National Aeronautics and Space Administration

Characterization of Bioelectric Potentials

NASA has invented a virtual system that monitors and interprets bioelectric signals in human muscles and related body components that are generated by gestures. This new system, which is both non-invasive and non-intrusive, translates bioelectric signals in the human body to one of more electronic commands for a selected instrument, such as a computer, signal processor, vehicle controller, and cellphone. The bioelectric signals monitored in this invention are primarily electromyographic (EMG) signals, which are due to motion of one or more muscles in the human body. The system includes two or more spaced-apart sensors, each including one or more electrodes that sense bioelectric signals appearing at the surface of the skin in the monitored person.

This patented technology is available for licensing from NASA's space program to benefit U.S. industry.

Technology Details

This invention monitors Electromyographic (EMG) signals which are due to the motion of one or more muscles in the human body. The virtual system forms and analyzes differences between signals generated at the sensing locations in each of a sequence of overlapping time intervals. Hidden Markov modeling or neural net analysis is used to identify a sequence of states that are associated with, and/or characteristic of, the bioelectric signals that accompany the human-made gesture. An initial chosen set of course and fine gestures includes, but is not limited to, using a hand and/or arm to make the following motions: stop/come, thumb-up/thumb-down, tapping with at least one finger, reaching for and depressing at least one key on a keyboard, moving a joy stick in at least one direction, touching a joystick without movement of the joystick, positioning a stylus near a touch screen, and similar gestures in a three-dimensional virtual environment. A typical gesture lasts between 0.3 and 3 seconds. Analyses of the bioelectric signals are performed by the virtual system and the resulting data signals are transmitted using an attached cable or transmitter to a signal processor that is programmed to respond to receipt of such signals. Alternatively, the system may transmit raw signal data, using the cable or transmitter to the processor for analysis of, and response to, the sensed signals.

Commercial Applications

- Cellular Biophysics
- Bimolecular computing
- Aerospace
- Biotechnology
- Medical devices

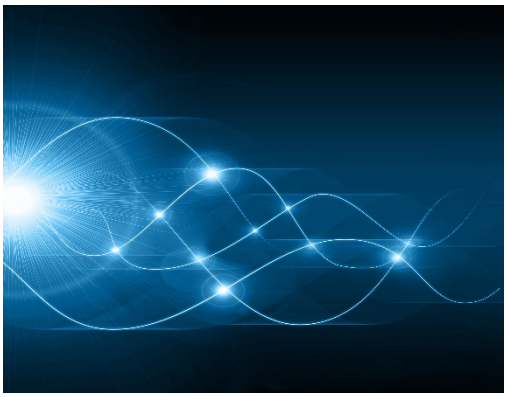
Patent

This technology is protected by U.S. Patent No. 6,720,984
(Reference No. ARC-14494-1)

Benefits

- Noninvasive, nonintrusive monitoring of bioelectric signals on a human
- Rapid, real-time analyses and identification of an executed gesture by a human
- Control of an instrument (computer, signal processor, cellphone, etc.)
- Control of an aircraft and other mobile vehicles
- Data entry from a keyboard or other device
- Virtual entry of data and command in extreme environments

Every movement in the workplace can be monitored by the EMG while providing freedom of movement to the wearer.



Electromyographic

Contact the Ames Technology Partnerships Office at 1-855-627-2249 or ARC-TechTransfer@mail.nasa.gov