

Design of a Multimedia Telemedicine System for Inter-hospital Emergency Consultation

In Cheol Park, M.D., Joon Ho Cho, M.D., Seung Ho Kim, M.D., Dong Keun Kim, PhD.¹ Sun Kook Yoo, PhD.¹, Jin Ho Oh, M.D.²

Purpose: The telemedicine systems for both timely decision of patient transfer and accurate direction of patient treatment through remote consultation are required for better patient care in emergency situation. In this paper, we present noble design methods to implement the emergency telemedicine system suitable for emergency consultation.

Methods: The prototype system designed can encompass multimedia components including radiological images, medical record, biological signals, video conferencing and full-quality video, as well as can transmit changing data in real-time. In the first stage, experimental tests at the local networks analyzed the technical aspects of designed systems, and optimize the parameters subjectively to run them with affordable error. In the Second stage, two medical emergency cases were examined between two hospitals, the first was advanced airway management, and second was the management a patient with cardiac problem.

Results: Experimental tests at the local networks, all multimedia components can be represented to both terminals without any problems. Two cases of clinical experiment have performed to demonstrate the clinical usefulness. Orotracheal Intubation was done successfully by local hospital physician who was directed by specialist at distant hospital. The second case, a patient with cardiac problem was good managed by specialist via this telemedicine system

without any problems.
Conclusion: Inter-hospital experiments demonstrate the feasibility to be effectively used at emergency department.

Key Words: Multimedia, Telemedicine, Emergency consultation

Department of Emergency Medicine, Yonsei University College of Medicine, Seoul, Korea, Department of Medical Engineering, Yonsei University College of Medicine, Seoul, Korea¹, Department of Emergency Medicine, Seran General Hospital, Seoul, Korea²

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Tel: 02) 361-5790, Fax: 02) 392-3715

E-mail: edksh@yumc.yonsei.ac.kr

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가 가
(HMRET; High-quality Multimedia Real-time
Emergency Telemedicine)

Modulation)
2.
Fig. 1 가
가
-IV 256 Mbyte , 1 GHz
(Central Processing Unit)
가 . USB (Universal
Serial Bus) 320×240
30 가
. PCI (Peripheral Com-
ponent Interconnect)
PCM (Pulse Code Modulation)

1. HMRET

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Table 1
가
MPEG-2 , JPEG
DICOM 3.0
H.261, F.711
encoding Huffman
DPCM (Differential Pulse Code

PCI
640×480
30 가
RS-232
RS-232
300
Hz, 12 bits
30
USB
100Mbps
Ethernet (LAN; Local Area Network)
PACS WAN (Wide Area Network)

Table 1. Design constraints for HMRET system

Data type	Priority	Real-time	Remarks
ECG wave	High	Yes	12 bits resolution, 300 Hz sampling ratio
Respiration, BP, and SpO2 wave	High	Yes	12 bits resolution, 200 Hz sampling ratio
SpO2 value, systolic pressure, diastolic pressure, temperature, heart rate	High	Yes	Update once per 30 seconds
Radiological images (X-ray, CT, MR etc.)	Low	No	Capture by either DICOM 3.0 or digital camera interface
Medical record	Low	No	Capture by digital camera
Full-quality video	Medium	Yes	640×480 resolution, 30 frames/second
Audio in video conferencing	High	Yes	Do not disturb conversation
Video in video conferencing	Low	Yes	320×240 resolution

3.

kernel

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filter,

(Fig. 2, 3).

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block

TCP/IP

visual C++

custom-built

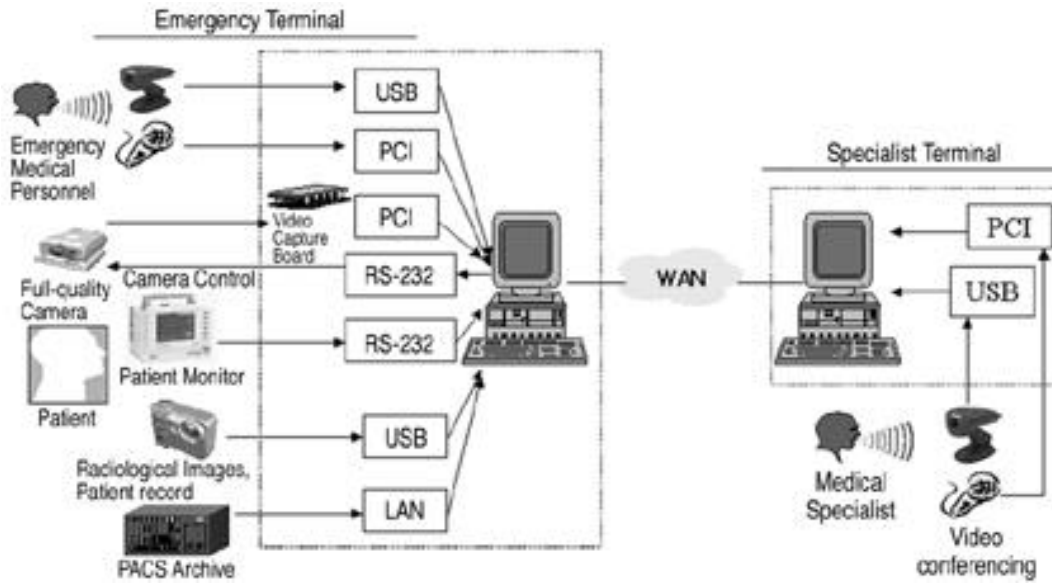


Fig. 1. Hardware configuration of the HMRET system

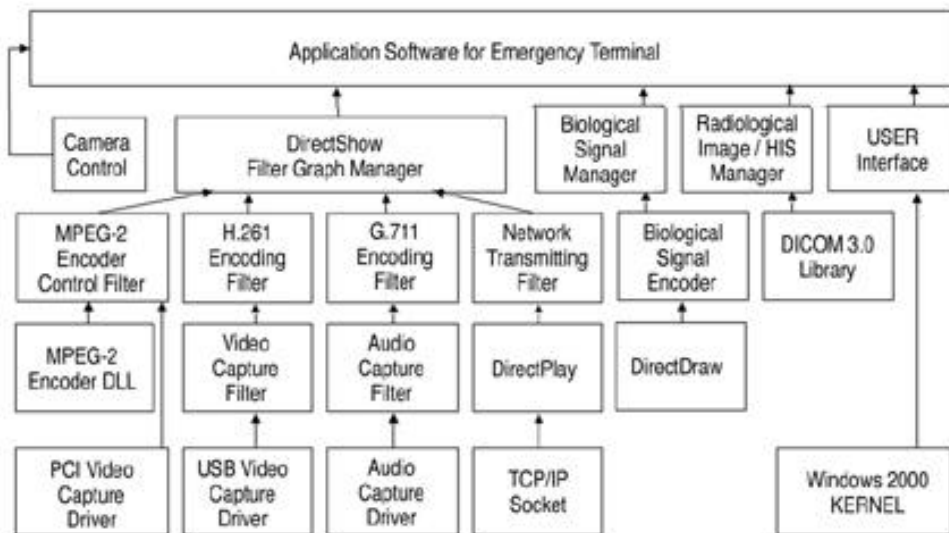


Fig. 2. Software configuration for emergency terminal

block Direct show, DirectPlay, DirectDraw

Fig. 4

PACS

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. 100 Mbps

Ethernet

가 tele-pointer

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4.

CSU (Channel

Service Unit)

E1 (

4 Mbps)

Ethernet (100 Mbps)

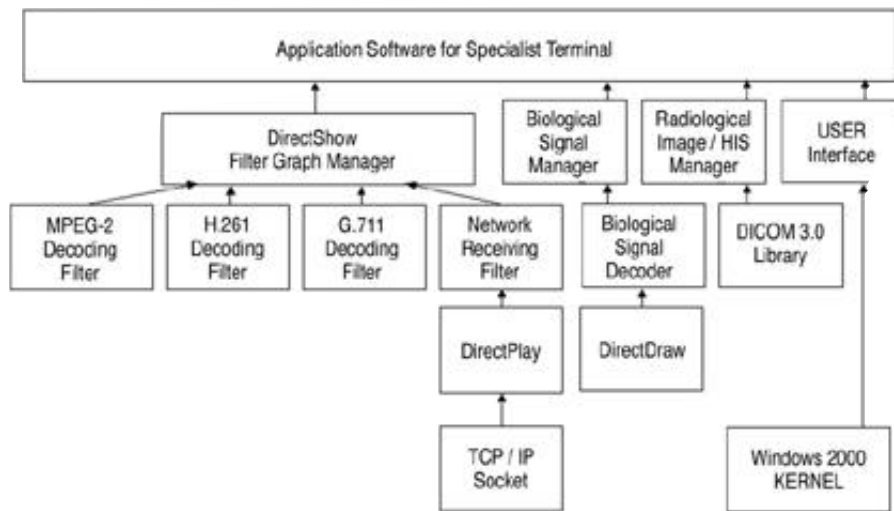


Fig. 3. Software configuration for specialist terminal

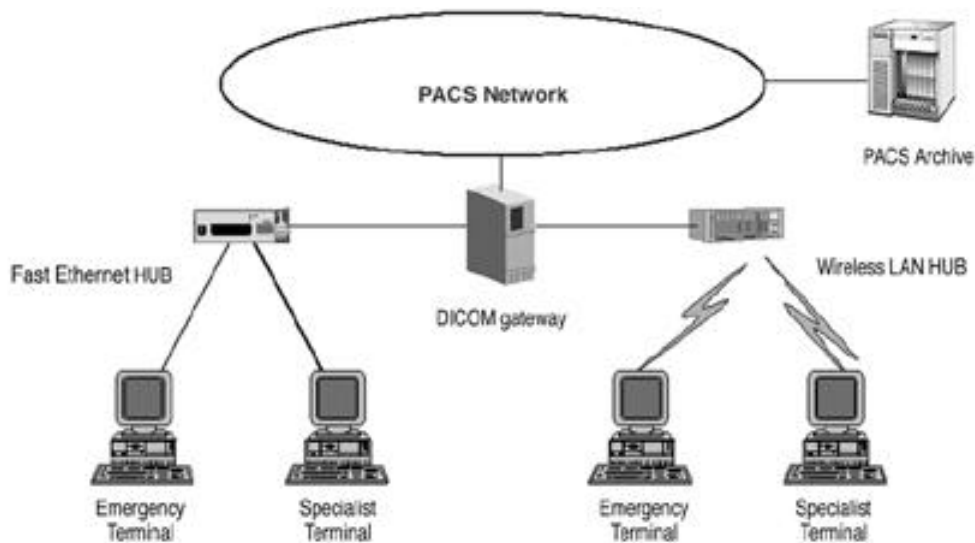


Fig. 4. Experimental network using fast Ethernet HUB and wireless LAN HUB.

(CISCO 3600) (Fig. 5).

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3.5

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Fig. 6

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10

HMRET

30

(Fig. 7).

Ethernet

1.5 Mbps

6 Mbps

MPEG-2 encoder

가

가

2

Fig. 7 D

2.9 Mbps

가

tele-pointer

가

2

7

30

9

30

2

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2.5 Mbps

(1.5~3.9 Mbps)

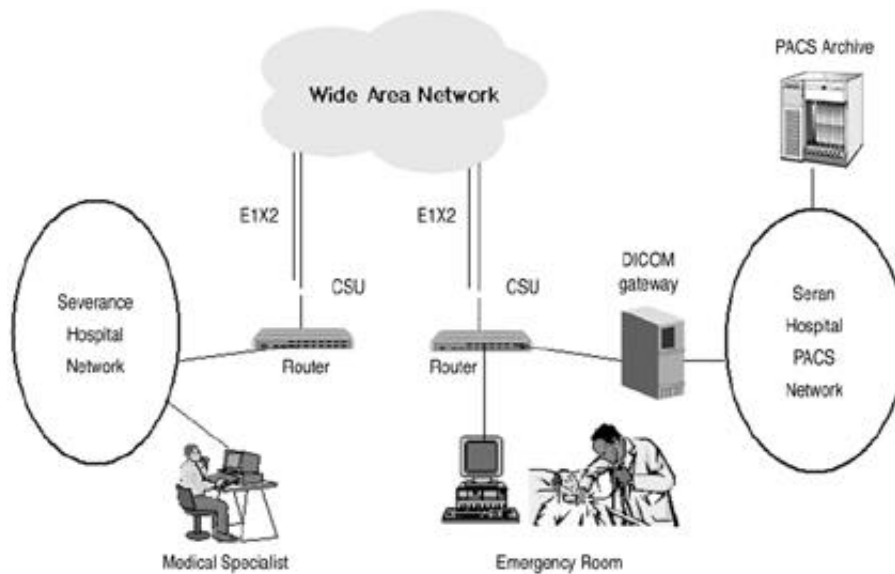


Fig. 5. Experimental setup between Severance and Seran hospital using leased two E1 lines.



Fig. 6. Artificial respiration procedure using manikin conducted through remote consultation.
 A. System set up
 B. Emergency personnel initially diagnoses the patient and starts to communicate with the remote specialist for the patient status.
 C. Remote specialist guides how to maintain the patient breathing
 D. Emergency medical personnel conduct the artificial respiration procedure through remote consultation.

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HMRET

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^{8,9)} Stahl ⁹⁾

. Roger ¹⁰⁾

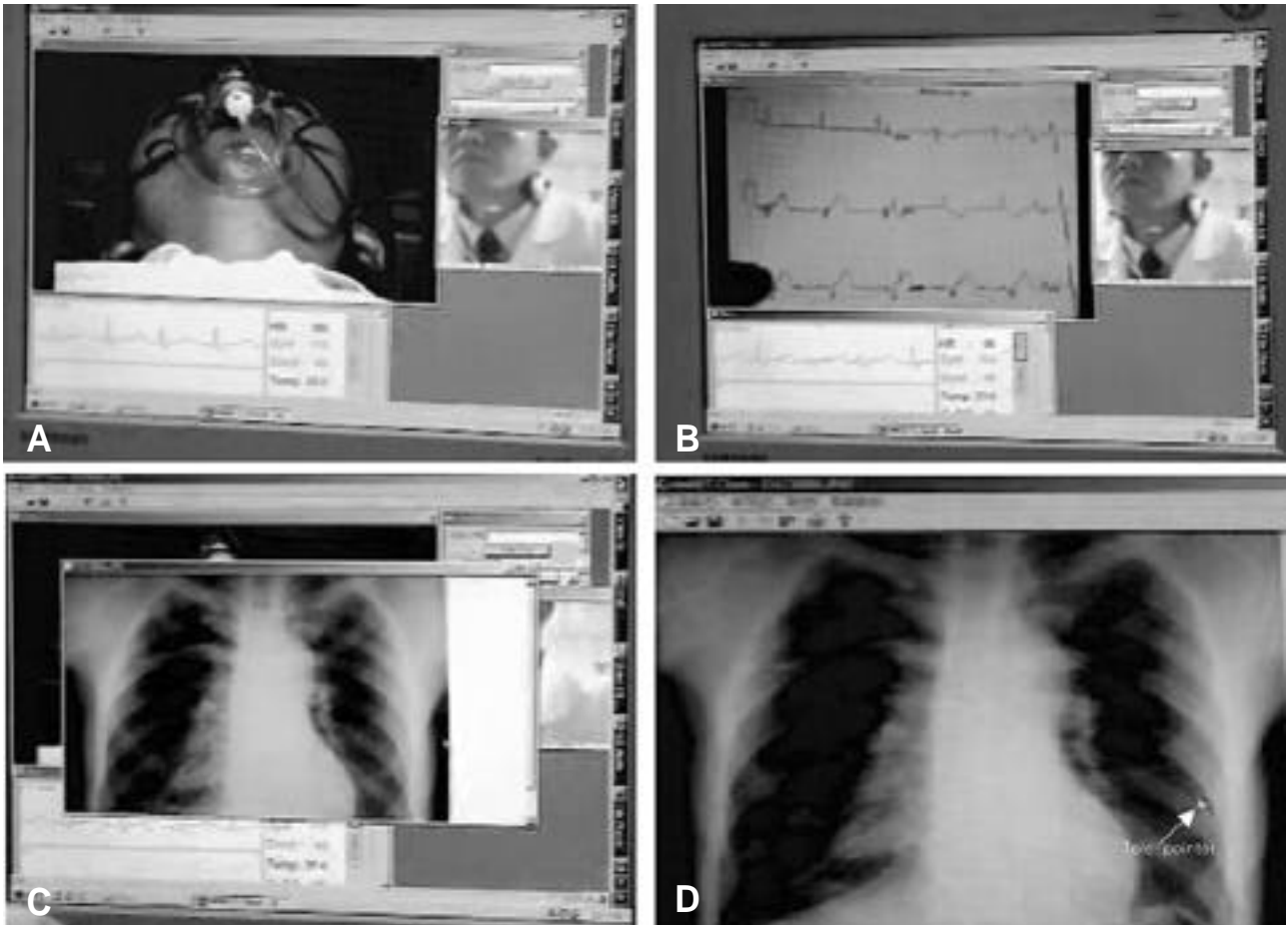


Fig. 7. The decision-making to transfer the cardiac patient to tertiary hospital conducted through remote consultation.

- A. Start of consultation
- B. Sometimes, transmission of chart recorded ECG using video camera is convenient and simple.
- C. View of chest X-ray
- D. Tele-pointer synchronizes the operation at both sides in inspecting the suspicious area.

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PACS

(Picture Archiving and Communications System)

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Frederick ⁹⁾

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