Using IP-videoconferencing systems in a Surgery Consulting

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Abstract. In this paper we describe how to use IP-videoconferencing systems in medical surgery consulting. We started to think about how we could use special doctor's services without patients having to travel a long way. The answer to this question is that the information goes from one place to another, not the patient. First we had a pilot project, where we used the 3xISDN transmission rate and now we are using ATM. We have here in Satakunta a local area network between our Satakunta Central Hospital and the Health Care Center in Noormarkku and Kankaanpää, so we have very good environment to do this kind of research. Our network is quite fast, we can use the 10 Mbps bitrate and in this network there are no other activities in this moment, so there are not any interferences. There is a surgery specialist in the hospital and a doctor in the health care center with a patient. The specialist looks at the monitor, where there is a videopicture of the patient from the health care center. Then the specialist makes the treatment plan for the patient.

1. Introduction

Telemedical practical research have been done by The Health Informatics Center of Excellence in Satakunta (HC-ICE). In this consortium there are three different parties. They are Satakunta's healthcare department, Pori School of Technology and Economics and Pori Telephone Company. The aim of the project is to develop telemedicine services for health care centers [1]. Telemedicine services include teleradiology[2], telepathology, tele-endoscopy and teleultrasound medical examinations and laboratory-medical referral-opinion.

The development of those activities which support the use of information technology in health care is important for the project. The project will be implemented in co-operation with other information network projects in order to find synergy between them. We have four medical projects. These are surgery consultation services to health care centers, evaluation of radiology services [3], citizens' and experts' information services using various transfer media and web based clinical information sending- and storing server service. This paper treats the surgery consultation service for health care centers.

In the first surgery consulting pilot project we used ISDN (Integrated Services Digital Network)-video conferencing systems. The outcome of the pilot project was that the end users, doctors and patients were very satisfied with the technical reliability of the system [4]. We utilized Picture Tel videoconferencing systems with document cameras. In this project we had 50 surgery patients from two health care centers. The surgery specialist was in the Satakunta Central Hospital and the Health Care Center doctors were with the patients in the health care centers.

Because we got good results from the first project and Pori Telephone Company built a fast and modern local area network, we decided to test surgery consulting by IP-based videoconferencing systems. With this pilot we wanted to find a good, low-priced desktop videoconferencing system which is also easy to use. With this kind of system we can give the same expert services to all patients in spite of were they live and in which hospital the specialist works.

2. Methods

The ISDN-conferencing systems and services use the H.320 standard that enables transmission speeds 384 kbps. This speed is enough to get a good quality picture, but these systems for clinical use are quite expensive. And these new desktop videoconferencing systems that utilize TCP/IP - protocol are less costly but require high bandwidth. This standard H.323 enables transmission speeds of up to 768 kbit/s. Videoconferencing is highly valued because it enables businesses of all kinds to conduct diversified, visual communication over distances that otherwise could only be bridged by time-consuming travel.

In this project we used the virtual local area network, that Pori Telephone Company has built. This local area network is a secure private virtual network. The 10 Mbps transmission rate is used between the hospital and the health care center. At this moment there are no other activities in this network, so there are no interferences. The connection between the partners are based on PVCs (*Permanent Virtual Connection*) and the information rate varies from 2 Mbps to 10 Mbps. The protocol used is TCP/IP and the LANs are connected virtually. In figure 1 we represent our consulting technical setup and the architecture of the IP (*Internet Protocol*) over ATM (*Asynchronous Transfer Mode*) area network in Satakunta.

For both Satakunta Central Hospital and the Health Care Center in Noormarkku the desktop videoconferencing system is provided by Sony Trinicom. This videoconferencing system contains a videoconferencing card, a small colour videocamera with microphone and datasoftware for the program and it uses the TCP/IP-protocol.

In this surgery project we had 50 patients. The surgeon was in Satakunta Hospital and the patients were with an other doctor in the Health Care Center of Noormarkku. The surgeon saw the picture of the patient on the PC screen. The general picture was shown with the smaller camera, which was placed over the monitor.

The document camera (EV-450 AF PAL) was used to look at the patient from further off. The document camera contained a good zoom lens, a base light possibility, and a possibility to turn the camera. It was good also, when the patient was on the examination table and the surgeon wanted to get an exact picture. We also showed paper documents and X-ray pictures with the document camera.



Figure I. Technical setup

3. Results

In the surgical consultations the doctor in the health care center interviewed and examined the patient in front of the videocamera, as the surgeon watched the PC-monitor in Satakunta Central Hospital. The study material consisted of 50 surgical patients. 23 of them were men and 27 of them were women. The men were aged between 12 and 80 and the women were aged between 15 and 90. The data was collected from questionnaires filled out by the doctors and the patients.

Figures two and three we represent the average answers five technical questions, such as "How well could you present your problems in teleconsultation compared with a visit to the doctor?" Figure two shows that the patients' opinion of the technical suitability of the teleconsultation was superior in 21 % and good in 54 % of the cases. Figure three shows that the doctors' opinions were that in 65 % of the cases the technical suitability of the teleconsultation was superior and in 29 % it was good.

Figure four shows the average answers to the questions regarding satisfaction and reliability. For example "The treatment plans made in teleconsultation were as reliable as if they had been made in hospital". Forty-four out of 50 patients (60 % completely agreed and 28 % agreed) thought that the decisions concerning their problems were as reliable as in face-to-face contact and only three % of the patients thought that the decisions might have been unreliable and two patients didn't say their opinion. Figure five shows the average of the doctors' opinions of satisfaction with teleconsultation. In 75 % of cases the health care center doctor thought that the teleconsultation was very reliable compared with a visit to the outpatient clinic at the hospital, and in 22 % of the cases satisfactorily reliable.

Then we presented the patients with different kind of statements dealing with how much the technique disturbed the consulting, such as "The technique got so much attention, that my problems were in secondary place". 59 % of the patients thought that it didn't disturb at all and 19 % thought that it maybe disturbed a little. A few patients thought that the technique disturbed the consulting too much. This is shown in figure six. The doctors thought that the technique didn't disturb the consulting in none of the cases. These doctors' opinions are represented in figure seven.





Figure 2. The patients' opinions of technical suitability of the teleconsultation





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Figure 5. The doctors' satisfaction regarding teleconsultation

Figure 6. The patients' thoughts the disturbina aspects of the technique

Figure 7. The doctors thoughts of the disturbing aspects of the technique

4. Discussion

First we had some problems with sound. We used in the first instance the microphone of the small camera. If the patient and the doctor were far away from the camera, the doctors and the patients didn't hear each other well. We also had problems with the sound, if more than one person talked at the same time. We resolved this problem using the callport. The callport is a machine which includes loudspeakers and microphone in the same device. With the callport we got a good sound quality. But it is quite an expensive way to do it. We have to study if it is possible to reach the same quality with using a soundcard and a cheaper microphone. We have tested some but we haven't found a good system yet.

Another thing which we have to test, is to make a videoconferencing between H.320 and H.323 systems using a gateway. We have to learn if these different systems are negotiating with each other. If they do, there are more possibilities to extend videoconsulting to many other health care centers. And of course we have to study how the multipoint videoconsulting suits the medical consulting.

Technically the videoconferencing system functioned reliably, and the quality of the video picture was good. Nearly all patients would have been saved from travelling to a face-to-face appointment, because they got a detiled treatment plan during the videoconsultation. The doctors were satisfied with the reliability of the medical treatment plans in teleconsultation.

We can conclude that surgical consultations are reliable in a teleconferencing system, and that the patients were satisfied with the new method.

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