

ELG 5124 - Virtual Environments

Assignment #2

Due date: *Tuesday, March 27th, 2007, 11:30 AM*

Consider the Minimally-Invasive Surgery (MIS) Virtual Environment (VE) Training application discussed in Ch. 8 of [Burdea&Coiffet, 2003] G. Burdea and Ph. Coiffet, *Virtual Reality Technology*, (second edition with CD-ROM), Wiley, New Jersey, 2003.

Design (functional block level) a multimodal VE system for MIS training, which integrates commercial haptic, video, and audio Human Computer Interfaces (HCIs). The lowest granularity level of the functions to consider should reflect the basic tasks/operations performed during laparoscopic surgery (e.g. cutting with the small scissors tool).

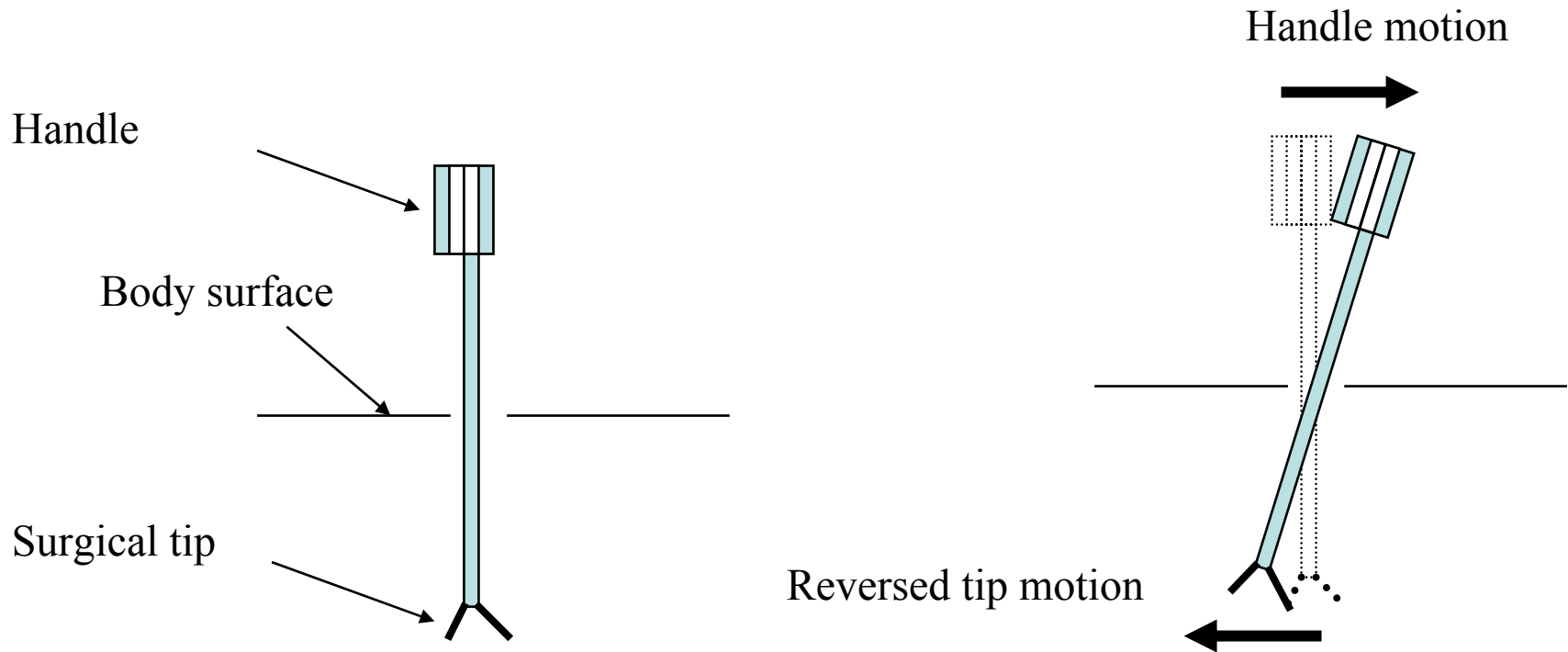
Identify the commercially available components and discuss the modelling, computational (HW and SW) and data communication characteristics of the designed system. Discuss the limitations of the resulting system and propose possible component improvements (HW and SW) that will increase the performance level of the system.

Minimally-Invasive Surgery (MIS)

- ✓ Many current surgical procedures are done “minimally invasive”;
- ✓ MIS has *advantages* for the patient:
 - less hospital stay (from one week to less than one day);
 - less scarring (three 1-2 cm cuts);
 - faster recovery.
- ✓ MIS has *disadvantages* for the surgeon:
 - loss of direct (3D) view of the cutting area – has to look at a 2D monitor;
 - loss of tactile feedback, which is filtered by the laparoscopic instrument (stick with a handle);
 - the “fulcrum effect” due to the orifice in the body

MIS - continued

- ✓ The *fulcrum effect* cannot be compensated by increased attention;
- ✓ Requires training to automate the proprioception;
- ✓ Training should not be done on animals, much less on patients!

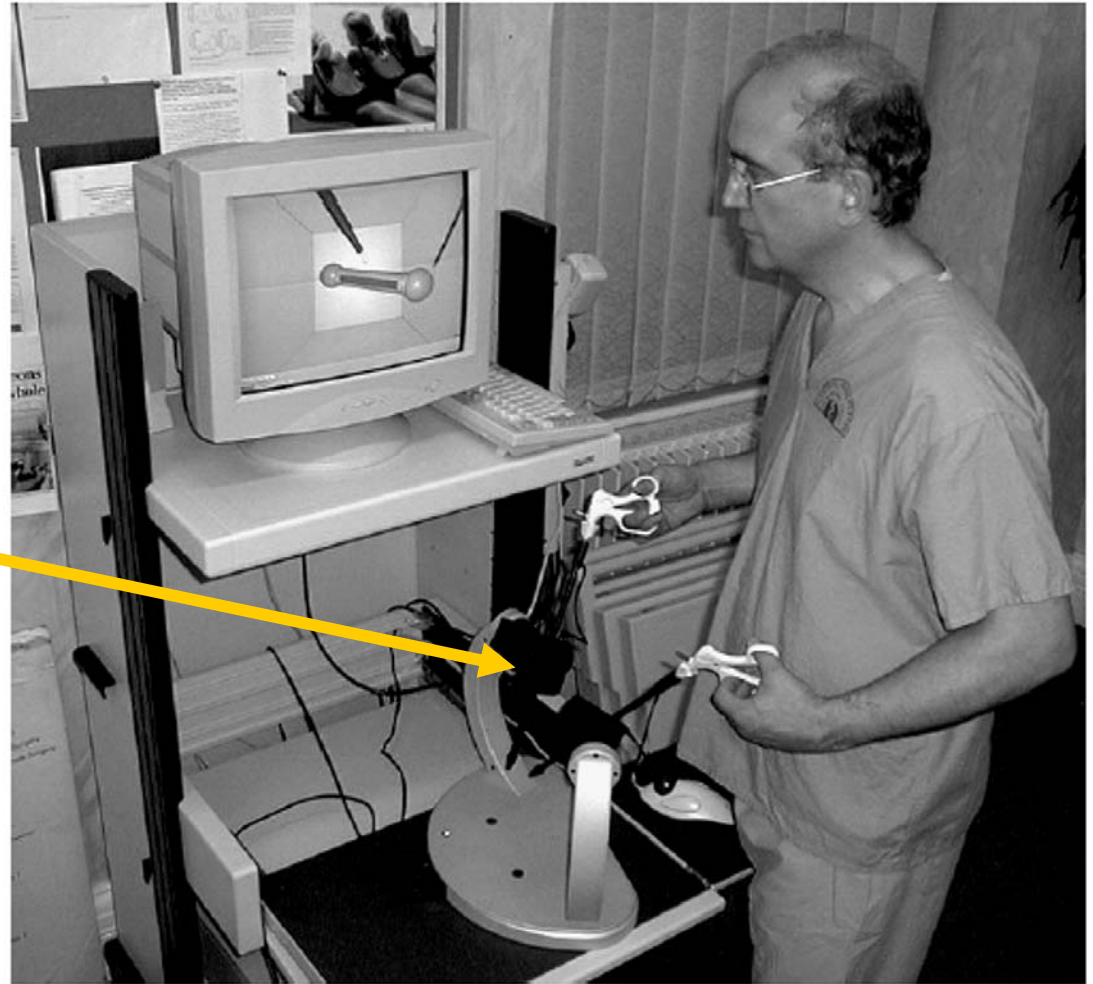


MIST VR

✓ The Minimally Invasive Surgical Trainer in Virtual Reality (MIST VR) developed in UK is a computerized system to train and assess MIS skills;

✓ It consists of a PC coupled with an Immersion Laparoscopic Interface (dual hand version);

✓ No force feedback is provided



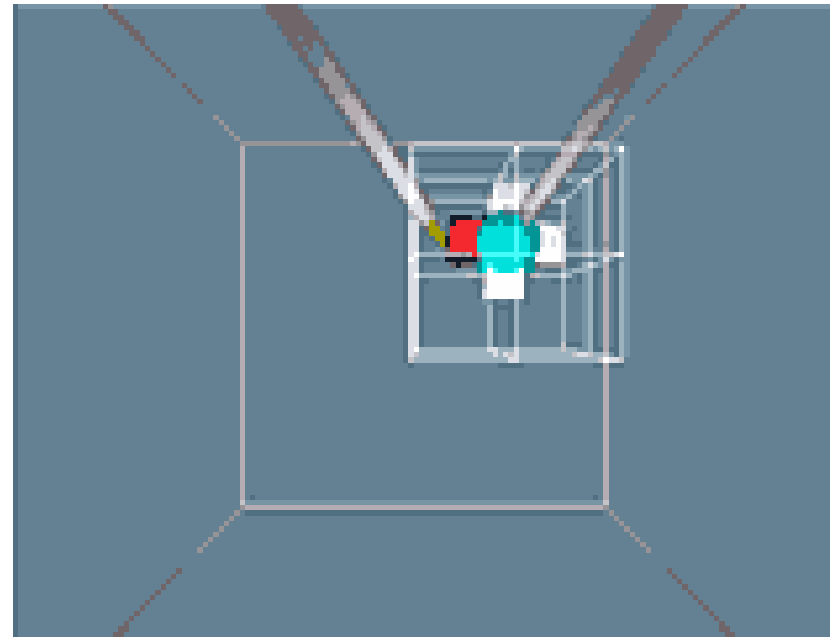
MIST VR

- ✓ The simulation consists of six 3-D manipulation/cutting/burning tasks of graduated difficulty;
- ✓ Task time, motion length, errors, are measured transparently and available remotely to the instructor. (www.vrweb.com/docs/news/mist.htm)

Real laparoscopic task (tissue burning)

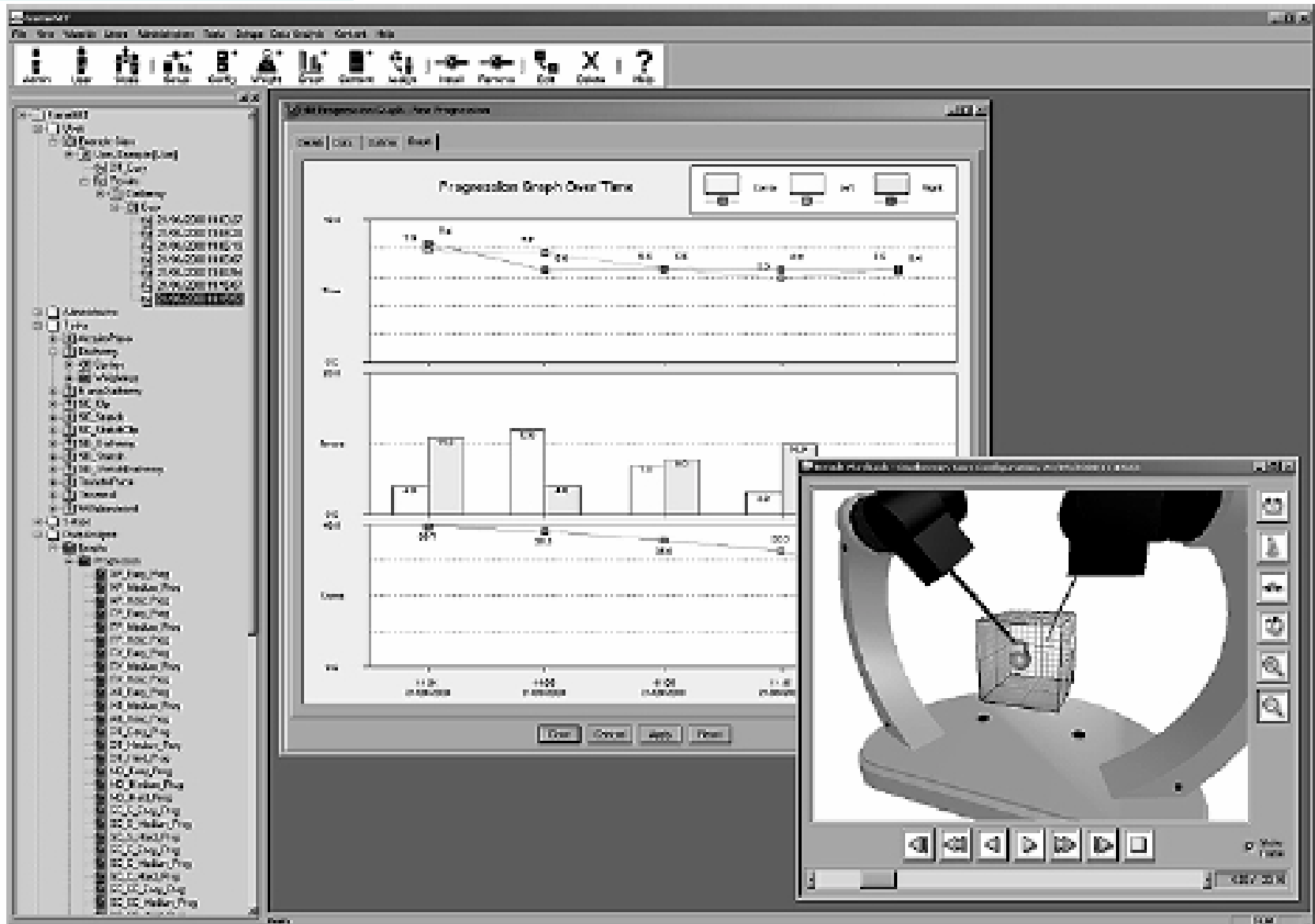


Equivalent MIST VR task



MIST VR - GUI

(www.vrweb.com/docs/news/mist.htm)



From Ch. 8 of: G. Burdea and Ph. Coiffet, *Virtual Reality Technology*, (second edition)Wiley, New Jersey, USA, 2003.

Laparoscopic Surgical Workstation

- ✓ Immersion Co. has recently introduced the “Laparoscopic Surgical Workstation,” with force feedback for insertion, pitch, yaw, handle twist and handle grip;
- ✓ Works with a PC, being connected over a PCI card.
- ✓ Has more realistic graphics (through “LapSym” software).

http://www.immersion.com/medical/docs/LSW_data_sheet.pdf

