# Building Immersive Mobile AR Experiences with Unity

# PALOIT

Crafting tech as a force for good.



WORLD ECONOMIC FORUM New Champions Community

### WHO ARE WE?



# Akkapon Somjai (App)

Technical Lead

asomjai@palo-it.com

# Yanyong Prommajarn (Toei)

Fullstack Software Developer

yprommajarn@palo-it.com

# **ΡΛLΟ**ΙΤ

A **global tech innovation consultancy** dedicated to achieving your business goals through next-level product-centric software delivery.

We provide expertise across the full product journey from ideation to launch and scale, using Sustainable IT practices as a commitment to crafting **tech as a force for good**.





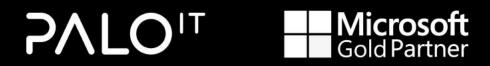
### GitHub Verified Partner







# B GitHub Copilot



**GitHub** Verified Partner

### What We Do?

### **PRODUCT CONSULTING**

#### **New Digital Product Innovation**

- Validate Product-Market Fit
- Formulate Implementation Plan
- Minimize Development Cost

#### **Existing Product Optimization**

- Increase Product Adoption
- Identify Product Improvements
- Improve Viability and Profitability

### **ORGANIZATION CONSULTING**

#### **Delivery Acceleration**

- 3
- Enable Value-Based Delivery

Reduce Time to Market

- Modernize Tech Infrastructure
- · Align Business and Product Delivery
- Staff Empowerment

#### Sustainability For Positive Impact

- Sustainability Fundamentals
- ESG Data Management
- Enabling An Impact Mindset
- Tech For Good



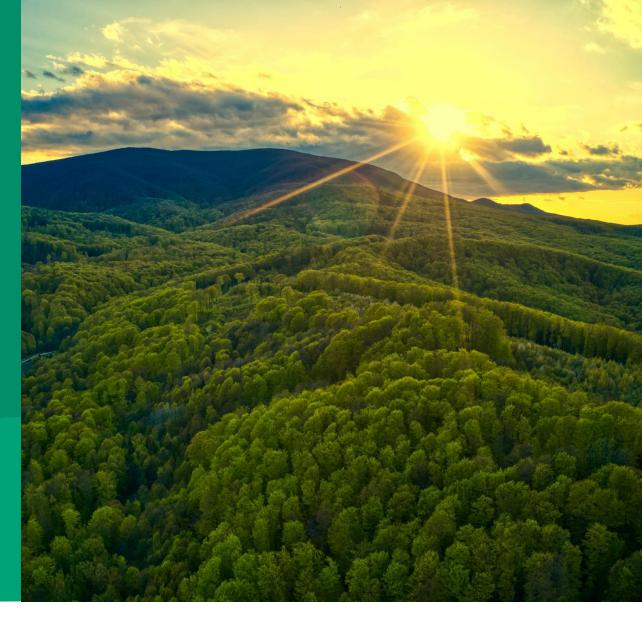


#### Contact Us

### Agenda

- 01 Introduction to AR Foundation
- 02 AR Face Tracking
- 03 AR Image Tracking
- 04 AR Plane Detection
- **05** Summary
- 06 Q & A

# Introduction to AR Foundation









### INTRODUCTION TO AR FOUNDATION

# What is Augmented Reality(AR)?

- AR overlays digital elements onto the real world
- Combines physical and virtual worlds
- Creates interactive experiences, including:
  - **Face Tracking**: Adds virtual objects to a user's face, allowing for facebased interactions in AR.
  - Image Tracking: Triggers AR content when a specific image is detected in the real world.
  - Plane Detection: Scans horizontal and vertical surfaces, enabling interaction with virtual 3D objects on these surfaces.



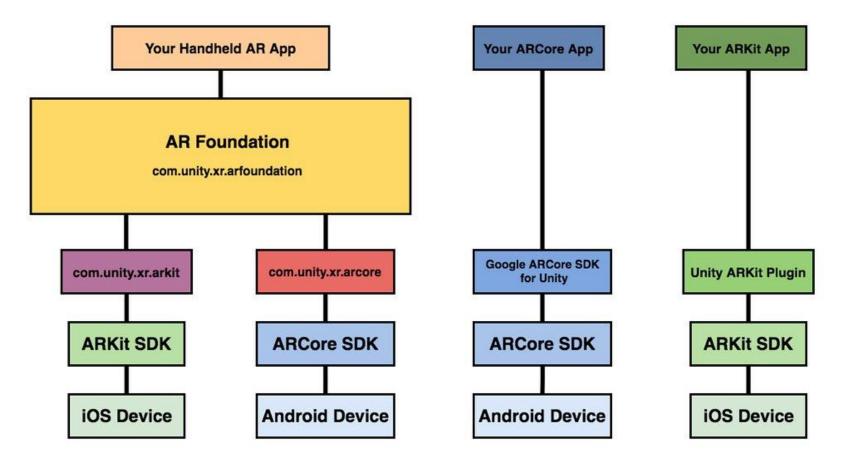
# INTRODUCTION TO AR FOUNDATION What is AR Foundation?

- Cross-platform development framework: Build once, deploy to multiple platforms such as iOS, Android, Meta Quest, HoloLens and so.
- Simplified AR development: Focus on core AR features like face tracking and image tracking
- Access to native AR capabilities: Leverage device-specific functionalities



### **INTRODUCTION TO AR FOUNDATION**

# **AR Foundation Architecture**



## INTRODUCTION TO AR FOUNDATION Required Unity Packages

### **AR Foundation**

6.0.3 · August 19, 2024

From **Unity Registry** by Unity Technologies Inc.

com.unity.xr.arfoundation

### Apple ARKit XR Plugin

**6.0.3 · August 19, 2024** From **Unity Registry** by Unity Technologies Inc. *com.unity.xr.arkit* 

### XR Plugin Management

4.5.0 · July 08, 2024

Installed as dependency

From **Unity Registry** by Unity Technologies Inc.

com.unity.xr.management

### Google ARCore XR Plugin

6.0.3 · August 19, 2024 From Unity Registry by Unity Technologies Inc. *com.unity.xr.arcore* 

### **XR Simulation Environments**



Author unknown

com.unity.xr-content.xr-sim-environments

# **AR Face Tracking**



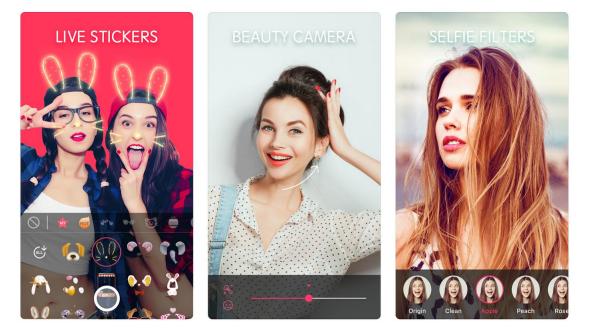




### **AR FACE DETECTION**

### Use Case: Face Tracking App

This app allows users to enhance their photos with virtual face tracking, helping them experiment with different looks and styles without the need for makeup or accessories. It also ensures that filters fit perfectly to their facial features, providing a seamless and fun experience.



### **AR FACE DETECTION**

# **Required Scene Settings**

	XR Origin								
😭 XR Origin									
🕎 🗹 XR Origin	Sta	itic 🔻							
Tag Untagged	▼ Layer Default								
🔻 🙏 Transform	0	72 I							
Position	X O Y O Z O								
Rotation	x 0 Y 0 Z 0								
Scale 🗞	X 1 Y 1 Z 1								
🔻 # 🖌 XR Origin	0	72 I							
Script	🛙 XROrigin								
Origin Base GameObject	⊕ XR Origin								
Camera Floor Offset GameOb	🕆 Camera Offset								
Camera	🖿 Main Camera (Camera)								
Tracking Origin Mode	Device								
Camera Y Offset	1.1176								
🔻 😨 🖌 AR Face Manager (Sc	ript) 🛛 🥹	⊉ :							
Script	3 ARFaceManager								
Trackables Changed (ARTra	ckablesChangedEventArgs`1)								
List is empty									
	+ -	-							
Face Prefab	🗊 AR Default Face								
Maximum Face Count									
	Add Component								
Asset Labels									

The **AR Face Manager** is a component of the AR Foundation package that detects and tracks human faces in the physical environment.

**Face Prefab:** When a face is detected, the AR Face Manager instantiates a Face Prefab to represent the face.

# Simulation



# Demo

AR Face Tracking



# **AR Image Tracking**





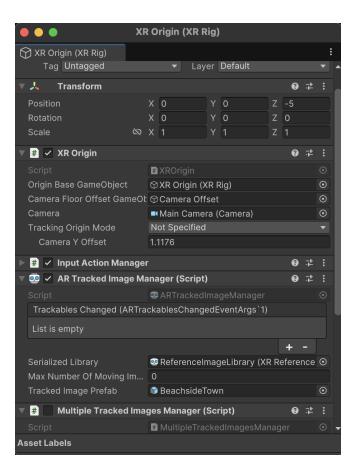


## Use Case: AR interactive App

This app allows users to interact with their environment by scanning images to unlock augmented reality experiences. It helps users access additional content, such as 3D models, videos, and animations, directly from printed materials or objects. This seamless integration of digital content with the real world provides an engaging and informative experience.



## **Required Scene Settings**



The **AR Tracked Image Manager** is a component of the AR Foundation package that detects and tracks 2D images in the physical environment, and it displays 3D models on these detected images.

### **Concept of AR Tracked Image Manager**

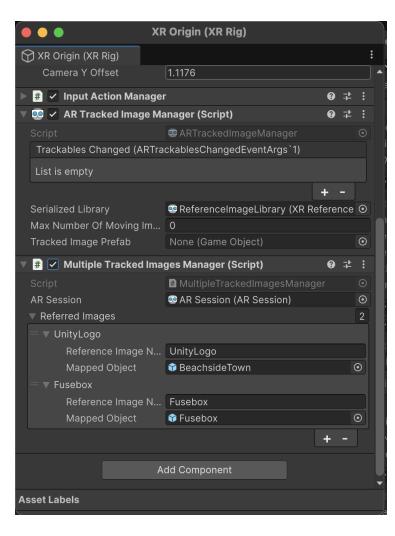
🛑 🌕 🌒 Refei	rencelmageLibrary	
🥺 ReferencelmageLibrary		:
		Open
Name	BeachsideTown	
Specify Size	×	
Physical Size (meters)	X 0.1 Y 0.1	
Keep Texture at Runtime	<ul><li>✓</li></ul>	
Name	Fusebox	
Specify Size	<ul> <li>Image: A set of the set of the</li></ul>	
Physical Size (meters)	X 0.1 Y 0.1	
Keep Texture at Runtime		Ĩ
<b>et unity</b> Select		
Asset Labels		
		۲
AssetBundle None	▼ N	lone 🔻







# **Multiple Tracked Images**















# Demo

AR Image Tracking



# **AR Plane Detection**







## **Use Case: Virtual Furniture App**

This app allows users to decorate their room with virtual 3D furniture, helping them save money by avoiding unnecessary store visits and preventing mistakes like buying furniture that doesn't fit their space.



### **Concept of AR Plane Detection**

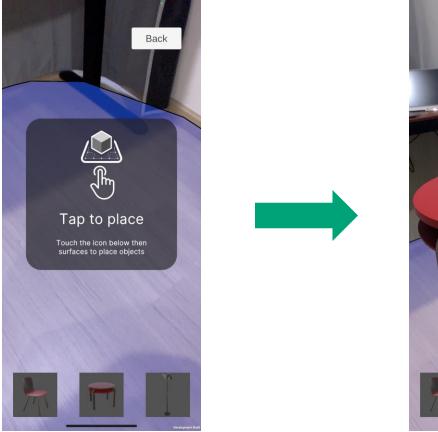
Rotate the camera to scan surfaces



Scanned surfaces turn blue to indicate they're ready for interaction.

# **Concept of AR Ray Casting**

Tap the blue area to place





A ray is cast from a screen point into the world, and it checks for collisions with the blue area. If the ray hits the blue area, it indicates that the furniture can be placed there.

# **Required Scene Settings**

Image: AR Raycast Manager (Script)       Image: ARRaycast Manager       Image: Construct of the second sec	¢	✓ XR Origin (XR Rig) Tag Untagged	_	•	Layer	De	efault	_		Sta	atic	•
Rotation X 0 Y 0 Z 0   Scale Input Action Manager Image: Imag		🙏 Transform								8	÷	
Scale N I Y I Z I     # ✓ XR Origin Ø # # #     # ✓ Input Action Manager Ø # # #   Ø ✓ AR Raycast Manager (Script) Ø # # #   Script Ø ARRaycast Manager Ø   Trackables Changed (ARTrackablesChangedEventArgs`1) I   List is empty I I   Ø ✓ AR Plane Manager (Script) Ø   Script Ø ARPlane Manager Ø   Trackables Changed (ARTrackablesChangedEventArgs`1) Ø   List is empty I I   I I <td></td> <td>Position</td> <td>Х</td> <td>414</td> <td></td> <td></td> <td>896</td> <td>Z</td> <td>0</td> <td></td> <td></td> <td></td>		Position	Х	414			896	Z	0			
# ✓ XR Origin • ± :   # ✓ Input Action Manager • ± :   • ✓ AR Raycast Manager (Script) • ± :   Script • ARRaycastManager   Trackables Changed (ARTrackablesChangedEventArgs`1)   List is empty   + -   Raycast Prefab   None (Game Object)   • ✓ AR Plane Manager (Script)   • ✓ Independent of the state		Rotation	Х	0			0	Ζ	0			
# ✓ Input Action Manager ② ↓ ⋮   ✓ ✓ AR Raycast Manager (Script) ② ↓ ⋮   Script ③ ARRaycast Manager ○ ✓ ⋮   Trackables Changed (ARTrackablesChangedEventArgs`1) ⊥ ↓ -   List is empty ↓ -    Raycast Prefab None (Game Object) ○ ↓ -   Raycast Prefab None (Game Object) ○ ↓ ·   Script ☑ AR Plane Manager (Script) ② ↓ ·   Script ☑ ARPlaneManager ○ ↓ ·   Trackables Changed (ARTrackablesChangedEventArgs`1) ⊥ · ·   List is empty ↓ - · ·		Scale 🖄	5 X	1			1	Ζ	1			
Image: AR Raycast Manager (Script)       Image: AR Raycast Manager       Image: AR Raycast Manager         Script       Image: AR Raycast Manager       Image: AR Raycast Manager         Trackables Changed (AR Trackables Changed Event Args`1)       Image: AR Raycast Prefab       Image: AR Plane Manager         Raycast Prefab       None (Game Object)       Image: AR Plane Manager       Image: AR Plane Manager         Script       Image: AR Plane Manager       Image: AR Plane Manager       Image: AR Plane Manager         Trackables Changed (AR Trackables Changed Event Args`1)       Image: AR Plane Manager       Image: AR Plane Manager         Itst is empty       Image: AR Plane Manager       Image: AR Plane Manager       Image: AR Plane Manager		🗯 🖌 XR Origin								0	규는	
Script       Image: ARRaycastManager       Image: Comparison of the second sec		# 🔽 Input Action Manager								0	규	
Trackables Changed (ARTrackablesChangedEventArgs`1)         List is empty         + -         Raycast Prefab       None (Game Object)         Image: Im	▼	💀 🗹 AR Raycast Manager (Scrip	t)							0	ᅷ	
List is empty  AR Plane Manager (Script)  AR Plane Manager (Script)  C AR Plane Manager (Script)  C Trackables Changed (ARTrackablesChangedEventArgs`1)  List is empty  + -		Script		ARRay	castMana	age						
H       -         Raycast Prefab       None (Game Object)       ©         Image: Comparison of the system of the sy		Trackables Changed (ARTrackable	sCh	angedEv	entArgs`	`1)						
Raycast Prefab       None (Game Object)       ☑         Image: AR Plane Manager (Script)       ☑       Image: ARPlane Manager       ☑         Script       Image: ARPlane Manager       Image: ARPlane Manager       Image: ARPlane Manager       Image: ARPlane Manager         Trackables Changed (ARTrackablesChangedEventArgs`1)       Image: ARPlane Manager		List is empty										
Image: AR Plane Manager (Script)       Image: AR Plane Manager         Script       Image: AR Plane Manager         Trackables Changed (ARTrackablesChangedEventArgs`1)       Image: AR Plane Manager         List is empty       Image: AR Plane Manager         Image: AR Plane Manager       Image: AR Plane Manager <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>+</td> <td>-</td> <td></td>										+	-	
Script @ ARPlaneManager @ Trackables Changed (ARTrackablesChangedEventArgs`1) List is empty + -		Raycast Prefab	١	lone (Ga	ime Obje	ct)						$\odot$
Trackables Changed (ARTrackablesChangedEventArgs`1) List is empty + -	T	💀 🗹 AR Plane Manager (Script)								0	규는	
List is empty + -		Script	0	ARPIan	eManage							
+ -	Trackables Changed (ARTrackablesChangedEventArgs`1)											
+ -		List is empty										
										+	-	
Plane Prefab 🛛 🗳 AR Default Plane 🖸 🖸		Plane Prefab		AR Def	ault Plan	е						$\odot$
Detection Mode Horizontal -		Detection Mode	F	lorizonta	al							

• The **AR Plane Manager** component in Unity's AR Foundation is responsible for detecting and managing flat surfaces (or "planes") in the real-world environment, such as floors, tables, or walls, through the device's camera.

**Plane Prefab** is the virtual plane to display when the system detect the surface.

 The AR Raycast Manager component in Unity's AR Foundation allows you to cast "virtual rays" from the camera view into the real world to detect specific AR objects or surfaces

## **Required Scene Settings**

Main Camera								Sta	atic	•
Tag MainCamera			▼ Layer	De	efault					•
▼ 🙏 Transform								8	走	:
Position		Х	0	Y	0	Ζ	0			
Rotation		Х	0	Y	0	Ζ	0			
Scale	ĊQ	Х	1	Y	1	Ζ	1			
▶ ■t 🗸 Camera								•	ᅷ	:
🔒 🗹 Audio Listener								8	ᅷ	:
🔻 💽 🖌 AR Camera Manager (Sc	ript)							8	- <del> </del> -	:
Script			ARCameraMana	igei						۲
Auto Focus										
Image Stabilization										
Light Estimation		E١	verything							•
Facing Direction		W	'orld							•
Render Mode		Aı	ny							▼
🕨 💀 🔽 AR Camera Background (Script)							8	규	:	
🕨 🜱 🔽 Tracked Pose Driver (Inp	out Sy	ste	em)					9	÷	:
		Ac	ld Component							

Set the **Facing Direction** to "World" to make sure the app can only use the phone's back camera. This is essential for detecting AR planes feature.

## ADD SECTION HERE Required Scene Settings

We need to create a UI script that receives planes detected by the AR Plane Manager.

The script will place a virtual 3D object on a selected plane by using a raycast from the AR Raycast Manager.

# 🗸 AR Creative Input Man		8 ≓
	ARCreativeInputManager	
AR Plane Manager	🖾 XR Origin (XR Rig) (AR Plane Manager)	
AR Ray Cast Manager	🥺 XR Origin (XR Rig) (AR Raycast Manager)	
Marker Prefab		
Element 0	😚 Props_HiHat	0
Element 1	😚 Props_Cap	0
Element 2	🗊 Candlestick	0
	H	
Decorate Buttons		
Element 0	Is Black Hat Button (Button)	0
Element 1	Brown Hat Button (Button)	0
Element 2	Candle Button (Button)	0
Selected Marker Index	-1	
Current State	Select Field	
Marker Pool		
List is empty		
	+	
Current Active Marker	None (Game Object)	
Tutorial UI Objects		
Element 0	Prompt_ScanSurfaces	0
Element 1	Prompt_TapToPlace	0
Decorator Offset	X 0 Y 0.05 Z 0	

# Demo

Virtual Furniture App







# Summary







### SUMMARY

### AR Foundation: Benefit & Limitation Benefits:

- **Cross-Platform Compatibility**: AR Foundation is designed to work across both iOS, Android, and VR headsets, saving developers from writing separate code for each platform. This simplifies development and speeds up the process of building AR apps
- **Built-In Support for Advanced Features**: AR Foundation includes plane detection, image tracking, and face tracking, making it easy for developers to create immersive AR experiences.
- **Effective Collaboration:** By using the Unity Engine, we streamline testing and fine-tuning of 3D assets, making it easier for 3D artists and software developers to work together efficiently.

### Limitations:

- Limited XR Simulation Environment Support: The XR Simulation Environment does not support certain subsystems like face tracking, body tracking, and object tracking.
- **No Official Support for Web Platforms**: AR Foundation does not support deployment to web-based AR platforms, so apps are limited to mobile and VR headset devices only.

### SUMMARY

### **Reference Documents**

AR Foundation Document :
 https://docs.upit/2d.com/Dockages

https://docs.unity3d.com/Packages/com.unity.xr.arfoundation@6.0/manual/index.html

 Unity Official Mobile AR Development Course: <u>https://learn.unity.com/pathway/mobile-ar-development</u>







