

VUFORIA

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VUFORIA OVERVIEW

It is one of the most used SDK – software development Kit for Augmented Reality.

It exploits computer vision to recognize and track planar images and simple 3D objects, such as boxes, in real time, to enable developers to position and orient virtual objects, (as 3D models): Vuforia uses marker to analyze the real scene and to decide the position to instantiate virtual objects.

It supports Unity:

- <https://developer.vuforia.com/downloads/SDK>
- <https://assetstore.unity.com/packages/templates/packs/vuforia-engine-163598>



IMAGE TARGETS (2D)

Vuforia detects “feature points” in your target image for Marker Based AR.

It exploits a database of target images to be recognized and a Target Manager.

Then it uses the data obtained to compare the features in the target image from the database and the receiving frame from camera.

Vuforia is not open source, implementation details are unknown.



<https://library.vuforia.com/objects/image-targets>



VuMarks

VuMarks are Bar - Codes by Vuforia, and they are customizable to convey and encode data (they can encode a variety of data formats) or to act as a trackable AR target.

Differently from Image targets, the VuMarks enable to differentiate among identical looking products based on their Instance ID. They can be individually recognized and tracked by the Vuforia SDK.



<https://library.vuforia.com/objects/vumarks>



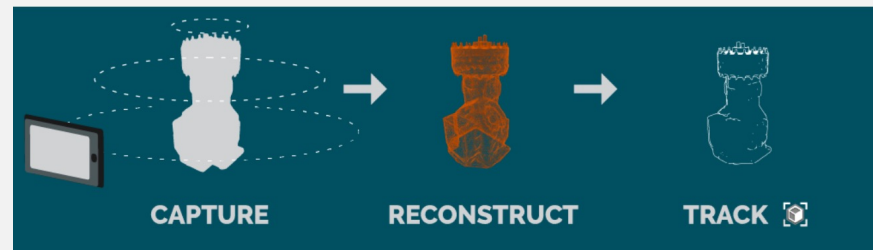
3D OBJECT RECOGNITION

As we have already seen with ARKit + ARFoundation, it is also possible to use 3D objects as markers for Marker Based AR.

First, the real object should be scanned to obtain a virtual 3D model, then it can be used as a Marker Target. The object can be scanned with a 3D camera as a LIDAR.

3D objects should be:

- Opaque, they should not be transparent or semi-transparent
- Rigid
- No/Minimum moving parts



<https://library.vuforia.com/model-targets/how-create-model-targets-3d-scans>



UNITY AND VUFORIA ACCOUNT SETUP



UNITY PACKAGE AND SETUP

- You can download the SDK from
 - <https://developer.vuforia.com/downloads/sdk>
- You need a Vuforia Account to download the SDK and also to obtain a Base License.
- You can download here the Vuforia unitypackage for Unity
- You can then create an empty Unity Project and import the unitypackage.

- Vuforia Samples are available at:
 - <https://assetstore.unity.com/packages/templates/packs/vuforia-core-samples-99026>



UNITY PACKAGE AND SETUP

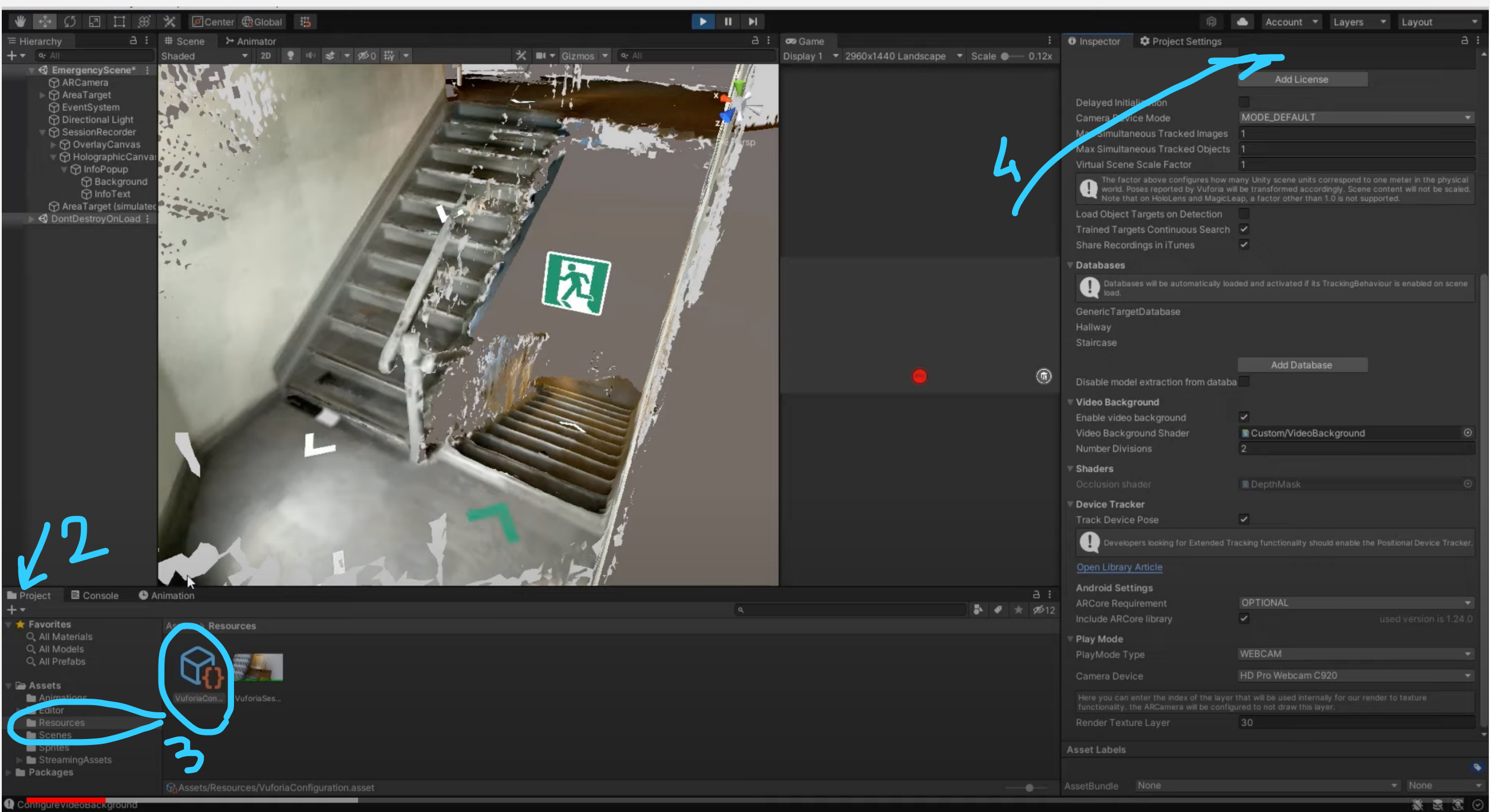
If you want to distribute a Vuforia application, you need to pay the Vuforia license which is quite expensive. For testing you don't need it, but you need one Basic License (Development Key).

To develop in Unity:

1. When logged in, the Basic License (Development Key) can be generated at: <https://developer.vuforia.com/vui/develop/licenses>
Copy the Basic License Key.
2. When you are developing in your Unity Project with Vuforia, you can look at the Project section
3. Assets > Resources you can find the VuforiaConfiguration.asset , click on it.
4. And then in the Inspector you can paste the Basic License in the space on top of the "Add License" button .

(image explanation in the next slide)





1 2

3

4

Configure videoBackground

Inspector Project Settings

Delayed Initialization

Camera Device Mode **MODE_DEFAULT**

Max Simultaneous Tracked Images 1

Max Simultaneous Tracked Objects 1

Virtual Scene Scale Factor 1

The factor above configures how many Unity scene units correspond to one meter in the physical world. Poses reported by Vuforia will be transformed accordingly. Scene content will not be scaled. Note that on HoloLens and MagicLeap, a factor other than 1.0 is not supported.

Load Object Targets on Detection

Trained Targets Continuous Search

Share Recordings in iTunes

Databases

Databases will be automatically loaded and activated if its TrackingBehaviour is enabled on scene load.

GenericTargetDatabase

Hallway

Staircase

Add Database

Disable model extraction from database

Video Background

Enable video background

Video Background Shader **Custom/VideoBackground**

Number Divisions 2

Shaders

Occlusion shader **DepthMask**

Device Tracker

Track Device Pose

Developers looking for Extended Tracking functionality should enable the Positional Device Tracker.

[Open Library Article](#)

Android Settings

ARCore Requirement **OPTIONAL**

Include ARCore library used version is 1.24.0

Play Mode

PlayMode Type **WEBCAM**

Camera Device **HD Pro Webcam C920**

Here you can enter the index of the layer that will be used internally for our render to texture functionality, the ARCamera will be configured to not draw this layer.

Render Texture Layer 30

Asset Labels

AssetBundle None

IMAGE TARGETS DATABASE

It is possible to create a new Image Target Database here (it is mandatory to be logged in the website):

<https://developer.vuforia.com/vui/develop/databases>

- Click on “Add Database” and then on Type: “Device”
- Select the DB
- Click on “Add Target” button
- Select the image, the width and a name: the image will be ranked from 0 (poor image) to 5 (very good target)

To generate 5 star images, you can use the marker generator at:

<http://www.brosvision.com/ar-marker-generator/>



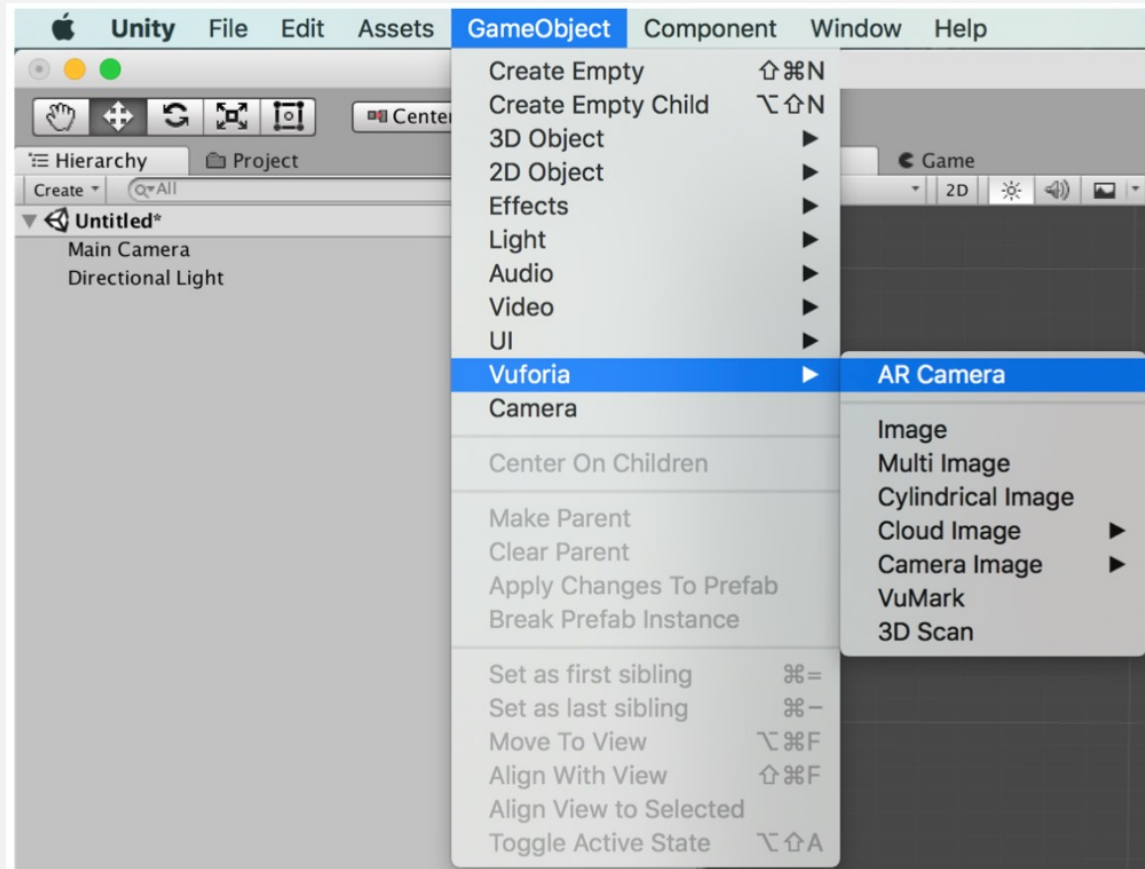
INSIDE THE UNITY PROJECT

<https://library.vuforia.com/getting-started/getting-started-vuforia-engine-unity>



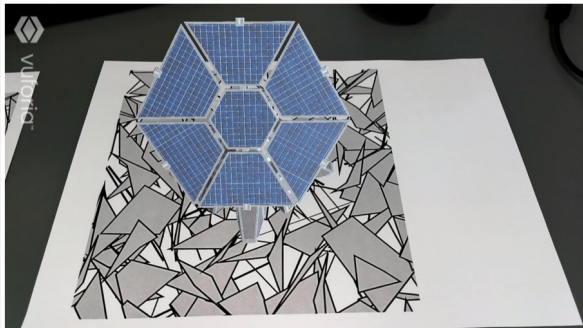
AR CAMERA

When using Vuforia, you need to add to the Scene a new type of camera: the AR Camera.



TARGET MANAGER IN UNITY

- Right click in the Inspector:
 - Vuforia Engine -> Image Target
- Select the new object
- From the inspector, in the “Image Target Behavior” script:
 - Assign your database in the “Database” drop-down options.
 - Your database will have the same name you assigned in the Vuforia website.
 - Select your image target
- Add the virtual object to spawn when the target is visible, as child of the Image Target.
- The content will be automatically displayed, and it will move and rotate according to the real-world marker position and rotation.



<https://library.vuforia.com/getting-started/vuforia-target-manager>



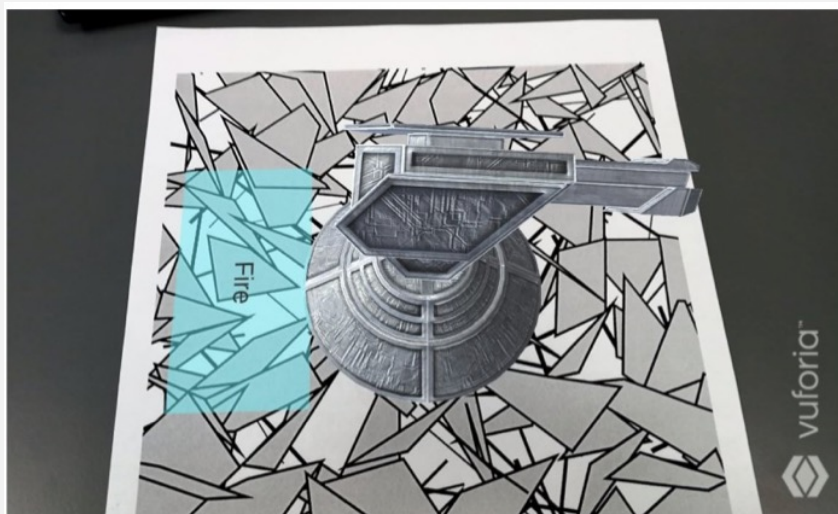
VIRTUAL BUTTONS SAMPLE SCENE

The target can be interactable, by adding a VirtualButton instead of or in addition to a 3D virtual object:

The sample scene is available at “3-VirtualButtons scene” in the Vuforia Samples:

<https://assetstore.unity.com/packages/templates/packs/vuforia-core-samples-99026>

- Select your ImageTargetBehavior -> Advanced -> Add Virtual Button
- This will create a new child GameObject called “VirtualButton”.
- Select it, and remove the “TurnOffBehaviour” script, if present.



<https://library.vuforia.com/objects/virtual-buttons>



Unity: buttons events

```
[SerializeField] private VirtualButtonBehaviour vbb;  
private void Awake()  
{  
    vbb.RegisterOnButtonPressed(OnButtonPressed);  
    vbb.RegisterOnButtonReleased(OnButtonReleased);  
}  
  
public void OnButtonPressed(VirtualButtonBehaviour vb)  
{  
    Debug.Log("Button pressed: " + vb.VirtualButtonName);  
}  
  
public void OnButtonReleased(VirtualButtonBehaviour vb)  
{  
    Debug.Log("Button released: " + vb.VirtualButtonName);  
}
```



Unity: touch events

```
void Update ()
{
    if (Input.GetMouseButtonDown (0))
    {
        Ray ray = Camera.main.ScreenPointToRay (Input.mousePosition);
        ShootRay(ray);
    }
}

void ShootRay(Ray ray)
{
    RaycastHit rhit;

    bool objectHit = false;
    GameObject gObjectHit = null;

    if (Physics.Raycast(ray, out rhit, 1000.0f))
    {
        objectHit = true;
        gObjectHit = rhit.collider.gameObject;
        // Do whatever you want with the detected game object
    }
}
```



BUILD SCENE OR PLAY IT

You can build the scene for iOS or Android.

You can also test it with the editor: you can test it with a physical camera (Webcam) connected to the Pc, then it is automatically detected and used for testing.

With unity editor play mode, complex features, like GroundPlane may not be available.

<https://library.vuforia.com/unity-extension/vuforia-play-mode-unity>



ONE EXERCISE

- Create an account on <https://developer.vuforia.com/>
- Generate two markers using <https://www.brosvision.com/ar-marker-generator/> and print them. Uncheck the “Color” option, to avoid unnecessary ink. Gray-scale images are fine.
- Add the markers in the Vuforia website, create a database and import in in the Unity project.
- Add two Image Targets with the markers of the database.
- Try some basic interactions with them. Use virtual buttons and/or touch events.
- Download a free package like this: <https://assetstore.unity.com/packages/3d/environments/sci-fi/robots-turret-free-sample-147413>
- Associate the two markers with two turrets (contained in the previous package) and try some basic interactions. For example, touching them or their virtual buttons, they could shoot each other.

