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Design and implementation of family doctor health management platform based on Internet of Things module

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Abstract

This paper applies the health Internet of Things technology to build a family doctor health management platform, aiming to build a long-term, effective and scientific platform to assist the treatment of chronic disease patients with the help of vital signs sensing equipment. The health management platform not only provides a way for patients to understand their own physiological conditions, but also provides a terminal interface for doctors to operate, allowing doctors with professional knowledge to diagnose patients' conditions, and then effectively control chronic diseases.

Keywords

Internet of Things technology; Remote home health monitoring; Chronic disease control; Physiological signal acquisition sensor.

1. Project background introduction

1.1. The organism perception technology is becoming mature

With the rapid development of economy and society, people's living standards have been improved unprecedentedly, and people are paying more and more attention to their own health conditions.At the same time, the number of patients suffering from chronic diseases is still on the rise year by year. Due to factors such as irregular life and rest, unhealthy diet, high work pressure and lack of exercise, chronic diseases tend to become younger. With the rapi d development of the Internet of Things information technology, the technology of sign perception continues to mature, and the collection of vital signs also presents the trend of diversification and informatization, which provides mature equipment conditions for providing high-quality and efficient remote health monitoring services.

1.2. Project Objectives

The framework of the health management platform "Design and Implementation of the Family doctor health management Platform based on the Internet of Things Module" in this project consists of two parts: physiological information acquisition terminal device and cloud service device, as shown in Figure 1.

It adopts the latest sensor, Internet of Things, single chip microcomputer and cloud technology, and according to the requirements of auxiliary medical and health management platform, Designed and realized a family doctor health management platform based on the Internet of Things module with predetermined functions to help patients with chronic diseases to treat diseases scientifically and effectively.

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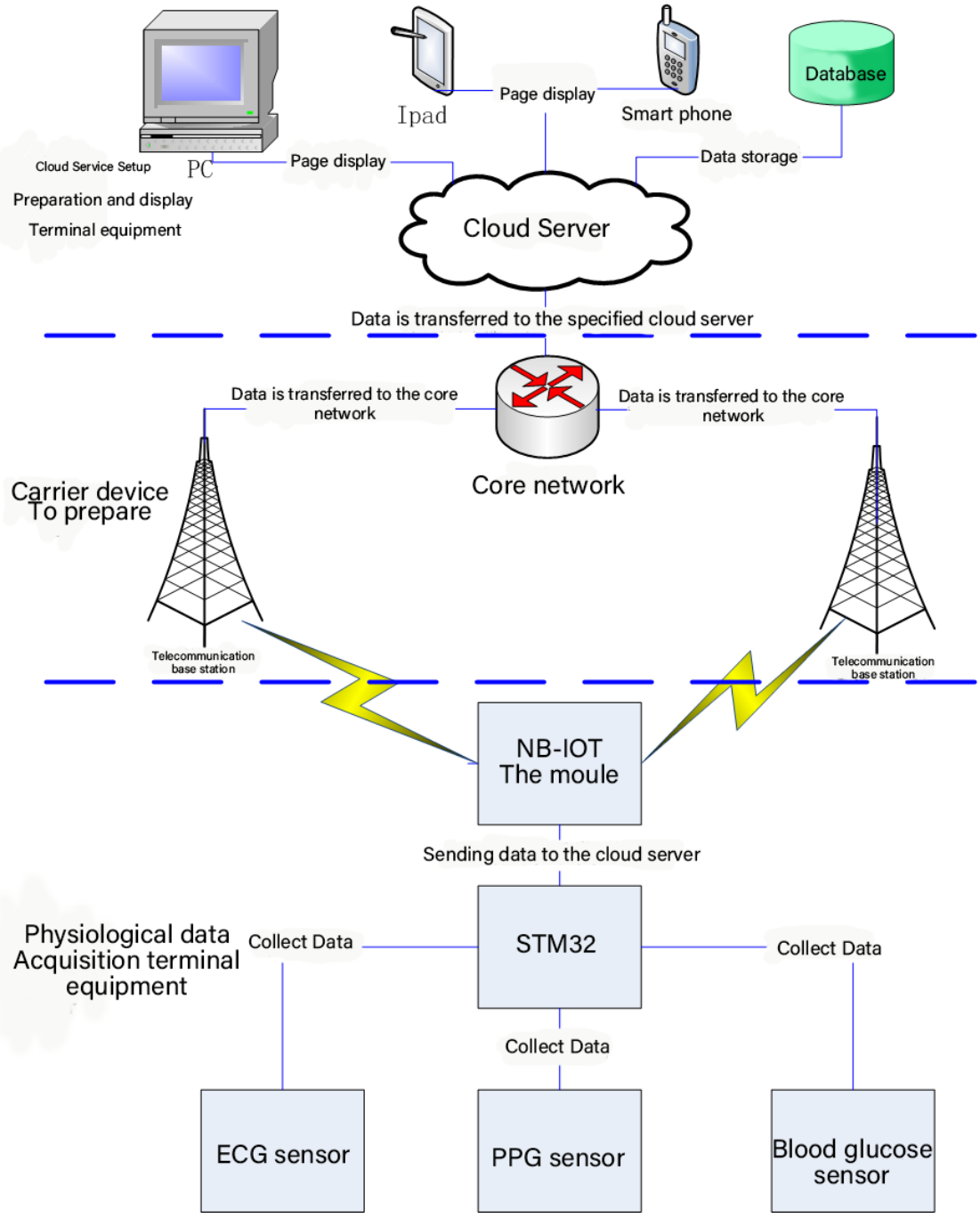

Figure1 System block diagram of family doctor health management platform

1.3. Platform functional architecture

This project collects the patient's physiological information through the physiological information collection terminal device and uploads the data to the specified cloud server through the wireless network.Data packet parsing, storage processing and page display on the device side of cloud service: the number of received and resolved data by the cloud server According to the package, after the verification is correct, the data is stored in the corresponding form of the database, and the page side realizes the registration and login as well as the operation page of the doctor, patient and administrator with different functions.The platform can achieve the following seven functions:

(1) Blood oxygen, blood glucose, heart rate and blood oxygen detection: as a basic function of the family doctor health management platform based on the Internet of Things module, a human physiological data acquisition terminal is necessary to achieve health management.

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(2) Wireless communication: In order to realize the portable characteristics of physiological information acquisition terminal equipment, the communication mode of wireless communication is selected, and the narrowband Internet of Things module is selected to realize the function of wireless communication.

(3) Communication protocol: The NB-IoT module adopts the User Datagram Protocol (UDP), which is characterized by unreliability, that is, the data packet cannot be completely error-free during transmission. Therefore, in the process of communication between physiological information acquisition terminal device and server device, the communication protocol is designed to ensure the reliability of data packet transmission.

(4) Cloud server service functions: Since the wireless module of the narrowband Internet of Things transmits data to the public network server through the base station, the cloud server is used to realize data receiving, parsing and storage functions.

(5) Mysql database: In order to realize data storage and historical data acquisition, Mysql database is built on the cloud service device, and the page terminal can obtain human data from the database and display it.

(6) Web page: provides operable terminals for patients and doctors through Web pages, and implements pages corresponding to different operation functions according to different roles of patients and doctors. In addition, in order to effectively manage the account information of doctors and patients, implements operation pages for administrators.

2. Key technological breakthroughs

2.1. Data Hardware module

2.1.1. Data collection

The data acquisition module of the Internet of Things is highly integrated with the health signs acquisition device, and is used as the terminal service software for the data acquisition of users' health signs.It automatically uploads the collected physical signs to the cloud server through the application of wireless communication environment.The acquisition module mainly includes infrared and near-infrared pulse wave sensors, electrocardiogram acquisition sensors and blood glucose sensors.The MAX30102 module of infrared and near-infrared pulse wave, produced by Maxim, is selected as the pulse wave signal acquisition terminal. MAX30102 is an optical sensor module that can continuously monitor the biological signals of human pulse wave.Ecg acquisition sensor adopts ADI's single lead ECG module AD8232, AD8232 is often used The AD8232 is also used in ECG integrated signal conditioning modules and other biopotential measurement applications. It is often designed to obtain weak biopotential signals from noisy conditions.The blood glucose module is composed of blood glucose test paper, blood glucose test paper connector and operational amplifier circuit. It calculates the blood glucose concentration by using the voltage data collected.

2.1.2. Data processing module

The physiological information acquisition terminal requires a microprocessor to control sensors and other processing.The function of the microprocessor is to obtain ECG signal of sensor AD8232 through ADC, pulse wave data of sensor MAX30102 through I2C, micro potential signal of MCP6002 through ADC, and process and calculate the collected data. Finally, the calculated data will be sent to the wireless NB-IoT module using UART.

2.2. Software Module

2.2.1. Overall Plan

As can be seen from the system diagram in Figure 1.1, the software design of this platform includes three parts: physiological information acquisition terminal equipment, cloud server

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equipment and communication program design.The overall software scheme diagram is shown in Figures 2 and 3.

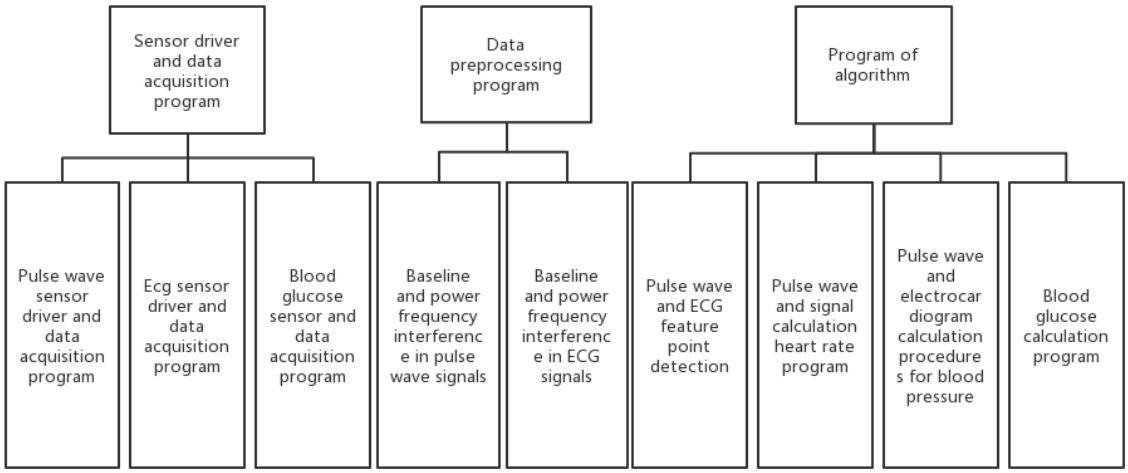

Figure2 Software overall plan a

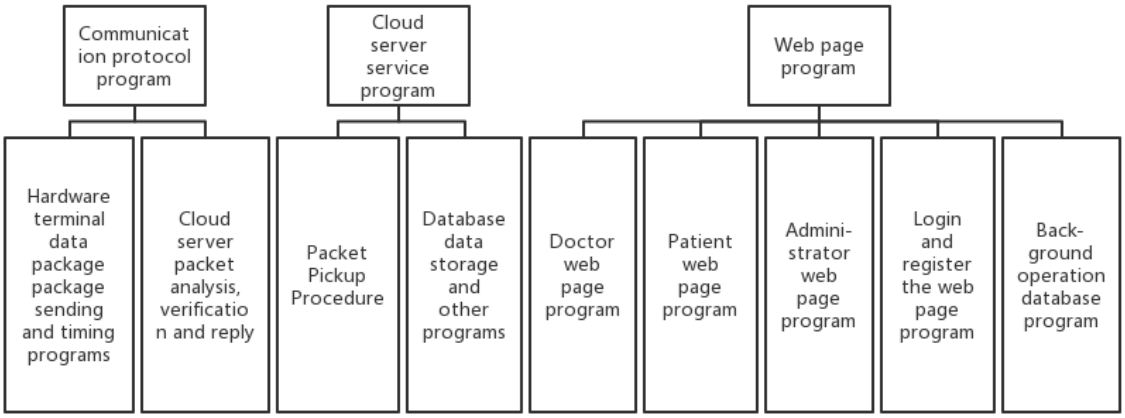

Figure3 Software overall plan b

2.2.2. Design and implementation of cloud server service functions

Since NB-IoT needs to communicate with servers with public IP addresses, cloud server equipment is rented as the communication server device, and Mysql database and Apache server are built on the basis of it to realize data storage and network pages.

One of the main tasks of the cloud server side is to receive and analyze data packets transmitted through the NB-IoT module. Since the NB-IoT chip integrates the UDP client program, in order to realize the communication between the server side and the NB-IoT module, The server side needs to implement the server side program of UDP protocol. After the communication connection between the server side and the hardware side is established, the server side can receive the data packet sent by the hardware side. The server side analyzes the data packet, analyzes the field data in the data frame, and calculates the second to fourth field data in the data frame by CRC algorithm. The calculated value is compared with the parity data in the data frame. If the value is different, the NACK message of the hardware device is returned.If so, an ACK message is returned.For data frames with no exceptions, you need to insert the data into the database, obtain the handle of the form corresponding to the data type before storing the data into the corresponding form, and release the database handle after data storage. In this way, the server completes a data processing.

2.2.3. Database design and implementation

The user table, patient table, doctor table, equipment data table, doctor patient contact table, equipment binding table, service schedule, case table, system setting table, purchase record table, blood glucose record table, heart rate record table, blood oxygen record table, blood

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pressure record table and user data table are designed according to the requirements. The purpose of this design is to classify and store the data of different structures. Data of different structures are independent of each other. In order to establish associations between independent forms, the forms are associated with primary keys and foreign keys. The primary key represents the unique and non-repetitive identification of the form, while the foreign key represents the primary key of other forms.

2.2.4. Web design

The design of web page system is divided into two parts: the front end design and the back end design. The front end design is mainly to design the overall rendering effect of the page and the jump between the pages. The back end design is mainly to realize the data association between the database forms, the data interaction between the page and the database, and to process the information submitted by the page end.

The core goal of the web system is to realize the terminal page that interacts with users. Users can browse the user page on mobile phones, computers and other devices, and all kinds of data and medical record information can be intuitively displayed on the page. In addition, the design advantage of the web page is that it can be compatible with different mobile terminal devices, and users do not need to worry about the installation of additional software due to the replacement of the terminal. To a large extent from the technical level to solve the user will encounter the problem

The navigation bar of the computer terminal is used to display all the page function modules, while the mobile terminal will collect all the page functions in the navigation bar due to the limitation of resolution. Users can slide down the screen of the mobile phone and see all the page function modules, which are the same as those seen on the computer terminal. Moreover, the web pages of the two different terminal devices do not appear confused.The webpage includes five parts: automatic configuration module page, administrator module page, public module page, doctor module page and patient module page.

1. The design of automatic configuration module page enables the web page system to be easily and quickly deployed and migrated on the cloud server device, which greatly reduces the time required for manual deployment of the system. The deployment environment refers to connecting to the database, generating designed data tables in the database and generating administrator and user data.

2. The page design of administrator module includes the design of administrator login page, doctor management page and user management page. The doctor management page allows the administrator to review the application for registration of doctors, and can perform the operation of approval or rejection;The user management page can view the user list information, check the user balance and recharge for the user.

3. The design of the page of the public module includes the design of the page of registration, login, password forgetting and device binding, etc., realizing the functions of user registration, user login, password retrieval and device binding for users.This module will involve relatively private account password and device identification code and other data, so it will be designed in an encrypted way.

4. The page design of doctor module includes the function of viewing patients' physiological data, filling in medical records, modifying medical records and distributing, etc. On the page of viewing patients' physiological data, you can see all patients who have signed a contract with the doctor, and check the details of a patient's physical monitoring physiological data. Doctors can write medical records for the patient according to the physiological data of the patient. The medical record may be kept or issued as a draft.

5. The page design of patient module includes service management page, equipment management page, physician management page, medical record management page and data

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modification page. The service management page includes the functions of purchasing services and viewing service purchase records. Authorize the physician to see the medical monitoring data for the purpose of providing health advice and writing medical records.The device management page includes viewing the device currently bound to the patient, and inquiring the monitoring physiological data functions of blood pressure, heart rate, blood oxygen and blood glucose devices.

3. Development prospect

The family health management platform is not only simple to operate, but also can carry out health management for patients to assist them in scientific and effective treatment of chronic diseases. In addition, with the development of sensor technology in the future, more physiological sensors can be added to this platform so as to carry out more comprehensive health management for patients, and the platform framework does not need to be changed. We only need to add new functions to this framework, so as to realize the upgrade and expansion of platform functions.

With more and more types of physiological data acquisition sensors and more and more mature technology, many physiological detectors can be purchased on the market, so that users can easily understand their own physiological data. The idea is to integrate the functions of physiological detectors related to chronic diseases into the health management platform, and doctors with professional knowledge. So that patients can be treated at home for chronic diseases. With the increase of the number of patients and the relative concentration of medical resources, the management platform is based on reducing the burden of medical resources and assisting patients with scientific and effective treatment. This platform will certainly benefit the society. Although the platform is not comprehensive enough in the detection of chronic diseases, in the future, with the emergence of new technologies, the platform will be more and more perfect, and really benefit patients with chronic diseases.

Acknowledgments

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