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Greenhouse Automation using Wireless System

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Abstract:
In modern greenhouses, multi measuring is required to make the greenhouse automation system work efficiently. So, we were used several sensors to design the greenhouse measuring system. This paper focuses on developing a greenhouse automation system based on MSP430 microcontroller with wireless sensor networks (WSNs) and remote monitoring. The system has software and hardware sections. The microcontroller senses temperature and humidity levels with the help of input sensors and process the output to take appropriate control action wirelessly. The proposed system is capable of detecting the level of temperature. This system also has alert to be known action in the greenhouse. The advantages of system are ultra-low power and high integration with MSP430 microcontroller. The aim of design is decreasing the power consumption. 3.3 V lithium batteries is enough to work design requirements. The proposed system is a low cost and user friendly with high stability and reliability.

Keywords: Wireless Greenhouse Automation, Remote Monitoring, MSP430 Microcontroller, Ez430-RF2500.

I. INTRODUCTION

A greenhouse is a place where plants are grown. It ranges from small part to huge structures with different models such as roof or transparent glass. The primary heating mechanism of green house is convection. Ventilation is one of the most important components in a modern greenhouse. If there is no proper ventilation, plants can become prone to problems [1]. The main purpose of ventilation is to regulate the temperature and air movement to prevent plant to pathogens and fresh air. Previously, human labour plays a very critical role in monitoring plants. Some plants need 24 hours attention so that the qualities of the plant must be controlled. But, this type of manual practice is time consuming. Modern wireless technologies can be implemented to greenhouse that it provides excellent assistance for the agriculture industry Due to the rapid development in wireless technologies, it is known that wireless communication is the best way for remote controlling in agriculture industries. The number of development of advanced monitoring and control systems are increasing because of cheaper solutions in the current market. The trend is going to wireless systems [2]. Moreover, wireless systems have much improvement to collect data as compared to old methods regarding time-consuming and labour-intensive manually [3]. In addition, there are several devices for agriculture monitoring activities [4]. Also previous study [5, 6, 7, 8, 9, 10] show us that a microcontroller based greenhouse system is an innovative method. This paper is proposed to provide automatic watering according income high resolution data of temperature and humidity sensors. The proposed system is embedded systems which control the climatic parameters of a greenhouse and reduce human intervention. The sensors sense the changing and the microcontroller reads this data from its input ports which is converted to a digital form by the ADC. Then the microcontroller performs the actions until values of parameters come back to threshold level. Papers should clearly describe that the system is low-cost, effective, flexible and user-friendly. Moreover, this paper focuses on the study of remote monitoring that send alert notification message to farmer computer about temperature of greenhouse and battery level of microcontroller. This improved old method of collecting data in farming ecosystem. There are numerous technologies but many of them still require a great human intervention. The next section in this paper contains description of the greenhouse system. After that, section 3 describes the methodology of study. Section 4 contains the conclusion of the proposed system.

II. GREENHOUSE SYSTEM

Greenhouses protect crops from overheating or super cooling and help to keep out pests [11]. It protects crop from marginal environment conditions throughout the year for yielding food production. Irrigation is one of the important thing on the greenhouse systems. The water is the main element to ensure surviving plants. As we all know, most of the gardener watering their plants manually but it is not efficient way. In order to maintain the condition and overcome the problem, the automatic watering system is used. The system is composed of sensor nodes for collecting data, base nodes for processing collected data, relay nodes for driving devices for adjusting the environment inside greenhouse for data storage and processing. Using automatic rather than manual way in the watering system reduce time. Temperature and soil moisture probe are used to control watering greenhouse.

III. METHOD AND MATERIALS

This study involves the implementing of a control system in greenhouse systems in order to turn the water valve ON or OFF according soil moisture values which come from ADC of microcontroller.

Figure.1. Soil Moisture Probe [5]

1.1 Design

The block diagram in Fig. 2 shows how the inputs and outputs is connected into microcontroller. The computing subsystem is made up of microcontroller unit and memory. The former (Microcontroller Unit, MCU) is responsible for controlling the sensor, carrying out communication protocol and processing the algorithm of sensing data. The hardware used in this study was EZ430-RF2500 sensor to perform the temperature monitoring activities. Temperature data is captured by the wireless temperature sensor We used MSP430F2274 microcontroller and wireless module Ez430-RF2500 that are shown Fig 3.

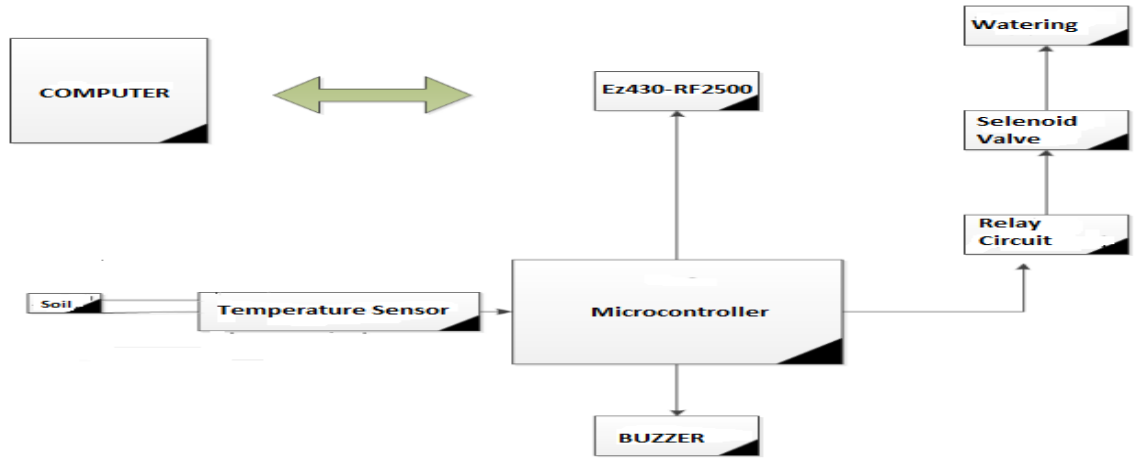

Figure. 2. Greenhouse Watering System with Microcontroller

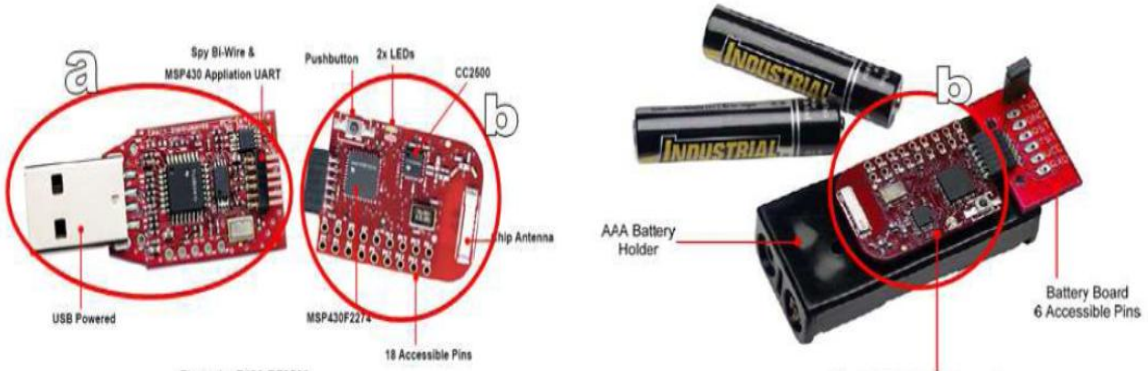

Figure. 3. MSP430F2274 Microcontroller and Ez430-RF2500 (12)

A relay is an electrical switch that opens and closes under the control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many contacts. In Fig. 3 show that there is relay circuit to run solenoid valve.

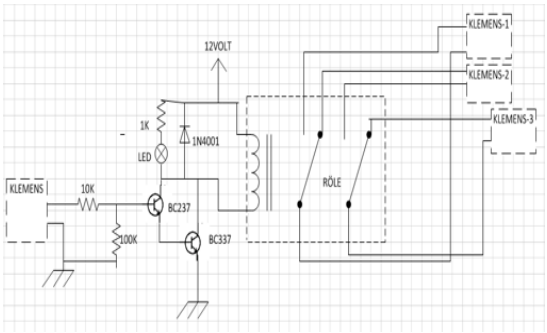

Figure. 3. Relay Circuit [5]

The data come from sensor that it converts into A/D and CPU carries out specific operation when conditions are provided.

1.2 Wireless network

The eZ430Rf2500 module is a small wireless radio development kit from Texas Instruments based on the MSP430F2274 microcontroller [13] and CC2500 wireless transmitter [14]. The eZ430RF2500 module has a limited communication range (10m) and necessitates range extenders to send the measured data to central monitoring station. Therefore we also choose a low-cost 2.4 GHz transmitter (CC2500) designed for very low-power wireless applications. As a network protocol, we decided to use the SimpliciTI [15] from Texas Instruments to transfer data from sensor node to central monitoring station. SimpliciTI has as the main features low memory needs, advanced network control, and sleeping modes support. It is intended to support the development of wireless networks containing battery operated nodes and require low data rates.

IV. CONCLUSION

In this paper, we have designed and implemented a system that can understand the temperature remote monitoring, alerting system, the state of crops by using sensors and optimize crop growth conditions in greenhouse. This system is of highly

practical value in realizing information and automation of greenhouse. The system performance is quite reliable and accurate. This will reduce the time of using the manual way of watering. The system has successfully overcome quite a few shortcomings of the existing systems by reducing the power consumption, maintenance and complexity, at a reduced cost and at the same time providing a flexible and precise form of maintaining the environment. It can also cope with exceptional situations by providing the greenhouse environment and information about a device's operating state to users every certain time.

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