



Augment your reality with ARCore

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The logo features the word "MIXIT" in a bold, sans-serif font. The letters "MIX" are white, and "IT" is orange. A grey chevron-like shape is positioned between the "X" and "I". The text is centered on a dark blue square background, which has a subtle gradient shadow at the bottom. In the top right corner of the overall image, there is a faint, light grey network diagram consisting of interconnected nodes and lines.

MIXIT

#MIXIT18

Augmented Reality

- ⬡ A way of fusing the real and the virtual world by overlaying digital data on to real-world analogue views.
- ⬡ Anyone with a mobile phone or laptop with built-in video capability can augment and extend their reality with easy-to-use applications.

Application areas

Games	Marketing	Fashion
Social media	Health	Tourism
Industry (cars, boats ...)	Press	Ads

Virtual Reality



- Artificial environment, presented as reality alternative.
- Experienced senses:
 - Hearing.
 - Sight.

Headsets



VR vs AR

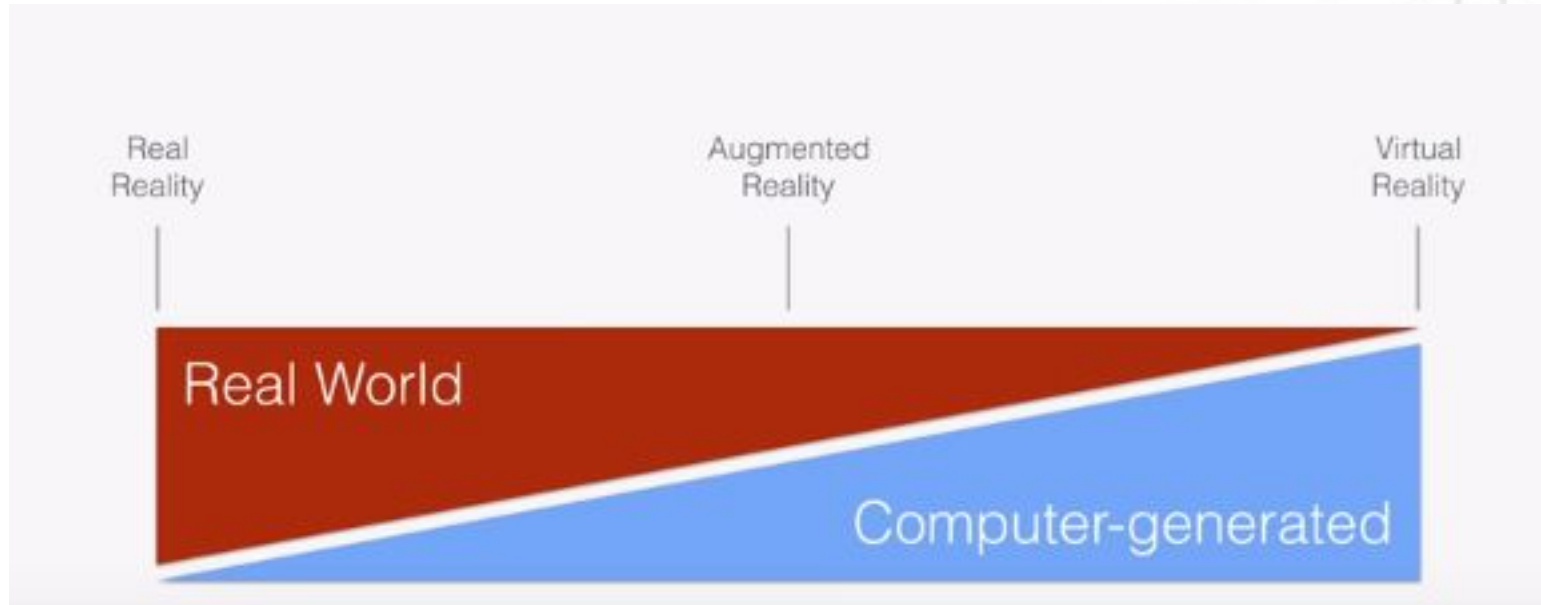
AR:

- Combine the real world and virtual data in real time.
- Be interactive in real world.
- Using a 3D environment.

VR:

- Alternative to the real world.
- Creation of content.

VR vs AR



Augmented Reality



ARCore

- Release : Dec'17
- ARCore is a platform for building augmented reality apps on Android.
- In simple words, ARCore is meant to enable us to interact with digital content in a physical way.



ARCore



ARCore

- The fruit of the tango project (beginning from 2014)
- Portable (unlike tango)



ARCore

- ⬡ Motion tracking allows the phone to understand and track its position relative to the world.
- ⬡ Environmental understanding allows the phone to detect the size and location of flat horizontal surfaces like the ground or a coffee table.
- ⬡ Light estimation allows the phone to estimate the environment's current lighting conditions.

ARCore released

- ⬡ A reference design for hardware to all OEMs.
- ⬡ Bigger cost for the OEMs.

ARKit



ARKit

- ⬡ VIO system with simple 2D plane detection.
- ⬡ Tracking position in real world in real time:
 - ⬡ Visual tracking (camera): a pixel is mapped to a point in RW (30fp/s).
=>based on distance
 - ⬡ IMU : Gyroscope+Accelerometer (reading 1k/s) =>based on acceleration.
- ⬡ Result in the Kalman filter: which one is providing the best estimation (ground truth) and publish to ARkit SDK.

ARKit

- ⬡ Dead Reckoning : measure user motion/device movement between IMU readings (a guess) : source of error if it continues without a reset.
- ⬡ Simple plane detection: “sparse” point cloud

ARKit

- ⬡ How ?
- ⬡ One lens.
- ⬡ Normally 2 camera: 2 frames, calculate the distance with the imu Dead reckoning.
- ⬡ 1 camera : capture one frame then move and capture the second.
- ⬡ ++Error removal

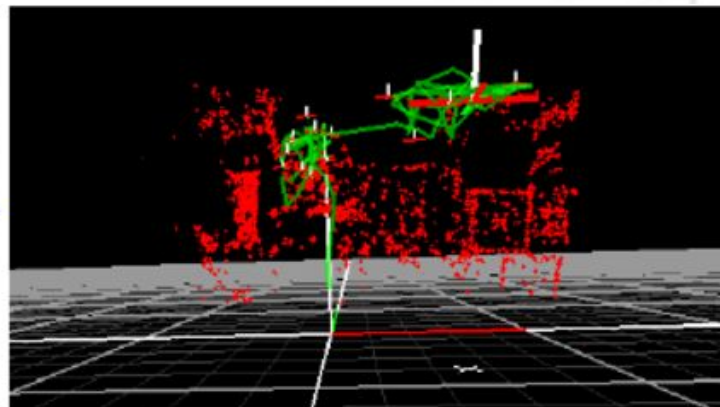
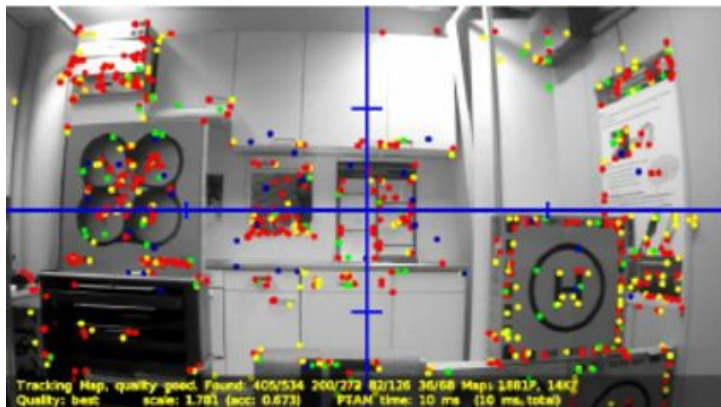
ARKit

- ⬡ Couple VIO algorithms to sensors.
- ⬡ Calibrating to eliminate errors.
- ⬡ Full control of the production chain.

Optical calibration

- ⬡ Geometric calibration : FOV for example
- ⬡ Photometric calibration : color mapping, matching pixel with real world point ...

ARCore vs ARKit



ARCore vs ARKit

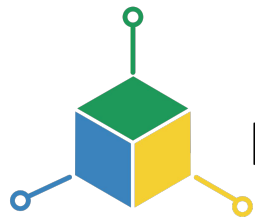
- ⬡ ARKit has some advantages when it comes to tracking, referring to a person's phone understanding where it is in 3D space,
- ⬡ ARCore is better equipped for mapping a person's surrounding as well as more reliable tracking recovery.

Alternatives

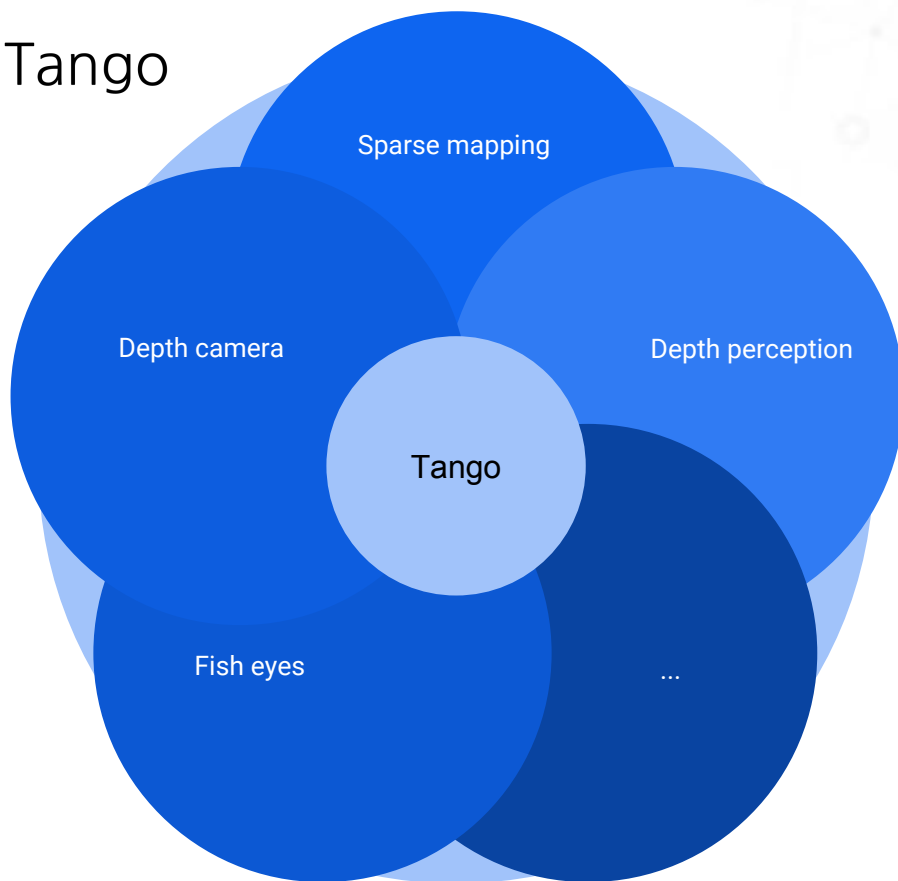


Tango

- ⬡ Tango started out mostly focussed on tracking the motion of the phone in 3D space. Many of the original ideas were aimed at indoor mapping. It was only later that AR & VR became the most popular use-cases.
- ⬡ Hardware reference design (like hololens) : hardware reference design
- ⬡ Source code based on what FlyBy done.

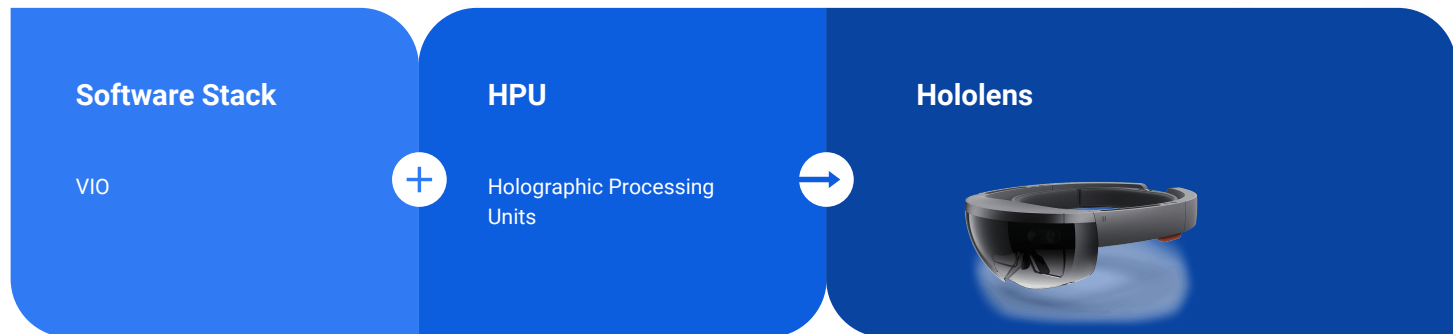


Project Tango



Hololens

Same software stack for VIO + HPU

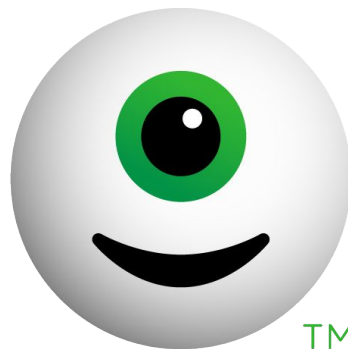


Vuforia

- ⬡ Hardware independent
- ⬡ Cross platform
- ⬡ Generally you need a marker

vuforia

by Qualcomm



Wikitude

- Supported Platforms: Android, iOS, Smart Glasses.



OpenCV and other open source projects

- ⬡ Visual tracker only
- ⬡ some use of sparse maps



WEBXR

WebXR makes it easier for developers to target all devices, just like when the web browser debuted decades ago for the first time, making it easy to target millions of devices with a single codebase.

WEBXR



Develop ARCore App



Android

```
if (session == null) {  
    Exception exception = null;  
    String message = null;  
    try {  
        switch (ArCoreApk.getInstance().requestInstall(this, !installRequested)) {  
            case INSTALL_REQUESTED:  
                installRequested = true;  
                return;  
            case INSTALLED:  
                break;  
        }  
  
        // ARCore requires camera permissions to operate. If we did not yet obtain  
        // runtime  
        // permission on Android M and above, now is a good time to ask the user for it.  
        if (!CameraPermissionHelper.hasCameraPermission(this)) {  
            CameraPermissionHelper.requestCameraPermission(this);  
            return;  
        }  
    }  
}
```



Android

// Create the session.

```
session = new Session(/* context= */ this);

} catch (UnavailableArcoreNotInstalledException
    | UnavailableUserDeclinedInstallationException e) {
    message = "Please install ARCore";
    exception = e;
} catch (UnavailableApkTooOldException e) {
    message = "Please update ARCore";
    exception = e;
} catch (UnavailableSdkTooOldException e) {
    message = "Please update this app";
    exception = e;
} catch (UnavailableDeviceNotCompatibleException e) {
    message = "This device does not support AR";
    exception = e;
} catch (Exception e) {
    message = "Failed to create AR session";
    exception = e;
}
```



Android

@Override

```
public void onSurfaceCreated(GL10 gl, EGLConfig config) {  
    GLES20.glClearColor(0.1f, 0.1f, 0.1f, 1.0f);
```

// Prepare the rendering objects. This involves reading shaders, so may throw an IOException.

```
try {
```

// Create the texture and pass it to ARCore session to be filled during update().

```
    backgroundRenderer.createOnGITHread(/*context=*/ this);
```

```
    planeRenderer.createOnGITHread(/*context=*/ this, "models/trigridd.png");
```

```
    pointCloudRenderer.createOnGITHread(/*context=*/ this);
```

```
    virtualObject.createOnGITHread(/*context=*/ this, "models/andy.obj", "models/andy.png");
```

```
    virtualObject.setMaterialProperties(0.0f, 2.0f, 0.5f, 6.0f);
```

```
    virtualObjectShadow.createOnGITHread(
```

```
        /*context=*/ this, "models/andy_shadow.obj", "models/andy_shadow.png");
```

```
    virtualObjectShadow.setBlendMode(BlendMode.Shadow);
```

```
    virtualObjectShadow.setMaterialProperties(1.0f, 0.0f, 0.0f, 1.0f);
```

```
    } catch (IOException e) {
```

```
        Log.e(TAG, "Failed to read an asset file", e);
```

```
    }
```

```
}
```



Unity3D

◻ Unity is a platform for creating experiences in 2D and 3D.

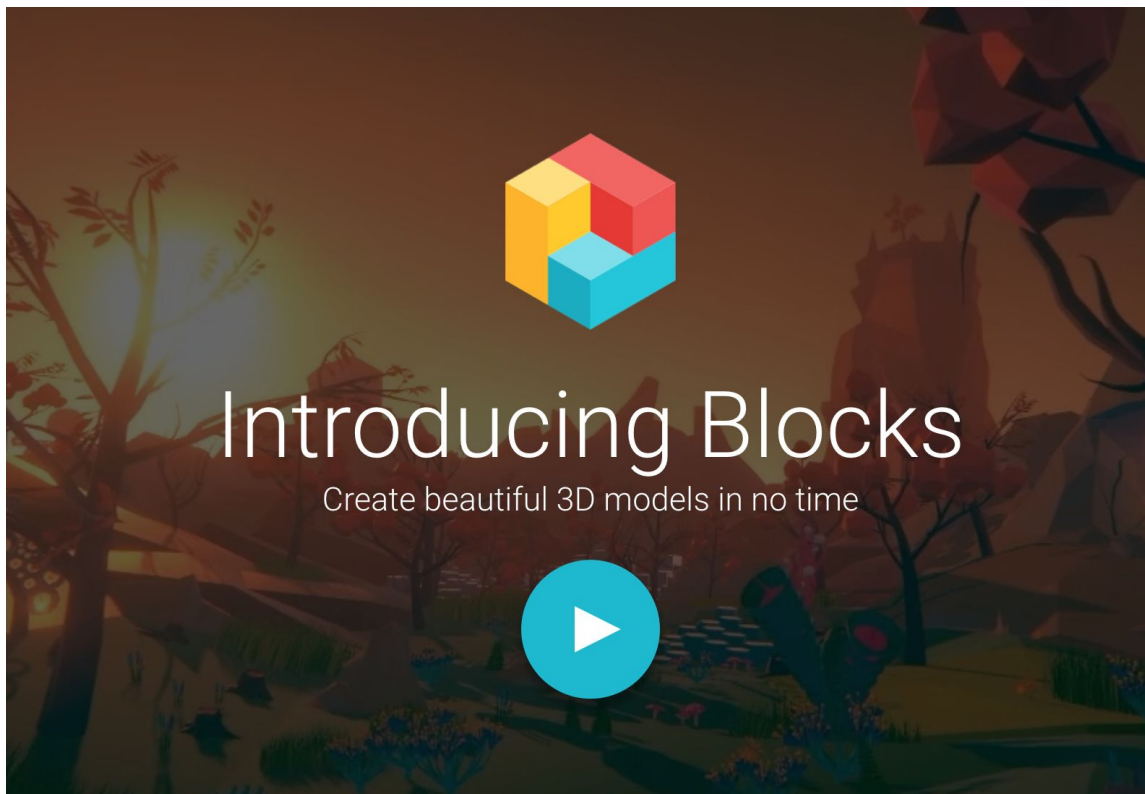
◻ SDK : a software development kit for ARCore.



ARCore Unity

- ⬡ Point cloud : Contains a set of observed 3D points and confidence values.
- ⬡ Arcore device : contains the session and tracking type
- ⬡ Change to android : build settings
 - ⬡ minimum api 7.0
 - ⬡ multithread rendering : disabled (cpu)
 - ⬡ xr settings : tango support
- ⬡ Download arcore services and proceed to install (via adb for example)

Blocks



Demo



Download the project



https://github.com/wajdibr/arcore_programmez

Future of AR

- ⬡ Depth camera : power consumption, sunlight
- ⬡ Deep learning : outdoor relocalization
- ⬡ Large area mapping
- ⬡ Inputs
- ⬡ 3D reconstruction : shape of objects in real world :
collision/occlusion

Future of AR

- ⬡ Limitations: low light/excessive motion/flat surfaces with no textures/lose sensors (camera/gyro/accelerometer)/plane detection takes some time.
- ⬡ Unite Austin 2017: Cross platform AR apps
- ⬡ Multiplayer ar: tanks network demo

References

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- ◻ <http://www.augment.com/>
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- ◻ <https://www.youtube.com/watch?v=rFbcOGuDMPk>
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- ◻ <https://www.youtube.com/watch?v=vRmTn25xm7Q>
- ◻ <https://www.youtube.com/watch?v=oNekBgognFE>

Thank you !

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