Automatic Irrigation System Using ZIGBEE

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Abstract- *Irrigation is the main concern for agriculture. Long gone are the days of manual watering or relying on servant to water when you are on vacation or away on business. The Project presented here water to our plants regularly when you are out for vocation. The circuit comprises sensor parts. Sensors like Temperature, soil moisture, Light Sensor, Water Level Sensor are interface to the Microcontroller. Microcontroller we are going to use is LPC2138 of ARM7 family. Sensors output is analog so we have to use ADC to convert it into digital which is built in for ARM7. The microcontroller monitors the soil moisture sensor and when sensor sense the dry condition then it will automatically starts water pump using relay. It is also possible to start water pump through SMS on GSM module. It will shut off as moisture level reaches to predefined threshold level.*

Keywords- GSM Module, ZigBee, Sensors, ARM7, ADC.

I. INTRODUCTION

The main aim of this project is to design low cost Automated Irrigation System Using a zigbee and GSM Module. The existing monitoring systems of agricultural irrigation System are manual. We need human support for so. There are limitations for human to monitor all the parameters. There are chances of human errors. Like human calculations may not be precise sometimes. Or human may not cover larger area. We need some smart system which will automatically measure the parameters. In these application parameters calculations and controlling will be precise even over the larger area. Sensors like Temperature, soil moisture, Light Sensor, Water Level Sensor are interface to the Microcontroller. Microcontroller we are going to use is LPC2138 of ARM7 family. Sensors output is analog so we have to use ADC to convert it into digital which is built in for ARM7.The microcontroller monitors the soil moisture level and when sensor sense the dry condition then it will automatically starts water pump using relay. It is also possible to start water pump through SMS on GSM module. It will shut off as moisture level reaches to predefined threshold level. 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. An algorithm was developed with threshold values of temperature , water level, LDR and soil moisture that was programmed into a microcontroller-based gateway to control water quantity. It also control the temperature of particular area, moisture . All that values are display on the LCD screen. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated areas. The automated irrigation system hereby reported, consisted of two components wireless sensor units (WSUs) and a wireless information unit (WIU), linked by radio transceivers that allowed the transfer of soil moisture and temperature data, implementing a WSN that uses ZigBee technology. The wireless information unit has also a GSM module to transmit the data to a web server via the public mobile network. The information can be remotely monitored online through a Graphical User Interface application. The purpose of this project is to provide cell phone based embedded system for irrigation to reduce the manual monitoring of the field and get the information in the form of message.

II. LITERATURE SURVEY

On irrigation based system we search three papers. These papers short summary is given below:

An Automated Irrigation System for Rice Cropping with Remote Supervision[1].Rice cropping farms are significant loads in power systems due to the large amount of electrical energy required by the irrigation system. In Brazil, power companies invest in research to improve energy efficiency of this type of load. This paper presents an automated irrigation system based on supervisory control (SCADA) and wireless communication. The main objective of the project is to monitor and control the level of water in the crop, which represents an important impact on energy efficiency and water consumption. Specific characteristics of rice cropping irrigation was taken into account, such as large distances involved and different working schemes of water pumps. A complete solution is presented and it includes equipment description for reliable communication and supervisory features. Agricultural ecosystem monitoring based on autonomous sensor systems[2].More than two-thirds of freshwater consumed worldwide are used for irrigation, and large quantities of Freshwater can be saved by improving the efficiency of irrigation systems. Irrigation control systems deployed in agriculture can substantially be enhanced by implementing intelligent monitoring techniques enabling automated sensing and continuous analyses of actual soil parameters. Automatically scheduling irrigation events based on soil moisture measurements has been proven an effective means to reduce freshwater consumption and irrigation costs, while maximizing the crop yield. Focusing on decentralized autonomous soil moisture monitoring, this paper presents the design, the implementation, and the validation of a low-cost remote monitoring system for agricultural ecosystems. The prototype monitoring system consists of a number of intelligent wireless sensor nodes that are distributed in the observed environment. The sensor nodes are connected to an Internet-enabled computer system, which is installed on site for disseminating relevant soil information and providing remote access to the monitoring system. Autonomous software programs, labelled "mobile software agents", are embedded into the wireless sensor nodes to continuously analyze the soil parameters and to autonomously trigger irrigation events based on the actual soil conditions and on weather data integrated from external sources. Automated Irrigation System Using a Wireless Sensor Network and GPRS Module[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. The automated system was tested in a sage crop field for 136 days and water savings of up to 90% compared with traditional irrigation practices of the agricultural zone were achieved. Three replicas of the automated system have been used successfully in other places for 18 months. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited geographically isolated area.

III. PROPOSED SYSTEM

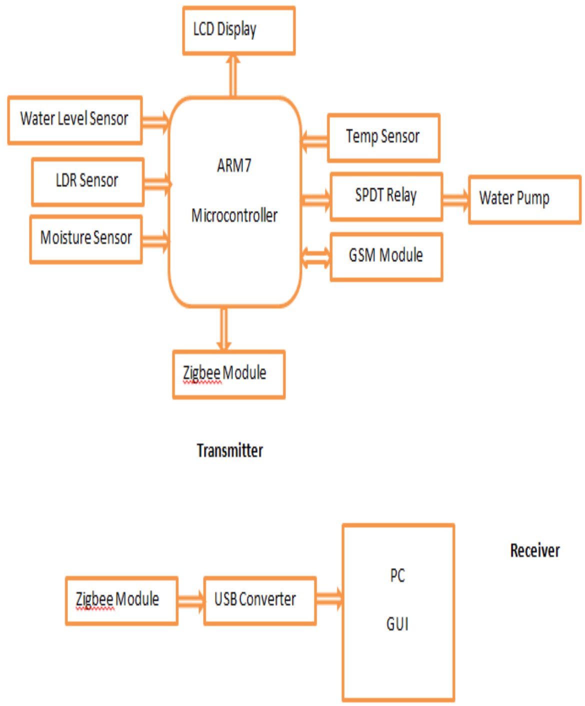


Fig 1. Block Diagram of Automatic irrigation system using zigbee

This system basically have two nodes Sensor Node and GUI node Sensor node will have Temp sensor, Soil Moisture Sensor, Water Level Sensor, Light Sensor etc. These sensors will be interface to ARM7 based Microcontroller which is heart of the system. Sensors output is Analog so ADC is needed. ARM 7 have built in 2 ADCs so we select. Also its having 32 bit RISC architecture so processes faster as compare to other Microcontrollers. We are using Zigbee communication as it is trusty and noise free as compare to RF communication. We are avoiding Bluetooth as its having limited range. Water pump is used for water supply. Because of its high current rating we will interface it through SPDT relay to Microcontroller. Soil Moisture sensor will sense dryness and accordingly pump will be action. GSM is used to indicate over condition of any of the sensor to farmer. It is also use to control water supply from distant location. All these data will be sending to receiver node where we can put it this data in GUI (PC).MATLAB will be use for GUI application.

Temperature Sensor:-

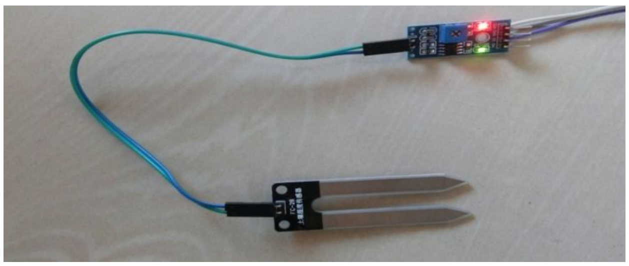
The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

ZiggBee Module:-

XBee 802.15.4 OEM RF module is used for embedded solutions providing wireless end-point connectivity to devices. This is an ideal module for robots to PC or robots to robots communication. This module can give range of 30 meters indoor or 100 meters outdoor. This XBee wireless device can be directly connected to the serial port (at 3.3V level) of your microcontroller.

IV. RESULTS

Moisture sensor:



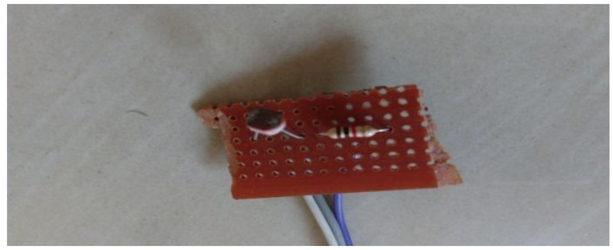
Here output of moisture sensor is analog , so it is necessary to convert it into digital ,this is done by ADC. The whole range of digital count is from 0-255.. But we have set the count to 100 for threshold level of sensor.

The main function of moisture sensor is that to detect moisture in soil , when the digital count is in pre-defined level (i.e. moisture is ok in soil.) then water pump will not start .But when moisture decrease below threshold level the water pump will start through SPDT relay.

Temperature sensor:

This sensor is used to detect the temperature around the plant. What ever temperature is present in that time is shown on LCD as well as terminal on PC or laptop.

LDR sensor:



This sensor is used to detect the light falls on the plant is measure in ohm. the detected value is display on LCD.

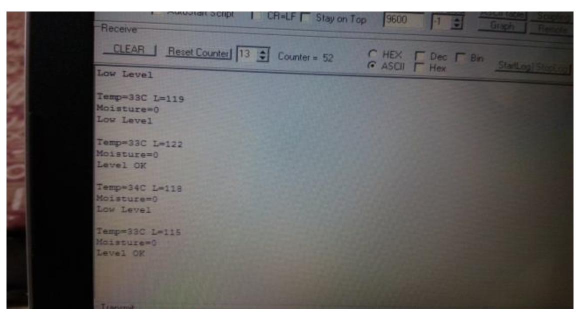
Level sensor:

As name indicate this sensor is used to indicate the water level present in tank and it will display on LCD.

It indicate two levels are follow:

- Low level
- Level ok

Terminal on PC or laptop:



This software is used to display the various parameter on PC monitor which are detected by various sensors at field location. Data displayed on LCD will received through zigbee receiver and will displayed on PC monitor.

V. APPLICATION AND ADVANTAGES

Advantage

1. Wireless Sensor Systems
2. Faster Controlling
3. Automatic Indication
4. Accurate system
5. No intervention of Humans so precise.

Application

1. Agriculture
2. Green Houses
3. Botanical Research

VI. CONCLUSION

An automatic irrigation system using zigbee was presented in this system. Its main features are: Observe the water level, temperature, moisture level, light intensity and the use of a communication system based on GSM to allow remote supervision. The control of the any type crop conditions is done by a dedicated controller, which eliminates the need for a computer on site. In addition, the controller has an interface that allows access to its parameters and also the implementation of a standard operation. This irrigation system allows cultivation in places with water shortage thereby improving sustainability. The irrigation system can be adjusted to a variety of specific crop needs and requires minimum maintenance.

The modular configuration of the automated irrigation system allows it to be scaled up for larger greenhouses or open fields. In addition, other applications such as temperature monitoring in compost production can be easily implemented. Furthermore, the Internet link allows the supervision through mobile telecommunication devices, such as a GSM based mobile. Besides the monetary savings in water use, the importance of the preservation of this natural resource justify the use of this kind of different irrigation systems.

ACKNOWLEDGEMENT

It is a great pleasure for us to present a project **“Automatic irrigation system using zigbee”** where guidance plays an invaluable key and provides concrete platform for completion of the project.

The hard work and perseverance of our mentor will always be embedded in our memory. Project execution would not have been possible for us without the continued assistance of certain people. We take this opportunity to express our deepest gratitude for all the heartfelt assistance rendered.

We thank **Prof. M. A. Maindarkar** our project guide who was responsible for coordinating all efforts and sincerely grateful to him for helping to achieve high standards of performance.

We are very grateful to **Prof. P.R Badadapure** HOD of ICOER, Wagholi for making available all the facilities required for the successful completion of the project.

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