

# Development of a Nursing Skill Training System Based on Manipulator Variable Admittance Control

Due to the recent aging society and shortage of nursing experts, the use of robot-based skill training systems is an emerging topic in nursing education, as many innovative robotic systems have been developed to simulate real patients, offering a safe and self-directed platform for nursing students to learn and practice their skills. Among these training systems, several human patient simulators (HPS) [1-3] have been proposed to simulate the patient's performance during patient transfer; however, without an entire motion model and control strategy, most HPS show limited effectiveness in simulating actual patient behavior.

Herein, this work presents a novel patient transfer training system that has the potential of improving the practical skills of nursing students [4]. The reason we set the patient transfer skill as the target of our system is that it is one of the highest risk motions which causes both patient and nurse's injury among many nursing skills, hence improving the novice's skill of patient transfer contributes to reduce the injury in the practical situation. The procedure of development our training system is as follows. First, we propose a simplified force model for patient transfer motion to estimate the contact force in the absence of wearable sensors (Figure 1). We then reveal the correlation between the nurse's force and patient's motion during the transfer through the utilization of the variable admittance model. Finally, we demonstrate the feasibility of the proposed patient transfer training system by performing several experiments on a UR10e robot. To the best of our knowledge, this system is the first patient transfer skills training system that simulates force interaction between nurse and patient using a collaborative robot.

Figure 2 shows the example of the training of the patient transfer motion with proposed training system. As shown in Figure 2, the patient can train and learn the transfer motion through the system. We anticipate that our proposed system will be an effective aid for student nurses to learn patient transfer skills. We believe that this innovative approach can make a contribution to the field of nursing education, addressing the current challenges of inadequate resources for nursing education.

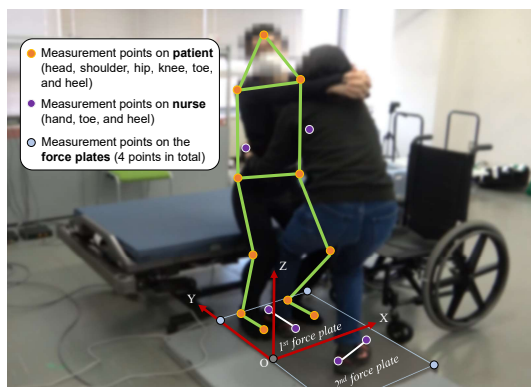


Figure 1. Modeling interaction between the patient and nurse.

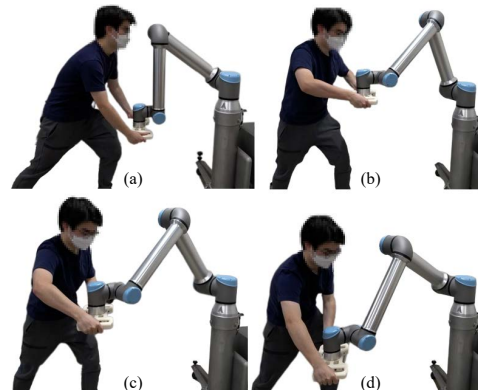


Figure 2. Example of the training with proposed system.

**Keywords:** Robot patient, Modeling of human motion, Nursing education

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