

Mobile On-patient visualization device of medical images (P-952)

Key facts

- A combination of iPad and ToF camera makes medical images visible directly on the patient
- Easy orientation and intuitive navigation through 3D images before and during medical intervention
- Sophisticated and error-prone mental transfer of virtual images seen on a separate monitor to the patient becomes dispensable
- Handy and cheap visualization device allowing a broad applicability

Background

Visualization of patients' anatomical data is mainly done on a monitor of a radiological workstation after subsequently manipulation of static 3D images acquired with computed tomography (CT) or magnetic resonance imaging (MRI) scanners. Although image-guided surgery profits from today's powerful image acquisition and processing techniques, visualization and interaction with pre-operatively acquired images is still challenging and rather non-intuitive. This is because the provided displays require the physician to mentally transfer the 3D virtual image to the patient. This not only requires considerable skill and experience, but is also prone to failures, which might have very serious consequences for the patient under therapy.

Technology

To address this issue, we developed a new concept for on-patient visualization of anatomical data acquired with an arbitrary modality (typically CT or MRI). The method is based on a mobile device consisting of a flat display and a Time-of-Flight (ToF) camera (Fig. 1) which can be moved along the patient to provide a view on internal anatomical structures via augmented reality. For this purpose, the pose of the mobile device, which represents the viewing direction of the user, is continuously estimated by registering (i.e., aligning) the ToF data acquired during the visualization process with the patient surface extracted from the 3D medical data set. During camera pose estimation, a custom-designed algorithm accounts for the

camera specific localization errors. In the current implementation, four different visualization modes are available as shown in Figure 2.

Advantages

- No reference markers are needed for localization
- Movements of the patient are allowed
- Inexpensive hardware/software equipment suitable not only for bigger hospitals, but also for smaller doctors' practice

Development Stage

We are developing a prototype including hard- and software in order to validate it at the DKFZ.

Applications and Commercial Opportunity

Since the developed visualization device combines many advantages, the applicability ranges from all kind of classical surgical planning to e.g. anatomy teaching and dialog between patient and doctor.

Inventors

The invention was jointly conceived by Lena Maier-Hein, Markus Fangerau and Hans-Peter Meinzer of the Division of Division of Medical and Biological Informatics (E130).

Intellectual Property

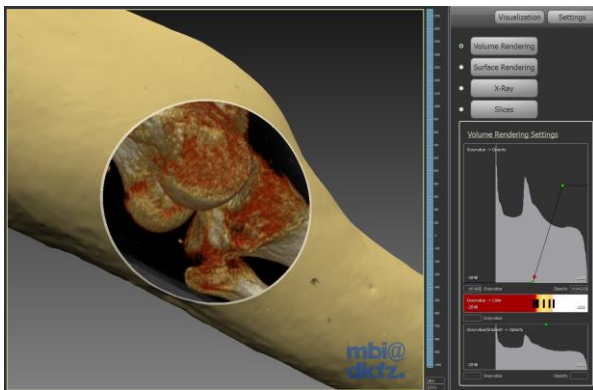
A patent family "Visualization of anatomical data by augmented reality" was published as [WO2012062482](#) and nationalized as [EP2637593](#) and [US9498132](#) (granted).

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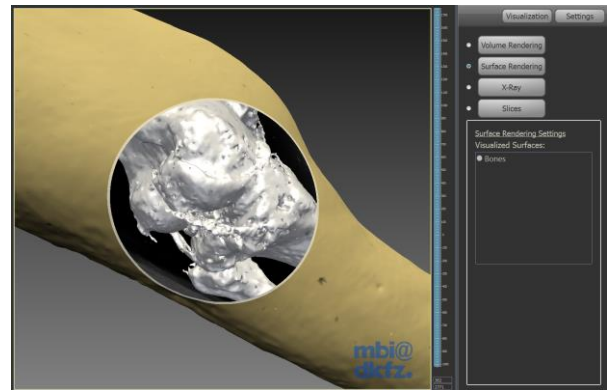
Figure 1:



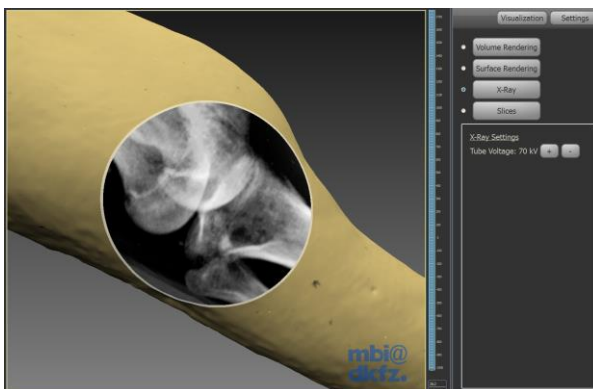
Figure 2:



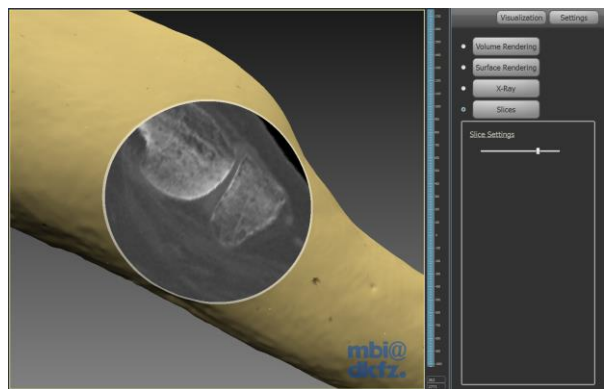
i) volume rendering



ii) surface rendering



iii) x-ray rendering



iv) slice view