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Design of air quality detection system based on MCU

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Abstract

With the development of economy, more and more ordinary families choose to install a safe at home to store their valuables, and the development of technology brings about more and more diversified types of safe. In this design, the AT89S51 of Atmel Company is used as the main control chip and data memory unit, combined with the circuit of keyboard input, alarm, display and unlock, with assembly language programming, designed a can change the password and has the function of alarm simulation password box. When a user enters a password incorrectly five times, the safe will send data to a remote receiver via the WIFI module (you need to install the appropriate APP in advance) to alert the user that someone is trying to open your safe. If you want to re-use the safe, you must enter the correct administrator password. But when the administrator password entered three times wrong, the entire safe system will be locked, only to contact the manufacturer can be unblocked. At present, with the rapid development of the Internet of things, the combination of hardware and software of the safe combination lock system will have good prospects for development.

Keywords

Password system, WiFi module, mobile phone terminal.

1. Introduction

Compared with the traditional key lock, the electronic password lock designed in this paper has the advantages of convenience and high security. Users do not need to go out with a key, key input password can be unlocked. The whole lock has no keyhole, so don't worry about thieves using tools to pick the lock. And in the age of the Internet of things, we have wi-fi on the lock, and when someone tries to enter a password and makes more than five mistakes, the microcontroller will send an alert message to the user's mobile phone (which requires a specific mobile app to be installed) through the WIFI module. Really achieve safe, convenient function. Believe in the future, such electronic lock will be more and more, will also be the trend of the times.

2. Single-chip microcomputer basic principle WIFI technology and WIFI module:

2.1. System block diagram see figure 2.1:

This topic studies the electronic password safe, the password lock through the circuit board and the program control, the operation is simple, and the password can be changed at any time, with the progress of the times must be the trend of the times. The subject of the safe password system has two major parts, are: hardware part, software part.

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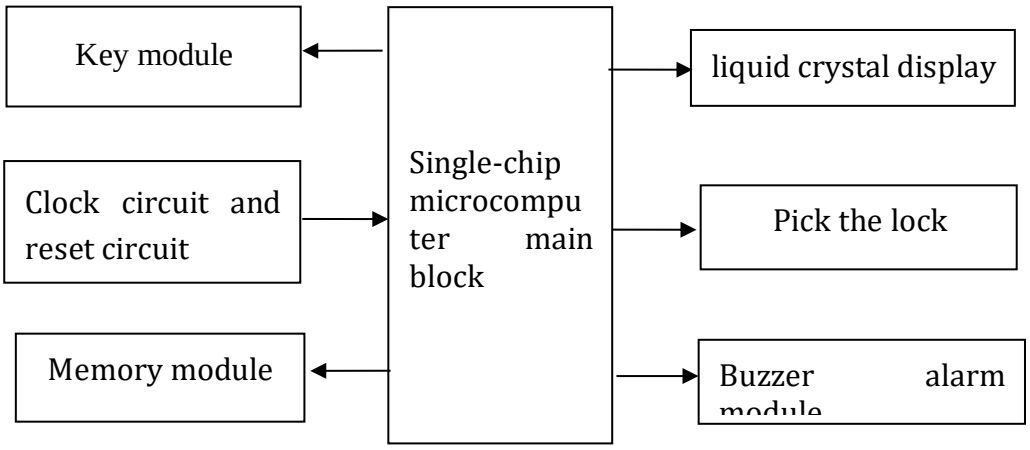

Figure 2.1

2.2. STC89C52 chip As shown in figure 2.2:

The 89C52 is a low-voltage, high-performance CMOS8-BIT microprocessor with 4K bytes of FPEROM -- Flash Programmable and Erasable Read Only Memory, commonly known as a Read-Only Memory. The device is manufactured using Atmel high-density Non-volatile random-access memory manufacturing technology and is compatible with industry-standard MCS-51 instruction sets and output pins. Atmel's AT89S52 is an efficient microcontroller, which combines multi-function 8-bit CPU and scintillation memory in a single chip. It provides a convenient and cost-effective choice for many embedded control systems.

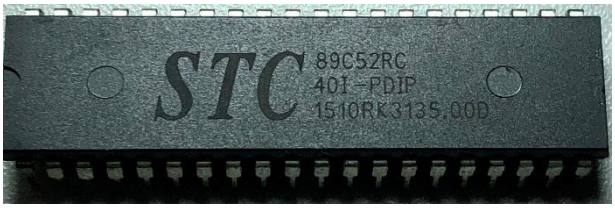

Figure 2.2

2.3. ESP8266 WIFI module As shown in figure 2.3:

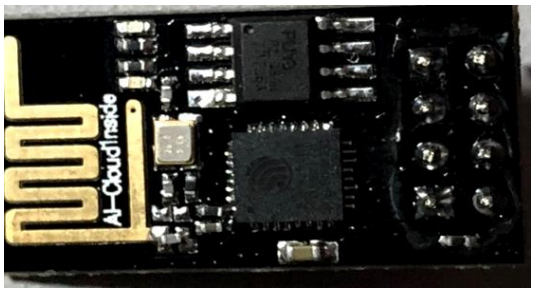

Figure 2.3

ESP8266 is a complete and self-contained wi-fi module that can install and run many applications or uninstall all of the WI-FI node network functions from other application processors. When ESP8266 is used as the only application processor in the device, it can be started directly in the external flash memory of MCU. Its built-in Cache (Cache) facilitates performance, such as system stability, while reducing memory requirements. On the other hand, when a wireless network is connected to a WIFI adapter, it can be added to all microcontroller-based programs in a way that is easy to understand, just Connect through the serial peripheral

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interface or the CPU AHB bridge interface. ESP8266's powerful on-chip processing and data storage capabilities enable it to integrate sensors and other application-specific components through the GPIO port, so that the minimum requirements of the early development and operation of the system to achieve the minimum footprint of resources. ESP8266 WIFI module is highly integrated, including memory management converter, antenna switch SHS-M09C, so very few external circuits and components, the entire solution, including the front-end modules, minimizes PCB space at run time.

2.4. The ESP8266 pin definition is shown in figure 2.4

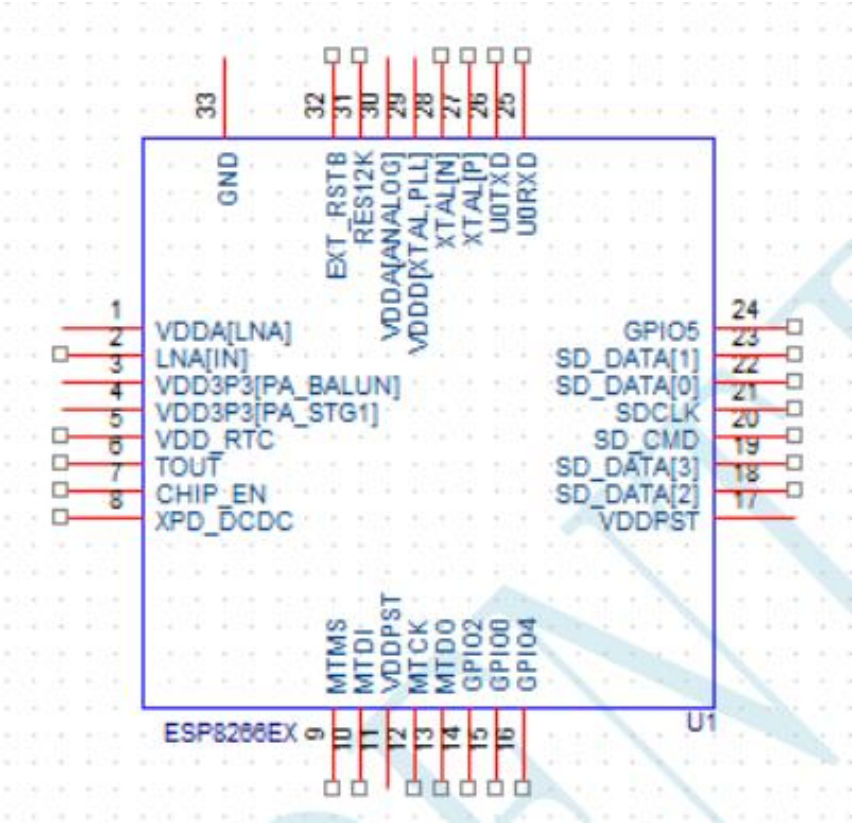

Figure 2.4

2.5. Table 3esp8266 the pin function is defined in Table 1 below

Table 1

Pin	Name	Function
1	VDDA	Analog power supply 3.0-3.3 V
2	LNA	RF antenna interface, chip output impedance of 50ω
3	VDD3P3	Power Supply 3.0-3.3 V
4	VDD3P3	Power Supply 3.0-3.3 V
5	VDD_RTC	NC (1.1V)
6	TOUT	ADC pin
7	CHIP_EN	Chip enable end. High Level: effective, the chip works
8	XPD_DCDC	Deep-Sleep Wakeup ; GPIO16
9	MTMS	GPIO14 ; HSPICLK
10	MTDI	GPIO12 ; HSPIQ
11	VDDPST	Digital and IO power supplies (1.8 v-3.3 V)
12	MTCK	GPIO13 ; HSPID

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13	MTDO	GPIO15;HSPICS
14	GPIO2	Can be used to burn Flash UART TX; gpio2
15	GPIO0	GPIO0 ; SPICS2
16	GPIO4	GPIO4
17	VDDPST	Digital and IO power supplies (1.8 v-3.3 V)
18	SDIO_DATA_2	Connect to SD (200 ω in series) ; spihd; HSPIHD
19	SDIO_DATA_3	Connect to SD (200ω in series) ; SPIWP; HSPIWP
20	SDIO_CMD	Connect to SD (200ω in series) ; SPICS0
21	SDIO_CLK	Connect to SD (200ω in series) ; spiclk
22	SDIO_DATA_0	Connect to SD (200ω in series) ; spiq
23	SDIO_DATA_1	Connect to SD (200ω in series) ; spid
24	GPIO5	GPIO5
25	U0RXD	Can be used to burn Flash UART RX; GPIO3
26	U0TXD	GPIO1 ; SPICS1
27	XTAL_OUT	The crystal oscillator output terminal is connected, and can be used to provide the clock input of BT
28	XTAL_IN	Connect the crystal oscillator input terminal
29	VDDD	Analog power supply 3.0-3.3 V
30	VDDA	Analog power supply 3.0-3.3 V
31	RES12K	Series 12k ω resistance to low
32	EXT_RSTB	External rest signal (low level effective)

3. Hardware design

3.1. The design of keyboard circuit

The matrix keyboard schematic is shown in figure 3.1 :

In this work, our password keyboard set a total of 12 keys, of which 10 password keys and 2 function keys (including change password keys, delete keys) .

The keyboard used in single-chip microcomputer system is divided into coding keyboard and non-coding keyboard:

① the coded keyboard itself has the hardware circuit which realizes the main function of the port receiving, not only can it automatically check whether the key is pressed and accomplish the functions of eliminating jitter and preventing string keys, etc. , the key code corresponding to the pressed key function (such as ASCII code) is provided and sent to the CPU together.

②Keys on a non-encoded keyboard are arranged in rows and columns. The function of the key is simply to connect or disconnect the contacts, so you must write the corresponding code to match it, in order to display the corresponding key code, most importantly, the unencoded keyboard requires little additional hardware. So for the sake of brevity, I use a non-coded keyboard. But using non-coding keyboard needs to solve the problems of key recognition, delay jitter elimination and how to display key code by coding. The keyboard code diagram will be posted later in the article。

Independent keyboard can work under the query mode, read the status of keys through I/O serial port, when a key is pressed, I/O port becomes low level, other keys not pressed

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corresponding to high level, this reads the level state to determine if a key is pressed and which key is pressed.

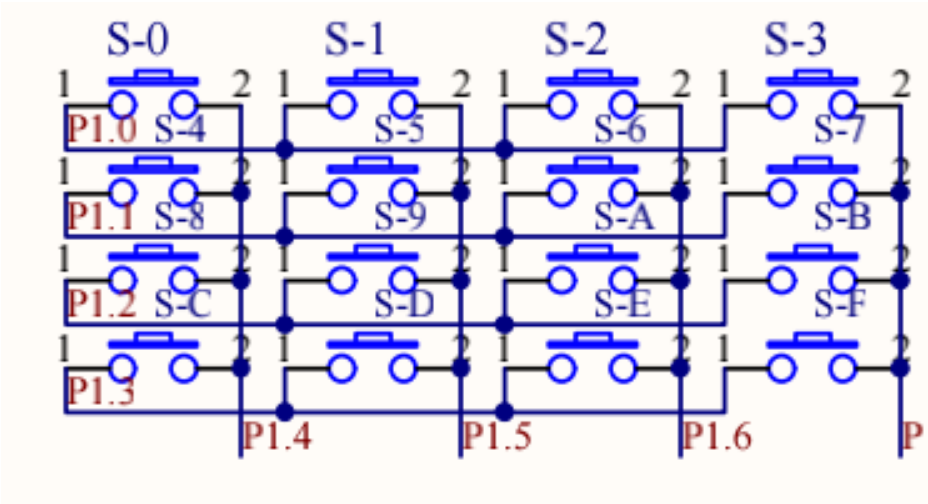

Figure 3.1

3.2. liquid crystal display As shown in figure 3-2:

There are two ways to connect the LCD module with the microprocessor: the first way is direct access, which connects the AT12864 data port directly with the data port of the LCD module, and the second way is indirect control, aT12864 simulates the timing of the LCD screen through the IO parallel interface, and indirectly realizes the control of the liquid crystal display. We used the first method of direct access.

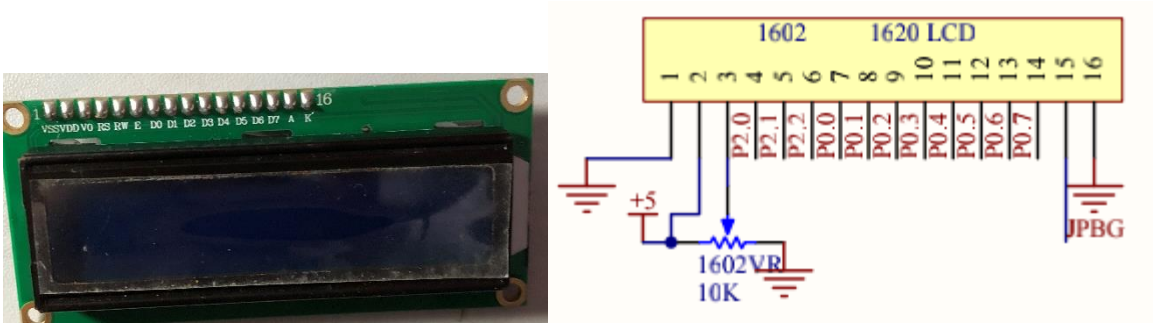

Figure 3.2

3.3. Buzzer alarm module

The buzzer is a kind of integrated electronic component, which is powered by DC voltage. The electromagnetic buzzer is composed of oscillator, electromagnetic coil, magnet and vibrating diaphragm. When connected to the power supply, the signal current generated by the oscillator through the electromagnetic coil, so that the electromagnetic coil produced a magnetic field, vibration diaphragm in the magnetic field under the role of periodic vibration sound. Buzzer is widely used in electronic toys, alarm, school bell, telephone, timer and other electronic products. The buzzer mainly divides into the piezoelectric buzzer and the electromagnetic buzzer two kinds. The electromagnetic buzzer is divided into active buzzer and passive buzzer two, this time our work is the choice of passive buzzer.

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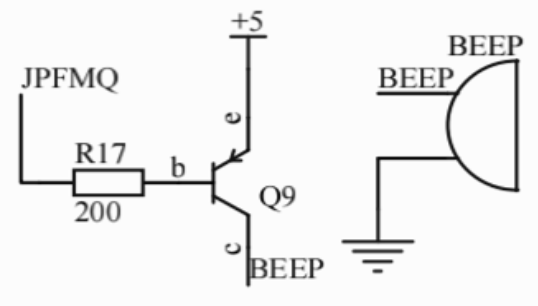

Figure 3.3 Schematic of Buzzer

3.4. The introduction of reset circuit

Microcontroller reset is to re-initialize the CPU and other functional parts of the system, so that they are in an initial state, and from this state began to work. Reset once when the system is powered on, reset again when the system presses the button, and reset again when the button is released. So you can control its reset in the system by pressing the button to close and disconnect.

The principle of the reset circuit is shown in figure 3.4:

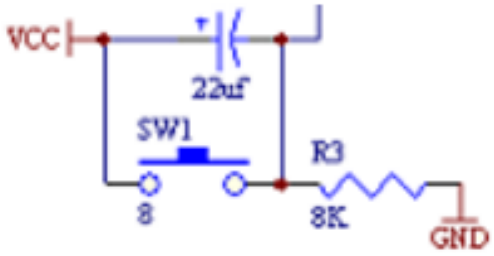

Figure 3.4

3.5. Introduction of clock circuit

The clock circuit of our design consists of a 12MHz crystal oscillator and two 22PF ceramic patch capacitors. There is a high gain inverse amplifier in the single chip microcomputer chip to construct the oscillator. The pins XTAL1 and XTAL2 are the input and output of the reverse-phase amplifier. On the outside of the chip, XTAL1 and XTAL2 are connected with Crystal oscillator and trimming capacitors to form a self-excited oscillator with stable performance, which is the structure of the clock circuit of the single-chip microcomputer. In general, capacitors C 1 and C 2 take values around 20-100PF, and we take 22PF.

The schematic diagram of the clock circuit is shown in figure 3.5

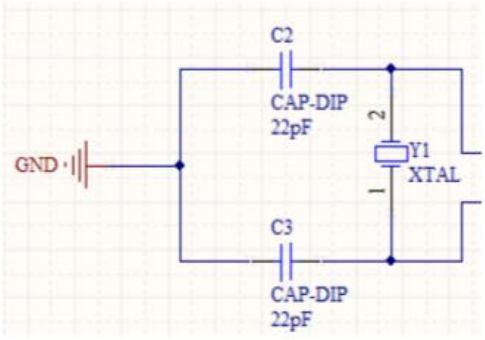

Figure 3.5

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4. Software design

4.1. keyboard scanning

4.1.1. Scan detection:

SCM every period of time, to detect the state of the IO port, when not triggered, the pin is high-level, trigger is low-level.

4.1.2. Interrupt detection:

Interrupt scanning mode is the CPU CPU in the execution of other operations, when there is a key press, to CPU interrupt, CPU response interrupt, immediately to interrupt service program that is keyboard scan program to send commands, this greatly improves the efficiency of the CPU.

4.2. Key Shake

After the key is closed, a delay program is executed, with a delay of 5ms-10ms, to detect the state of the key again after the leading edge jitter disappears. When the release of the key is detected, a delay of 5ms-10ms is also given, and only after the back edge jitter disappears can the key be transferred to the processing program. When the key is pressed or raised, the level will have violent jitter, these jitter will cause interference to the judgment of the key state. So Shake it off.

4.3. Password change

When you want to change your safe password, first you have to enter the old password, in the old password input correct, to enter the administrator password, in the above two password input correct, you can change the combination of your safe.

4.4. Password comparison judgment

The function of this module is to compare the password entered by the keyboard with the password set. If the password is correct, it will be unlocked. If incorrect, the buzzer will alarm.

4.5. LCD display module

The function of this module is to display, for the privacy of the user, when we write the display program, when entering the password, the LCD screen will display"*" instead of the password entered all the display.

4.6. Alarm alert module

To ensure security, the buzzer will sound an alarm when the user enters the wrong password more than 5 times.

4.7. The Code Lock System diagram is shown in figure 4.1:

This time our design is a safe password system, its main feature is that when someone tries to unlock your password many times, the safe can send the alarm information to the user's mobile phone through the WIFI module plus the administrator password, the security is greatly improved.

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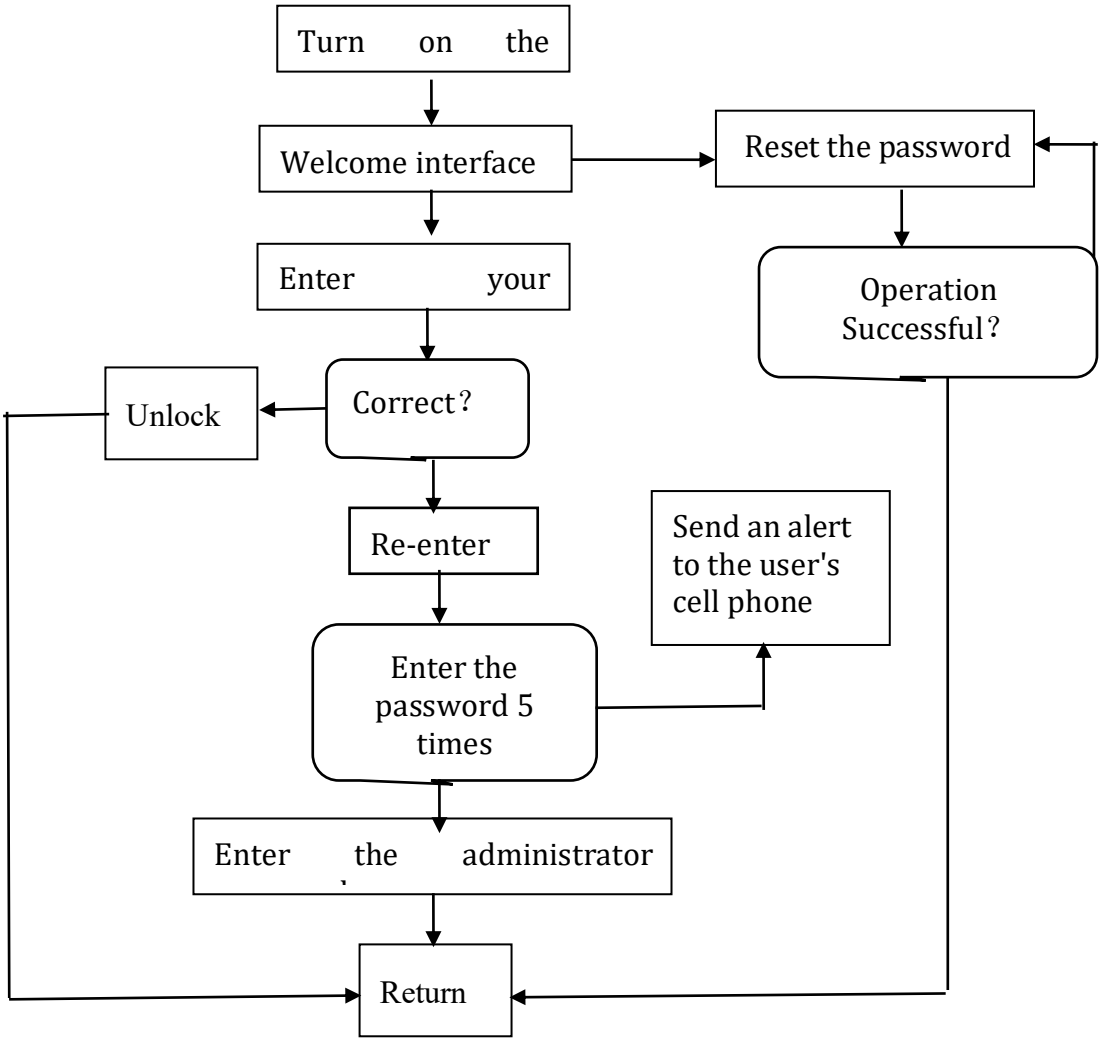

Figure4.1

4.7.1. The flow chart for password modification is shown in Figure 4.2:

We're writing key. C both single-chip keyboard code, set a separate reset password key. The idea is that when a user wants to change his or her password, he or she can simply press this button. To improve security, users will be asked to enter the administrator password when they reset their password. If successful, the"Admin password" will pop up and ask you to enter your old password. You can not change your password until you have entered both correctly. The requirement to enter your administrator password first is to prevent people from secretly changing your password when they know your old password. To improve security.

4.7.2. The flow chart for password recognition is shown in Figure 4.3:

We designed a safe password system that, when a user enters his or her password incorrectly five times, the safe will send an alert via the WIFI module to the user's phone (which requires an APP to be installed in advance) to alert the user that someone is trying to open your safe. If you want to re-use the safe, you must enter the administrator password. However, when the administrator password input error twice, the entire insurance password system will be locked, only contact the manufacturer can be disarmed system.

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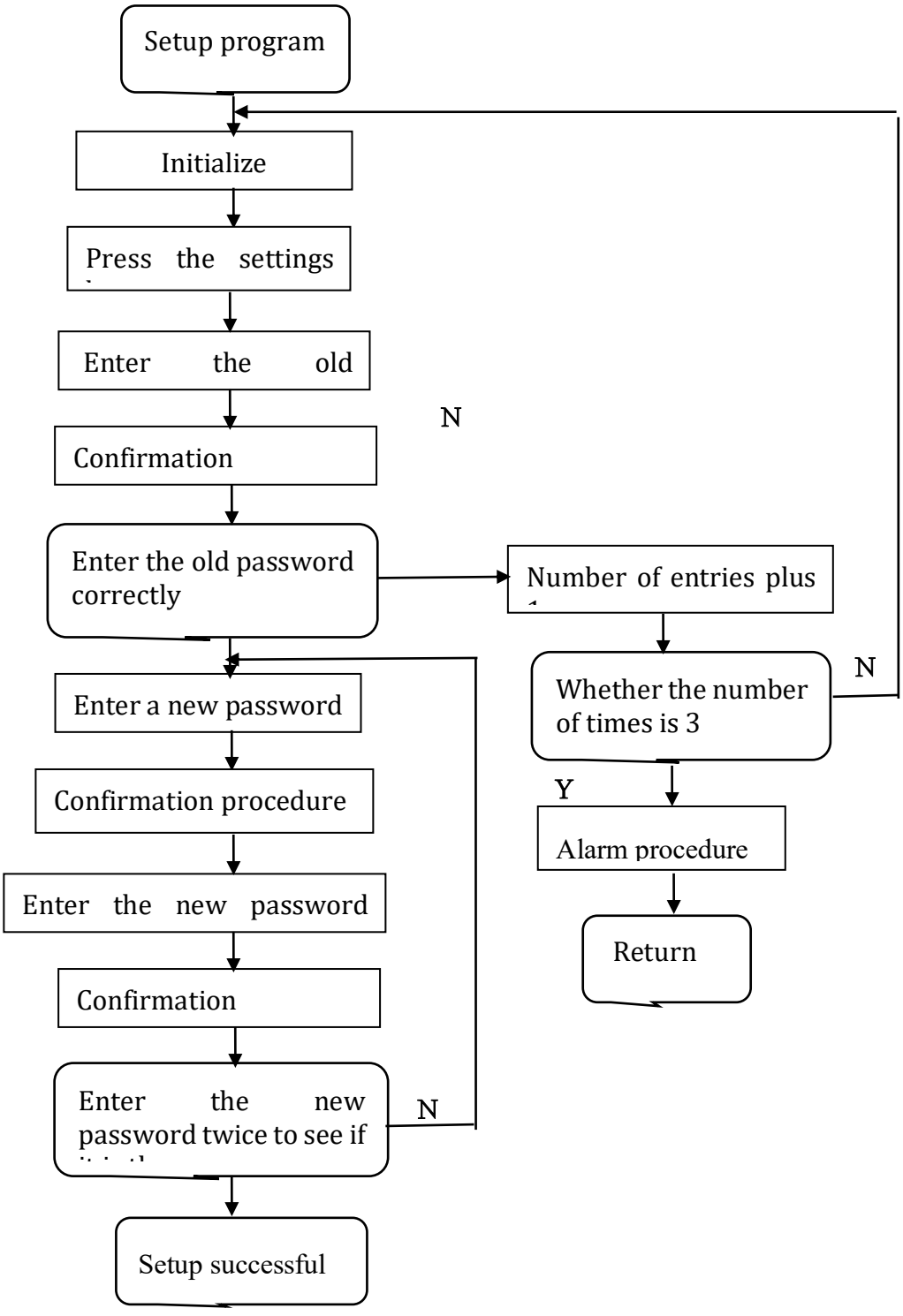

Figure4.2

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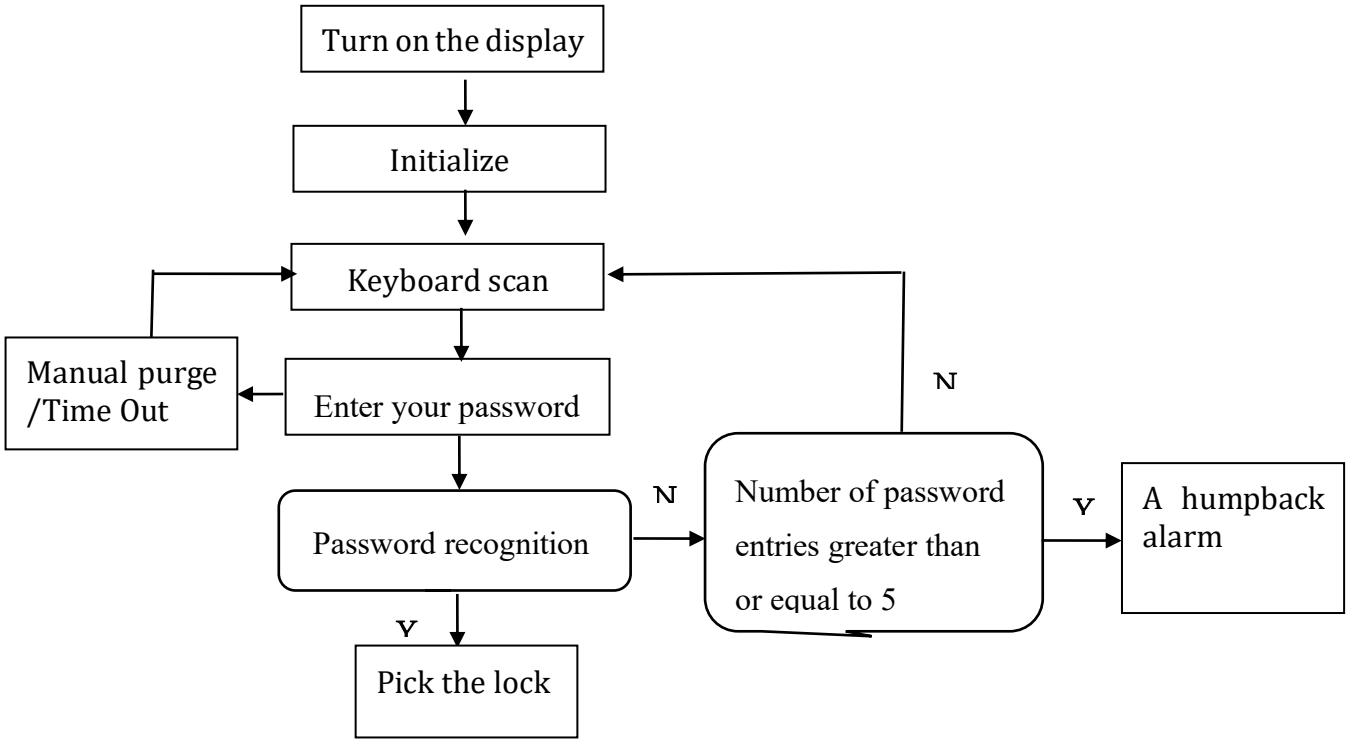

Figure 4.3

4.8. Mobile application terminal installation

In view of the wide variety of APP types on the internet today, this topic uses a piece of software that is available and used on the Internet as a receiver to connect with the wireless network sent by the ESP8266 wifi module used in the design, this can save time and cost, but also as a general-purpose software for users to use.

4.8.1. Server debugging

In this paper, the module of ESP8266 is set up as the transmitter-tcp server, which sends the specified wireless network signal to connect with the specified receiver, in order to transmit the alarm information data processed by the alarm module. After connecting and supplying power to our ESP8266 module, refer to the data manual, enter AT system and debug our WIFI module to AP mode. Because the baud rate and port of ESP8266 WIFI module are generally universal, we don't make changes here. You can proceed to the next step.

4.8.2. Mobile phone debugging

After we finish debugging the server side, we can debug the receiver side, mainly by connecting the IP and Port of the server to the sender side, then the server and the receiver can be sent and received in one direction.

After the debugging is finished and the line is connected, when the user enters the wrong password each time, the buzzer sounds the alarm and the mobile phone connected to the ESP8266 module wireless network can receive the alarm information from the password system, inform the safe owner of safety information in time, even if users go out, do not have to worry about safe theft, greatly enhance the safe security performance, it also enables users to better understand the convenience that the internet of things brings to our lives.

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