Design and Implementation of Liquid Crystal Display Control System Based on Mobile APP

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Abstract: This paper designs and implements the liquid crystal display control system controlled by mobile phone APP. The liquid crystal display control system of mobile phone APP is divided into two parts. The first part is the use of STC12C5A60S2 single chip microcomputer to control the VGA controller and drive the liquid crystal display, and the second part is the development of mobile phone APP. The two parts use bluetooth communication.The liquid crystal display system controlled by mobile phone APP is easy to operate, widely used and of great practical application value.

1. Introduction

Liquid crystal display screen has become an important device of social informatization. APP is the abbreviation of Application in English. Due to the popularity of APP in iPhone smart phones, the current APP mostly refers to third-party applications of smart phones [1]. More and more household appliances are controlled by remote control, and there are more and more remote controls in the home. It is very inconvenient to store, find and use them in daily life. If the remote control of an old model home appliance is lost, it’s difficult to match. Mobile phones are now the most commonly used handheld communication devices, we have been used to carry mobile phones and mobile phones often in the side [2]. As a result, many people want their phones to be used as remote controls for their appliances. For hotels, restaurants and other public places, there is an urgent need for a low-priced liquid crystal display system that can display information and be controlled by mobile phone APP.

The liquid crystal display control system of mobile APP designed in this paper is divided into two parts. The first part is to use STC12C5A60S2 single chip microcomputer to control VGA controller to drive the liquid crystal display. The second part is to develop mobile APP. Modify the display content through the mobile phone APP as the user's remote-control terminal. STC12C5A60S2 is used as the main control chip to process Bluetooth data, send display data and read picture data. After the content is released by the APP, the data is transmitted to the MCU through the Bluetooth module, and the MCU processes the content data displayed to the VGA controller. The VGA controller controls the display to display the effect by identifying the display data sent by the MCU.

2. The System Composition of Liquid Crystal Display Control System of Mobile Phone APP.

The design of the liquid crystal display control system for mobile APP is divided into two parts. The first part is the development of mobile APP, and the second part is the design and development of the hardware of the liquid crystal display system. The schematic diagram of system structure is shown in the figure. The hardware of the liquid crystal display system is mainly composed of the main control chip, SD card module, liquid crystal display, Bluetooth module and VGA module. The system composition is shown in figure 1

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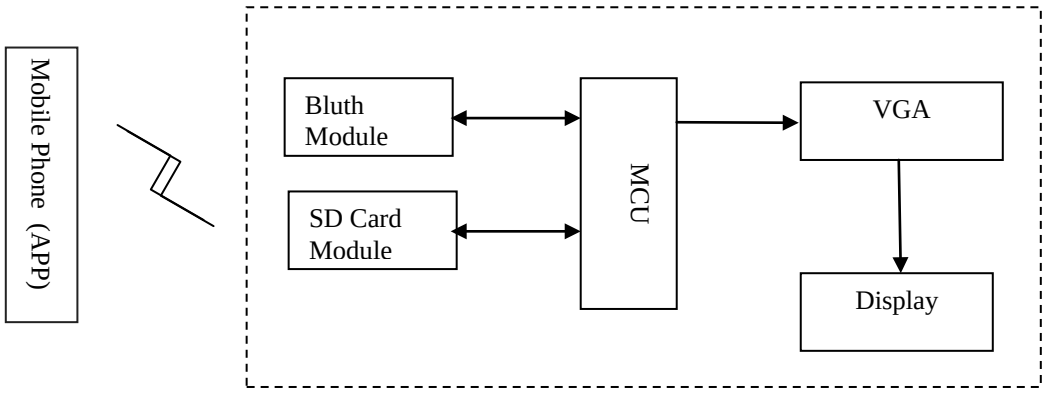


Figure 1. Schematic diagram of liquid crystal display control system of mobile APP

This design takes STC12C5A60S2 as the core controller. Compared with the ordinary 51 core chip, it has strong performance processing capacity in all aspects and has multiple IO ports with reuse function. It can meet more needs of users. There are quite a few advantages [3].

In terms of communication, this design adopts Bluetooth communication and uses UART communication mode. Bluetooth is an application technology for short distance wireless transmission. Ordinary Bluetooth support and devices within a distance of 10 meters for short distance wireless communication, but also has a special Bluetooth, support for longer distance. The transmission band USES 2.4g band, which is the universal band, making it widely used in many aspects without any restrictions.

Bluetooth receiver uses HC05 Bluetooth module, compatible with Bluetooth 2.0 protocol [4,5]. The sending end adopts mobile device APP to transmit data with Bluetooth module. Scientific and technological progress is very rapid, and the development of intelligence is also followed by the choice of APP to make users carry more convenient and faster. APP can provide users with the best experience, vivid interactive interface, simple user interface and so on.

In the display data transmission part, this design adopts VGA (Video transmission standard), which is called Video Graphic Array in English, and uses the commonly used VGA interface. The Display section uses Liquid Crystal Display, or Liquid Crystal Display. The sending end of display data adopts font-turbo-vga640480 controller, which can be controlled by many types of microcontroller. Its resolution is 640*480, which is relatively high. It can display 65536 colors, very colorful. Using parallel port output, the data transmission rate is very fast [6,7]. It also has 4 cache areas, which can quickly switch the screen to display data. It has a special flush memory for various fonts and font sizes. It saves the time for the user to connect the external memory and is more convenient [8].

This design also uses SD card module, with SD card BMP file storage and reading work. Under the control of the APP, the corresponding image can be transmitted to the display, and the picture and text can be matched to make the design effect better.

3. System Software Design

Bluetooth Driver: This design uses Bluetooth device and App for data transmission. When using Bluetooth module, a Bluetooth driver needs to be written. This can be better to send and receive data, call. There is text transmission in this design, so it is not a traditional single-byte transceiver. So you need to write a Bluetooth driver. The Bluetooth program diagram is shown in figure 2. The procedure of Bluetooth is as follows:

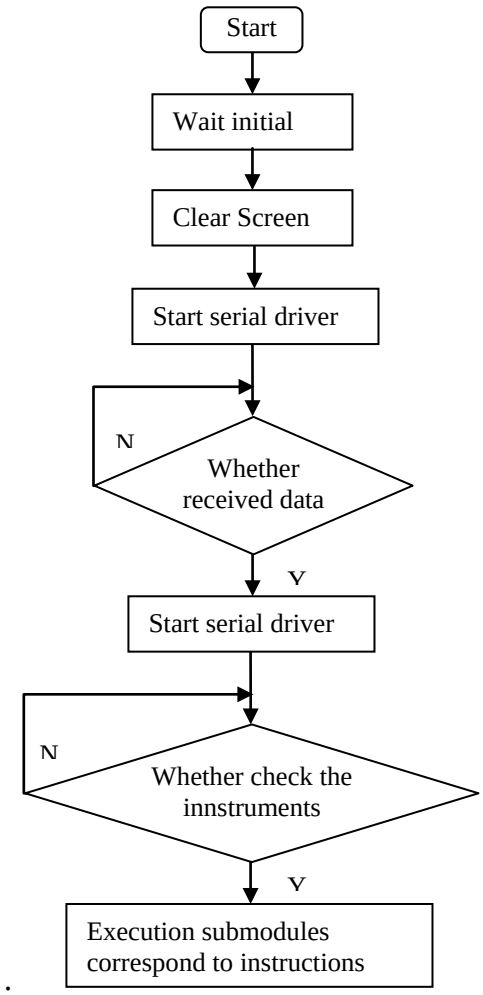
Step 1: Bluetooth communication baud rate setting: use T1 timer to set 9600 baud rate.

Step 2: Send data: parameters include data pointer, data length, send flag position 0, assign data value to SBUF, wait for send flag position 1 (means after sending a byte), subtract 1 from the length, continue sending until the length value is 0.

Step 3: Receiving data: when the serial port receives data, a count variable is used to record the length of the received data. After receiving the data, the data is copied into the pointer, the count is cleared, and the length of the copied data is returned.

Step 4: Receiving monitoring (whether the data receiving end) : first of all determine whether receive data counter variable is greater than 0, the second test data if there's any change, if change continues to receive, if you don't change add a spare time count, if the free count up to 30 said after receiving data, then receive flag sets 1, shows the receiving end.

Step 5: Serial driver: whether the receive flag is set 1, MCU will transmit the received data and the length of the data into main function



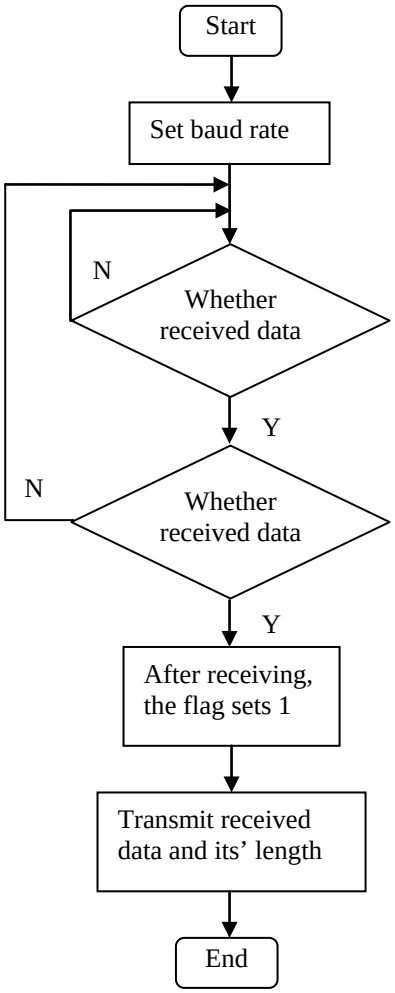


Figure 2. The Bluetooth program diagram

Figure 3. The development process of APP

System Software Design: The APP making software used in this design is MIT APP Invonter. Guangzhou server is used. This is a graphical programming tool, which has a variety of functions to provide users with choices, can quickly make some simple App. Especially suitable for users who can't write App in JAVA [9,10]. The production process of APP is as Figure 3.

4. Conclusion

After the hardware was built and the software was written, the system was tested and optimized. In the process of testing, many problems were encountered. After repeated debugging.Some solutions were formulated as follows.

First: SD card cannot read properly.

Problem analysis :(1) the timing of reading and writing of SD card is not rigorous; (2) the capacity of SD card

Solution :(1) carefully check the time sequence of reading and writing of SD card, and pay attention to the delay problem. The speed of STC12C5A60S2 is faster than that of ordinary 8051, so you need to pay attention when writing delay sub-functions. (2) the capacity of SD card module selected this time is less than 1G, and the reading fails due to too large capacity.

Second: After receiving the data sent by the App, the displayed words cover each other.

Problem analysis: the same row and column were selected twice on the App side

Solution: when sending data, see whether the row and column prompt changes the data to send, or first clear the screen in sending data.

Third: The picture shown is inverted.

Problem analysis: BMP format storage data problem

Solution: because the BMP format takes image data from bottom to top, from left to right. So the first data is the data at the bottom of the picture. So there are two solutions: (1) turn the image upside down and take the data, and (2) display the image by showing the bottom first and scanning the coordinates in reverse order.

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