Microcontroller Based Wireless Greenhouse Automation Using Solar Energy

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ABSTRACT

The growth of crop in greenhouse depends on various factors like temperature, humidity and other parameters in greenhouse. So it is important to monitor and properly measure and adjust the temperature, humility and other parameters in the greenhouse. So wireless monitoring system is developed, which is based on wireless communication technology, does not need cables& possess simple system construction. The main objective is to monitor & control the environment as per the crop requirement. In this different sensors like temperature sensor, humidity sensor ,soil moisture sensor etc. are interfaced directly to microcontroller.

In this paper we use a method for the monitoring temperature, relative humidity& soil moisture inside a poly house using microcontroller. In the proposed method, the greenhouse controller senses the change in relative humidityandtemperature with the help of input sensors and process the output to take appropriate control action. The system is a low cost and user friendly with high stability and reliability. This system also avoid the wastage of water by checking moisture in soil .This all system works on solar energy which is conventional energy source.

Keywords *-PIC microcontroller ,temperature sensor, humidity sensor ,moisture sensor, solar panel.*

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1. INTRODUCTION

In this project we have designed microcontroller & solar panel based greenhouse automation system. In this system we monitor the temperature, humidity& avoid the wastage of water by checking moisture of soil.We have used a Temperature sensor LM35 to sense the temperature. This temperature sensor can sense the temperature of the atmosphere around it. Humidity is controlled through humidity sensor. Here we are connecting a moisture based Electrode sensor. It detect the moisture in soil, if there is enough moisture then motor will automatically turn off.

Analog input of all this sensors are given to ADC to convert it into digital signal .This digital data is displayed on LCD. Solar panel are used to generate solar power and battery is used to store this energy in the form of electricity. Use of solar panel makes the system design Eco-friendly&optimize use of nonconventional energy sources, saving electricity& reducing environmental pollution.

Centralized control unit summarizes the data, collect &send to PC as well as receives control instructions from PC and adjust the environment parameters of every terminal. The PC collects the environment parameters of every terminal through RF transceiver and displays it, which gives all kinds of control instruction according to these parameters.

2.RELATED WORK

This paper proposed a system on Greenhouse monitoring & control system based on zigbee wireless sensor network using 8051 microcontroller. In this paper they discussed about polyhouse monitoring &control system based on zigbee wireless sensor network using ARM controller& is accessible to the user through the internet.[1]They have discussed about Greenhouse environment monitoring technology implementation

Based on android mobile platform,which uses android mobile phone as monitoring section.In this paper parameters in the greenhouse are monitored on the pc as well as the android mobile phone from any place in the world as it is connected to the internet through the teamviewer software.[2]In this paper the discussion is about humidity and moisture monitoring in greenhouse using zigbee monitoring system. In this paper wehave proposed low cost method using ARM microcontroller &zigbee technology to accurately monitor and control the various parameters like temperature, humidity, soil moisture.[3]They proposed a method automatic meter reading based on ZigBee-GSM system .In this paper they are using GSM modem to transmit fault messages to user via ZigBee[4]In this the discussion is about a closed loop automatic irrigation system monitoring the temperature and water usage. The system can be used in greenhouse as well as open fields. The real time values of temperature, soil moisture are transmitted using zigbee technology through the wireless medium from field to substation which controls the motor and irrigation valves according to the desired moisture level[5]

In this system whenever the prescribed humidity or water level of soil decreasing below prescribed threshold level. For this purpose we use a humidity sensor and water level sensor. The prescribed level of water varies depending on different crops and nature of the soil, here directly feed the type of soil & automatically set the water level. The farmer easily control and monitor the field using pcthrough Zigbee.[6]

Describe a remote monitoring system based on SMS of GSM. The system includes two parts which are the monitoring center and the remote monitoring station. The monitoring center consists of a computer and a TC35 GSM communication module. The computer and TC35 are connected by RS232. The remote monitoring station includes a TC35 GSM communication module, a MSP430F149 MCU, a display unit, various sensors, data gathering and processing unit.[7]
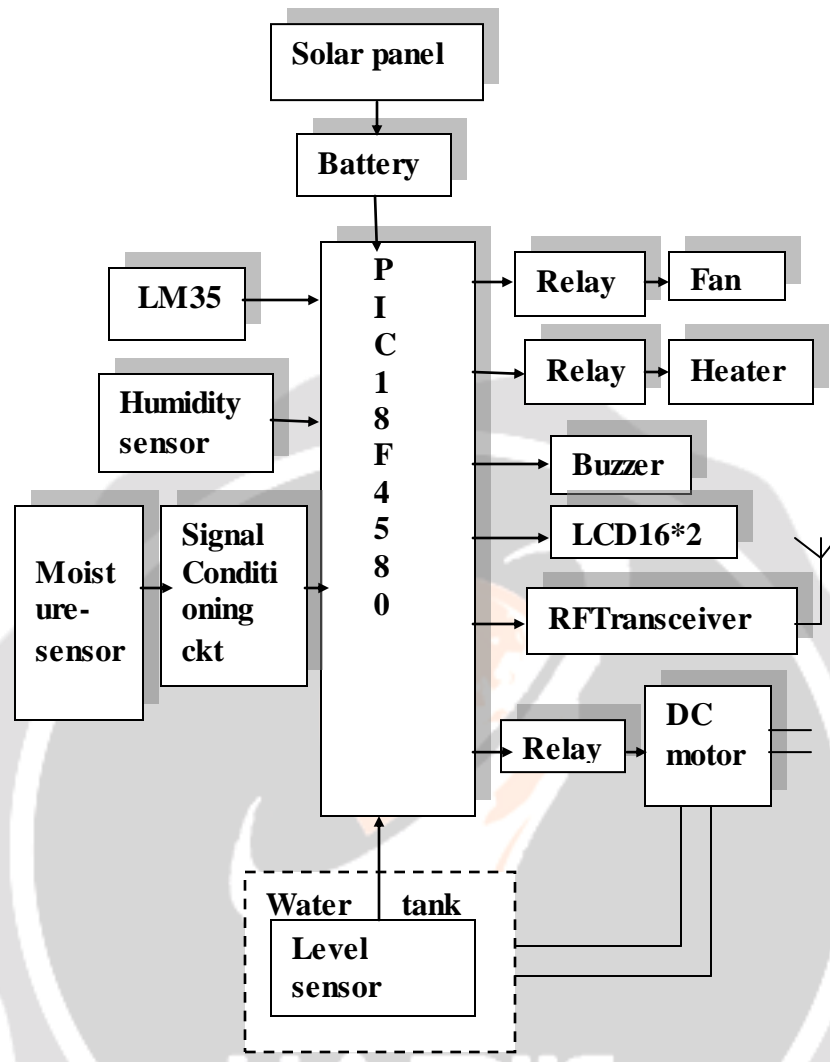
3.SYSTEM DESIGN

1.Green House Unit:

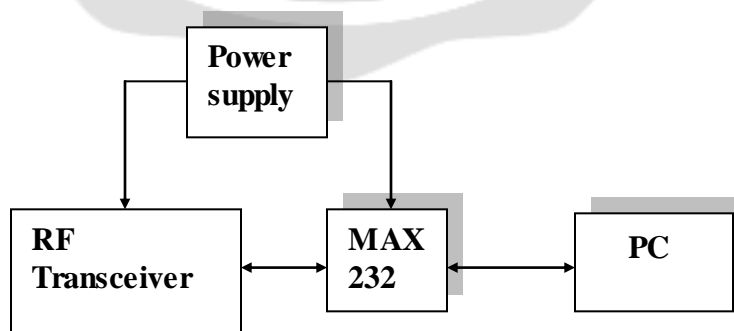**FIG-3.1** Block Diagram Of Greenhouse Unit

2.Monitoring Unit:

FIG-3.2 Block Diagram Of Monitoring Unit

1.PIC 18 microcontroller:(PIC18F4580)

PIC 18 is 8 bit processor ,meaning that the CPU can only 8 bit of data at a time. PIC18 has 40 input output pins. It has maximum 4096bytes of data RAM .the data RAM size for PIC18 varies from 256 bytes to 4096 bytes. The PIC18 has RISC architecture. That comes with some standard features such as on-chip ROM ,data RAM ,data EEPROM ,timers , ADC &USART and input output ports.

The advantages of all PIC18 microcontrollers are high computational performance at low price – with the addition of high-endurance, Enhanced Flash program memory.

Features:
- Flash program memory (for PIC18FX480 devices-16 Kbytes&for PIC18FX580devices- 32 Kbytes).
- A/D channels (for PIC18F2X80 devices- 8 and for PIC18F4X80 devices-11).
- I/O ports (for PIC18F2X80 devices 3 bidirectional ports and only 1input portandforPIC18F4X80 devices 5 bidirectional ports).
- CCP and Enhanced CCP implementation (1 standard CCP module for PIC18F2X80 deviceandone standard CCP module and one ECCP module for PIC18F4X80 device).
- Parallel Slave Port (present only for PIC18F4X80 devices).
- PIC18F4X80 devices has two comparators.

2.Temperature sensor:(LM35)

Temperature sensor is used to sense the temperature. We have used a Temperature sensor called LM35. This temperature sensor can sense the temperature of the atmosphere around it or the temperature of any machine to which it is connected or even can give the temperature of the human body in case if used. So, irrespective of the application to which it is used, it gives the reading of the temperature. The LM35 series are precision integrated - circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

Temperature sensor is an analog sensor and gives the output into form of analog signal. This signal is feed to ADC which will convert it into digital form. Once converted into analog form, the microcontroller can process the digital temperature signal as per the application.

3.Humidity sensor:

Basic humidity sensor is a device that measures relative humidity of system in given area. Humidity sensors are available in analog as well as digital form. The digital humidity sensor works via two micro sensors that are calibrated to the relative humidity of given area these are then converted into digital format via analog to digital conversion process which is done by chip located in same circuit

4.Moisture sensor:

In this we are used moisture based Electrode sensor. As soon as the water dries up then the electrode voltage rises to 5v which is applied to the positive terminal and the output of the amplifier is 0v which will in turn, turn on the AC motor.
When the water level rises then the electrode voltage drops to 0v which is applied to the non-inverting terminal and the output of the amplifier is 5v which will turn off the AC motor.

5.Level sensor:

Water level sensor is used to detect water level in water tank .Basically the unit is made up of sensor acting as switch .In proposed system we make use of IC CD4066 for water level sensing. It works on principle of conductivity of motor.

6.LCD:(16*2)

LCD is used in a project to visualize the output of the application. We have used 16x2 LCD which indicates 16 columns and 2 rows. So, we can write 16 characters in each line. So, total 32 characters we can display on 16x2 LCD.LCD can also used in a project to check the output of different modules interfaced with the microcontroller. Thus LCD plays a vital role in a project to see the output and to debug the system module wise in case of system failure in order to rectify the problem.

7.Buzzer:

Buzzers are used in a system to indicate or to grab the attention regarding an emergency situation occurred. Buzzer produce sound which indicates the need of instant attention as the condition goes haywire.

8.Relay

A relay is an electrically controllable switch widely used in industrial controls, automobiles,&appliances. It allows the isolation of two separate sections of system with two different voltage sources. One such relay is called an electromechanical (or electromagnetic)relay (EMR).The EMRs have three components :the coil ,spring and contacts. When current flows through the coil, a magnetic field is created around the coil(the coil is energized),which causes the armature to be attracted to the coil. The armatures contact acts like a switch & closes or opens the circuit. When the coil is not energized ,a spring pulls the armature to its normal state of open or closed .

Features

- 92/8 gold silver alloy on silver palladium is suitable for low level switching application.
- High density PC board mounting can be provided by small size and light weight (2.54gmm)terminal pitch.
- GS –T type have Low coil power consumption andGS-D type have high coil power consumption are available to meet users selection.
- Plastic epoxy resin sealed type for washing procedure.

9.RF Transceiver:

RFM73 is low power high speed FSK/GFSK trans receivermodule specifically operating in the world with ISMfrequency band at 2400-2483.5MHZ the maximum air data rate can be up to 2Mbps.

4. METHODOLOGY

❖ Algorithm for greenhouse unit:

1. Start
2. Initialize ports and LCD.
3. Read water level & convert data in digital form.
4. If Water level is below threshold level then turn OFF motor otherwise read moisture in soil.
5. If moisture in soil is low then turn ON motor, otherwise it will be OFF.
6. Read temperature, if temperature is low then turn ON heater otherwise if it is high turn ON fan.
7. Read humidity, If humidity is high then turn on fan otherwise go to step 3.
8. Display parameter on LCD.
9. Send the parameter to PC.

❖   Algorithm for monitoring unit:

1.   Start.
2.   Wait for data from greenhouse.
3.   If data acquire display the parameter on PC otherwise go to step 2.

5.RESULT:

SR.NO	PARAMETERS	OUTPUT
1.	**Temperature** a) Temperature is high b) Temperature is low	a) Fan will be ON b) Heater will be ON
2.	**Humidity** a) Humidity is high	a) Buzzer will be ON
3.	**Moisture** a) Moisture is high b) Moisture is low	a) Motor will get automatically OFF b) Motor will get automatically ON
4.	**Water level** a) Water level goes below threshold level b) Water level is above threshold level	a) Motor will get automatically turn OFF b) Motor will remains ON

Table-5.1: Result

Parameter showing on LCD display:

1.Temperature: 2.Soil Moisture

3.humidity: 4.Water level:

6.CONCLUSION:

Greenhouse climate control is currently one of the main objectives of engineering in precision agriculture. Temperature and humidity are variables which have a direct relationship with the plant production. Moreover, recent investigations have shown that is not enough to adjust temperature and humidity ratings to maximum and minimum set points which are affordable for plant needs. However, the relatively new computational technologies such as microprocessors, digital signal processors and field programmable gate arrays are allowing continuing the implementation of more sophisticated control systems. Theparameter liketemperature, humidity, soil moisture is monitored and control using microcontroller transmitted through RF trans receiver.In this we also try to avoid wastage of water by checking the moisture of soil.

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