NEWS RELEASE

NTT

May 30, 2002

Nippon Telegraph and Telephone Corp. (NTT)

NTT Develops "Echo Canceller" with Noise Reduction

-- Enables comfortable hands-free communications even while driving or during video teleconferencing in noisy office environments --

Nippon Telegraph and Telephone Corp. (NTT; Head office: Chiyoda-ku, Tokyo; President: Jun'ichiro Miyatsu) has developed an "echo canceller "with a noise reduction function that enables comfortable, hands-free communications using a microphone and loudspeaker, even in noisy environments.
The unique feature of the recently developed unit is that it incorporates a function to reduce ambient noise sufficiently without any distortion in the transmitted speech -- a function that could not be achieved with conventional echo cancellers. In the conventional hands-free communication system, clear sounds could only be achieved when the talker was in quiet room, or was wearing a headset with a microphone and earphone. This new technology can be used in video teleconferencing applications using PCs in noisy office environments, or for clear communications during hands-free operation of mobile phones while driving. NTT expects that the new technology will thus be adopted for use in a wide range of business and personal situations.

○Background to Development

When video teleconferencing systems -- which run on high-performance PCs that have become increasingly common to ordinary users -- are used in regular office environments, a problem has arisen in that in addition to echoes*1 emitting from the loud speakers, the microphone picks up ambient noise from sources such as air conditioners, the PC's cooling fan, or people's noise. All of these extraneous noises prevent the clarity of the conversation. In the case of hands-free mobile phone systems in automobiles, the microphone picks up engine noises and other sounds associated with the vehicle's operation, resulting in harsh noises that grate on the user's ear. The success of these applications will rely on the development of technologies targeting hands-free communication systems that can be used in diverse environments without being affected by ambient noise.

○Keys to Related Technologies

In the hands-free communications using a microphone and loudspeakers, there are three types of sounds picked up by the microphone: the user's speech, echoes, and ambient noise. Conventional echo cancellers utilize a technology that cancels the echo element among these three combined sound types. Specifically, it iteratively learned the relationship between the far-end speech and the echo, and estimated echo replica

being created by the far-end speech. It then subtracted that estimated echo replica from the signal picked up by the user's microphone, which contains the three combined elements described above. With this technology, however, ambient noise on the user's side could not be canceled, because it is impossible to estimate this noise using the same method; as a result, ambient noise could not be reduced. There was yet another problem that echoes smaller than the ambient noise (i.e., echoes "hidden" in the noise) could not be completely canceled.
NTT CyberSpace Laboratories' newly developed echo canceller with noise reduction function resolves these problems, using the technologies outlined below to reduce out ambient noise and even echoes hidden in that ambient noise.

(1)Highly accurate noise reduction using differences in temporal and frequency characteristics between speech and noise

Stationary noises in office environments (like air conditioners) have two unique characteristics that differ from human speech: the signals change gradually over time, and they contain frequency components with broader ranges than speech. By using these characteristics, the system estimates only the stationary noises, and then reduces these noises by subtracting the appropriate gained noise in each frequencies from the mixed sounds -- which include ambient noise -- picked up by the microphone. This technology achieves a sound reduction level of up to 20 dB. This is equivalent to reducing the noise level of a busy production plant to that of a quiet meeting room, and will ensure a dramatic improvement in clarity for voice communications.

(2)Two-stage configuration achieves high-performance echo cancellation

NTT's new echo canceller first uses conventional methods to cancel echoes which have a higher level than the that of ambient noise. Next, it generates the residual echo replica by using the reverberation frequency characteristics, as well as the frequency characteristics of the speech, to approximate the smaller echoes that could not be cancelled because they were hidden in the ambient noise. Finally, the approximated echo corrected appropriately in each frequency is subtracted from the microphone input.

(3)Human auditory characteristics prevents distortion in speech.

This technology makes echoes and other noise inaudible with a minimum degree of cancellation by using an auditory phenomenon called "masking," in which the lowest sound pressure level detectible to the human ear is increased through the presence of other sounds. This function has been incorporated to avoid excessive cancellation processing of the transmitted speech, thus ensuring that the speech transmitted during communications are as natural as possible.

○Future Developments

The popularization of broadband networks will no doubt give rise to extensive remote collaborations and communications linking a wide range of venues, including offices, homes, and automobiles. NTT will endeavor to put the new echo canceller to use in these applications immediately. It will also incorporate stereo sound to achieve more natural sound, and examine multi-location video teleconferencing applications for improved convenience.

<Glossary>

*1 Echo

Echo is the sound which is emitted from a speaker, reflected from walls and fed

back into the microphone.

- Figure 1 Typical application for echo canceller with noise reduction
- Figure 2 Cancellation of ambient noise and echoes hidden in ambient noise

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