

Design of Agricultural Greenhouse Monitoring and Production and Sales

Unification system

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Abstract: *This research project design a new agricultural greenhouse monitoring and production and sales unification system, aim to solve the problem of traditional greenhouse cannot be remote control and sales channels narrow. Based on internet of things technology, the detection and control of the indoor environment is realized and the production and sales unification platform is constructed. To achieve a scientific control of the growing environment of crops and the platform-based of agricultural products sales. The system integrates data acquisition, intelligent control and production and sales together, helps to reduce the cost of storage and preservation and slow-moving phenomenon.*

Keywords: Modern agriculture greenhouse; Environmental intelligent monitoring; Production and sales unification

I. Introduction

Modern agricultural production scale is expanding day by day. On the one hand, it has increased the greenhouse automation and intelligent management needs, on the other hand, the economic loss and waste caused by the phenomenon of agricultural storage and fresh-keeping processes and slow-moving are becoming more and more serious. "Internet +" as the development model of the information age is increasingly used in various fields. Internet of things technology using LAN or the Internet and other communications technology, ties things, sensors, controllers, and managers together and forms the intellectualized network of the character association and the thing association.

Modern Intelligent Greenhouse based on Internet of Things, uses the "Internet + agriculture" model to build a monitoring - production and marketing platform. It can be 24-hour real-time monitoring of the greenhouse environment. At the same time, it remote control to adjust the field device so that it can use a standardized cultivation process. It also promptly releases crop information and expands the sales market. Therefore, farmers can product crops determined by

sales and balance supply and demand. The system realizes the agriculture modernization, the automation and the informatization.

II. General Design of System

The construction of this system is divided into two main parts: The system which can monitor and control the environment in greenhouse and the platform which can connect production and marketing.

(1) The greenhouse environment monitoring and controlling

In the greenhouse, sensors (temperature and humidity sensor, gas sensor, optical sensor) and controller (PID controller) are installed in the greenhouse to transmit the collected environmental data to the monitoring and controlling center through wireless transmission. According to the given standard parameter, the center will return particular command to the controller. Farmers can monitor the parameters in the system, and change environmental parameters according to certain requirements, and then adjust the greenhouse environment.

(2) The platform of sharing production and marketing information

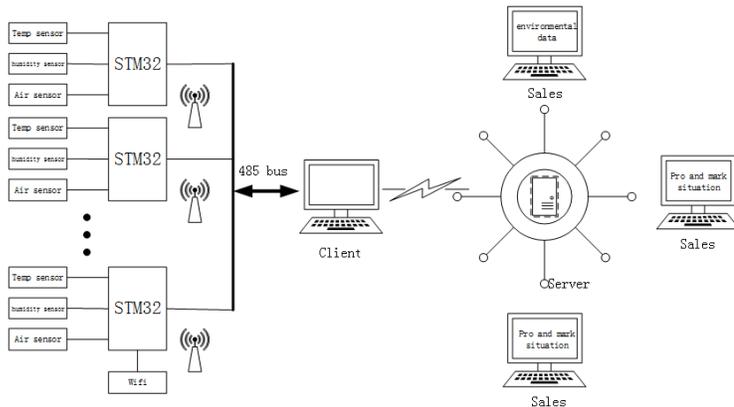
The website are built by the DREAMWEAVER compiler program, and the database are created by MySQL compiler program. The lower machine collects data and sends them into the database which is connected to the website. The information of the greenhouse environmental data (such as: temperature, humidity, light, etc.), and crop information (Species, quantity, growth, etc.) are released to the internet. In order to ensure the safety of users, there are two identity rights to differ farmers from consumers).

The development of the system based on the technology of Internet of Things, which cannot only make interconnection between sensors, controllers, machines and users with sensors

network, but also link farmers with sales market via the Internet. Thus building a system which is modern, informationalized, intellectualized, and production and marketing integration.

The system is designed as a three-layer structure with the Internet of Things concept, which is composed of the bottom layer perception layer, the middle layer communication layer and the top layer network layer.

The conception of the system as shown below: (The picture shows the main components contained in each module, and the main transmission technology.)



The system includes three modules in the function realization: the environment detection and regulation module, the wireless sensor network module and the Web terminal service module.

Components contained in each module:

(1) The environment detection and regulation module

Including various types of sensors, environmental regulation equipment, core control unit.

(2) The wireless sensor network module

Including RS485 bus, client, wireless WIFI.

(3) The Web terminal service module

Including the client.

The system uses wireless network technology, RS485 bus technology and the Internet so that the components are connected to each other to achieve information interaction.

III. System module design

1. The lower machine--Monitoring and Control of Environment in Greenhouse

The lower computer realizes the monitoring, acquisition and control of the environmental parameters with hardware and software, and stores the collected data into the database.

The whole wireless monitoring system is composed of sensor node, monitoring host and ZigBee wireless sensor network.

ZigBee is based on IEEE802.15.4 protocol of short distance, low power, low data rate, low-cost two-way wireless communication technology can be embedded in various devices. The network function is the most important characteristic of ZigBee. The traditional agriculture mainly depends on manpower to monitor the growth of the crop. It cannot make the environmental parameters reach the standard value accurately. After adopting the ZigBee network composed of thousands of sensors and control centers, the modern agriculture increasingly turns into the informational, intelligent, and large-scale production.

With ZigBee technology, the monitoring of environmental information can be realized by building information transmission network, which consists of sensors and control chips and real-time monitoring system. The temperature sensors, humidity sensors and optical sensors located in the bottom monitor data in real time. Through the wireless communication network in the ZigBee module, the sensor nodes send environmental data collected in real time to control Chips of the host system through the hierarchical network. The monitoring data management software on the host machine will display the received the data in real time on terminal. At the same time, the control chips upload data, and send commands to the main controller overrun STM32 in accordance with the data.

The main controller based on STM32 chip, includes bus communication and other communication ports. The STM32 is specifically designed for embedded applications requiring high performance, low cost and low power consumption. With six ultra-low power modes, the STM32 family can complete tasks with minimal power consumption at any set time. In addition, the circuit is designed to achieve low-voltage high-performance, STM32 can effectively extend the battery-powered equipment charging interval.

After receiving the control command, the main controller STM32 automatically run the relay control light box, control the exhaust fan and so on, to adjust the greenhouse environmental parameters to meet the normal range. At the same time, the monitoring and control center of the system will record the environmental information into the database, and update them to the Web server. Users can check environmental information by visiting the Internet. As long as

connecting to the network, user can read information from any terminals to monitor greenhouses Environmental.

The system mainly includes the following equipment:

(1) Sensors Network Equipment: temperature sensors, humidity sensors, light sensors and other environmental parameters compose sensors network. In the greenhouse, a large number of randomly distributed sensor nodes interacts with the surrounding environment through the sensors. By wireless communicating technology, the data collected from the same sub-room can be transmitted to the monitoring center in the system.

(2) Control Network Equipment: relay light boxes, exhaust fans, humidifiers and other equipment and the main controller STM32 compose control network. Every controller realizes heating, exhaust, enhanced lighting, humidification and other automated operations. The controller STM32 receives the control command issued by the monitoring center in the system through the wireless transmission, and then carries out the operation.

(3) Web-Terminal Servers: On connecting to the Internet, users can visit the monitoring center of the system and read the environmental information from any terminals. However, users can monitor the environmental parameters of every sub-room in 24 hours, and remotely send control commands to control the scene equipments to adjust the greenhouse environment.

(4) Information Dissemination Platform: With the Internet, the greenhouse owners release the information of crop growth, while consumers or purchasers can get information and reserve or buy the products on the platform.

2. Host computer—Building of Production and Marketing Interoperability Platform

In recent years, with the rapid rise of the Internet, the impact of the Internet on traditional industries makes the Internet an important channel for people to quickly access, publish and communicate information. The sale of agricultural products also requires the Internet. The building of Production and Marketing Interoperability Platform mainly uses ASP server technology and the exploitation of the front and back of the page.

2.1 Building of Server Construction

ASP is a server-side scripting environment developed by Microsoft which supports VBScript, JavaScript and other scripting languages. Completing web application development

by using ASP to combine HTML pages, script commands, and ActiveX components could meet the functional requirements.

ASP can be used to create dynamic interactive web pages and web applications. We chose IIS server of Windows 2008 operating system of Ali cloud server. Login remote IIS. There are several following steps to achieve to build IIS:

(1) Configure IIS

Configuring IIS mainly sets main computer and selects the default web site home page, including the binding domain name and modifying the port number used by the site, while edit read and write permissions.

(2) Set up a virtual directory

On the IIS server, set up one or more virtual directories on a site as needed.

(3) Create a website

In IIS, set the physical path of the Web site in the interface of adding a site and add or delete a website.

(4) Test web server

Use “http://localhost” to access test. This access directly to web pages stored in the system tray. If users access successfully, they can access the domain name of their website.

2.2 Design of database and data sheet

Database use SQL server 2008. The database mainly includes a series of management and development tools. It can complete a variety of conventional operations according to different commands and SQL statements.

Online sales of greenhouse vegetables mainly related to the users’ registrations and the addition and delete of vegetables information, so it needs two data tables. The data table created as shown in Table 1 and Table 2 below.

Table 1 User registry

Field Name	Type of Data	Length	Defaults	Field Description
Name1	varchar	50		Username 1
Name2	varchar	50		Username 2
Name3	varchar	50		Username 3

Table 2 Vegetable information table

Field Name	Type of Data	Length	Defaults	Field Description
Name1	varchar	50		Tomato

Name2	varchar	50		Chinese cabbage
Name3	varchar	50		Eggplant

2.3 Design of Function Module

A simple web page consists of four modules: user name registration module, user name login module, vegetable information display module and vegetable purchase module.

The main function of the user registration module is to add new user information to the database. Ordinary users can only browse the website of the vegetable information. Registered users can enter the function to buy vegetables. The registration page can be seen at the front page of the site.

The main function of the user login module is to provide some entrance for users to purchase vegetables. If you select automatic login, the system will automatically record the information of the logged-in users, and they can be directly into the membership center without having to log in again in 24 hours. At the same time, users will automatically jump to the main page after logging in successfully.



Figure 1 Web site login screen

Viewing module of vegetables' information:

The main functions of vegetables' information viewing module are to publish the information of mature vegetables to the web farmers, withdraw outdated vegetables from sale, and modify the picture and price of vegetables with the change of time.



Figure 2 The main page information of the website

Purchasing module of vegetables:

Consumer users put the vegetables they want into the shopping cart and place an order with detailed order information, and then complete the payment. At the same time, database automatically update original information.

IV. Conclusion:

This paper introduces the design and implementation of a system based on Internet of Things, which implements the monitoring and control of a modern agricultural greenhouse. It can monitor and control the environment of the agricultural greenhouse in real time through the Internet, and realize the interaction between the farmers and the consumers. Farmers can master environmental information in agricultural greenhouse in real time and remote control of field equipment, at the same time, the information of crops will be released to the production and marketing platform, this system can also make the production plan and accept reservations in advance so as to reduce the cost of storage and preservation, and solve the problem of poor sales reasonable. Compared to the traditional agricultural greenhouse, it needs lower labor demand, at the same time, the potential market is bigger.

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