DESIGN A SET OF LOW COST WEB MONITORING AUTOMATIC IRRIGATION SYSTEM BASED ON RASPBERRY PI USING ZIGBEE TECHNOLOGY

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ABSTRACT :-

In this paper, we proposed an embedded system to develop a smart irrigation monitoring system using raspberry pi. Focus area will be parameters like temperature and soil wetness. This method will be a substitute to ancient farming method .We will develop such a system that will facilitate a farmer to know his field status in his home or he could also be residing in any a part of the planet. It proposes a automatic irrigation system for the agricultural lands. Presently the automation is one of the necessary roles in the human life. It not only provides comfort but also reduce energy, potency and time saving. Currently the industries are use automation and control machine which is high in price and not appropriate for using in a very farm field. Thus here it additionally designs a smart irrigation technology in low price that is usable by Indian farmers. Raspberry pi is the main heart of the full system. Automation permits us to manage appliances automatically.

Keywords: Raspberry pi, Web Application, Zigbee, relay, automatic irrigation system.

1. INTRODUCTION

In worldwide, nearly 60 % of the land is roofed with agriculture and it needs 80 % of obtainable water in the earth. The water consumption goes high and therefore the usage of water from 1950 onwards for various purpose are shown in Figure-1.

So, it's necessary to use the water economically[1] and this paper describes an automatic irrigation system with the use of embedded Linux board and 8051 microcontroller. Previously, so many systems[2-4] were developed for reduction of water usage in irrigation system by means of automatic devices[5], however none developed for real time applications.

This paper describes concerning the real time irrigation system. The main drawback in real time system is information can't be transmitted on web directly as a result of the farm in remote locations.[6] So, in this paper we are using 2 controllers, one controller tracks the information from each sensing element and transmit this data to another controller employing a wireless communication device. For tracking information from sensors we are using 8051 microcontroller. the information is transmitted from one to another controller using ZigBee transceiver.[6,7] Raspberry pi two is another controller used for controlling web application. The user must

login into the web application[10] to regulate the motor or sending messages to the controller to prevent the motor. This technique provides management of motor by the user in anyone method either web[11,12] based or automatic. It contains a number of sensing element nodes, every node contains temperature sensing element, moisture sensing element, water level sensing element and motor. Every sensor node are placed based on range of sensors and motor.

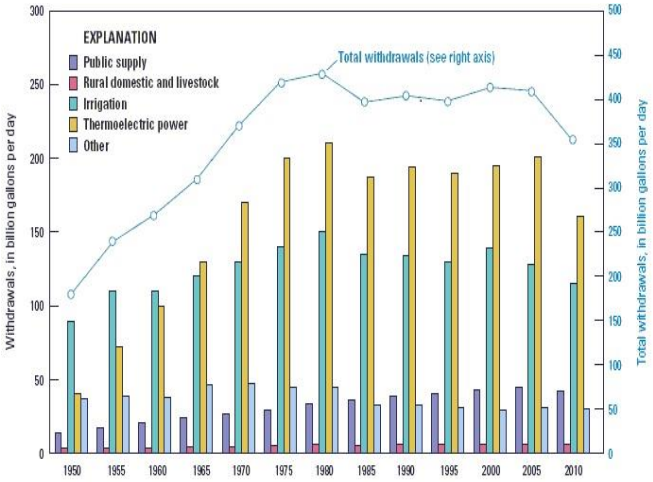


Figure 1. Usage of water from 1950 to 2010.

By the use of this type of irrigation system we can save the fresh water. Nearly 10 percent of fresh water using for farms is reduced using this system. This paper contains mainly three sections like overview of the system, operation and implementation of the system.

2. SYSTEM OVERVIEW

2.1 Raspberry Pi 2

The Raspberry pi 2 acts like a CPU and is connected with monitor, keyboard or touch display and with the peripherals used. In the Raspberry pi 2 number of models will be available. In this paper model B is used and it gives six times the processing speed of other previous models.

The Raspberry pi 2 model B has a Broadcom BCM2836 processor. BCM2836 is high powered ARM cortex-A7 based quad-core processor and operates at a frequency of 900 MHz with memory capacity to 1 Gbyte. It has 40 pin GPIO Header for interfacing the external devices to com-municate with the processor. The communication media are like I2C, CAN, SPI and in this project GSM is used in direct connection with the TRX and RXI pins in GPIO. It has quad USB ports, 10/100 BaseT Ethernet socket, DSI Display connector, Micro SD card slot, 5 v Micro USB, HDMI port, CSI camera connector and 4-pole 3.5 mm jack. All of these are shown in Figure 2.

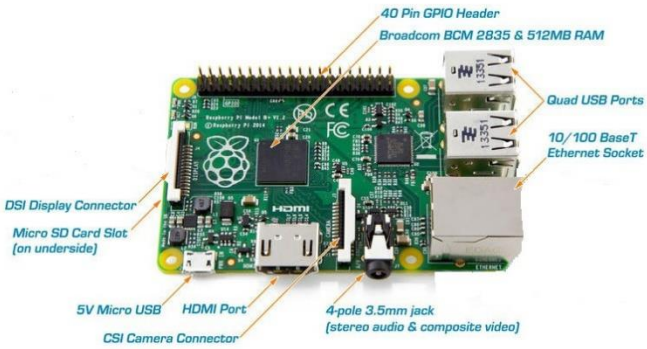


Figure 2. Raspberry pi 2.

This Raspberry pi 2 works on the basis of raspbian OS. Different types of Raspberry pi are working on different operating systems. Raspbian is an open source OS based on Debian optimize for the Raspberry Pi hardware. This Raspberry pi 2 contains an OpenCV based image processing library.

2.2 Temperature Sensor

A sensor will convert one kind of energy into electrical energy and here we want to sense the temperature around the area. For this purpose, LM35 is used as

temperature sensor. The output of the LM35 is in analog form, it is converted into digital using ADC. After conversion of ADC these digital data is given to 8051 microcontroller.

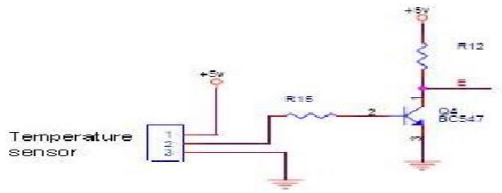


Figure 3. Temperature sensor.

2.3 Moisture Sensor

Moisture sensors are of different types. Here we used Soil moisture sensors to measure the soil wetness. Measuring soil wetness in agriculture helps farmers to manage water level more efficiently. Irrigation system consumes different water levels at different stages of growth. Critical plant growth stages farmers use less water to grow the crop with high quality. The soil moisture sensor gives reliable readings in all soil types, installation at both the soil surface and at depth. This sensor measures volumetric soil moisture content with ±3% precision. How moisture sensor is connected to controller is shown in Figure 4.

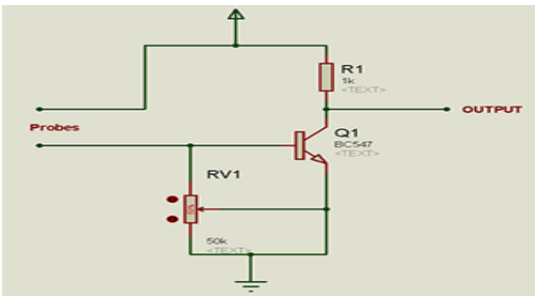


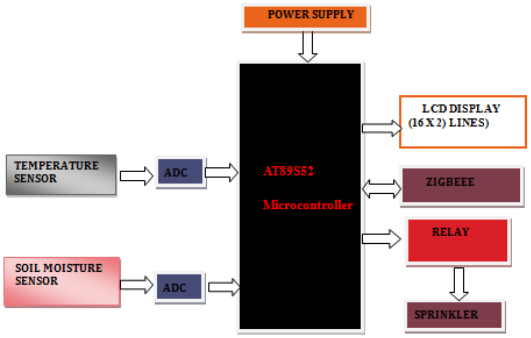
Figure 4. Moisture sensor.

2.4 ZigBee Transceiver

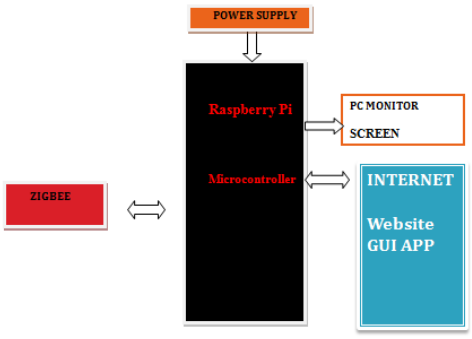
ZigBee transceiver is a wireless device used to transmit information from one location to another location. Here we used two zigbee transceiver modules one is at sensor node and another is at coordinator node in order employ communication between them. ZigBee transmits or receive data with secure in the form of packets. It sends data based on IEEE 802.15.4 PHY and MAC layers. It transmits data with different speeds like 250 kbps (@ 2.4 GHz), 40 kbps (@ 915 MHz) and 20 kbps (@ 868 MHz).

3. OPERATION

Figure 5 shows the block diagram of the Proposed system. This entire system is divided into two parts namely sensor node and coordinator node . The sensor node consists of 8051 microcontroller and different sensors. This controller reads the sensor data time to time from all the sensors connected to this controller.



(a)



(b)

Figure 5. Block Diagram of (a) Field Sensor Section (b) Field Monitoring Section

The Sensor node consists of temperature sensor, Soil moisture sensor, field motor, Zigbee and 8051 microcontroller. Temperature sensor LM35 detects the temperature in the field and soil moisture sensor detects wetness in the soil. Then fed this analog values to ADC. The obtained digital value fed to 8051 and then transmit this information wirelessly using Zigbee Technology.

The coordinator node consists of Raspberry pi 2 with BCM2836 processor and 1 GB RAM. By using Zigbee transceiver coordinator node receives the sensor information and fed to the embedded web server. The user can login to the web server and access the data from anywhere in the globe. The user can also control the motor from web application by sending control commands.

The operation of the entire system is explained by the flow chart shown in

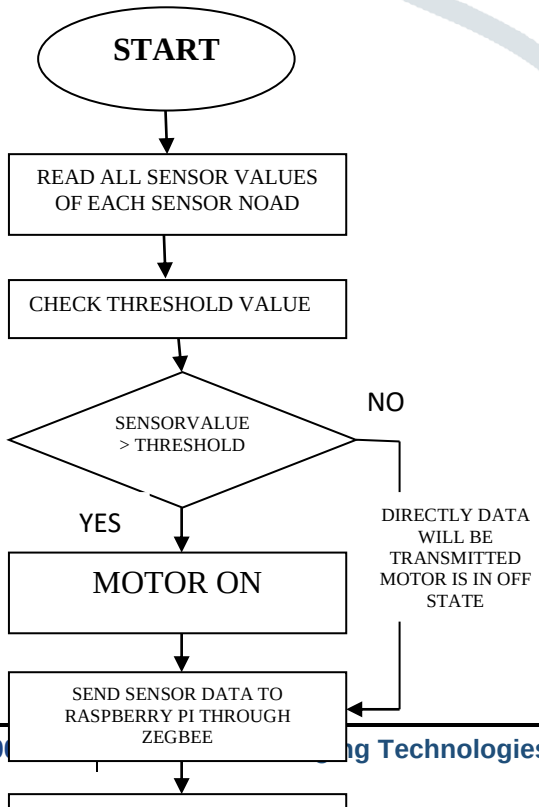
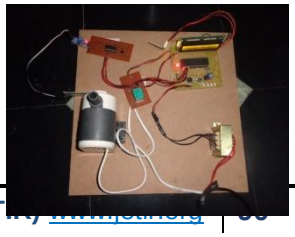


Figure 6: Flow Chart

Figure 6. Initially all sensor reads its values at each sensor node. Microcontroller takes this sensor data and check for threshold for each sensor. If any sensor value crosses its threshold value motor ON at particular node automatically without any human intervention. Then system sends sensor values to Raspberry pi through Zigbee. User can login to web application and monitor the sensor data and control the motor from remote location at particular node.

4. IMPLEMENTATION OF THE SYSTEM

The entire Hardware setup of the proposed system is shown in Figure 7. It includes both field section and embedded web server section. While we login to this application, the value of each sensor obtained is shown in Figure 8. The web application for this system is shown in Figure 9. The web application contains a server name with IP address. When user want to control the system then login into



web app and control.

Figure 7. System hardware kit.

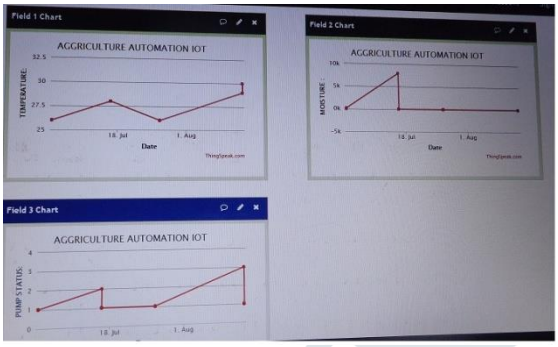


Figure 8. Application showing sensor values.

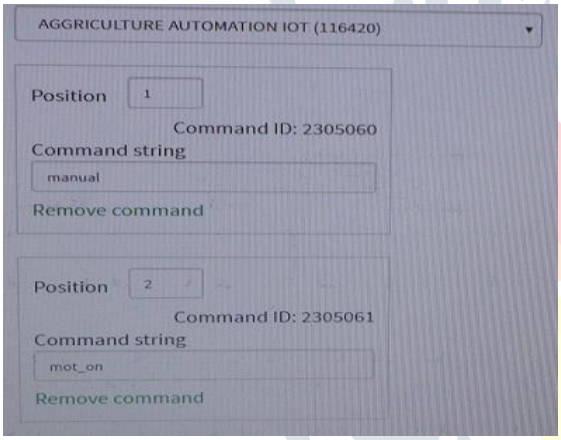


Figure 9. Application to control motor.

5. CONCLUSION

This web based real time irrigation system saves fresh water used for agriculture purpose. This system works in real time and efficient. Users easily operate the irrigation system through web application. This system enables of watering the crop by understanding and analyzing of the soil parameters like moisture and temperature. It uses easily integral wireless ZigBee transceiver for sending or receiving data. The controllers, components and software used for this system are based are real time purposes.

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