Raspberry Pi-based IoT Printing System

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Abstract: With the rapid development of the Internet of Things, while the printing function requirements are getting higher and higher, Raspberry Pi as a new small computer, has the advantages of small size, easy to carry, can build a variety of systems, and so on, with Raspberry Pi as the printing system access to the Internet of Things carrier, design a network access and material connectivity, data storage and cloud and the implementation of scanning printing and synchronization of the printing system, can be suitable for multi-scene printing, improve the printing system's work field and efficiency.

1. Introduction and benefits of Raspberry Pi

1.1 Raspberry pi introduction

Raspberry Pi is the British charity "Raspberry Pi Foundation" for computer programming learning research, Raspberry Pi is based on Linux open embedded system a credit card-sized single-board computer, he can adapt to a variety of operating systems and installation and normal use of the corresponding application software, its development language includes Python, Java, C and other most widely used languages, so by the vast number of creators and open source hardware developers.

Raspberry Pi, after years of development and innovation, has now been updated to raspberry Pi 4 Computer Model B, as shown in Figure 1, with a 64-bit quad-core processor with 1.5GHz, Broadcom BCM2711,withmemory changed from 1G to 4G today, at the same time, the microSD storage system has double data rate support, supports H.265 decoding, dual-band Wi-Fi, Bluetooth 5.0, dual micro HDMI output, supports 4K resolution, and has two Usb 3.0 and two USB 2.0 interfaces, full throughput Gigabit Ethernet (PCI-E channel), and gPIO pin output of the common protocol, etc., can be implemented with the corresponding Linux system.

Figure 1 Raspberry Pi 4 Computer Model B

1.2 Raspberry pi advantages

Compared to embedded microcontrollers such as the usual STM32 and 51 microcontrollers, it can not only complete the same IO pin control, but also run the corresponding operating system, which is

generally Linux system, so that more complex task management and scheduling can be completed, but also can support the development of upper-level applications, for our Provides a wider application space. And the choice of developing language is not limited to C language, it can be adapted to the most widely used languages, so that through his connection to the underlying hardware and upper-level applications, the Internet of Things cloud control and cloud management, the same can ignore the RASPPi IO control, Use Raspberry Pi to build small network servers and do small test development and services. Compared with the average PC computer platform, Raspberry Pi can provide the IO pin, which allows him to directly control the functionality of other underlying hardware, which is not possible for the average PC computer, while the Raspberry Pi is small in size and low cost, and can complete some PC tasks and applications as usual, which makes his application even larger. Based on these advantages, we enable the Printer's IoT capabilities by connecting it to a handheld printer, which makes it portable and fully functional, and will be applied to a wider range of areas.

2. Internet of Things Printing System Framework

The Internet of Things refers to the internet through infrared induction, radio frequency identification and other information sensing devices to connect to the Internet, the formation of objects and objects connected to achieve intelligent, information, remote control management and identification of the network, but also based on the traditional telecommunications network, the Internet, etc. of an information carrier, can make all independently found ordinary physical objects formed Connect. The Internet of Things (IoT) is widely used in the convergence of networks through universal computing and intelligent perception and recognition technology, and is therefore known as the third wave after the development of the world information industry after computers and the Internet.

2.1 Iot Network Architecture

IoT network architecture generally consists of the perception layer, the network layer, and the application layer.

The IoT perception layer generally consists of data short-range transmission and data acquisition, i.e. first through camera sensors, other devices to collect information and data in external space, through Bluetooth, ZigBee, infrared and other short-distance no Line or line transmission technology Transfer data and information or work together to gateway devices. To achieve an intelligence of the outer space should identify, process, and automatically control the information and physical entities through the communication module and connect to the network and application layers.

The IoT network layer is generally based on established networks such as mobile communication networks and the Internet, not only using the currently more sophisticated, such as long-distance wired communications, wireless communications and network technology, in order to achieve "things and The Internet of Things network layer will also use iPv6, 2G/3G, Wi-Fi and other communication technologies to realize the combination of broadband and narrow band, the combination of wired and wireless, and the combination of perceptual and communication networks. The main implementation will be the data and information that will be obtained from the perception layer for stable transmission.

IoT Application Layer Processes information and data transmitted from the network layer through various types of information processing systems, making accurate manipulations and decisions, completing intelligent management, applications and services, and finally exchanging information with people through the devices and people needed. Mainly to solve the contradictions between the human-machine interface and realize the function of information processing and exchange, application is the driving force and ultimate goal of the development of the Internet of Things.

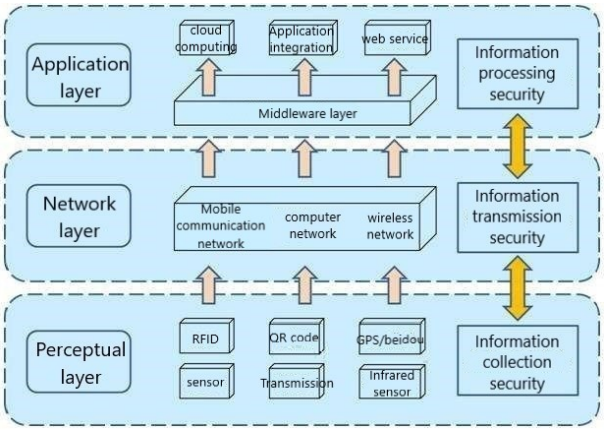

Figure 2 IoT Network Architecture

2.2 Basic system features

In the three-tier edtrusion layer of the Internet of Things, the network layer and application layer, the most important core structure is the perception layer, we compare the perception layer as the human eye, skin and other sensory organs, and we now take Raspberry Pi as the printer's senses to help him get more information and complete more operations, raspberry Pi IoT printing system based on the original printing based on the original printing based on the original printing module, dual communication module, scanning module, scanning module, etc. Realize network access and materialization, data storage and cloud-based, scan printing and synchronization and time-sensitive printing and confidentiality, control the corresponding communication modules, complete the networking and materialization of Raspberry Pi and printing systems, You can then implement one-to-many, remote synchronization time-sensitive printing after it is connected to the network. At the same time on this basis, the use of cloud-based storage transmission printing, to further ensure the confidentiality of printing, and then use the cloud to store data. The IoT print flowchart is shown in Figure 3.

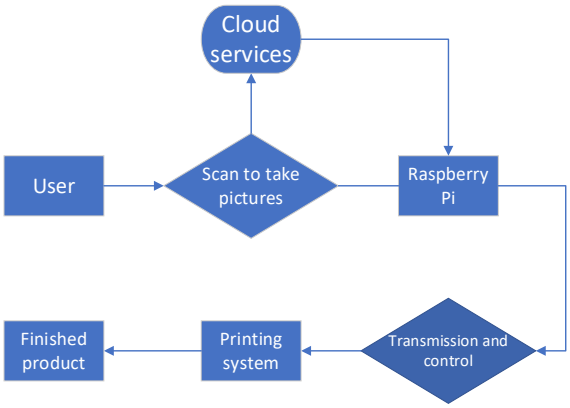

Figure 3 IoT printing process

3. System scenarios

3.1 System Framework Design

The Internet of Things build of Raspberry Pi and the Print System can be built on the Linux operating system, using the Raspberry Pi Access Networked Cloud Platform to control the printing system for a series of tasks that allow users to print directly by scanning files or transferring files over long distances. The system is therefore designed with two connection points, Raspberry Pi's connection to the print system and Raspberry Pi's connection to the Internet of Things cloud. The former connects the Internet of Things through wired serials or wireless technology Bluetooth, WiFi,

etc. to build communication protocols, while the latter connects the Internet of Things cloud by building servers.

3.2 Print System Communication

Raspberry Pi communication with the printing system because it can be based on the same operating system, the communication protocol will be easy to build, the system's communication body is composed of serial communication protocol, we use Raspberry Pi equipped with the serial port, configuration Raspberry Pi file, write serial communication code, part of the source code is shown in Figure 4.

```
/* 设置字符大小*/
//opt = opt;
//cfmakeraw(&opt);//配置为原始模式
//opt.c_cflag &= ~CSIZE;//c_cflag 控制模式标志

/*设置波特率*/
switch (baud_rate)
{
    case 2400:  speed = B2400;  break;
    case 4800:  speed = B4800;  break;
    case 9600:  speed = B9600;  break;
    case 19200: speed = B19200; break;
    case 38400: speed = B38400; break;
    default:    speed = B115200;break;
}
cfsetispeed(&opt, speed);
cfsetospeed(&opt, speed);
tcsetattr(fd,TCSANOW,&opt);

opt.c_cflag &= ~CSIZE;

/*设置数据位*/
```

Figure 4 Partial source

After the compilation is complete, the results and operation on raspberry Pi are shown in Figure 5.

```
pi@raspberrypi:~/grb/usb $ gcc -o usb *.c *.h
pi@raspberrypi:~/grb/usb $ ./usb
open dev [/dev/ttyUSB0]
read[11][test string]
read[11][test string]
read[11][test string]
```

Figure 5 Compilation results and operation

Send a string "test string" through the host computer, the Raspberry Pi will return a string "N01" ~ "NO4" in order, that is, the debugging results of serial communication are shown in Figure 6.

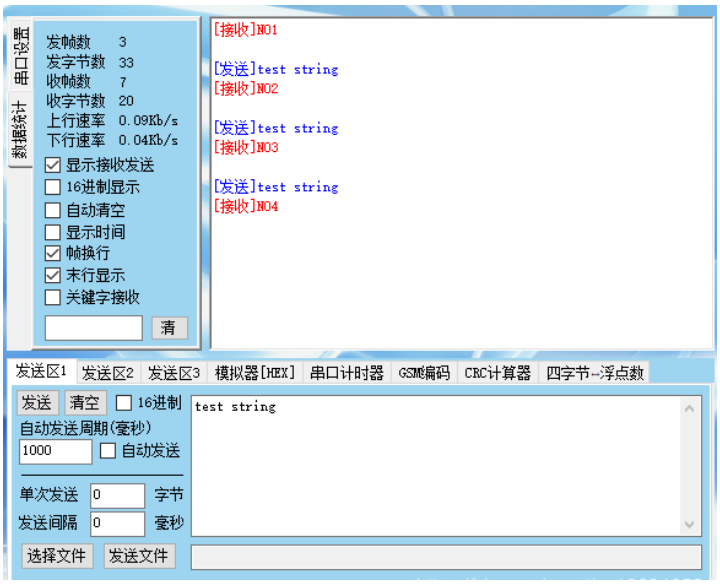

Figure 6 Serial debug results

3.3 Cloud Communications

Raspberry Pi and the cloud communication system are implemented by building web servers, while webservice providers rely on the Flask framework in the python language, based on Alibaba Cloud's cloud servers. This service side creates a platform that can upload, store, and download image files, enabling Raspberry Pi to be directly connected to the cloud, and different users can share picture files remotely. And the Web service side can record the user's login status, distinguish the user's properties, and give some user administrators permission, can modify the system directory, delete. And the password recorded in the database is "salted" processing, so that the user password is protected, to avoid the theft of the database at the same time, the stolen party with the "crash library" operation to steal other information of the user, at the same time can be uploaded by the printer image files editing and modification.

4. Conclusion

With the rapid development of the Internet of Things, and printer sales are growing at an annual rate of 8%, which indicates that the scope of printing applications will be more and more extensive, the speed of development will be rapid, and the existing printing system is not enough to support the application of the wider field, this paper will be Raspberry Pi and printing system combined to build IoT communication, design network access and material ization, data storage and cloud ingenuity, and scan printing and synchronization The printing system will effectively improve the printer usage scenarios and application areas, will effectively solve the sudden or unusual printing needs.

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