

WIRELESS BRAIN-COMPUTER INTERFACE FOR ELECTRIC WHEELCHAIRS WITH EEG AND EYE-BLINKING SIGNALS

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ABSTRACT. *This paper mainly proposed a wireless electroencephalogram (EEG)-based brain-computer interface (BCI) and a drive circuit for DC motors to control electric wheelchairs through a Bluetooth interface for paralyzed patients. Paralytic patients can not move freely and only use wheelchairs in their daily life. Especially, people getting motor neuron disease (MND) can only use the eyes and brain to exercise their willpower. Therefore, real-time EEG and eyes blinking signals can help these patients effectively. However, current BCI systems are usually complex and have to send the brain waves to a personal computer to process the EEG signals. In this paper, a simple BCI system and a drive circuit for DC motor can help paralytic patients easily drive the electric wheelchairs. The proposed BCI system consists of a wireless physiological signal-acquisition module and a signal processing unit. Here, the physiological signal acquisition module and signal processing unit were designed for extracting EEG and eyes blinking signals from brain waves which can be directly transformed into control signals to drive the electric wheelchairs. The advantages of the proposed BCI system are low power consumption and compact size so that the system can be suitable for the paralytic patients. The experimental results showed feasible action for the proposed BCI system and drive circuit with a practical operating in electric wheelchair applications.*

Keywords: EEG, BCI, Electric wheelchairs

1. **Introduction.** Electric wheelchairs have been considered as one of important mobility aids for the elderly as well as the physically impaired patients. Clinicians pointed out that approximately 50% of patients including paralyzed patients cannot be able to control an electric wheelchair by conventional methods. Especially, people getting MND can only use the eyes and brain to exercise their willpower. In the context, EEG-controlled wheelchairs are a mobility aid especially suitable for the paralyzed patients that are unable to operate the electric wheelchair completely. The motivation of the EEG-controlled wheelchairs is to facilitate assistance in mobility in order to accomplish complex navigational tasks in realistic environments for the paralyzed patients. It includes the development of automatic navigation strategies and personalized interactive assistance to enable the patients to move wheelchairs efficiently and easily.

When the patients have suffered from MND, their muscle does be gradually wasting and weakness and then their body is frozen. The main type of MND is named Amyotrophic Lateral Sclerosis (ALS). Because of the famous American baseball star Lou Gehrig died of this disease, it is also called Lou Gehrig's disease. Their words, swallowing and respiration are dysfunctional until respiratory failure and death. The disease can infringe upon anyone, but more common in age 40-70 years old. The development of the disease