P300-based EEG signal interpretation system for robot navigation control

ABSTRACT

In recent years, Brain-Computer Interface (BCI) research has provoked an enormous interest among researchers from different fields. The most popular approach is a non-invasive method, using Electroencephalogram (EEG) analysis which acquires signals from the brain. The aim of this project is to develop a brain signal interpretation system that can convert one thought into multiple movements for mobile robot navigation. A signal interpretation system is designed and developed to receive the EEG signal via User Datagram Protocol (UDP) transmission, converts the signal to several robot commands that are pre-programmed according to the robot's programming software and send the commands to the robot through the operating computer. Using signals from four electrodes to evaluate the signal interpretation system, a success rate of 75-80% is received, while a total response time of only 61 seconds needed by the system from the start of the stimuli until the robot has finished all commands sent by the system, as compared to the conventional method of one-thought-one-movement which can take around 30 seconds per command. With this system, user can expect faster execution of the robot commands, less thinking therefore less exhausting, making BCI a pleasant experience for all users regardless of their health conditions.

Keyword: Brain-computer interface (BCI); Electroencephalography (EEG); Event related potentials (ERPs); P300