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Paper Title: The development of a competitive multiplayer electromyography-based biofeedback video game

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Abstract

Biofeedback training is a method of combining information technology with physiological therapy and rehabilitation. Electromyography (EMG) is a muscle biopotential measurement technique that is widely used for monitoring the activity of muscles. This method has been applied to biofeedback training and lets individuals learn to control their muscles properly through the visualization of electrical signals. Video games have been incorporated into EMG biofeedback training to make the sessions more enjoyable and challenging. Competition has been considered one of the key factors enhancing self-improvement to overcome challenges in video games. This work proposes the development of a real-time EMG biofeedback system that is integrated into a multiplayer competitive video game. The development consisted of the implementation of a low-cost EMG data acquisition device and EMG biofeedback software. The system was designed with the aim of demonstrating a method of acquiring EMG signals from the antagonistic forearm muscles of two players and utilizing them to myoelectrically control a virtual table tennis video game. A multiprocessing architecture has been applied to biofeedback software development to achieve the goal of a real-time system. This allowed the software to simultaneously handle the EMG data stream, process the data, control the video game, and record the data to memory storage. The system evaluations show that, with this development, the competitive EMG biofeedback system was able to respond to the players' controls with an average response time of 14 msec, and the myoelectric control parameters are adjustable to associate with the player's muscle strength.