

## Design of A Smart Home Equipment Based on STM 32

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### Abstract

In order to improve the quality of people's living standard, this article introduces an intelligent aromatherapy stove based on STM32. In terms of temperature detection of intelligent aromatherapy stove, we use buzzer as temperature alarm, DS18B20 as temperature sensing device, and external relay to drive electric heater to work, so as to realize the heating function of aromatherapy stove. In terms of music playing of intelligent aromatherapy stove, this article briefly introduces the basic circuit design and function realization of MP3 module. In terms of Bluetooth data transmission of intelligent aromatherapy stove, the communication between Bluetooth module and App is realized, so as to achieve the control of intelligent aromatherapy stove by mobile phone.

### Keywords

Smart home; Temperature sensor; Singlechip; Bluetooth.

## 1. THE OVERVIEW OF INTELLIGENT AROMATHERAPY STOVE

Aromatherapy has a long history in China. From the Western Zhou Dynasty to the Han, Jin, Tang, Song, Yuan, Ming and Qing Dynasties, not only the spices became more and more dainty, but also the utensils became more and more exquisite [1]. With the continuous improvement of people's quality of life, people are more eager to increase the interest and enjoyment of life. The functional design of some building indoor equipment is gradually developing towards automation and intelligence. In order to improve the indoor air quality, the intelligent aromatherapy stove can purify the air by fumigating the traditional Chinese medicine (*Artemisia argyi*, *Angelica dahurica*, etc.). And through a variety of ways to ease the body and mind, play a certain role in protecting the body and mind.

## 2. THE INNOVATION OF INTELLIGENT AROMATHERAPY STOVE

(1) The intelligent aromatherapy stove has the function of soothe the nerves. After being ignited, aromatherapy will produce a certain aroma, which is produced by the combustion of *Angelica dahurica*, wormwood and other Chinese herbal medicines. It has the effect of tranquilizing and disinfection.

(2) The intelligent aromatherapy stove has the function of playing music. When the aromatherapy stove starts to work, MP3 module will send out a variety of pleasant music, which can meet the needs of different users. While smelling the fragrance, people can also hear wonderful songs, which makes you feel relaxed and happy, like entering a fairyland.

(3) The intelligent aromatherapy stove has the function of wireless transmission. Through the mobile phone app software, the intelligent aromatherapy stove can be flexibly controlled to realize the functions of timing switch, information feedback, light and sound reminder.

### 3. THE SYSTEM FLOW DESIGN OF INTELLIGENT AROMATHERAPY STOVE

The specific functions of the aromatherapy stove are realized in two stages. In the first stage, the aromatherapy stove relying on STM32 chip development, peripheral auxiliary A/D conversion circuit, aromatherapy head, LED and so on. In the second stage, the wireless transmission module and storage module are added to achieve the function of storing different types of music and facilitating users to demand music through mobile phone software, as shown in Figure 1.

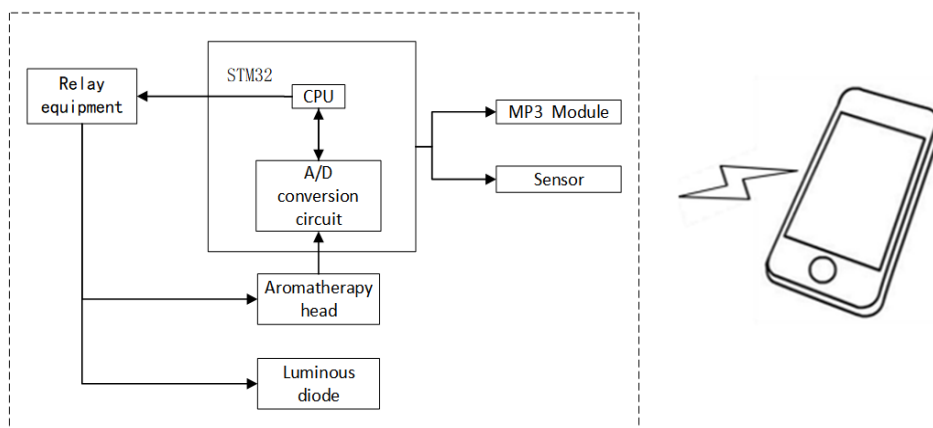


Figure 1. Schematic diagram of intelligent aromatherapy stove

In the first stage, when the power is turned on, the temperature sensor starts to collect the real-time temperature of the outside. The external real-time temperature is displayed on the 1602 LCD. When the temperature is lower than the lower temperature, the red LED lights up, the relay closes, and the electric heater starts to heat wormwood.

In the second stage, combined with MP3 module, reads MP3 audio files directly after power on, and realizes volume amplification through external speaker. At the same time, through the program control, the MP3 module is powered on when the aromatherapy is ignited.

### 4. THE HARDWARE DESIGN OF INTELLIGENT AROMATHERAPY STOVE

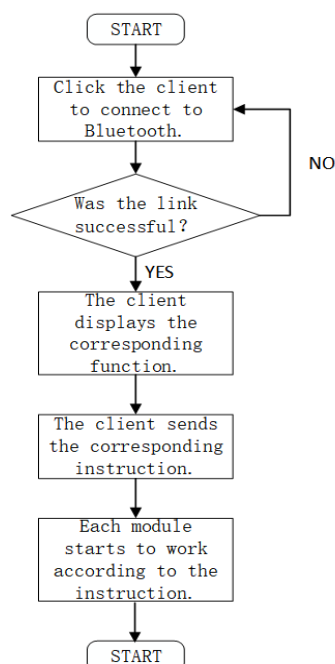


Figure 2. Flow chart of intelligent aromatherapy stove

This project designs a set of intelligent aromatherapy stove system based on STM32 from three stages of temperature control module, MP3 module and Bluetooth transmission module, as shown in Figure 2.

#### 4.1. Temperature Control Module

The temperature control module is composed of STM32 chip, temperature sensor, buzzer, key switch and electric heater controlled by relay [2].

**Temperature detection:** The module is composed of 5V power supply, buzzer, indicator light, temperature sensor, electric heater, relay protection control circuit to achieve constant temperature control function in the aromatherapy stove. The temperature sensor is installed in the aromatherapy stove to detect the temperature in the stove in real time. The detected temperature data is output by analog voltage signal, and the data is transmitted to STM32 chip through I/O interface. After calculation, the calculation results (temperature) are compared with the upper and lower thresholds and displayed on the LCD.

**keying circuit:** It consists of three buttons (set, up and down). When the switch is turned on, the temperature regulating key SET is first pressed. Then the temperature rising key UP is pressed, so that the temperature threshold will rise by 0.1°C; Click the cooling button Down, so that the temperature threshold will drop by 0.1°C. Finally, click the thermal control key to determine the upper and lower limits of the threshold.

**Heating circuit:** When it is detected that the temperature in the aromatherapy furnace is lower than the limited range (lower than 50 °C), the red indicator light turns on, the relay closes, the electric heater is connected to the 220V power supply to starts to work. so that the temperature in the aromatherapy furnace is constant at the burning temperature of wormwood.

#### 4.2. MP3 Module

Mp3 module is composed of main control module, power module, audio storage (SD card) and audio decoding [3].

**main control module:** STM32 chip is used as the core of MP3 player, and SD card is used as data storage medium. Through writing program code, music can be transmitted to MP3 and other format audio files in SD card in STM32 chip.

**power module:** The +5V DC power supply is obtained from the external power supply for system operation. At the same time, filter capacitors are placed to ensure the stable operation of the power supply and minimize the influence of the power supply on the output.

**audio storage module:** SD card has the advantages of low price, large storage capacity, strong universality and security. SD card supports two bus patterns: SD pattern and SPI pattern. In this project, the audio data MP3 file takes SD card as the carrier, so the circuit design must include the read SD card module.

**audio decoding module:** The selected audio decoder chip is VS1003. The VS1003 is a monolithic audio decoder and encoder that provides a variable sampling rate ADC and Stereo DAC for user applications. VS1003 decoder chip decodes MP3 files. Finally, it converts the decoded digital signal into analog signal and outputs it through power amplifier.

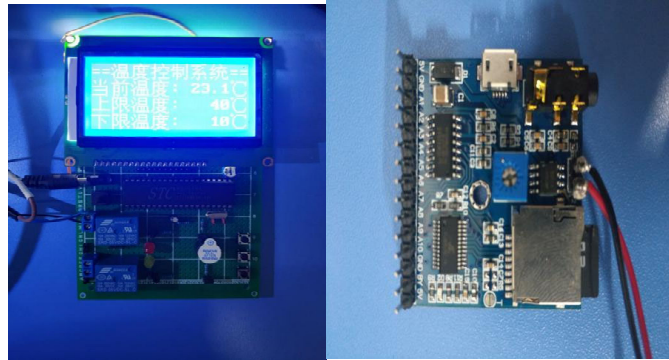
#### 4.3. Bluetooth Transmission Module

Bluetooth transmission module is composed of baseband controller, program memory, RF interface and I/O interface for external communication [4].

### 5. THE PICTURE OF INTELLIGENT AROMATHERAPY STOVE

When the power is turned on, the temperature sensor starts to work, sends data to the sensor 51 chip through the data line, and displays the external real-time temperature on the 1602 LCD.

The upper and lower alarm temperature are preset by the program. When the present temperature is lower than the lower temperature, relay 1 is closed, red LED is on, and the heating plate is connected with 220V power supply to start working. Then, the sound system of the censer starts up, which can produce a variety of pleasant music to meet the needs of different users, as shown in Figure 3.



**Figure 3.** Physical picture of the intelligent aromatherapy stove

## 6. CONCLUSION

This smart aromatherapy stove can not only radiate fragrance through the air, but also affect the human body imperceptibly. It can also comfort people's spirits by playing music, which plays a very good role in improving people's sleep quality.

## ACKNOWLEDGMENTS

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