

ROBOT SUIT HAL

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The study of robotics has been a revolutionizing field with the prospect of yielding unlimited potentials to the human race. From convenient luxuries to assistive technology, there is no boundary to the applications of modern robotics. One very promising development is the invention of the Robotic Suit HAL (Hybrid Assistive Limb®).

HAL serves to provide necessary aid to patients suffering from a range of mobile disorders, including muscle rigidity, cerebral paralysis, stroke, spinal cord injury, post-polio syndrome, and muscular dystrophy. Professor Sankai Yoshiyuki and his research team designed the suit at the University of Tsukuba in Japan. The full body suit is composed of eight electric motors that generate torque to support the body's natural movements. Unlike other devices that are activated in response to a patient's movement, the HAL anticipates the patient's intentions through the implementation of a unique hybrid control system.

The hybrid control system consists of two separate routines. The first is the Voluntary Control System. This system reads and interprets the bioelectrical signals that manifest on the surface of the skin when a muscle is innervated by an impulse from the brain. The suit's bioelectrical sensors detect these signals and relay them to a small computer, which then analyzes the signals and calculates the adequate amount of power assistance needed. Finally, the robotic power units are activated to move the corresponding limbs fractions of a second before the muscles contract. The second control system is the Autonomous Control System. This system stores information from previous sequences of motion in a database in order to coordinate each power unit more smoothly. In the event that insufficient bioelectrical signals are available, due to

complications in the nervous system or in the muscles, the HAL robotic suit has the ability to utilize other signals, such as the FRF (floor reaction force), joint angles, and shifts in the patient's center of gravity to determine the desired motion.

The first HAL prototype was released in 1999 as a lower limb support system. Since then, it has undergone many further transformations in becoming the first cyborg-type robot of its kind. The present HAL-5 model weighs about 23kg, the majority of which is self-supported by the suit's exoskeleton. Powered by an AC100V battery that can last over two and a half hours, the suit is capable of multiplying one's original strength by a factor of 2 to 10. In addition to patient rehabilitation support, HAL may one day find a use in assisting soldiers, disaster relief workers, and emergency personnel.

Professor Yoshiyuki is now the proud CEO of Cyberdyne Inc., founded in June of 2004. In October of 2008, Cyberdyne completed its new manufacturing facility and hopes to increase their production of Robot Suit HAL.

References:

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