



technology opportunity

Sub-vocal Speech Recognition

A System for Understanding Electromyographic or Sub-vocal Signals



The sub-vocal communication system provides one or more tiers, in addition to conventional audible communication, to exchange or transfer information compactly, reliably, and accurately.

Communication between two or more humans, or a human and a machine, is traditionally dominated by visual and verbal modalities, the former being largely alphanumeric. Methods to automate human-to-human or human-to-machine communication, such as commercial speech recognition, emphasize the audible signal characteristics. A totally auditory approach places a number of constraints on signal quality, including sensitivity to ambient noise, a requirement for proper formation and enunciation of words, and use of a shared language. Physical limitations during sound production or sound recognition also becomes problematic in unusual environments, such as handling hazardous materials (HAZMATs), extra vehicular activity (EVA) space tasks, underwater operations and chemical/biological warfare (CBW). Conventional auditory speech may be undesirable for private communication in many daily situations; such as discrete or confidential telephone calls, offline or sotto voce comments during a teleconference call, certain military operations, and human-to-machine commands and dialogs. Communication alternatives that are both private and not dependent upon production of audible signals are desirable.

Benefits

- Communication is no longer hindered by noise level
- Multiple options allow for compact, reliable, and accurate exchange of information in challenging contexts
- System relies on muscle signals and requires minimal acoustic input opening options for multiple communication generators

Applications

- Medical service workers
- Emergency service workers
- Homeland security investigators
- SWAT team members
- Physically disabled and speech-disabled persons
- Robotic control
- Silent cellular phones

Technology in Detail

Sub-vocal speech is a new form of human communication that uses tiny neural impulses (EMG signals) in the human vocal tract rather than audible sounds. These EMG signals arise from commands sent by the brain's speech center to tongue and larynx muscles (the speech articulators) that enable the production of audible sounds when air is moved through the articulators. Sub-vocal speech recognition arises when EMG signals are intercepted before an audible sound is produced and, in many instances, allows inference of a corresponding word or sound. If sub-vocal EMG signals are received and appropriately processed, production of recognizable sounds is no longer as important. Further, the presence of noise and of other intelligibility barriers, associated with audible speech such as accents, no longer hinder communication. The method works because neuro-muscular signals remain reasonably consistent, arising as they do from use of a shared language constraint between (sub-vocal) speaker and listener.

Patents

This technology has been patented (U.S. Patent 7,574,357).

Licensing and Partnering Opportunities

This technology is part of NASA's Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to inquire about licensing possibilities for this technology for commercial applications.

For More Information

If you would like more information about this technology, please contact:

**Andrew Vo
Technology Partnerships Division
NASA Ames Research Center
(650) 604-0004, andrew.vo@nasa.gov**