About AR Foundation

CE/CZ 4001
Virtual and Augmented Reality

AY2021/2022 Semester 2

References

- About AR Foundation
  - About AR Foundation | AR Foundation | 4.2.2 (unity3d.com)
- Getting Started With ARFoundation in Unity Jan 2019
  - https://www.youtube.com/watch?v=Ml2UakwRxjk
- Unity AR Foundation Tutorial - Tap to Place Objects in AR Jan 2020
  - https://www.youtube.com/watch?v=xguiSueY1Lw

About AR Foundation

- AR Foundation allows us to work with AR platforms in a multi-platform way within Unity.
- This package presents an interface for Unity developers, but does not implement any AR features itself.
  - Since it communicates with both AR Kit and AR Core, the same objects and code can be used in development for both iOS and Android apps.
- To use AR Foundation on a target device, we also need separate packages for the target platforms officially supported by Unity.
  - ARCore XR Plugin on Android
  - ARKit XR Plugin on iOS
  - Magic Leap XR Plugin on Magic Leap
  - Windows XR Plugin on HoloLens

MonoBehaviours and APIs

- Device tracking
  - Track the device's position and orientation in physical space.
- Plane detection
  - Detect horizontal and vertical surfaces.
- Point clouds
  - Also known as feature points.
- Anchor
  - An arbitrary position and orientation that the device tracks.
- Light estimation
  - Estimates for average color temperature and brightness in physical space.
- Environment probe
  - A means for generating a cube map to represent a particular area of the physical environment.

- Face tracking
  - Detect and track human faces.
- 2D image tracking
  - Detect and track 2D images.
- 3D object tracking
  - Detect 3D objects.
- Meshing
  - Generate triangle meshes that correspond to the physical space.
- Body tracking
  - 2D and 3D representations of humans recognized in physical space.
- Collaborative participants
  - Track the position and orientation of other devices in a shared AR experience.
- Human segmentation
  - Determines a stencil texture and depth map of humans detected in the camera image.

- Raycast
  - Queries physical surroundings for detected planes and feature points.
- Pass-through video
  - Optimized rendering of mobile camera image onto touch screen as the background for AR content.
- Session management
  - Manipulation of the platform-level configuration automatically when AR Features are enabled or disabled.
- Occlusion
  - Allows for occlusion of virtual content by detected environmental depth (environment occlusion) or by detected human depth (human occlusion).

- ARCore and ARKit both provide a real-time (simple) estimate of the light in the scene, so the developer can instantly adjust the simulated lighting to match the real world (and maybe trigger an animation at the same time)

https://miro.medium.com/max/1200/1*PoHQwWRlz7dJWlGEiBF0lw.gif

	ARCore	ARKit	Magic Leap	HoloLens
Device tracking	✓	✓	✓	✓
Plane tracking	✓	✓	✓	
Point clouds	✓	✓		
Anchors	✓	✓	✓	✓
Light estimation	✓	✓		
Environment probes	✓	✓		
Face tracking	✓	✓		
2D Image tracking	✓	✓	✓	
3D Object tracking		✓		
Meshing		✓	✓	✓
2D & 3D body tracking		✓		
Collaborative participants		✓		
Human segmentation		✓		
Raycast	✓	✓	✓	
Pass-through video	✓	✓		
Session management	✓	✓	✓	✓
Occlusion	✓	✓		

Glossary

- Tracking
  - The AR device's ability to determine its relative position and orientation in the physical world.
- Trackable
  - A real-world feature, such as a planar surface, that the AR device tracks.
- Feature Point
  - A specific point in a point cloud.
  - An AR device uses the device’s camera and image analysis to track specific points in the world, and uses these points to build a map of its environment.
- Session
  - An AR instance.
- Session Space
  - The coordinate system relative to the beginning of the AR session.
  - For example, session space (0, 0, 0) refers to the position at which the AR session was created.
  - An AR device typically reports trackables and tracking information relative to its session origin.

ARSession

- An AR scene should include an ARSession component.
- The AR Session controls the lifecycle of an AR experience by enabling or disabling AR on the target platform.
- The ARSession can be on any GameObject.
- When you disable the ARSession, the system no longer tracks features in its environment, but if you enable it at a later time, the system attempts to recover and maintain previously-detected features.

AR Session Origin

- The purpose of the ARSessionOrigin is to transform trackable features, such as planar surfaces and feature points, into their final position, orientation, and scale in the Unity scene.
- AR devices provide their data in “session space”.
  - An unscaled space relative to the beginning of the AR session, the ARSessionOrigin performs the appropriate transformation into Unity space.
- This concept is similar to the difference between "model" or "local" space and world space when working with other Assets in Unity.
- For instance, if you import a house asset, the door's position is relative to the modeler's origin.
- This is commonly called "model space" or "local space".
- When Unity instantiates it, it also has a world space that's relative to Unity's origin.

- Likewise, trackables that an AR device produces, such as planes, are provided in "session space", relative to the device's coordinate system.
- When instantiated in Unity as GameObjects, they also have a world space.
- In order to instantiate them in the correct place, AR Foundation needs to know where the session origin should be in the Unity scene.

- ARSessionOrigin also allows you to scale virtual content and apply an offset to the AR Camera.
- If you're scaling or offsetting the ARSessionOrigin, then its AR Camera should be a child of the ARSessionOrigin.
- Because the AR Camera is session-driven, this setup allows the AR Camera and detected trackables to move together.

Scale

- To apply scale to the ARSessionOrigin, set its transform's scale.
- This has the effect of scaling all the data coming from the device, including the AR Camera's position and any detected trackables.
- Larger values make AR content appear smaller.
- For example, a scale of 10 would make your content appear 10 times smaller, while 0.1 would make your content appear 10 times larger.

End