Introduction

In reality, there are many problems in medical care management, such as emphasising money over materials, paying more attention to buying and not managing, the medical care management system and internal control system are not perfect, the utilisation rate is low, and the supervision before, during, and after the event is ineffective. Strengthening the management of medical care has become a major issue for hospitals to strengthen economic management. To improve the way of medical care management, it is necessary to use modern advanced technology to improve or even replace the existing methods, so as to improve the degree of automation of medical care management. Automatic identification and data collection 5G network technology provides a reliable and efficient method of automatic identification and transaction management. It realises the two processes of data collection and data transmission through one technology [1]. Compared with the backward manual data collection and transmission method, it can effectively save time and reduce the probability of errors, which is in line with the future development trend. For medical care management, the advanced automatic identification technology-radio frequency identification technology is selected as the technical means, and the medical care management system based on RFID technology is the focus of this paper.

The hospital began to carry out nursing management. Use the establishment of electronic files to facilitate the updating and transfer of nursing care. Because it is controlled by a computer system, it can make nursing management more rational [2]. However, there are also corresponding drawbacks. Using the form of scanning code for management will increase the working time of the staff and cause the staff to make mistakes. RFID technology is a new type of radio identification technology. The application in
the medical management system obtains nursing signals in real time through a specific reader. This approach greatly saves nursing management time and facilitates the application and management of medical care.

The nursing system application accurately and in real time records the operations of medical staff in the clinical information system, which aids in the monitoring of nursing quality. How much is the difference between the actual execution time and the time required by the doctor’s order during the actual execution process, when the clinical nurse took medicine or injected the patient? If the doctor’s order was not executed for any reason, it can be viewed and generated at any time. Various statistical reports are available. Furthermore, with this information, it is possible to determine which orders are carried out by each nurse, as well as the actual workload of clinical nurses, providing an objective goal for nurses to reward hard work and punish laziness, and to better allocate nursing human resources throughout the hospital.

For this purpose, RFID technology is a type of non-contact automatic identification. It is also a limitless communication technology. Radio signals are used to identify specific objects and to read and write data about them. It is not necessary to distinguish between the system and a particular object. There is a mechanical or optical contact [3]. RFID technology is being used in a medical care management system. It will make medical care management much more efficient. RFID has a long history as a technical tool, but its application has grown and developed rapidly in recent years. The use of RFID in the industry has recently become a hot topic of discussion. This new high-tech application can be found in scientific and technological circles, as well as business, industrial, and fashion circles. The development and application of radio frequency identification technology will be a technological revolution in my country’s automatic identification industry, and achieving a mature and comprehensive application of radio frequency identification technology in my country will be a long-term process that will necessitate our joint efforts [2].

The innovations of this paper are integrating RFID technology with the current advanced 5G network architecture and applying it to medical care management. If this system management is successfully applied, it will help to change the long-term difficult management of medical care, and promote the current. The ward management system is reformed, and the degree of automation of the medical service is improved at the same time.

The structure of this paper is arranged as follows: Chapter 1 introduces the related applications and research of 5G network architecture and RFID technology in other fields; Chapter 2 introduces the principle and development of RFID technology in detail; Chapter 3 integrates 5G network architecture into RFID. The advantages of the system are introduced in the technology; the fourth chapter designs the overall system process of RFID technology that integrates 5G network; the fifth chapter applies the system to the medical care system; the sixth chapter summarises the full text.

2. Related Work

In terms of RFID standardisation research, work began in the 1990s, and there is currently no unified RFID standard in use anywhere in the world. There are currently three major RFID standard systems in use around the world. The ISO/IEC18000-6 standard was developed by ISO. ISO/IEC18000-6 Second edition, which was published in December 2010 [4], is the most recent version. A. Banchs, D. Gutierrez-Estevez, M. Fuentes, and others test the use of wireless sensors and RFID technology to improve the company’s logistics warehouse management. The experiment’s main goal is to manage goods storage space in order to ensure that they are placed in the correct location [5]. T Han, S Zhu, B Xie, and colleagues combined RFID and wireless sensor technology to improve food storage management. The system is capable of managing product freshness and accurately identifying rotten and deteriorated commodities. IntelliTrack has also created an Android-based inventory management solution. It can easily read RFID tags and barcode information using Android smartphones as an information collection tool, making inventory management more convenient and efficient [6]. According to the current state of warehouse management, Alsinglawi B et al. proposed an optimal design scheme for a warehouse management system based on RFID technology, and detailed the design principle and implementation of the system. The system achieves a technological breakthrough by cleverly applying RFID technology to warehouse management links such as receipt, picking, inventory, adjustment, and shipment. Chung SH, X Zhang, Han-Xiong LI, X Zhang, Han-Xiong LI, X Zhang, and Han-Xiong LI to carry out centralised management of wireless resources, and the access network separates the control and data planes and uses a centralised processing method. The core network, for example, primarily employs the separation of control and data planes to perform tasks such as offloading and flexible routing [7]. This method, which uses virtualisation technology, can improve the openness, flexibility, and scalability of 5G core network architecture while also utilising cloud computing and big data technology. The 5G network’s business is analysed and processed, the 5G network’s business perception and user behaviour abilities are improved, and intelligent technology and the 5G core network architecture are combined [3]. Andrioli I stated that ONS’s service is the backbone of the RFID network, and it is extremely vulnerable to denial-of-service attacks. If the problem of denial of service attacks is not adequately addressed, the RFID network’s availability will be jeopardised [8]. DNS Security Extension (DNSSEC) adds some security features to the DNS protocol, primarily providing three services: key distribution and management, original data authentication and integrity verification, and transmission and request authentication. These services are capable of preventing the majority of DNS security threats [9]. People’s lifestyles will inevitably change in the 5G era, according to Ahmadi S. The network transmission speed will be faster and more stable once we officially enter the 5G era. Better network services will be provided. The 5G network is inextricably linked to people’s daily lives. As a result, the
analysis of new technology in the 5G network and the 5G core network architecture can assist people in better understanding 5G technology and realising its importance in network technology advancement [10]. Larsson applied the directed graph workflow modelling theory to the workflow modelling of the 5G network architecture system, defining the execution rules for each activity in the work model, which aided and supported the development of an RFID-based warehouse management system [11]. Xiang et al. studied the intelligent management method of the clothing supply chain based on 5G network technology, and realised the intelligent management of the clothing supply chain warehousing and distribution process [12].

It is believed that with the development of artificial intelligence [13–16], RFID technology will penetrate into all areas of life. With the gradual improvement of living standards, patients want to receive more comprehensive care in the hospital, and RFID will be very popular for patient location management. A research point.

3. RFID Technology and Its Application Overview

3.1. The Working Principle of RFID System. First, the reader is powered on to make it in working state, and then the radio frequency signal that is consistent with the working frequency of the reader is transmitted through the antenna. When the tag is in the area where the radio frequency signal can reach, the coupling element inside the tag plays the role of the radio frequency signal. Under this condition, an induced current is generated, the internal circuit of the tag is connected, and the information recorded inside the tag is transmitted at a certain frequency through the built-in antenna. After the antenna receives the signal, the reader encodes and decodes the signal, and the reader transmits the encoded or decoded data information to the background host connected to the reader.

3.2. Characteristics of RFID Data Transmission. In the radio frequency identification system, the radio frequency reader is a device or equipment that reads and writes the stored information of electronic tags. The radio frequency reader is connected to the computer network through a standard interface, and the database is used on the network platform to process and transmit the huge RFID data.

The data communication between the reader and the tag includes the data communication between the reader and the electronic tag and the data communication between the electronic tag and the reader. The reader and the electronic tag construct a non-contact information transmission channel between the two through their respective antennas, as shown in Figure 1.

The characteristics of the field around the antenna, which is the fundamental law of electromagnetic propagation, completely determine the performance of this spatial information transmission channel. The antenna inside the electronic tag receives the signal sent by the reader and returns the data requested by the reader; the voltage regulator converts the radio frequency signal sent by the reader into a DC power supply and stores energy via capacitors. The voltage stabilising circuit then provides a stable power supply for the tag; the modulator modulates the data sent by the logic control circuit, and after the modulation is complete, it is sent back to the reader through the antenna; IOU, and return the corresponding data to the reader according to the reader’s requirements; and the storage unit stores and identifies the data. Passive tags are those that do not have a battery inside the electronic tag to provide direct power, instead relying on the reader’s radio frequency energy. Passive tags have a small range, but are inexpensive and have a long life. A portion of it is converted into DC power to provide indirect power to the tag.

An active tag is one that has a battery inside to provide power directly and does not require energy conversion. Its identification range will be expanded as a result, but the volume will increase as well, and the cost will rise. It can be divided into low frequency (30 Hz-300KHz) tags, intermediate frequency (3-30 MHz) tags, and high frequency tags (UHF tags and microwave tags) based on the operating frequency [17]. Low frequency tags include UHF tags and microwave tags. Low-frequency tags have a limited range of action, and a large number of low-frequency tags cannot be read at the same time; otherwise, collisions will occur, and energy will be transmitted via inductive coupling. Inductive coupling is also used for energy transmission in intermediate-frequency tags. Low-frequency tags are a combination of intermediate frequency tags and low-frequency tags, but they work in high-frequency frequency bands if classified by radio frequency, so they are frequently referred to as high-frequency tags. Ultra-high frequency (UHF) tags operate in the ultra-high frequency (UHF) or microwave frequency bands. The frequency tag transmits energy through electromagnetic coupling, with ultra-high frequency having a faster transmission rate and a larger effect area [18].

3.3. SPA Relative Positioning Algorithm. Middleware is a large category of basic software, not a kind of software, and belongs to the category of reusable software. This definition also distinguishes middleware from supporting software and utility software. If an error occurs during data transmission, the middleware system can correct the error, and can also avoid collision when reading tags through some anticollision algorithms, ensuring the accuracy of data transmission. Middleware can control the flow of data, decide which application to send the data to, save important data, and transmit data to multiple applications in batches. Middleware not only realises interconnection, but also realises interoperability between applications; middleware is software based on distributed processing, and its most prominent feature is its network communication function [19].

Middleware is a general service located between the operating system and application software. It is mainly used to shield the differences of network hardware platforms and the heterogeneity of operating systems and network protocols, so that application software can run smoothly on different platforms, and has Tuning load balancing, connection management, and scheduling functions. The main idea is from the local to the global idea, and the positioning process
is divided into two processes, which are the process of establishing the local coordinate system and the process of establishing the global coordinate system. Figure 2 is a schematic diagram of node coordinate calculation [20].

What is shown in Figure 2 is the coordinate system $q$ with the node $f$ as the origin, and the directions of its $X$ and $Y$ axes must satisfy the selected adjacent nodes $p$ and $g$, so that $p$ is located on the negative semi-axis of $X$, and the $Y$-axis coordinates of $q$. The value is a positive number. The values of $i p$, $i q$, and $p q$ can be known through ranging, although the algorithm selects a group of nodes with the highest density in the network as the reference point for establishing the global coordinate system of the network, and selects a node with the largest degree of connectivity among them as the origin of the coordinate system. However, because all nodes need to participate in coordinate establishment and transformation calculations, the communication overhead of the SPA algorithm is almost exponentially proportional to the number of nodes.

3.4. SPA Clustering Relative Localisation Algorithm of Nearest Neighbours. When there are multiple tags to be located at close range in the system, the reader and the reference tag need to read a large amount of data, and the channel throughput is very high. In order to reduce the load on the hardware and improve the localisation accuracy, a relative localisation algorithm based on SPA clustering based on the nearest neighbours of the relative positions of the labels is proposed [21]. The positioning algorithm not only adopts the reference tag system of LANDMARC to reduce the system cost, but also uses the important information of the nearest neighbours of the relative positions of the tags to perform relative positioning.

Suppose there are 1 RF readers, $m$ reference tags, and $u$ tags to be located. The reader is in continuous working mode, the detection range is 1-8, and it is detected every 30 seconds. Define the corresponding signal strength vector, $\theta = (\theta_1, \theta_2, \cdots, \theta_m)$ in $\theta_i$ represents the value of the reference tag on reader $i$, $i \in (1, n)$. For each label $p$ to be located, $p \in (1, u)$.

The definition is shown in (1).

$$E_j = \sqrt{\sum_{i=1}^{n} (\theta_i - S_i)^2}.$$  (1)

It represents the relationship between the reference tag and the tag to be located in terms of signal strength difference. The smaller the $E$, the closer the reference tag is to the tag that needs to be found. The label node that has been determined to be the nearest neighbour sends a message to the surrounding nodes, and the nearest neighbour node estimates its own position by referring to the label (the message includes the ID, coordinates, node type, nearest neighbour node, master node, and other information of the nearest neighbour node). All nodes that receive the message become slave nodes of the nearest neighbour node, record the message, and obtain the nearest neighbour hop number $I$ [22]. $m$, $I = 0$, $I = 1$, $I = 0$, $I = 1$, $I = 0$, $I = 0$, $I = 0$ (1,$r$). These label nodes that have recorded information from the nearest neighbour save and broadcast this message to the adjacent label nodes within one step, forward it once, and increase the hop value by one until all label nodes have received the information from the nearest neighbour set node. As the threshold, use the node in the nearest neighbour set that was first received by the timer of the label to be located, stop timing, and record the hop value of the nearest neighbour set node, with each to-be-located node recording the information of the nearest neighbour set node.

4. RFID Technology and New Technology Integrating 5G Network Architecture

4.1. 5G Network Architecture. The 5G network standard proposes the goal of pooling DU equipment. Operators hope to adopt the centralised deployment method of DU pooling to aggregate services from multiple base stations and transmit them to the CU, which can greatly improve the efficiency of DUs. It is beneficial to the deployment of cooperative
strategies between base stations [23]. However, it is not clear whether DU equipment can be pooled. At present, the DU equipment provided by manufacturers is basically one DU per base station. Even if DUs are concentrated together, it is a stack of multiple DU equipment, which cannot share baseband resources, as shown in Figure 3.

The size of the DU capacity determines the number and deployment location of the DU, and the performance requirements of the bearer network are also quite different. If the capacity of the DU can reach about 200 base stations, the DU can be deployed in the aggregation node of a typical city, and aggregate the services of all the base stations under the aggregation node. If the capacity of the DU is small, in the aggregation node of a typical city, multiple DUs need to be deployed to aggregate the services of all the base stations under the aggregation node. The mid-transmission network needs to support certain three-layer functions, which will increase the construction cost of the mid-transmission network.

4.2. 5G Network Architecture Integrates the Advantages of RFID Technology. RFID integrated with 5G network architecture does not require wired readers, and RFID tags have another function. That is, the information on the label tape is allowed to be updated. RFID readers can scan multiple label tapes at the same time, and each barcode must be read by the corresponding barcode scanner one by one: linear barcodes can only hold 10-20 characters of data; in contrast, RFID readers are not affected. Limited storage capacity, it can store thousands of characters of data; in addition, the RFID label tape can be wiped with alcohol, which effectively avoids the bar code cannot be read and lose its function when it is used in a humid environment or is contaminated by blood or wear, more suitable for applications in the medical industry [24].

With the help of various mature technologies such as RFID and mobile computing, the work links such as massive information input and manual transcription in medical work will be greatly reduced. The application of EDA enables medical staff to obtain and process patient diagnosis and treatment information anytime and anywhere, which greatly reduces the work intensity and work pressure of medical staff, and also comprehensively improves the work efficiency of medical staff. Using RFID technology to mark and identify information such as medicines, biochemical specimens, equipment, medical staff, and patient identities, using EDA for RFID identification, can not only quickly confirm the information correspondence, but also effectively eliminate the occurrence of manual judgment errors.

5. Overall Design of 5G Wireless Nursing Information System Based on RFID

5.1. RFID System Node Location. According to the distribution of the RFID system, a 100*100 square area is constructed, and the reference tags are evenly distributed. Set the number of reference labels in the simulation program to 4, that is, place 4*4 reference nodes evenly in a 100*100 square area. The specific coordinate changes of the reference labels are shown in Table 1 and Figure 4.

Determine the nearest neighbour set by the nearest distance, the number can be set as needed, and make a preliminary estimate of its position, according to the algorithm proposed in the previous section. To calculate the position of its neighbour nodes, the nearest neighbour is used as the main node. Other nodes use timers to select the main node for relative positioning at the same time. Then, based on the number of hops between the master node and the nearest neighbour node, gradually transform the coordinates to the master node’s system with fewer hops until they are unified to the system’s absolute coordinates. To compare the algorithms, the RFID technology system’s algorithm node positioning is first performed, which means that only the position coordinates of the reference nodes are used for positioning on the basis of the system modelling. 4*4 reference nodes are evenly spaced across a 100*100 area, 50 nodes (node labels) are generated at random, and the communication radius is set to 25. The real results are shown in Figures 5 and 6.
Figure 3: Schematic diagram of 5G network deployment.

Table 1: Change trend of reference coordinates.

<table>
<thead>
<tr>
<th>Serial number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
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<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>X direction</td>
<td>0</td>
<td>23</td>
<td>56</td>
<td>81</td>
<td>46</td>
<td>82</td>
<td>57</td>
<td>24</td>
<td>69</td>
<td>64</td>
<td>18</td>
<td>28</td>
<td>53</td>
<td>95</td>
<td>47</td>
<td>65</td>
</tr>
<tr>
<td>Y direction</td>
<td>0</td>
<td>45</td>
<td>69</td>
<td>35</td>
<td>57</td>
<td>61</td>
<td>94</td>
<td>28</td>
<td>36</td>
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<td>25</td>
<td>76</td>
<td>31</td>
<td>41</td>
<td>68</td>
<td>57</td>
</tr>
</tbody>
</table>

Figure 4: Trend of reference coordinate changes.
During the simulation of RFID technology system, only the information of reference nodes is used for positioning, and the number of nodes in this system is large, the positioning error fluctuates greatly, and the positioning accuracy is poor.

5.2. Fusion RFID System Clustering Relative Positioning Based on 5G Network Architecture. The system settings are the same as the RFID system simulation, and 10 nearest neighbour nodes are initially set. The simulation diagrams are shown in Figures 7 and 8.
Figure 7: Simulation results of the RFID clustering relative positioning system of the nearest neighbours.

Figure 8: RFID clustering relative positioning system of near neighbours.
Figure 9: Positioning accuracy with different number of nodes.

Figure 10: Positioning accuracy under different number of unknown nodes.
Compared with the 5G network architecture system that only uses the position information of reference nodes, the accuracy of the RFID clustering relative positioning system using the relative position information of the nearest neighbours between nodes is significantly improved. Since the coordinates of the unknown node must be determined by the coordinates of at least three known adjacent points, having the coordinate reference of the nearest neighbour node plays a great role in improving the accuracy of the algorithm.

Some points, such as point positioning deviations, are relatively large, which may be due to the complex algorithm and the accumulation of errors during multiple coordinate transformations. When the node calculates the position and coordinate transformation, it needs to use multiple information such as angle information and master node position information, and it also needs to perform multiple calculations, which may cause error transmission and accumulation, as shown in Figures 9 and 10.

The randomness of this algorithm is very strong, and the error of the algorithm is relatively small when there are multiple nodes. The reason is that the relative position information between nodes is fully utilised, and the probability of outliers is small.

6. Overall Design of Medical Care Management System Based on 5G Network Architecture and RFID Technology

6.1. System Description. Medical care mobile management is based on the traditional medical care management system, combining 5G network architecture based on mobile computing terminal care, RFID technology, and computer technology to realise the mobile and intelligent management of hospital fixed asset management medical care.

The system is based on the hospital’s existing equipment management system and financial asset management system. The wireless network in the hospital area is used as the transmission medium to complete the data interface with the background equipment management system through the operation of the handheld terminal. The background management system completes the connection with the existing medical equipment, manage the association of relevant information, mark relevant objects (equipment), and realise the functions of comprehensive management, query, and statistics mainly based on equipment.

6.2. Architecture. The medical equipment management system is comprehensively designed based on the overall architecture of the digital hospital. The system architecture is based on the hospital’s 5G network architecture system, using data security extraction and virtual database technology as the data exchange layer. The hospital’s existing local area network and wireless network exchange platform are used as the network transmission platform, the nursing staff’s handheld PDA with mobile software client, the work place with desktop PC software client, combined with RFID technology as the actual and mobile application of the system.

On the data exchange platform, the existence of middleware provides an exchange platform for mutual access between databases, data exchange between various system application front-ends and HIS data centres, and also satisfies the requirements of different hardware and system software for the environment. In fact, the middleware not only provides a data exchange platform for the current medical equipment management system, but also produces the actual effect of the data bus, providing a comprehensive data exchange platform for the existing and future information management systems of the hospital. The construction of this system provides a better integration platform for the hospital’s existing applications, and also provides a standard interface for the expansion of hospital data applications in the future.

6.3. 5G Network Topology. Because this system is only intended for use by hospital personnel in the hospital, the mobile management system for medical equipment will use a client-server structure rather than a browser-server structure. Wireless switches and AP points are installed in the equipment management office and equipment use department to form a wireless local area network based on the hospital’s wired local area network of twisted pairs. The handheld PDA terminal is equipped with a wireless network card and is connected to the local area network via wireless means. It is only used by nursing staff. The system architecture is based on the hospital’s original local area network, and the data centre hosts an application server. The system application services are provided by this server, which is connected to the LAN.

The system architecture is based on the hospital’s original local area network, with an application server installed in the data centre. This server is connected to the LAN to provide system application services; a detection and protection system is configured on the LAN to provide system security and management services; and, depending on the number of APs and APs, a detection and protection system is configured on the LAN to provide system security and management services, configure the appropriate number of APs for the length of the network cable; configure the RFID system in the hospital to provide positioning services; configure the access control system of the fixed reader at the hospital’s exit to alarm the equipment; configure the nursing staff’s front-end equipment and software system. At the device management office, set up the device management system and RFID printer (provide the required device labels). A medical care equipment management system can be built from this.

7. Conclusions

RFID technology is an emerging automatic identification technology in recent years. Based on the research on RFID indoor positioning system, this paper proposes a clustering SPA relative positioning algorithm based on nearest neighbours in the 5G network architecture system. Based on the research on the application of RFID in hospital medical care management, the medical care mobile management system
is designed, mainly including the database system of the system, the handheld data acquisition and wireless transmission system based on the 5G network platform, and the management system running on the desktop PC. A detailed design is carried out to expect that RFID technology can be applied to medical care management. The accuracy of the nearest neighbour nodes directly affects the positioning accuracy of the entire system. This simulation only uses the simplest triangulation method to estimate it. Error analysis can be introduced in future research, and some data can also be considered when estimating node positions. Correlation methods, such as Chan algorithm and recursive iterative algorithm, further improve the accuracy.

**Data Availability**

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

**Conflicts of Interest**

All the authors do not have any possible conflicts of interest.

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