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Research Article

Research on the Smart Medical System Based on NB-IoT Technology

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In recent years, with the constant development and integration of Internet technology, Internet of Things technology, and intelligent terminal technology, to make people's work and life more comfortable and convenient, these new technologies have been more and more widely used in daily home life such as social education, agricultural production, industrial production, medical, and other fields. However, at present, there are still a lot of room for development in the application of new technologies in the medical and health industry. Especially in the context of hospital information construction and medical difficulties, the functions of fixed information points such as traditional nurse stations and doctor stations no longer meet the growing medical needs of people. Therefore, how to introduce these new technologies and design to a practical and low-cost intelligent medical information management system that realizes the convenient management and efficient management of medical personnel has become a top priority. In view of the problems faced by the hospital, this paper proposes an intelligent medical plan based on NB-IoT technology and develops a smart hospital information management system. Test results indicate that patients can easily and conveniently register their appointments through the Android mobile client. Through checking medical records and hospital news updates, medical staff can more easily complete their work. Comparison results of performance variance between the common server and adaptive algorithm web server demonstrate that an adaptive load balancing algorithm can achieve a more accurate allocation of the load. Therefore, the web smart medical information management platform can manage hospitals more comprehensively.

1. Introduction

At present, with the continuous development of information technology, people's material living standards have been significantly improved, and the hospital's informationization construction has also achieved certain results [1–4]. Intelligent medical care has become a new direction and goal of hospital informationization and intelligent construction. The emergence of Internet of Things technology has greatly promoted the informationization and intelligent construction in the medical and health field [5]. The huge application space of Internet of Things technology in the field of medical construction has been widely concerned and studied by medical administrators and academic staff [6, 7]. At present, the vast majority of developed countries in the world have begun to apply the Internet of Things technology to the construction of medical and health fields in order to promote the reform of the medical and health system and provide the people with intelligent medical and health services that are available at any time [8]. In the process of establishing intelligent medical care in China, the Internet of Things technology will play a more important role, providing technical support for the intelligent management of personnel and equipment in hospitals to meet the needs of current medical information management and equipment fields. In management and public health security, smart management is needed to improve the overall level of medical and health services and eliminate potential safety hazards [9]. Therefore, it is of great significance to carry out research on the application of Internet of Things technology in the field of intelligent medicine [10, 11].

The concept of the Internet of Things (IoT) has received worldwide attention since its inception and has quickly become a research and application focus driven by academia and government [12, 13]. Among them, the EU has identified it as a strategic development plan for information and communication technology in Europe [14]. Asian countries such as Japan and South Korea have also proposed plans to accelerate the construction of IoT infrastructure and have made many substantial advances in the popularization and application of the Internet of Things [15]. At the same time, China has also vigorously promoted the research and application of Internet of Things technology from the national strategic level and at the same time integrated emerging technologies such as the Internet of Things with traditional industries to achieve a win-win situation for scientific and technological progress and economic development [16–18]. Among the many technologies in the Internet of Things, the earliest and most widely used RFID technology is the most comprehensive and promising RFID technology [19]. This technology utilizes the transmission characteristics of radio frequency signals to achieve automatic contactless identification of items. Compared with barcodes, QR codes, optical recognition, ultrasonic recognition, and biometrics (including voice, face, fingerprint, and iris), RFID has an automatic recognition technology with non-line-of-sight range, which has strong interference resistance and carrying ability. The obvious advantages are low production costs and relatively long working life. Therefore, it is widely used in commodity logistics, raw material supply chain, assembly line manufacturing, automatic vehicle identification and billing, security access control systems, intelligent library management, and many other fields [20, 21].

There are a lot of studies on smart medical care at home and abroad. Zheng et al. have realized the key content and core technologies of intelligent medical care tracking and health management informationization based on the Internet of Things, including the integration of medical devices and information and the collection of medical health, intelligent data analysis technology, personalized intelligent medical service recommendation technology, user privacy information protection, and network security technology [22]. Zuo and Yang Guoliang summarized the internal relationship between hospital informationization and smart medical care and also summarized the status and trends of hospital informationization and smart medical development at home and abroad. Combined with the practical experience of hospital intelligent medical innovation application, a patient-centered smart medical application model is proposed from the aspects of core technology and application prospects and effects [23]. Yang et al. have proposed and designed a registration system based on Android devices to solve the problem of the difficulty of traditional appointment registration. Based on the related technologies of Android client development, the C/S architecture of Android, Web, and MySQL libraries is designed. The mobile terminal sends a reservation request to the server through the wireless network, and the server uses the Servlet technology to implement the reply of the application and then accesses the database through the JDBC technology and transmits the accessed data to the mobile terminal. The mobile terminal uses the HTTP client to exchange information with the server, and the data transmission format is JSON format. Finally, the design of each functional module of the mobile terminal, the design of various interfaces, and the design of the database to be used are completed [24]. da Costa et al. studied different methods of data collection and integration of hospital vital signs, considering common heuristic methods, such as weighted early warning scoring system, analyzing the possibility of using intelligent algorithms, and proposing patient data integration in hospital wards—the possible directions to improve efficiency, optimize resources, and reduce patient health deterioration [25]. Park et al. proposed a scheme providing a way to describe profiles, data abstraction procedures, and functionalities that support the building of context information sets derived from raw data sets in the manner of a semantic web stack [26]. Shao et al. [27] proposed the idea of combining incremental learning with active learning to fine-tune the prediction model to improve prediction accuracy in special situations.

Jerbi et al. proposed and developed a secure cryptographic protocol called CoopECC that leverages the organization of IoT nodes into clusters to distribute the load of cluster head (CH) among its cluster members. Simulation results show that the proposed protocol CoopECC outperforms the original ECC algorithm, in terms of computation time, consumed energy, and the network's life span [28].

In view of the problems faced by hospitals, this paper proposes an intelligent medical plan based on NB-IoT technology and develops a smart hospital information control system. Through this system, patients can easily register and view medical records and hospital news updates through the Android mobile phone client; and medical staff can more easily complete their work. And this paper conducts a simulation to verify the performance of the system.

2. Proposed Method

2.1. Internet of Things Technology

2.1.1. The Concept of Internet of Things Technology. The development of the Internet of Things is the third wave of information development and an important stage of development in the information age. The Internet of Things is a network of "objects and objects," that is, based on the original Internet, communication networks, and information identification devices such as radio frequency identification, infrared sensors, and IoT protocols. The wired and wireless world extends users to any project, enabling any project to connect to the Internet, exchange information, and communicate. Computers analyze large amounts of data and perform intelligent identification, track location, further tracking, and management. Its main purpose is to connect goods and objects through the network to achieve mutual communication and coordination. It integrates computer networking and communication and sensing technologies into a wide range of applications. The Internet of Things has expanded from traditional logistics to transportation, urban management, power grids, education, and health care.

In general, the research and development of the Internet of Things is still in its infancy, both domestically and abroad. Experts and scholars in different fields have different views on the research of the Internet of Things. The understanding of the location and characteristics of the Internet is not uniform. For this framework model, standard systems and key technologies still lack a definition of effectiveness.

The general definition of the Internet of Things—the English name of the Internet of Things: Internet of Things (IoT), also known as Web of Things—refers to various information sensing devices, such as radio frequency identification (RFID) technology, global positioning systems, sensors, laser scanners, infrared sensors, gas sensors, and other equipment and technology to collect any real-time need to monitor, connect, interact, and collect sound, light, heat, electricity, mechanics, chemical objects or processes, biology, location, etc. The information is a huge network formed by Internet integration. The goal is to facilitate the identification, management, and control of objects and objects, objects and people, and connections between all projects and the network. Based on this general definition, the Internet of Things is a sensor network connected to the Internet. It connects to the wireless network through electronic tags, sensors, QR codes, and interfaces embedded in objects, providing intelligence to objects and enabling communication between people and objects—a dialogue between inanimate objects, that is, an intelligent dialogue between objects.

2.1.2. The Main Communication Technology of the Internet of Things. At present, the Internet of Things wireless network technology can be mainly divided into radio frequency technology, infrared technology, IEEE 802.11b and IEEE 802.11a protocol technology, HomeRF protocol, ZigBee technology, and GSM technology. Among them, the radio frequency technology is very mature, the cost is low, the permeability is good, but the interference resistance is not ideal, and the safety is flawed. The most serious problem is that it has not yet established a consistent standard. The communication protocols of different products of different companies are also very different. Infrared technology is a relatively mature technology, but it must be connected within the line of sight. It is too restrictive and not suitable for us in the usual sense. Medical Network; IEEE 802.11 is a wireless LAN standard developed by the IEEE (Institute of Electrical and Electronics Engineers). Its business is mainly limited to data access. It is used to solve wireless access between terminals in office LANs and campus networks. The IEEE Group has introduced two new standards IEEE 802.11a and IEEE 802.11b because IEEE 802.11 cannot meet the demand for speed (up to 2 Mbps) and transmission distance; IEEE 802.11b and IEEE 802.1la are high-speed transmission protocols. The quality of the communication signal is high and expensive, and they are more suitable for office wireless networks. The HomeRF wireless standard consists of open industry standards developed by the HomeRF working group to enable wireless communication between computers and other electronic devices. Because the HomeRF network does not have a password, it is less secure. Its anti-interference ability is very poor; although ZigBee technology and Bluetooth technology belong to the IEEE802.15 protocol, there is overlap in a certain range, but their respective technical characteristics determine that their application focus is still very different. As a low-power, low-data-rate, low-cost technology, ZigBee is more suitable for communication between home automation, security systems, and low-cost devices that perform low-data-rate transmissions. The GSM communication technology is the most widely used communication network technology in the world and is suitable for industrial production. It provides short message service (SMS) mechanism and stable performance and has two-way data transmission function, providing powerful communication for data remote transmission and monitoring equipment. The platform is supported, and since the GSM network has no limit on the number of users, it adapts to the scale requirements of the terminal instrument and realizes nationwide networking and roaming. The network work has been completed, the user can use it directly, and the network coverage is wide. While ensuring powerful network functions, it saves customers a lot of network construction time and network maintenance costs.

2.2. NB-IoT Technology

2.2.1. NB-IoT Network Architecture. The traditional LTE network technology design focuses on high bandwidth and fast response on demand. However, the emergence of NB-IoT technology is more than the traditional LTE network technology. The biggest feature is the number and variety of terminals and low power consumption. In the era of rapid development of network technology, the current LTE network design is very backward, which cannot meet the needs of practical applications. To meet the connection requirements of application terminals based on NB-IoT technology, 3GPP to LTE network, the overall architecture and process have been improved.

As shown in Figure 1, the NB-IoT terminal is connected to the base station eNodeB through an interface, performs interface access processing and management functions in the base station eNodeB, and is connected with the IoT core network through the S1-lite interface, and the high-level processing unit IoT platform receives data transmitted from the core network and distributes to different types of application servers receiving different types of data for application services.

In order to send the Internet of Things data to the application, the cellular Internet of Things defines two optimization schemes in the evolved packet system. One is

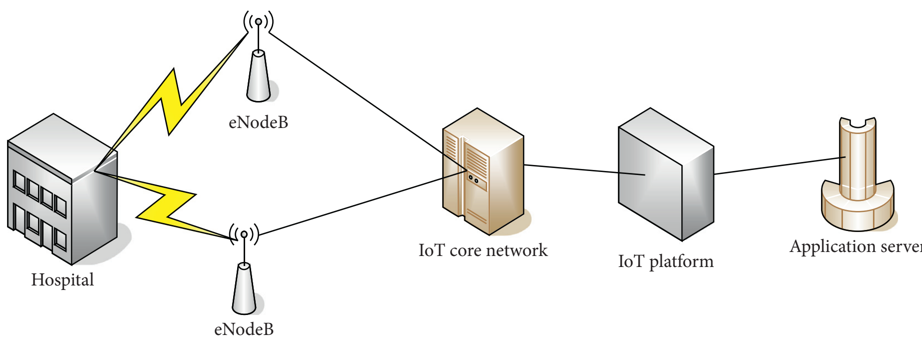

Figure 1: NB-IoT end-to-end system architecture.

the CIo TEPS user plane function optimization, and the other is the CIo TEPS control plane function optimization, as shown in Figure 2. The CIo TEPS control plane function optimization scheme is indicated by a solid line in the figure, and the CIo TEPS user plane function optimization scheme is indicated by a broken line in the figure. CIo TEPS control plane function optimization: uplink data are transmitted from the base station eNodeB to the MME, where the transmission path is divided into two branches: transmitted to the PGW through the SGW and then transmitted to the application server, or connected to the application server through the SCEF, the latter only supports the non-IP data transfer. The downlink data transmission path is opposite to the uplink data transmission path. This scheme does not need to establish a data radio bearer, so this scheme is often used when performing nonfrequency small packet transmission. CIo TEPS user plane function optimization: This data transmission method is the same as traditional data traffic, sending data on the radio bearer, first transmitting the data to the SGW, then to the PGW, and finally transmitting the data to the application server. The data transfer method of this scheme generates additional overhead when establishing a connection but is relatively faster in the transmission of a packet sequence.

2.2.2. NB-IoT Key Technology. We can divide the structure of the Internet of Things into three different levels according to different functions. Functions from top to bottom are the application layer, the middle layer, and the sensing layer, respectively. In order to make it easier for everyone to understand, computer is selected as a metaphor: the bottom sensing layer is equivalent to the input and output devices in the computer system, such as keyboard and mouse. The main function is to obtain external information. The second is the middle layer. It is like a bus system and a storage system in a computer system. Its main function is to transfer and store information acquired by the sensing layer. The top application layer is equivalent to the CPU in the computer system, processing and calculating the information transmitted from the middle layer and explaining what to do next.

Perception layer: to achieve data collection and perception, the main role is to perceive the recognition and recognition of objects and collect event information. The main role is to collect physical events and data in the physical world, various identifications, physical quantities, sound, image monitoring data, two-dimensional codes, RFID tags, and pilot/writer, including sensors, sensor networks, cameras, intelligent terminals, and so on.

The middle layer: it has the ability of network transmission and information intensive processing to realize a wider range of interconnection functions. The sensor network mobile communication is integrated with technologies such as the Internet to transmit the perceived information with high reliability and high security.

Application layer: it includes industry-level applications such as smart appliances, intelligent transportation, smart medical, intelligent logistics, and smart power. In the application layer, a smart application solution that combines and implements ubiquitous networks and business processes is present. By implementing the ubiquitous network application layer, you can achieve the integration of ubiquitous network technology and industry trends and create real value for society.

2.2.3. Characteristics of NB-IoT Network. In the more than 20 years of the development of the Internet of Things, most of the methods used have been targeted at specific industries or nonstandardized solutions. The disadvantages are poor security, low reliability, and high maintenance costs. After so many years of development of the Internet of Things, we can conclude that standardization is a key factor in the success of IoT communications. The main criteria for the communication between the Internet of Things and traditional cellular communication are as follows:

(1) The Internet of Things application is the Internet of Everything, so the number of terminals that need to be connected is huge, and the number of connections is relatively small for traditional cellular communication

(2) Because there are numerous devices connected to IoT communication, ultra-low power consumption is required to maximize resources

(3) IoT applications need to have excellent coverage and penetration to ensure that they do not lose signals, which fundamentally guarantees the success of IoT systems

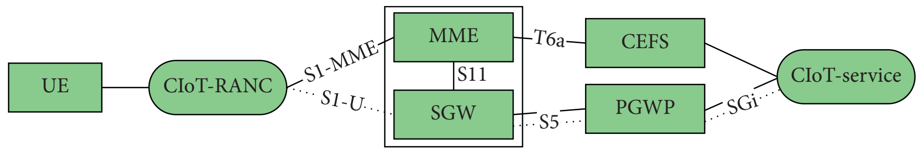

FIGURE 2: NB-IoT refinement overall architecture diagram.

NB-IoT technology has the following four characteristics:

(1) Power Saving Technology. In modern mobile network communication systems, terminals do not always work with the network, and usually there is no data upload and download. Therefore, under the principle of ensuring effective transmission of the terminal system and the network, the DRX (discontinuous) receiving mechanism is also called discontinuous reception. The terminal can enter sleep mode. During the sleep process, the transceiver (Tx/Rx) is disabled. Because it does not need to monitor the network channel, it must be taken out of the sleep state. In order to achieve power saving, based on the NB-IoT technology, the IoT terminal after the data are sent enters the sleep mode, waits until the timer is turned off, activates the wake-up terminal and collects the real-time data uploading network, and then enters the sleep state after the data are successfully transmitted. The loop is the terminal and will be in a static state for a long time, reducing unnecessary losses and extending the operating cycle and life. The NB-IoT technology has the advantage to adapt to the requirements of different applications in practice, hence becoming the most popular emerging Internet of Things technology.

(2) Strong Coverage Technology. The 3GPP standards organization defines the coverage capabilities of NB-IoT, which require more than existing GSM and LTE networks. Increase coverage by at least 20 dB. The NB-IoT strong coverage technique consists primarily of improved power spectral density and repetition and time diversity techniques. The gain of the narrowband is measured by PSD (power spectral density). The NB-IoT uplink carrier bandwidth is 3.75/15 kHz. Compared with the existing 2G/3G/4G uplink 200 kHz (excluding the protection bandwidth, actually 180 kHz), the PSD gain is about 11 dB: log ((200 mW/15 kHz)/(200 mW)/180 kHz) = 10.7 dB. That is to say, the NB-IoT unit has a higher bandwidth than the 2G/3G/4G, so it can cover longer distances under the same conditions. The gain due to repetition is related to the number of retransmissions and demodulation performance, and the theory can be improved by 9–12 dB (repetitive downlink data transmission). NB obtains time diversity gain by repeated transmissions and uses low-order modulation mode to improve demodulation performance and enhance coverage.

(3) Large Connection Technology. First, it is determined by the traffic model and the user distribution model. The NB-IoT base station is designed based on the Internet of Things model. The model of the Internet of Things is different from mobile phones. The traffic model is that the number of terminals is large, but the amount of data packets sent by each terminal is small, and the delay of transmitting data is not high. The current 2G/3G/4G base station is designed to ensure that users can conduct business at the same time and greatly guarantee delay. Based on this method, the number of connections or the number of accesses between users is controlled to be approximately 1 k (400 for a single cell). However, based on NB-IoT, service latency requirements are not high and more user access can be added during design. This allows terminals of approximately 50 k to be in one cell at the same time, and a large number of nonworking terminals can be in a dormant state, and the sleep time control mechanism is maintained by the base station and the core. The network, once there is data transmission, can quickly enter the active connection state. Second, the efficiency of uplink scheduling is small, and the efficiency is high. NB-IoT is based on narrowband technology with smaller bandwidth and smaller uplink scheduling particles. Resource utilization will be higher under the same resources.

(4) Low Cost. Compared with LoRa, NB-IoT does not need to re-establish network RF, which is basically multiplexed. Taking China Mobile as an example, the frequency band of 900 MHz is relatively wide. Only a part of the 2 GHz frequency band needs to be cleared, and the simultaneous deployment of LTE and NB-IoT can be directly performed. Low speed, low power consumption, and low bandwidth also bring low-cost advantages to NB-IoT chips and modules.

2.3. Adaptive Algorithm for Fuzzy Control. There are many adaptive methods for fuzzy control, which have many classifications, such as direct adaptive fuzzy control, indirect adaptive fuzzy control, hybrid adaptive fuzzy control, or recursive least squares-based adaptive. Fuzzy adaptive control and other design adaptive algorithms are because simple fuzzy control sometimes cannot fully describe the system, or the general fuzzy control algorithm has certain defects in the absence of expert experience. Therefore, these control rules are constantly changing during the control process. These parameters allow the fuzzy controller to be close to the optimal controller. This method is also based on the idea that the adaptive law of certain parameters in the fuzzy controller is designed to achieve self-adaptation. This paper uses direct adaptive fuzzy control. Direct fuzzy adaptive control is used in nonlinear controllable specification systems, which is expressed as

$$\begin{aligned} x(n) &= f\left(x, x^{(1)}, \ldots, x^{(n-1)}, +bu\right), \\ y &= x, \end{aligned} \tag{1}$$

where f represents an unknown continuous real function and b represents an unknown normal number. Since f is an unknown real continuous function, using conditional statements instead of f, the adaptive fuzzy control is expressed as

$$\text{If } E_i = A \text{ and } E_i = B, \text{ then } U_i = C. \tag{2}$$

These fuzzy control statements are elements of the fuzzy rules table that make up the server. The last parameter in these control statements is the elements of the server fuzzy rules table, which are variable parameters, and the adaptive algorithm continuously corrects these parameters and outputs them. y can be closer to the desired trajectory. In this system, the output is the difference in performance of the three web servers; therefore, it is a straight line with $y = 0$.

A direct representation of the adaptive fuzzy controller is expressed as

$$u = u_D(x|\theta), \tag{3}$$

where u_D represents the fuzzy system, and θ indicates the variable parameters.

The fuzzy controller was finally designed as

$$u_D(x|\theta) = \frac{\sum_{l_1=1}^{m_1} \cdots \sum_{l_1=1}^{m_n} \overline{y}_u^{l_1 \ldots l_n}\left(\prod_{i=1}^{n} \mu_{A_i}^{l_i}(x_i)\right)}{\sum_{l_1}^{m_1} \cdots \sum_{l_1=1}^{m_n}\left(\prod_{i=1}^{n} \mu_i^{l_i}(x_i)\right)}, \tag{4}$$

where $\overline{y}_u^{l_1 \cdots \mathrm{ln}}$ represents a variable parameter. When the formula (4) is taken int the set θ, the fuzzy controller is obtained as

$$u_D(x|\theta) = \theta^T \xi(x), \tag{5}$$

where $\xi(x)$ is the $\prod_{i=1}^{n} m_i$ dimension vector. The Lyapunov function can be defined as

$$V = \frac{1}{2} e^T P e + \frac{b}{2\gamma}\left(\theta^* - \theta\right)^T \left(\theta^* - \theta\right), \tag{6}$$

where γ represents a normal number, and P_e denotes a positive definite matrix and satisfies the Lyapunov equation, which is expressed as

$$\Lambda_e^T P + P\Lambda_e = -Q, \tag{7}$$

where Q represents an $n \times n$ positive definite matrix. By deducing,

$$\dot{V} = -\frac{1}{2} e^T Q e - e^T p_n b\omega, \tag{8}$$

where

$$\dot{\theta} = \gamma e^T p_n \xi(x), \tag{9}$$

where P_n is the last column of P, which is the adaptive law of θ.

$$Q = \begin{bmatrix} 50 & 0 \\ 0 & 50 \end{bmatrix}, \Lambda_e = \begin{bmatrix} 0 & -1 \\ 1 & 10 \end{bmatrix}, \gamma = 50 \tag{10}$$

Take the formula (10) to design the adaptive law and calculate θ. Since the parameters need real-time correction, it is necessary to modify the fuzzy control rules in real time and design fuzzy rules to meet the following requirements.

$$\text{If } E_i = A, \text{and } E_i = B \text{ then } U_i = N, \tag{11}$$

where N is the specific control output value, and A and B are the fuzzy languages.

Therefore, the general fuzzy control rule table is converted to Table 1.

3. Experiments

3.1. System Function Analysis. In order to realize different functions for different needs of different patients, the whole system consists of Android terminal and web server. By adapting existing systems, it is more adaptable to new user needs. This paper divides the smart medical system as follows.

3.1.1. Android Terminal. The Android terminal is mainly for patients who are visiting the doctor, which realizes the following functions: the patient can log in to the system through the mobile terminal and can check information about the outpatient expert on the Android terminal, such as the length of medical treatment, the depth of qualification, and the reputation of the word of mouth. After knowing the doctor's information, the patient can make an appointment online, which is convenient and quick to operate, without wasting a lot of time to queue up in the hospital. At the same time, the patient can also check the medical records and consumption records at any time. The function of the Android terminal is depicted in Figure 3.

4. Discussion

4.1. Experimental Analysis of Load Balancing Algorithm. The experiment of general fuzzy control algorithm and the experiment of adaptive fuzzy control algorithm proposed in this paper are conducted. The performance data of web servers is obtained at every 10 seconds in the experiment, and the variance is obtained as in Figure 4.

The variance of the web server performance under the common algorithm has been fluctuating around 0.032. However, it has not caused a large fluctuation, and there is no such problem that only one server is seriously overloaded at a certain point in time and other servers are inactive,

Table 1: Server fuzzy rule table.

	$N3$	$N2$	$N1$	$P1$	$P2$	$P3$
$N3$	6	4	2	−2	0	−2
$N2$	6	4	2	−2	0	−2
$N1$	4	2	0	0	−2	−4
$P1$	4	2	0	0	−2	−4
$P2$	2	0	−2	2	−4	−6
$P3$	2	0	−2	2	−4	−6

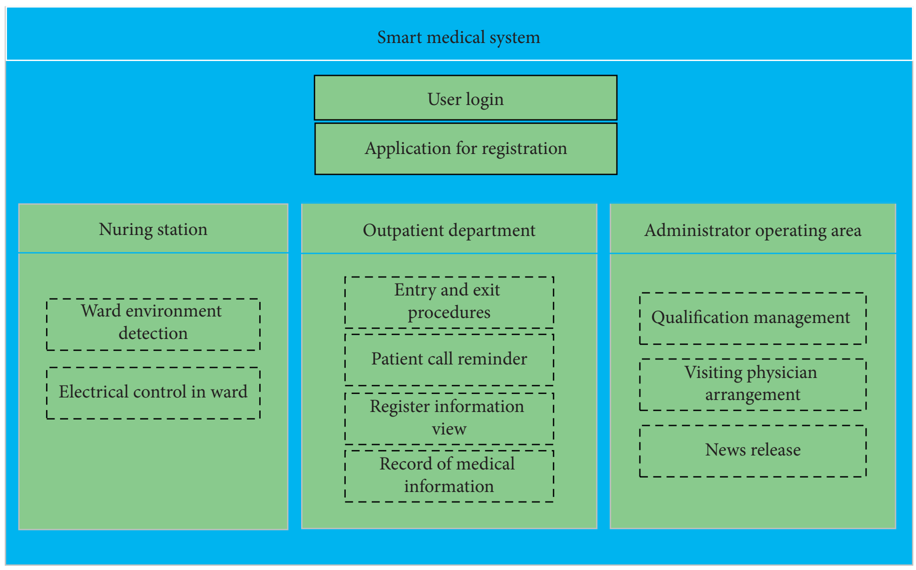

Figure 3: The function of the smart medical information system.

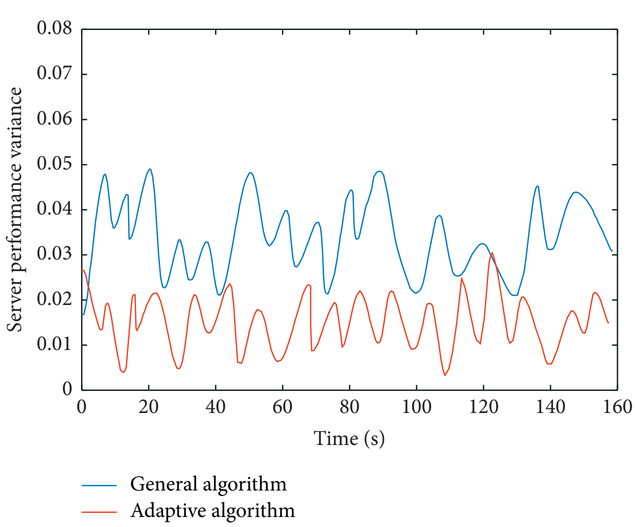

Figure 4: Comparison of performance variances between the common server and adaptive algorithm web server.

which means that the variance of this algorithm is relatively stable, and the algorithm has better stability. However, the mean variance is slightly higher than the mean of the variance of the adaptive load balancing algorithm, which is the result of the inaccuracy of the fuzzy control rules, which indicates that the fuzzy rules of the initial design may be biased or incorrect. It can be seen from Figure 4 that when the adaptive load balancing algorithm is used, the variance of web server performance has been fluctuating around 0.0116. Consequently, the control system can achieve a more accurate allocation of the load, and the performance variance is relatively small. The experiment shows that the fuzzy control rules are more accurate after correction, and this algorithm also maintains the advantage of the stability of the general load balancing algorithm. The variance curve does not appear to have large fluctuations, and there is no divergence.

4.2. Implementation of Some Functions of the System. After installing the app to the Android phone, click the app icon. The first step is to open the login interface. The login interface is presented in Figure 5. If there is no account, the user can click the "Registered" button to make the registration and register a new account. If the user has an account, input the user's name, password, and verification code. When these three are correct, the user will enter the system. After the user successfully logs in the platform, the program jumps to the function operation interface, and the operation surface is as shown in Figure 6. The operator interface provides users with seven main functions: telemedicine, news, health education, consulting doctors, medical records, appointment registration, and overhead records.

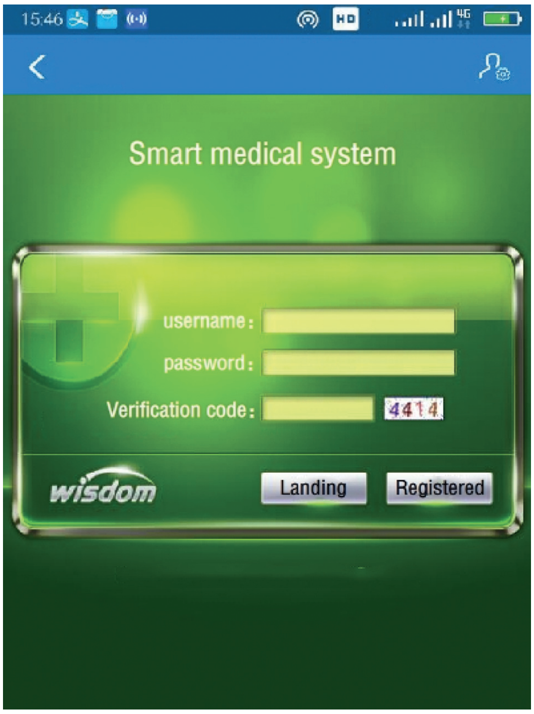

Figure 5: Android terminal login interface.

Figure 6: Android terminal system operation interface.

After the user successfully logs out through the system, the system will feed back a reservation result for the user and the information of the registered department, the attending doctor, the time of the appointment, the location of the clinic, the name of the patient, and the like, as shown in Figure 7.

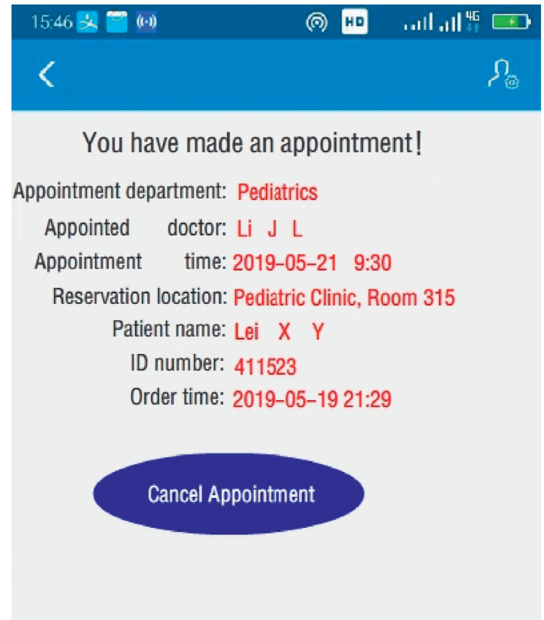

Figure 7: Appointment registration information feedback.

5. Conclusions

Based on our research, the following conclusions are drawn:

(1) This paper first introduces the current development status of smart medical care, then analyzes the functional requirements and feasibility of the smart medical system in detail, and draws the overall functional framework of smart medical system. Then, according to NB-IoT technology and IoT theory knowledge, a detailed system design method is proposed for smart medical treatment. According to the system to be designed, the feasibility of the system implementation is proved.

(2) This paper deeply studies adaptive fuzzy control and learns the practical application based on the basic knowledge of adaptive fuzzy control. The design of adaptive fuzzy control is applied to the load balancing algorithm, and the load balancing algorithm based on adaptive fuzzy control can provide a powerful control theory and method for the smart medical system.

(3) In view of the problems faced by the hospital, this paper proposes an intelligent medical plan based on NB-IoT technology and develops a smart hospital information control system. Test results show that patients can easily and conveniently register their appointments through the Android mobile client. Medical staff can more easily complete their work via checking medical records and hospital news updates. Comparison analysis of performance variance between the common server and adaptive algorithm web server indicates that the adaptive load balancing algorithm can achieve a more accurate allocation of the load. Therefore, hospitals can be managed more

comprehensively by means of the web smart medical information management platform.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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