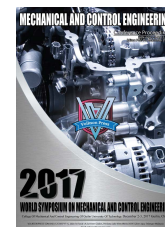




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DESIGN OF MULTI-LANGUAGE AUTOMATIC PLAYER SYSTEM

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ABSTRACT

This paper is presented a design of system of multi-language automatic player, which is based on AT89S52 microcontroller and ISD4004. System hardware circuit is mainly composed of single-chip control circuit, liquid crystal display circuit, voice module circuit, keyboard module, power amplifier and power conversion circuit six modules. Part of the program is written in C language. The program is debugged with Keil software and downloaded to the microcontroller for debugging. The system can be achieved in Chinese, English, Cantonese and Japanese four languages in the order of play and loop play two modes, and can be based on the needs of tourists to switch any language to play. After a lot of debugging, the production of an intelligent, convenient voice broadcast is developed.

1. Introduction

The traditional tape voice recording system is subject to many limitations in the use of electronic and information processing due to its large size and inconvenient use. The development of digital voice recording, and playback system is a concrete application of multimedia technology in recent years [1]. This system not only overcomes the various shortcomings of the tape in recording and playback, but also can quickly find and edit the recording content. Digital voice recording, and playback system refers to the use of digital technology for voice signal acquisition, processing, and voice signals can be stored in a certain storage device can also make the voice signal can be output when needed. Relative to the analog equipment, digital equipment is easy to integrate, miniaturization, low cost, stability, easy to operate, making digital voice recording and broadcasting system to a wide range of penetration of instrumentation, artificial intelligence, telephone recording and playback, vehicle arrival Voice prompts, mobile phones and other portable electronic products, voice acquisition systems used in surveillance environments, smart toys and many other fields.

However, the current general digital voice recording and playback system, the voice is simply collected, stored and played [2]. Although the voice fidelity can be ensured to a large extent, too much voice data will cause excessive demand for storage devices. For large systems, it can be solved by using a large capacity hard disk, or even a large disk array, but for small devices, the same method fails to be used due to limited capacity [3]. In recent years, the research of speech signal processing technology has made great progress, it is providing a new development space for digital voice recording and playback system. The acquisition and procession of voice change from the original simple waveform encoding to parameters encoding and compression. By this way will greatly reduce the storage of voice data. The system of multi-language automatic player introduced in this paper does not use a dedicated voice processing chip nor does it require an extended interface circuit. It only uses microcontroller as the core controller to complete the digitization of voice signals. That is to achieve voice storage and playback [4].

2. OVERALL DESIGNING

The system is composed of six modules: single chip control circuit, liquid crystal display circuit, voice module circuit, keyboard module, voice power amplifier circuit and power conversion circuit [5]. The function of recording and playing is realized through the connection of single chip and ISD4004, single chip program and the control of keyboard. When the

keyboard is switched to the recording, the external artificial sound is transformed into an electrical signal through a microphone. The electrical signal is sent to the voice chip through the circuit coupling, and it is filtered by the voice chip and then amplified by the LM386 audio power amplifier. Finally, the sound is output through the loudspeaker.

A diagram of the overall structure of the system is shown in Figure 1.

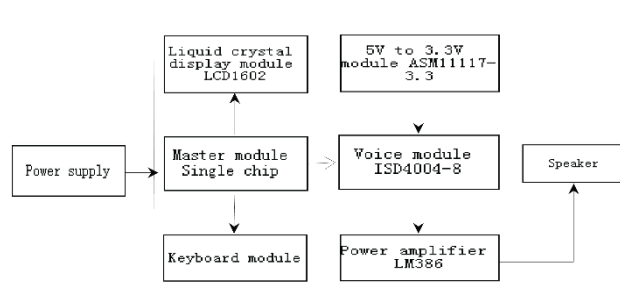


Figure 1: The overall structure of the system

3. HARDWARE DESIGNING

3.1 Introduction of hardware

3.1.1 Introduction of AT89S52

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory [6]. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the Industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watching timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the

AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset [7].

3.1.2 Introduction of ISD4004

ISD4004 voice chip ISD are from the United States launched the new products. On the voice chip pin description of the internal circuit, etc. it is easy in the ISD chip information provided by the company found, I will not describe too much, only a brief introduction to its characteristics make one.

ISD4004 voice chip operating voltage of 3V, single recording time of 8 minutes, good sound quality, suitable for mobile phones and other portable electronic products. The chip uses CMOS technology, including oscillator, anti-aliasing filter, smoothing filter, audio amplifier, auto-squelch and high-density multi-level flash memory array [8]. The chip design is based on all operations that must be controlled by the microcontroller, and the operation commands can be fed through the serial communication interface (SPI or Microware). The chip uses multi-level direct analog storage technology, each sample value stored directly in the on-chip flash memory, it can be very real, natural reproduction of voice, music, tone and effect sound, to avoid the general solid recording circuit due to quantification and Compression caused by the quantization of noise and "metal sound" [9]. It uses the frequency of 4.0KHZ, 5.3KHZ, 6.4KHZ and 8.0KHZ. The lower frequency and longer recording time will lead to poor sound quality. The intra information is stored in the flash memorizer, which can be saved 100 years above (typical) in the case of power off and repeated recording more than 100,000 times.

3.2 Circuit designing

3.2.1 Single chip control circuit

Single chip control circuit plays a coordinate role in the whole system. It needs to detect various parameters such as keyboard, voice broadcast and so on, and it also drives liquid crystal to display related parameters. We use the 51-series microcontroller AT89S52 microcontroller as the system master chip in this system [10]. The single-chip minimum system was made of the single chip, clock circuit and reset circuit. The clock circuit is selected 12MHZ crystal to provide the clock, the role of the microcontroller to provide a time base, which requires a basic instruction time required for a machine cycle, single-chip reset circuit. Press the reset button can make the microcontroller into the power-on Starting state.

3.2.2 Liquid crystal display circuit

Liquid crystal display circuit use LCD1602. Use the P0 of AT89S52 as the data line; Use P1.2 of AT89S52 as the LCD's EN; Use P1.1 of AT89S52 as the LCD's R / W; Use P1.0 of AT89S52 as the LCD's RS. EN is the chip select signal triggered by the falling edge, R / W is the read and write signal, and RS is the data / command selection terminal. The module design points are as follows: Display module initialization: first clear the screen, and then set the interface data to 8 bits, the display line number is 1 line, the font is 5 × 7 dot matrix, and then set to the overall display, cancel the cursor and font blinking. And finally set to forward increment mode and will not be shifted. Send characters to the LCD display buffer, the program uses 2 characters array, one to display characters, the other to display voltage data, the characters or data to be sent to the corresponding array, and then unified display. First take a character or data to be displayed sent to the LCD display buffer, and then the program use delayed procedures to wait 2.5ms. Need to determine whether the address to meet the display number, if the address number is not enough address plus a take a character or data to be displayed.

3.2.3 Voice module circuit

Here is the instruction of AT89S52 and ISD4004 pin connection: P1.5 and /SS are connected to control whether the ISD4004 is gated; Connect P1.4 with MOSI to enable the voice chip to read the address from this pin; P1.3 is connected to MISO so that the microcontroller from the pin can receive the signal from the voice chip; P1.6 is connected to SCLK as a clock input for ISD to synchronize data transmission between MOSI and MISO; P3.2 and /INT are connected to receive the EOM signal from the voice chip to obtain ending message of the speech segment and then it control its playback or fast forward operation; ISD4004 audio signal output pin AUDOUT output to the external amplifier through a wave capacitor.

3.2.4 Keyboard module circuit

The key module uses a number of independent keys, one end of the button IO port, one end of the ground, due to the link with the microcontroller IO port has internal pull-up, so when the button is not pressed, IO detected when the high Flat, when the button is pressed, the equivalent of IO short ground, so this time the microcontroller detects the level is low, by detecting the status of the IO port at different times can be judged by pressing the button. The four keys represent the following functions: The first is a function button that can be used to switch between the different parameter settings screens; The second is a switch button, you can use it to switch minutes, seconds and other parameters to set different interface; The third is an incremental button; The fourth is a reductive button.

3.2.5 Power amplifier circuit

LM386 is used to amplify the power of speech signal. In order to minimize the peripheral circuit components, the voltage gain is set in 20. An external capacitor between the first pin and the eighth pin, and the voltage gain can be adjusted to an arbitrary value until 200. It is applied to this system. the speech signal can be amplified from the AUDOUT pin of the ISD4004 into the third pin of the LM386.

3.2.6 Power conversion circuit

As the ISD4004 requires 3.3V power supply, and the system itself is powered by the 5V USB, so it needs linear voltage regulator to convert voltage from 5.5V to 3.3V. The voltage stabilizer chip used here is ASM1117-3.3. A diagram of the circuit schematic is shown in Figure 2.

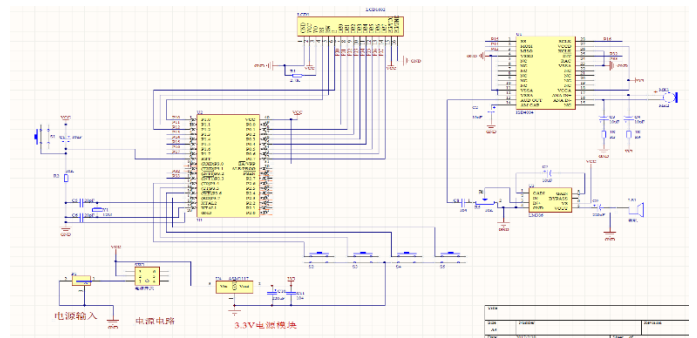


Figure 2: Circuit schematic diagram

4. SOFTWARE DESIGNING

From the previous analysis and hardware schematics can be seen in the whole system, voice recording and playback function by single-chip AT89S52 and ISD4004 communication to achieve. The software's core part is the recording and playback procedures, the main program mainly complete initialization. LED display the number of voice segments, scan the keyboard to identify the key function, select the different keys calling the corresponding subroutine to complete the re-recording, cycle sequence playback, loop singles, playback pause and other functions. Users can choose different playback modes and languages according to their own needs.

A diagram of the main program flow chart is shown in Figure 3.

A diagram of the recording program flow chart is shown in Figure 4.

A diagram of the playback program flow chart is shown in Figure 5.

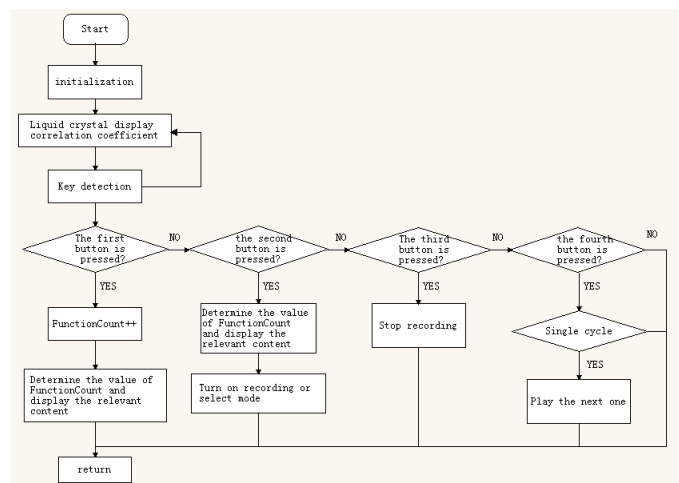


Figure 3: The main program flow chart diagram

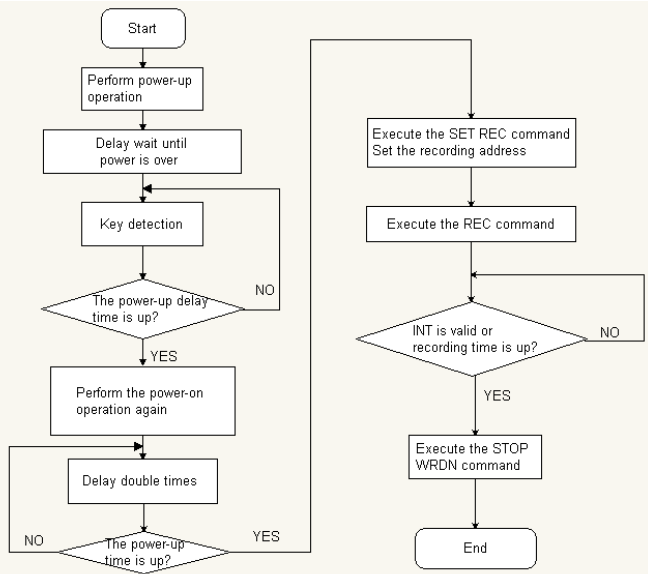


Figure 4: The recording program flow chart diagram

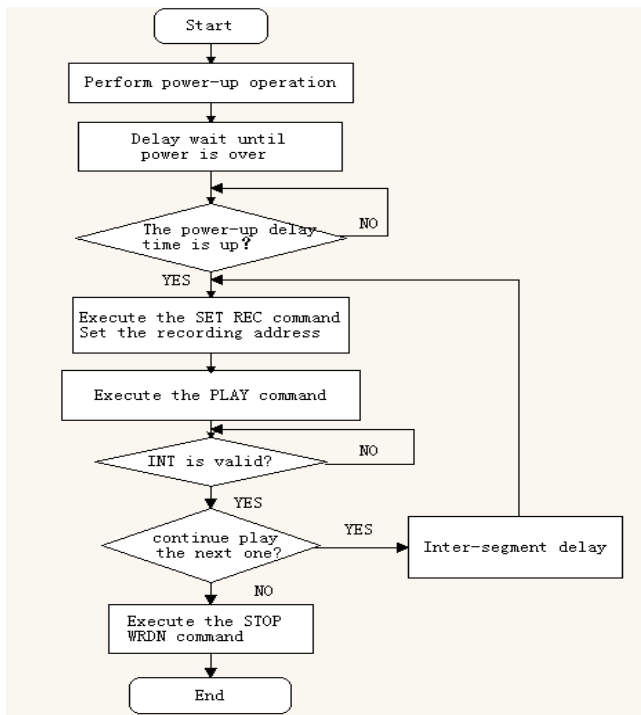


Figure 5: The playback program flow chart diagram

5. CONCLUSION

The system takes full account of the reliability and cheap and practical use of the variability, breaking the use of the previous voice chip, the use of software programming improvements to save hardware circuit resources. The entire circuit is stable and reliable, the output of the sound clear as well as beautifully. The maximum recording time of the system is eight minutes. If the recording time needs to be increased, only need to increase the number of ISD4004 chip. Through the chip select can increase the recording time.

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