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Remote monitoring automatic irrigation system for home gardens using GSM

[1] GNK Suresh Babu, [2] Sarala D.V, [3] Manjunatha S J, [4] Srivatsa Shashikumar
[1] Professor,Dept of MCA,AIT,VTU,INDIA
[2] Assistant Professor,Dept of CSE, APSCE, VTU, India
[3] Technical Lead Engineer,Alten Calsoft labs,Bangalore,India
[4] 8th sem Student, Dept of CSE, APSCE, VTU, India,vatsa0267@gmail.com

***Abstract*— In this paper we present a prototype for automatic controlling and remote accessing of irrigation motor. Prototype includes sensor node, controller node and mobile phone. In sensor node, soil moisture sensor and wireless transceiver is integrated with ARM cortex microcontroller. In controller node, GSM module, wireless transceiver, keypad, LCD display and a motor is integrated with ARM7 microcontroller. The sensor node can be deployed in irrigation field for sensing soil moisture and the sensed data is sent to controller node. On receiving sensor value, the controller node checks it with required soil moisture value. When soil moisture in irrigation field is not up to the required level then the motor is switched on to irrigate associated agriculture field and alert message is send to registered mobile phone.The controller node has navigation keys to set the mode of operation and an LCD display to view sensor data. The prototype is tested by abstracting three pots containing soils with different moisture level as irrigation fields. Results show the proposed prototype is effective in automatic controlling and remote accessing of irrigation motor based on the feedback of soil moisture sensor and commands from mobile phone.**

***Keyword*- ARM7 microcontroller, LCD Display, Motor**

I. INTRODUCTION

Irrigation is one of the powerful sources in India but it is hard for an individual person to monitor continuously and regularly. This is due to laziness of mankind. In order to make this irrigation easier our system comprises some changes in the usual irrigation system. The newly developed project controls water supply automatically in water crisis areas through moisture sensor. The project covers the application of Sensor based Irrigation system through wireless sensor networks, which uses a renewable energy as a source. In this system Wireless Sensor Networks Plays a major role in Environment monitoring system and provides unmanned irrigation. WSN consists of moisture sensors, temperature sensor, embedded controllers and uses ZigBee protocol for communications.

Though our country claims to have developed in terms of science and technology, erratic power supply or complete breakdown for hours together has almost become routine today. Solar power is being increasingly utilized worldwide as a renewable source of energy. India has huge untapped solar off-grid opportunities. This project gives information about development procedure of an embedded system for Off-Grid irrigation system. The design projects on developing an intelligent controlled mechanism for best possible utilization of resources for irrigation. The farmer (user) can water the fields/garden from any place using GSM technique which provides an acknowledgement message about the job status. ZigBee is a specification for high level communication protocols using small, lowpower digital radios based on an IEEE 802 standard for PAN. ZigBee devices are often used in mesh network form to transmit data over longer distances, passing data through intermediate devices to reach more distant ones. This allows ZigBee networks to be formed ad-hoc, with no centralized control or high-power transmitter/receiver. The microcontroller used in the system is the PIC which is based on the Harvard architecture. It controls all the processes and is low cost, widely available, has large user base, extensive applications, availability of low cost or free development tools. The main advantage of this project is optimizing the power usage through water resource management and also saving government's free subsidiary electricity. This proves an efficient and economy way of irrigation and this will automate the agriculture Systems based on PC as the main controlling device make it possible to control remotely from any part of the world provided internet access is available. But on the flip side, the system is of high cost due to the requirement of a computer. And special hardware and software installation is required to control the devices in a particular design. It is difficult to monitor and control the status of different sensors and devices in case of power failure unless you have a battery backup which is an additional cost.

In order to overcome these drawbacks, we have proposed a system which uses renewable energy source and a wireless sensor network protocol called ZigBee which

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enables remote monitoring of the crops in the gardens.

II EXISTING SYSTEM

The wireless irrigation system consists of a weather station and is equipped with Bluetooth and global positioning system (GPS).Weatherstation transmits the status of the soil moisture(humidity) and temperaturethrough theBluetooth to a computerized base station which can be accessed by internet.Some systems save 20-30% of water consumption as compared with the conventional method.

Slave nodes consists of a set of sensors (temperature and soil moisture sensors),water valveactuators ,single chip microcontroller and wireless transceivers. The master receives the garden temperature and soil moisture from the slave nodes .The water valves are operated according to predefined irrigation modes.

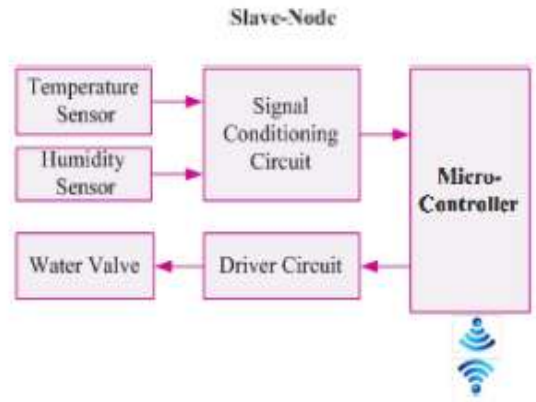

Fig. 1. Building blocks for the Slave-Node

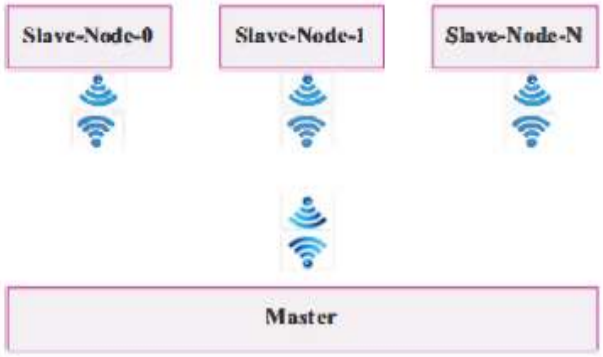

Fig. 2. Master-Slaves hardware layout

III METHODOLOGY

The system is developed based on ZigBee which consists of four parts: wireless sensor networks, gateway, transmission network, remote monitoring center. The sensor nodes can obtain the temperature, humidity information in real time, and then transferred to the remote monitoring center by the gateway via the transmission network. In irrigation process the soil condition is sensed by the sensors and the information is processed by the controller and transmitted over the ZigBeemodule.The data will be processed by the microcontroller and then can be transmitted to farmer's mobile phone using GSM module by using AT commands that are instructions used to control a modem. Then the commands via SMS can be given by the farmer through GSM which will initiate or terminate the irrigation process via relay controlled motor in the field depending on the moisture conditions of the soil. The readings can also be displayed on the LCD interfaced with the controller and the record can be maintained so as to make a comprehensive report to enable the farmer take proper decision about the timely irrigation and pest controlling.

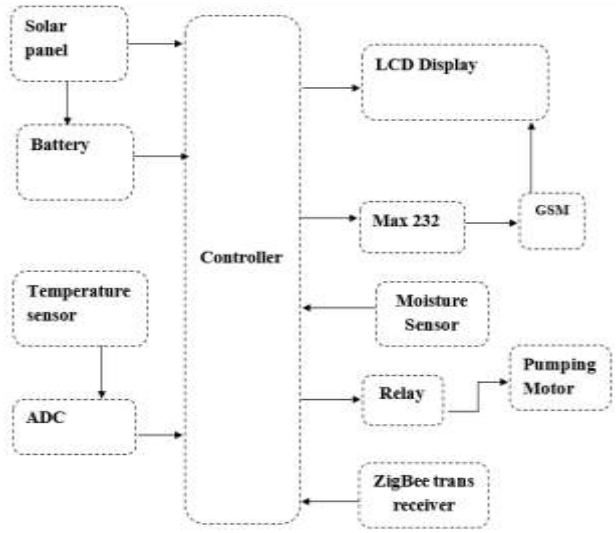

Fig.1 Block diagram of transmitter.

Fig.2 Block diagram of receiver.

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IV FLOWCHART AND ALGORITHMS

A. Algorithm for temperature sensor

Step1: take the readings from temp sensor
Step 2: If temp> 38^C
Print "temp ^c switch on motor"
Else
Print "temp ^c"
Step 3:Continue to read data at a delay of 1000ms.
Step 4:De-initialize the sensor and terminate.

B. Algorithm for Soil moisture sensor

Step 1:take the readings from soil moisture Sensor
Step 2: If Moisture < 25%
Print "no water".
Print "switch on the motor".
Else
Print "water content"
Print "switch off motor".
Step 3: Continue to read data at a delay of 1000ms.
Step 4:De-initialize the sensor and terminate.

C. Algorithm for intrusion detection

Step 1: Wait for animal to enter the field
Step 2: If animal touches the fence switch on the Buzzer.
Step 3: Print "Intrusion entering the field"
Step 4 : Send the message to desired mobile Number.
Print "intrusion entered the field take care".

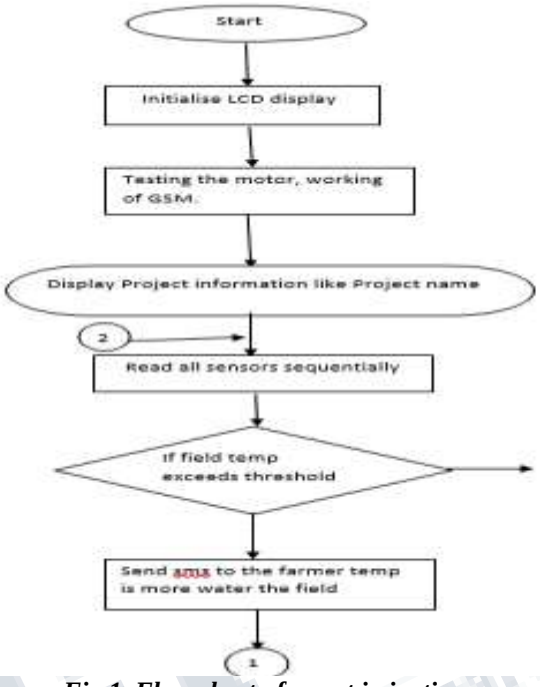

Fig 1. Flow chart of smart irrigation

The flow diagram describes about initialization of LCD and reading of temperature from temperature sensor and sending sms to the user.

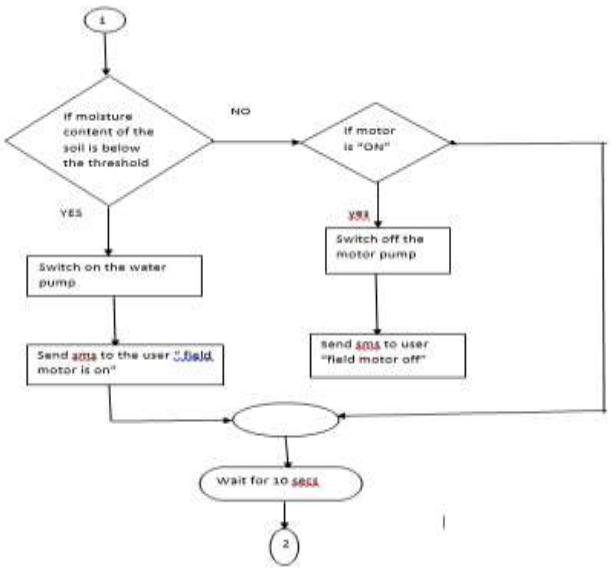

Fig.2 Flow chart of smart irrigation

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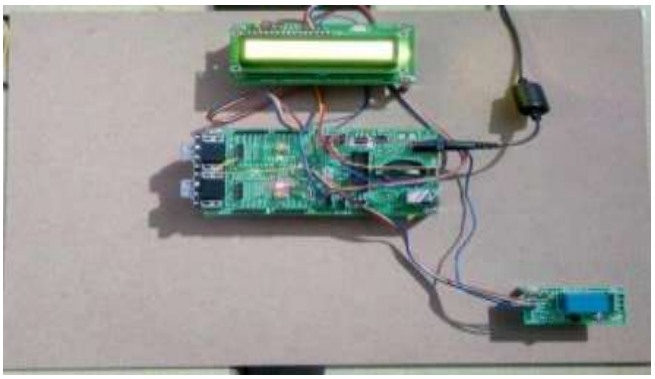
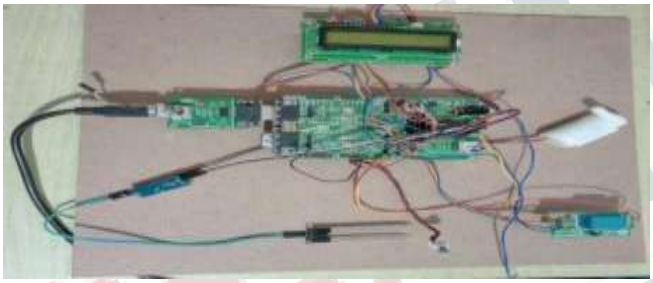
V. PERFORMANCE RESULT

1. Interfacing LCD Display to Microcontroller



The LCD Display is used to show the string giving theN information about the project as well as the data when some action is taken place.

2. Interfacing soil moisture sensor to Microcontroller



The soil moisture sensor estimates the water content present in the soil and if the value is below the threshold it triggers the motor.

3. Interfacing Temperature Sensor and Microcontroller

The temperature sensor is used to evaluate the amount of heat present in the atmosphere and GSM module is used for communication i.e to send and receive SMS to/from user mobile.

4. Overall interfacing to Microcontroller

The overall architecture comprises of all the components which work in a cooperative manner in order to carry out the irrigation process.

VI .CONCLUSION AND FUTURE WORK

Here we present a prototype for automatic controlling and remote accessing of irrigation motor. Prototype includes sensor node, controller node and mobile phone. The sensor node is deployed in irrigation field for sensing soil moisture value and the sensed data is sent to controller node. On receiving sensor value, the controller node checks it with required soil moisture value. When soil moisture in irrigation field is not up to the required level then the motor is switched on to irrigate associated agriculture field and alert message is send to registered mobile phone. Mobile phone is used for sending request SMS to get soil moisture value in irrigation field and commands can be sent as SMS to switch on/off the irrigation motor. Prototype is experimented by abstraction three pots containing soil with different moisture level as irrigation fields. The experimental results show that the prototype is capable for automatic controlling and remote accessing of irrigation motor based on the feedback of soil moisture sensor. The prototype can facilitate farmer in monitoring and controlling irrigation activity from remote location. The future enhancements in this project are plant type and soil type can be used to suggest the user about the fertilizers, water level for each type. An additional feature of monthly growth analysis can be added. The user can be provided a prior alert about the level of water tank.

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