Object Handling Precision Using Mouse-like Haptic Display Generating Tactile and Force Sensation

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Submitted: Mar. 19, 2013 ***Accepted: May 10, 2013*** ***Published: June 5, 2013***

Abstract- This paper presents development of new haptic display capable of stimulating the muscles and tendons of the forearms as well as the tactile receptors in the fingers as a new approach for virtual reality device. Investigation of simultaneous presentation of both tactile and force effects are conducted and presented in this paper. The haptic display consists of a tactile display with a 4-by-12 array of stimulus pins driven by micro-actuators and an articulated manipulator. The display's handle was constructed replicating a conventional PC mouse so that anyone could comfortably use it without special training or operation knowledge. Vertical movement of the virtual tactile pad in the virtual world is controlled in proportion to the compressive force applied on the display pad. This makes it possible to reduce the operator's energy consumption during manipulation in 3D-space. Operators can now work in 3D-space in spite of their manipulations actually being done in 2.5D-space. Evaluation

experiments were performed using the display, in both force-only mode and combined-mode (force + tactile) to verify its presentation capability. In the experiments, subjects tried to assemble virtual blocks in a line. Experimental results shows that the display combining tactile and force sensations provide higher accuracy in a precise virtual assembly task compared to the force-only display because the proposed display provides relative motion between the hands and the blocks.

Index terms*:* Haptic device, virtual reality, 2.5D-display, tactile sensation, objects handling.