

A novel system for hands free manipulation of digital X-rays in a sterile environment

FRAME MC

Department of Orthopaedics, FVRH, Falkirk, UK

mr.mark.frame@gmail.com

Background: Digital X-ray PACS systems are now universally used within orthopaedics across the UK and the world. The images are easily accessible throughout the patients' treatment journey. They are used routinely as a guide and reference during orthopaedic surgery itself. However, once the operating surgeon is scrubbed and sterile, the interaction with the images and the computer are impossible without becoming contaminated.

Aim: I aimed to develop a system to allow the surgeon to interact with the standard PACs system whilst scrubbed and sterile to aid in the management of orthopaedic surgical patients. I aimed to do this using commonly available, and low cost consumer electronics.

Methods: I developed a system to translate the movements of the surgeon's hand gestures in the air to the manipulation of the digital X-ray images on the standard Kodak Carestream PACS system. This was done using freely available software (Win&I, €39), which utilises the openkinect drivers for control of the Microsoft XBOX KINECT (an infrared assisted depth of field camera originally built for gaming on the Microsoft XBOX platform, £85), and an XBOX KINECT camera and a small USB foot pedal (£15). This was connected on a standard intel personal computer running Microsoft Windows 7. The standard security policies remained intact for the hospital computer. No other modifications were required for the system to run. The pedal was connected via standard USB connections. The pedal emulated mouse clicks. Right click, left click and shift click for selection within the pacs software.

Results: The system worked as expected and was intuitive, with a very short learning curve. Using gestures from the operating table without calibration of the system, the surgeon was able to select images, move them on screen, zoom in to specific areas. He was also able to manipulate CT/MRI scan slices including 3D reconstructions. It did not require the surgeon to become unsterile at any point during the surgery, and allowed full independent use of all functions of the digital PACs system. This was all done for a total cost of less than £130.

Discussion: Digital X-rays offer many advantages over traditional printed films and have allowed the surgeon to utilise them in many more situations and extract more information from them than ever before. This novel use of consumer electronics and software allows the surgeon to utilise the information within the digital images during the surgical management, often when it is needed the most and up until now has been difficult to access independently and in a speedy manner. This is the first example of this technology being used to control digital X-rays in clinical practice. Using consumer electronics allowed us to solve a complex problem for a very small financial outlay, which would be in reach of any department. The use of the system was very intuitive as shown by the ease of use by many different members of the surgical team through out the study.