상호참여형 멀티미디어환경인 두레와 PACS를 연동한 원격진료시스템

Telemedicine System using the PACS and DooRae(Collaborative Multimedia Environment)

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요 약

정보통신기술의 발달로 병원 및 의원에서의 진료방법이 변화를 가져오게 되었다.

본 논문에서는 상호참여형 멀티미디어 프레임웍인 두레와 의료정보전송을 위한 PACS와의 연동을 통한 이상적인 원격진료시스템제안과 이에 따른 기능 및 프로토콜을 (HIS/RIS/PACS) 인터페이스 함으로써 기존시스템과의 효율성과 차별성을 제시하고 있으며, 특히, 퍼스널 컴퓨터기반 멀티미디어환경에서의 원격진료시스템을 구현함으로서, 기존시스템과 차별성을 두었다.

Abstract

Development of information technology makes a telemedicine system feasible along with the traditional medical practice of visiting a hospital (or clinic). This telemedicine workstation would include a PACS interface and between inpatient and outpatient HIS/RIS/PACS transaction protocol.

Although this system has adopted PACS, this technology has been available for several years the integration of the system into clinical operation has had limited success due to stringent requirements of radiologists as well as the load demanded on the system.

I. Introduction

In accordance with the improvement of our standard of living, the growing demand for a more confortable life, importance of health and safety, increasing frequencies of entertainment and games, searching for convenient and effective business process, and searching for a high quality of cultural life. In accordance with this trend, development of various-state of the art equipment makes telemedicine feasible. Telemedicine systems require communication technology and multimedia technology (audio/video) to support medical processing which locate distantly between doctor and patient and fulfillment of the telemedicine software development for effective medicine. This situation can be solved by the development of communication equipment and compression technology to compress large audio/video data but it needs expensivefacilities. Specially it requires rapid and large multimedia data (audio/video) transferring on high-speed private communication networks and the creation of session and application sharing to recognize the sessions on communication networks. It also requires expensive hardware costs and the high technology of application sharing[1].

The CMC technology was developed as CBM (Computer-Based Multimedia) technology which interfaces with high-speed network technology and multimedia information process technology. The CBM technologies which are different from the CMC technology support real-time interaction (dialogs, questions/answers, etc) so that it is noticed as base environment for a telemedicine system using interaction media for multimedia data.

II. PACS Requirement of Telemedicine System

The following requirements for a telemedicine system have been compiled based on this experience with telemedicine. A telemedicine workstation would include a PACS interface, an ATM interface, an electronic stethoscope, a microphone and a camera, a PC, and a film digitizer. The corresponding system used by the consultant would be similar, but may not require media acquisition devices such as the film digitizer and stethoscope. Depending on a specific application, multimedia systems for telemedicine will require different combinations of hardware and/or software components described under each of the following categories.[2,13]

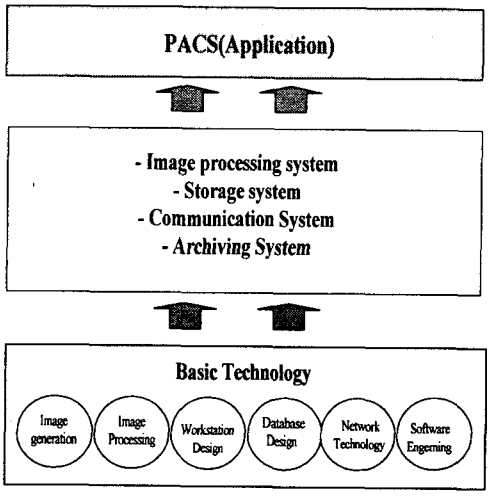


Figure 1. PACS Components

Images may be obtained from a number of sources. Still digital cameras can be used for acquiring highresolution images, e.g., for teledermatology or telepathology. X-ray films are digitized with laser scanners while images from digital imaging modalities such as MR, CT and CR are available directly in digital, DICOM-compliant formats[3].

Video and audio clips and medical images require temporary or permanent local storage. This storage can be provided through either magnetic and/or magneto-optical(MO) drives. If the telemedicine system is incorporated within a PACS, new incoming and old comparison images can be stored permanently in the PACS archive and accessed by the telemedicine system as needed.

Compression of medical images historically reversible or "losseless," limiting compression ratios to between 2:1 and 4:1. Lossy compression schemes have not been widely used for both clinical and legal reasons. However, standard and newer compression algorithms such as JPEG and wavelet based compression can yield "visually lossless" images with compression ratio between 10:1 and 20;1 , which produce statistically identical diagnostic results compared with using the original images without any lossy compression.

Image processing requirements for telemedicine applications can be derived from duplication the functionality available to corresponding tasks performed in the clinical environment without telemedicine. Basic image manipulation functions such as 90 degree rotations, horizontal and vertical flip are essential to correct the errors in image acquisition and assure that images can be presented to the clinicians in a way that they are accustomed to viewing them[4].

III. Telemedicine System for DooRae Application

Traditional medical systems are made up of very expensive hardware. Therefore, it need that the implementation of low price and user friendly CBM-based telemedicine systems which are presented in this paper[5~8].

Figure 2 is the video window that shows a doctor and a patient the patient's medical record during the medical session. This video window can be opened by several patients by software CODEC and performs high quality and rapid video processing with the by hardware CODEC. The widow on the bottom-right applies to the medical consultation process between doctor and patient with pictures and slides, etc.

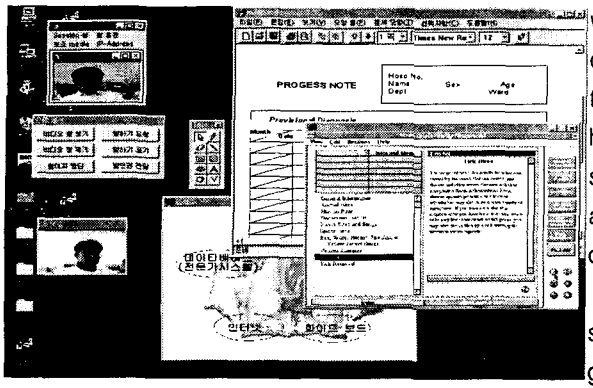


Figure 2. Example of telemedicine system widow

The whiteboard in the top-right applies to the treatment of patient's medical and psychological state through drawing graphic, writing text, learning and chatting. The tool box on the bottom left is the user interface part and displays the user friendly icon.[6-11].

IV. Telemedicine Environment

The structure of this system is made up of cooperative organizations around the core organizations, and the user (figure 4). The core organization consists of a telemedicine center and hospital or clinic. The cooperative organizations which support the core organization consists of cooperative clinics physical/health organizations, pharmacies, medical information providers, nurses, physical therapists, etc. From home or the user organization (school, company, special area or remote area) can request telemedicine.

The basic services are provided for the user by the telemedicine center. For basic items of medicine, the user is supported by an expert system. When a doctor is needed but does not need to be palpated, the user can be supported by a telemedicine system that operates like a face-to-face environment using CBM based video conferencing (which is interactive multimedia DooRae environment). For normal palpation, as through explained the situation by interacting between the doctor and patient on telemedicine. So that it is convenient to decide whether the patient has to go to a hospital (or clinic) or can be cured by drugs or other treatment without going to hospital (or clinic). When a patient has to go to a hospital (or clinic), the system checks the doctor's schedule at the hospital (or clinic) and make an appointment so that either the doctor or patient can have convenient and effective medical procedure.

For the advantage of the telemedicine, the patient can save the time and money and decrease the anxiety of going to a hospital (or clinic), and a hospital (or clinic) can perform on cyberspace transcending space and temporal spaces. And it maintain medical structure and construct a convenient medical welfare by consortium((which consists of physical/health center, drug store, or medical information provider, etc) for public welfare.

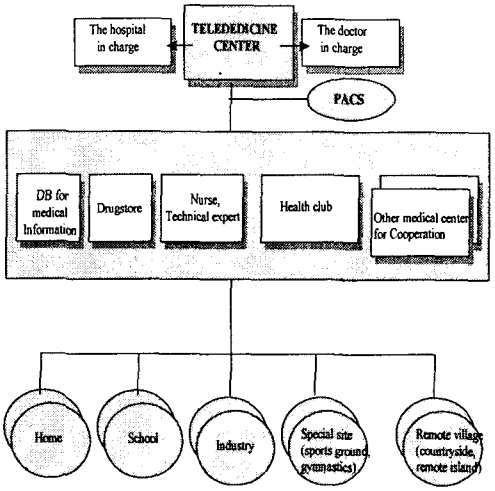
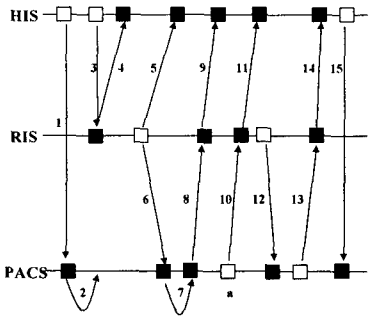


Figure 3. The structure of telemedicine center

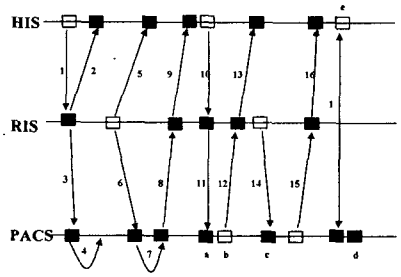
The role of center in figure 4 supports additional medical services by A managing patients and medical organizations and providing the services for patients. The structure of telemedicine in a hospital(or clinic) contains patient medical history.

The registration and administration process, support of expert system and database and medical support room (nurse room, X-ray or CT room, special treatment room, etc) for interactive telemedicine system.



1. Patient admission
2. Call to the past picture for examination
3. Registration for examination
4. Registration approval
5. A report for receipt
6. Patient receipt
7. - Obtain new picture for examination
   - Join examination information & past picture
8. Report for obtain picture
9. Report for obtain picture (can search)
10. An oral statement
11. Inform to finished of an oral statement
12. Report transcription
13. Approval reporter
14. Inform to report completion
15. Inform to the leaving the hospital
a. - Research & decipherment of picture

Figure 4. HIS/RIS/PACS transaction for inpatient



1. Registration for examination
2. Registration approval
3. *Inform to date for examination registration*
4. Call to the past picture for examination
5. A report for receipt
6. Patient receipt
7. - Obtain new picture for examination
   - *Join examination information & past picture*
8. Report for obtain picture
9. Report for obtain picture (can search)
10. Inform to registration date
11. Inform to registration date
12. *An oral statement*
13. Inform to finished of an oral statement
14. Report transcription
15. Approval reporter
16. Inform to report completion
a. - Control to priority decipherment
b. - Research & decipherment of picture
c. - Confirmation & modify of report
d. - Saving of picture
e. - Picture search & diagnosis and treatment

Figure 5. HIS/RIS/PACS transaction for outpatient

Figure 4 and Figure 5 present to each inpatient and outpatient case for HIS/RIS/PACS transaction. Figure 6 is for application example, this is telemedicine LAN network within hospital.

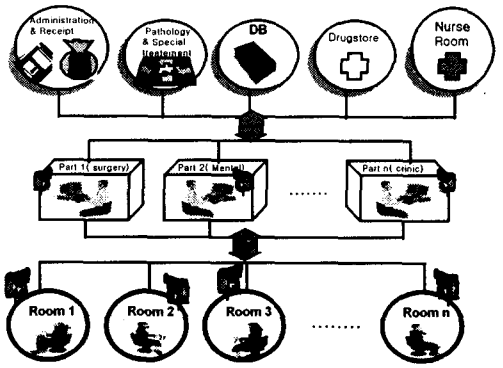


Figure 6. Telemedicine LAN network within hospital

V. Result & Analysis

A growing number of hospitals worldwide are implementing hospital-wide Picture Archiving and Communications System (PACS). A great deal has been written on the advantages, disadvantages and cost benefits of PACS. This presentation will focus on the highlights of clinical operation using PACS in a new hospital with approximately 380,000 radiological examinations per year, 50% by PACS and the rest by conventional films.

Table 1. Comparison of a Conventional Medical System and a PACS System

	Conventional Medical System	This System (PACS + Collaborative)
A depository	Large	Small
Maintenance expenses	High	Low
Development costs	Don't care	High
Efficiency (Storage)	Bad	Good
Efficiency(Speed)	Slow	Fast
Flexibility	Bad	Good

The merits of PACS which are presented in table 1, are as follows; a depository, maintenance expense, development costs, efficience(storage, speed),

flexibility(see table 1, Figure 10)[14]. Figure 11 is Audio, Video, Text and Image data interaction rate of PACS/RIS/HIS/Telemedicine relation.

This system is a real time collaborative telemedicine system which has a low cost for the general home PC user. And it supports a distance telemedicine of many function(see the table 2) between a doctor and a patient, among the doctors through the high technology of information communication.

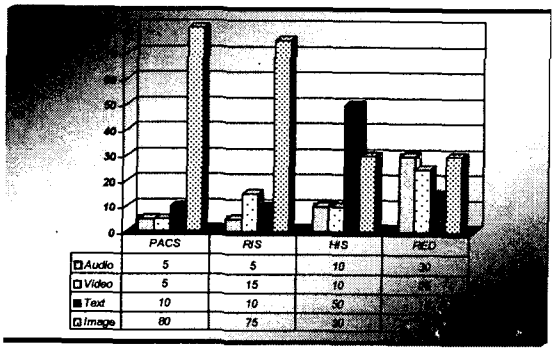


Figure 7. Audio, Video, Text and Image data interaction rat of PACS/RIS/HIS/Telemedicine relation

VI. Conclusion

Development of information technology makes a telemedicine system feasible along with the traditional medical practice of visiting a hospital (or clinic). This telemedicine workstation would include a PACS interface and between inpatient and outpatient HIS/RIS/PACS transaction protocol.

The corresponding system used by the consultant would be similar, but may not require media acquisition devices such as the film digitizer and stethoscope. Although this system has adopted PACS, this technology has been available for several years the integration of the system into clinical operation has had limited success due to stringent requirements of radiologists as well as the load demanded on the system.

This system can decrease the overload of a hospital (or clinic), and give the opportunity to individuals who are distantly located or cannot afford to visit the hospital (or clinic) to have medical benefits through indirect medical treatment.

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