

Research on Smart Security Wristband based on Cloud Services

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Keywords: cloud services; NFC; smart security wristband; research; application

Abstract: Taking the short-term usage of missing yellow wristband and insufficient information of custodian into account, this paper designs and implements a cloud-based NFC missing yellow wristband system. NFC, near field communication, connected through network media such as 2G, 3G, 4G and WIFI, uses cloud services to find lost people, and provides personal information about lost people for their family and assistance center, which achieves the prevention of getting lost. The test finds out that the smart security wristband system based on cloud services can effectively provide personal information and help find lost people.

1. Introduction

Along with the growth of domestic economy, social development and the improvement of people's livelihood, the pace of people's life is also accelerating, especially young people have heavier and heavier work pressure. According to statistics, the proportion of children is 15%-20% of the total number of children in the whole country. Due to the increasing children, especially since the two-child policy, researches on the monitoring of children's physical quality are also increasing. Generally, eight constants are required to have a clear understanding of children's physical quality. Therefore, the wristband system is designed and implemented by the photoelectric volume blood-tracking method capable of effectively monitoring the bilingual signals of the installer such as the heart rate and the amount of exercise, and effectively performing the analysis. Their basic physical quality will be reflected on wristbands. More importantly, with the advancement of sensor, wristbands can detect physical status in a more comprehensive way.

At present, the mainstream missing wristband is mainly to store and provide information in wristband to a certain degree, and it also has disadvantages, such as information loss. For example, there is information loss when water is put into the wristband, so that it cannot perform centralized management and realize the data updating, and the quantity of information stored is limited. Based on this, this paper designs a cloud-based NFC missing yellow wristband which applies NFC technology into anti-lost yellow wristband for the first time in China.

2. Introduction to Technologies

2.1 The photo plethysmo graphy (PPG)

The photo plethysmo graphy (PPG) is a non-invasive detection method to detect changes in the amount of blood in a biological tissue with a photoelectric device. When the surface of the finger is illuminated to light of a particular wavelength, the light is transmitted to the photoelectric detector by transmission or reflection, and during the process, the light is absorbed by the skin muscles and blood. The light absorption coefficient of skin muscles and tissues is constant and only affects the DC component of the photoelectric signal. The amount of liquid in the skin periodically changes with the activity of the heart. The contraction period, with the maximum increase in light absorption of peripheral blood, is the minimum capacity expansion period of the detected light intensity. On the contrary, the intensity of the detected light is the largest, and impacted by the periodic light intensity, the change in light intensity is converted into a change in the electrical pulse signal by the volume pulse blood flow.

2.2 The monitoring technology of accelerated speed

The wristband uses triaxial accelerometer to detect the accelerated speed. The triaxial accelerometer is equipped with inductor chips for shaking, falling and rising during acceleration. The voltage varies with inertia and gives the quantized value through the internal ADC (analog-to-digital converter). In the actual measurement process, a filtering program is required to obtain the available data to prevent noise. The triaxial accelerometer itself is an electronic filter that uses the digital signal to further calculate and process the output digital signal to increase the noise reduction effect, and thereby obtain the high-quality data required for the design.

3. System Architecture

The NFC yellow wristband can sense lost information after the “click” sound of the wristband, to provide relevant suggestions for young children, and emergency treatment methods under special conditions. At the same time, it can know the location of the lost person through the mobile phone and the map information control center, so that the child’s current location can be obtained, and the mobile phone can also give indication information. Besides, family and civil personnel can obtain feedback from the wristband of the lost person. NFC yellow wrist system consists of NFC tag, cloud server and NFC terminal (generally mobile phone).

First of all, the NFC bracelet tag. It is the list band printed with unique numbers. The ntag203 chip is internally configured to store the personalized URL of the chip number information, which is encoded by the NDEF.

Secondly, cloud services. It is composed of data instance and Tomcat server. The data instance stores cloud service instance ID, coding information of yellow tag and cloud service execution log. After reading the address of the chip, the mobile phone accesses the server, reads the contents of the database, and feeds back to the portable phone, thereby implementing the list.

Thirdly, NFC terminal (mobile phone). NFC terminal is electronic products with NFC function, and the common one is mobile phone. When the NFC function is turned on from the phone, it will get close the location of chip in list band, read the address in chip and provide Internet access. The server is accessed by the mobile browser, gets access results and returns to the mobile browser for display.

4. Software and Hardware Design and Main Technologies

4.1 Introduction to NFC

NFC (Near Field Communication) is a near field wireless communication technology based on RFID radio frequency identification and Internet technology, which can automatically start network communication within 10cm, non-touch communication, e-wallet and certification. The operating frequency is 13.56MHz, the transmission speed is 106 to 848kbit / s, and it supports wireless protocols such as Bluetooth and 802.11. NFC technology conforms to international standards and is a very competitive technology in the field of short-range wireless interconnection.

4.2 NFC device operating mode

NFC has three operating modes, that is, an NFC terminal (generally mobile phone) as a reading device (reading device), a device with NFC terminal as reading target (card mode) and a point-to-point mode before NFC terminal.

First, NFC terminal (generally mobile phone) as a reading device (reading device). The reader mode is to take NFC terminal as a reading device, and the NFC-enabled mobile phone can read data in NFC standard format and read the supported tags. In other words, NFC chip in an NFC mobile phone is used as a card reader that communicates with other NFC compatible devices. Of course, the read data can be saved in the phone or saved in the SIM card. The communication principle of the reader mode and the tag mode is the same. This paper uses mobile phone NFC chip as the reader.

Second, a device with NFC terminal as reading target (card mode). Card mode is called tag mode. In others words, the device is used as tag and relevant information will be stored in tags. Once it is close to a particular identification terminal, the terminal will automatically give full play to its function as a transponder according to the identification of the device. The application of NFC terminal as mobile payment is also a function of installing card mode. The tag mode is a passive mode, and as long as the reading device can generate a high-frequency electromagnetic field, the NFC chip can realize the device sense when passing.

Third, the peer-to-peer mode before NFC terminal. Wireless data exchange with point-to-point communication mode or non-contact ranging technology refers to connecting two devices with NFC functions together to achieve data point-to-point transmission. Before the communication, NFC mobile phone needs to create its own unique RF city to transmit data, based on the active communication mode, the point mode complies with the ISO/IEC 18092 standard.

4.3 Hardware design of yellow wristband

NFC missing yellow wristband can be used to encode information using passive RFID technology without the power of the battery and can be used for long a period of time. The chip is sealed in an allergic and flexible silicone under the conditions of rain and sweat, and it cannot be carried if lose information. Compared to ordinary wristbands, NFC smart missing wristband has excellent durability and is not affected by the environment and can be used for a long time.

The yellow wristband is made of gold rubber with a core inside. The ntag203 chip has stable performance, fast reading and writing speed, signal response, reading function and function of collision prevention. NDEF (NFC Data Exchange Format, which is the data format within NFC tags negotiated by the NFC organization) is used to encode personal URL. NDEF is a lightweight and compact binary form with various data types defined by URL, vCard and NFC. NDEF consists of various data records, each of which consists of a header and a payload. The data type and size are indicated by the header of the gray code payload. NFC missing yellow wristband is the entire type and identifier and is a mobile Internet application.

4.4 Motion data acquisition and processing

The actual time modulation data of the installer's motion data is acquired by LIS3DH chip, which is mainly based on the following three aspects. First of all, LIS3DH is a triaxial accelerometer sold by ST Microelectronics. It reduces the packaging area and improves the function of the chip, 90% higher than the power of current solution in the market. Secondly, the high-pass filter is built into LIS3DH, which simply removes the DC component of the measured acceleration. The high-pass filter has four operating modes, such as E normal mode and reference mode, where the FDS, HPenI, and CTRL REC2 filters are independently applied to output data. Thirdly, the external filter can be continuously obtained without affecting the occurrence of the interrupt.

In addition to the high-pass filters attached to LIS3DH chip, in order to further reduce the effects of noise, digital filters have been added to the hardware. The use of Kalman filtering is mainly based on that it is a very efficient recursive filter. The measurement includes a series of incompleteness and noise to estimate the state of the dynamic system. Kalman filtering is a kind of recursive estimation, because if the estimation of the previous state and the observation of the current state are obtained, the estimation of the current state can be calculated, so it is not necessary to record the historical information of the observation or estimation, and it is convenient to apply corresponding algorithms to process data after obtaining the Kalman filter processed data, so as to obtain the motion status of installer and send data to mobile client.

4.5 The design of cloud services database

The cloud server database has three lists, a city information list, a cloud instance information list, and a cloud service log list, respectively. The city information list is to store city information, cloud instance information list is to store the basic configuration information, basic information and wristband number information of cloud service instance, and the cloud service log is to store the execution log information of cloud service instance.

4.6 The functional design of mobile phone client

The design of the mobile client mainly includes functional design, data transmission design using the background server, and data display method design, which are introduced in detail.

First of all, the functional design of mobile client. The mobile phone client of this system complies with the MVC architecture, in which the function of binding wristband is for mobile users to save basic information of wristband based on the initial connection. Then, the mobile phone client actively connects the wristband; the binding removal of wristband is that the basic information of the wristband is deleted by the customer. The portrait drawing function is for the mobile phone customer to create line chart corresponding to the data received from the processing. The establishment of a consultation window with the hospital means that the corresponding API can be opened on the back-end server and shared with the hospital.

Secondly, the data transmission design using the background server. Data transmission is in Json format, which is the lightweight data exchange language commonly used in data transmission. In transmission, it is necessary to avoid the attacker from obtaining the key data of Json, such as user password. The irreversibility of MDS algorithm uses MD5 encryption technology here. Because the means monitors the packet, decoding is difficult. In addition, in order to prevent attacks such as hash collisions, the user password is added twice with MD5 password before being sent, which greatly increases the security of data transmission.

5. Experimental Verification

5.1 The preparation of experiment conditions

This experiment mainly tests whether the NFC wristband tag function and the corresponding database instance information are consistent. The test device is Huawei Glory 7. 50 NFC yellow wristbands are randomly extracted, the mobile phone network and NFC function are turned on, and the information near the chip position with the NFC yellow wristband is read.

5.2 Experimental results

When the phone is close to the yellow wristband, the browser will automatically enter the Internet to read photos, names, contact information and other information. The 50 wristbands tested were basically free of errors. The experimental results show that the products realized with white paper basically conform to the original design intent.

6. Conclusion

This paper analyzes problems existing in smart wristband system, proposes the design scheme of NFC yellow wristband system based on cloud services, and introduces the system architecture of cloud-based yellow wristband. The experimental results show that this system has characteristics of simple operation, strong security and stable information. In its application, NFC mobile phone is applied to sense chip. There is no need to download and install APP. It is just necessary to turn on NFC function and touch wristband gently, to read all images and information recorded in wristband, which increases the interactivity and convenience, so it can be promoted.

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