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TITLE: H.322/3 and an example software based multimedia conferencing system
PURPOSE: Information

Abstract

This document describes an example LAN based multimedia conferencing system, with interworking to standard H.320 terminals in the public network via an ISDN gateway. All video and audio codec functions are software based. Common PC platforms and audio and video capture cards are used.

This document is provided as an illustration as to what is possible in multimedia conferencing using commonly available PC based hardware.

1. Introduction

The Video and Multimedia Conferencing (VMC) project is a development from within the Video Communications Group at Monash University, and is supported by funding from the Australian Government, Siemens Ltd, Telstra, and the Australian Computing and Communications Institute. This document reports on work in progress and updates earlier contributions [1-3].

The project aims to provide multimedia conferencing on a LAN using standard PC based hardware. Interworking with H.320 terminals in the public ISDN network is provided through a gateway. An economical solution is achieved through the use of software based coding and off-the-shelf audio and video capture cards.

The feature of the VMC system is the low complexity software implementation of the video coding algorithm, which allows implementation on PCs while maintaining compatibility with H.261 codecs.

An overview of the system under development is shown in Figure 1. Figure 2 shows a typical view as seen by the terminal user. Table 1 provides a summary of some of the major aspects of the system

2. Terminal functionality

The VMC terminals provide audio video conferencing as well as a shared chalkboard application.

The feature of the system is the low complexity implementation of the video coder and decoder which makes software implementation possible. The encoder uses no motion compensation. The intra/inter coding mode decision is based on motion-detection. A 4x4 DCT is used. The drift that results in the decoder loop when working with a standard H.261 coder is minimised by appropriate loop filtering. This aspect of the work has been published [4, 5].

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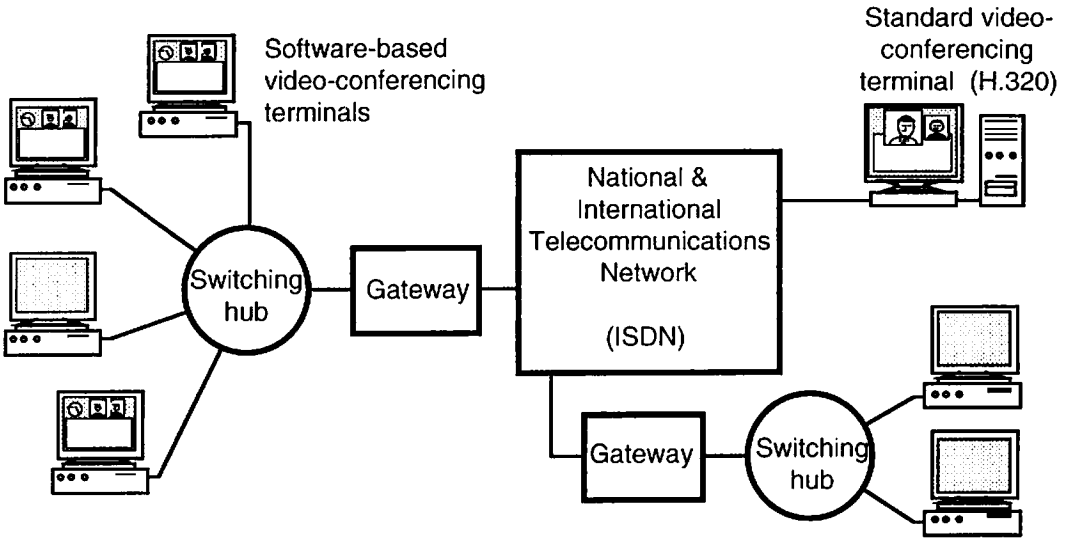
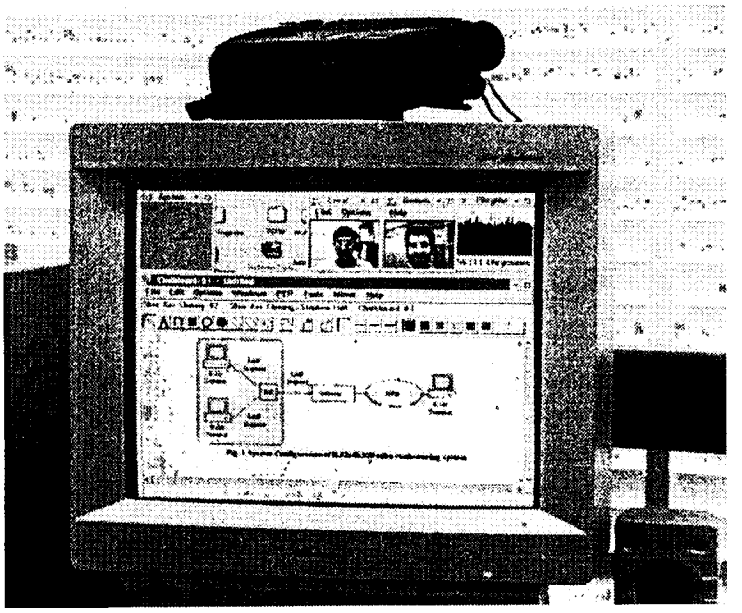


Figure 1. VMC project overview



cpu loading

Figure 2. Prototype VMC software based video conferencing system terminal

It has been found that a video frame rate of greater than 8 frames/s is required to show reasonable lip synchronisation. This was found to be more important than a high resolution image.

The current audio capture cards are not fully compatible with H.320. The ActionMedia II card produces 32 kbit/s ADPCM which is incompatible with ITU-T recommendations. The sampling rate of this card is 11kHz. Sampling rate conversion and the A-law companding function is performed in software. The second capture card, the PAS16 sound card, is used to supplement the audio gain of the ActionMedia II card. While this card provides stereo audio encoding or decoding, it is not possible to use this card for simultaneous audio encoding and decoding, as required in a conference application.

Audio and video streams are carried in separate LAN packets. This avoids the computationally intensive process of the H.221 bit multiplex and synchronisation in the terminal, and provides a fair distribution of computational requirements between the terminal and the gateway [6]. Good sychronisation between the audio and video on the LAN is achieved by interleaving audio and video packets, and by minimising processing delays.

aspect	parameter	description
terminal hardware:	platform	60 MHz Pentium, OS/2
	AV capture	ActionMedia II card (+ PAS16 sound card)
video coding:	image size	88 x 72 pixels
	frame rate	10 frames/sec
	bit rate	64 kbit/s
	DCT size	4x4
	coding algorithm	intra/inter decision based on motion-detection, no MC, no inverse DCT
	decoding algorithm	loop filter optimised to minimise drift
audio coding:	algorithm	32 kbit/s ADPCM (ActionMedia II card), 64 kbit/s PCM (PAS16 sound card)
data:	shared application (IBM person to person)	chalkboard (not integrated into AV transport protocol)
LAN:	protocol	Novell IPX/SPX
	AV transport protocol	header with 1 bit field to distinguish between audio and video packets
gateway hardware:	platform	90 MHz Pentium, OS/2
	ISDN interface	Tennyson Technologies ISDN card

Table 2. Parameters of the VMC software based video conferencing system

In the prototype system the LAN segments are lightly loaded. Some segments are shared amongst a number of users. When packet loss occurs recovery of the audio and video decoders occurs quickly. The conferencing system is considered to be tolerant to some packet loss.

There is no flow control of audio or video packets between the gateway and the terminal. A future option may be to negotiate a packet rate at call establishment.

This software is written in C code and run on the OS/2 operating system. No optimisation of the code has been done. Code optimisation is expected to give a significant speed improvement.

3. Gateway functionality

The main software function of the gateway is the conversion between audio and video packets on the LAN and the H.221 bit multiplex for the public ISDN network. The gateway also provides rate adaptation between the LAN terminals and the ISDN B channels.

An ISDN card in the gateway interfaces to the ISDN network and provides ISDN signalling. Access to the public network through such a shared gateway anticipates that, just as with current customer premises telephone equipment, more calls are made internally then externally.

4. Status of work

Currently terminal-to-terminal audio video conferencing, with a shared chalkboard, is implemented. The gateway is under development and expected to be completed within the next three month period.

5. Future work

Future work will consider the following

- optimisation of software
- use of other capture hardware
- porting of software to other real time operating systems
- implementation of both terminal and gateway functions in one Pentium PC. It is expected that a high performance PC will be required.

6. References

[1] S. Hall, "Packetisation of H.221 frames for LANs", ITU-TS SG15 AVC-587, Daejeon, October, 1993.

[2] S. Hall, "Design of H.32z terminals for LANs", ITU-TS SG15 AVC-512, Boston, July 1993.

[3] S. Hall, "H.32z protocol for LANs", ITU-TS SG15 AVC-513, Boston, July 1993.

[4] K. Pang, H. G. Lim, and S. C. Hall, "A low complexity H.261-compatible software video decoder", *Australian Telecommunications Networks and Applications Conference 1994 ATNAC'94*, Melbourne, Australia, 5-7 December 1994.

[5] H. G. Lim, K. K. Pang, T. K. Tan, and S. C. Hall, "A low complexity H.261-compatible software video decoder", to be published in *Signal Processing: Image Communication*, Vol. 7, 1995.

[6] R. J. Lang, S. K. Cheung, and S. Hall, "Packet/circuit interworking for multimedia conferencing services", *Australian Telecommunications Networks and Applications Conference 1994 ATNAC'94*, Melbourne, Australia, 5-7 December 1994.

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