Home Electrical Equipment Control System Based on Speech Recognition Technology

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Abstract: With the rapid development of economy and science and technology, people have higher and higher requirements for the quality of home life, and smart home systems are required to have higher convenience and comfort. Driven by the widespread application of new generations of artificial intelligence and new generations of computer intelligence technology, the human home electronic infrastructure will definitely move forward in a more intelligent direction, especially the outstanding contribution of speech recognition technology. The purpose of this article is to study home electrical equipment systems based on speech recognition. This article will start from the software and hardware parts of the system. The upper computer system implements voice collection, recognition, and processing, and issues corresponding action commands. Through serial communication, a serial control network is formed. Standard home electronic equipment, real-time remote control of home appliances through voice recognition technology. The experimental results show that the voice recognition technology will replace the traditional wireless smart buttons and manual control, which provides a new technology and development strategic direction for the development and application of wireless smart home systems, and improves the intelligence and application process of home electronics. The wireless control of voice control and mesh network simplifies the control process of home equipment and improves the control efficiency. At the same time, it also plays a positive role in improving and improving the quality of life of people with reduced mobility.

1. Introduction

In the 1980s, the widespread application and development of hmm neuron models and artificial neural networks in the research of speech recognition systems further deepened the research on speech recognition; in the 1990s, with the rapid arrival of the Internet and multimedia, our speech recognition was urgently required The system went further from the complicated laboratory into real life. Speech recognition technology is an information technology discipline that has been further developed and strengthened in the past two decades, especially in the past ten years. At home and abroad, it has become a hot topic of information technology for scientific research [1]. Many well-known government salaries in developed countries have invested heavily in practical research and application technology development dedicated to speech recognition systems. Nowadays, many smartphones based on speech sensor recognition, mobile phones with speech sensor recognition, and laptop computers have appeared on the market. The voice recognition

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products of products, especially in-home appliances, are widely used [2-3]. Therefore, many people are optimistically predicting that voice control recognition systems for home and electrical equipment based on voice sensor recognition technology will quickly enter the field of home appliances within 10 years [4].

With the development and application of speech recognition technology, traditional control systems have exposed many problems and deficiencies, and are being replaced by new-type control devices in many fields and industries. Traditional logic control systems have been widely promoted and applied in a variety of applications due to their simple working principles, easy implementation, good anti-interference, economical and practical advantages in the design of their logic control systems [5]. This logic control system mainly relies on the interconnected lines to transfer analog signals by using the opening and closing movements of electrical contacts, so it often has low operating frequency, complicated circuit connections, and a large workload of maintenance. Large volume, and many other shortcomings. In particular, this logic control system often adopts a fixed wiring method, so that it can only adapt to a fixed logic control equipment process requirements, when the control equipment or its manufacturing process requirements When changes occur, the fixed wiring must be replaced again, and sometimes the original system control equipment may be scrapped, causing unnecessary waste of resources. Because of the poor operating flexibility and universality of this control system, traditional logic control equipment systems often can only process one logical signal directly, and cannot process their analog signals, so they are far from fully adaptable to a certain Technical requirements for logic control systems for some modern household and industrial electrical equipment [6-8].

This article studies a home electrical equipment control system based on voice recognition technology. A smart home control system is implemented through a voice recognition module and a Mesh network based on Bluetooth 5. Through this system, simple voice commands can be recognized, and then the working status of the corresponding electrical equipment can be controlled based on the voice results [9-10]. Recognition, so as to realize the basic functions of voice control, make the control more convenient, and also have a good effect on improving the quality of life of people with reduced mobility [11]. There is no need to manually turn on, switch, or close the functions of household electrical equipment. Start a new era of smart home, so that the broad masses of people can better enjoy the intelligence of life [12].

2.Methods

2.1 Concept of Speech Recognition Technology

This technique of voice image recognition mainly refers to a kind of speech recognition class that allows us humans or machines to convert signals in various sounds and text languages that belong to us as human beings through various voice and text understanding to become corresponding or corresponding text languages such as text or language commands. The visual recognition information technology major of speech is a comprehensive technical discipline which is closely related to the acoustics of scientific speech system, the acoustics of media, phonetics, linguistics, the theory of mathematical speech signal information processing system, the theory of information theory, the basic subject of computer and many other specialized disciplines of speech. It is essentially an important scientific and technological representation tool devoted to the study of the exchange of information between people and other machines, primarily to enable all humans and their machine sons to quickly understand and correctly understand the different voices and languages belonging to human beings. It is an important technical manifestation of promoting

intelligence between humans and other machines.

2.2 Basic Principles of Language Recognition

Most speech recognition systems today use the principle of pattern matching. The donor voice waiting for speech recognition is converted through the microphone to become a speech recognition signal, and then sent from the top of the recognition system to the loser for speech pre-processing. The feature extraction part is mainly used to identify and extract the various sound recognition parameters contained in the information identified by the speaker's voice sample that can represent its essence. Usually speech recognition training begins before the speaker is identified, by extracting the speaker's repeated voice to repeatedly extract the donor's voice, initially by extracting and removing excess information from the speech recognition sample, and retaining critical speech data to extract the speech implementation. Pattern matching is the data center of speech recognition system, which is mainly based on the knowledge of speech experts and certain speech recognition criteria to calculate the approximate degree between the donor speech characteristics and the inventory speech mode used, inferring the information and meaning to extract the voice of the loser. This speech recognition system mainly uses two parameters, the reverse-spectrum recognition coefficient and the traditional base tone recognition cycle, while the reverse-spectrum recognition coefficient is used only for the speaker in the speech signal recognition of the speech control command, and the reverse-spectrum recognition coefficient can be used by linear prediction algorithm to adopt the reverse-spectrum recognition coefficient (lpcc) The method of pcc speech recognition parameters can be extracted directly by using the covariance algorithm to directly seek the lpc inversion coefficient, and then the lpcc parameter sought directly.

$$R_n(j) = \sum_{n=0}^{N-1} s(n)s(n - j) \tag{1}$$

$$R_n(j-i) = \sum_{n=0}^{N-1} s(n - j)s(n - i) \tag{2}$$

$$c(j,i) = R_n(j-i) = \sum_{n=0}^{N-1} s(n - j)s(n - i) \tag{3}$$

$$c(j,0) = \sum_{i=0}^{P} \alpha_{i\,C(j,\,i)} = 0 \tag{4}$$

The concepts and methods of calculating the base sound signal estimation of covariance include the covariance algorithm with the base-self-mean correlation amplitude difference function, the algorithm of the difference from correlation between the average signal seeking short-term signal based on the voice signal, the covariance processing based on homomorphic voice signal and the covariance algorithm based on linear prediction speech signal encoding. In this paper, the design of the base sound system can directly adopt the algorithm of the function of the correlation amplitude difference from average. In the system design s(n) is a windowed voice signal, and its non-zero interval is n-0,1, n-1. The self-average correlation amplitude function algorithm for s(n) is also known as the short-term self-average correlation amplitude difference function used to find the speech cycle signal, indicating that:

$$R_w = \sum_{n=-\infty}^{+\infty} S_w(n) S_w(n+l) = \sum_{n=0}^{N-l-1} S_w(n) S_w(n+l) \tag{5}$$

$$R_w(0) = \sum_{n=0}^{N-1} S_w^2(n) \tag{6}$$

The short-term self-point and related zero peak window chart functionise at the zero point r(0) at each point, and there is a large self-point and related zero peak between the various time integer points of the longest period of the short time base tone, after selecting the appropriate window chart function and using the related zero peak window filter. As long as the first maximum point of the self-point and related zero peak window chart function is quickly and accurately located and the average position of the associated zero peak and the second maximum zero point is accurately calculated, it is easy to accurately estimate it and derive the longest period of the short time base tone.

2.3 System Background Control Center and Actuator Module

Background voice control processor center is mainly composed of the primary unit of the foreground and the Bluetooth 5 module in the background, which is used to control the background reception from the mesh network and makes corresponding processing of the background; Bluetooth 5 module and the corresponding relay processing module in the background composition, when the background received from the background control processor center of the actuator instructions, the corresponding background actuator instruction module in the microcontroller automatically control the action of the background relay, to achieve the background power supply interruption.

3. Experiment

The first step, power on the system, first of all, the initialization, each Bluetooth voice video recognition control module of the individual Bluetooth 5 devices in their respective Bluetooth microcontroller drive control directly to form a mesh Bluetooth data network. The interface Bluetooth chip voice signal recognition chip module based on the Bluetooth voice signal recognition chip module has the voice reset and initialization of the ld3320 in the Bluetooth chip. And all temporary need for a single-chip host user-recognized Bluetooth voice interrupt signal and data entries through a single-chip host direct transmission to the Bluetooth voice signal recognition chip module data list, single-chip users can be through an open external voice interface at any time to perform voice interruption, Wait for all Bluetooth voice signal recognition module signals to continue to enter;

The second step is to control the voice signal processing of the microcontroller of the household electrical equipment. When an electrical device collects a speech recognition signal sent to the background, if the voice signal is obtained by the voice signal processing recognition signal to match the signal of an entry in the external recognition list, the current result triggers an external interruption. In the service program that triggers the external interruption, the microcontroller can judge that the signal represents the speech recognition command according to the value of the corresponding signal register, after which the single-chip control center uses the Bluetooth 5 device to send the voice command directly to the control processing center of the microcontroller background through the mesh network of the microcontroller. If the speech recognition signal

obtained by the microcontroller does not match all speech recognition entries in the external recognition list, the microcontroller discards the current result and no longer continues to trigger an external interrupt, and resumes waiting for the input to collect the speech recognition signal.

The third step, the control management center constantly sends the command information from the mesh control network from the microcontroller to the receiving user, and automatically generates the corresponding Bluetooth control instructions of the microcontroller according to the control command information received by the microcontroller, and then sends the message to the user in the form of a broadcast message through the mesh control network of the microcontroller. If the control command information is sent by a Bluetooth control network command from the microcontroller control center and the control address of the relay is exactly the same as its own Bluetooth control address, then the microcontroller automatically controls the relay according to the command of the Bluetooth control center to carry out the corresponding pass-through control action of the microcontroller, This allows the microcontroller to realize the remote control of various electrical equipment.

4.Results

4.1 Analysis of the Effects of Noise on Speech Recognition

Through the experiment, the author collected data on the effects of noise on speech recognition, as shown in Table 1:

Table1. Effect of noise on control effect

Noise level	10dB	20dB	30dB	40dB	60dB	70dB
Control effect	well	well	general	A bit bad	bad	very bad
*Data came from sorting of algorithm results						

Table 1 shows that there has been historic progress in speech recognition, but there are still some technical shortcomings. Noise processing is a difficult problem to break through. In environments where noise is relatively small, it can be very good for control. But in a noisy environment, it's hard for the system to discern the speaker's language.

4.2 System Control Effect

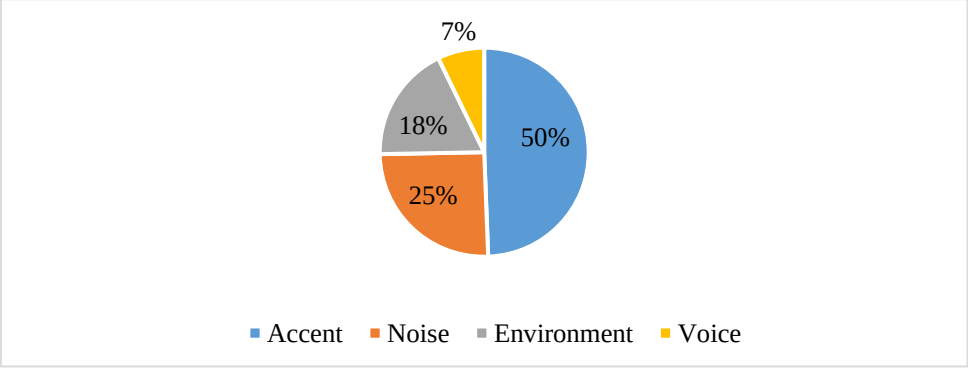

Figure 1. Percentage of several major factors affecting control effectiveness

Through Figure 1, it is not difficult to find that the main factor affecting the control effect of household electrical equipment system is accent, followed by noise, the smallest factor is the size of speech sound. Although speech recognition-based home electrical control systems have a lot of a bit. However, the development of speech recognition technology has entered a relative bottleneck period. It is impossible to deal with the noise and dialect recognition in the environment effectively,

which limits the development of speech recognition technology to a certain extent. Some speech recognition enterprises are well-funded, large number of users, comprehensive user experience data, customer demand is a good driver of the development of speech recognition products, these key technical advantages are what we, traditional speech recognition technology providers lack, These key technical advantages also provide a strong technological innovation impetus for the rapid development and application of speech recognition application technology in the future, and also have enterprises who want to completely break the current technology bottleneck in the development of speech recognition industry, and find effective ways to solve the current problems such as speech noise, dialect use caused by speech recognition errors.

Effects of environmental noise and interference. Almost all of the original speech templates in the voice library are sampled and stored in a non-disturbing environment. How many speech recognition systems are also designed based on these speech templates? However, in the actual environment, this absolutely no noise environment almost does not exist, especially in people's daily life. These ambient noise and interference significantly reduce the performance of speech recognition. In addition, the language information is very fuzzy, and the information changes greatly. The recognition and understanding of natural language also affect the control effect. Some of the words prescribed by humans sound similar, which is common in many languages. Voice mode is different for different speakers, but in different situations, it is also different for the same speaker. It's too unstable.

5. Conclusions

The home electrical equipment control system based on speech recognition technology is not mature enough, because the accuracy of speech recognition technology itself is difficult to measure. Environmental noise, the user's voice (by age, gender, accent, accent, health, speech intensity, even the time of day speaking, etc.) can all affect recognition performance. But once these technical problems are broken, they will improve the level of human-computer voice interaction and promote the pace of intelligent technological innovation in the home appliance industry.

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