Construction and Application of Intelligent Agricultural Greenhouse Irrigation System

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Abstract. In the environment of scientific and technological progress and the wide application of intelligent agriculture, the project designs and implements an intelligent agricultural greenhouse irrigation system based on MCU, which makes the greenhouse planting of crops more convenient and reasonable. The main modules of the irrigation system are soil moisture detection module, liquid crystal display module, timer module, MCU control module and watering module. The system detects the soil humidity through the humidity sensor, displays the humidity on the LCD, and drives the watering module to work through the single chip microcomputer control module. The function of timer is to control the watering time and water consumption, and intelligently complete the automatic work of agricultural greenhouse irrigation system. Through this system design, the application of SCM in various fields can be expanded. It makes the irrigation of agricultural greenhouse intelligent. It provides a solid foundation for the construction of green agriculture.

1. INTRODUCTION

Due to the continuous improvement of modern people's quality of life, there are many choices for food intake. Among them, melons, fruits, vegetables and other crops are the main choice. With the rapid development of modern science and technology, fruits and vegetables from different regions and seasons can appear on the table all year round. Greenhouse planting is the main way to achieve this goal. This problem can be solved by forming an automatic irrigation system.

It is composed of irrigation canal head project, water conveyance, water distribution project and field irrigation project. The irrigation canal head project includes reservoir, water pumping station, dam diversion project, dam free diversion project, water well and other forms, which are used to timely and appropriately draw irrigation water. The water conveyance and distribution project includes the canal and canal system buildings. Its task is to safely transport the water quantity introduced into the canal head and distribute it reasonably to all parts of the irrigation area. According to its function and scale, the fixed channel is generally divided into four levels: dry, branch, bucket and agriculture. Depending on the size and topography of irrigation area, the number of channels can be increased or decreased appropriately. Canal system buildings include water distribution buildings, water measuring buildings, control buildings, connecting buildings, cross buildings, flood discharge buildings, water discharge buildings, etc. Field irrigation project refers to temporary gross canal, water conveyance ridge ditch, field irrigation ditch, border field, temporary water distribution and water measuring building, etc. Under the agricultural canal, which is used to irrigate farmland to meet the needs of normal crop growth or soil improvement.
In order to make full use of water and soil resources, China connects several small irrigation systems nearby, and conducts unified dispatching and management of water resources in mountainous and hilly areas with scattered land, insufficient water source and unbalanced distribution of water and soil resources in the south. The water distribution channel is connected with the Tangyan of Xingluo checheb. When the river is abundant, the water will be filled with ponds; When the river is insufficient, the pond weir is used to irrigate the water to make up for the shortage of the river water, and a long rattan melon irrigation system is formed.

The function of intelligent agricultural irrigation system is not to spend a lot of manpower cost to solve the problem of watering, and there is systematic monitoring to ensure that crops will not wither due to water shortage. The significance of the design of intelligent agricultural irrigation system is to reduce the labor cost, so that the growers can have a good harvest, and at the same time, consumers can enjoy the fruits and vegetables with good quality and low price. Intelligent agricultural irrigation system mainly includes software design. The module can be divided into soil moisture measurement (measurement data acquisition), analog-to-digital (AD) conversion, humidity value display and other sub modules. The circuit structure can be divided into: soil moisture measurement, analog signal conversion, digital signal, soil moisture display and related control management software. The user terminal completes information collection, processing, data transmission, display and other functions.

2. HARDWARE COMPOSITION OF IRRIGATION SYSTEM

The irrigation system generally consists of two parts. It is composed of soil humidity measurement circuit, AD conversion circuit, humidity display circuit, single chip microcomputer and related control software; The hardware block diagram of the system is shown in Figure 1.

Figure 1 Schematic diagram of hardware structure of agricultural greenhouse irrigation system

The hardware design has an open Colink emulator, which provides a simple, convenient and fast development environment, saves time and improves efficiency for application development.

Through the external interface module, the communication between the microcontroller and the external module is realized, and the availability of the system is enhanced and expanded, which provides an effective solution for adding new functional modules in the future.

Temperature and humidity sensor DHT11

DHT11 digital temperature and humidity sensor is a temperature and humidity composite sensor with calibrated digital signal output. The application of special digital module acquisition technology and temperature and humidity sensing technology ensures that the product has high reliability and excellent long-term stability. DHT11 device adopts simplified single bus communication. Single bus means that there is only one data line, and the data exchange and control in the system are completed by single bus.

Liquid crystal display

The monitor displays the collected information on the screen.
Buzzer
After receiving the control signal from the microcontroller, the buzzer gives an alarm.

humidity sensor
The humidity sensor can convert the collected soil moisture signal into electrical signal and transmit it to the microcontroller.

3. SYSTEM SOFTWARE DESIGN
The function of the software is simple and convenient, mainly using C language programming, debugging is more cumbersome, according to the requirements of the control system to write the software, through the download line to download the program to the hardware system for debugging.

The main functions of the program are: to detect the soil humidity, judge whether the humidity is lower than the lower limit, and automatically run the alarm system and start the water pump system when the humidity is lower than the lower limit.

The flow of software design is as follows: the first step is to write the relevant program c code, the second step is to burn the compiled program into the hardware system for debugging, the third step is to collect soil moisture through the real test, the fourth step is to set the pre collected threshold value and carry out the test again. If the buzzer and the water pump are successfully started, the development is completed, if not, the software can be used to collect soil moisture, The program needs to be reinitialized, and then go back to the third step to re collect data and set a new threshold until the buzzer and water pump are successfully started.

Figure 2 flow chart of software system program design
The software design of the system includes the soil moisture detection program, the program for processing the collected data, the program for setting the upper and lower limits of humidity, the display program, and the buzzer program. This design is an intelligent agricultural irrigation system based on MCU. After the system is started, the initialization and display interface is added. The appropriate upper and lower limits of humidity can be set by using the button. The humidity sensor detects the soil humidity. The single chip microcomputer processes the data to judge whether it meets the conditions for crop irrigation. If it meets the conditions for irrigation, the water pump will be started after the alarm to irrigate the crops. In the process of watering, the soil moisture was detected continuously, and when it reached the upper limit, the watering was stopped.

4. SYSTEM OPERATION AND TEST
Irrigation system operation test mainly tests the following four functions.

4.1. soil moisture detection function
The humidity sensor is inserted into the soil to detect the soil humidity and add water to the soil at the same time. When the soil moisture gradually increases, the number on the OLED display gradually increases, but there is no alarm. After a while, you can hear the buzzer alarm, and see the indicator light flashing, the water pump starts, and the digital value of ad on the OLED display is greater than 30% RH (the preset alarm threshold is 20% RH).

4.2. display function
The change of soil moisture can be correctly displayed on the OLED display.

4.3. buzzer alarm function
When the humidity sensor detects that the soil humidity is lower than the lower limit; Buzzer alarm.

4.4. water supply function of water pump
When the buzzer alarm is heard, the water pump starts.

The test results show that each module of the system can operate stably and easily, and the humidity can be detected successfully, the display screen can display normally, and the buzzer and water pump can operate normally. It has good operability and accuracy.

Sprinkler irrigation requires the use of pressurized water to spray. Water is usually pumped, pressurized, and delivered to all levels of pipelines and nozzles, and sprayed out through nozzles. Sprinkler irrigation can use a variety of agricultural pumps, such as centrifugal pump, submersible pump, deep well pump, etc. Where there is power supply, the motor is often used as the power of the pump.

5. SUMMARY
The irrigation system is based on single chip microcomputer, and the soil humidity is detected by DHT11 sensor. At the same time, the upper and lower limits of humidity and humidity are displayed in LCD1602 LCD module, and the relay is used to control the water pump for crop irrigation. The relay opens the water pump to water the soil environment humidity within the range suitable for plant growth to improve the soil humidity bad environment. Irrigation system is to detect the moisture of agricultural greenhouse soil, and realize the automation and intelligence of irrigation system. The precision control of irrigation system is improved, and the data processing of sensor is accurate and clear. In terms of expansion, wireless control system can be added to observe the situation of crops and water pump can be used for water supply by ourselves. The system has the advantages of low cost and convenient installation, and has a wide range of practical value.

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