Design of Tibetan-Chinese Bilingual Garbage Recycling System Based on Interaction Design

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Abstract: In order to strengthen the promotion of the concept of garbage classification in Tibetan areas, to solve the environmental problems such as low efficiency of garbage classification and poor accuracy of garbage delivery in Tibetan areas. This paper first analyzes the status quo of garbage classification in Tibetan areas, the popularity of Mandarin residents in Tibetan areas, and the main population of garbage classification, and determines the feasibility of the project. Secondly, through the design of hardware system, software system and interactive system, the whole system framework is built. Finally, on this basis, a non-contact Tibetan and Chinese bilingual intelligent trash can is formed by establishing the hardware and corpus. The design provides help to improve the environmental awareness of Tibetan residents, accelerate the promotion of garbage classification, and popularize the basic knowledge of garbage classification.

1. Introduction

Since the "14th Five-Year Plan for the Development of Urban Solid Waste Classification and Treatment Facilities" issued in 2021, it has been pointed out that there is an unbalanced regional development of domestic waste classification, and most cities in central and western regions are still in the preliminary stage[1] of exploration. As one of the inhabited areas of ethnic minorities in China, Tibetan areas still have problems[2-3] such as insufficient local publicity and popularization, residents' indifferent awareness of classification, and inadequate infrastructure, which affect the ecological environment of local pastures and grasslands and hinder the development[4] of local economy. In addition, due to the lack of garbage disposal facilities in Tibetan areas and the lack of accuracy, it is not only difficult for residents to effectively dispose of and classify different types of garbage, but also prone to inaccurate classification. Therefore, in order to better promote the awareness of environmental protection in ethnic areas, our research goal is to develop an intelligent garbage classification system with Tibetan and Chinese bilingual functions. By combining non-specific speech recognition technology and citing Tibetan residents, improve their garbage classification knowledge to Tibetan residents, improve their garbage classification efficiency, and promote the garbage classification and recycling system.

The study has important implications. First of all, garbage classification is crucial to environmental

protection, but in ethnic areas, due to language and cultural differences, it is often difficult to popularize garbage classification knowledge. [5-6] By developing a Tibetan-Chinese bilingual intelligent waste sorting system, we will provide a convenient and easy-to-understand learning tool for Tibetan residents to effectively promote their participation in the waste sorting and recycling system. At the same time, by referring to the speech recognition technology that integrates Tibetan and Chinese bilingual corpus, our system will achieve more accurate and efficient speech interaction, making it easier for Tibetan residents to obtain information about garbage classification. This will greatly improve the efficiency of their learning and application of waste classification knowledge, and provide strong support for achieving environmental protection goals.

In addition, the innovation of this study is the use of non-specific speech recognition technology combined with Tibetan and Chinese bilingual corpus, filling the gap in the market of smart garbage cans lacking Tibetan and Chinese bilingual function. Our system will realize the user's voice input recognition and automatically parse into the corresponding Tibetan and Chinese bilingual instructions, so as to provide personalized garbage classification guidance. This innovation will bring an important breakthrough in garbage classification education in ethnic areas, and provide a basis for the application of similar smart devices in other ethnic areas.

2. Research content

As a region with unique environment and fragile ecology, improper garbage classification in Tibet poses a serious threat to its ecological environment and people's health.

As the government of Tibet Autonomous Region attaches great importance to environmental protection, the treatment work has also received corresponding input. In order to solve the problem of improper garbage classification in Tibetan areas and considering the low popularity of Putonghua, this research focuses on garbage disposal in Tibetan areas and studies the life of residents in Tibetan areas from the status of garbage classification. The specific contents are as follows: Combined with the situation of intelligent garbage classification in Tibetan areas and the production amount of each kind of garbage were studied, and the popularity of Mandarin among residents in Tibetan areas was studied through the language method of voice wake-up module.

3. System Architecture

The hardware layer of the system is composed of four parts: garbage can kit, data transmission module, voice recognition module and main control unit. Communication is carried out through the NB-IOT module. The data transmission module is responsible for collecting the information of each sensor and the LD3320 voice recognition module and transmitting it to the main control unit. The master control unit is responsible for receiving the voice signal from the data transmission module and completing the corresponding actions according to the voice instruction. The system also includes a cloud platform for data analysis, which is responsible for the management of the Tibetan-Chinese bilingual corpus and the regular update and maintenance of the corpus. Among them, NB-LOT is mainly developed on the basis of LTE. It mainly adopts LTE related technologies and makes corresponding modifications according to its own characteristics, so that it can support a wider range of application scenarios. At the same time, through ICRoute company's high-performance LD3320 speech recognition chip, determined the architecture of the voice control system, to provide a guarantee for the realization of data voice transmission. The system architecture is shown in Figure 1.



Figure 1: System architecture diagram

4. System Design

4.1 Hardware design Summary

Through infrared recognition, when a pedestrian is recognized to stop for a period of time, the master control unit receives a signal and sends a message to the language module to prompt the user to throw garbage. When receiving a foreign language signal, it gives corresponding feedback according to the voice content, such as: "User: garbage can, language reply: I am/what's the matter/want to throw garbage?" When the user wants to put garbage, the trash can will prompt the user to say the name of the garbage. At this time, after the user says the name of the trash can, the corresponding garbage hatch controlled by the steering engine will be opened. The language recognition system of the user will send different messages to the main control unit through the serial port USART protocol according to different kinds of garbage. The master control unit receives it through the serial GPRS module and then sends it to the webpage background for data recording.

4.2 Software design summary

The user's behavior and preference for garbage bin classification and placement can be obtained, and the class characters of Tibetan-Chinese bilingual corpus can be added or modified to improve the accuracy of garbage classification.

4.3 Interaction design

Compared with ordinary garbage cans, interactive design using human voice and smart garbage cans can bring many advantages. First of all, this interactive way is more natural, convenient and easy to use. Users do not need to carry out complicated operation process, but simply oral instructions or voice expression can realize the purpose of controlling the garbage can. At the same time, this interactive way can also improve efficiency and accuracy, to avoid forgetting classification, classification is not accurate and other problems.

In this system, residents can interact with the intelligent garbage can through the garbage station placed in towns and villages through the non-specific voice voice recognition module, dictate the name of garbage to the garbage can, the non-specific voice voice recognition module sends the result to the main control board through serial communication, the main control board accepts the result, controls the corresponding trash can lid open, and the residents put the garbage into the bucket. It is designed to make residents more sanitary and accurate garbage delivery through voice interaction mode.

5. System implementation

5.1 Hardware Implementation

LD3320 voice module can output and input pins are A25-27, B2-3, B6-8, output type for high and low level, pulse signal and PWM signal, using these operation pins, you can realize the communication between voice module and main control unit. MG9 series steering gear receives the information of the main control unit through serial communication to control the switch of the trash can cover.

5.2 Implementation of Corpus

Dialect corpus is a kind of database that collects and collates the phonetic materials of dialects in different places. It provides linguists and researchers with data sources to study and compare the differences and connections between different dialects. Through dialect corpus, various characteristics of dialect vocabulary, grammatical structure and pronunciation can be explored, so as to help people better understand and study the diversity of Chinese dialect culture and the law of dialect evolution. At the same time, it is of great significance for protecting and inheriting the excellent dialect culture of China and promoting the protection and development of local dialects.

Due to the large number of dialects in Tibetan areas, it is necessary to deal with Tibetan dialects [7]. Firstly, the speech is preprocessed. As there are two main pronunciation in Tibetan areas, namely: Chinese dialect pronunciation and Tibetan dialect pronunciation. Therefore, it is necessary to deal with the two different sounds separately in the pre-processing. In this paper, the Chinese dialect pronunciation and Tibetan dialect pronunciation are preprocessed respectively, that is, the consonant phonemes are split at a certain interval, so that they can be identified separately, so as to get more accurate results. The webpage background, the data analysis cloud platform and the main control unit share the same database, and collect user feedback to update and maintain the corpus regularly.

6. Advantages

The Tibetan-Chinese bilingual Intelligent garbage sorting system is a system that uses artificial intelligence and language recognition technology to recognize Tibetan-Chinese bilingual input and further classify garbage. Its main advantages are as follows:

Convenience: Users can input in both Tibetan and Chinese, and there is a platform for processing pronunciation factors, so as to determine the specific name of the garbage, and the system determines the type of garbage, and get the classification result without further thinking.

Environmental protection: The intelligent garbage classification system can classify the garbage more carefully, so that the effective recycling can be carried out, reduce environmental pollution.

Efficiency: This system can maximize the speed and accuracy of garbage classification, improve work efficiency.

Cultural protection: the system is bilingual in Tibetan and Chinese, which can provide more detailed records for the development of the Tibetan language database to a certain extent, and can protect the Tibetan language and cultural heritage.

In general, the Tibetan-Chinese bilingual intelligent garbage classification system can improve the efficiency and accuracy of garbage classification, has the significance of environmental protection,

but also has the significance of cultural protection, is a scientific and technological innovation conducive to the development of society and environment.

7. Conclusions

The intelligent garbage can is an intelligent garbage can based on STM32 main control board and LD3320 non-specific speech recognition module. It is innovatively designed on the basis of the traditional garbage can. By combining it with the cloud platform through hardware equipment, the Tibetan and Chinese bilingual voice interaction function is realized. The intelligent garbage can not only has the function of ordinary intelligent garbage can, but also can realize the speech recognition garbage classification and precise garbage placement. The smart trash can can effectively solve the problems of residents in Tibetan areas, such as lack of knowledge and awareness of garbage classification. The smart garbage can is innovative and practical, which is of great significance for improving the living quality of residents in Tibetan areas. In the follow-up, the design scheme of the smart garbage can will be optimized to improve the user experience in view of the problems existing in the process of garbage disposal of Tibetan residents.

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