



## Smart Technology for Real Time Weather Monitoring and Control in Agriculture Based on Green House

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### Abstract

In the past few years, embedded system technologies are used in wide range of application in Agriculture. One of the applications is monitoring and control of weather parameters in agriculture field. Here the parameters like humidity, temperature, soil moisture and leaf wetness can be measured by using various types of sensors and processors such as temperature sensor, humidity sensor, leaf wetness sensor and ARM processor with Zigbee protocol. By using this, various environment parameters in the agriculture field can be measured and control. In this application the sensor is act as a main role that passed the collecting information to controller via Zigbee technology. All sensors are controlled by ARM microcontroller. The Global System for Mobile communication (GSM) is chosen as a transmission to all because it is high speed and security. It provides current status of the environmental conditions that details are suitable for farming.

**Keywords** –Wireless Sensor Network, ARM Processor, Sensors, Environment Parameters, GSM

### I. Introduction

In the continuous economic growth, the demand in the agriculture is also increasing. The better technology is needed to improve the efficiency and quality of production in the agriculture field. This project which is helps to control and monitor the environmental climate parameters in the agriculture. In this, agriculture field can be modified like green house environmental. The system contains ARM microcontroller, Zigbee, GSM, Motor, and various sensors like temperature sensor, humidity sensor, soil moisture sensor and leaf wetness sensor. Sensors send the signal to the microcontroller at a particular time period and the signal that can be converted into the digital signal

using ADC which is inbuilt in the microcontroller. When any of the environment parameters cross the threshold level, the microcontroller gives a command to the motor and relay to turn on. The water level indication application is also used in the agriculture field, if the water level is reached to threshold level zigbee module send the indication message to farmer's mobile phone. The embedded based control system is used to maintain the crop growth in agriculture field.

### II. System Architecture

The Important parameters can be measured by the various sensors. This paper aims to build automatically collecting parameters such as humidity, temperature, and soil moisture and leaf wetness in the agriculture field. The sensors like humidity sensor, temperature sensors, and soil moisture sensors are to be used to collect the various parameters in the agriculture environment. These sensors passed the collecting information to the Micro controller via Zigbee transceiver. The whole field can be first divided into the small sections or some parts in the agriculture field are taken into the measure. LM 235 can be used as Temperature Sensor and Soil Moisture Sensor can be used as to detect the wetness of the soil in the agriculture field. Once the Sensors are reached their threshold value the sensor sends the signal to the microcontroller to turn on and off the relays. The leaf wetness sensor can be used to measure the leaf wetness of the crop and send the corresponding output to the microcontroller. If the wetness of the leaf is below to the threshold value the exhausting fan can be turn on by using the relays and it's controlled by the microcontroller. A traditional approach to measure these parameters in an agriculture environment meant individuals manually taking measurements and checking them

at various times. The Zigbee act as both transmitting and receiving of data in the wireless medium. The Global System for Mobile Communication (GSM) is chosen as transmission to mobile or PC because it is high speed and safekeeping. The working method of this system can be explained by the flow chart see fig.a) System Architecture.

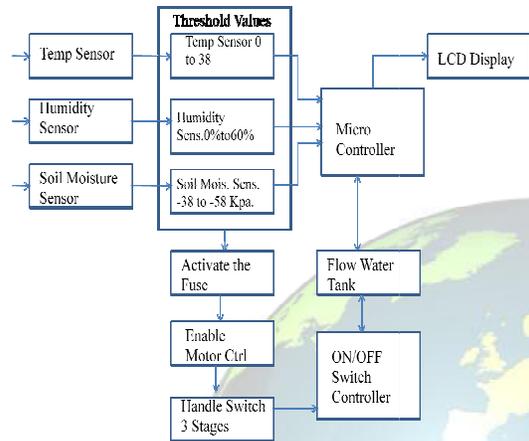


Fig a) System Architecture

The main operational of this paper is to constantly check the temperature, humidity and soil moisture conditions through internal ADC and displays the readings on the LCD display. If the reading goes beyond the threshold values then the specified person will be indicated through SMS using the GSM module, which is connected to the microcontroller. Fig b) shows the picture of transmitter of system and fig c) shows the picture of receiver of system that is placed in the agricultural field, which will sense the respective parameters and show the values on the LCD display and process it to send SMS through GSM to the user mobile.

### Transmitter Section

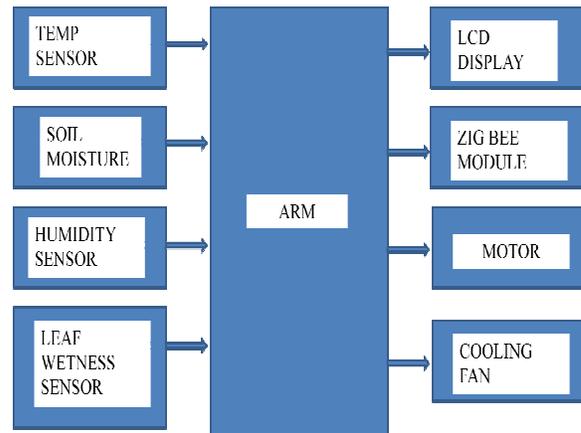


Fig b) Block Diagram of Transmitter Section

### Receiver Section

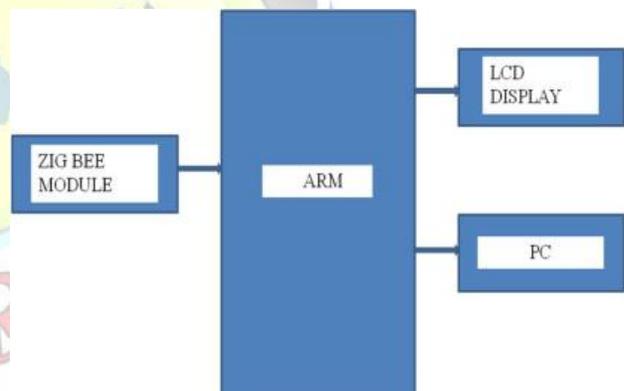


Fig c) Block Diagram of Receiver Section

## III. Hardware Description

### Sensor

Sensors are used to convert physical quantity into electrical signal, which responds to an input quantity by generating a functionally related output usually in the form of an electrical signal. Sensors are used to measure the small changes in the agriculture environment and it send to the microcontroller. Here following sensors are to be used; they are tabled as follows,



Name	Range	Threshold Level	Description
Temperature Sensor (LM35)	-45°C to 150°C	0°C to 38°C	Serial Sensor that measures temperature
Humidity Sensor (SH220)	0% to 100%	0% to 60%	Serial Sensor that measures humidity in climate
Soil Moisture Sensor	0% to 100%	0V or 5V	Sensor with on/off signal to detect if soil needs water

Table 1) Sensors and its Range

### Microcontroller

A microcontroller (MUC) is a small computer with I/O, memory are in build which are used in automatically controlled devices. Effective management for Greenhouse based agriculture here used ARM7TDMI-S LPC1768. That employs a unique architectural strategy known as THUMB, which makes ideally suited to high-volume applications with memory. It has a inbuilt Analog to Digital Converter and it has a two instruction sets are 32-bit ARM instruction set and THUMB instruction set. The peripheral complement of the LPC17xx includes up to 512kB of flash memory, up to 64kB of data memory, Ethernet MAC, a USB interface that can be configured as either Host, Device, or OTG, 8 channel general purpose DMA controller, 4 UARTs, 2 CAN channels, 2 SSP controllers, SPI interface, 3 I2C interfaces, 2-input plus 2-output I2S interface, 8 channel 12-bit ADC, 10-bit DAC, motor control PWM, Quadrature

Encoder interface, 4 general purpose timers, 6-output general purpose PWM, ultra-low power RTC with separate battery supply, and up to 70 general purpose I/O pins.

### Zigbee

Zigbee is wireless communication technology with lot of advantages like short distance, low complexity, low energy consumption, slow data rate and low cost. It is based on IEEE 802.15.4 Standard with the coordinating mutual communication among thousands of sensors which is in small size. Through the radio waves zigbee transmit the sensor values to the microcontroller. In zigbee module there are three types of topologies are used they are star, mesh and cluster tree. Here mostly used star and mesh. ZigBee defines the application and security layer specifications enabling interoperability between products from different manufacturers. In this way ZigBee is a superset of the 802.15.4 specification. The distances that can be achieved transmitting from one station to the next extend up to about 70 metres, although very much greater distances may be reached by relaying data from one node to the next in a network. The main applications for 802.15.4 are aimed at control and monitoring applications where relatively low levels of data throughput are needed, and with the possibility of remote, battery powered sensors, low power consumption is a key requirement. Sensors, lighting controls, security and many more applications are all candidates for the new technology. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or Wi-Fi.

### IV. Simulated Results

Here using ARM microcontroller the program is successfully build and compiled in Keil µVersion and the corresponding output is simulated in Proteus7 tool and got a simulated result in a single window. The result based on greenhouse environment by the automatic manner. Automatic monitor and control in the agriculture field can be fully done based on coding. Here, the sensors value



is mentioned in the coding. In simulation result shows the measured sensors value which is given in the coding. Visual Basic software is used to vary the values according to wish. In this fig d), output obtains for automatic controlling of greenhouse based agriculture. Here the sensors are connected into the input port of the ARM microcontroller. Sensors gives the physical input to the microcontroller, then it can be converted into the digital signal by using analog to digital converter that is inbuilt in microcontroller. If the measured temperature value from temperature sensor crosses the threshold value then the microcontroller gives the signal to motor driver circuit to ON motor. If the moisturising value reached above 60% in air the microcontroller gives the signal to the exhausting fan to reduce the moisturise level.

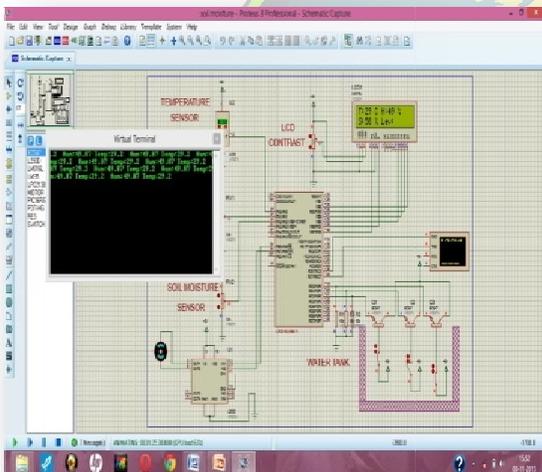


Fig d) Simulation output of Automatic Controlling process

In figure the water level indication is also to be used, in this three indication switch is used they are low level, medium level and tank full. If the tank is full 3<sup>rd</sup> switch is ON and alert message is send to farmer and the motor will be OFF automatically. LCD display is used to project the output result or the sensors measured value. In this Zigbee module is used to transmit and receive the signal to the microcontroller and to the farmer's PC or mobile phone.

## V. Conclusion

An embedded based real time monitoring and control system has been designed and implemented

to measure the environment parameters like temperature, humidity, soil moisture and leaf wetness in the greenhouse based agriculture. This system allows farmer to monitor the crop growth and control the fertility of soil. This system is economically reducing the energy consumption and save power. Maintenance of this system is less complexity and low cost. This system has a good practical value used in the greenhouse based agriculture.

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