Implementation of a Controlling Interface for a Force Feedback Glove

Type:	Semester/Bachelor thesis
Industry partner/ Institution:	Computer Vision Laboratory, ETH Zurich
published	September 29. 2005
internal supervisor	Rui, Zhang, rui.zhang@imes.mavt.ethz.ch Josef Meile, meile@imes.mavt.ethz.ch Andreas Kunz, kunz@iwf.mavt.ethz.ch
External supervisor	Christoph Spuhler, spuhler@vision.ee.ethz.ch
Duration and Workingplace	Winter semester 05/06, ETH Zurich

Keywords

Electronic interface, Dielectric Elastomer (DE) actuator, high voltage, force feedback, visualization, virtual reality, programming, C++

Environment

Force Feedback Devices (FFD) enable users to touch and to manipulate virtual objects in a virtual environment (Fig.1). A lightweight, portable and non-obstructive force feedback glove is highly demanding in the field of virtual reality. The bottleneck of such a glove is to design and develop actuators with high energy density. In the last decade, great attention has been paid on Dielectric Elastomer (DE) actuators as they preliminarily exhibit similar characteristics to human muscles. As shown in Fig.1, mini spiral-spring roll DE actuators (*Φ12mm*40mm*) with max. 7 N blocking force and 11% free strain have been made and tested at EMPA Dubendorf. To demonstrate a force feedback glove based on the DE actuator in virtual reality, a simulation including finger position sensing (CyberGlove), 3D virtual hand and object, collision detection, and force rendering has been done. Implementation and controlling of the actuator through computer need to be done in this study.

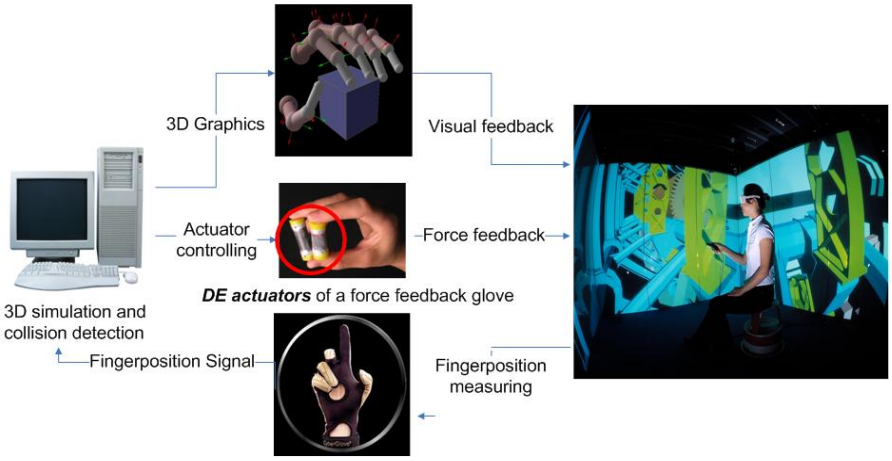

Figure 1 Touch Virtual Reality: Force feedback glove with dielectric elastomer actuators

Content of the Thesis

Firstly, the existing code including reading finger position, load virtual hand and virtual object, update the graphics, and calculation of the force vectors need to be studied. Then, based on a given characterization of the DE actuators, code converting the calculated force vectors to control signals for the actuator will be programmed. Electronics interface between the computer and a given high voltage supply need to be built. Integration of the whole electronics interface, as well as the high power supply into the glove will be considered and implemented.

Tasks

- Know-how collection
- Project plan
- C++ programming (code for converting force vectors to control signals)
- Electronics interface design (I/O cards design and Current amplifier for the high power supply)
- Implementation of the electronics into the force feedback glove
- Demonstration of the interface based on the DE force feedback glove
- Intermediate, final presentations and a final written thesis