Poster Session1

MP-20

December 10

12:50-13:50

Development and evaluation of an electric walking machine

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Abstract - As society ages, the exercise of elderly people has become increasingly important. Therefore, this study was conducted to complete an electric support cart that can encourage elderly people to exercise. For this study, we produced a prototype of an electric support cart and evaluated it. The prototype was designed so that the user can walk in a natural walking posture. We used a VICON motion analysis device for measurements. We measured the state of walking using the prototype and compared it with normal walking. Measurement results confirmed that each joint moment of the lower limb was greatly reduced. The prototype produced in this research is effective for reducing the power necessary for walking.

APPARATUS

Fig.1 An electric walking machine.

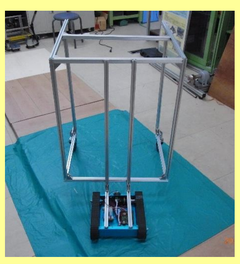

Fig.2 Front and side view of prototype.

Fig.3 The crawler robot.

∗ Maintaining the natural walking posture was the most important design concept.

∗ Frontal drive wheels were set in a forward position to keep the user's posture of bending down from the waist, which is caused by auxiliary wheels.

∗ Examining the body of the subject of our experiment, the handrails were attached 880 mm high from the floor.

∗ Figure 3 demonstrates the crawler robot used for our prototype walking machine. The robot (Nexus Robot) is driven by two 12-V motors with PWM control through an Arduino 328 compatible board.

METHOD

Fig.4 Camera position.

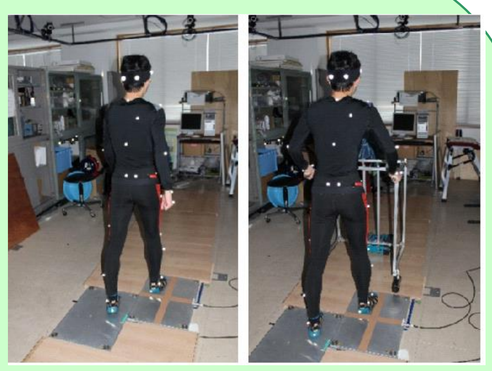

Fig.5 Measurement scene

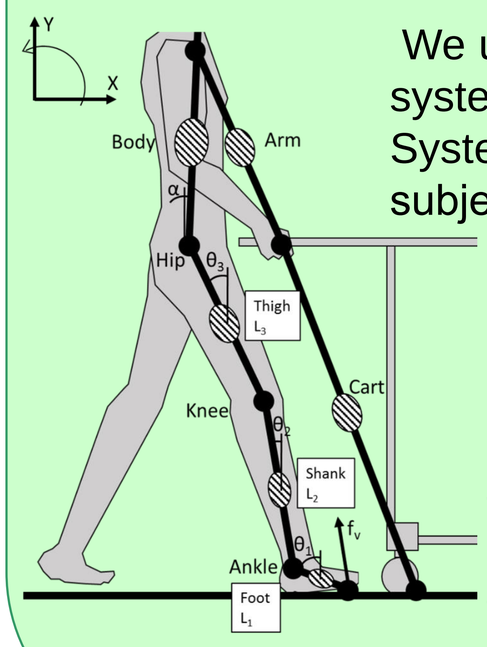

Fig.6 2D linked solid model.

We used a 3D motion analysis system (Bonita ; Vicon Motion Systems Fig.4) to measure the subject's ambulation activity.

Considering gravity and acceleration, we can ascertain the ankle , knee , and hip joint moments from the balance of lateral and vertical forces and that of the moment using dynamics.

EXPERIMENTAL RESULTS

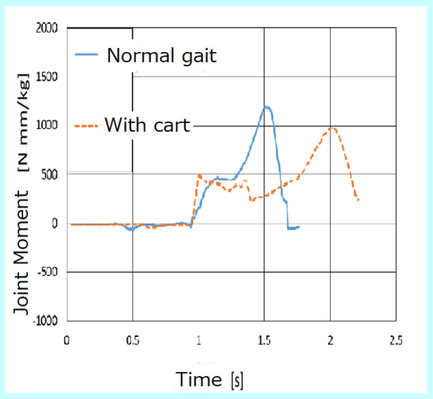

Fig.7 Ankle moment at the gait.

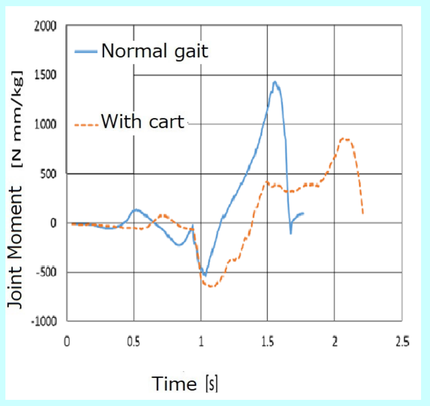

Fig.8 Knee moment at the gait.

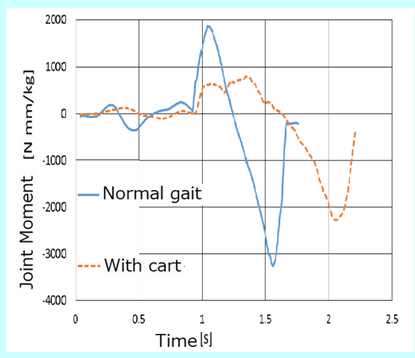

Fig.9 Hip moment at the gait.

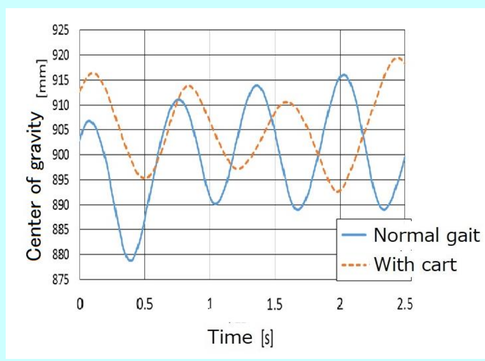

Fig.10 Trajectories of the center of gravity.

We speculate that walking while holding a handrail supports a person as if the person were walking while being supported by sticks in both hands. The person might feel like walking while supported at four points and might feel less burdened by body weight on the feet.

CONCLUSIONS

Although we have confirmed the effectiveness of our prototype electric walking machine, we identified several new challenges as well. They include the handrail height, its relation with joints in upper limbs, and differentiation of our machine from existing ones. In particular, establishing a calculation method of moments about joints in the upper limbs is important for finding balanced proper means of walking for the whole body and presents issues of urgency. Based on these findings, we intend to conduct additional comparison experiments to improve our prototype machine.

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