ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 9, September 2016

Raspberry Pi and Arduino Based Automated Irrigation System

Sneha Angal, Prof. Ramesh Y. Mali

M.E Student, Dept. of Electronics & Telecommunication, Dhole Patil College of Engineering, Pune, India

Assistant Professor, Dept. of Electronics & Telecommunication, MIT College of Engineering, Pune, India

ABSTRACT: An automation system for an office or home is increasing day-by-day. It makes an efficient use of the electricity and water and reduces much of the wastage. In small areas like office premises, buildings, house gardens etc. where watering plants at regular interval matters, the proposed irrigation system will be very efficient. The paper presents a home automation system based on Raspberry pi, Arduino microcontrollers, and zigbee and relay boards to water plants. Raspberry pi is the control block in this automatic irrigation system. The commands from the Arduino are processed at raspberry pi in Matlab C code. Zigbee module is used for communication between the Raspberry pi and Arduino. This paper contributes an efficient and fairly cheap automation irrigation system. By using moisture sensor the irrigation system is made smarter and automated. System once installed has no maintenance cost and is easy to use.

KEYWORDS: Raspberry pi; Arduino; Zigbee; relay; automatic irrigation system

I. INTRODUCTION

Irrigation of plants is usually a very time-consuming activity; to be done in a reasonable amount of time, it requires a large amount of human resources. Traditionally, all the steps were executed by humans. Nowadays, some systems use technology to reduce the number of workers or the time required to water the plants. With such systems, the control is very limited, and many resources are still wasted. Water is one of these resources that are used excessively. Mass irrigation is one method used to water the plant. This method represents massive losses since the amount of water given is in excess of the plants' needs. The excess water is evacuated by the holes of the pots, or it percolates through the soil in the fields. In addition to the excess cost of water, labour is becoming more and more expensive. As a result, if no effort is invested in optimizing these resources, there will be more money involved in the same process. Technology is probably a solution to reduce costs and prevent loss of resources.

Automation or automatic control is the use of various control system for operating equipment. The biggest benefit of automation is that it saves labor; however, it is also used to save energy and materials and to improve quality, accuracy and precision. The requirement of building an automation system for an office or home is increasing day-by-day. Industrialist and researchers are working to build efficient and economic automatic systems to control different machines like lights, fans, air conditioners based on the requirement. Automation makes an efficient use of the electricity and water and reduces much of the wastage [1].

The proposed irrigation system makes the efficient use of water. Water is fed to the plant whenever there is need. There already exist irrigation systems which water plants on the basis of soil humidity, pH value of soil, temperature and light. Wherever these parameters are required in big agricultural fields their productivity of the crop matters. Our proposed irrigation system will be very efficient in small areas like office premises, buildings, house gardens etc. where watering plants at regular interval matters.

This paper presents a smart drip irrigation system to water plants with the use of devices like raspberry pi, Arduino microcontrollers. Zigbee is used to control the system wirelessly.

II. RELATED WORK

In [2] focus on a smart irrigation system which is cost effective and a middle class farmer use it in farm field. The objective of the paper was to control the water motor automatically and select the direction of the flow of water in pipe with the help of soil moisture sensor. Finally send the information (operation of the motor and direction of water) of the

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 9, September 2016

farm field to the mobile message and g-mail account of the user. In [3] an automated irrigation system was developed to optimize water use for agricultural crops. The system has a distributed wireless network of soil-moisture and temperature sensors placed in the root zone of the plants. In addition, a gateway unit handles sensor information, triggers actuators, and transmits data to a web application. An algorithm was developed with threshold values of temperature and soil moisture that was programmed into a microcontroller-based gateway to control water quantity. The system was powered by photovoltaic panels and had a duplex communication link based on a cellular-Internet interface that allowed for data inspection and irrigation scheduling to be programmed through a web page. Single-chip microcontrollers equipped with wireless transceivers are gaining popularity in smart home automation because of their built-in resources, low power consumption, size. A wireless irrigation system for a smart home garden that can be integrated with existing smart home control system [4]. In [5] a novel way of using the hybrid solar and wind energy effectively for pumping solution in rural parts of India was described. This system uses further Wireless sensor network (WSN) for monitoring the moisture content of the soil in various parts of the cultivation land to maintain the moisture. The system was simulated by using MATLAB/ Simulink. In [6] proposed the automatic and real time irrigation system based on detecting of water shortage information in crops with acoustic emission (AE) technology. In [7] proposed an agriculture cloud support system that is SVM based agricultural automatics irrigation system that adjusts the quantity of water automatically based on sensor data. In recent years various agricultural systems have been proposed and implemented. However it is difficult for beginners in home gardening to use existing agricultural support system. This system enables that if users don't have expertise in agriculture about irrigation, they can irrigate properly. In [8] presented an automatic irrigation system using solar power. Solar power is mainly used to supply the required power to pump set and humidity sensors are used to sense whether the sol is a wet or dry conditions. Additional components used are microcontroller and op-amps. An irrigation system using zigbee in wireless sensor network and embedded Linux board provides a web interface to the user so that the user can control and monitor the system remotely. The system works according to algorithm developed for watering the crop User can make the system ON or OFF remotely [9].

III. PROPOSED SYSTEM

The block diagram of the proposed automated irrigation system consists of the raspberry pi and Arduino. The proposed system is divided into two as master and slave. The master consists of Raspberry pi, relay and water pump.

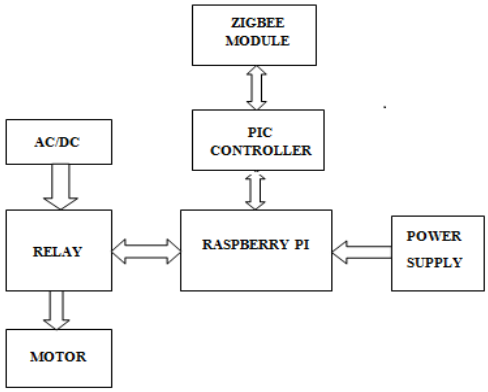

Fig. 1: Block Diagram of the Master side of the System

A. *RASPBERRY PI*

Raspberry pi is a pocket personal computer with Linux operating system installed on it. This is super cheap to encourage young people for learning, programming, experimenting and innovation. Resembling like motherboard, raspberry pi has all the components to connect inputs, outputs and storage.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 9, September 2016

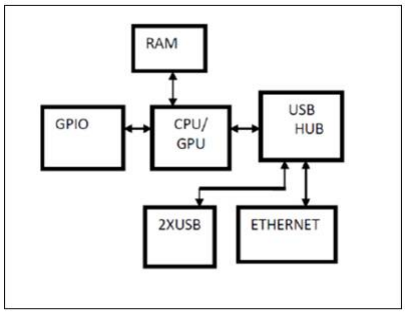

Fig. 2: Block Diagram of Raspberry Pi model B

B. ***ZIGBEE MODULE***

ZigBee (over IEEE 802.15.4) technologies based on short range WSN and it was selected for this battery-operated sensor network because of its low cost, low power consumption, and greater useful range in comparison with other wireless technologies like Bluetooth (over IEEE 802.15.1), UWB (over IEEE 802.15.3), and Wi-Fi (over IEEE 802.11) . The ZigBee devices operate in industrial, scientific, and medical 2.4-GHz radio band and allow the operation in a so-called mesh networking architecture, which can be differentiated into three categories: 1) coordinator; 2) router; and 3) end device.

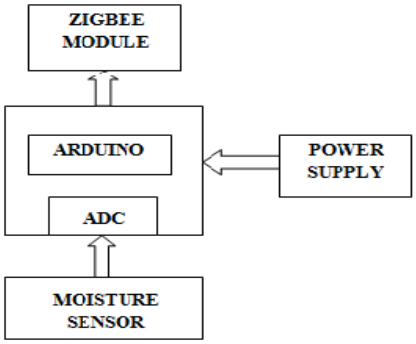

Fig. 3: Block Diagram of the Slave side of the System

The slave consists of Arduino and moisture sensor. Zigbee module serves as backbone for the communication between master and slave.

C. ***ARDUINO***

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

D. ***MOISTURE SENSOR***

Soil moisture sensors measure the water content in soil. Soil moisture is an important component in the atmospheric water cycle, both on a small agricultural scale and in large-scale modeling of land/atmosphere interaction. Vegetation and crops always depend more on the moisture available at root level than on precipitation occurrence. Water budgeting for irrigation planning, as well as the actual scheduling of irrigation action, requires local soil moisture information. Knowledge of the degree of soil wetness helps to forecast the risk of flash floods, or the occurrence of fog .A soil moisture probe is made up of multiple soil moisture sensors. We will use the moisture sensors which can be inserted in the soil, in order to measure the moisture content of the soil. The moisture sensor is connected to transistor. One probe is connected to the collector and one to the base of the transistor. The output voltage is taken at the emitter. As the base or collector current is high the output voltage is also high. More output voltage means more moisture.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 9, September 2016

IV. METHODOLOGY

The system can be represented using algorithms and algorithms are designed using flowcharts.

A. *IRRIGATION ALGORITHM:*

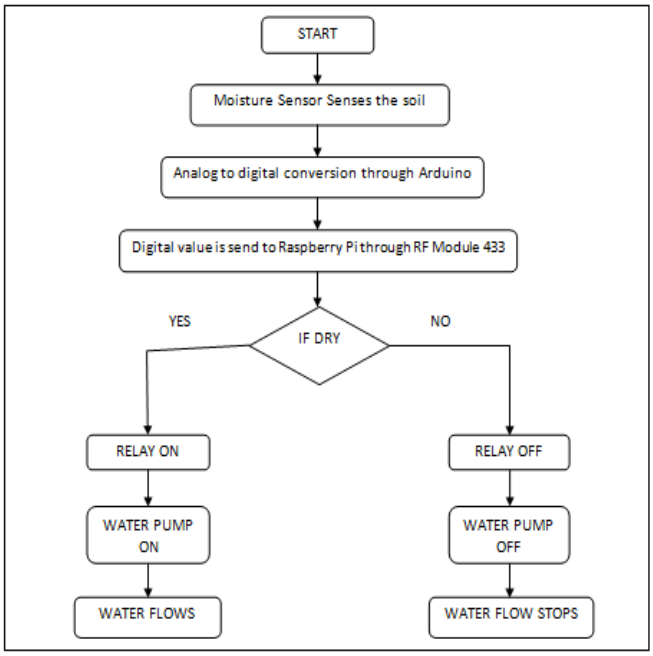

Fig. 4: Flow Chart of the System

The logics of the algorithm help to identify whether there is need of water to plant. Further, logics and decision making conditions help soil moisture condition of the soil and it always maintain moisture.

First the moisture sensor senses the soil. The output of the moisture sensor is in the analog form. The ADC of the Arduino converts the output of the moisture sensor into digital form. The digital value is then send to the Raspberry pi through RF module which decides whether to soil is wet or dry and according to that water the plant. If the soil is dry, Raspberry pi actuates the relay and water pump starts which leads to water to flow. If the soil is wet, Raspberry pi turns the relay of as a result water pump is off and water flow stop.

V. SIMULATION RESULTS

The installation of the automated irrigation system is done. The experiment was run for watering plants to check the reliability of the system. It is found that the system works properly and the water is passed to the plants as and when required.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 9, September 2016

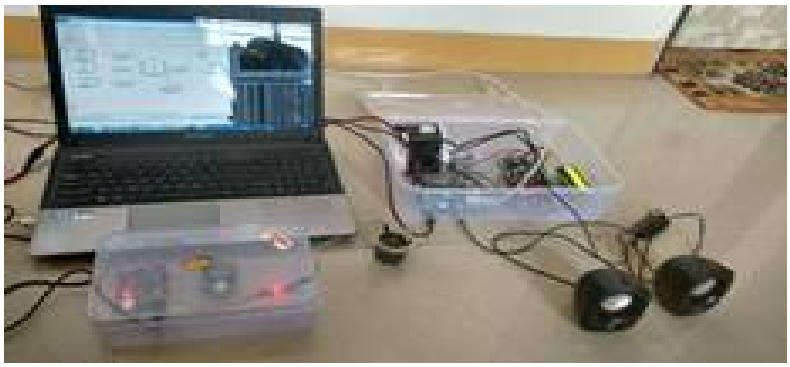

Fig.5: Irrigation System Installation

If the soil is dry, Raspberry pi actuates the relay and water pump starts which leads to water to flow. If the soil is wet, Raspberry pi turns the relay on as a result water pump is off and water flow stop. In figure [6] the results are shown.

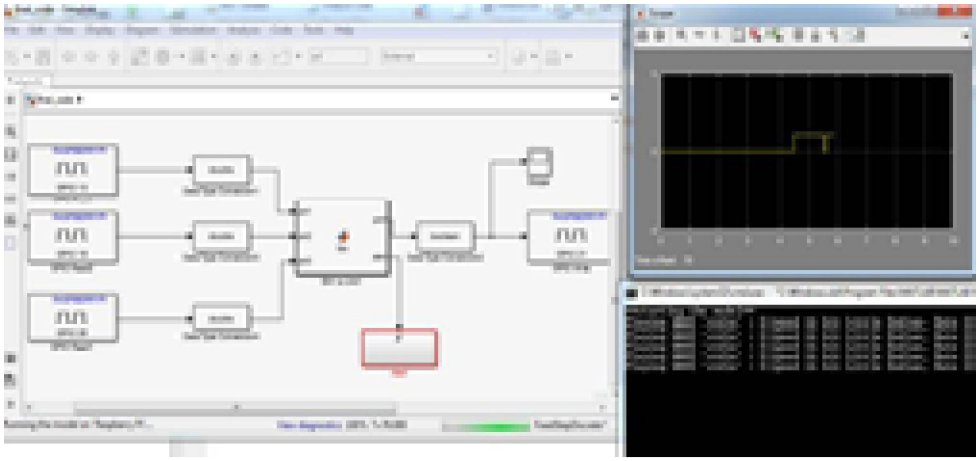

Fig. 6: Figure showing the status of the motor.

VI. CONCLUSION AND FUTURE WORK

In this work, we successfully develop a system that can help in an automated irrigation system by analyzing the moisture level of the ground. The smart irrigation system proves to be a useful system as it automates and regulates the watering without any manual intervention. The primary applications for this project are for farmers and gardeners who do not have enough time to water their crops/plants. The moisture sensors and temperature sensor measure the moisture level (water content) and temperature of the different plants. If the moisture level is found to be below the desired level, the moisture sensor sends the signal to the Arduino board which triggers the Water Pump to turn ON and supply the water to respective plant. The system features a custom sensor design for power efficiency, cost effectiveness, cheap components, as well as scalability end ease of use. In future there are some tasks that should be done and would develop the system to a more mature state. A modular design that gives the opportunity to users of using energy sources, connectivity and sensors as modules could be a very useful and easy-to-use .The system may be further extended for outdoor utilization.

REFERENCES

1. N.Agrawal and S. Singhal “Smart Drip Irrigation System using Raspberry pi and Arduino” in International Conference on Computing, Communication and Automation (ICCCA2015), 2015

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 9, September 2016

2. Gutierrez J, Villa-Media, J.F; Nieto- Garibay,A; Porta-Gandara;"Automated Irrigation System Using a Wireless Sensor Network and GPRS Module" IEEE transaction on Instrumentation and Measurement Year: 2014, Volume: 63, Issue: 1 Pages: 166 – 176
3. R.Hussain, J.Sehgal, A.Gangwar, M.Riyag " Control of irrigation automatically by using wireless sensor network" International journal of soft computing and engineering, vol.3, issue 1, march 2013, pp.48t 324-328
4. Chuang Yu, Yi Wu, Yang Yu, "Intelligent Irrigation System Based on Fuzzy Control", Artificial Intelligence And Computational Intelligence (AICI), 2010 International Conference on, 2010, pages 519-521
5. R.Karthikeyan, P.Mahalakshmi, N.GowriShankar, "Wireless Sensor Networks For Efficient Irrigation System Using Hybrid PV -Wind System
6. Shi-feng Yang, Jian-ying Guo, Xiu-Qing Wang, "Detecting Of Water Storage Information In Crops With Acoustic Emission Technology And Automatic Irrigation System" Symposium on Piezoelectricity, Acoustic waves and device applications, 2008, pp. 566-569
7. Suzuki, Y; Ibayashi, H; Mineno, H; "An SVM Based Irrigation Control System for Home Gardening", Consumer Electronics (GCCE) IEEE 2nd Global Conference, October 2013, pp.365-366
8. Ameer S, Chaubey S.S, Joseph M., Rajeshirke P., " Automatic Irrigaton System Trough Solar Power", International Conference on Electrical, Electonics, Signals, Communication And Optimization (EESCO) IEEE, Jan 2015,pp. 1-5
9. Tarange, P.H; Mevekari, R.G; Shinde, P.A.; "Web Based Automatic Irrigation System Using Wireless Sensor Network And Embedded Linux Board" , International Conference On Circuit , Power And Computing Technologies (ICCPCT), March 2015, pp. 1-5
10. Chikankar P.B, Mehetre D, Das S, "An Automatic Irrigation System Using Zigbee in Wireless Sensor Network", International Conference on Pervasive Computing (ICPC), January 2015
11. Rani M.U, Kamlesh S, "Web Based Service To Monitor Automatic Irrigation System for the Agriculture Field Using Sensors", International Conference on Advances in Electrical Engineering (ICAEE), Jan 2014