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AR/VR Development Landscape [Part Two]

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Contents

Introduction

In the previous paper of this three-part series, we discussed three main topics: the ever-expanding and complex AR VR technology ecosystem, how these technologies would continue to evolve, and the different types of AR and VR applications.

This paper will expand upon the various developmental SDKs and frameworks available, the different functionalities provided by each of these, and strategies for utilizing these SDKs.

Development Tools

1. Unity

Unity is the leading platform to build AR,VR, or MR interactive experiences and real-time content. It is also one of the most advanced cross-platform game engines available. Unity provides users with the ability to create games and experiences in 2D and 3D, using the primary scripting API in C# and drag and drop functionality. Unity supports the following platforms as of today:

Mobile	iOS, Android, tvOS, Android TV
Desktops	Windows(Universal Windows Platform), Mac, Linux
Web	WebGL
Console	PlayStation (PS4/PS5), Xbox (Xbox One, Xbox Series X/S), Nintendo Switch, Stadia
Virtual/Extended	Oculus, Playstation VR, ARCore, ARKit, Windows Mixed Reality (HoloLens), Magic Leap, Steam VR, Google Cardboard

2. Unreal

Unreal Engine is a game engine used to create 3D games, and other industries have begun to adopt it, as well. For example, the film and television industry creates virtual sets that can be tracked with a camera's motion around actors and objects and be rendered in real-time.

The AR framework provided by Unreal Engine allows the creation of AR apps for iOS and Android platforms from a single code base. A complete sample project template that demonstrates all of the AR functionality is available in the AR Blueprint template.

As of version 4.26, the following platforms are supported:

Mobile	iOS, Android, HTML5
Desktops	Windows(Universal Windows Platform), Mac, Linux
Console	PlayStation (PS4/PS5), Xbox (Xbox One, Xbox Series X/S), Nintendo Switch, Stadia
Virtual/Extended	Oculus, Playstation VR, Windows Mixed Reality (HoloLens), Magic Leap, Steam VR, HTC Vive, OSVR, Samsung Gear VR

3. XCode

Xcode is an integrated development environment (IDE) for macOS containing a suite of software development tools developed by Apple for developing software for macOS, iOS, iPadOS, watchOS, and tvOS. Xcode is the tool to build AR applications using the ARKit framework provided by iOS.

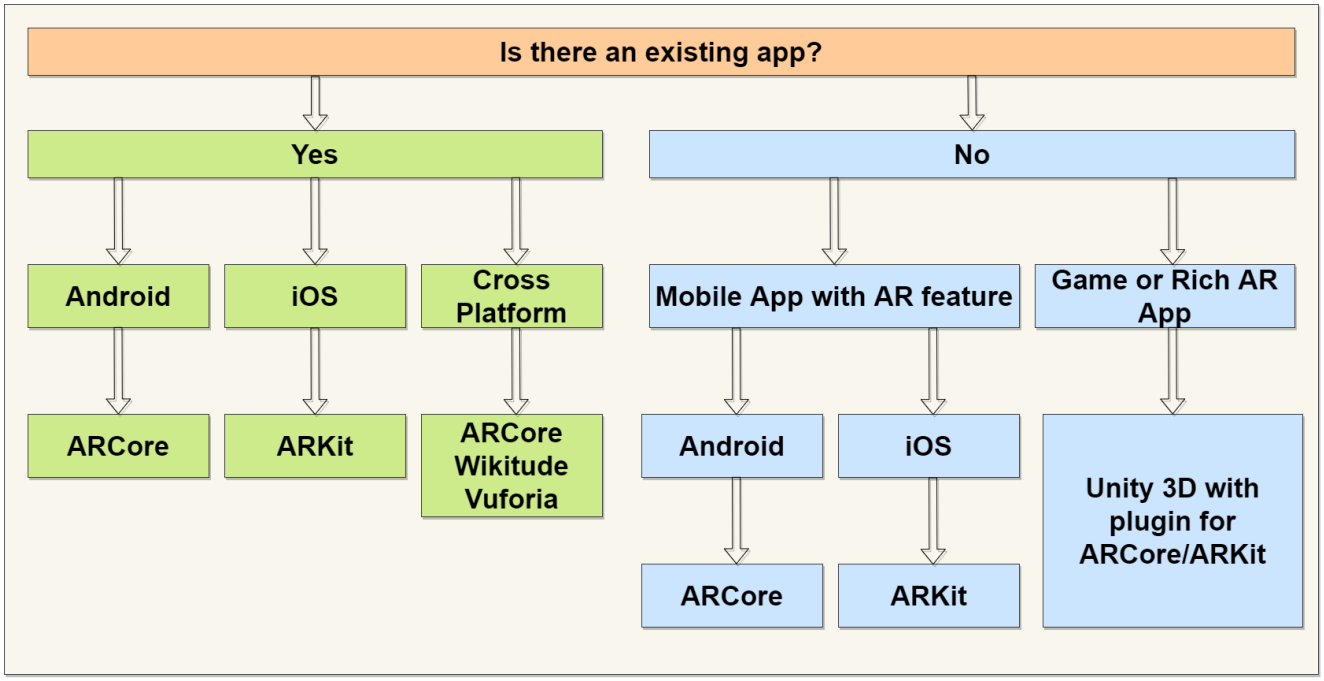
4. Android Studio

Android Studio is one of the popular tools for building augmented reality apps using ARCore with Sceneform of Filament SDK. To build a simple Android AR application and render 3D objects, you need to install the Sceneform Plugin to Android Studio.

5. Visual Studio

Visual Studio is a powerful IDE for numerous projects. For example, using Universal Windows Platform (UWP) from Unity builds a Visual Studio-ready project folder that opens in VS. From there, it is simple to compile, build, and deploy processes in order to run the app on the device.

Recommended SDK Tools for Different Applications



SDKs Used for AR Development

1. ARKit

ARKit is the augmented reality (AR) development platform from Apple for their iOS devices that allows developers to build high-detail AR experiences for the iPad and iPhone. The ARKit uses the device's camera, accelerometers, gyroscope, and context awareness features to perform environment mapping as the device moves. This, in turn, picks out visual features in the environment and tracks motion in conjunction with information from the sensors.

iPhone 6/6 Plus/7/7 Plus/8/8 Plus/X and iPad Pro models support the AR.

- ARKit provides the following functionality:
- SLAM (simultaneous localization and mapping) tracking and sensor fusion
- Ambient lighting estimation
- Scale estimations
- Vertical and horizontal plane estimation with basic boundaries
- Stable and fast motion tracking
- Image and object detection
- World, Geo, Face, Positional, and Orientation tracking

People Occlusion: Incorporates people with virtual objects, more realistic experience.

Motion Capture: Uses movement and pose in real-time. Uses a single camera.

Simultaneous Use of Front & Back Camera

Multiple Face Tracking: Tracks up to three faces at once.

Supported Platforms: iOS 11/12

Pricing: Free / $99 annual developer program for distribution

2. ARCore

ARCore is Google's proprietary augmented reality SDK that enables developers to create AR apps for compatible Android smartphones and tablets.

ARCore also supports iOS-enabled devices and gives developers access to users and handsets across both platforms.

Features provided by ARCore:

Motion tracking: Understands the phone's position relative to its surroundings.

Cloud Anchor: Multi-user, cross-platform for both Android and iOS.

Environmental Understanding:
- Detects feature points and planes
- Detects the size, boundary, and location of vertical, horizontal, and angled surfaces

Light Estimation:
- Lighting extension from the real world onto virtual objects

Augmented Faces:
- With devices without depth sensors, ARCore SDK provides facial tracking
with a 468 point 3D face mesh

Supported platforms: Android 7.0 and higher, iOS 11 or higher

Pricing: Free

Download this SDK here:
https://developers.google.com/ar/develop/downloads

3. Vuforia

The Vuforia SDK uses computer vision technology to recognize and track images and 3D objects in real-time. This enables developers to position and orient virtual objects in relation to real-world objects when viewed through the camera.

The position and orientation of the image are then tracked in real-time so that the viewer's perspective of the object corresponds with the perspective of the target, making it appear as if the virtual object is a part of the real-world scene.

In addition, the Cloud Recognition Service helps recognize a large set of images.

Model Target: Allows recognition of objects by shape using pre-existing 3D models.

Area Target: Augments real environments that can be scanned using a commercially available 3D scanner.

Image Target: Attaches content onto flat images.

Object Target: Created by scanning an object.

Multi-Target: Created using more than one Image Target.

Cylinder Target: Recognizes images wrapped onto objects that are cylindrical in shape.

VuMarks: Customized markers. Encodes a range of data formats, and supports both unique IDs and tracking for apps.

External Camera: Accesses video data from a camera outside of the one located in a phone or tablet when creating AR experiences.

Ground Plane: Allows placing of content on horizontal surfaces in the environment, like tables and floors.

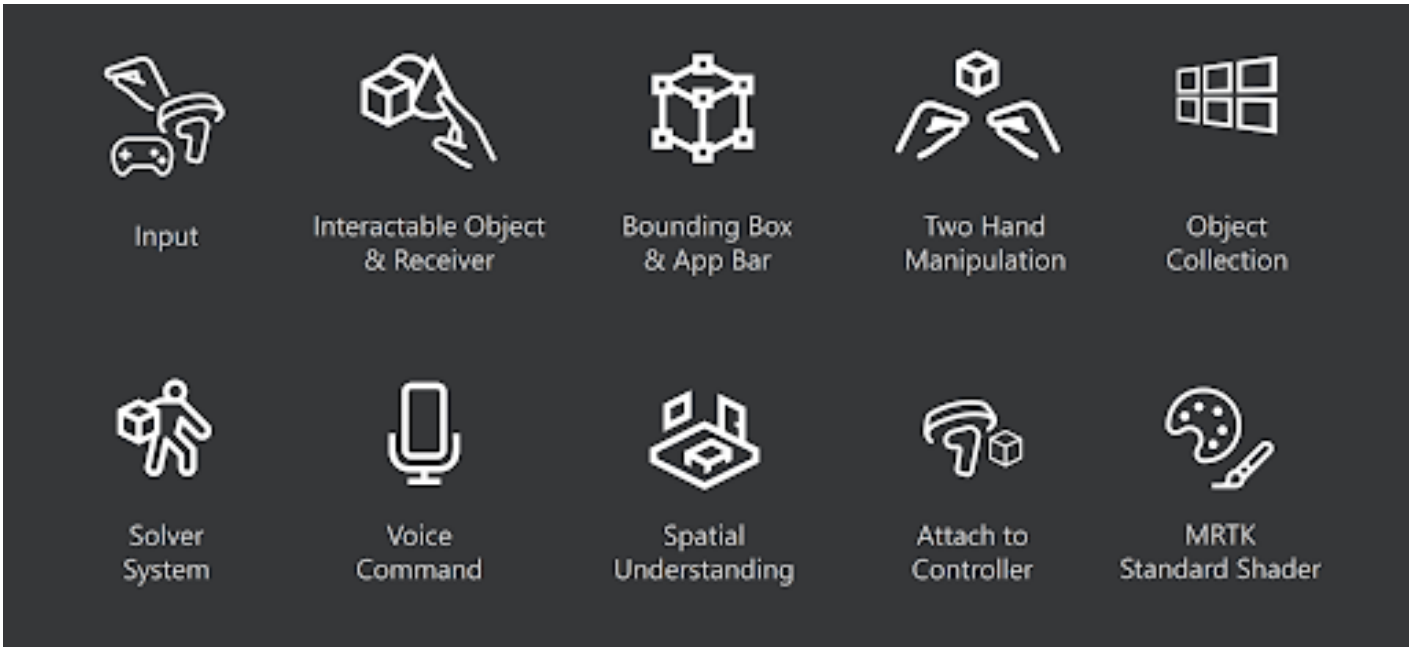
Supported platforms: Android, iOS, UWP, and Unity Editor

Pricing: $499 one-time purchase; For licensing $99/month

Download this SDK here:
https://developer.vuforia.com/downloads/sdk

4. Mixed Reality Tool Kit

The Mixed Reality Tool Kit (MRTK-Unity) is a Microsoft-driven project for accelerated cross-platform development in Unity. The toolkit enables rapid prototyping using the simulators, which reflects changes immediately. In addition, the toolkit works as an extensible framework as it also provides developers the ability to change core components.



Supported Platforms and devices:

OpenXR (Unity 2020.3.8+)	Microsoft HoloLens 2 Windows Mixed Reality headsets
Windows Mixed Reality	Microsoft HoloLens Microsoft HoloLens 2 Windows Mixed Reality headsets
Oculus (Unity 2019.3 or newer)	Oculus Quest
OpenVR	Windows Mixed Reality headsets HTC Vive Oculus Rift
Ultra Leap Hand Tracking	Ultra Leap Leap Motion controller
Mobile	iOS and Android

Reference:
https://docs.microsoft.com/en-us/windows/mixed-reality/mrtk-unity/?view=mrtkunity-2021-05

SDKs for AR

SDK's	License	Supported Platforms	Cloud Recognition	SLAM	3D Recognition	Smart Glass Support	Geo Location Support
Zapper	ZapWorks Studio starts at $60 per month	iOS and Android devices.	No				
ARGear	Free and Starts with 1$/month	iOS, Android, Windows, Web		No	Yes		
DeepAR	Free/Commercial	Android, iOS, Windows, WebGL			Yes		
EasyAR	Free personal edition and licensing cost starts from $39/month	Windows 7 and above, Mac OS X 10.15 and above, Android 4.2 and above and iOS 8.0 and above	Yes	Yes	No		No
Kudan	Free/ Paid £1,000/year/app (+VAT) OR Volume License	Android and IOS		Yes	Yes	Yes	Yes
LayAR	Free trial available, license Cost starts around - 3.50$	Android, iOS	Yes	Yes			
Lumin	Free/Commercial	Lumin OS	Yes	Yes		Yes	
Onirix	99 EUR/month	Android and iOS	Yes	Yes	Yes	Yes	Yes
Pikkart AR SDK	Free trial available, 299 EUR - SDK	Android, iOS	Yes	No	No	Yes	Yes
Wikitude Studio	Free/Commercial	Android, iOS, Windows for tablets, smart glasses (Epson Moverio, Vuzix M100, ODG R-7)	Yes	Yes	Yes	Yes	Yes
XZIMG	Free(Trail Only)	Android, iOS, Windows, WebGL/HTML5		No	Yes	Yes	
8th wall XR	License Costs are 99$/month (Agency) and 250$/month (Business)	Android and iOS		Yes			

SDKs for VR Development

1. Google Daydream View / Google VR SDK

The Google VR SDK provides the best tools to build VR apps for the headsets provided by Google. It has a vast developer community and hundreds of frameworks, tools, APIs, and SDKs. In addition, it supports both the Android and iOS platforms and is available for the Unity and Unreal game engines.

Where to use: To build VR applications for Google DayDream and Cardboard for both Android and iOS platforms.

Supported Systems:
1) Daydream: Android, Nougat or compatible hardware.
2) Cardboard (Android): Android or Lollipop.
3) Cardboard (iOS): Android or iOS.

License cost: Free.

Download this SDK from here: https://developers.google.com/vr/develop/android/download

2. Oculus Rift/ Oculus SDK

Oculus SDK is used to create applications for the Rift HMDs. Developers can choose to build the apps using Unity, Unreal, WebVr, etc. The SDK also comes with samples, assets, and audio packages to help build the VR apps. Developers can also build native Android apps for Quest, Quest 2 and Oculus Go using the Mobile SDK, which comes with the required libraries, tools, and resources.

Where to use: Build apps for the Oculus HMD devices.

Licensing cost: The Platform SDK is available for free within the Oculus SDK for Windows.

Download this SDK here: https://developer.oculus.com/downloads/package/oculus-sdk-for-windows/

SDKs for VR

SDKs	License	Supported Platforms	Cloud Recognition	3D Recognition
Google VR SDK	Free	Android, iOS		Yes
OpenVR SDK	Personal, Non-commercial	SteamVR	CloudXR	Yes
Oculus SDK	The Platform SDK is available for free within the Oculus SDK for Windows			Yes
PSVR dev Kit	To register and get this SDK by Sony you have to pay $2,500	For all PlayStation devices		Yes

Summary

The development field for XR applications is vast and filled with numerous SDKs that can be used to create professional and high-quality immersive experiences. In this paper, some of the best SDKs on the market were examined. Additionally, the selection process for choosing the appropriate tools and SDKs based on the application requirements were discussed.

The concepts and terminologies that XR developers utilize most in immersive technologies will be explained in the last part of this three-part series.

References

SDKs

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