

## Remote Monitor System Design of Edible Fungus Based on Zigbee

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### ABSTRACT

The main objective behind in order to solve large scale production of edible fungus, it has proposed a full set of remote monitor system of edible fungus greenhouse, which is on the basis of ZigBee technique. The system constitutes three layers: The sensor and control layer is comprised by CC2530 ZigBee wireless module, various sensors and device controllers, which can realize real-time information collection and device on and off control in the production environment; Thus the environmental data collected through the zigbee and transmit the data via the transmitter. The transmitter will integrate collected data and then transfer the data to the receiver. After that, the application layer such as system provides data services and compared to the preset value. If there exceeds a preset value, the controller can control the data on computer to timely monitor the production environment and control devices in the greenhouse.

Keywords: ARDUINO microcontroller, Zigbee module, Monitoring.

### 1. INTRODUCTION

Embedded system is a combination of hardware and software use to achieve a single task within a given time frame, repeatedly and endlessly, with or without human interactions. Embedded system of a computer system that monitor, respond to control an external environment. Environment connected to system through sensors, actuators and other input output interfaces. Embedded system must meet timing and other constraints imposed on it by environment. A remote monitoring system is designed, which can remote monitor farmland in real time and make informed management decisions. The system collects data of farmland by using zigbee modules, makes data fused by using high performance controller Arduino microcontroller, transfers data to remote computer by using Zigbee modules, and makes informed management decisions by computer. Not only can the solution improve the level of agricultural production, but it can also reduce human costs effectively. Fungi are the group of single celled and multicelled organisms that are nonmotile.

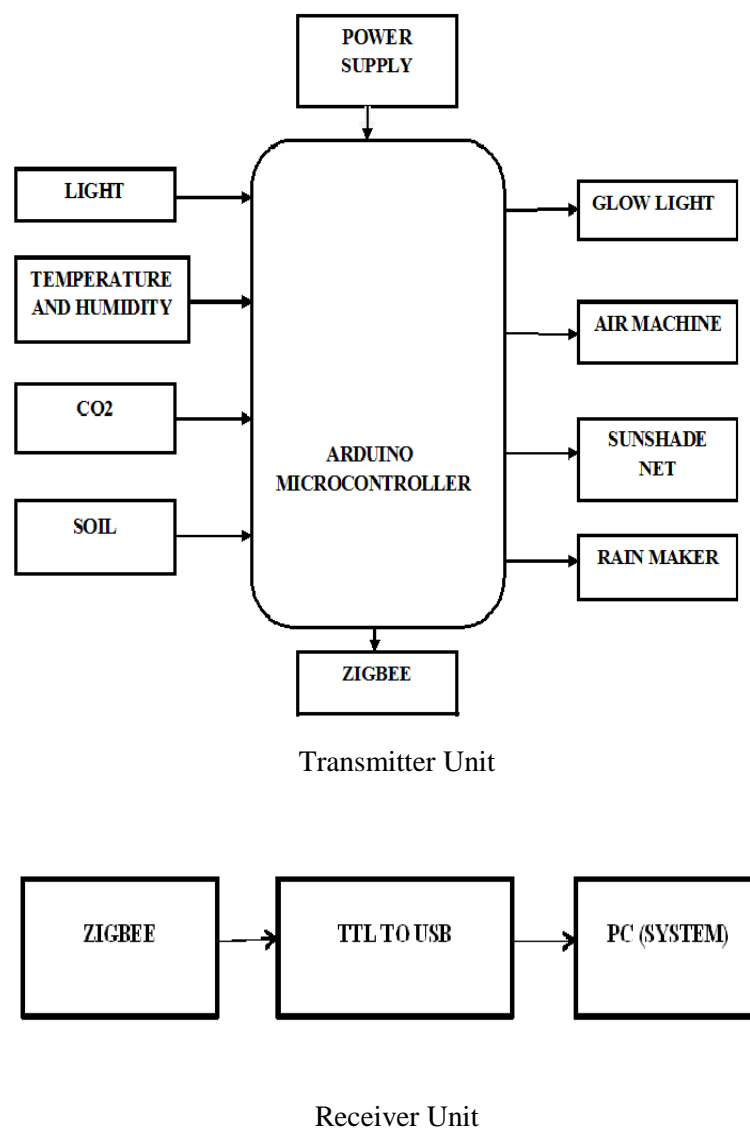
It provide essential nutrients for the growth of the plants. Several fungus are edible. Edible fungus contain large amount of vitamin D2. The edible fungus industry is one sunrise industry. Since 1990s, various kinds of fungus have appeared like plenty of bamboo shoots. With the continually improvement of people's demands to green and healthy dietary standard, the edible fungus industry tends obvious increasing in scale, yield, quality, security, proceed, benefit and etc. At present, centralized and scattered management models are still main model in the large scale production of edible fungus in our country.

The remote monitor system of edible fungus greenhouse basing ZigBee will bring convenience to factory managers and producers farmers. Through this system, they can monitor real time situation of the production environment and control the whole process of production management under the uniform standard, which can realize efficient and large scale production of edible fungus. Fungi cycle nutrients in the environment and a number of fungi are

edible. They also have medical and industrial uses. In Medical field, some types of edible fungus are used in traditional Chinese medicine .In Japan, Lentinan is approved for use in cancer treatments.

## 2. BLOCK DIAGRAM

The projects architecture consists of two parts such as transmitter and receiver. It consist of four input sensors such as temperature and humidity sensor, light intensity sensor, soil composite sensor and CO2 sensor. The four outputs are controlled such as air machine, rain maker, sunshade net and light by using Arduino. It requires 12V power supply. ZigBee has strong scalability and flexibility especially in a harsh environment, and it can improve the monitoring mode effectively and decrease human cost to some extent.



## 3. SYSTEM DESIGN

### 3.1 ARDUINO Microcontroller

Arduino is an open source computer hardware and software company, project, and user community designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive

objects that can sense and control objects in the physical and digital world. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers.

### **3.2 ZIGBEE**

Zigbee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. Hence, Zigbee is a low-power, low data rate, and close proximity (i.e., personal area) wireless ad hoc network. Zigbee is a low-cost, low-power, wireless mesh network standard targeted at battery-powered devices in wireless control and monitoring applications. Zigbee delivers low-latency communication.

### **3.3 Temperature and Humidity Sensor**

DHT11 sensor is used to measure the temperature and humidity. It has resistive humidity sensing component and a negative temperature coefficient (NTC). An 8 bit MCU is also connected in it which is responsible for its fast response.

### **3.4 Soil Composite Sensor**

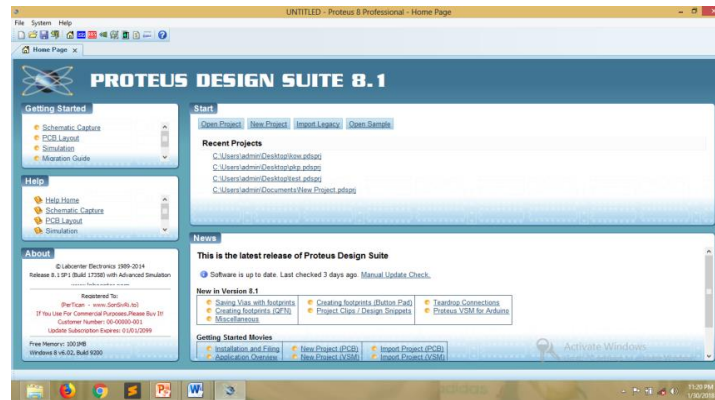
A simple soil moisture sensor for gardeners. Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

### **3.5 CO<sub>2</sub> Sensor**

A gas detector is a device which detects the presence of various gases within an area, usually as part of a safety system. This type of equipment is used to detect a gas leak and interface with a control system so a process can be automatically shut down. This sensor module has an MQ-6 onboard as the sensor component. There is an onboard signal conditioning circuit for amplifying output signal and an onboard heating circuit for heating the sensor.

### **3.6 Light Intensity Sensor**

LDR sensor module is used to detect the intensity of light. It is associated with both analog output pin and digital output pin labelled as AO and DO respectively on the board. When there is light, the resistance of LDR will become low according to the intensity of light. The greater the intensity of light, the lower the resistance of LDR. The sensor has a potentiometer knob that can be adjusted to change the sensitivity of LDR towards light.



Proteus 8 Professional

### 3.7 USB to Serial Converter

CP2102 chip from SiLabs is a single chip USB to UART Bridge IC. It requires minimal external components. CP2102 can be used to migrate legacy serial port based devices to USB. Hobbyists can use it as a powerful tool to make all kinds of PC interfaced projects. This module helps all those who are comfortable with RS232/Serial Communication protocol, to build USB devices very easily.

## 4. SYSTEM ARCHITECTURE

### 4.1 Main Functions

The remote monitor system of edible fungus greenhouse basing on ZigBee is made up by three layers: the sensor layer, the control layer and the application layer. It consists of two functions.

### 4.2 Data Collection Function

The system will collect greenhouse environment data that air temperature and humidity, light intensity, CO<sub>2</sub> concentration, compost temperature and etc, then upload the data to the Zigbee. The Zigbee will integrate the data and to transfer the data to the transmitter.

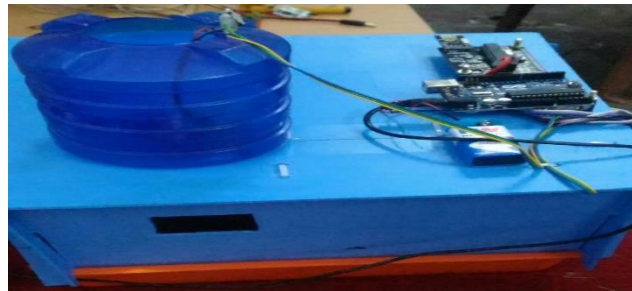
### 4.3 Device Control Function

After receive the data via the Receiver, the system will store the data into the database and then the client (include monitor terminal in greenhouse, mobile phone APP and remote computer browser) can timely acquire data from the database, which can show as forms like number or curve. If user finds that environment parameters are not favor of fungus growth on the client, he can give orders on it. The orders will through the receiver and controls it.

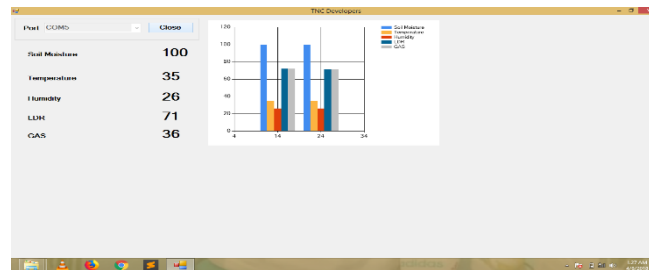
## 5. RESULTS

This Overall System is a remote monitor control system design of edible fungus. This Setup monitors the environmental data and control using Arduino Controller. The environmental data is automatically monitors via Zigbee. The data then be transmitted into the receiver through the transmitter. After that it will receive the data, the

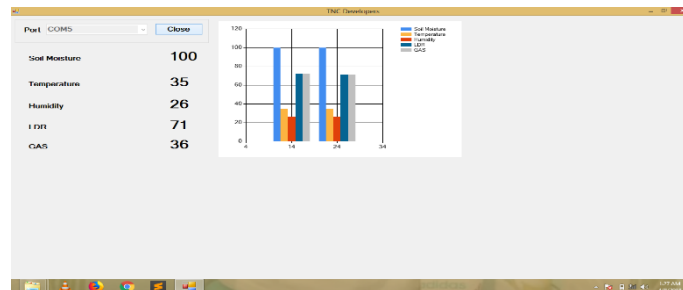
PC automatically monitors the data and compares the data with preset value. Using the Arduino IDE program, it will collect the data with the help of the Zigbee Protocol.



Overall System



System Output Analysis Graph



System Output Analysis Datasheet

## 6. CONCLUSION

It is very satisfying to implement this project and see it to fruition. The specifications are met, and goals have been achieved. Over all proposed system cost is low. The remote monitor system of edible fungus greenhouse applies ZigBee wireless sensor ad hoc. The site layout just need consider try to decrease obstruct in ZigBee wireless sensor modules. So it is applicable to different scale production demands. In the edible fungus production management mode of centered and disperse, adding this remote monitor system can realize the large scale production with uniform standards. The system provides multiple real time data storage and display forms, which can provide effective scientific data support to edible fungus production manager. And it also can provide basic data assurance to the food security management and trace management. The “smart energy public service cloud platform” used in the system will more help produce big data of fungus production. It also has the base to integrate other crops’ data

like production conditions and production data, which make for forming fast and efficient development of agricultural production.

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