

Technology Behind the Microsoft RoomAlive Project

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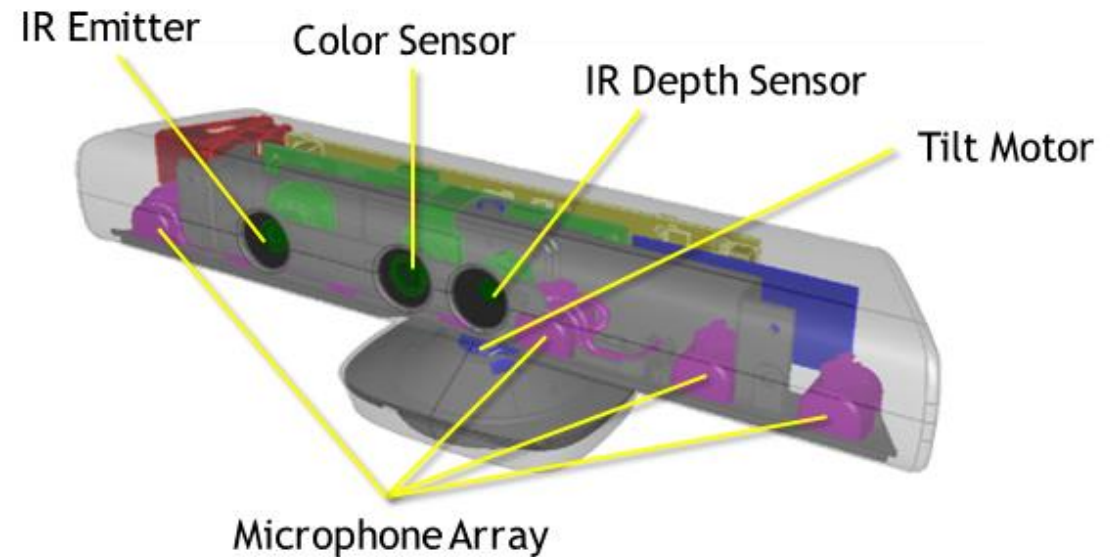
Plan

- Prehistory
- Kinect Device Device Overview
- RoomAlive Project
- Death
- What's next

PreHistory – Version 1

- Launched in Nov 2010
- RGB Camera - 640x480 30FPS
- Depth Camera – 320x240 8bits
- Range 0.4m – 4m
- FOV 43° V 57° H

- Bundled with Xbox 360

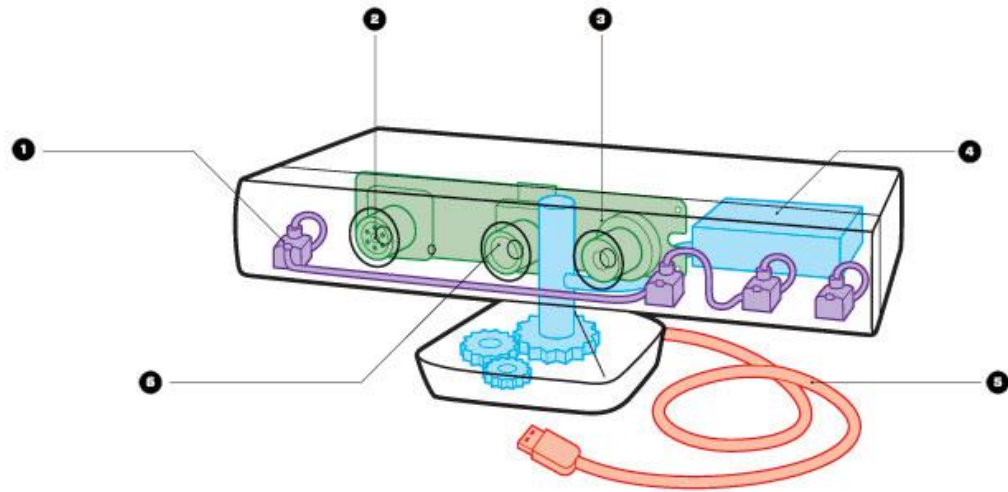


PreHistory – Version 2

- Launched in 2013
- RGB Camera - 1920x1080 30FPS
- Depth Camera – 512x424 16bits
- Range 0.4m – 4.5m
- FOV 70° V 60° H

- NOT Bundled with Xbox 360, Compatible with PC but has some gotchas

How it works



Microphone array

Four mics pinpoint where voices or sounds are coming from while filtering out background noise.

IR emitter

Projects a pattern of infrared light into a room. As the light hits a surface, the pattern becomes distorted, and the distortion is read by the depth camera.

Depth camera

Analyzes IR patterns to build a 3-D map of the room and all objects and people within it.

Tilt motor

Automatically adjusts based on the object in front of it. If you're tall, it tilts the box up. If you're short, it knows to angle down.

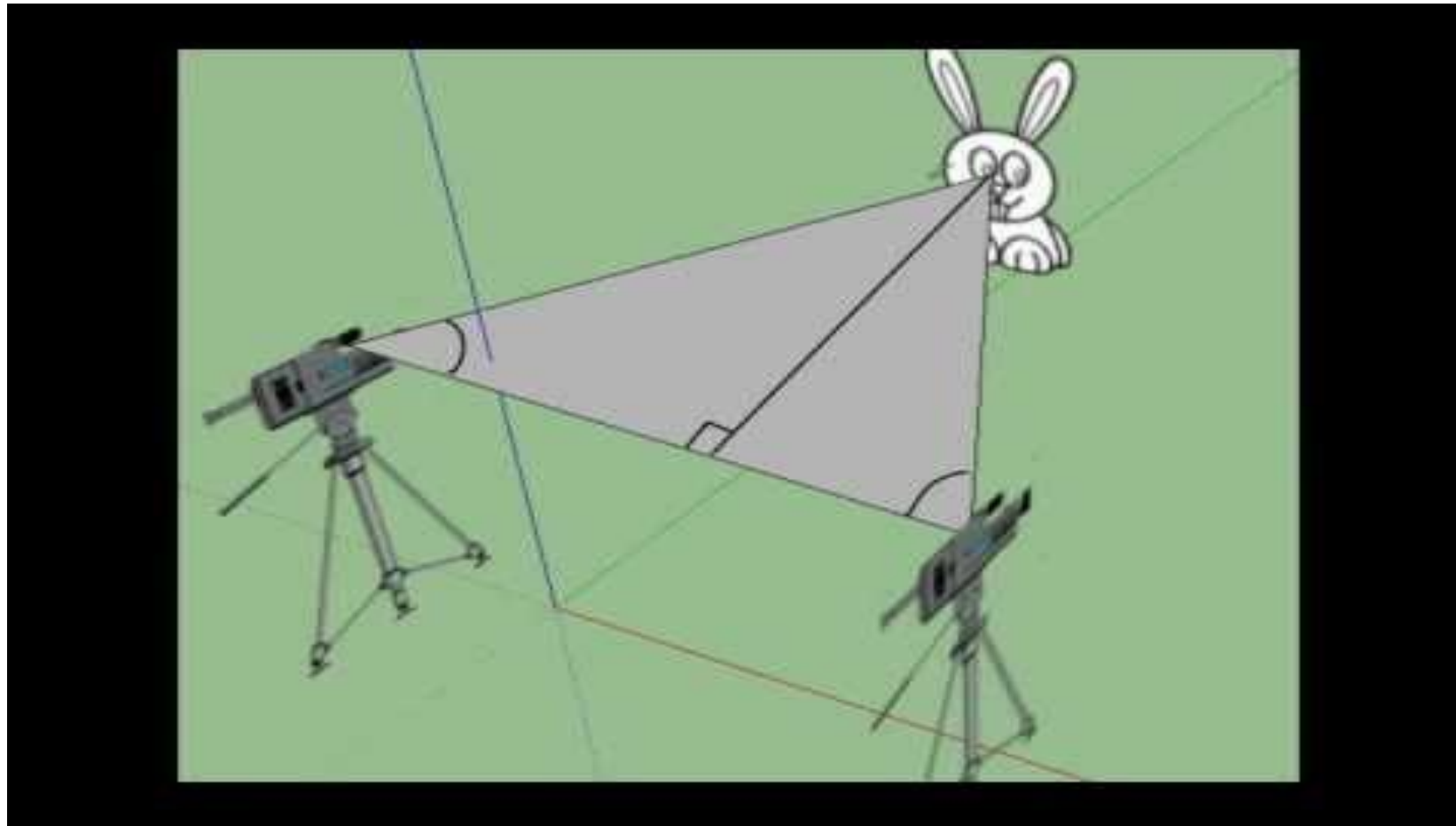
USB cable

Transmits data to the Xbox via an unencrypted feed, which makes it relatively easy to use the Kinect with other devices.

Color camera

Like a webcam, this captures a video image. The Kinect uses that information to get details about objects and people in the room.

How it works



Use in Art and Projects

- Has been cheap enough for indie devs to acquire
- Used in numerous small and big scale art experiences
- Can be used for quick mockup creation

Uses: Art



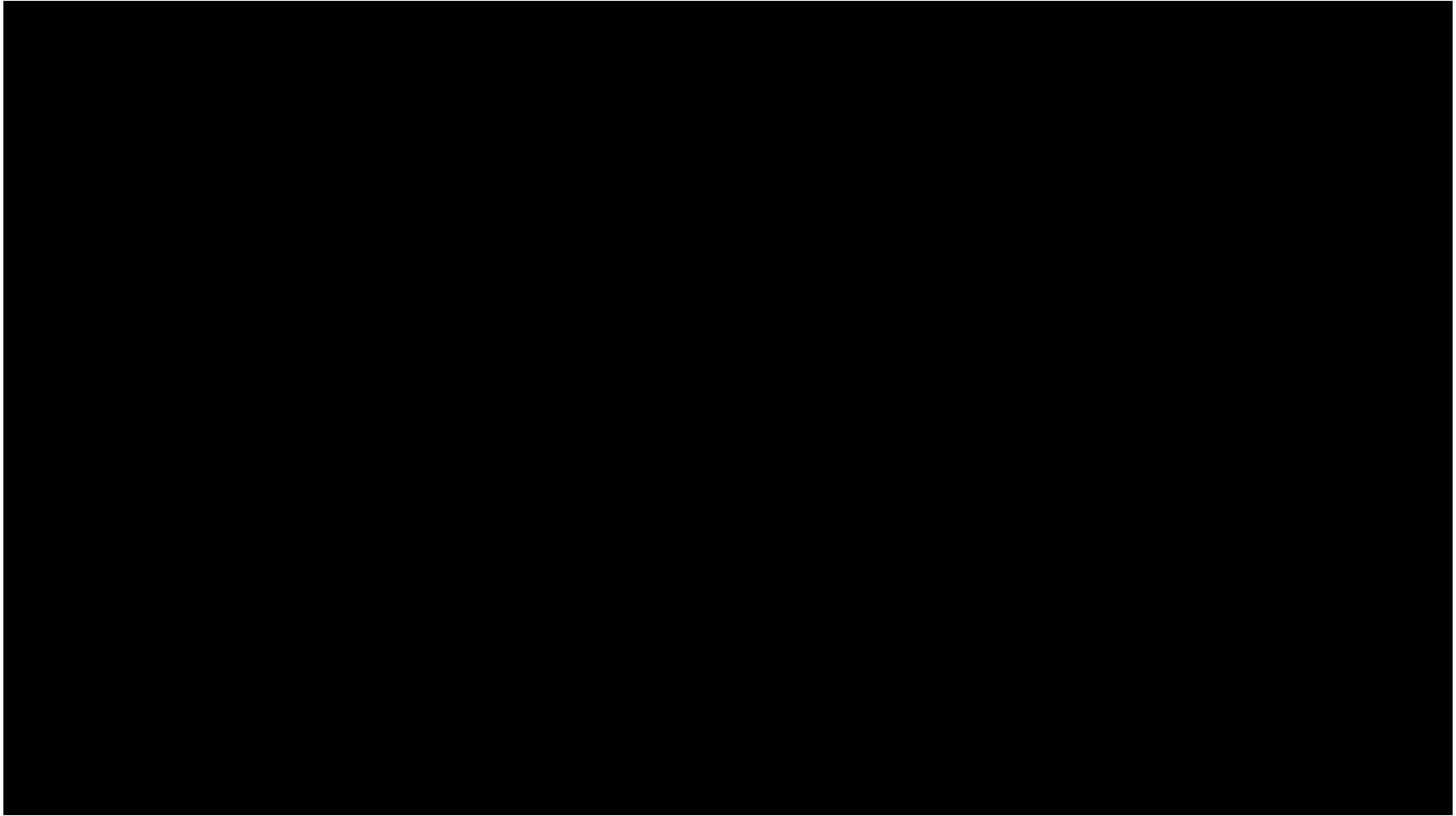
Uses: Art

- <https://vimeo.com/23335380>

Uses Art: Connected Worlds



Room Alive



IlluimiRoom



Room Alive: Magic of Calibration

- Each projector projects a series of Gray code patterns in turn. These are captured and saved by all Kinect color cameras. Gray code patterns are used to map from a given pixel coordinate in the Kinect color image to a pixel coordinate in the projector. All cameras observe the Gray code patterns in order to establish which cameras belong to a given 'projector group' (see above). Additionally, the depth image from each Kinect depth camera is saved.

Room Alive: Magic of Calibration

- CalibrateEnsemble recovers Kinect camera calibration information. This is used to compute the precise 3D coordinate of a given point in the depth image, and to map this 3D point to color camera coordinates.

Room Alive: Magic of Calibration

- During the Solve phase of CalibrateEnsemble, for each camera in the projector group, points in the saved depth camera image are transformed to 3D points. The 2D color camera coordinate is computed via the saved Kinect calibration information. These color camera coordinates are then associated with projector coordinates by way of the Gray code mapping. The end result is a set of 3D points for each depth camera in the group, and their associated 2D projector coordinates.

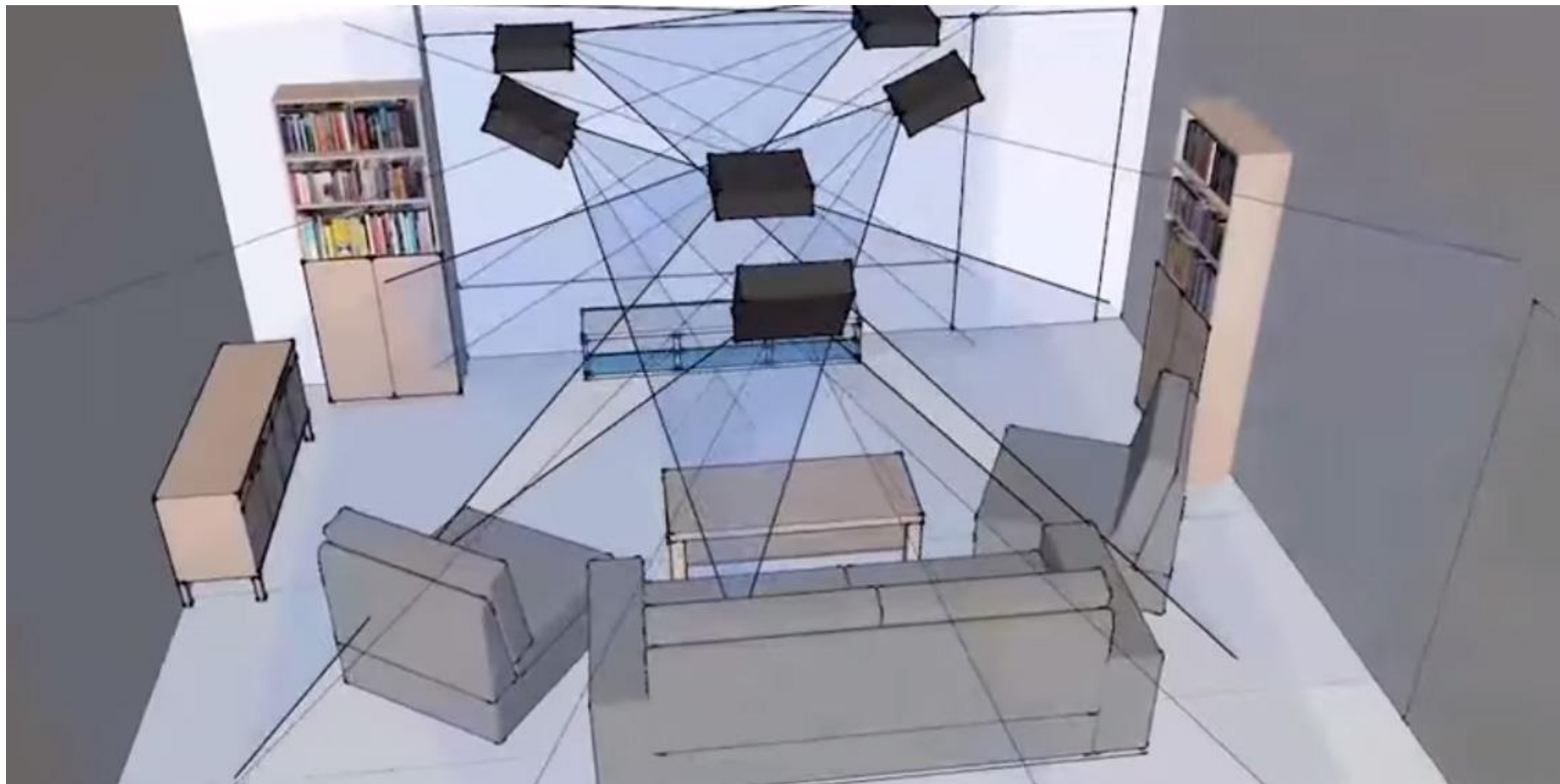
Room Alive: Magic of Calibration

- Projector intrinsics (focal length, principle point) and camera extrinsics (depth camera pose, in the projector coordinate frame) are computed by minimizing the error in the projection of 3D points to projector points. Because this projection is nonlinear, a standard Levenberg-Marquardt optimization procedure is used. This is performed for each projector in turn.

Room Alive: Magic of Calibration

- The 'ensemble' necessarily includes cameras that belong to multiple projector groups. These cameras can be used to put all camera and projector poses in the coordinate frame of the depth camera of the first Kinect listed in the .xml file. This is done via successive matrix compositions.

Room Alive: Setup



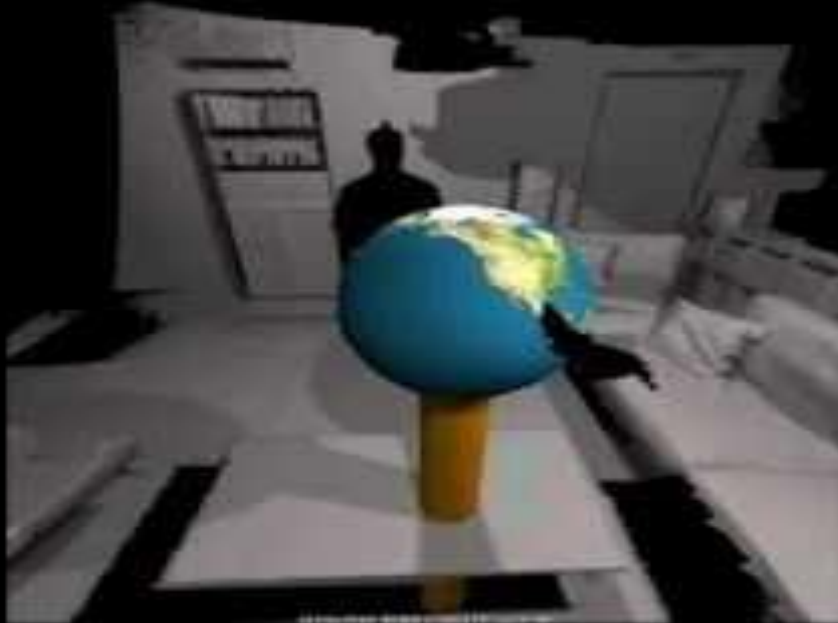
Room Alive: Projection

- Images are drawn as layers
 - Background is drawn first
 - Static objects
 - Dynamic objects
- Optimized for Unity
- User head position can be taken into account

Room Alive Examples: Resident



Room Alive Examples: Resident

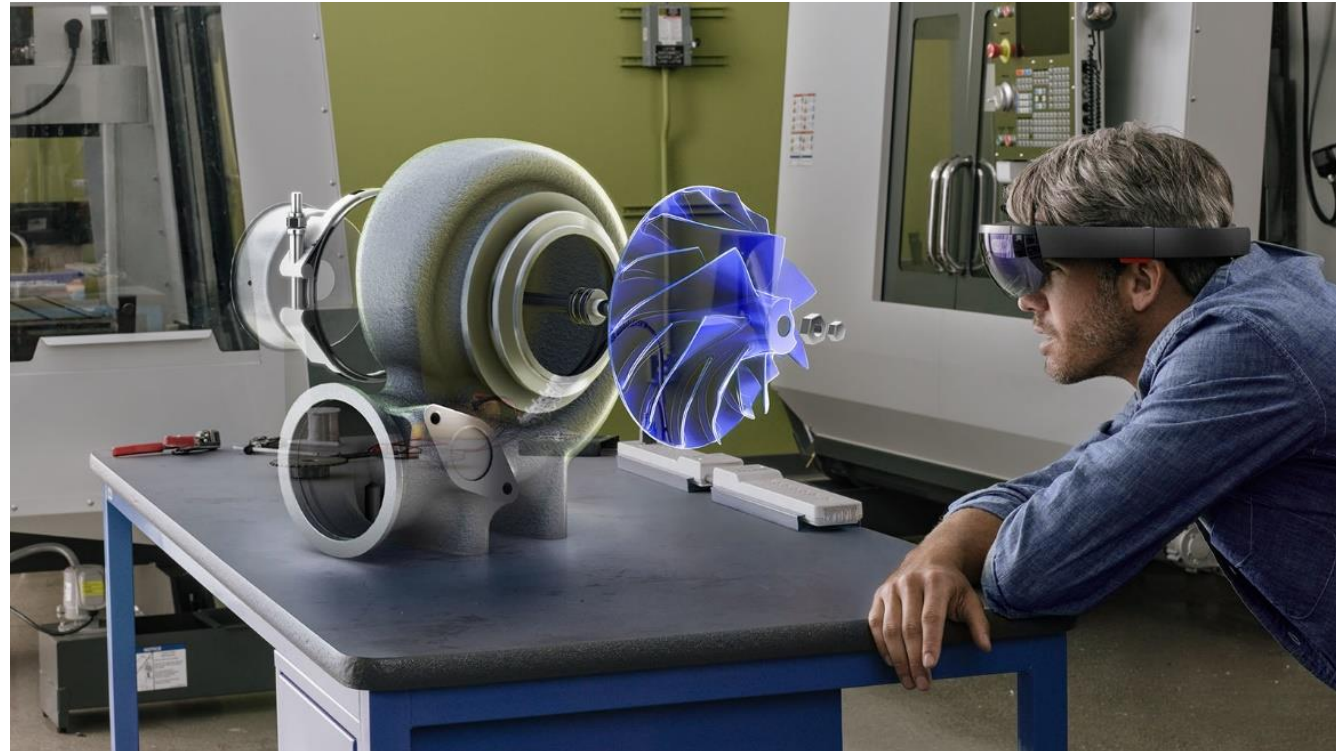


KINECT IS DEAD – THEY KILLED IT

- Microsoft Discontinued Kinect V2 on
- 35 million units sold since 2010
- All code for RoomAlive was opensourced on github

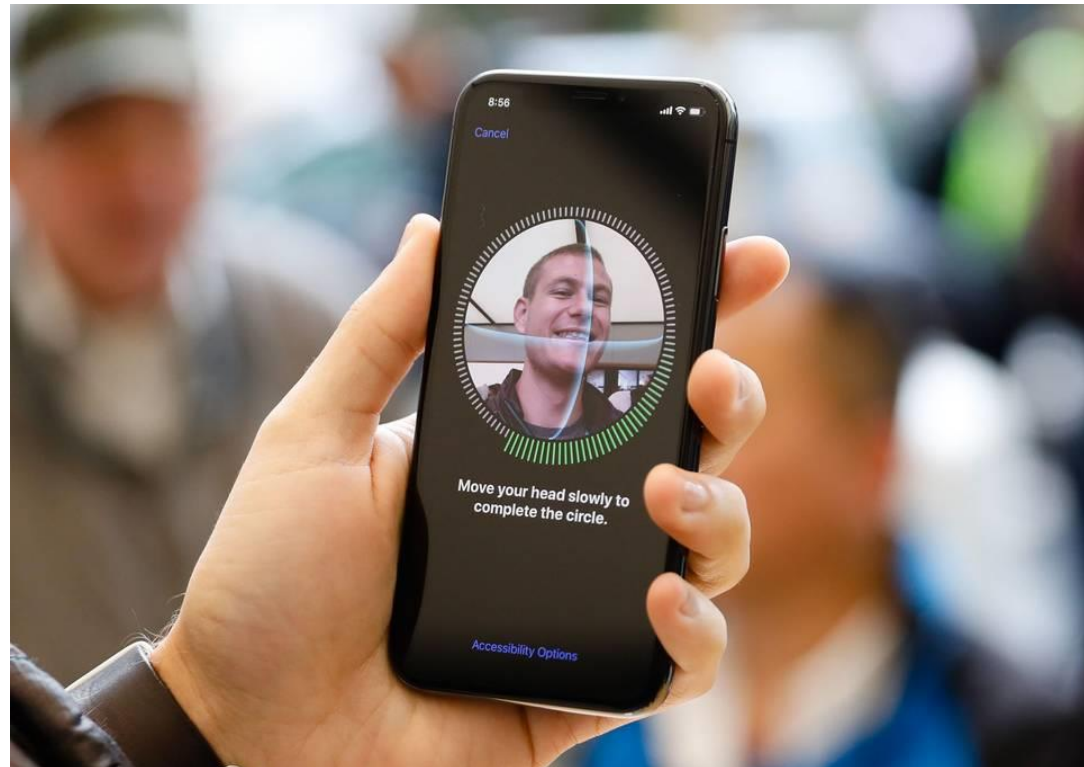
Kinect is dead – Well, not really

- Continues to exist as a part of Hololens Project



Kinect is dead – Well, not really

- Remember super original iPhone Face ID?
- Apple acquired Israeli company, PrimeSense in 2013



Kinect is dead – What's Next?

- VicoVR – 400\$
- Orbbec Astra/Orbbec Persee - 150-250\$
- Stereolabs ZED – 450\$

- Intel D400 series ~250\$
 - Depth Sensor at 90FPS

Fin

Questions?