Water Management in Irrigation System Based On GSM

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Abstract – In India, for development in food production agriculture plays an important role. In our country, mostly agriculture are depends on the monsoons which is not sufficient source of water. So in agriculture field the irrigation is used. In Irrigation system, water is provided to plant as required for the soil type. In this paper, automatic irrigation system based on GSM module. The communication between the soil moisture sensor and controller is done with the help of GSM module. In addition to that the data which is received via GSM from the Irrigation field is send on web page using android's operating systems. This software application will control the devices wirelessly. The system is most useful in Irrigation for proper management of water and cost cutting.

Index Terms - ARM7, Bluetooth, GSM, Humidity, Irrigation System, Soil Moisture, Temperature Sensor, WSN, ZigBee.

1. INTRODUCTION

India is large agriculture country, and there is a shortage of water resources. More than 60% water is used for the irrigation crop of the total water, and year by year the agriculture water consumption is increase. Efficiency is extremely low due to traditional method of irrigation water utilization. For obtaining high-quality farming monitoring parameters of temperature, humidity and moisture in soil is an important means. Due to the cost effective nature and deployment flexibility, networks of tiny autonomous sensors capable of wireless communication, have been successfully used in a wide range of applications

Today, To transmit data in remote Monitoring System Ethernet network, RF module, GSM and Bluetooth wireless network are used. It is high costs, hard to be developed and limited signal coverage wireless solution. While WSN (Wireless Sensor Network) dispenses with the substantial costs of wiring, the GSM & WSN technologies are most suitable for agriculture applications comparing with Wi-Fi and Bluetooth. Highly Robustness for the interferences has made GSM as a highly versatile and attractive technology among other short range wireless technologies. The design presented has the advantage of both GSM technology, the sensors and devices are controlled by both by using ZigBee when in a limited range with the appliances and using SMS for remote monitoring and control thereby reducing the usage charges of GSM .This standard technology, used for short range WSN with small, low-power digital radios. Because of it is simpler, less expensive, low power consumption and greater useful range as compared to other wireless networks such as Bluetooth or Wi-Fi so it was selected for battery operated sensor network. Through mesh networking where intermediate devices are used to reach more distant ones ZigBee devices can transmit the data over long distance. The ZigBee communication protocol is mostly useful for low data rate applications such as control and monitoring systems that require long battery life, short range and secure networking.

Features Zigbee:

- Low battery consumption. The ZigBee devices can operate for months or even years without battery replacement.
- Low cost and low power device.
- The low data rate, maximum data rate is 250Kbps.
- Easy to implement

2. EXISTING SYSTEM

Depending upon the requirements there are many existing systems used in Irrigation for remote monitoring and controlling. Wireless Sensor Network (WSN) technologies used for wireless communication between the sensors and controllers are Bluetooth, Wi-Fi, and ZigBee. For controlling the system microcontroller based or FPGA based system is used depending on requirement.

- Implementation of system using Microcontroller
- Implementation of system using FPGA

2.1. Implementation of system using Microcontroller

The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. AVR is a modified Harvard architecture 8 bit RISC single chip microcontroller which was developed by Atmel in 1996. ATmega16 is high performance low power Atmel AVR 8 bit microcontroller with 8kb of in system self-programmable

memory. There are 131 powerful instructions present in ATmega16. Most of single clock cycle execution and 32*8 general purpose working register, fully static operation. The AVR core combines a rich instruction set with 32 general purpose working registers. All the32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle.

Irrigation system based on wireless sensors with GSM-Bluetooth and microcontroller, It has simpler features designed with the objective of low cost and effective with less power consumption for remote monitoring and controlling devices using sensors which are controlled via SMS using a GSM module. A Bluetooth module is also interfaced with the main microcontroller chip.

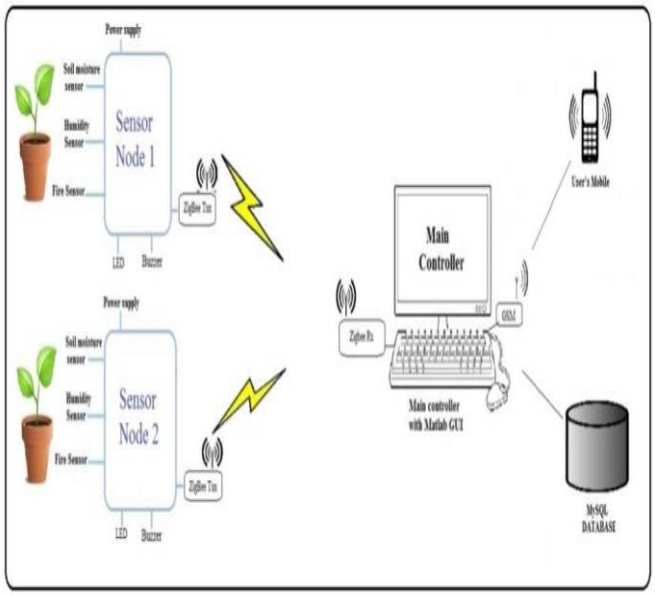
2.2. Implementation of system using FPGA

An irrigation control system can be developed based on a micro-controller unit (MCU) or an FPGA. An irrigation control system has already been done with 89C52, a kind of MCU. But the irrigation controller can only control the irrigation of a single greenhouse or a single piece of field due to the limitation of the pins of 89C52 (microcontroller), that means it control limited field. In order to support more requirements, some other peripheral circuits had to be added and more complex solution structure and debugging is resulted in an irrigation control system based on a MCU.As compared to MCU, an FPGA has more I/O pins and is able to control irrigation of several greenhouses without external interface circuits. It is most powerful, flexible and convenient to complete all the control logic by means of VHDL or Verilog. For fast in speed, small in size and easy to debug the irrigation control system based on an FPGA.

3. SYSTEM DESIGN AND IMPLEMENTATION

The main objective of the project is to provide Water Management in Irrigation System with monitor and control the parameters in agriculture sectors. However, a large number of devices do not have the network interface and the data from devices cannot be transmitted in network. A design of ARM7 processor-based embedded GSM interface is presented. As the parameters are discussed in the block diagram it will monitor the field and gives the accurate results to the user. The important thing is the level sensors to monitor the soil condition. If soil is dry means, this condition is very harmful to plants. So immediately release the water into the soil and make it wet. For this we will use the level sensors. In the case of monitoring the weather conditions temperature and humidity are useful.

The design of a remote control and monitoring system for agricultural that would graphically represent the soil condition of the crop distantly using ZigBee. At any abnormal condition, an alert message is sent to the user via GSM so that user can remotely perform an action by sending a message and simultaneously an alarm is raised.



- Controller

The microcontrollers are based on a 16/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller with 32 kB, 64 kB, 128 kB, 256 kB and 512 kB of embedded high-speed flash memory. Due to their tiny size and low power consumption, these microcontrollers are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. With a wide range of serial communications interfaces and on-chip SRAM options of 8 kB, 16 kB, and 32 kB, they are very well suited for communication gateways and protocol converters, soft modems, voice recognition and low-end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit 8-channel ADC(s), 10-bit DAC, PWM channels and 47 GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems.

For our implementation, AVR microcontroller is used which is a 32-bit RISC microcontroller with Harvard architecture. AVR is selected due to its high performance and lower power consumption functionality and offers wide range of innovative technical features. AVR also have some standard features such as on-chip 32K program ROM, 2K data RAM, 1K data EEPROM, 3 timers and 32 I/O pins. It also has some additional features like Analog to Digital converter.

- Soil Moisture Sensor

This moisture sensor can read the amount of moisture present in the soil surrounding. It's a low tech sensor, but ideal for

monitoring an urban garden, or per plant water level. This must have tool for a connected garden! To pass current through the soil this sensor uses the two probes, and then it reads that resistance to get the moisture level. More water makes the soil conduct electricity more easily, while dry soil conducts Electricity poorly. It will be helpful to remind you to water your indoor plants or to monitor the soil moisture in your garden Reflected microwave relation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners. this sensor is easy to use. Simply insert this rugged sensor into the soil to be tested, and the volumetric water content of the soil is reported in percent. The soil's field capacity, and maximum depletion point are mostly irrelevant, when using tension-based soil moisture sensors. A soil that is full of water will have a measured soil water tension near zero. Fruit trees and vines should be irrigated before they reach 40-50 centibars. For example, At earliest indications of water stress note the measured soil water tension, and be sure to irrigate before you reach that point in the future. Also take some readings right after irrigation. If the bottom sensor goes to zero, then it's possible you put too much water on. If it shows no movement at all apply more water next time to push water a bit deeper.

- Action Unit

The action unit consist of motors and valves which remotely operated by the user using GSM mobile. According to the user command action unit is controlled by the microcontroller which is interfaced with the controller.

- WORKING

The designed system consists of three nodes, Node 1 and Node 2 called as sensing node and node 3 is a Coordinator node. Node 3 plays an important role in the automated irrigation system. Node1 and Node 2 perform the same operation as it senses the information by using sensors and this sensing information is transferred to the ADC. The ADC is inbuilt in AVR microcontroller where ADC converts the Analog data to digital data and transfer to the UART for serial communication.

The ZigBee communication protocol is used for a wireless transmission of data. ZigBee transmits the data of sensor node to the Coordinator node where ZigBee receiver connected to PC receives and display the data graphically on the screen. For any particular crop, the threshold value can be set by the user and compare the threshold value with the actual value. If the threshold value exceeds the actual value then automatically alarm is raised and message is sent via GSM on the registered number. In case of fire, an alert message is sent to the user mobile. LED is used in place of pump so that a message can be sent by the user to on/off LEDs.

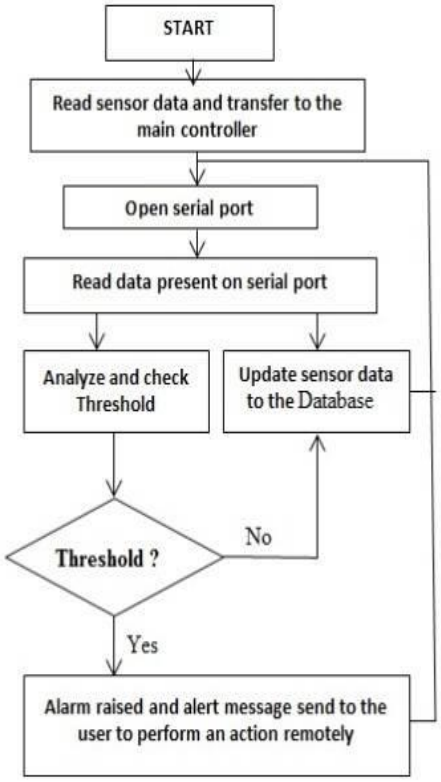


Figure: Workflow of the Automated Irrigation System

4. CONCLUSION

This system structures which is a blend of software and hardware. This system will offer flexible mode of operation, reliable control and data transmission. It is low cost water saving irrigation system. It requires only irrigation monitoring controller, low soil moisture sensors, system monitor and upper monitor computer hardware with related software. They will control electromagnetic valve, and realize the drip irrigation, sprinkler irrigation, micro-irrigation, and low-pressure pipe irrigation methods such as the automation of irrigation mode, achieve the purpose of a highly efficient precision. Irrigation process has extremely important in agricultural areas. This technology used to avoid more human efforts. It allows the user to monitor and also maintain the moisture remotely regardless of time. This can also useful for increasing the economy and demand of food necessity

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