the 200ft (60m) and work with 24GHz.

Fig 5. Zigbee

Relay

Relay is just a small electrical switch consisting of an electromagnet, a switch and a spring, that opens and closes beneath the control of another electrical circuit. The spring holds the switch in a single position, until a current is passed through the coil; the coil generates a magnetic field which moves the switch. As the relay has the capacity to control an output circuit of higher power compared to input circuit, its often used to automatically switch large electrical energy appliances

GSM Module

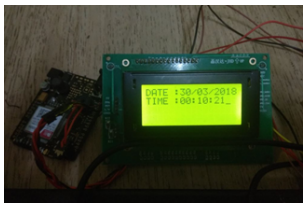
It comprises of GSM modem, serial correspondence and power supply.A GSM modem is a particular a particular kind of modem which recognizes a sim card and works over a participation to a portable administrator, much the same as a cell phone. The interfacing of GSM modulewith arduino nano can be utilized to send the detected datafrom the sensors that caution the customer through a smssent by GSM modem.

Fig 6. GSM Module

5 HARDWARE IMPLEMENTATION OF PROPOSED SYSTEM

The below figure shows the hardware implementation of wireless system.

The below figure shows the schedules of irrigation in plot with date, time, duration of the irrigate plot.



Software Used

We used the aurdino IDE and keil5 for programming of aurdino and Cortex M4. As Arduino is to be checked for this we interfaced it with our PCB or by interfacing it to the power source utilizing an connector which permits streaming 1 ampere of current. At that point we need to check the pre-introduced libraries and orders, which are helpful to plan our format by associating Arduino to our workstation. And our end goal to work with Arduino on our workstation, we have to download the Arduino programming unit,

where we can code the sensors, GSM and WI-FI modules as we require and we can gather and run those codes on the same Arduino programming and keil5.

6 Experimentation and Results

Threshold values we get for Temperature sensor and Soil moisture sensor.

The water motor is OFF.

Sensors	Threshold Values
Temperature Sensor	less than 35 deg
Soil Moisture Sensor	less than 70%

Threshold values when the water motor is ON.

Sensors	Threshold Values
Temperature Sensor	greater than 35 deg
Soil Moisture Sensor	greater than 70%

7 CONCLUSION

1. The wireless irrigation and monitoring system has been designed to reduce the water consumption and gives the only require amount of water to crop.
2. This system minimized the manual efforts with the help of schedules we introduce in system to irrigate the farm.
3. We can save the electricity using this system because we used the low power consumption devices to save electricity
4. It is very manageable and cost effective system.
5. This system we can use for any type of crop irrigation and in any place as it has small module hence it has very less maintenance.

ACKNOWLEDGMENT I am glad to present paper on Wireless Irrigation and Monitoring system using Zigbee and IoT towards the fulfillment of master degree in communication and network engineering .I take this opportunity to express my deep sense of gratitude towards my project guide Dr. Urmila Patil for their constant support.

References

[1] Joaquin Gutirrrez, Jaun francisco villa-Medina, Alejandra Nieto-Garibay, and Miguel Angel Porta-Gandara, Automated Irrigation System Using a Wireless sensor and GPRS Module, IEEE Trans. Instrum. Meas., vol. 57, no. 7, pp. 13791387, Jul. 2013.

[2] 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. 13791387, Jul. 2008.

[3] O.Mirabella and M. Brischetto, A hybrid wired/wireless networking infrastructure for greenhouse management, IEEE Trans. Instrum. Meas., vol. 60, no. 2pp. 398-407, Fe. 2011.

[4] L. M. Oliveira and J. J. Rodrigues, Wireless sensor networks: A survey on environmental monitoring, J. Commun., vol, 6 no. 2, pp. 143-151, Apr. 2011.

[5] H.-C. Lee, Y.-M. Fang, B.-J. Lee, and C.-T. King, The tube: A rapidly deployable wireless sensor platform for supervising pollution of emergency work, IEEE Trans. Instrum. Meas., vol. 61, no. 10, pp. 2776-2786, oct. 2012.

[6] Federico Viani, Michael Bertolli, Marco Salucci and Alessandro Polo, Low cost Wireless Monitoring and Decision Support for Water Saving in Agriculture IEEE Trans. Vol. 17, NO. 13, July 1, 2017.

[7] P. Manimaran, Mr. D. Yasar Arfath, An Intelligent Smart Irrigation System Using WSN and GPRS Module, International Journal of Applied Engineering Research ISSN 0973-4562 Volume 11, Number 6 (2016).

[8] Y. Kim , J. D Jabro, R.G Evans, Wireless Lysimeters for real-time online soil water monitoring, Springer-Verlag. Irrig Sci (2011) 29:423-430. DOI 10.1007/s00271-010-0249-X.

[9] Daniel K. Fisher, Hirut Kebede, A low-cost microcontroller-based system to monitor crop temperature and water status by Elsevier B.V. doi:10.1016/j.compag.2010.07.006.

[10] M. C. Rodrguez-Snchez, S. Borromeo, and J. A. Hernndez-Tamames, "Wireless sensor networks for conservation and monitoring cultural assets" IEEE Sensors J., vol. 11, no. 6, pp. 1382-1389, Jun. 2011.

[11] Genghuang Yang Yuliang Liu Li Zhao Shigang Cui Qingguo Meng Chen HongDa "Automatic irrigation system based on wireless network" Control and Automation (ICCA) 2010 8th IEEE International Conference on, pp. 2120-2125 9-11 June 2010.

[12] N. Wang, N. Zhang, ad M. Wang, Wireless sensors in agriculture and food industry- recent developemet and future perspective, Comput. Electron. Agricult., vol. 50, no. 1, pp 1-14, Jan. 2006.

[13] Y. erdem, l. arin, T. Erdem, S. Polat, M. deveci, H. Okursoy, and H.T.Gultas, 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.

[14] S. A. OShaughnessy and S. R. evett, Canopy temperature based system effectively schedules and controls centre pivot irrigation of cotton, Agricult. Water Manag., vol 97, no. 9, pp. 1310-1316, apr. 2010.