Group #25

CIS II Checkpoint presentations

Annotation Framework for Recurring Appointments in Medical Applications using Augmented Reality

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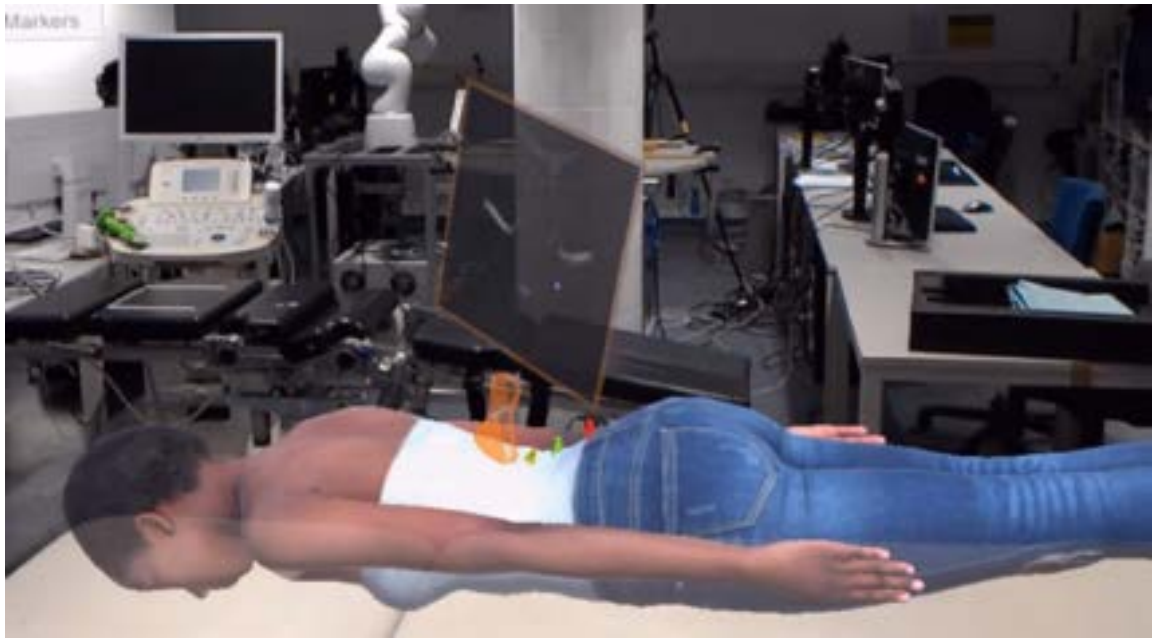
Project review

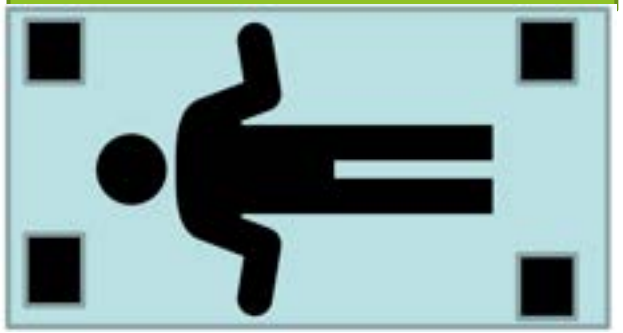


Scenes for display provided by mentor

- Use ultrasound to capture patient's anatomical information.
- Use a clicker to save the pose and positon of the tool with images in that location.
- Use Hololens for recurring images with augmentated reality display.

Project review

Track the human phantom

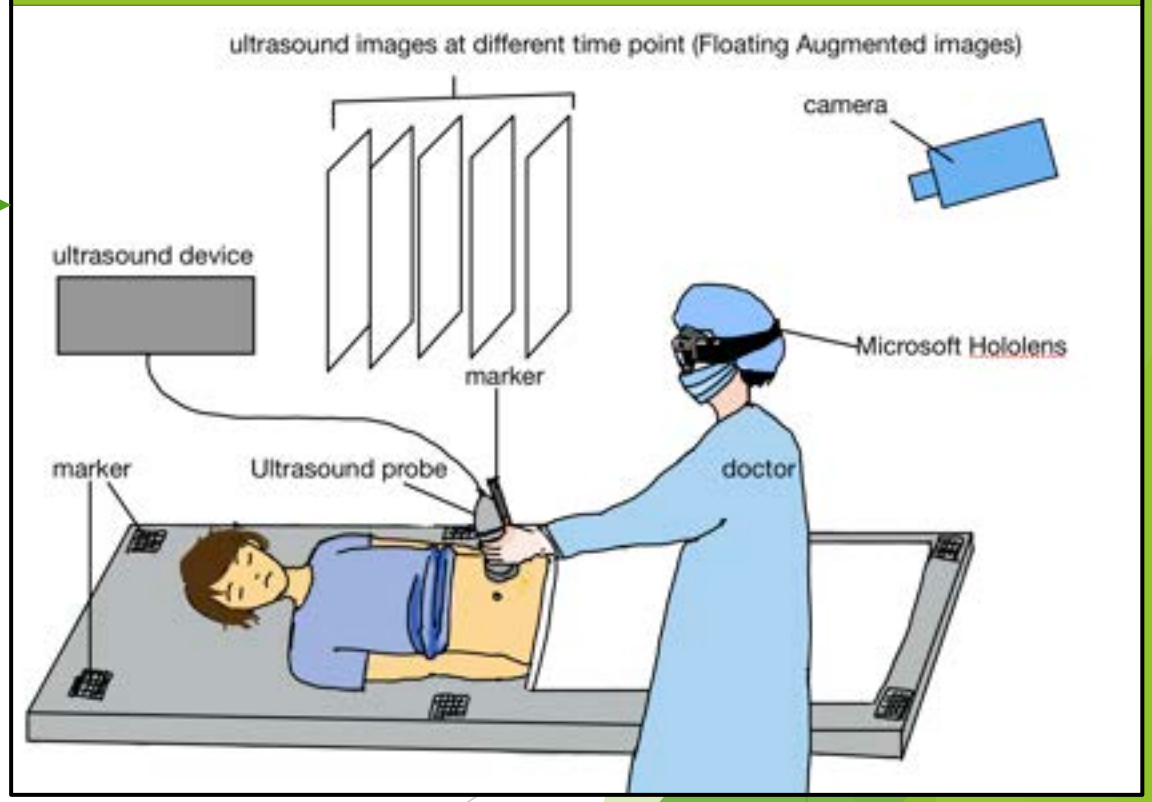


Track the ultrasound probe

Save the pose and position of the probe with anatomical image.

https://www.ithome.com.tw/news/104200

Visualization with Hololens for recurring and diagnosis



Tool tracking

- Use a small box to model the ultrasound probe and a big box to model the human phantom.
- Markers were attached in each box.
- Calculate the distance between markers.

Work flow

The entire workflow of AR tracking is:

- 1. Make optical markers.
- 2. Use the camera on the laptop to recognize the optical markers by image recognition using unity.
- 3. When finding the Markers, concentrate their space coordinates.
- 4. If find points of interest, save the typical coordinates for calculation.
- 5. Design algorithms for pose and position estimation.

My recent work

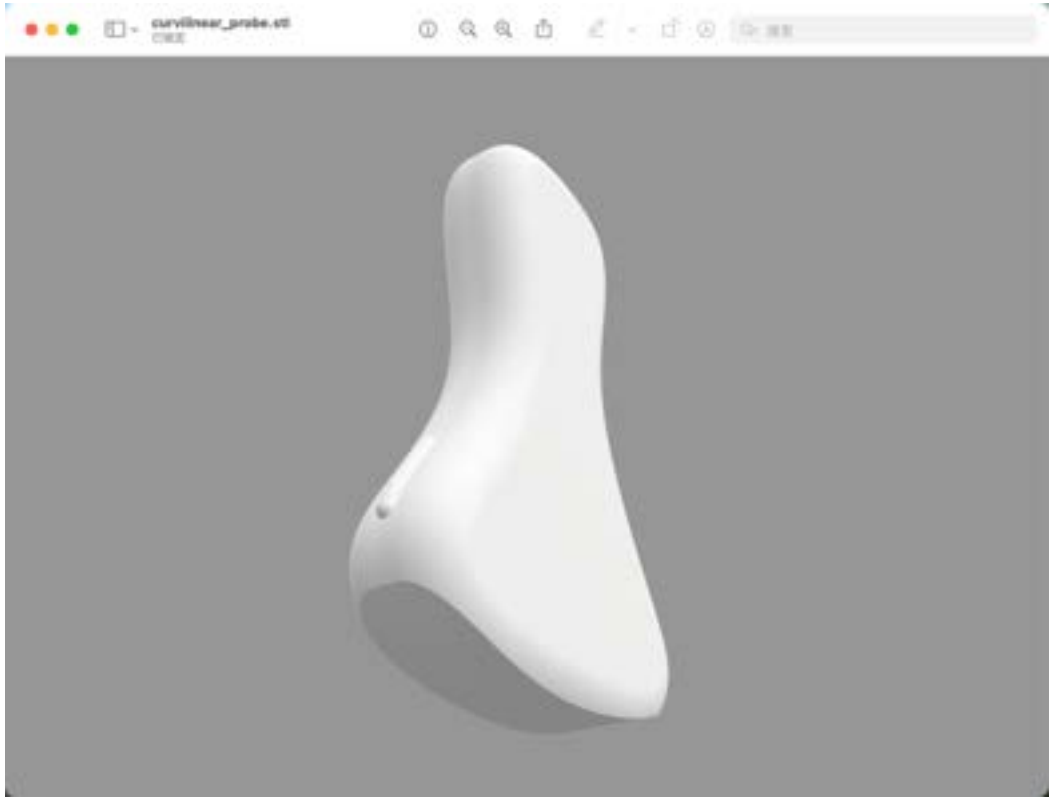
- Code
  - Calculate the orientation and location of the objects.
  - Save the coordinates.
  - Estimate the relative pose and position of the two objects.

```
# Save the coordinates of objects

using UnityEngine;
using System.Collections;
using System.Collections.Generic;
using System.IO.Ports;
using System.Threading;
using System.IO;
using System;
using System.Text;
using UnityEngine.UI;

public class pos : MonoBehaviour
{
    public Transform[] obj;
    private Vector3 o1;
    private Vector3 o2;
    private Vector3 o3;
    private Vector3 o4;


    // Use this for initialization
    void Start()
    {
        // WriteFileByLine("E:\\", "my_newfile1.txt", "");
        Screen.SetResolution(1920, 1080, true);
        if (File.Exists("D:\\my_newfile1.txt"))
            Read("D:\\my_newfile1.txt");
    }

    // Update is called once per frame
    void Update()
    {
        o1 = obj[0].position;

        o2 = obj[1].position;

        o3 = obj[2].position;

        o4 = obj[3].position;

    }
    public void WriteFileByLine(string file_path, string file_name, string str_info)
    {
        StreamWriter sw;
        if (!File.Exists(file_path + "//" + file_name))
        {
            sw = File.CreateText(file_path + "//" + file_name);//Create a text for writing UTF-8 encoding
            Debug.Log("Succeed! ");
        }
        else
```

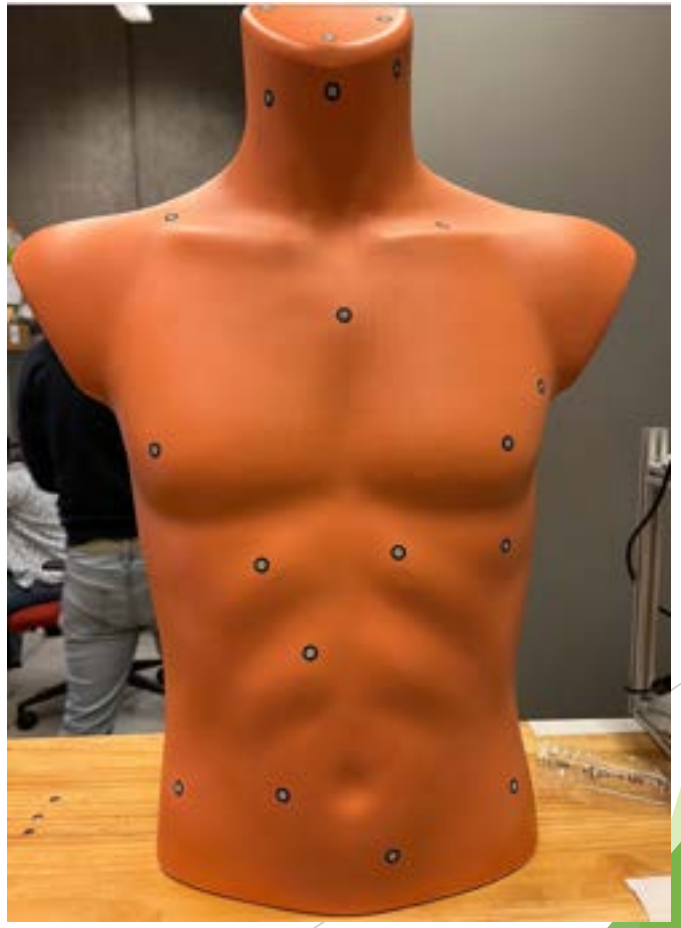
Difficuties

- Unfamiliar with c# programming.
- Errors in spatial coordinate calculation.

Next step



- Improve space estimation coding.
- Make 3D print of the ultrasound model.
- Make 3D scan of human phantom.



Further arrangement

- Use keyboard to save the ultrasound probe’s pose.
- Create a sphere with dimensions 5mm*5mm*5mm(remember the point) to annotate the key point for annotation.
- Repeat for each annotation point.

Deliverables

- Minimum(4.15): Finishing Tracking and Saving function.
  - **A working demo capable to track the tool pose and display visual augmentations of their pose with respect to the patient's body. Provide a git repository containing a readme file (include instructions on how to replicate, the system and its dependencies.) and the source code to replicate the project.**
    - Save the pose and position of the tool with respect to the patient's body.

      Provide c# code uploaded on google docs and github.
    - Record images with desired pose coordinates and show the recorded images during future visits.

      Provide image files with orientation and position information.
- Expected(4.30): Testing on a human body phantom.
  - In addition to the minimum, it is expected to include a 3D scanned replica of human body phantom and a 3D printed ultrasound probe.
    - Make 3D print of ultrasound probe model and use 3D scanner to create a virtual replica of the phantom.

      Provide 3D reconstruction file.
    - Evaluate the accuracy of the tracking technique.

      Provide a report containing the results of the tracking accuracy.
- Maximum(5.1-): Adding body tracking function.
  - Automatically identify the patient's body pose. Visualize the human body anatomy evolution with Hololens display.
    Provide source code for the tracking of patient's body pose.

List of dependencies

Items	Sources	Date	Status	Priority, possible effect and substitution
Computer with Unity Vuforia Engine and C#	myself	2/28	Available	Vital for programming. Computer in CAMP lab can be a substitution.
Human body phantom(torso)	CAMP lab	2/28	Available	Important for testing. Other body phantoms in CAMP lab can be an alternative choice.
Optical Markers	Augmented reality marker generator website	3/1	Printed	Important for tracking, but easy to get.
Cameras for tracking	CAMP lab	3/1	Available. Wait for mentor assignment.	For better tracking. But camera in the laptop can be a alternative with worse accuracy.
Use 3D printer	BIGSS lab's printer	3/14	available and could be used anytime (unless there is a printing runnig)	Use to print ultrasound probe model, which is important for experiment. LSPR one can be an alternative choice.
Microsoft Hololens and Hololens Clicker	CS department’s property	3/14	Lab purchased. Wait for mentor assignment	Virtal for image display. No alternative.
3D Scanner	BIGSS lab	3/31	available	Important for making 3D phantom virtual replica.

Updated timeline

Timeline

Arrangement	Start time	Deadline	Percentages	Notes
Plan and prepare for the project.	2/28/22	3/1/22	100%	finished
Use unity vuforia engine to track the relative pose and position of two objects with markers. Save the poses and positions.	3/7/22	4/5/22	50%	The system has been set up. We have objects with markers and vuforia environment for tracking. But there is some trouble on programming for calculation.
Make ultraound probe model.	4/1/22	4/1/22	50%	The ultrasound proble model is built. Wait for 3D printing.
Use 3D scanner to make 3D anatomy samples on a human body phantom.	4/5/22	4/10/22	0%	Pending
Make experiment on human body phantom for recurring anatomy tracking. Document the test results.	4/10/22	4/20/22	0%	Pending
Add interaction function for history image saving. Recur time-sequence images with tool position.	4/20/22	4/30/22	0%	Pending
Analyze prior work. If possible, add body tracking function.	5/1/22	5/6/22	0%	Pending

Thanks!