Design and implementation of telephone dialer based on Arduino

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Design and Implementation of Telephone Dialer based on Arduino

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Abstract. Introduces a system design scheme of the telephone dialer based on Arduino, including the design principle, hardware and software design and the experimental results in this paper. The scheme is based on the dual tone multi frequency (DTMF) dialing mode, using the Arduino UNO as the main controller, the serial port send out the telephone number to be dialed, speaker synthesize the voice.

INTRODUCTION

The invention of the telephone greatly satisfies the communication needs of people. In the early telephone system, a series of intermittent pulses were used to transmit the called number. Pulse dialing requires a large number of operators to manually complete long haul connections. In this way, with the increase of the telephone service, the efficiency is low and the error prone. In order to solve this problem, Baer laboratory scientists invented the DTMF (Dual Tone Multi-Frequency, dual tone multi frequency), the purpose is to allow the phone system to automatically receive the number and then complete the call.

THE PRINCIPLE OF DESIGN

Arduino Introduction

Arduino is derived from a teaching in Italy with open hardware projects, mainly to create interactive physical objects for practitioners want to try, love people and artists create invention constructs, it is adhering to the open source hardware, program interface free download, may also need to modify their own[1].

Arduino is a convenient and flexible, easy to use open source electronic prototype platform, which consists of hardware (Atmel AVR microcontroller, I/O interface and related circuits, etc.) and software (Arduino IDE) composition. Arduino's hardware platform is completely open, anyone can download the latest PCB design from its official website to copy. The hardware platform includes the main control circuit board of AVR micro controller and a large number of input and output of the electronic module based on various modules and the main control circuit board connection without welding, just as the center will be like building blocks, so Arduino is also known as the "electronic building blocks" [2]. In the aspect of software, Arduino IDE software development environment based on Eclipse of their own, using C++ language programming, microcontroller programming to many commonly used functions have been encapsulated into a modular functions work program developers call, which greatly simplifies the program development work [3].

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DTMF Principle

DTMF (Dual Tone Multi Frequency) signaling, gradually in the world within the scope of use in the push-button telephone, because it provides higher dialing speed, quickly replaced the traditional dial telephone dial pulse signal used.

DTMF represents a number by sending two audio simultaneously. Generally from four 1000Hz the following frequency (called low frequency group) and 1000Hz or more frequencies (called high frequency group), each time from the high and low frequency group to take a frequency of the method (called eight in two) A double tone code as a dialing signal.1~10 ten numbers only 10 dual tone, more than six dual-tone, can be used as control signal. Some fixed-line features less, only four low-frequency and three high-frequency synthesis of 12 dual tone is completely sufficient [4].

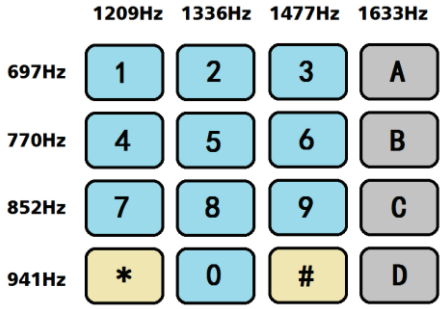

FIGURE 1. Dual Tone Multi-Frequency Keyboard

Dual tone multi-frequency dial pad is a 4 × 4 matrix, as shown in Fig.1. Each row represents a low frequency, and each column represents a high frequency. The user presses a key to send a combination of high and low frequency sinusoidal signals, such as pressing the "1" key on the keyboard, the phone will send a combination of 697 Hz and 1209 Hz signal to the telephone exchange. The switch can receive these frequency combinations and determine which key the user presses.

In order to avoid the voice frequency in the call number system, mistaken for the two-tone signal, resulting in malfunction, requiring frequency offset of not more than ± 1.8%, duration of more than 40ms. The level of the two-tone signal, according to the standard in the 3dB buffer, the low-frequency group is -10 ± 5.5dB, high-frequency group-9 ± 5.5dB.

HARDWARE DESIGN

Arduino UNO

Arduino UNO used in this design is the latest version of Arduino USB interface series, as the reference standard template for Arduino platform. UNO's processor core is the ATmega328, with 14 digital inputs / outputs, 6 of which can be used as PWM outputs, 6 analog inputs, a 16MHz crystal oscillator, a USB port, an electrical outlet, an ICSP header and a reset button. UNO has been released to the third edition, compared with the previous two versions have the following new features: AREF increased in the two-pin SDA and SCL, I2C interface support; increase IOREF and a reserved pin, the future expansion board will Compatible with 5V and 3.3V core boards. ATmega328 includes on-chip 32KB Flash, of which 0.5KB for Bootloader. As well as 2KB SRAM and 1KB EEPROM.

Experimental circuit

Experimental circuit shown in Fig.2, Arduino UNO the D11, D12 pin connected to a 1uF capacitor, then combined 100Ω resistor, and drive the speaker according to the DTMF frequency set by the pronunciation. Use, we pick up the phone microphone, the speaker close to the microphone position. In the serial port to send the need to dial the phone number (such as 10000), Arduino UNO control speaker issue dial tone, wait a moment to dial.

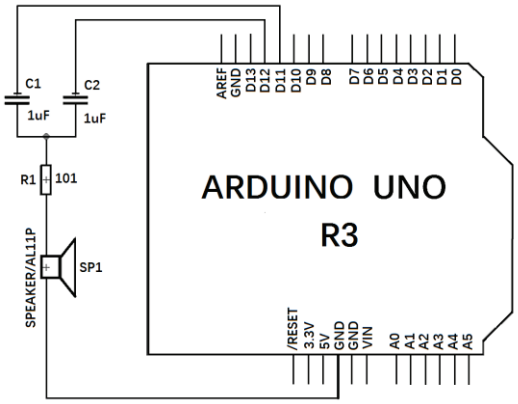

FIGURE 2. Experimental circuit connection diagram

SOFTWARE DESIGN

A key part of the software design is the DTMF play subroutine. The sub-function also three parameters, respectively, for the dial number, duration of pronunciation duration, the length of time interval pause. If the input number is empty, or if the duration is not positive, or if the pause time is not positive, it is regarded as an error and execution is immediately stopped and returned to the main routine. One freq1.play freq2.play two Tone library is defined in the good, Tone library download address: http://rogue-code.googlecode.com/files/Arduino-Library-Tone.zip. This Tone library comes with the tone function is characterized by the output at the same time in a number of different output frequency of the waveform, but comes with tone function in a period of time can only be a pin output.

```
void PlayDTMF(String Number, long duration, long pause)
{
        if(Number.length() == 0 || duration <= 0 || pause <= 0) return;
  //Separates the Number characters one by one.
    for(i = 0; i < Number.length(); i++)
{
            //If Number is a number from 0 to 9 characters
            if(Number[i] >= '0' && Number[i] <= '9')
 {
                    //It will be ASCII code minus '0' to be purely digital.
                Number[i] -= '0';   //A serial output, easy to view.
                Serial.print(Number[i], DEC);
        freq1.play(DTMF_freq1[Number[i]], duration); // Output one of the DTMF.
        freq2.play(DTMF_freq2[Number[i]], duration);  //Outputs another DTMF.
        delay(pause);
 }
         }
}
```

DTMF_freq1 and DTMF_freq2 are two arrays defined according to the DTMF keypad, as follows:

```
const int DTMF_freq1[]={1336,1209,1336,1477,1209,1336,1477,1209,1336,1477};
const int DTMF_freq2[]={941,697,697,697,770,770,770,852,852,852};
```

DTMF_freq1 the first element value of 1336, DTMF_freq2 the first element value of 941, that is, dual-tone multi-frequency keyboard 0 corresponding to the two frequency values.

DESIGN VERIFICATION RESULTS

Open Arduino IDE in the serial port terminal interface (shown in Fig.3), serial port select 9600 baud rate, and then send 10000 numbers, Arduino UNO will drive the speaker to generate the phone number of the two-tone frequency.

Pick up the phone, speaker near the phone's microphone, wait a moment to dial the set number. After testing, in accordance with the program design of automatic dial-up telephone is fully available.

FIGURE 3. Serial Port Send the phone number

CONCLUSION

This paper introduces the system design of telephone dialer based on Arduino, a new integrated development environment, which has certain practical value. This design can extend the application by driving an analog phone off-hook event, dialing with this circuit, and then by Arduino in accordance with the event control voice module to issue a different voice to the phone line. You can complete an automatic dialing machine, you can make alarm or telephone reminder.

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