

Designing and Modeling of Distant Words Recognition Pattern System for the Motion Control Systems in Vehicles

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Abstract: This paper states the design of a smart car based on ARM processor. The performance of this microcontroller based and voice integrated design is evaluated in terms of accuracy and velocity in various environments. In hardware design, we use ARM-7 LPC 2148 as the main controller, voice recognition module for voice command and use switches to control circuit board for controlling the car motion. In software design, in embedded C language for the purpose of coding. The experiment result shows that the car can be controlled by voice commands, it can do some basic motion such as open/close the window, open/close the door, start/stop engine, on/off headlight, movement control, such that the car can be controlled by the proposed intelligent system with voice command.

Keywords: Voice control, ARM processor

1. Introduction

The study of automation speech recognition (ASR) technology began in the 19th century. A system called Audry is the first English word recognition systems in the world. This invention makes people gradually pay attention to this new technology. ASR system, which is based on theories of multi-discipline to support this technology, includes signal processing, pattern recognition, artificial intelligence, etc. No matter which subject has significant breakthrough will promote the development of the ASR technology. One of the advanced finding is a theory named linear prediction analysis technique (LPC) which provided by the Japanese scientists. This new theory greatly improves the accuracy of speech signal feature extraction. As the speech recognition is more and more accurate, it has been transplanted to many commercial products, especially the design of the smart car. It also has a large number of applications in voice dialing, intelligent device control, data entry, etc. But the technology still has some disadvantage as following: firstly, the ASR system can only operate stable in silent environment. In noisy circumstance, the accuracy of the system would degrade. Secondly, the voice model library needs to be improved because the system cannot recognize continuous speech signals. When a series of signals is input into the computer, some information might be misunderstood or even lost, which restricts the field of application. The further research focus should be put on the improvement of the reliability of ASR system, optimization of speech model library and price reduction of the system for broadening the application in commercial products. This paper shows the whole process of the design of a voice control smart car, from controller. Selection to vehicle debugging. The whole design process is divided into hardware design and software design. After design the hardware circuit and programming, this smart car can achieve some basic functions.

2. System Design

A. Processor

Take ARM-7 LPC 2148 as the controller, using HM2007, which is specialized in speech, recognize and is specialized in voice playing, consist of the voice model. It needs some peripheral circuits to achieve the other functions. In addition, speech control function not only including the recognition and playing function, but also containing the voice compression, coding and decoding, all these functions are done by ARM processor. A condensed mic is used to give input command to the system through the voice recognition module. The operator gives voice as input in order to perform the to the desired task. Mic which converts the voice signal to the electric signal and the signal is given to the voice recognition module. The voice recognition module converts the analog signal into digital signal and the signal is transferred to the ARM-7 controller. The user can operate start stop mechanism of engine & other tasks as per the requirement with help of relay switching unit. Figure illustrated below shows the block diagram of the system.



Figure 1: ARM-7 board

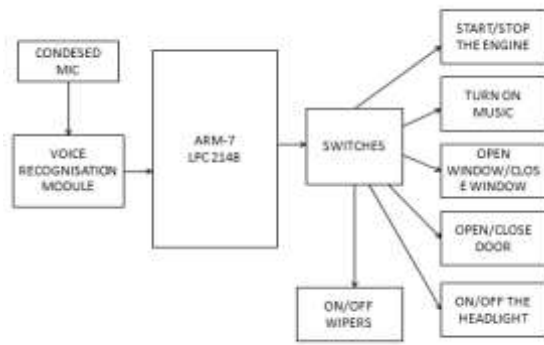


Figure 2: Block diagram of the smart car system

B. Voice Recognition Kit

HM2007 is a single chip CMOS voice recognition LSI circuit with the on-chip analog front end, voice analysis, recognition process and system control functions. A 40 isolated-word voice recognition system can be consists of external microphone, keyboard, 64K SRAM memory combined with the microprocessor.

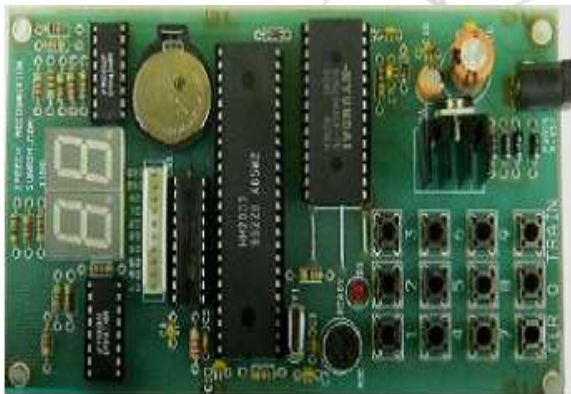


Figure 3: Voice Recognition Kit

The speech recognition system is a completely assembled and easy to use programmable speech recognition circuit. Programmable, in the sense that you train the words (or vocal utterances) you want the circuit to recognize. This board allows you to experiment with many facets of speech recognition technology. It has 8 bit data out which can be interfaced with the pic microcontroller for control the motor direction.

3. Drive System Design

We use a simple realy switch to turn on off the devices or motor interfacing with ARM controller and car system. Relays are used in the way that after receiving command the particularly assigned relay will gets turn on and function will be worked automatically on the voice command. Such a commands are prefixed commands while programming the commands are recorded and saved in to voice recognisiation module system.

The program of voice control intelligent car can be divided into four parts: the initialization part, training part, recognition part and retraining operation. Each process illustrate as following.

Initialization Part: set ports.

Training Part: After turn on the switch, the program will first judge the training marie. If the car has not been trained before, there would be a prompt tone ask you to train the car as follow requirements. After successful training, the generate speech model will store in the Flash. If the car has been trained before, the exist speech model will load in the recognizer.

Recognition Part: in this part the voice model will match with the model create before, if the recognizer identifies the corresponding command, the car will first play response recording and then execute the corresponding actions. Retraining Part: if the Training symbol is cleared, the program would began to run again, so it need to train the car once more.

4. Speech Recognition

Different ASR systems have different design schemes, but the principle of recognition is the same. Speech recognition system actually is a process which creates a voice model and determine whether the voice feature is matching with the existing model. Any ASR systems have three basic units: feature extraction, voice model library creation and model matching. Figure shows the block diagram of ASR processing.

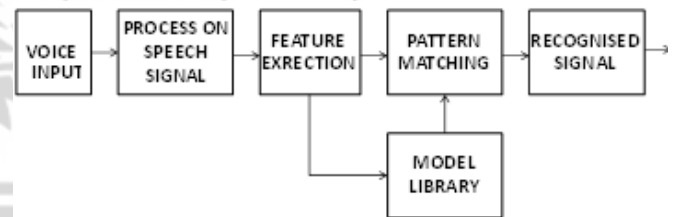


Figure 4: Speech recognition process

According to different standard, speech recognition technology can be divided into speaker- dependent ASR and speaker-independent ASR. In order to improve the recognition rate the design in this paper adopts the speaker-dependent recognition method. The first step is to create a voice model library. This step is critical because it provide reference to the voice identification.

Firstly, MIC gathers the voice signals and transforms it into electrical signals. After a series of filtering and amplifying, the sound waveform is sampled and quantized into digital quantity. Finally, analyzing and extracting the feature of the electrical signal to obtain the reconstructed speech model, the digital voice model is generally linear, which consists of a group of characteristic parameters extract from the digital signal. Voice recognition is such a process that matches the voice signal characteristic parameters with the voice signal model which is created before, according to some search and matching algorithm, searching the optimal voice signal which matches the exist model, then through the look-up table microcontroller can identify the result.

5. Conclusion

In this paper the design and implementation of a voice controlled car for acquiring and distinguishing the command for controlling the motion of the devices in the car. The design of voice control car fully takes advantage of the ARM-7 processor. The car completes the voice signal collection and playing by using voice input and output circuit control the car operation. The design not only reduce the manufacture cost compared with present market but also will give great competitive with other types of electrical cars. This project has many advantages like safety, comfort, energy saving, full automation etc. The future design can be improved by implementing wireless communication in the car. By improving this system, we directly enhance the life style of the disabled people in the community.

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