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Intelligent Auxiliary System for Chronic Disease Prevention and Treatment Based on Information Technology and Its application in Improving Patients' Trust Predicament

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ABSTRACT

Along with the rapid development of information technology, there are unprecedented opportunities and challenges in the area of chronic diseases. Chronic diseases' long-term nature, complexity and impact on patients' quality of life make it clear that traditional prevention model can not meet patients' diverse needs and increase their trust. It aims at providing personalized and accurate prevention and treatment plans based on AI, Big Data, Internet of Things, and other advanced technologies in order to improve doctor-patient trust. In this paper, we deeply discuss the system's overall structure, design, main functions, and its application effect on patients' trust dilemma.

1. Introduction

The rapid development of information technology brings unprecedented changes in health field in today's digital era. Chronic disease is a long-term complex disease, which has great impact on patients' quality of life, burden of society and economy, and medical resource allocation[1]. There are many limitations to the traditional model to treat chronic diseases, which are complicated and diverse. However, intelligent auxiliary system based on IT provides a new way to solve these problems. By integrating AI, Big Data and Internet of Things, the system provides personalized, accurate prevention and treatment plans for patients. In recent years, as IT becomes more mature and medical information technology becomes more and more mature, intelligent assistant system is becoming more and more popular in the medical field. In this article, we make a deep discussion from four aspects: system overall structure, each level design, main function, application effect to improve patient trust dilemma. This paper aims at providing useful reference and inspiration for medical workers and researchers in order to further develop and apply intelligent auxiliary system in prevention and treatment of chronic diseases.

2.The current situation of chronic disease prevention and treatment and challenges

2.1.The epidemic trends of chronic diseases and their social impacts

Cardiovascular disease, diabetes, hypertension and COPD are among the most important public health problems in the world. These diseases are characterized by long duration, complicated causes, high cost and difficult treatment, causing profound impact on patients' quality of life as well as social and economic burden. Chronic diseases cause long-term physical discomfort and mental stress in patients with chronic diseases, as well as large consumption of medical resources and social productive forces. According to the World Health Organization, chronic disease incidence and death rate is increasing year after year around the world, especially in developing countries where chronic diseases are a major cause of death. These popular trends not only burden individuals and families, but also threaten social sustainable development[2].

2.2.Limitations of treatment models for traditional chronic disease prevention

Traditional prevention model mainly relies on regular check-ups by medical institutions, doctors' diagnosis and

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treatment recommendations, and patients' self-management. However, many limitations have been exposed by this model in dealing with the complexity and variety of chronic diseases. First of all, there is little consideration for individual differences among patients in traditional prevention model, which makes it difficult to offer individualized treatment plans. On the other hand, patients often lack effective guidance and support, which leads to low compliance rate and poor disease control. Moreover, poor communication between doctors and patients and asymmetry of information has affected patients' trust in health care system. Patients often doubt doctors' diagnosis and treatment suggestions and lack of understanding of medical procedures, leading to increased distrust of medical system[3]. The trust predicament not only influences patients' treatment outcome, but also leads to increased medical disputes, which further intensifies the tension between doctors and patients.

2.3..Information technology's application potential for chronic diseases prevention and treatment

Along with the rapid development of information technology, its application in health field is becoming important means to improve its prevention and cure effect. IT can monitor, analyze and manage patients' health data in real time and provide personalized prevention and treatment plans. For example, with wearable devices and mobile medical applications, patients will be able to monitor their health status in real-time and upload it onto a cloud so that doctors can analyze and diagnose it remotely[4]. Application of this technique enhances patients' self-management ability as well as enhances doctor-patient interaction and communication. Moreover, big data analysis technology could extract and analyze massive amounts of patient data to provide accurate treatment recommendations and improve treatment outcomes. AI technology provides personalized health consultation and treatment plans for patients through intelligent algorithms, further increasing patients' trust in health care systems. However, application of IT is faced with many challenges such as data security, privacy protection, technology availability and operability, doctor-patient trust. Addressing these problems will require joint efforts by medical professionals, technology developers and policy makers to explore ways to prevent and treat chronic diseases that fully leverage technological advantages while preserving the essence of medical care.

3.Chronic disease prevention and treatment based on artificial intelligence technique

3.1.Overall system architecture

Intelligent auxiliary system based on information technology adopts the Integrated Development Environment (IDE). It integrates Java and Python programming languages to develop the intelligent assistant system. Relational database MySQL is used in the database and non-relational database MongoDB. This system extensively employs artificial intelligence (AI), big data and Internet of Things (IoT) technologies to assist in the prevention and treatment of chronic diseases. Through deep learning models, this system can identify patients' behavior patterns and preferences in order to provide more precise health advice. The massive amount of data generated by the system can be processed and analyzed using big data technology, including patients' health records, medical activity data, etc. Through data mining and analysis, valuable information can be extracted from this system, which provides medical decision support for doctors, and optimize the algorithm of personalized prevention and treatment. Furthermore, the system provides a platform of interaction between doctors and patients, providing a bridge between doctors and smart systems. On the platform, doctors are able to plan and carry out medical activities using smart tools[5]. At the same time, this smart system provides medical advice and assistance based on medical objectives and patient feedback. Such a model can take full advantage of doctors' professional advantages, and make full use of the high efficiency and accuracy of intelligent systems to improve medical outcomes.

3.2.Systems main levels design

3.2.1.Design of data layer design

The data layer is the base of the whole system in the intelligent auxiliary system based on information technology. Whether its design is reasonable or not relates directly to system running stability and data processing efficiency. Data layer is mainly responsible for the storage and management of patients' health data, doctor's medical data, and various kinds of information generated in operation. In order to guarantee data integrity and security, data layer adopts distributed database structure, which combines the merits of relational database and non-relational database. A relational database is used for storing structured data, for example, basic information of patients, medical records and test results[6]. These data are clearly structured and related. Through relational database, it is convenient to carry out data query and transaction processing. A non-relational database is used for storing unstructured data such as medical records, medical images and behavior data. All these data are flexible and scalable, which make it more suitable to deal with large amount of complicated data. Data encryption technology has been adopted during data storage process to ensure patient's and doctor's privacy[7]. At the same time, in order to deal with data loss or damage risk, a comprehensive backup and recovery mechanism has been designed in the data layer. Regularly backing up data, it can be restored quickly if necessary to ensure that systems function normally.

3.2.2.Design of logic layer design and its application

Logic layer plays a key role in data processing, business logic realization, and personalized prevention and control plan generation. In logic layer design, OOP is used to divide system functions into multiple independent modules, each responsible for specific business logic[8]. For example, personalized prevention and treatment module analyzes patient behavior data and health records, using machine learning algorithms and data mining technology to generate

personalized prevention plans and health advice. The module should take into account patient behavior pattern, health condition and lifestyle factors in a comprehensive way so that accurate personalized prevention and treatment plans can be achieved through complex algorithms. Parent-to-patient collaboration module is responsible for interaction logic between doctors and intelligent systems to achieve planning, execution and monitoring of medical activities. The module helps doctors better manage patients, evaluate their health status, and adjust health strategies based on real-time feedback through smart medical tools and support functions. Take assisted care for example. By using Python program, this paper establishes a patient health data set including patient characteristics and health indicators[9]. The format of the dataset is:\ [Exercise Time, Diet, Sleep Quality, Health Index]. By using big data analysis technology, we can predict patient health trends and provide medical advice. The code is as follows:

```
import pandas as pd
From sklearn.model _ selection import train _ test _ split
From sklearn.linear _ model import LinearRegression
From sklearn.metrics import mean _ squared _ error

Features = ['age', 'weight', 'height', 'exercise _ minutes', 'diet _ score']
Target = 'glucose _ level'
X = data[features]
y=Data [Target]
```

At the same time, the logic layer is designed to optimize algorithm and improve performance. Through efficient algorithm design and code optimization, the system is able to handle large data and complicated business logic quickly and stably. Furthermore, a high efficient data interaction interface between data layer and application layer has been established in logic layer to ensure smooth data flow among different layers in order to realize overall cooperative operation.

3.2.3.The application layer design of applications

Application layer is an interface for direct interaction between system and user. Its user experience and promotion effect are directly affected by its friendly and user-friendly design. Application layer provides different user interfaces for patients, physicians and system administrators. Each interface can be customized according to user's role and needs[10]. The Application Layer provides a visual Health Management Interface for patients that includes Health Monitoring, Health Consultation, Health Record Query and Online Consultation. All of these functions provide simple and clear interfaces for patients to perform health management tasks easily and provide real-time feedback on health outcomes. The doctor interface places greater emphasis on health management functions, providing tools for managing patients, uploading medical resources, analyzing health data, and interacting with patients on line. Through these tools, doctors will be able to plan and implement medical activities conveniently according to the patient's health data. System administrator interface provides advanced functions such as system configuration, user management, data backup and recovery. Application layer design also emphasizes to optimize user experience. Through user interface friendly design, simplified operation process, variety of interaction methods to improve user satisfaction. At the same time, an application layer enables access from a variety of terminal devices including computer, tablet and mobile phone so that the user can conduct health management and medical activities at any time[11].

3.3.System database design

The storage layer plays an important role in the intelligent auxiliary system architecture for chronic disease prevention and treatment. Its rationality and efficiency directly affect the performance, reliability and scalability of system. The storage layer manages and maintains a lot of data generated during system operation, including patients' medical records, doctors' medical information, system configuration information and all kinds of temporary data. Considering the variety of data types and usage requirements, it adopts hierarchical storage strategy that integrates multiple storage technologies in order to ensure efficient data storage, fast access, and secure protection[12]. According to structure degree, access frequency and importance of data, different storage media and technology are used respectively. For structured data such as patient's basic information, medical record, examination results, etc., it is organized and stored by relational database management system (RDBMS). A relational database has powerful data integrity constraints, transaction processing capabilities, and a mature Query Language (SQL) to efficiently support complex data operations and query requirements. For example, by means of relational databases, it is easy to analyze patients' health data in a statistical way, ranking calculations, and query operations based on multiple conditions[13].

For unstructured data such as medical images, health logs, behavior data etc., the system adopts a storage solution combining non-relational database (NoSQL) and distributed file system (DFS). Unstructured data is typically characterized by large volumes and various formats, which makes it difficult for efficient storage in conventional relational databases[14]. With its flexible data model, high scalability and high performance, NoSQL database is suitable for such data storage. As a popular NoSQL database, for example, MongoDB supports document storage mode, which makes it easy to store and retrieve the patient's medical log and medical image metadata. At the same time, we use distributed file system to store large-capacity multimedia files such as medical images and videos. A distributed file system can enhance storage capacity scalability, improve data reliability and access speed by distributing files between nodes. The Hadoop Distributed File System (HDFS), for example, ensures high data availability through multiple replica storage mechanisms for data blocks in unexpected situations like hardware failure. At the same time, its efficient parallel I/O capability can satisfy the requirement of fast accessing multimedia resource.

3.4.The system security design of software

Data security and privacy protection are indispensable to the design of system in today's digital era. Security layer

design aims at providing comprehensive security protection for patients' and doctors' data without leaking, tampering or abuse. Security layer adopts multiple layers of security protection measures including network firewall, intrusion detection system, data encryption technique and user identity authentication. A network firewall and an intrusion detection system have been set up on network boundary for real-time monitoring of network traffic so as to guard against malicious attacks and illegal intrusion[15]. Data encryption technology is used in data storage and transfer process. It is used to encrypt sensitive information during storage and transfer. In order to prevent unauthorized access, User Identity Authentication Mechanism strictly verifies user identity by user username, password, SMS authentication code. Additionally, Security Layer conducts regular security audits and security scans to promptly identify and correct security vulnerabilities in the system, ensuring its security and stability. Through these multi-level security measures, security layer provides safe and reliable learning environment for intelligent assistant system.

3.5.Compatibility design and system scalability

With the rapid development of medical information system, its scalability and compatibility is the key to ensure its long-term stability and continuous optimization. During the design process, the system took full account of future technological developments and changes in medical requirements. Its modular architecture and open standards guarantee easy expansion and upgrade of functions of the system. Modular structure makes each function module relatively independent. When it is necessary to add a new function or optimize an existing function, it is possible to develop and test these modules independently without affecting other parts of the system. The design not only improves the system development efficiency, but also reduces maintenance cost. Furthermore, the system follows internationally accepted open standards and protocols such as HTML5, CSS3, JavaScript, etc., ensuring stable operation on various operating systems and browsers, and supporting multiple terminal devices such as PC, tablet, mobile phone etc. The excellent compatibility makes the system adapt to different users' usage habits and equipment conditions. It provides powerful guarantee for wide application. At the same time, the system reserves interfaces for integration with external systems such as Information Management System (MIS) and Online Medical Platform so that it can be integrated into other Medical Information System so that it can share and work together.

4.The application of main system functions

4.1.Data analysis and intelligent health monitoring

Intelligent Health Monitoring and Data Analysis System is a key innovation in the system, which aims at real-time monitoring and analysis of patient health data. Through wearable devices and mobile medical applications, such as heart rate, blood pressure, blood sugar, and number of steps taken while exercising, the system collects health data in real-time. These data are uploaded to the cloud via Internet of Things technology for analysis and processing by the system. An intelligent data analysis engine has been designed to mine and analyze vast amounts of health data to provide accurate health assessment reports to physicians. These reports cover not only patients' basic health indicators, but also their patterns of behavior and health trends, pointing out their strengths and weaknesses. Furthermore, it provides personalized health advice to patients based on the results of analyses to help them better manage their health. It not only improves patients' self-management ability, but also provides strong decision-making support to improve the outcome of medical treatment and patient management.

4.2.Personalized prevention and control plan generation and optimization

In information technology based intelligent auxiliary system to prevent and treat chronic disease, it is key to create and optimize personalized prevention and treatment plan. It conducts in-depth analysis of patients' behavioral data and health records, including, inter alia, health indicators, lifestyles, behavior patterns, and health motivations. It is programmed in Python, employing advanced machine learning algorithms and data mining techniques to tailor specific prevention and treatment plans for each patient. The code is as follows:

```
（{
'age': [45],
  'weight': [70],
  'height': [170],
  'exercise_minutes': [150],
  'diet_score': [7]
})

health_plan=generate_health_plan
Print (f Management Plan of Health: {Health _ Plan})
```

In addition to health indicators and lifestyle adjustment suggestions, this plan is based on patients' behavioral patterns, and dynamically adjusts prevention and treatment content and difficulty levels to ensure patients always maintain moderate levels of challenge and success. For example, if a patient performs well on certain health indicators, the system will automatically skip the basic content and go straight to an advanced Health Management Module. The system provides supplementary materials and practical advice for patients with difficulty in one area, helping them gradually improve their health condition. Moreover, the system is able to optimize treatment plan according to patients' behavioral feedback and health evaluation results so as to ensure its scientificity and validity. The personalized prevention plan not only improves patients' health management level and health outcomes, but also stimulates them to enhance health consciousness and self-management ability.

4.3.Health evaluation and feedback in real time

The real-time health evaluation and feedback function is important to guarantee the effectiveness of personalized health management. It conducts comprehensive and objective evaluation of patients' health through various assessment

methods, including health indicators, health questionnaire survey and behavioral data analysis. An intelligent evaluation engine is designed to automatically analyze patients' health data and generate detailed health reports based on assessment results. These reports cover patients' health indicators as well as their behavioral patterns and health trends in all fields of health, highlighting their strengths and weaknesses. Furthermore, the system provides real-time health feedback based on assessment results, including health indicator reminders, health advice, and behavioral adjustment strategies. Timely and accurate feedback mechanisms help patients to better understand their health condition, adjust their lifestyle and manage health plan so as to achieve better health objectives. At the same time, doctors will be able to understand patients' health status through assessment results, adjust medical strategy and treatment plan to ensure effectiveness and pertinence of medical activities.

4.4.Sharing and medical resource management

Medical Resources Management and Sharing functions are important bases in support of personalized prevention, treatment and cooperation between patients and patients. The function provides rich medical resources to doctors and patients, including electronic medical records, medical images, health education materials and treatment plans. A smart resource management system is designed that can automatically classify medical resources according to medical goals and patients' needs so that doctors and patients can find and use these resources quickly. According to patients' health conditions, doctors can select appropriate medical resources from resource base and integrate them into medical activities. At the same time, the system allows doctors to upload their own medical resources so as to enrich their resource library. In order to promote the sharing of resources and exchange of experience among doctors, a platform for online resource sharing is provided. This platform allows doctors to share medical resources and treatment experiences, and to interact and discuss with other doctors. The sharing mechanism not only enhances the utilization ratio of medical resources, but also promotes doctors' professional growth and innovation in medical methods. Furthermore, the system can recommend personalized medical resources according to patient's behavioral patterns and health needs to help patients complete their health management tasks and improve their health outcomes.

5.System application case analysis

5.1.Case summary

In order to verify the application effect of information technology intelligent auxiliary system (hereinafter referred to as "prevention and treatment system") in actual medical care, two groups of patients with chronic diseases were selected for study. These two groups did not differ significantly in terms of basic health status, disease type and treatment progress, so there was a high degree of comparability. One group was appointed to observe group, using the prevention and control system to carry out health management activities. The other group used traditional medical management methods to manage health. The aim of this study is to evaluate the effectiveness of prevention and treatment system through comparison of behavior patterns, health indicators and health satisfaction.

5.2.Application methods

The control group adopted the traditional medical management approach in which patients were treated according to uniform medical guidelines and treatment plans. As part of a medical process, doctors assess patients' health through regular follow-up visits, examinations, and self-reports. The medical model emphasizes treatment and passive acceptance. There is little concern about individual differences between patients and personalized health management plans.

Compared with the control group, the control system was applied in a comprehensive way. At the start of the study, doctors created personal health records for each patient through a system that recorded basic information about each patient, health status and lifestyle. These data are used to generate personalized health management plans for each patient, along with recommendations for appropriate health resources. In the course of medical treatment, doctors utilize the system's intelligent medical assistance function to monitor patients' health data and behavior patterns and adjust medical strategies promptly. For example, patients with problems with certain health indicators may be offered further advice and support through personalised health advice provided through the system. At the same time, patients will be able to independently select health content, conduct self-assessment, and track their health behavior through online health management platform. The model fully reflects personalized health management and doctor-patient cooperation to better satisfy patients' individual needs and enhance health management efficiency.

5.3.Results

After six months' health management practice, we found that patients in control group had better health index than those in control group. To be specific, average health indicators (blood glucose, BP, HR) were significantly improved compared with control group. Healthy behaviors such as regular exercise, reasonable diet, timely medication etc increased 20%, health satisfaction increased 30%. As shown in Table 1 below, these data show that using prevention and treatment system can effectively increase patients' health management level, promote health behavior change, enhance trust and satisfaction of health system. Moreover, patients in observation group showed higher enthusiasm on medical compliance and self-management. The doctors and patients communicate more smoothly, and the incidence of medical disputes decreases obviously. These non-quantitative indicators have further demonstrated that prevention system plays an important role in alleviating patients' trust difficulties and promoting harmonious doctor-patient relationship.

Table 1.Comparison between two groups of patients with chronic diseases

Indicator/Group	Control Group (Traditional medical management	Observation Group (using the prevention and control system	Improvement percentage (observation group - control group)
Average blood glucose control rate (%)	65	80	+15%
Average blood pressure control rate (%)	70	85	+15%
Average heart rate control rate (%)	75	90	+15%
Regular exercise execution rate (%)	40	60	+20%
Implementation rate of reasonable diet (%)	35	55	+20%
Compliance rate of taking medicine on time (%)	50	70	+20%
Health satisfaction (%)	60	90	+30%
Medical compliance (%)	55	75	+20%
Improvement in self-management ability (%)	30	50	+20%
Incidence of medical disputes (%)	15	5	-10%

5.4.Mechanism analysis on improving patients trust dilemma

5.4.1.Design of data layer design

Due to information asymmetry and lack of understanding of doctors' diagnosis and treatment recommendations, patients' lack of confidence in medical decision process. Information Technology Intelligent Auxiliary System for Chronic Disease Prevention and Treatment provides detailed Health Data Analysis Reports and Personalized Health Management Plans so that Patients Can Understand Their Health Status and Make Decisions. By using big data analysis technology, the system deeply mining patients' health data, generating visual health trend charts and detailed health evaluation reports. These reports cover not only patients' health indicators, but also their impact on health through behavior patterns, lifestyles and other factors. When formulating treatment plans, physicians may rely on these data and reports to explain the scientific basis and expected effects of treatment plans. The transparent medical decision process enhances patients' trust in health system and enhances their health consciousness and ability of self management so that they can participate more actively in health management.

5.4.2.Improving interaction and communication between patients and patients

Poor doctor-patient communication is an important cause of patients' trust dilemma. According to traditional medical mode, patients and doctors communicate with each other through regular face-to-face visits. The method of communication has low frequency and limited transmission of information. Based on information technology, intelligent auxiliary system to prevent and treat chronic diseases has significantly improved the interaction between doctors and patients through online consultation, health consultation, and real-time feedback. Patients will be able to seek medical advice at any time through the online platform of the system, and they will be able to adjust medical advice according to patients' real-time health data. The system also supports video consultation and health log sharing functions so that patients' health conditions can be displayed more intuitively, allowing doctors to better understand the patient's condition. Furthermore, health education module is established in this system so as to enhance patients' ability to understand and manage their disease. It can enhance patient satisfaction and reduce misunderstandings caused by information asymmetry, so as to promote the harmonious doctor-patient relationship.

5.4.3. Provision of personalised health management plans

Traditional medical mode often adopts "one size fits all" treatment plan, and it can't meet patient's individual difference. Based on information technology, intelligent auxiliary system provides personalized health management plans for patients through deep learning and big data analysis techniques including diet recommendations, exercise plans, and medication adjustments. Using machine learning algorithms, the system generates personalized health management plans based on patients' health data, behavioral patterns, and lifestyles. These programs take account of patients' current health status, as well as predict potential health risks and provide appropriate preventive measures. For example, for diabetic patients whose blood glucose control is poor, the system generates personalized dietary recommendations and exercise plans based on patient's dietary habits and exercise frequency. The personalized health management plan not only enhances patients' health management level, but also enhances their trust in health care system.

5.4.4. Improving the effectiveness and quality of health care

Application of IT can significantly improve the efficiency and quality of medical care. Based on information technology, the intelligent assistant system can monitor patients' health status quickly through intelligent monitoring equipment and data analysis tools. Using wearable devices and mobile medical applications, the system collects health data such as heart rate, blood pressure and blood sugar, which is then uploaded to the cloud. The early intervention can enhance therapeutic effect and reduce patients' medical cost. Furthermore, it provides real-time patient health data to doctors so that they can better manage their patients and improve quality of care. Such high efficiency and precision medical services significantly increase patients' trust in health care system, making them more willing to accept medical advice and treatment plan.

6.Conclusion

Building and applying intelligent assistant system based on IT provides a new way to develop modern medical care. Through system framework design and functional implementation, the system is able to satisfy patients' personalized health management needs effectively, enhance efficiency and quality of medical care, promote doctor-patient trust. However, we should clearly realize that research and application in this area is still being developed and perfected. As technology such as artificial intelligence, big data, Internet of Things have been further developed, and medical concepts have been updated continuously. Intelligent auxiliary systems to prevent and treat chronic diseases will play an even bigger role in broader medical situations. We look forward to continuously improving its functions and optimizing its model through persistent research and practical exploration in order to make a greater contribution to modernization of medicine and improving patient quality.

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Declarations

Conflict of interest The author declares no conflict of interest.

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