Design of LED dot matrix hand writing display screen

LU Danping

Department of computer and electronic information of Guangxi Vocational & Technical College,
Nanning, Guangxi, 530226,

52506132@qq.com

Keywords: Writing input; LED screen; Light pen; STC micro-controller

Abstract. This paper introduces a design scheme of handwriting touch screen. In this scheme, the LED display is used as the display device, in addition special light pen, no additional parts required to achieve click, drag, handwritten Chinese character input and other operations in LED screen. The display uses STC micro-controller as the control core, under the software control, the display can accurately realize the recognition of coordinates and handwritten Chinese character input. It demonstrates the feasibility of this program.

Introduction

As a new computer input device, touch screen is the most simple, convenient and natural human-computer interaction mode. The touch screen is composed of a touch detection unit and a touch screen controller; The touch detection component is installed in front of the display screen for detecting user touch position, it will send signal to touch screen controller after touching; the main function of the touch screen controller is to receive the touch information from the touch point detection device, and then convert it into contact coordinates, then send to CPU, it can also receive command from CPU and execute it. The disadvantage of this structure is the need to install a touch detection unit in front of the monitor. And in the use process, due to repeated touch, it will produce tiny cracks, and once the cracks appear, the touch screen will be damaged, that is, the touching in crack point is not accurate. With the aggravation and increase of cracks, the touch screen will slowly become invalid.

The display color of the LED display screen is bright, and the stereo feeling is strong, which is widely used in finance, taxation, industry and commerce, telecommunications, sports, advertising, industrial enterprises, transportation, education system, station, wharf, airport, shopping malls, hospitals, hotels, banks, securities market, construction market, auction management, industrial enterprises and other public places.

Therefore, the author designs a kind of handwritten touch screen design based on LED display. In this scheme, no changes to the LED screen circuit structure and appearance are required, only need to add a special induction head, namely the lighting pen, with the help of the software, the position identification can be realized without disturbing the normal display of the information, and then complete the click, drag, Chinese input and other functions. The advantage of doing so is, additional touch parts are not required to achieve wide application with LED screen, then the service life will be long as that of LED screen.

Based on the above ideas, the author makes a 32 * 32 dot matrix LED screen and a lighting pen, which can achieve accurate implementation of the click drag and Chinese character input function.

System scheme design

This system is composed of lattice module, light pen module, controller etc. As shown in figure 1.

Figure 1, Structural sketch map of LED dot matrix writing display system

Dot matrix module. The controller used in this system is STC micro controller, to achieve the required function, the scan speed of dot matrix display must be improved, but the work speed of micro controller is limited, if to improve scanning speed and reduce IO port occupancy, parallel port scanning mode must be used. Therefore, We use the interface chip 8255 to extend 4 parallel IO ports to be used in scanning of dot matrix display, such scheme greatly improves the scanning speed of the micro controller to the screen. In addition, 32*32 LED dot matrix module requires taking up a lot of IO ports, therefore, this system uses serial port to send the display code. Therefore, the hardware uses 74LS154, 74HC595 to make column and line scanning device of 32*32 LED dot matrix module.

Lighting pen module. The requirement on lighting pen module must not be affected by the outside light, especially the influence of sunlight, it can also identify the weak light emitted by LED. Therefore, the light pen probe should have the sensitivity to be strong enough to meet the requirements. Through a lot of experiments and analysis, in the existing components, photodiode is the most device consistent with the requirement, photosensitive diode is subject to small interference by external light, the sun light has no effect on it.

The sampling circuit of lighting pen is shown in Figure 2, the working principle of the circuit is: The flicker frequency of the dot matrix screen is sampled by a photosensitive diode, when the light is detected by the photodiode, it will produce a pulse signal, such pulse signal is extracted by a differential circuit, then such signal is enlarged by window comparator, and a regulating potentiometer is used to adjust the reference voltage of the amplifying circuit, so as to make the output voltage to be +12V or -12V, finally, a NPN type triode is used to make depressurization on this signal, so as to make it in line with the sampling voltage range of micro controller (in the figure, the function of diode D5 is to prevent the triode from soft breakdown), this will serve as an input signal to the microcontroller.

Therefore, when using a light pen across the micro bright display that the human eye can not feel, very clear and useful signal can be seen on the oscilloscope, and when the light changes or the direction changes, there is no obvious change on the oscilloscope, the micro controller can respond the signal transmitted back by the light pen. The micro controller will receive the signal for external interrupt, it will apply for interrupt when there is a signal, so as to gain coordinates in the interrupt.

Figure 2, circuit diagram of lighting pen

Programming

General idea of programming. The method it uses is to determine the coordinates by identifying the micro light source on the screen by a lighting pen.

The function of this system is to stroke over the dot matrix screen by lighting pen, the corresponding points will be illuminated. To achieve such a function, the programming idea used in this system is: to set up a coordinate for dot matrix screen, that is, each point corresponds to a coordinate, for example, (12, 20) means the 20 points in the twelfth line. An array is established according to this coordinate, coordinate points corresponding to each point are stored in the array. Then read the array data at a certain time every day to turn the light (which is the screen scanning we usually say), as every point is lightened in a short time, but the man's eyes are hard to read it, but the lighting pen is able to capture this light, at the same time, a signal is introduced into the micro controller for external interrupt, when the MCU applies for interrupt, it then will read the scanned coordinates by screen scanning. Finally, the LED at this coordinate will be lightened to the visible display state, so as to realize the writing display function on the screen.

Programming optimization. According to the designed program by above ideas, if the lighting pens strokes too fast, the crossing points will be found not lightened. This is because each scan requires a scan of the entire screen, if the pen strokes faster, the scan speed can not keep up. To solve this problem, we must improve the scanning speed, but if increasing the speed of scanning the entire screen, then the LED brightness will be weakened, and the light pen is not easy to identify it. In order to improve the scanning speed, the method used in this system is: when getting the first coordinate point, just scan the 8 coordinates points near this coordinate, rather than the entire screen, which greatly improves the scanning speed. For a period of time of scanning these eight coordinates, if the light pen does not capture this signal, which means a stroke has been completed, and then restore the entire screen scan to wait for the determination of the first coordinate point of the next stroke. And then it scans again only eight nearby coordinates, so motion is repeatedly to complete the writing of a word.

Interrupt programming flow chart. There are two main interrupt programs in this system: External interrupt and timer interrupt. The external interrupt is mainly used to obtain the light pen signal, namely the matrix coordinate. The timer interrupt is mainly used to set the scan time, scan position and the output to detect light pen signal. Flow chart as shown in Figure 3, figure 4.

Figure 3, Timer 0 interrupt flow chart

Figure 4, External interrupt 0 interrupt flow chart

Summary

The test shows that under the normal display of images or text at the same time, this LED display screen can complete the identification of single point coordinates in the writing process of light pen. Under the assist by software, it can also complete the image drag and handwriting input operations. So this scheme is feasible, and can be extended to LED as a display device, and other various occasions requiring touching or handwriting input.

References

- [1]Han Bing. Touch screen technology and Its Application.Chemical Industry Press. 2008
- [2]Suo Xuesong.Sensor and signal processing circuit.China Water Power Press.2008.
- [3] Liu Jing.Control technology on MCU.Beijing Institute of Technology press.2008.
- [4]Zhou Zhimin.Design on LED driver circuit.Publishing House of Electronics Industry.2008.