

Annotation Framework for Recurring Appointments in Medical Applications using Augmented Reality

Computer Integrated Surgery II, Spring, 2021

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Introduction

- Several medical procedures require doctors to use diverse medical imaging modalities to track the evolution of multiple conditions and diseases.
- Usually, it's hard for doctors to visualize the images while looking at the patients' body. Therefore, providing the images next to the patients may facilitate this task.
- Some of these procedures are repetitive. For example, obstetric inspection and facet joint injection require the patients to get recurring images from specific part of their body.

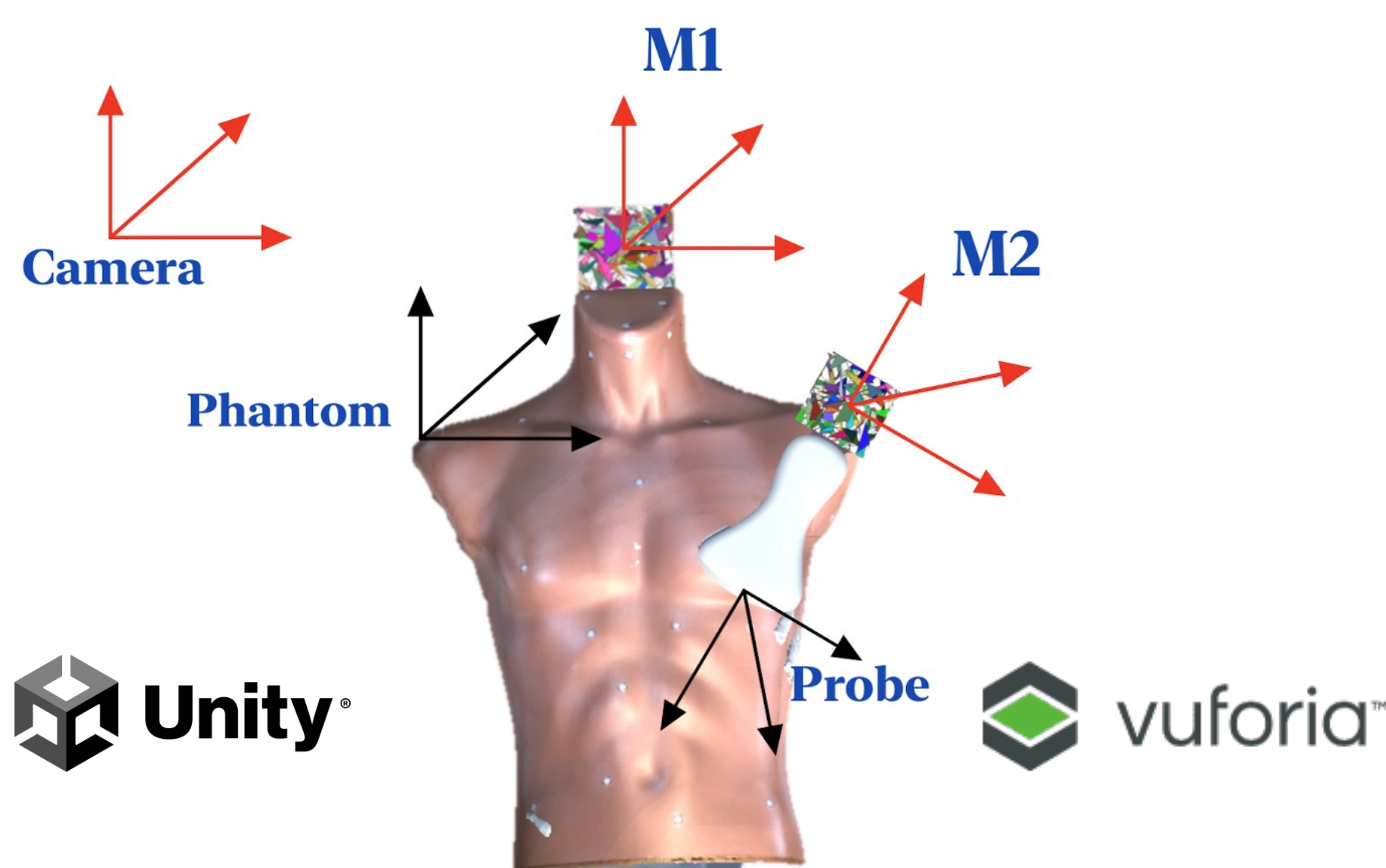
The Problem

- Doctors always need to use a monitor to observe the medical images. But the monitor is far away from the patient's body so the doctor's sight needs to move between the monitor and patient's body repeatedly and it's inconvenient.
- The locations for scanning are difficult for doctors to memorize for recurring so some locations may be missed or difficult to search for future visit.

The Solution

The solution is an annotation framework that can show the images next to the patients and allow the surgeons to save the pose where the images are taken. The system utilizes ultrasound imaging and AR head mounted display to assist this kind of procedures. Realizing the system involves three different steps: tool-pose estimation, image acquisition and visualization.

- Tool-pose estimation:** Track the position and orientation of the human body and ultrasound probe and estimate the relative pose and position of the tool and human body. Current work was based on Unity 3D and Vuforia Engine.

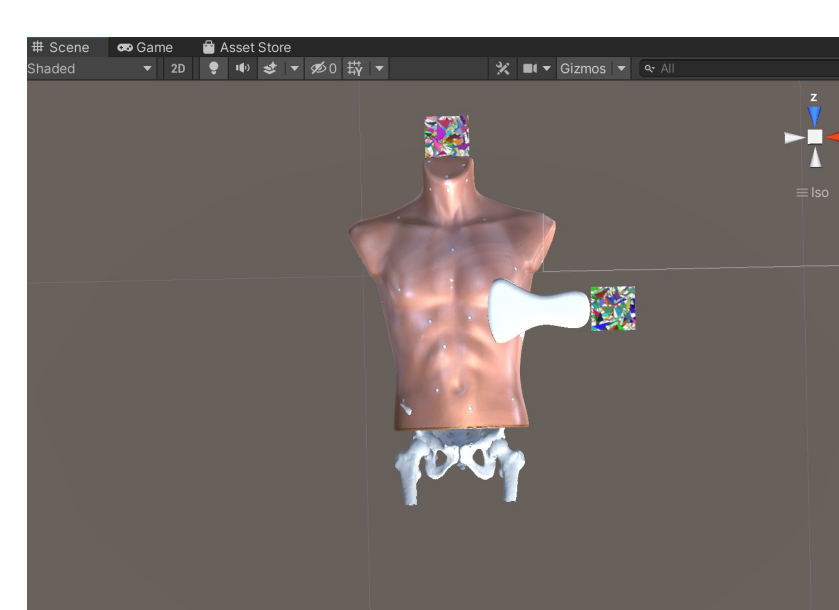


$$T_{phantom}^{probe} = (T_{M1}^{phantom})^{-1} (T_{camera}^{M1})^{-1} T_{camera}^{M2} T_{M2}^{probe}$$

- Image Acquisition:** Use keyboard to save the locations and images for recurring. For future visits, doctors can call the history images for comparison.
- Visualization:** Display the annotations and history images with augmented reality HMD device.

Outcomes and Results

- Build unity scenes for displaying ultrasound probe and human torso.
- Track the relative pose and position of two objects.
- Save the location information of the tool with respect to the human torso.
- Save the history images taken by the camera for recurring.



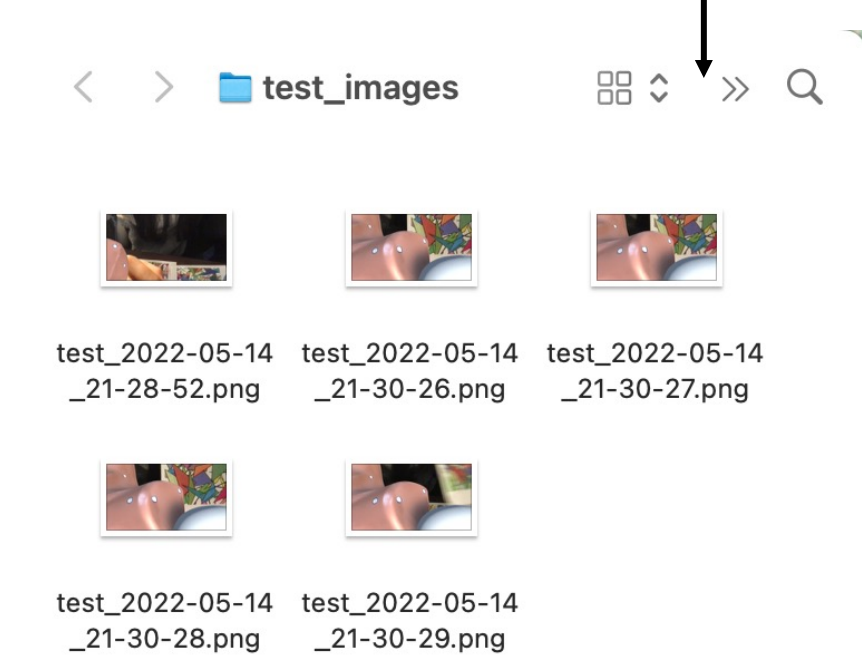
Build the scene.



Track the markers.

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relative position and orientation.JSON - 已编辑
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Save the position.



Save the image.

Future Work

- Try to implement the framework on facet joint injection procedure.
- For further research, replace the Vuforia engine with surgical tracking systems to improve the tracking accuracy.
- Design a user-interaction and image-display system with HoloLens.

Lessons Learned

- Building Unity projects.
- Methods and tips for using Vuforia Engine.
- Starting programming with C#.
- Experience on designing augmented reality solutions.

Credits

- The AR solution, programming work and marker-making was accomplished by myself. The 3D scanning of the human torso was finished by mentor Alejandro.

Support by and Acknowledgements

- Thanks for the support by my mentor Alejandro Martin Gomez.

