Walking Assist System of a Leg-Paralysis Person

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Gerontology becomes significant research in recent rapidly-aging society for the purpose of supporting elderly people on life self-reliance. The robotics field contributes to the research issue developing assistive machines for elderly persons and paralyzed patients.

In our research, we mainly focus on walking-assistive systems for impaired people such as muscle-weaken and hemiplegics persons. On the basis of the analytical results, we develop three assisting devices for walking improvement: stimulator using somatic reflex, functional electric stimulation, and power assist machine.

Stimulator Using Somatic Reflex – Some leg on paralyzed patient has special somatic reflex which is the result of nerve reorganization. We built a device that can stimulate this reflex for walking support (Fig. 1).

Functional Electric Stimulation is a method to activate paralyzed leg muscles with electric stimulation. FES has an advantage to use the person's own muscular system, therefore, it is not necessary to build an external actuation system.

Modular Walking-Assist Devise This device is a modular design that consists of a RC servomotor, a wire, and a tension sensor and actuates joints by reeling wire (Fig. 2). The advantage of wire driven mechanism is the flexibility to attach it in any place on the user's body. Moreover, cooperated actuation of those devices should support the problematic muscles of the various patients.

Motion-State-Classifier - We measure walking state of a leg hemi-paretic person with surface electromyographic (EMG) sensors, angular sensors, acceleration sensors, and ground reaction force sensors. We propose the feedback system which is enable to control walking-assist device (Fig. 3).

Keywords: Gerontology, Walking Assist, Leg Paralysis, Somatic Reflex, Functional Electrical Stimulation, Power AssistReferences

1) A. Yamakawa, R. Kato, K. Matsushita, H. Yokoi, and T. Arai, "Development of Walking Assist Device: Adaptive Recognition of Individual Walking States for Patients with Leg Paralysis", 16th Intelligent System Symposium, pp.321-322, 2006.
2) S. Takenaka, K. Matsusita, H. Yokoi, and T. Arai, "Development of Walking Assist Machine: Adaptive Mechanism and Controller for Walking Characteristics of Users", Proceedings of 16th Intelligent Symposium, pp.319-320, 2006.

Fig. 1 Stimulus Point and Stimulator

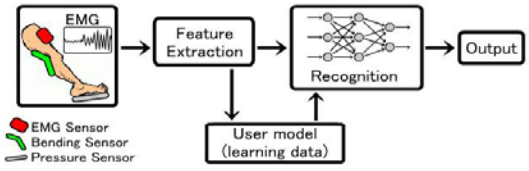

Fig. 3 Motion-State-Classifier

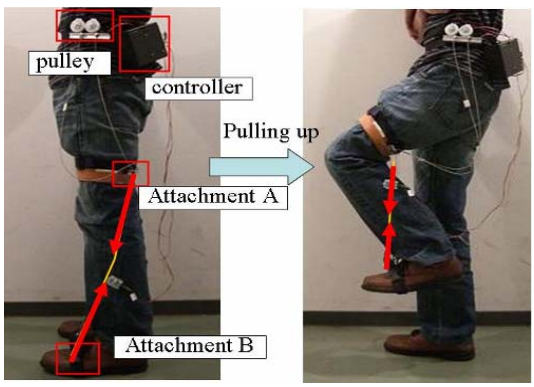

Fig. 2 An Example of Support