Based on Embedded Database Greenhouse Temperature and Humidity Intelligent Control System

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Abstract: - The article based on embedded database of greenhouse temperature and humidity control system intelligent. Put forward by embedded database system set up in an ideal environment for data greenhouse temperature and humidity control, greenhouse crops in the process of growth under control. To address the growth of greenhouse crops in the process of temperature and humidity controlled environment is not ideal at the same time improve the efficiency of control and cost-effective system. The article focuses on the system design, the structure of the control system, hardware software make up and the system control strategy. At the same time outlines some research directions. This control system has a simple hardware structure, reliable data records, installation, maintenance and use of convenience features. Can used in kinds of temperature and humidity automatic control of environment of type.

Key Words: - Embedded database；Temperature and Humidity； Control；data filtering；Greenhouse；Microcontrollers

1 Introduction

Over the past 20 years, with progress in science and technology, computer technology and control the rapid development of its applications continue to expand. The level of technology in the relatively backward agricultural sector, computer-controlled technology has grown out of nothing, from less to more progress has been made; control technology in which greenhouse and control system is a typical example. The artificial environment of temperature and humidity controlled greenhouse agriculture is one of the key technologies. At present, many parts of the country have introduced a number of the greenhouse control system and at the same time a positive force for the Organization for the key technology research, design and manufacture of China's national conditions, with high technical level of greenhouse control system [7].

With embedded Microcontrollers technology intelligent control system is to develop in the direction [2]. The database is the decision-making intelligent control system's core, is the intelligent control foundation. It needs to store a lot of expertise and examples, but also to constantly update and add real-time data. In order to ensure that greenhouse environment in normal agricultural production and high efficiency, improve the quality and quantity of agricultural products, reducing the labor intensity

and energy conservation, the need for greenhouse environment in the temperature and humidity control. Middle-and-low grade products currently in control of the greenhouse there are still some technical problems: generally used only for a single set of temperature and humidity control. As the day of crops on the environment of temperature and humidity requirements not the same, users must frequently adjust the controller settings, it is very difficult to meet the requirements of modern agricultural production [4]. Development of a group of existing greenhouse, low prices and reliable system of temperature and humidity intelligent control system is necessary.

The greenhouse environment is the non-linear, the distribution parameter, time-variable, the long delay, the multivariable coupling and plurality of controls object system [9]. In the greenhouse cultivates the different crops to need the different habitat. Establishes the greenhouse environment embedded database system's goal in the greenhouse temperature and humidity control system to lie in: (1) experiences the expert with user's actual need unifies, nimble and the automatic production suits the specific cultivation object the monitoring strategy; (2) has not provided the cultivation crops which

regarding the system the expert experiences, the user may through control system's use operation the way independently establishes the monitoring database, and long-term preservation; (3) the monitoring strategy data which establishes has been possible to carry on the optimization and the revision regarding the system by the user [6]. In the present greenhouse control, on the one hand the plant culture environment expert experiences the software study serious lag in the greenhouse hardware technology development, simultaneously the greenhouse user tried to find out the plant culture experience is unable to enter the control system promptly. This study solved the problem.

Intelligent Automation and greenhouse environment control system used in conjunction, can be achieved within the greenhouse temperature, light, water, gas, science and regulation, to ensure that throughout the year in the greenhouse crops that can be in the best growing conditions so as to avoid the outside world climate To regulate agricultural production, promote agricultural growth and development, prevention and control plant diseases and insect pests and increase production output value, and so on purpose. Equipped with embedded database system for environmental regulation of greenhouse plastic and glass greenhouse is a greenhouse in the future development direction. Analysis of the impact of greenhouse universal application of the factors is not hard to see, from a technical perspective, the need to address two key issues, including, first, within-the-art greenhouse cultivation and production of high-technology, and the second is the use of embedded database technology to improve intelligence control Greenhouse's technical performance.

2 System Design
Embedded control system is an embedded computer electronics core of intelligent control systems. Embedded systems used in the embedded database can be roughly divided into two major categories 1) The database will be embedded in applications so that the database has become part of the program used. This is often referred to as embedded software. 2) The other was embedded hardware, embedded database that is embedded in the hardware. The

system can greatly improve the performance and efficiency. Such as vehicle navigation, routers, information appliances, DVD recording devices, robots, and other embedded systems. In such embedded systems, in addition to hardware, software needed to gain control over it. The embedded database used in this control system belongs to the first kind. Is to come from the writers of agriculture for crop growth environment the experience of data embedded in this control system software, so that the control system performance and efficiency.

Greenhouse temperature and humidity environment intelligent control is a complex system, in order to enable them to apply the actual production, should be intelligent greenhouse environment control system hardware configuration to optimize and improve greenhouse intelligent control system cost. At the same time, due to the greenhouse control system is a system of continuous operation for a long time the entire control system should have a high reliability. Research on greenhouse environment control system of intelligent design requirements for the full severity of the greenhouse control of the entire performance is very important.

2.1 System Design Goals
On the whole, greenhouse temperature and humidity measurement and control design goals are as follows:
(1) To achieve a 24-paragraph programmable adjustment procedure set curve, regulate every day, heating, temperature drop and holding temperature above three paragraphs. Only operator set for a period of time (a year) in paragraph 24 of the value of the temperature and humidity can be provided with the necessary program-controlled greenhouse environment curves of temperature and humidity;
(2) With temperature and humidity data entry, temperature $0 \sim 50\,^{\circ}\mathrm{C}$, humidity $0 \sim 100\%\ RH$.
(3) Arbitrarily set to enter, modify or view any 1 year 1 hour to set greenhouse temperature, humidity data set;
(4) One hours per year of greenhouse average temperature, humidity, the average recorded in the controller;
(5) At the same time be able to show the current temperature and humidity inside the greenhouse, accurate to one decimal place;
(6) With manual control and automatic control of the two working methods;
(7) To set the starting time control;
(8) To show real-time clock; be able to show the work of state systems; be able to show the

process of temperature and humidity control curve;

(9) The system can also RS-232 interface with the machine connected PC. Out of print for some time in the greenhouse with temperature and humidity data, information or data can be stored for a long time.

2.2 Design of An Embedded Database

Embedded database is a basic feature of the database data files, embedded database directly by calling the API to access data on the achievement of the operation. Embedded database and other databases difference is that the former is a process-driven, which is in response to the engine. Embedded database is a very important feature of a very small volume, high reliability. Many embedded in the database performance is also superior to other databases, so embedded in the system with a wide range of applications.

In an analysis of existing data on greenhouse temperature and humidity control system and database technology on the basis of the status quo, the design of embedded database environment for the growth of crops. In the design process, using examples of parameters - pattern recognition method, summed up the known relationship between the data and a half of experience in law.
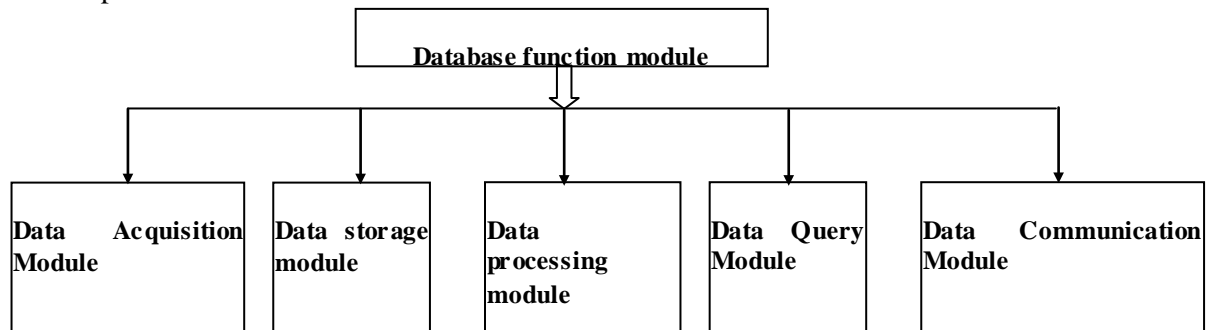
2.2.1 The Establishment of An Embedded Database

Embedded database applications in intelligent temperature and humidity control system is of great significance, the most important thing is to accumulate data in order to facilitate the growth of crops to control the overall effect of the situation analysis. In the control system embedded in the database, the data from the following table: the object stored data table, kept the collection of real-time data on temperature and humidity information table, set the storage temperature and humidity data sheet information.

(1) Object information tables

"Object Information" table to be stored in the control of greenhouse crops in the current data object, the table by the name of the crop growth cycle, from time to time and field crops such as the characteristics of the composition. The list of crops in some kind of object data table is the basis of this control system has a very important role in the following two tables with all of the associated data tables.

(2) Real-time temperature and humidity data tables

Real-time temperature and humidity data tables used to store the scene node send real-time data from the scene, long-term accumulation of data to users for analysis. The table by date, temperature, humidity

Fig.1 The embedded database system makes up

According to the parameters will be an example - on the part of the pattern recognition method unknown number of characteristics of the forecasting function. Preliminary results show that: there is a database of research on greenhouse temperature and humidity control system has value. Tightly coupled technology used in database management system introduced expert system tools, database management systems expert system knowledge base design and development of the agricultural environment of embedded database system. The proposed database system design, the completion of the agricultural experts said that with the knowledge of management and its embedded database and storage, expression.

and time in four fields is composed, namely recorded in the corresponding period per hour delivery from the temperature and humidity information, and other field composition.

(3) Set temperature and humidity data table

Table set temperature and humidity of a system to be used to store crops in the greenhouse temperature and humidity in the ideal setting. The table dates from 24 hours a day, every hour in the set temperature, humidity, and other fields of settings.

Of the control system of database system block diagram shown in Figure 1.

2.2.2 Management of the Embedded Database

When the embedded database based on the greenhouse temperature and humidity control systems to intelligent user, the system will give users with a dialogue environment, choice of applications, applications and its application, and people lose the new application requirements. Knowledge of database management software that reasoning machine the user to answer, automatic control, expand and update the knowledge base of knowledge, in accordance with the requirements of users to search the data suitable match for the greenhouse environment of temperature and humidity control. Embedded database control system in use, and control process, through the acquisition of new input data in the embedded database already exists and the object of the distance between, to judge whether they are the same or similar. New users will lose the same
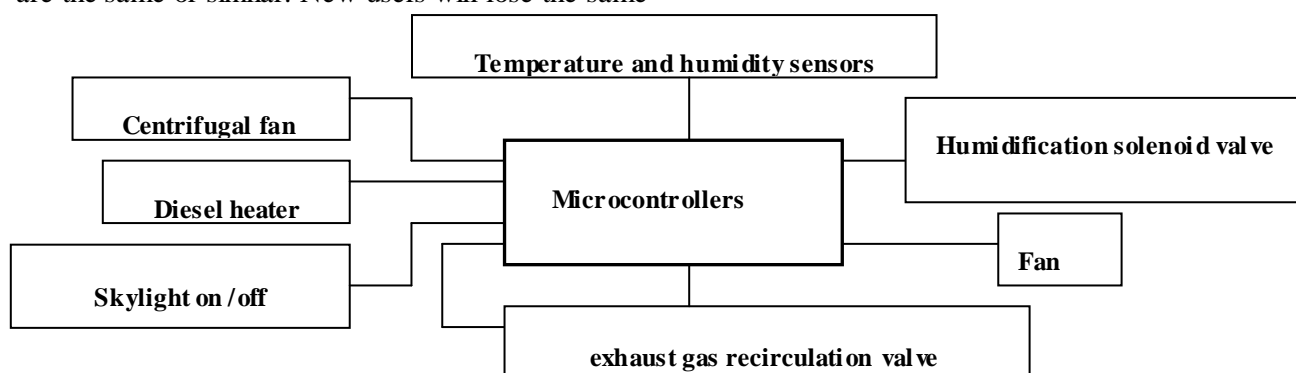
values in a year), temperature and humidity control system in accordance with the temperature in the database system Humidity data in the smart control greenhouse temperature and humidity. In addition, the system in controlling greenhouse temperature and humidity within the same time, automatically record the actual environment of the greenhouse temperature and humidity values as data preservation, the future agricultural experts to develop a more reasonable crop growth temperature and humidity data, the next cycle as the ideal value, Make the system better able to control greenhouse temperature and humidity, for the crops to provide the best temperature and humidity of the environment.

Fig.2 Schematic diagram of systematic hardware structure

or similar object to the embedded database, which will be rounded down to different objects, make embedded database system more perfect, more universal [13].

3 The system Makes Up

The control system embedded database in the ideal temperature and humidity data from agricultural experts to study the growth of crops ideal temperature and humidity data. In control, in accordance with the system measured temperature and humidity data and storage of agricultural experts of different crops to provide the ideal data to control greenhouse in the object (in this system in the sunroof, heater, fan and water facilities in first class) The operation, so that the greenhouse temperature and humidity values in the best state of crop growth. That is, the system can automatically control one year in temperature and humidity inside the greenhouse. According to users within the greenhouse cultivation of crops in this type of control system of importation of agricultural experts from the experience of temperature and humidity data (in every hour of time to the temperature and humidity

3.1 The Systematic Hardware Makes Up

According to the functional and technical indicators schematic diagram of system hardware design structure shown in Figure 2, as was the object of all motor control, Electromagnetic valve, Electromagnetic switches, etc.- electrical equipment, and the controller use of the environment and relatively poor, in order to improve the control system The reliability, output controller interface using solid state relays, solid state relays contain photoelectric isolation and SCR, it has good effects of segregation, the strong and weak, for electrical isolation, a further SCR Can reduce the power of the weak-interference, improve system reliability.

3.1.1 Input Module

This module's major function is passes to the greenhouse in temperature and humidity data the computer. The traditional load module is by temperature, the humidity sensor, the special-purpose amplifier and ADC is composed. What because they process is the simulated signal, is disturbed easily the influence which and floats warm, creates the precision and the reliability is not high. Adopt the

advanced integrated transducer of digital temperature and humidity in the input subsystem of this system. Its most major characteristic is the direct output digit quantity, does not need the signal amplifying circuit and ADC. Moreover it uses "a main line" the system, may receive, the transmission data in a data line, and may hang meets many sensors, the microcontrollers distinguishes through the difference different sensor serial number measures the temperature and humidity spot one by one.

3.1.2 Data Storage Module

This module uses the microcontrollers internal FLASH memory, enables the controller both online to revise in 1 year the random number of days 1 hour temperature and humidity ideal setting value, and can in the record greenhouse each hour average temperature and the average humidity value, moreover the request power failure data does not lose. The controller must record the data are many (in for 1 year, daily 24 hours, each hour has a temperature and humidity setting value, but must record in 1 year each hour greenhouse temperature and humidity mean value). If uses each data 1 byte (i.e. 1B), altogether needs $365 \times 24 \times 2 = 35040B$. The data automatic input storage modules, completes the data test result saves according to the specific form in the corresponding storage space.

3.1.3 Control Output Module

The controller to control more objects, humidification solenoid valve, open skylights, roof clearance, fan, heater, furnace blower and exhaust gas recirculation (EGR) heat exchange electromagnetic switches, the control system 8 arranged following the solid-state output Electrical appliances (a stand-by in order to control the expansion of the new object). 5V output using solid-state relay to control power to control the voltage of 380 volts. In order to improve the reliability of the machine, the control module added to the output optocoupler, with the former level after level no electricity. Transistor arrays using solid-state relay driver, so that more clean circuit. At the same time reducing the number of circuit elements so that will help improve the reliability of the control system.

3.1.4 Display Module

Of the control system of LCD display module is mainly used to show the system to control and monitor the state. As the need to display Chinese characters and graphics, the system uses an LCM

240128 graphics LCD module. The liquid crystal display module is a cost-effective liquid crystal display module that can easily carry out a variety of characters and graphics display. The liquid crystal display module with the character generator inside, you can work in the way of graphics and text, this software can be set up to achieve. It is mainly used to show the system on-line monitoring of the results. Use little one common interface of controller as data line, regard every control signal line of LCD as respectively with another interface of six the units. The specific content of the show: shows the current time, real-time data on temperature and humidity, temperature and humidity set of data and equipment charged with the current state of the show, as well as temperature and humidity control of the process curve, and so on.

LCD module with the microcontroller interface of two ways: direct access and indirect access, direct access by the liquid crystal display module as a memory or I / O devices directly connected to the microcontroller bus; indirect access Refers to the liquid crystal display module as a terminal of the microcontroller and the parallel port connection, and the microcontroller through the parallel port on the achievement of the operation of liquid crystal display module control. The system designed to achieve indirect access, indirect access is through the software implementation of the micro-controller module needed to have the operation of timing, be able to more easily meet the liquid crystal display module in the timing requirements.

3.1.5 Clock Module

Controllers at a pre-determined ideal temperature and humidity values and ideals, according to the current time control, so controllers require accurate clock. Clock module in the use of special clock chip, it is a kind of built-in crystal, I2C bus interface to support the high-precision real-time clock chip. The series chip clock to ensure accuracy of $\pm$ 4ppm, that is, the error is less than two minutes. The chip built-in battery, a built-in rechargeable battery, in a case full of power can take the time to ensure that the internal clock for more than one year. Has selected high accuracy clock chip module, had guaranteed the overall system has the accurate clock.

3.2 Control System Software

The structural block diagram of systems soft ware of this control is as shown in Figure. 3. The control system software includes the following modules:
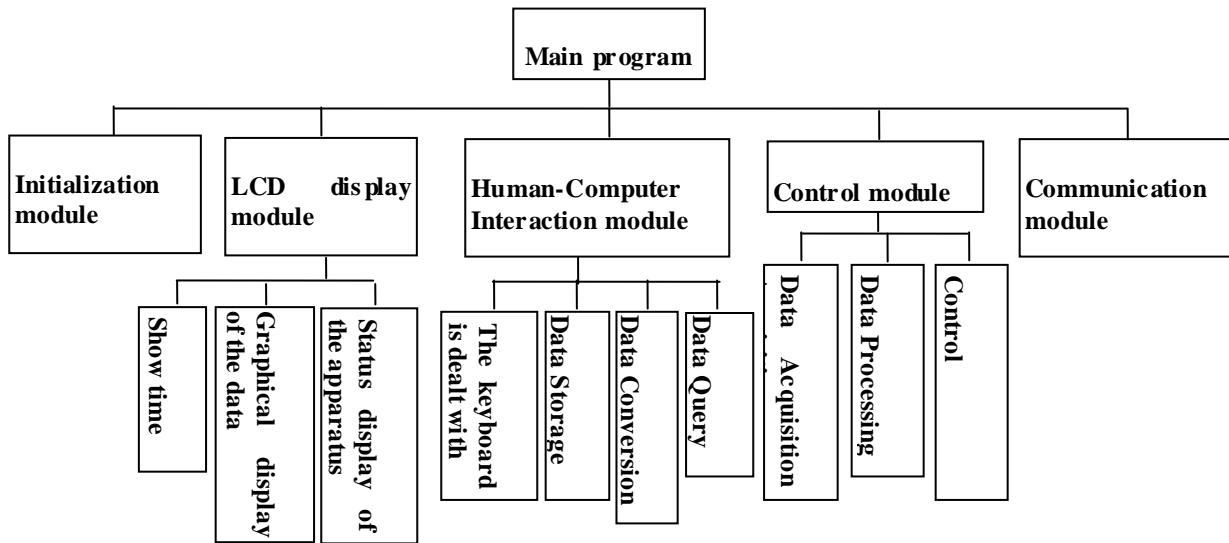
Fig.3 Software architecture

initialization module, display modules, keyboard processing module, data acquisition modules, data-processing module, the decision-making control module, real-time clock module and communications modules. Data format choice: In order to reduce data storage space, we collected the temperature and humidity data for a number of treatments, in order to save data storage space. The database system based on the principle of independence, separation of data from the program, the establishment of an embedded database management module specialized management.

Of the control system of C language embedded software design. C language used for the control system software design allows this system to control access to high-reliability systems at the same time also is able to meet the real-time requirements of the system and facilitate the upgrading and maintenance of the system, is the control system software design of the main programming language. The use of C language for embedded control systems development; assembly language programming has incomparable advantages. First of all, have the flexibility to debug programming, almost all of the current range of embedded systems have the appropriate level of the C language simulation to debug the system, making it very convenient debugging environment; C language as a result of the development of the modular approach, making use of development Module may be modified by other projects, in favor of more collaborative programming; generated code compiler efficiency, portability, based on the C language environment of embedded systems to meet the basic platform of independence.

The control system software has realized the collection save and control of the real-time data. According to the data collection process to collect data to calculate the current error and the error rate of change, after the controller has been dealing with the volume control, and then to be a certain amount of control to be dealing with the current actual control, to control the skylight And fan, spray head, furnace systems, the implementation agency. Control module software processes as shown in Figure 4.
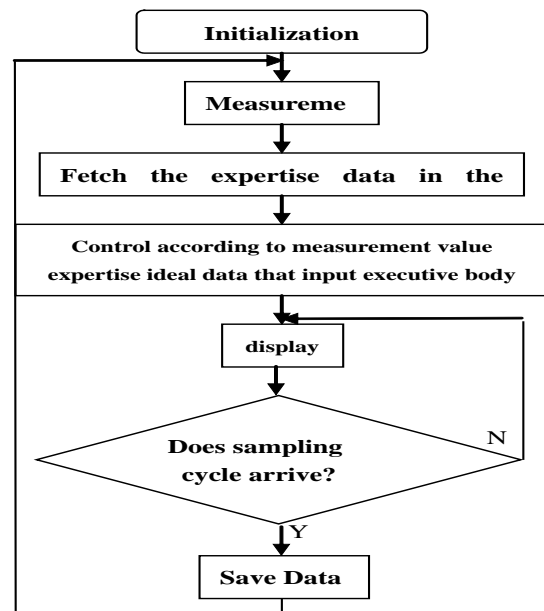
Fig.4 The software controls the module procedure

3.2.1 Cycle Control Cycle
Cycle control is transferred from the control of quantity is named after a time, from its in-house

computer data collection. It means that each cycle of control after a long period of time, a change in control of every output and maintains control of the next cycle. Can be called and controlled loop sampling period. In view of the greenhouse temperature and humidity greater inertia, and crops on the temperature, the reaction time is not sensitive wetlands, and most of control object (such as the furnace, sunroof, etc.) cannot be frequent opening and closing, the controller to control the cycle Five minutes. Delay Module waiting for a cycle of five minutes, during this period to measure and display the current temperature and humidity values.

3.2.2 Control Process

Control module choose state of exporting according to temperature and humidity input state of data arrived to gather. Control module program, according to temperature and humidity set point data (The data from agricultural experience datum of expert) that establish among them control system this entirely. While controlling, control the operation that is accused of the target compared with experience data according to the measurement result according to the control strategy, so that the temperature and humidity of the greenhouse is in the peak that a certain crops grow.

3.2.3 Sampling Data Filtering

Control system used in the actual environment, there is always a variety of signal interference, in order to interfere with these signals and improve the reliability of the data collection system requires the use of sampling data filtering technology [1]. As the signal interference of very short duration, so the digital signal acquisition, the re-collection, in a row until two or more of the same sample, as the only effective input signal. If the result of sampling many times, always changes is deemed that it is invalid to sample. In meeting the requirements of real-time, if the adjacent signal acquisition process between the insertions delay the program they can inhibit a wide pulse, anti-interference effect will be even better [3].

In the development of the system, through theoretical analysis, as well as the actual experimental data analysis, the control system of filtering data used to determine the filtering process increases fuzzy arithmetic average of the composite filter data filtering method, was a very good filtering effect. And the sampling data used to control the data obtained in the previous average value, because the arithmetic average of seeking to use division, and in addition to the process of losing some of the data.

The specific method is to sample data obtained after the first data filtering, for a set of data and to determine the number for the control of the data, of course, in the process need to control the first set of data Multiplied by the number and data. After the system test, confirmed the use of such data can be satisfied with the effect of filtering and high reliability of the system.

3.3 System Reliability Design

Often the working environment is abominable interfere with being relatively great by the electric noise in the embedded control system and more and more complicated with the software, it is more and more serious that the system operates the unstable phenomenon, so, dependability has already become and weighed the important factor with good and bad embedded system. Embedded control system is often used to describe the reliability of embedded microcontroller in the system provided for under the conditions stipulated period of time to complete the function. Just as the reliability of the concept. Practical work, make it necessary for the amount in the form of concrete that the level of reliability, such as reliability, maintenance, failure rate, mean time between failure (MTBF), the average maintenance time (MTTR), and so effectively. To improve the reliability of two aspects: First, as far as possible so that the system provides less time failures and errors; second, the failure occurred quickly ruled out [5]. In order to improve the reliability of embedded control systems, from the reliability of the hardware and software in order to address the reliability. Hardware consider how improve components and parts and dependability of apparatus mainly. Adopt the anti-interference measure improve the system adaptive capacity and redundant structural design to the environment. The main software testing technology into account, since the fault diagnosis technology, automatic error detection and correction technology, to restore the system design technology.

3.3.1 Hardware Reliability Design

The embedded microprocessor system used extensively at present all have internal anti-interference measures. While selecting the embedded microprocessor for use, need to check conscientiously whether there is the performance, in order to design the control system with high dependability. It is therefore necessary to choose strong anti-interference capability, the watchdog microprocessor. The power selects the switch power that can fluctuate within the range of voltage of

wider electric wire netting for use. This control system uses high-performance industrial grade switching power supply as a power control system. Part of the host and peripheral circuits using different power supply circuits, power supply adequate power to make rated power required for the normal operation of the power of 1 times, so that in itself can reduce the power generated ripple and harmonic interference. Memory options: non-volatile memory. Disturbance when the biggest concern is the loss of data. The system uses non-volatile memory, we can make sure the data is not lost when power brownout. On the handling of the PCB, since the use of environmental control systems have more moisture; so in order to improve the reliability of the control system, control system for the PCB needs to be done to deal with moisture.

Consider following several issue of also at the same time when hardware conceptual design of control system this: 1, Systematic dependability is decided by dependability of each component in the system. So long as performance indexes to can meet system, should ground reduced system structure as much as possible, reduce the quantity of the component simplify the hardware design plan. 2, Divide the function of the software and hardware rationally, the function that can base on the premise that CPU time resources allow be finished with the software conveniently must be realized with the software. 3, the failure of many components and temperature are closely related to the thermal design is correct or not affect the stability and reliability of the system is to be one of the main factors. Components of the pin solder joint, inter-connector modules, such as bus plug-in electric interconnection of electronic circuit in a high failure rate, requires a high degree of importance. 4, anti-interference technology to solve problems in hardware design has always been a headache. Interference source of transmission and ways to interfere with the object is to cause interference in the three elements. Common interference suppression measures are: filtering, grounding and shielding, isolation, set up to absorb interference and network cabling, and so reasonable. Adopt reasonable Grounding technology, shield technology, isolation technology, long-line transmit, inhibition that power interfere with, etc. means raise systematic anti-interference ability.

3.3.2 Software Reliability Design
Strive to program simple. Is a simple program to improve the quality of the important technical measures, including the two-fold: first, concise program of its own; Second, the software control

system hardware to achieve the reduction of power consumption. Program to prepare concise, reflected in the size of each module program, there is no useless words, the system did not rubbish program and loopholes. Because the rubbish program not only consumes hardware resources increase CPU load, but also apt to present the uncertain factor in operating to be one of the factors influencing software dependability. Embedded in the control system, the hardware resources have been added to the number of energy-saving control, such as changes in the operation of CPU operating frequency, CPU idle mode and so on. The energy saving mode can be controlled through the software. Energy is not only the significance of the reduction in power consumption; more important to reduce energy loss in the process reduce the CPU and hardware components in the temperature, to extend the useful life of hardware and indirectly to increase the reliability of the software running [10].

Because the system is composed of hardware and software systematic dependability is divided into two respects of hardware dependability and software dependability. Through quality to improve components and parts, adoption redundant to design, carry on preventative maintenance, set up anti-interference device measure, can improve the dependability of the hardware, but it is not enough to want to get ideal dependability, usually utilize software to further improve systematic dependability. The concrete measure includes: The measure of the software, the embedded application system program finishes in advance, there may not be illegal order or seek the location. It must be that the system is interfered with that the system breaks down CPU has made mistakes while reading the order. Upon completion of the design applications need to finally do not have to deal with the ROM. The principle is in case the program can resume by oneself to here.

3.4 Multi-Sensor Data Fusion
Multi-sensor data fusion is the sensor technology, pattern recognition, artificial intelligence, fuzzy theory, probability and statistics, such as cross-disciplinary phase of an emerging discipline that studies how to give full play to the characteristics of each sensor, the use of their complementary, redundancy, to increase measurement Data accuracy and reliability of access to more accurate identification, judging and decision-making. This is a smart theory of one of the important areas of research. The source of multi-sensor data fusion can be the result of more than a single sensor data sources more accurate to judge a more complete.

Data fusion greatest advantage lies in its ability to coordinate a reasonable multi-source data, fully integrated useful information monitoring and control system to improve the accuracy of the measurement. The source of multi-sensor data fusion is based on the limited purpose of collecting data on the Elimination of measurement uncertainty than single measurements of the arithmetic mean more accurate and reliable measurements to data fusion operation after parameters as the original data On-line performance calculated the results of the control system to better reflect changes in the parameters of control.

Data integration technology to the control system of multi-sensor data provided by the multi-level, dealing with various aspects, has many advantages. For example, more than a single sensor can be more comprehensive and accurate information system, a set of sensors similar to the collection of data redundancy, the redundancy of information in the proper integration can reduce the overall uncertainty of information, some of the different Types of sensors collecting data have obvious complementarities, which complement each other and are appropriately treated with a single sensor can compensate uncertainty and the limitations of range, multi-sensor integration can increase the reliability of
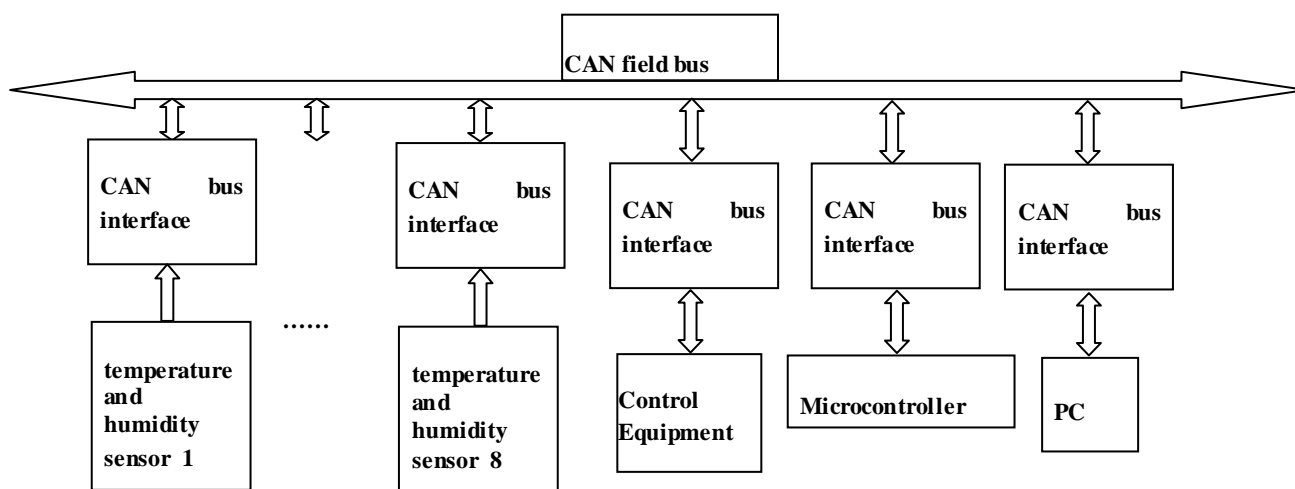

Fig.5 Multi-sensor microcontroller and the CAN bus interface

3.4.1 Multi-Sensor Interface

This control system in a number of sensors and microcontroller connections through the CAN field bus interface reality, as shown in Figure 5. CAN field bus temperature and humidity sensor node hardware circuits produced by Atmel's microcontroller AT89C51CC01, CAN transceiver 82C250, temperature and humidity sensor and circuit components, such as Anti-interference circuit. The microcontroller nodes to the core, the use of high-precision temperature and humidity sensors on the temperature and humidity data collection and access to the data processing, CAN controller used to communicate with the CAN bus, it can be completed independent of the total CAN Line of data receiving and sending work to improve the control system of anti-interference ability, in the CAN controllers and CAN transceiver 82C250 access to high-speed optocoupler isolation chip.

3.4.2 Data Fusion

the system, such as when one or A certain number of invalid sensors, the system can still work properly.

As the greenhouse environment is a larger space, using a single sensor is very difficult to accurately reflect the actual environment of greenhouse temperature and humidity values. In order to improve the control system of this control, using a number of temperature and humidity sensors. This data fusion approach to 8 sensors designed to carry out a reasonable request is divided into 2 groups, the use of Kalman filter for the best local estimate, and then sent to the partial results of the estimated global level to deal with integration in order to get the best estimate of the system. Can see that this approach not only because of various parallel processing of information, thereby reducing the dimension of information, reduces the amount of calculation, the calculation of time-saving, easy to achieve real-time control, and for further system fault detection and fault isolation may be provided. The use of the system shown in Figure 6 of the information fusion of thought decentralized implementation of the filtering program.
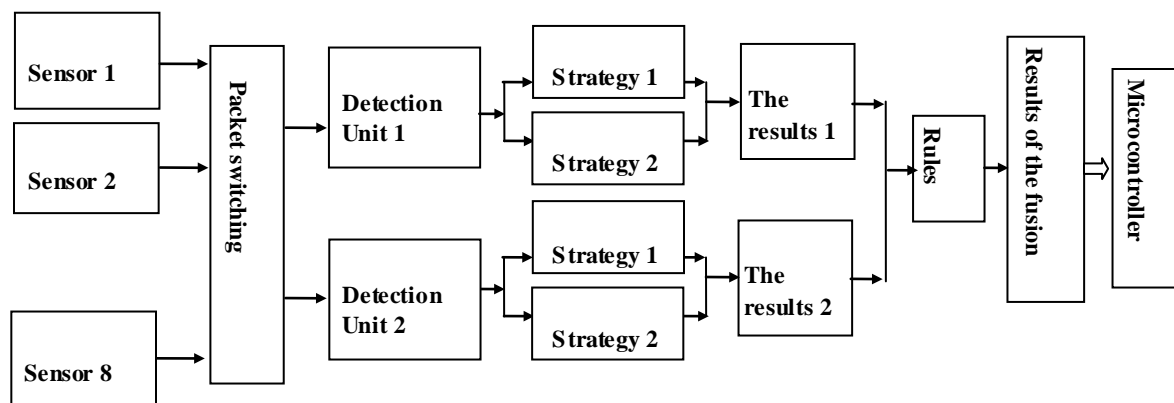
Fig.6 Multi-sensor data fusion process

3.5 Interactive Systems Design

With the advances in computer technology, control systems for human-computer interaction interface of the degree of human nature have become increasingly demanding [11]. Humanization is designed. The humanization of the embedded system is designed and reflected in the good boundary plane and easy maintenance after making mistakes of human-computer interaction. The first human-computer interface friendly attractive, reliable and easy to operate; II is a real-time monitoring of the process, the revised parameters to make intelligent and reasonable analysis of the wrong operation and modify the parameters, and refused to carry out a warning and information to help. It causes the possibility of the system crash because of operating by mistake to reject. In order to improve the control system of human-computer interaction of the human interface，of the control system of human-computer interface using principles of ergonomics, the scientific theory system of the scientific method and system for the full design, make this control system user interface can be used as much as possible for the user's application needs. If the system of automatic control, the system user interface LCD display module, the user can easily understandable way, the system shows the current state of and concerned about the needs of the user information, such as the present time, the current system, the measured temperature and humidity data Implementation of the automatic control system has been the number of days that the current system equipment, such as state information. And the user experiences need to enter data system settings, users are also easy to understand and adequate information in order to prompt the proper use of user-friendly. At the same time, users also need to consider the interactive system, a better fault tolerance. Is to allow a user to operate in the course of an error, the system can

make the right tips, and the system would not have affected the normal work. That is, control system user interface design need to fully understand the system, users of the system needs to fully from the perspective of the user interface design system, but they are not from the perspective of designers to design the control system user interface. This system was designed to have a good user interface system. Although the design of these requirements greatly increased the difficulty of design, but improved overall system performance.

3.6 Control Strategy

Control strategy, is thought and method controlled, is the general name of a series of function module which users produce for realizing to the free control of operation procedure of the system. Control strategy itself one frame that offer systematically, the inside their put " tactics trip " made up of tactics condition components and tactics component, the embedded systematic developer utilizes the procedure ordering languages to write to finish the control strategy, make, control application system can operate embedded database, control according to order and terms that establish apparatus target open and close, confirm working state of apparatus wait, realize to apparatus working accuracy control and orderly dispatch management of course.

In the control system, control strategy is the heart of the system. As temperature and humidity control of the process control parameters and control targets more, and the control of large differences in the nature of targets, and the control parameters and control targets implicated each other, the use of conventional digital PID algorithm, Dahlin algorithm or fuzzy algorithms are more difficult, And because it is difficult to establish control parameters, control results may not necessarily ideal [8], it adopted the original analog operators approach - a ping-pong back to poor control. This method of program is

simple, imitating the operator operation, temperature and humidity control at control points to close objects to a certain low-value (adjusted) were opened, the cycle work. System can be set according to the ideal of smooth curves of intelligent control temperature and humidity of the greenhouse environment. In control, according to the system of measurement data are stored and the results of experts on different crops to provide the ideal data to intelligent control object of the operation, so that the greenhouse temperature and humidity values in the best state of crop growth. The whole temperature control module control of the state divided into three: GT (T) temperature is higher than set, EQ (T) temperature is set and LT (T) less than the temperature settings, the humidity control, control is also divided into three Of state: GT (H) and humidity is greater than set, EQ (H) and the humidity is set LT (H) and humidity is less than set. Temperature and humidity measurements of the relationship between state and expressions are as follows:

IF $T_{MEA} < T_{SET} - \triangle T$ THEN T_{STATUS}=LT

（T） ; The temperature is less than the value set

IF $T_{MEA} > T_{SET} - \triangle T$ AND $T_{MEA} < T_{SET} + \triangle T$ THEN T_{STATUS}=EQ（T） ; The temperature is equal to the value set

IF $T_{MEA} > T_{SET} + \triangle T$ THEN T_{STATUS}=GT

（T） ; The temperature greater than the value set

IF $H_{MEA} < H_{SET} - \triangle H$ THEN H_{STATUS}=LT

（H） ; The humidity is less than the value set

IF $H_{MEA} > H_{SET} - \triangle H$ AND $H_{MEA} < H_{SET} + \triangle H$ THEN H_{STATUS}=EQ（H） ; The humidity is equal to the value set

IF $H_{MEA} > H_{SET} + \triangle H$ THEN H_{STATUS}=GT

（H） ; The humidity greater than the value set

T_{STATUS}：The current temperature;

H_{STATUS}：The current humidity

T_{MEA}：Temperature measurements

H_{MEA}：Humidity measurements;

T_{SET}：Setting temperature;

$\triangle T$：The current temperature tolerance

H_{SET}：Setting humidity

$\triangle H$：The current humidity tolerance。
Control the implementation of the rules:
Heat: IF T_{STATUS} = LT (T) THEN turns on furnace automatically.
Cool: IF T_{STATUS} = GT (T) THEN turns on skylight automatically.
Humidification: IF H_{STATUS} = LT (H) THEN humidification-open solenoid valve automatically.
Go to wet: IF H_{STATUS} =GT (H) THEN turns on ventilator automatically.

Test results show that this control method can significantly improve the environment of the greenhouse temperature and humidity, which can effectively control greenhouse crops.

4 Results and Discussion

In this paper, based on the embedded database of greenhouse temperature and humidity control system is a practical significance of the application system. The System achieves the greenhouse environment automatic control temperature and humidity. But systematic overall performance can be still needed to further improve. Respects such as for instance systematic stability, adaptability, etc. have working content that the need goes on and studies. Here are some ideas for discussion. 1. The control system on how to obtain a higher stability of the system, the greenhouse control system how to adapt to the natural environment outside the greenhouse is different from the natural environment in the greenhouse under different control methods, in order to achieve better control of the greenhouse effect. 2. The greenhouse control system and effective ways to reduce energy consumption and improve the overall control system performance. 3. Greenhouse control system of how best to achieve adaptive control, that is, in order to reduce energy consumption and control to meet the greenhouse effect. 4. An increase in the greenhouse, video surveillance systems, real-time master of greenhouse crops, in order to grow crops there is any problem with real-time to take the necessary measures.

Modern greenhouse environment control system is a non-linear, lagged behind, and multiple-input multiple-output of the complex control system, a single control algorithm is difficult to meet the modern greenhouse environment, intelligent control requirements, will cross a variety of control algorithms and integration of hybrid control Algorithm in the greenhouse environment for the application of intelligent control and research is very active [12]. To explore a new type of indoor environment and greenhouse crops to obtain information on ways to build on the growth situation crops and the environment inside the greenhouse between the mathematical model, to set up outside the greenhouse climatic conditions inside the greenhouse and set the conditions for variable driven small greenhouse climate simulation models for greenhouse Within the digital environment simulation test and study further to achieve the greenhouse crops with physiological indicators of intelligent control, intelligent control system hardware configuration and provide a theoretical

basis for structural optimization. In short, the greenhouse temperature and humidity control system with a wide range of applications, which can include more advanced features as well as the more complex issue. Difficulties continue to break so that the control system more intelligent and better reliability and adaptability, is the constant pursuit of the Institute.

5 Conclusion

In this paper, through embedded control system for greenhouse-related technology research, a practicality and high levels of greenhouse technology embedded intelligent control system, including systems architecture, systems software and hardware design. This article focuses on practical research. The aim is to design a highly practical and technical level of greenhouse intelligent embedded control systems. The use of manual analogue system of control and improve the reliability of control. The adoption of the output corresponding to a set of equipment for the handling of state control, and simplifies the operation and control procedures, so that control is easy to implement, so that a reliable system operation, equipment control systems to avoid a state of conflict. At the same time, this control system can also be used for other automatic control temperature and humidity environment, with better prospects. Its temperature and humidity information embedded database storage and graphics display to users for further analysis of the greenhouse temperature and humidity of history is of great significance and practical value. It is the alternative to the traditional way to control temperature and humidity control system ideal greenhouse.

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