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Product Report: SightSpeed Video Messenger

SightSpeed's Video Messenger is a desktop video conferencing application for Windows. The company SightSpeed, founded by the developers of the video CODEC incorporated into the application, claims to offer high quality, real-time video over IP-based networks (including Internet and corporate enterprise networks) for DSL or higher connections [1]. For \$4.95 a month, or \$49.50 per year, the users can purchase an application that supposedly outperforms Microsoft's NetMeeting and similar available products in terms of delay (latency), at much higher spatial resolution and frame rate. Since the video is coded with a new type of video codec that is computationally inexpensive, the latency achieved is at times slightly faster than the plain telephone, which eliminates the need to delay the audio to synchronize with the video [1]. Low bit-rates achieved with this new codec and compression techniques employed enable full two-way (full duplex) natural conversations with video feeds.

The figure below shows the video messenger's user interface. Similar to typical text-based messengers, SightSpeed has a list of friends who are using the same product and with whom it is possible to establish a video conferencing call. Once the connection has been established, a new window (176x120) opens up with a video feeds of the other person (this person's video can also be visible, superimposed in the lower-right corner of the window - in the figure only the colorbars are shown, because the camera is not plugged in). Besides some basic options available in text-based messengers, SightSpeed offers a monitoring application, which reports the details about the network throughput, CPU usage, and latency at which the video is being delivered.



Figure 1: SightSpeed's Video Messenger GUI

The core of SightSpeed's application is CU30, a software-based video codec developed at Cornell University's Laboratory for **D**igital **S**ignal **C**ompression & **V**ideo **E**ncoding **R**esearch (DISCOVER), which can provide full duplex, full color, high-quality CIF/Q-NTSC video at 30 frames per second on average PC systems [3]. Contrary to the codecs from MPEG family, CU30 does not transform visual information into a frequency domain, but instead attempts to exploit the deficiencies of human visual system (HVS) as much as possible. Motivated by the experiments which showed that the human eye is a poor image-capturing device, but that the brain compensates for this by interpolating the missing pieces, the DISCOVER team defined a perceptual threshold (in terms of difference from the previous frame), below which there is no need to code visual information. They use an algorithm called *conditional replenishment* to code only the address of the "surviving" pixels (after thresholding) and their intensity values. The compression of a frame is then done using *facsimile-based* techniques and it is coded as a bi-level picture (with two levels representing surviving and non-surviving pixel positions) plus an intensity vector. The first frame of any sequence is intra-coded and simple linear prediction is used for intra-frame pixel predictions [4].

Properties of HVS are exploited also in case when the objects in a video are in motion: CU30 will enhance the edges of the object and degrade the detail within it, which the brain will interpolate. This, together with a number of other elements adopted from the study of HVS, combines to form a real-time compression and decompression system with latency under 15 ms (which should be added to the average 50ms delay of an IP network – human perception threshold is 100ms), [1].

In terms of data transport, SightSpeed uses only one port for all communications. It uses either standard UDP or TCP packet encapsulation, therefore allowing all firewalls to be easily modified to support its data; since UDP does not provide guaranteed delivery, SightSpeed has developed adaptive rate-distortion algorithms for loss recovery, dynamic bandwidth adaptation, and congestion control, which are combined with a video codec in the application layer. SightSpeed network protocol also provides 128-bit SSL encryption and is compatible with SIP [2].

[1] White Paper on SightSpeed Technology, <http://www.sightspeed.com/files/SightSpeed-WhitePaper.pdf>

[2] White Paper on SightSpeed Firewalls and Security, <http://www.sightspeed.com/files/SightSpeed-FirewallsWhitePaper.pdf>

[3] Cornell University's DISCOVER Lab, <http://discover.ece.cornell.edu/html/about.html>

[4] Chiu Yi-Jen and Berger Toby, "A Software-Only Videocodec Using Pixelwise Conditional Replenishment and Perceptual Enhancements", *IEEE Trans. on Circuits and Systems for Video Technology*, April 1999.