

Research On Agricultural Water Saving Irrigation System Based On Artificial Intelligence Technology

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Abstract: This paper designs an intelligent pumping and irrigation system based on single chip microcomputer. The system is designed based on electronic automatic detection and control devices. It belongs to an embedded system and is controlled by software. The system uses the currently mature and commonly used sensing technology. The circuit control system controlled each part reasonably, and achieved the purpose of automatic detection and irrigation.

Introduction

Fuzzy control is a non-linear control method that does not require the establishment of an accurate mathematical model of the object. Based on domain expert knowledge or operator experience, an effective control strategy for the object can be formulated. The response speed is fast, but the control error is large. PID control The controller is very robust and adaptable to time-varying systems. Based on the advantages of the above two control methods, aiming at the characteristics of non-linear and severe lag of the irrigation system, this project focuses on designing a fuzzy BP neural PID control system. The designed controller makes the soil moisture constant by controlling the change of soil moisture It is stable near the optimal soil moisture value of plants, so as to realize real-time and appropriate irrigation of plants.

1. Overview Of Smart Irrigation System

The application of Internet of Things technology in agricultural irrigation system is getting more and more attention. There has been a lot of research on smart irrigation equipment based on the Internet of Things technology at home and abroad, and great progress has been made in development and application. This kind of irrigation can achieve precise and timely irrigation, which can not only improve water use efficiency, but also promote agricultural production and income. Establishing a modern irrigation management technology system and applying high and new technologies to make irrigation more precise is the general trend of agricultural development in developed countries. In our country, due to the continuous reduction of agricultural labor force in recent years, the smart irrigation system has gradually been accepted by everyone, but the relatively high price is the biggest obstacle to its promotion to ordinary people, and agricultural products due to their higher economic benefits and price sensitivity Relatively low, therefore, China's agricultural production has a great impact on agricultural production. It is a pioneer in the application of intelligent irrigation systems. Due to the lack of water in the western region, and the need for the development of planting industry, self-sufficiency, such irrigation technology is urgently needed.

The new invention of the Internet of Things is a very important component of science and technology. What you can know without thinking is that this kind of thing is to connect something to the Internet. The general application of the Internet of Things in irrigation is to combine a large number of sensor nodes with field facilities, greenhouse equipment and drip irrigation facilities to form a modern intelligent irrigation system. The intelligent irrigation system can collect, store, and display the environmental parameters of the greenhouse or field, and there are some machines that can control the field in a far place. This system collects information through several sensing machines, and can quickly know the field, so that it can realize its own monitoring of agriculture, can automatically control the environment, and can automatically manage and provide some correct

information. In this way, the agricultural alley will gradually change the pattern. It is necessary to regard personnel relations as the center, as well as mechanical equipment as the main mode of production, and information and software as the main mode of production, and finally achieve self-sufficiency. It is also possible to control production without humans and brains.

2. The Core Elements Required For Smart Irrigation Systems

Many aspects, personal masters in multiple dimensions. Being able to get comprehensive, unbiased information about the growth of agricultural products, and particularly large-scale information and data, is also the basis for deciding the irrigation system. The amount of water in the deep part of the land is constantly changing. The surface of the ground also has the temperature below the ground, the cube of the agricultural products can absorb water and the weather, and the amount of water required by the agricultural products and the living environment. . More comprehensive ecological data contains information about the history of the place, information about the future prediction of the place, analysis of the amount of water required by the agricultural products of the place, analysis of the nature of the soil, etc. The use of a fully automatic watering system can combine the field information with a large ecological database, so that it can be used to irrigate glue with the information of crop growth, and can accurately find the location and distribution of crop water absorption. Only irrigation technology can automatically know whether the agricultural products are to be watered, and can automatically know how much water is in this acre of field, so that if you can, you can clearly understand the water in this field. Using this information can also predict whether it will rain in the next few days, so that the duration of watering can be automatically set, as well as the amount of water to be watered and the time of watering.

Use this high-tech approach to irrigation and decision-making. This is because the data in the field and the information in the large database are exchanged and exchanged, so that the exchange of information can reach the decision to control the irrigation system. Once the irrigation decision is implemented, the pumps in this system and the controller of varying frequency , The control valve in the field, the water gun will be opened. For example, in the process of watering, if you can accurately know whether it will rain in the next two hours, the irrigation system will automatically stop and make full use of the rain in the sky. This system can also calculate based on the data in the database, whether it rains enough, and need to continue irrigation without irrigation.

Return information very deeply, and then study, make corrections yourself, and make improvements by yourself. The system that returns information is the biggest difference between the automatic watering system and the previous tax payment model. This system transmits the information of all machines such as water quantity, water pressure, machine, frequency conversion machine, electric valve, etc. to the place where automatic irrigation is controlled. The sensor machine in the field will transmit the depth of irrigation and the amount of water used for irrigation to the controller. The automatic infusion controller will analyze and compare the returned data and the final data, so that the irrigation will be solved. When the automatic watering controller is connected with the largest database. This automatic irrigation controller can get the latest information from the cloud database to make a decision. Under this comparison, the previous watering controller did not have an automatic inspection and alarm system. The system had no way to determine whether there was a water leak or if there was a problem with the electric valve door.

The watering and fertilization of this system are very accurate. The controller of the automatic irrigation system can control the concentration and dosage of fertilizer and fertilizer. Finally, the solid fertilizer or liquid fertilizer becomes the most primitive fertilizer. Because solid fertilizer can turn into liquid, it can be very symmetrical for a certain period of time, and the fertilizer can be sent to the root in an appropriate ratio.

3. Fuzzy Control System

Fuzzy control is a computer control system based on fuzzy set theory, fuzzy linguistic variables

and fuzzy logic reasoning. It is a kind of intelligent control method that imitates human behavior in fuzzy reasoning and decision-making processes. The operator or expert's experience is reduced to fuzzy control rules, then the sensor signal is blurred, and the fuzzy input is used to adapt the control rules to complete the fuzzy logic inference, and finally the fuzzy output is clarified to become analog or The digital quantity is sent to the actuator to control the controlled object. Fuzzy control consists of three steps, namely fuzzy, fuzzy reasoning, and clarity. Its structure is shown in Figure 1. The content of fuzzy controller design includes:

- (A). Structural selection and parameterization of fuzzy controller;
- (B). Selection of fuzzy rules;
- (C). Establishment of knowledge base;
- (D). Determine the method of fuzzification and defuzzification;
- (E). Selection of fuzzy inference operators;
- (F). Adjustment and perfection of control performance.

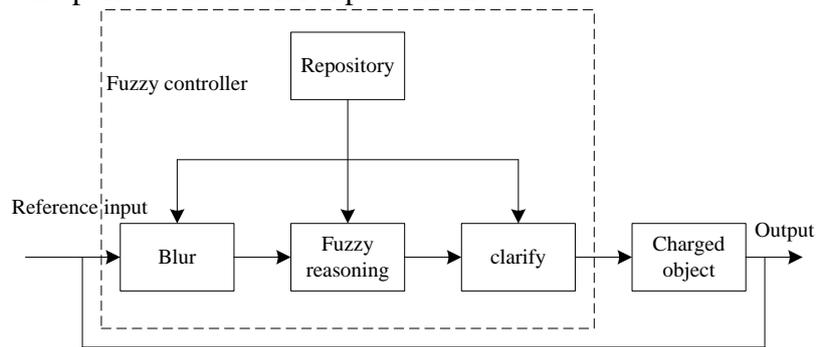


Figure 1. Block Diagram Of Fuzzy Control System

4. BP Neural Network

The basic idea of the BP network learning algorithm is to attribute the errors in the output layer that do not match the "expectations" to the improper connection weights and thresholds used. By backpropagating the error of the output layer node to the input layer by layer to allocate to each connection node, the reference error of each connection node can be calculated, and the connection weights and thresholds can be adjusted accordingly, so that the network can reach Corresponding mapping requirements.

The deviation e and the change rate ec of the deviation of the fuzzy control input are obtained through fuzzy processing to obtain the respective fuzzy linguistic variables E and EC . As input to the neural network, fuzzy rules and fuzzy language reasoning are all done by the neural network. The neural network outputs the fuzzy language value of the pump motor. After de-molding, the irrigation water volume is controlled by the pump motor. Its structure is shown in Figure 2.

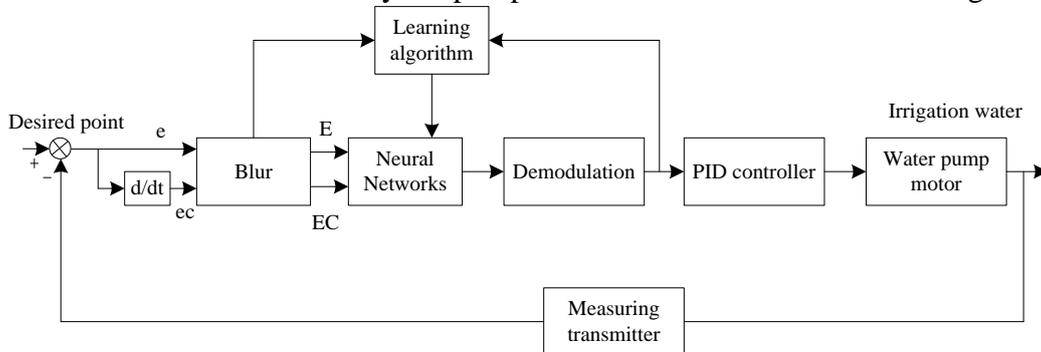


Figure 2. Principle of fuzzy BP neural PID control system

The calculation steps of the fuzzy neural network PID control algorithm can be summarized as follows:

- (A). Select the number of structural input layer nodes and hidden layer nodes of the BP network

in advance, and give the weighted initial value of each layer, and select the learning rate and inertia coefficient;

(B). Archive and blur the temperature error and error change rate as the input of BP network;

(C). Calculate the input and output of the neurons of each layer of the BP network, control the parameters of the PID controller, and control the irrigation volume of the water pump motor of the vegetable greenhouse;

(D). PID control uses classic incremental numbers;

(E). Calculate the connection weights of the modified output layer and the positive hidden layer.

Conclusion

Due to the development of artificial intelligence technology, some control theories such as expert system, fuzzy logic control, neural network control, collaborative control, etc. are widely used in the prediction and modeling of engineering problems. These theories are based on automated sensor equipment, monitoring soil moisture, using meteorological data, estimating plant transpiration, and then analyzing and processing the control theory, making logical judgments, and further sending signals to actuators to control the closing of some solenoid valves, better, More timely and more accurate prediction of environmental parameters, and timely adjustment of output response to adapt to the needs of crops in different growth periods of water.

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