

Remote Rehabilitation Development Status in China—To Eliminate the Disabled People's Space Obstacles

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Abstract—The remote diagnosis and remote medical smoked to part. In China, in accordance with the requirements of different applications of remote diagnosis and Relates to the technical difference, which can be divided into special purpose remote diagnosis and treatment system, the remote will Referral system, remote medical consultation system, remote rehabilitation technology and remote operation technology. In this article, will introduce China for the special purpose of service remote diagnosis and treatment system and technology, including: China disabled status and virtual reality technology; China's domestic family medical care system and China's current situation of the development of telemedicine.

Keywords—China, Remote rehabilitation, The disabled people

IN China, the remote rehabilitation is a modern information and communication technology and rehabilitation medicine combines multi-disciplinary subject, it can be defined as: in the comprehensive use of communication, remote sensing, remote control, computer, information processing technology based on the realization of the remote, medical rehabilitation service.

In China the research starting point is different, Baconian rise, basically be telerehabilitation system as a means of communication, to eliminate AIDS evaluation expert and distance between disabled spatial disorder, on how to put the remote rehabilitation system itself as an auxiliary apparatus for evaluation and diagnosis system, promote the development of rehabilitation medicine etc., has mentioned, but not for substantive research. China in this product, see Chinese Shenzhen FIMITIC self-developed China's first disabled telerehabilitation system coverage, the system focuses on specialist and patient communication and exchange, make the online to Chinese experts in rehabilitation counseling rehabilitation, suggestions.

From at present Chinese remote rehabilitation general development situation, the research has many limitations, are in the initial stage. Therefore remote rehabilitation system plays an important role in the study.

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I. CHINA DISABLED STATUS AND VIRTUAL REALITY TECHNOLOGY

China's disabled people has a total of about 67000000, is the world's most populous country. In addition, China's elderly population aged over 65 of the total population of more than 11% of the total, and there is a trend of sustained growth. While in China, now the rehabilitation therapists base is only 5460 people. In the face of such a big gap between supply and demand of China," in 2015 to the disabled rehabilitation" strategy faces serious challenges. The construction of a perfect Internet remote rehabilitation medical system not only makes the medical rehabilitation becomes easier, but also from the patient perspective makes the rehabilitation training is more humanized, set a number of physiological information detection as one, can help Chinese rehabilitation physicians make more objective rehabilitation evaluation, so as to adopt more reasonable and effective rehabilitation scheme.

In this way, China based on the design of a network of one to many remote rehabilitation training robot system, and applied clinical rehabilitation training. Based on the principle of human body engineering works of the mechanical arm design, and the use of magnetic rheological motor and torque motor in series to increase rehabilitation security, at the same time on the EMG signal, oxygen saturation and other physiological parameters on-line monitoring; the use of computer network technology make patients according to the rehabilitation physician in the remote setting of rehabilitation training; physicians to simultaneously monitor multiple rehabilitation training of patients with process, thereby greatly reducing the number of rehabilitation physicians need be personally on the scene; virtual reality technology greatly improves the disabled rehabilitation training enthusiasm and effect. Experiments show that China develops the network on a far range help disabled rehabilitation robot system in China has a good applicability and effectiveness.

A. Establishing a remote rehabilitation training

Making use of network teleoperation robot technology, the traditional face-to-face rehabilitation training in patients with physicians into remote rehabilitation training, rehabilitation training instrument can be used for Chinese nursing homes, community hospitals, family, and is no longer confined to hospital.

B. Simultaneously monitoring a number of patients

One to many remote monitoring model makes a Chinese rehabilitation physicians can simultaneously monitor a plurality of rehabilitation training of patients, has solved in China "patients many , therapists little" contradictory.

C. Game design complete rehabilitation training China's long-range treatment

The number game interface design, can meet the needs of different Chinese handicapped and disabled different rehabilitation stage demand, so that the disabled to get rid of the tedious training process, and according to his own interest free game, easily completed rehabilitation training.

D. Evaluation of rehabilitation

Remote rehabilitation training robot in addition to rehabilitation training function, can also be disabled Chinese condition feedback and rehabilitation evaluation in one set. EMG detection and temperature, pulse, blood oxygen saturation monitoring can be more scientific, more effective for people with disabilities to carry out rehabilitation training.

E. The use of ergonomic

Based on the principle of human body engineering mechanical structure design, stable and reliable drive technology makes the rehabilitation training to more security, comfort.

F. There are two motor combination to complete the rehabilitation

MRF motor as a passive force generator, the training mode damping damping force needed, safe and reliable; the torque motor is complete the rehabilitation in the passive mode and power mode. Combination of two motor rehabilitation training to ensure full security.

G. Multimedia training in the rehabilitation

Gives full consideration to persons with disabilities have the blind, deaf, etc., application of traditional man-machine interface in China, not suitable for these populations. Therefore, in China, especially for this part of the disabled, the rehabilitation robot status information, and multimedia information (voice, video) to convey to all people with disabilities, persons with disabilities can learn in real time the extent of his rehabilitation, training completed good or bad, and so on. At present, China's research in this area are mainly Tsinghua University, Southeast University, Shanghai Jiaotong University, Fudan University, Harbin Institute of Technology, Harbin Engineering University. Among them, Shanghai Jiaotong University and Fudan University, co-launched a "neural motion control and control of sources of information." The study was designed to extract neural information, the use of neural information to control the electronic prosthetic hand. Currently, the seven degrees of freedom prosthetic hand simulator has been designed to complete the extraction of information being nervous animal testing, information integration and control circuit design progress.

Tsinghua University in China, the country's "863" support, since 2000, which carried out the study of robot-assisted neurological rehabilitation, development of an upper limb rehabilitation equipment UECM, can be carried out within two degrees of freedom in the plane running training. For local rehabilitation training, and is one to one training. Not only can remote rehabilitation therapy, the patient can be in the home or community hospital for rehabilitation therapy, and can achieve many of the medical, that is more than a doctor can guide the rehabilitation of patients, greatly reducing the shortage of doctors in China the pressure.

According to statistics, at present in the Chinese medical service agencies (including community hospital) for a total of 31. More than 80% of them are individual clinic and the county the following basic medical institutions. In these medical institutions with medical instruments and equipment, has around 15% is nineteen seventies and products, 60% is the last century before 80 time metaphase products.

To be sure, with the continuous development of national economy, the medical institutions will be eliminated the old, old, disabled, medical instruments, thus promoting the rapid development of medical device industry. In addition to the medical system focused on rural medical service system and the city community health service system, market segments in basic medical equipment demand will be more obvious.

Chinese Research Center on Aging been engaged in a survey of urban elderly in China, 4.8 percent of people with deposits. With China's economic development, the elderly pension will continue to increase. By 2010, China's elderly will total 7319 pension billion; 2020 will reach 814.5 billion yuan; to 2030, will increase to 838.3 billion yuan. Part of these funds will enter the consumer market. The home medical equipment market, strong consumer is the key to see if products meet the needs of older persons.

II. CHINESE COMMUNITY HOME TELEMEDICINE SYSTEM

A. China's domestic home health care system

China domestic home medical care system In China, family digital medical care health care system has been included in the national "863" plan. In a family oriented telemedicine, medical website based on Internet developed rapidly, such as: China, network, the remote medical network, tomorrow, china.com far referral network, on-line hospital, the new century health care network, new health network hospitals. These sites have provided more abundant medical information query functions, and some medical experts to provide medical advice.

In recent years, in remote monitoring, in China, some units are actively committed to research, also developed a number of products, such as ECG BB machine, ECG and blood pressure monitoring system. Tsinghua University professor of leadership and in 1995 developed the family caring nurse small series, this research has formed product. While the Chinese community based family medical care health systems research has just entered a substantive stage, at present in terms of technology there are a lot of problems: user-specific data acquisition

interface design is the remote medical monitoring the development of a bottleneck, and the speed of the network, security is solved urgently.

At present, the Chinese community family health care system of the service objects are: (1) on the recovery of patients after operation in the home; (2) for disabled and elderly persons; (3) high patient population family care; (4) health (pregnant) family care.

Community and family health care role performance in: (1) to improve the care of chronic disease management level, reduce the cost of health care, improving the quality of life and medical service quality. (2) the family nursing Engineering (home health care, HHC) to reduce the cost of health care, to improve early diagnosis and treatment of cardiovascular disease, remission is difficult to see a doctor, hospital beds of tension etc have important sense. (3) it makes patients do not have to travel long distances to see a specialist, to overcome the distance barrier, the elderly and people with disabilities can remain within doors in the comfort of home care to become a reality.

B. Information transmission

The information transmission of Chinese community medical care to transmit the information content: Patients with major physiological parameters, such as ECG, blood pressure, body temperature, respiration and blood oxygen saturation; and real-time video signal and a portion of the image, the picture information. Audio and video information and the main physiological parameters need to be transmitted in real time, in which the real-time video signal for the physician to view the condition of patients with. Physiological information data for clinical diagnosis. Therefore, these data reliable transmission and required different levels of real-time system design is the main issues of concern. The system is composed of multiple physiological parameter information system to provide a specific transport pathways, according to user configuration to determine. Audio and video real-time transmission part is based on the DirectShow technology to realize the multiple users of the audio and video data transmission.

C. Real-time audio and video transmis

Real-time audio and video transmission part of the implementation is currently in China, a remote health care system, designed to direct the use of the existing desktop video communications system. These systems are not designed for medical applications, the data acquisition and processing of the results can not fully meet the needs of telemedicine. For example, follow the video transmission standard H.263 desktop video communications system designed to transmit video conference speakers head and shoulder signal, for higher video requirements, such as live surgery broadcast on insufficient. Thus, starting from the purpose of medicine, telemedicine systems will require a desktop video communication over the existing system more multimedia data processing capabilities.

Microsoft's Direct Show technology provides a way of achieving. Microsoft DirectX is a Microsoft supplied on the Windows platform for creating games and other high-quality

multimedia applications designed a set of low-level application programming interface [1]. This new technology to achieve real-time audio and video data collection, coding and transmission, and the RTP and RTCP as the underlying transport protocol, can effectively reduce the bandwidth consumed by multicast technology and component-based thinking, design and implementation of online audio and video media streaming, real-time transmission system.

Using Microsoft's DirectShow technology, which use low-level driver support for DirectX, COM objects and through the modular approach, the multimedia data capture, transmission, processing and reproducible differences from the hardware, synchronization, complex problems such as media data format separate, providing a unified API and base classes, which simplifies the Windows platform multimedia application development.

Because in DirectShow, the various network-related operations (such as Winsock initialization, RTP packet disassembly) are encapsulated in the filter, so long as the corresponding RTP filter design, it is easy to construct a transmitter (patients with end) and receiver (care Center) application.

D. China's long-range treatment

Based on China's community health care community hospital system has been the status quo at this stage of community health and community residents have a strong theoretical and trial value. For real-time audio and video transmission, because of component-based application system independence between the various modules and strong, and good scalability and adaptability. Through the LAN (resolution 640 × 480) of the experiments show that RTP protocol based on COM components and systems under the framework of applications with real-time, fault-tolerant, scalable, high code reuse in different application systems interoperable to achieve the advantages of relatively simple.

China's telemedicine After 30 years of development, from the use of telephone, fax, radio communications to still images and real-time interactive television technology, virtual reality and tele-robotics and a series of new communication technology and electronics technology, the speed and scale of development is surprising. March to July 2003, severe acute respiratory syndrome in China during the burst, distance learning, video conferencing has played a role can not be ignored.

Remote recovery is no exception. Its possible application areas include: the dysfunction or disability, family members or caregivers, rehabilitation professionals, or by video conference between clinical experts (video-conferencing) in the form of communication, tracking and follow-up, and answer problems; ② ADL plans to help patients develop and timely reminders, such as memory impairment were designed according to the schedule timer to remind their medication on time, complete household chores and functional activities; ③ to assist patients to complete the activity log (self-recording); remote home security monitoring, such as the use of stoves, smoke alarm

activation; ⑤ Internet browsing information and guidance to find support [2]; computer-assisted cognitive assessment and retraining, to provide electronic assistance tools and so on. The practical application of these aspects is not limited to the above. The aim is to help the rehabilitation of individuals to accept remote communities in return for greater success and reduce complications, “eliminate the disabled people`s space obstacles”.

REFERENCES

- [1] L. Zhou, YH. Wang and Q. Liu, “Virtual reality technology in sports in the rehabilitation of application,” *Journal of Clinical Rehabilitative Tissue Engineering Research*, vol 5, pp. 156–158, 2007.
- [2] YC. Hou, LH. Ji, “From medical Angle discusses hemiplegia rehabilitation training the design of robot arm,” *The Chinese clinical rehabilitation magazine*, vol 34, pp. 221–222, 2007.