K. Hashimoto, Y. Sugahara, H-O. Lim, A. Takanishi. Human-carrying biped walking vehicle. Gerontechnology 2008; 7(2):119. The barrier-free concept has been disseminated in order to allow the elderly and disabled wheelchair users to be self-reliant and lead an active social life. However, realizing the barrier-free concept is very expensive and complex through infrastructure improvements alone. Therefore, we have developed the human-carrying biped walking vehicle, WL-16RIV (Waseda Leg - No. 16 Refined IV), which have 6-DOF parallel mechanism legs. The final goal of this research is to build a biped walking wheelchair having locomotion and mobility equivalent to a human being. We believe that a biped walking wheelchair is a viable solution in barrier-free engineering that is much more effective and low-cost than infrastructure improvements. **Mechanical design** DESIGN WL-16RIV consists of two legs and a waist and is capable of walking independently, with an unladen weight of about 68 kg. Each leg consists of a 6-DOF Stewart Platform parallel mechanism. Main components of the mechanical design of WL-16RIV are a pelvis, 12 linear actuators, 12 conventional upper universal joints, 6 customized lower joints, two force/torque sensors and a gyroscope. WL-16RIV is actuated by 12 DC servomotors controlled using 12 on-board servo-drivers and an on-board master computer. The movable stroke of each linear actuator is about 350 mm from maximum to minimum stretched configurations. **Walking control method** As the control method of this robot, a model based walking control method based on ZMP (Zero Moment Point1]) criteria is used. With walking stability control methods2] using two force/torque sensors mounted on the feet, WL-16RIV can walk on uneven terrain with 20 mm height and 10 degrees inclination. The robot can also go up and down stairs with the rise of 250 mm. **Results and discussion** We exhibited WL-16RIV at the Wired NextFest held in Los Angeles in September 2007, and about 170 people rode on this robot without accident (*Figure 1*). Through hardware experiments, the effectiveness of the developed hardware and control methods were confirmed. Our next goal is to conduct various experiments and improve the hardware and control method toward the practical application.

References

1. Vukobratovic M, Stepanenko J.Mathematical Biosciences 1972;15:1-37
2. Hashimoto K, Sugahara Y, Kawase M, Ohta A, Tanaka C, Hayashi A, Endo N, Sawato T, Lim H-O, Takanishi A. Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems; 2006; pp 1755-1760

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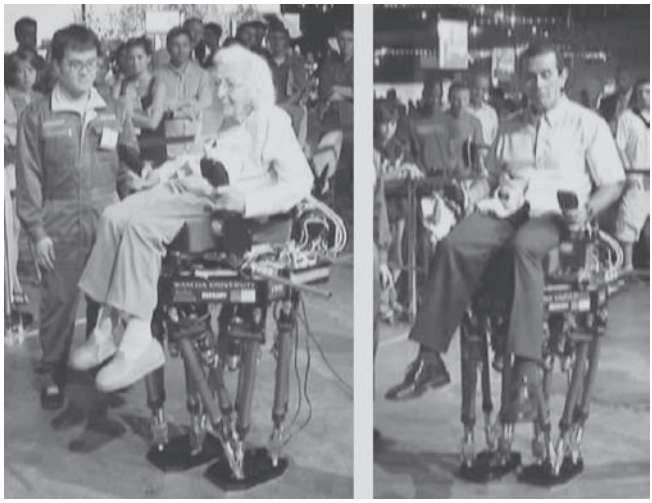

(a) About 90-year-old lady (b) The mayor of Los Angeles

Figure 1 Human-carrying biped walking vehicle, WL-16RIV