Applications for effective representation of imaging with X-ray CT

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Introduction

The technology of X-ray CT is currently advanced and used in various situation.

CT allows us to observe the 3D voxel internal structure of an object, but the represent method of CT data is still displaying cross sections in 2D images such as MPR (multi-planar reconstruction, multi planar reconstruction) since we usually perceive 3D objects only in terms of surface information.

The evolution of AR (Augmented Reality) and VR (Virtual Reality) is progressing, helping us to understand things with complex structures.

- AR allows us to observe things fixed in the virtual space by moving viewpoint.
- VR allows us to observe things by moving virtual object in a fixed location.

AR and VR may be able to solve problems in the representation of CT data and establish a new method of representation.

Purpose

Two methods to effectively represent the data captured by X-ray CT has proposed.

1. To use AR to display for allowing the observer to observe the object and its cross-section in the direction of 2π solid angle.
2. To use a VR by spatial reproduction display and motion capture for allowing the user to intuitively understand the internal structure of the object and observe its cross-section

Proposal Systems

Representing system using AR

<Milestone>

a) Users can confirm any cross-section images of the object from 2π solid angle.

b) User can intuitively grasp the interior of objects that are difficult to observe with the human eye.

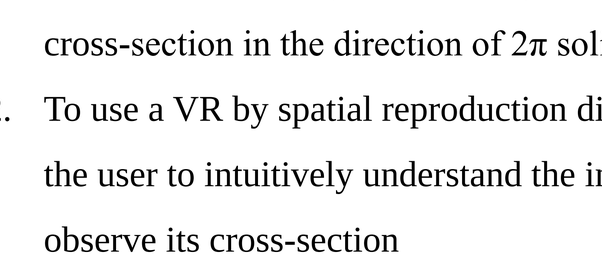

Fig1. Image of the AR displayed on the device

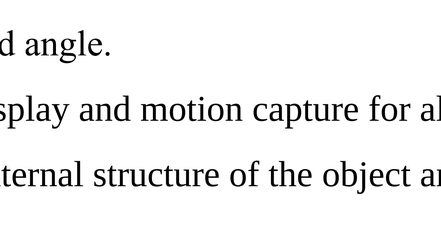

Fig2. Image of 2π solid angle

The system is configured as shown in the Figure 3.

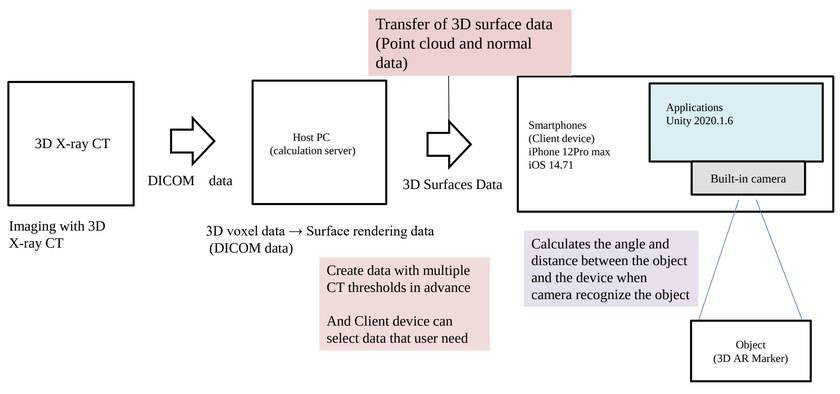

Fig3. Proposal system of data transfer using AR

Representing system using VR by spatial reproduction display and motion capture

<Milestone>

a) By using the stereoscopic display and motion capture, users can hold the captured data in their hands and gesture to rotate it to see the part they want

b) Users can control the data at will and display the cross-section of the object from 360-degree angle they want to see.

The system is configured as shown in the figure 4.

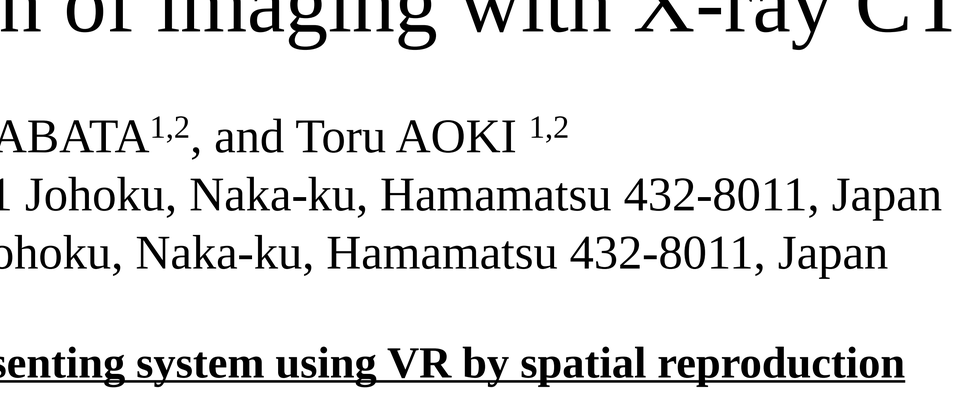

Fig4. Proposal system of data transfer using VR by spatial reproduction display and motion capture

Result

As a result, by representing system using AR, the AR image of the object and cross-section can be displayed on the mobile device.

By representing system using VR by spatial reproduction display and motion capture, user can move the 3D and rotate with 360 degrees view and confirm cross-section of the data for understanding the internal structure of the material intuitively.

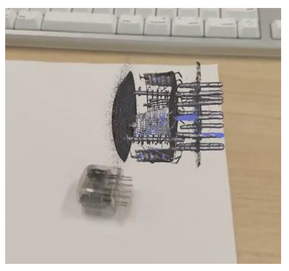

Fig5. The AR image displayed on the device.

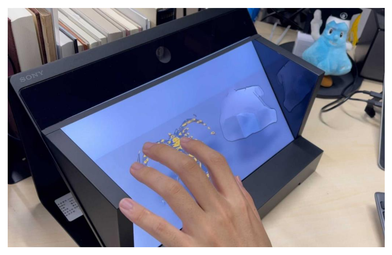

Fig6. The 3D image displayed on the spatial reproduction display and motion capture captured hand movement

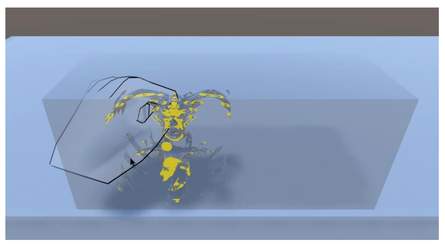

Fig7. The cross-section image displayed on the display

Conclusion

- **On the system using AR, user can check the cross-sectional image of the object at any 2π solid angle.**
- **On the system using VR by spatial reproduction display and motion capture, user can move the 3D data in all directions, up, down, left, right, front and back, and rotate it 360 degrees view and confirm cross-section of the data so that understand the internal structure of the material intuitively.**

Approaches to the representation of CT data from the respective directions of AR and VR were addressed. Each of these approaches should be changed depending on the object to be observed.

For example…

- The approach of using AR is more suitable for checking Large objects that cannot be represented by a single viewing angle.
- The approach of using VR will help us understand the relative spatial position of things (up and down, left and right, front and back) from a single perspective.