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Controller for Navigating 3D Medical Imaging Data

Professor David J Lomas and Dr Martin Graves have developed a novel control device that can be used to navigate volumetric image data whilst avoiding visual distraction:

- Allows the easy orientation of 2D views from 3D data
- Improves workstation ergonomics allowing the operator to concentrate on the diagnostic image rather than operating the interface
- Minimises spatial disorientation and allows for a more rapid workflow
- Leverages existing clinical skills, knowledge and intuition

Potential Uses

- Interactive 2D reformatting of and navigation through volumetric imaging data
- Interactive selection of image plane in magnetic resonance fluoroscopy

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Background

Despite the recent explosion of volumetric medical diagnostic image data from imaging technologies such as computerised tomography (CT) and magnetic resonance imaging (MRI) the ergonomics of medical imaging workstations have not changed. Although oblique planar reformatting of this data is becoming a routine part of the diagnostic reporting process it is still limited by visually distracting interactions with the workstation interface that are required to obtain the desired diagnostic image in oblique section. Typically on current commercial medical workstations several mouse interactions with multiple reference images are required to select, drag and rotate reference lines or buttons as part of this process.

Technology

Professor David J Lomas from the Department of Radiology at Cambridge University and Dr Martin Graves of Cambridge University Hospitals NHS Foundation Trust have developed a novel human interface device called constrained surface controllers (CSC) that can be used to navigate volumetric image data whilst avoiding visual distraction. The mode of action of the CSC is based upon clinical experience of performing real-time ultrasound examinations.

In ultrasound a hand-held imaging transducer is moved smoothly over the body surface whilst the operator concentrates on the output image on a display. An experienced operator knows automatically where the imaging plane is positioned because of the non visual proprioceptive feedback through their hand (i.e they know where their hand is positioned in space without looking at it) and because the motion of the transducer in relation to the body is limited by the constraining surface of the subject's skin surface. The operator integrates this information with their knowledge of the body's internal anatomy and learns to obtain desired image planes within the 3D volume of the patient's body by just watching the output image on the display as they move the transducer. They can direct their visual attention and concentration fully to the continually changing output diagnostic image and not on distracting interactions with the system interface.

EG Technology, one of the UK's leading product design, development and engineering consultancies, has worked with the team to develop a novel prototype (Figure 1). The controller applies a similar constraining surface concept to the navigation of previously acquired 3D volumetric image data (such as from CT or MRI) within a workstation. The technology uses mechanically constrained reference surfaces with directly correlated translation and rotation information to allow the reformatting of oblique planes through volumetric data in an analogous way to an ultrasound examination. The results are devices that allow intuitive control of the reformatting plane location without the distraction of interacting with the workstation tools.

The CSC device has been successfully integrated into research MRI fluoroscopy systems to allow interactive positioning of an acquired real-time image plane in patients in a similar fashion to ultrasound.

Publication

Constrained surface controllers for three-dimensional image data reformatting. Radiology (2009) 252(1): 218.

Commercialisation

We are seeking commercial partners for licensing, collaboration and development of this technology. This technology is protected by patent application number PCT/GB2008/000077 filed on 10/01/2008.

Figure 1: Planar constrained surface controller