Trimble Mixed Reality Applications

User Manual

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Introduction to Microsoft HoloLens

Hardware

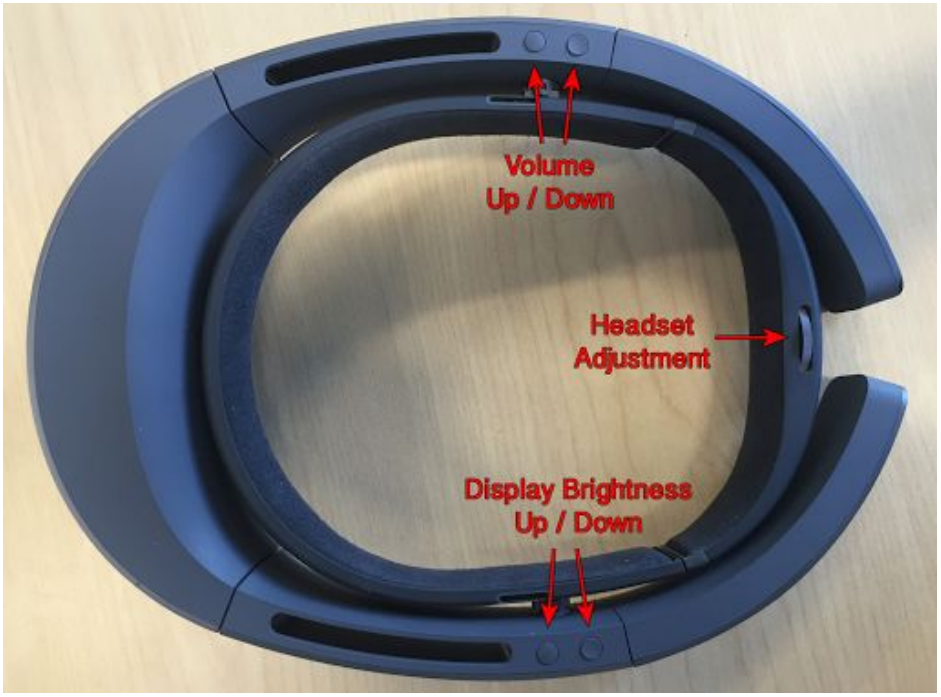
Overview

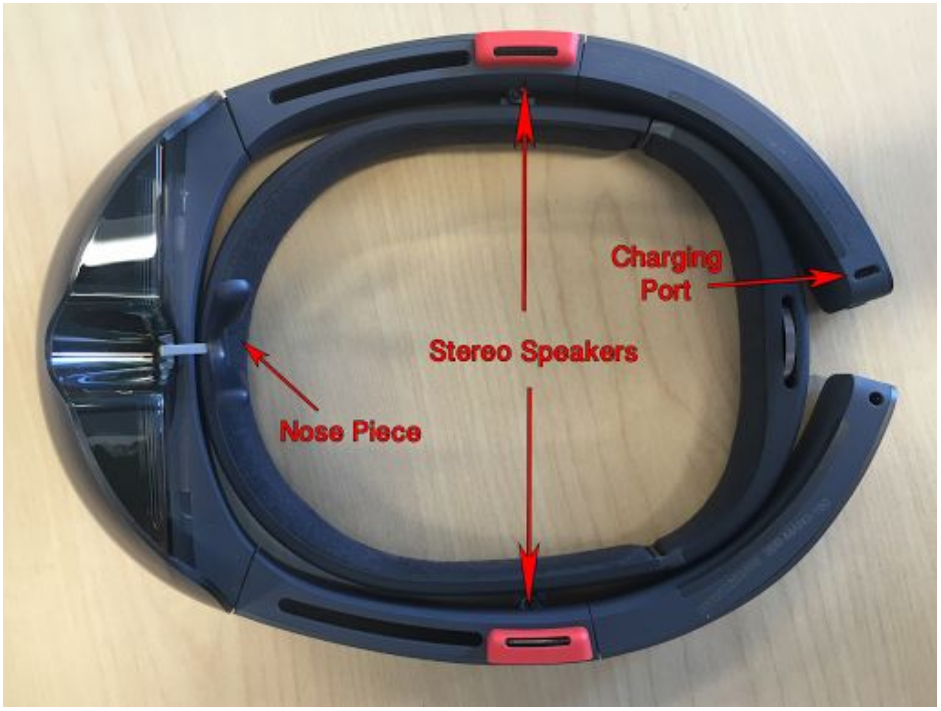
Trimble has been collaborating with Microsoft on the HoloLens project since early 2014; officially the first commercial partner to develop on the platform. Microsoft HoloLens is the first fully untethered, wearable, holographic computer, enabling high-definition holograms to integrate with the real-world. The device is a wearable headset that contains a fully self-sufficient computer featuring an mixed-reality operating environment in which any Windows application can run.

The device features an array of sensors (including depth sensors, cameras, gyros, magnetometers, and accelerometers) that constantly collect data about the user's environment. The depth sensors simultaneously capture a three-dimensional mesh of the physical environment while the cameras (and other sensors) determine the device's location (X, Y, Z, roll, pitch, and yaw) relative to it. This information is used to synchronize the digital content in the mixed-reality world with the physical environment in which the user resides.

Buttons and Specs

The externals of the HoloLens device are relatively uncomplicated; the majority of interface with the device is through the holographic environment.





Power and Charging

The HoloLens power button is on the rear arm, opposite the micro-USB charging port and beside the device status LEDs. One click of the button will turn the device on and another will put it in ‘Sleep’ mode. Pushing and holding the power button for 5 seconds (while the device is running) will shut the device down.

The HoloLens device is charged using a micro-USB cord and outlet connector. We recommend that you always use the provided cord and brick to reduce the risk of over or under-charging.
When plugged in, the 5 status LED lights above the power button on the device will cycle. After a few cycles they will stop and illuminate between 1 and 5 of the lights to show the current battery charge. Once all 5 illuminate (after a cycle) the device is charged.

Note: The device will turn itself on when first plugged in if it is in ‘Sleep’ mode. If the sleep settings on your device are set such that the device will run for a while when plugged in without automatically shutting off, make sure to turn the device back off so that it charges faster.

Care Instructions

To ensure that you keep your HoloLens device in proper working condition, kindly follow these suggested care instruction guidelines.

Cleaning Lenses

- Use static and lint free lens wipes. Never use alcohol or other cleaning substances.
- If necessary, breath on the lens and wipe in one direction; not in circles.
- Be very gentle as the lenses are easily damaged.

Reducing Damage

- Store devices in their respective boxes.
- Do not leave your device powered on when not in use.
- Do not drop or subject to impact when placing on a surface.
- Hold device from strengthened areas, such as between the lens and red speaker. Do not hold the device from the adjustable strap or hinged rear piece.
- When removing the device from your head, loosen the adjustable wheel first.
- Do not allow device to hang (such as on a hook). Always place on a flat surface.
- Handle device with clean hands.
- Canned aerosol duster is recommended for regular cleaning (once a week or as needed). Do not turn can over such that it expends liquid. Do not put nozzle closer than 3 inches from hardware.
- Use only the provided cables to charge/sync the device.
- Be extra careful with cords attached to the device and PC.
- Tugging on cords puts unnecessary stress on connections to hardware that can easily cause damage to the connections.

Using The Device

How to Wear

The HoloLens device has multiple adjustable pieces to ensure the user a comfortable fit and optimal viewing of the holographic display:

- The adjustable headband [2] moves independently of the primary device [1]. It can be rotated up/down to contact the forehead in different locations and forward/backwards on the device to move the display closer to or further from the user's eyes. This allows the user to better line up the field-of-view of the device and/or leave room for their eyeglasses.
- The scroll-wheel [3] on the rear of the adjustable headband [2] is used to tighten or loosen the headband. If the user is not using the nosepiece [4] or headstrap [5], the user will want to keep the adjustable headband firmly tightened around their head to keep the device in place and from resting on their nose.
- The nosepiece [4] is optional and can be removed by gently pulling it out of the slot. It has a metal attachment piece that can be gently bent to adjust to different noses.
- The overhead strap [5] is optional and can be removed on each side by pushing in the raised button on the strap. The top of the strap is velcro and can be adjusted as needed.

Note: The device has a defined field-of-view rectangle that is seen when looking through the holographic display. You will be able to see peripheral vision around it. The adjustments above are made to ensure that you can see everything within the boundaries of the holographic field-of-view.

Hardhat

For more information on Trimble's Hard Hat Solution for HoloLens, including assembly and proper fit, please refer to this guide.

Gestures

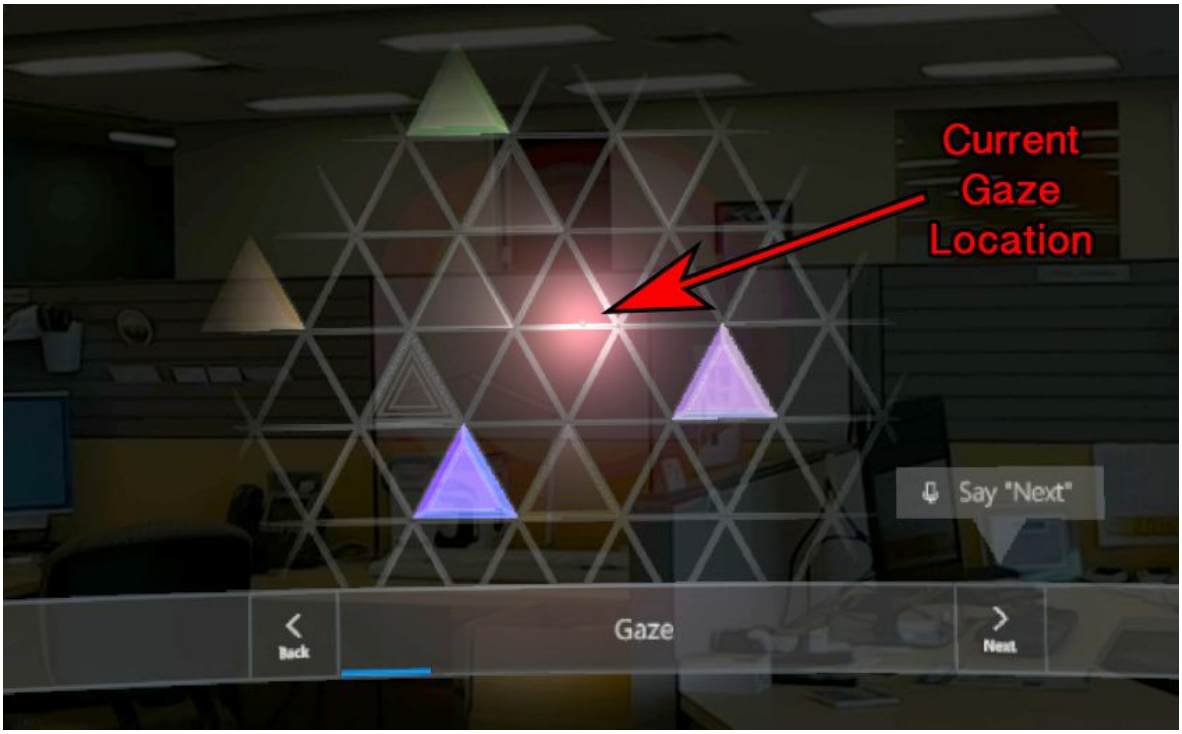
HoloLens natively supports a variety of gestures that allow the user to interact with the holographic world. These gestures are activated by the user by putting a hand in front of the device and performing known movements. The hand needs to be within the line-of-sight of the sensors (which is wider than the field-of-view) but does not necessarily have to be pointing at whatever is being interacted with in holographic space. Instead, the user's gaze dictates where the action is going to take place. Think of your gaze as a mouse cursor, while your hand is the buttons on your mouse. Just like with a computer, the cursor dictates where the action will take place (gaze) and the buttons dictates what action to take (gestures).

Note: Try to avoid having your hand too close to the device as it may block the sensors while they are running. The optimal location for you hand is approximately 1 foot (30 cm) in front of the device and slightly offset to the side (as to not block your view).

A core application called 'Learn Gestures' exists on the HoloLens Windows home screen and can walk you through a tutorial of gestures. The basics are described below.

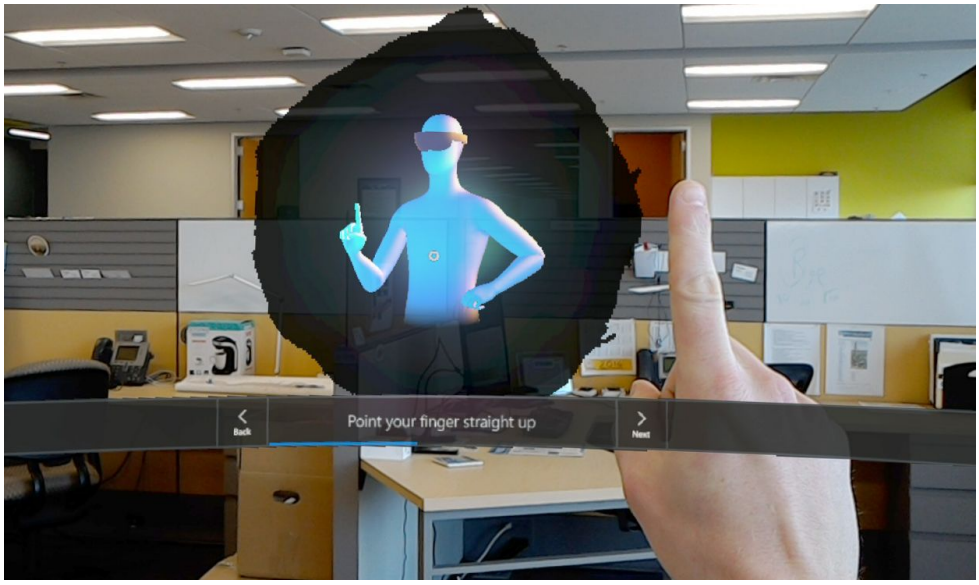
Gaze

Where the device is pointing is called your Gaze. As you move your head (not your eyes), a cursor will follow your movement to show where you are currently gazing. This is your mouse cursor for gesture actions.



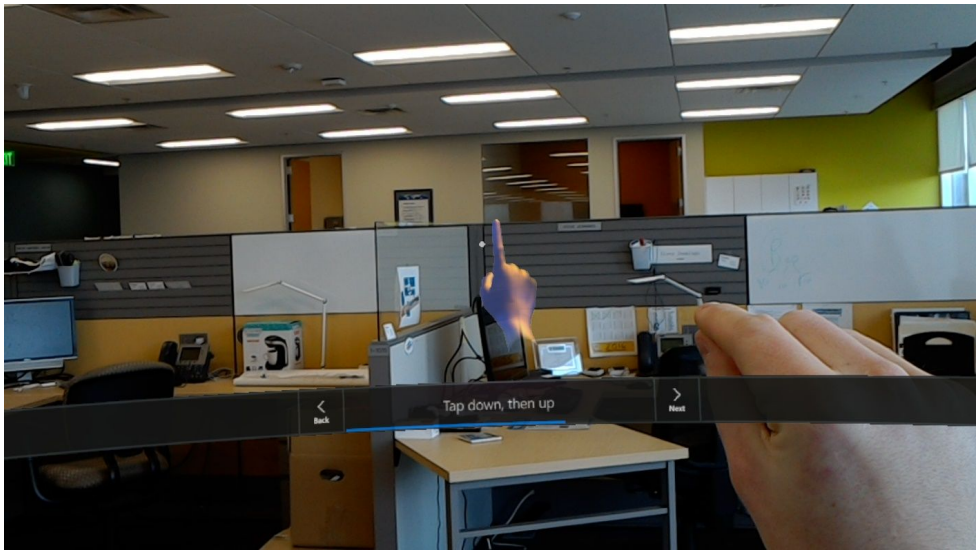
Ready

The Ready gesture is performed by making a closed fist and raising your index finger, much the same way that you'd tell someone "wait a minute!" At its core, this gesture lets the device know that you're about to make a selection gesture. Oftentimes the Ready and Air Tap (next section) gestures are done sequentially without a pause to select something in the holographic space. The Ready gesture by itself can be used to ensure that the device is seeing your hand (i.e. you're in the field-of-view of the sensors). The cursor following your gaze will turn from a solid dot to a ring when the device senses the Ready gesture.



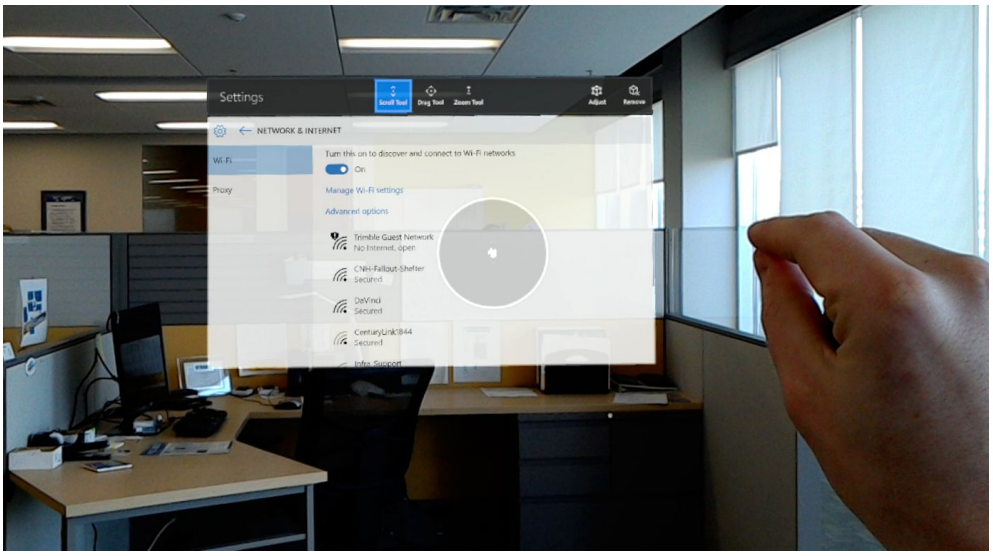
Air Tap

The Air Tap gesture is your left mouse-click. Hover your gaze over what you want to select, begin in the ready position, then firmly "click" your finger down and back up. The gesture is similar to if you were tapping someone on the shoulder to get their attention.



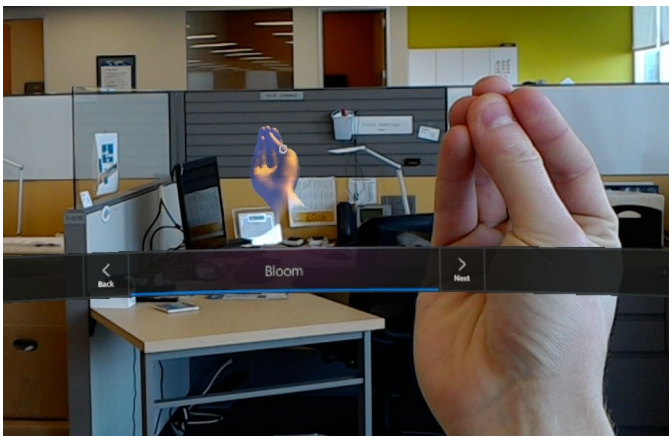
Pinch

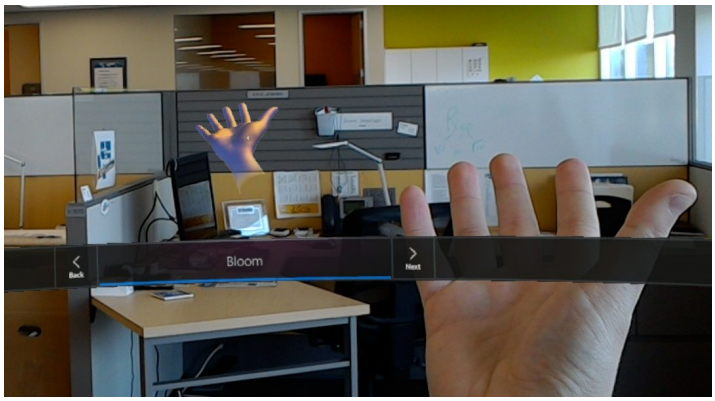
The Air Tap allows the user to do a single click on an object by tapping their finger down and then back up. If the finger is not raised back up, but rather held in a pinching position, the user can grab hold of things in the space. While pinching, move your hand around to adjust the hologram. Below, you can see that a Pinch mixed with moving the hand up and down can be used to scroll through a menu.



Bloom

The Bloom gesture is accomplished by opening a closed fist in front of the device. This is used as a “go home” button. When in an application, the Bloom gesture will take you back out of it. When nothing is running the bloom gesture will open the Windows home screen.

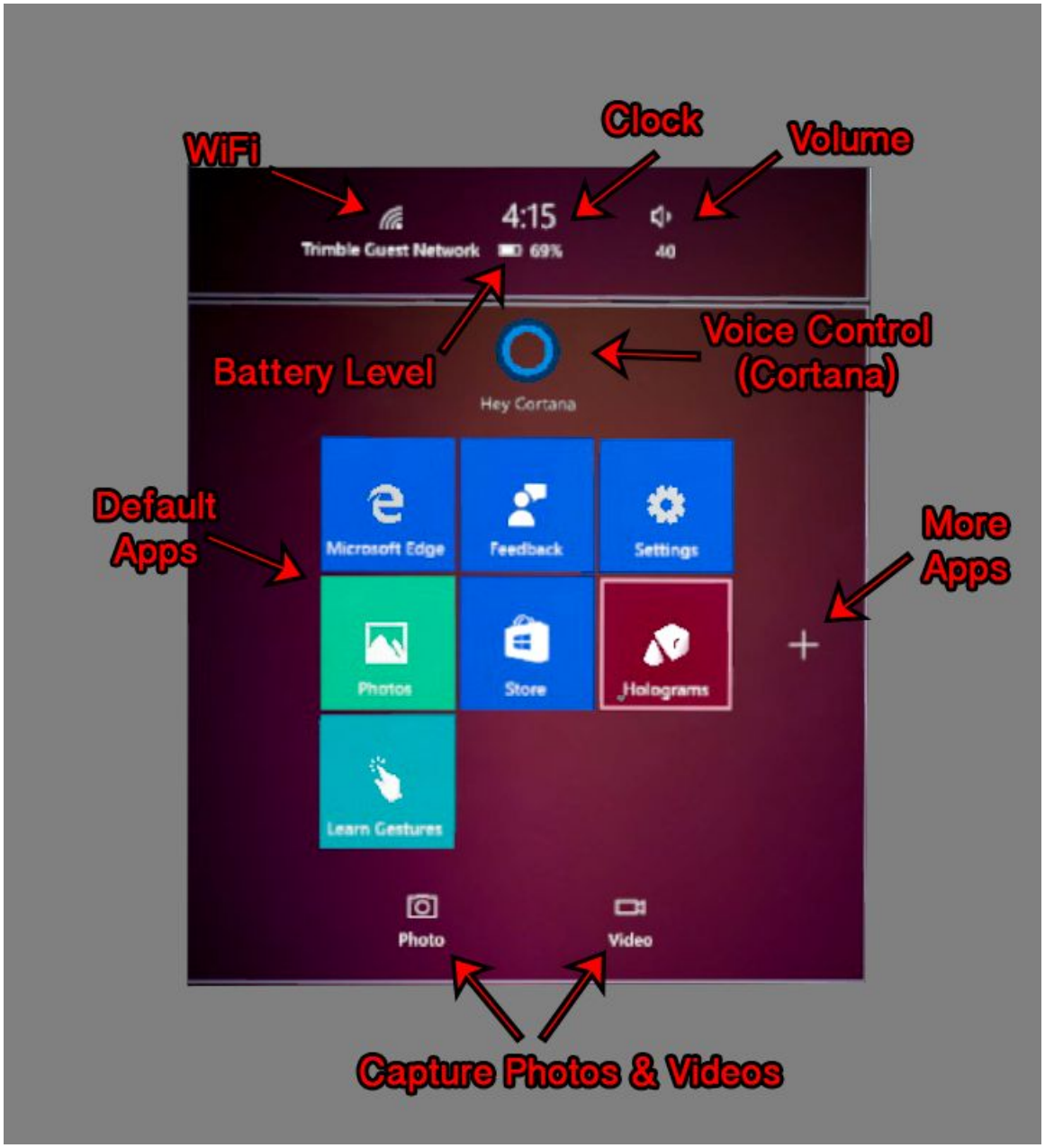




Applications & Settings

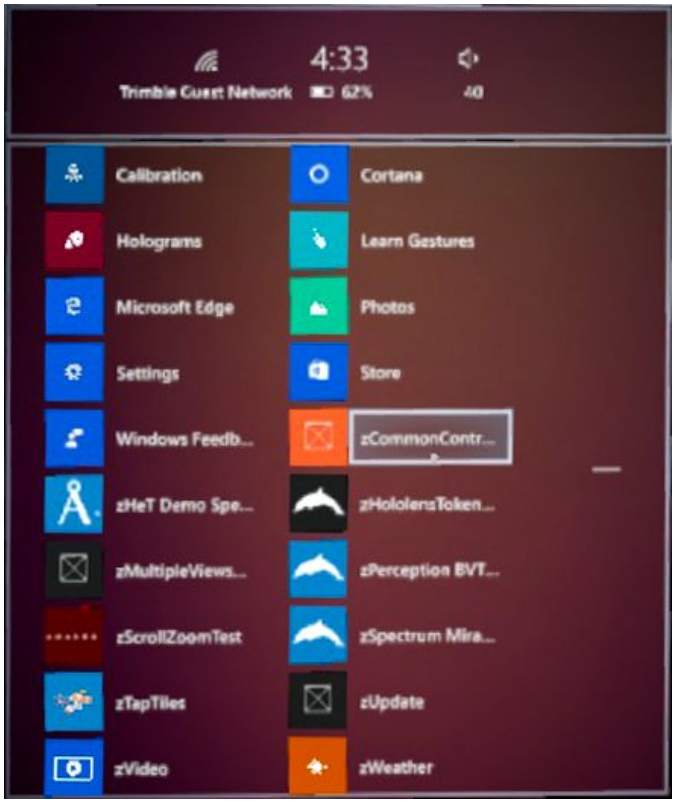
Home Screen Overview

When HoloLens is turned on, the user is prompted with the Windows holographic home screen. This is the main portal from which all HoloLens applications are launched. You can return to this screen at any time using the Bloom gesture.



Opening Applications

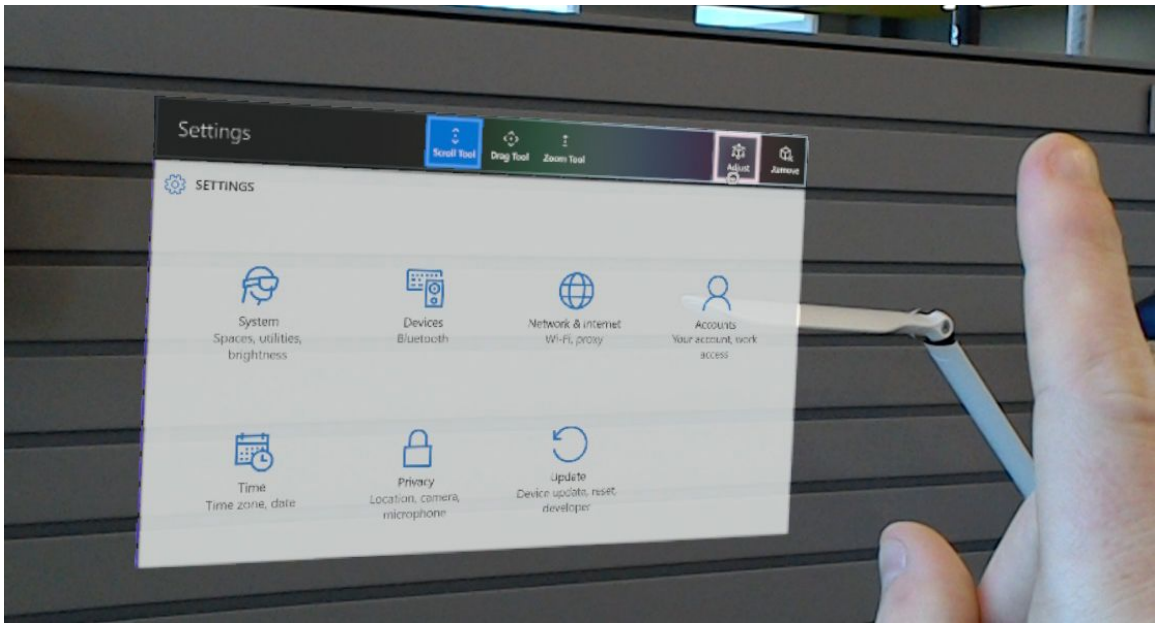
Default HoloLens applications are shown on the home screen. To access more applications, such as the Trimble-installed apps, select the '+' button on the home screen.



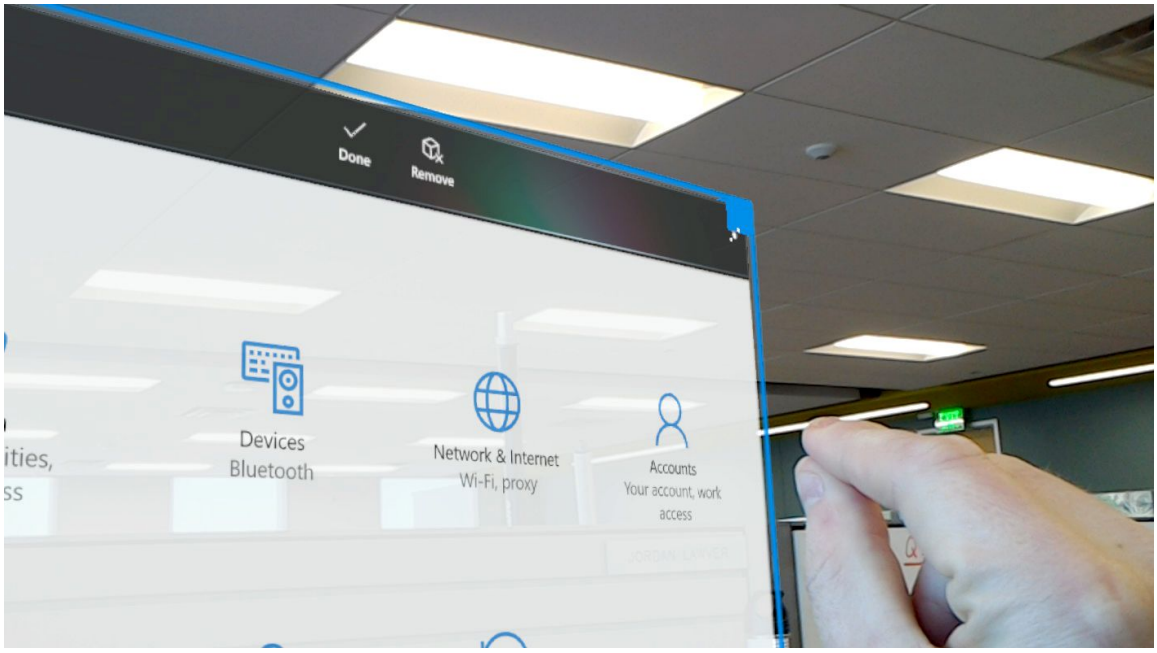
Pinning and Adjusting

When an application is launched, it will first show a 2D box that must be pinned in the holographic environment. HoloLens will automatically recognize 3D vertical surfaces in the scene where the user can Air Tap to pin them. Once pinned, the application will stay on that vertical surface.

The location and size of the application window can be adjusted by selecting the ‘Adjust’ button on the top-right corner of the window.



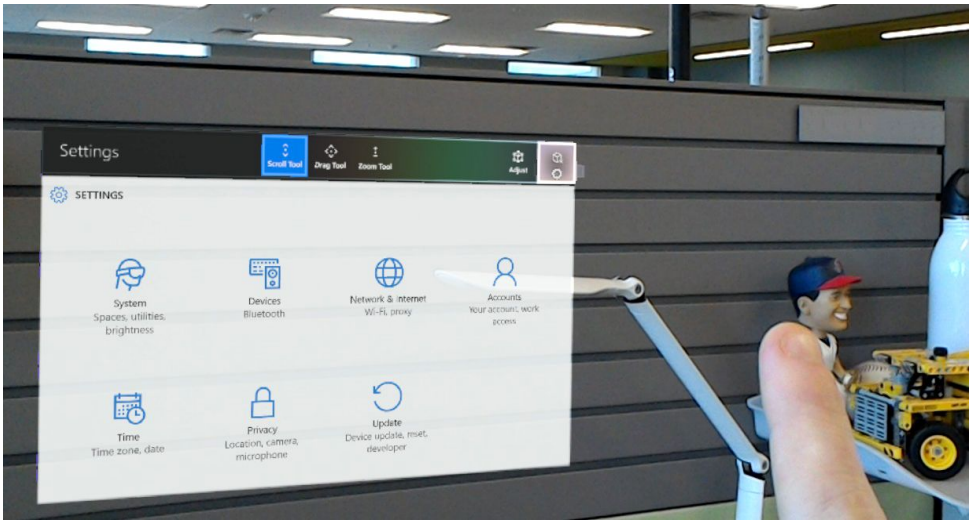
Pinching and dragging on the adjustment window will drag the location of the window. Pinching and dragging on any of the corners will change the size of the window. Click ‘Done’ when satisfied with the size and placement of the window.



Note: Some applications (including the Trimble apps) will hide the 2D box once they begin running. Performing the Bloom gesture will close the holographic part of the application and return to the 2D app screen.

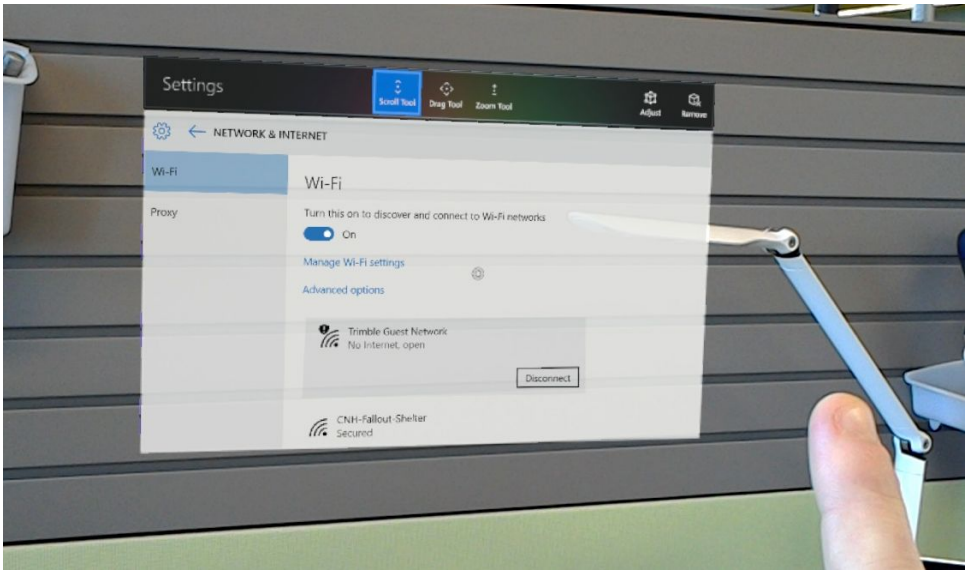
Closing Applications

Selecting the ‘Remove’ button in the top-right corner of the 2D app screen will quit the application. To quit a holographic app that is actively hiding the 2D app box, first perform a Bloom gesture to expose the app box and then click ‘Remove’.



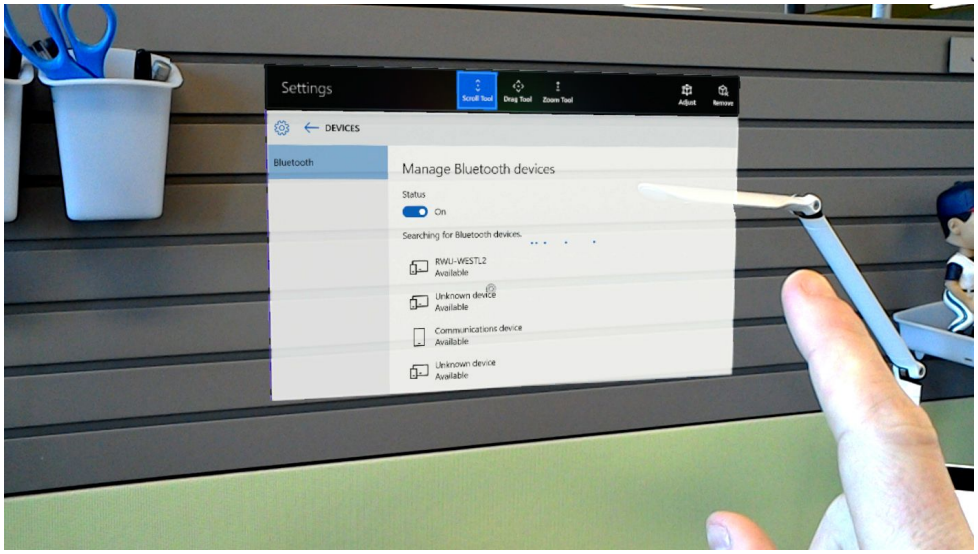
Connecting to WiFi

HoloLens needs an active internet connection to run most of its applications, as well as to tether to a computer to access the Web Interface. To connect to WiFi, first launch and pin the ‘Settings’ application. From here, select the ‘Network & Internet’ option. This will launch the ‘Wi-Fi’ menu where you can scroll (pinch and drag) to find the network you want to connect to. You may be required to enter a password if the network is secured.



Connecting Bluetooth Devices

It’s oftentimes useful to connect peripherals to HoloLens, such as Bluetooth keyboards. To do this, first launch and pin the ‘Settings’ application. From here, select the ‘Devices’ option. This will launch the ‘Manage Bluetooth devices’ menu where you can scroll (pinch and drag) to find the device you want to connect to. Once you connect, HoloLens may ask you to enter a PIN on the connected device.



Advanced HoloLens Controls in Web Interface

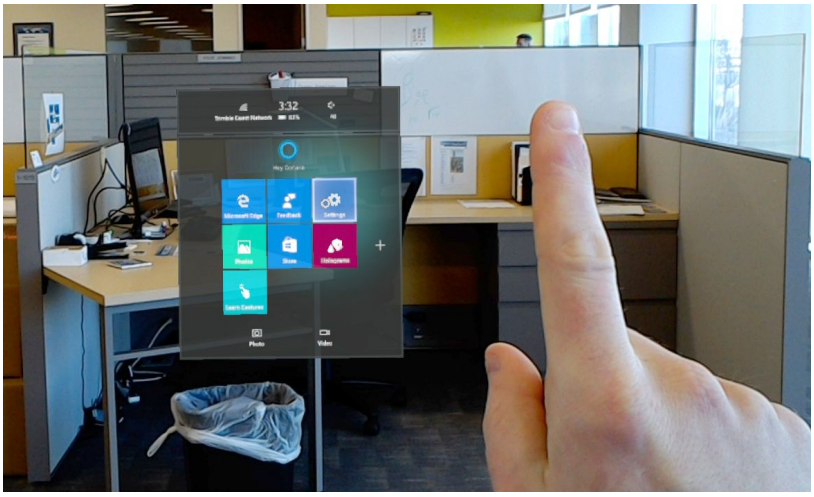
Accessing Web Interface

Connecting to WiFi

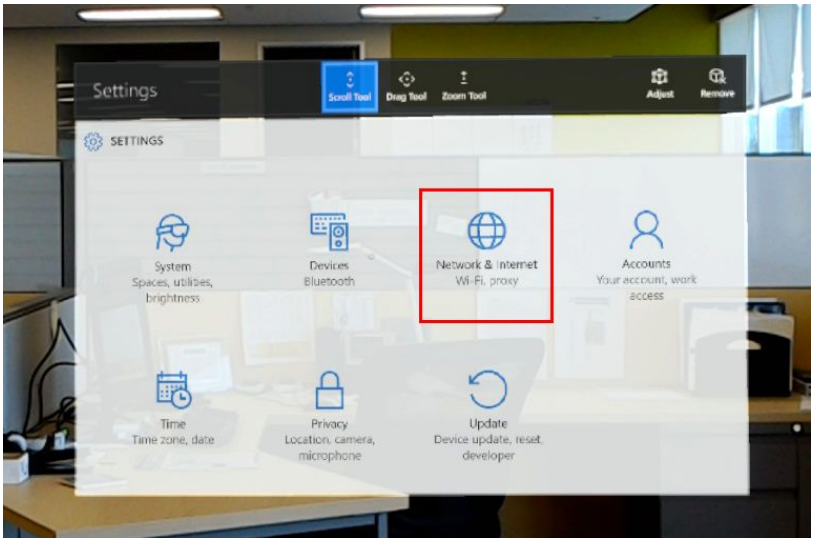
In order to access the HoloLens web interface, the user must tether the device to a computer using a WiFi connection. Ensure that both devices (HoloLens and the computer) are connected to the same WiFi network and that network credentials are entered if required. For instructions on connecting the HoloLens device to WiFi, refer to the section Connecting to WiFi.

Locating IP Address

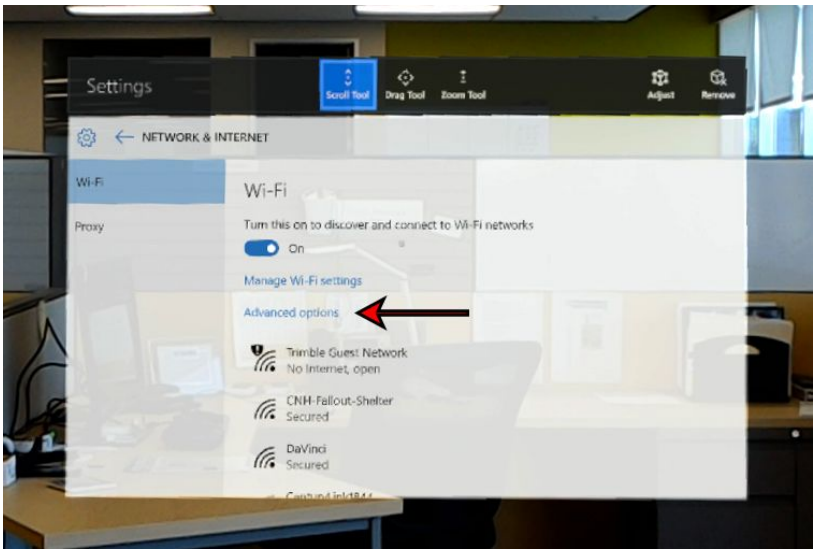
1. From the HoloLens start menu, launch and pin the ‘Settings’ application:



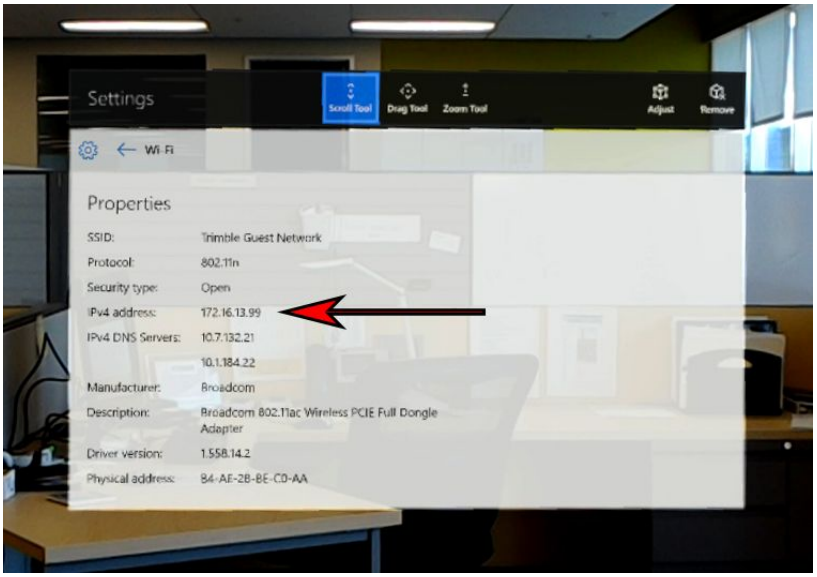
2. Select the ‘Networking & Internet’ button to open the device’s network settings:



3. Select ‘Advanced Options’:

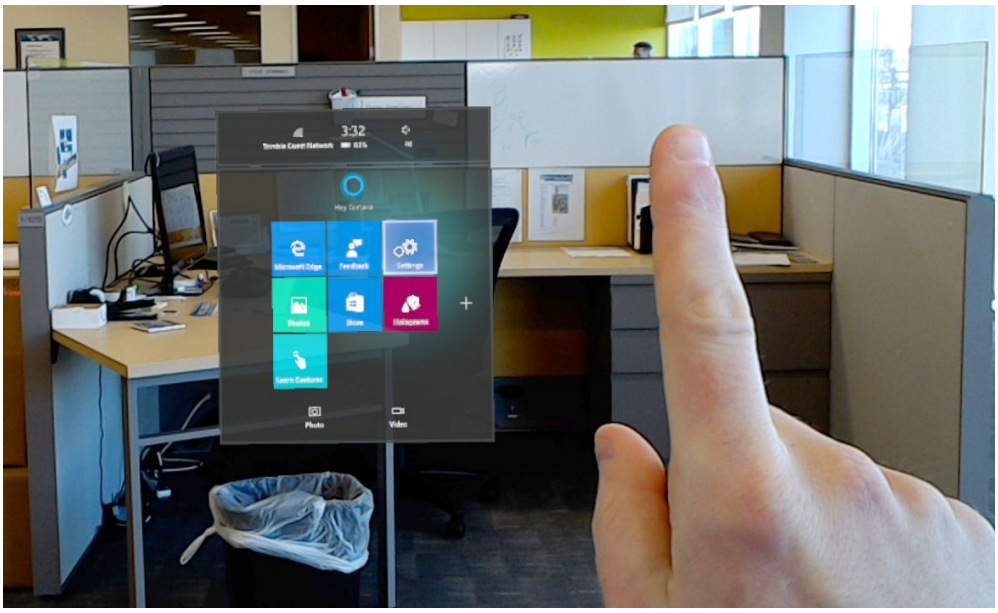


4. Locate the IPv4 address for the device:

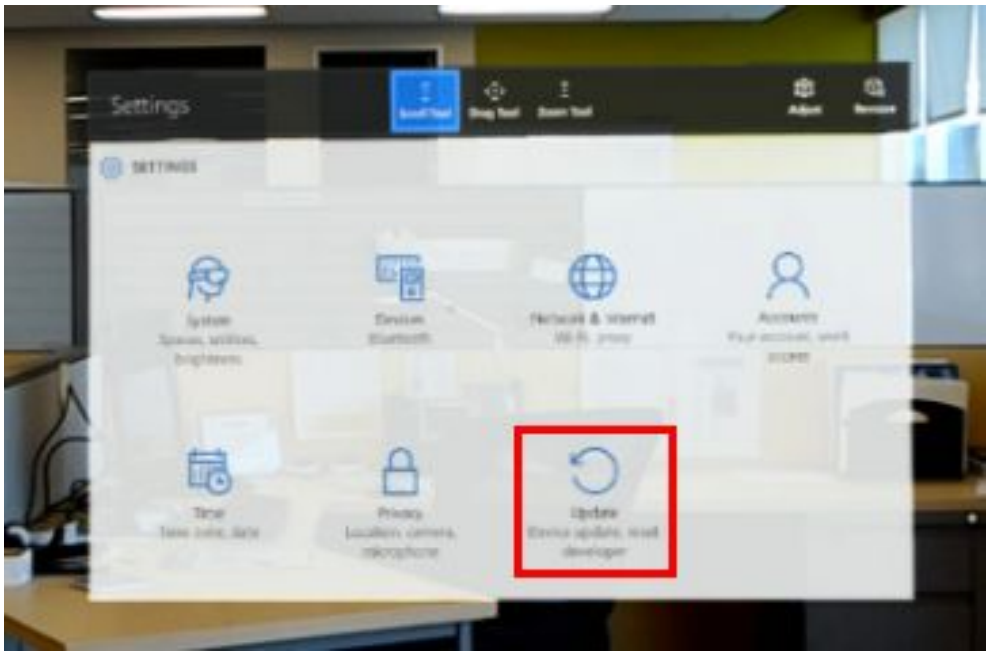


Enabling Developer Mode

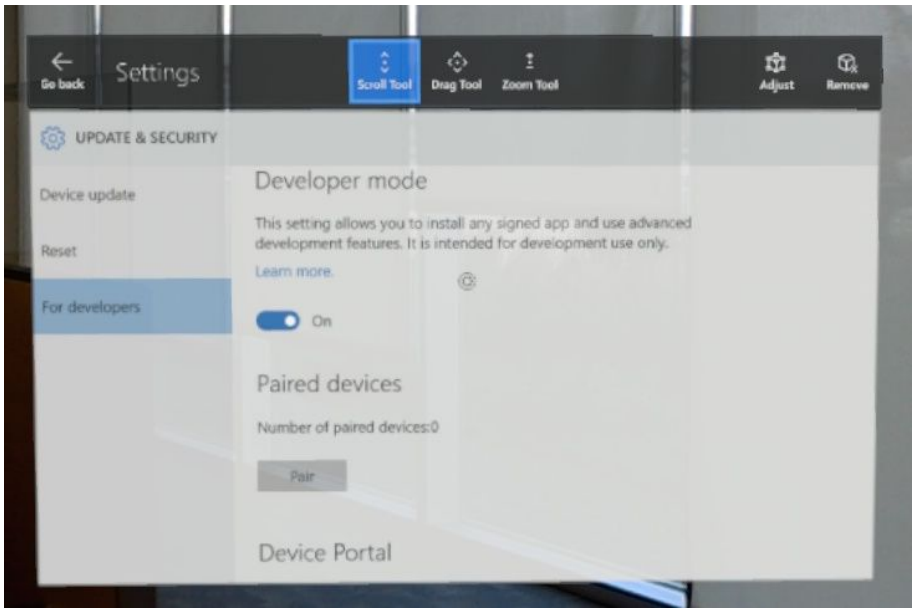
1. In order to access the HoloLens web interface the device must have ‘Developer Mode’ enabled. To do this, first open the ‘Settings’ application on the device.



2. Next, select the ‘Update’ button:

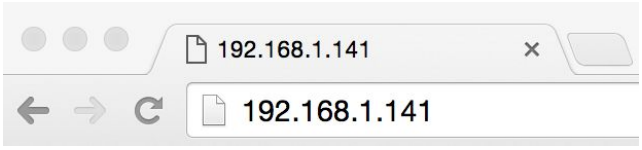


3. Along the left sidebar, select ‘For developers’. Then turn the toggle switch on for both ‘Developer mode’ and ‘Device portal’. Restart the device after enabling these options.



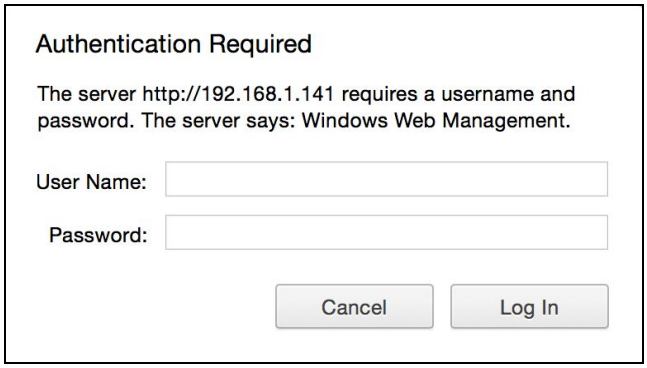
Tethering HoloLens to a Computer

1. After ensuring that the computer and HoloLens are on the same network, enter the IP address of the HoloLens into an internet browser:



   a. Alternatively, a user can tether the device to a computer via USB and connect via IP at http://127.0.0.1:10080/. This is recommended for large application files and/or slow WiFi connections.

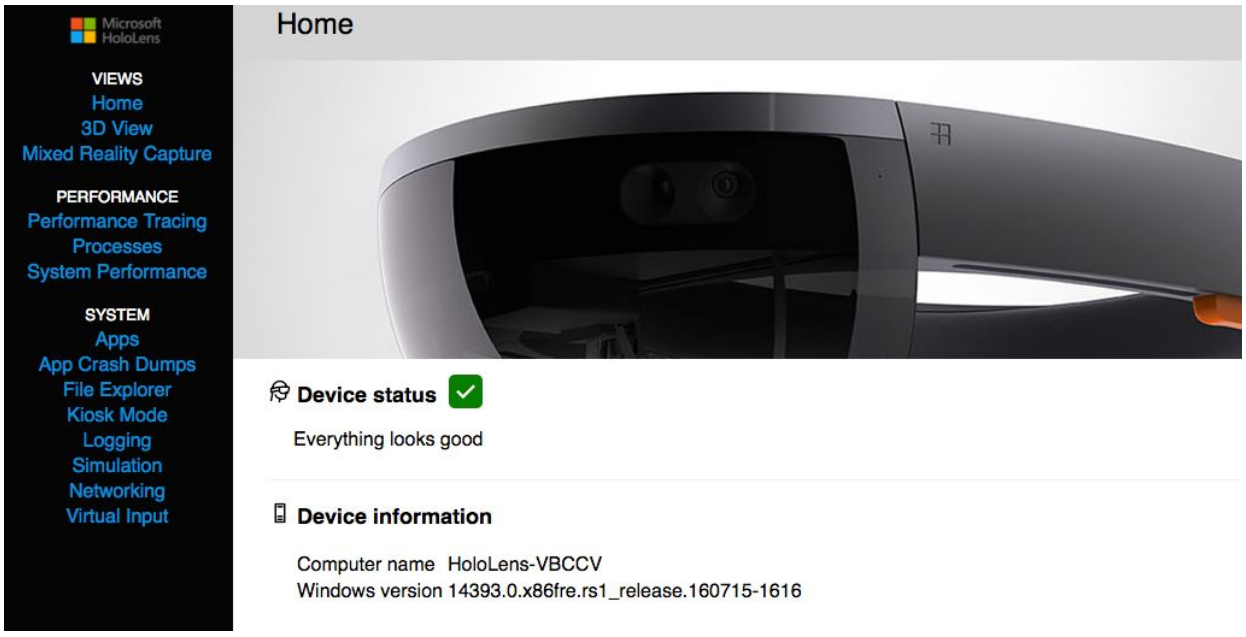
2. Enter the device’s login credentials to access the device. To change the username and password of your HoloLens device, refer to the Reset Username / Password section.



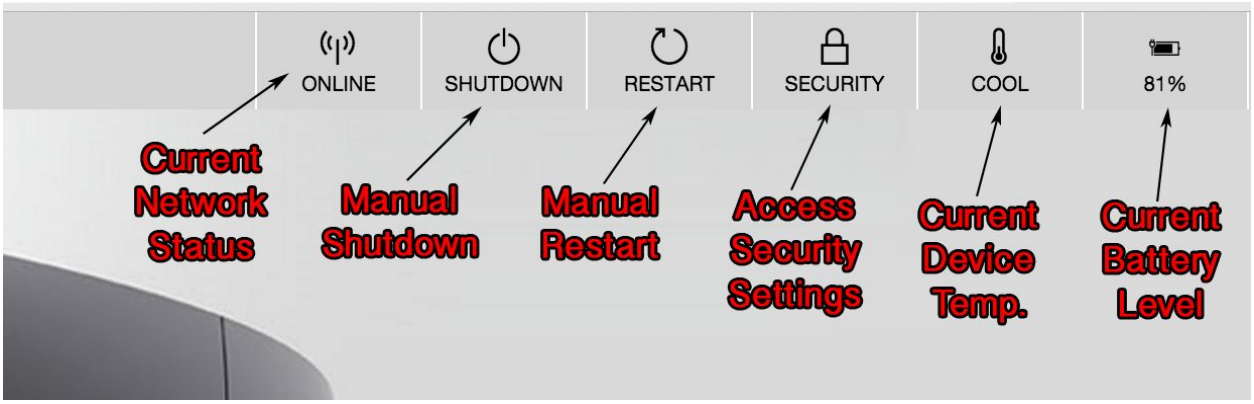
Device Information

Accessing Device Information

The main screen of the HoloLens Web Interface provides a variety of useful information related to the connected device. The links along the left side of the page give access to more advanced settings, some of which are explained in the following sections.



Basic diagnostic information about the device is provided along the top bar of the homepage.

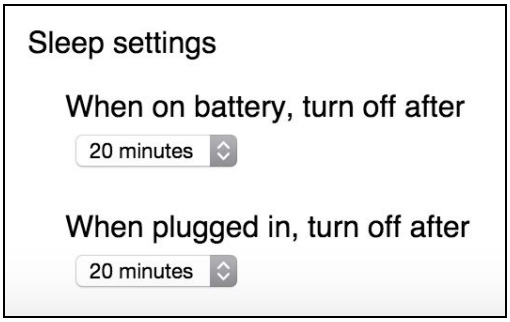


Advanced Settings Adjustment

Sleep Settings

The power settings determine how much idle time can pass before the device will automatically power down. These settings are customizable on each device and if the device is running on battery or plugged in.

The settings menu is found on the bottom of the home-screen. The device should reflect a change to a new setting immediately. Refresh the page to double-check that the setting has taken hold.



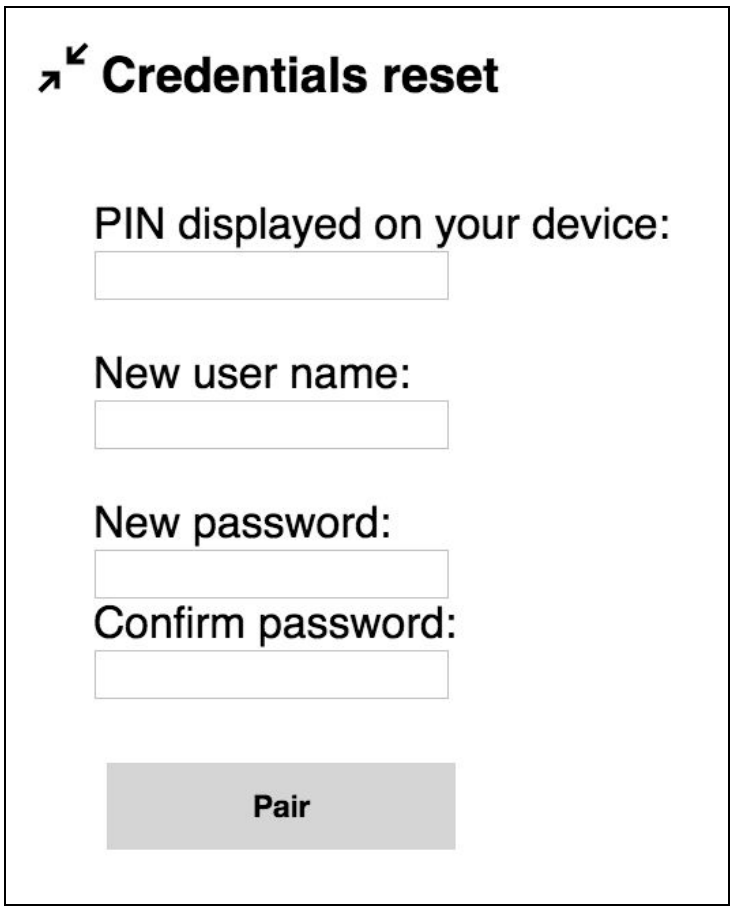
Reset Username / Password

This process will reset the username and password of the HoloLens device itself. These are the credentials used to access the device from the Web Interface.

1. Click on the ‘Security’ button on the top bar of the Web Interface.

2. Click ‘Request PIN’ under the ‘Credentials Reset’ heading. Put on the HoloLens device and jot down the PIN that it displays.

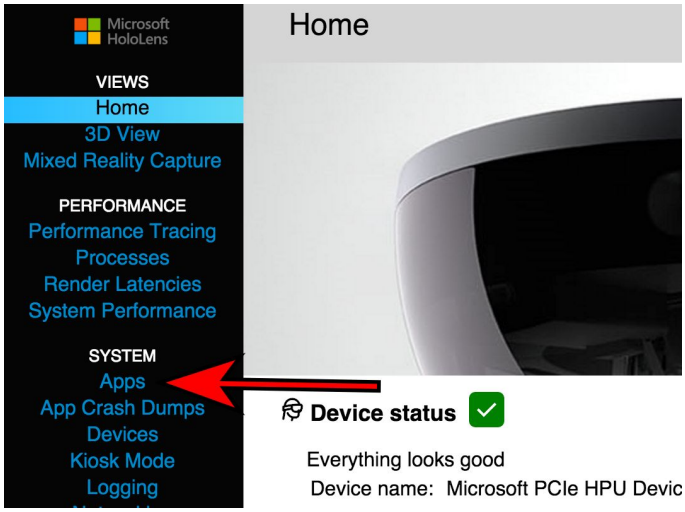
3. Enter this PIN, as well as a new username and password, into the Web Interface and click ‘Pair’ to finish the process.



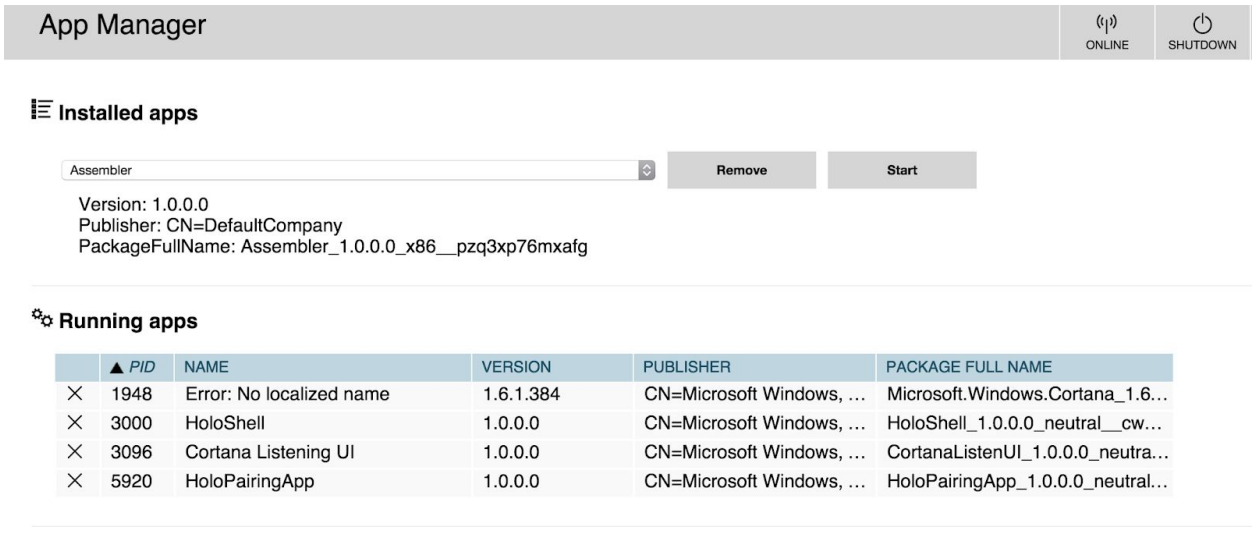
Applications

Viewing Active Applications

All information regarding applications that are on the device can be accessed from the ‘Apps’ menu item on the left sidebar of the Web Interface.

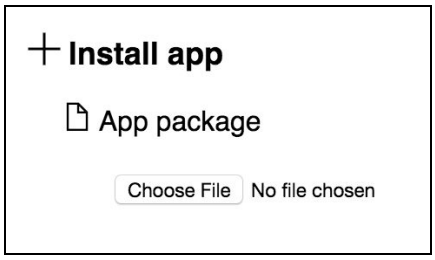


Once on the applications page, all apps that are currently installed and/or running on the device can be seen in the ‘Installed apps’ and ‘Running apps’ menus. You can quit an active application using the X button to the left of the application that is running.

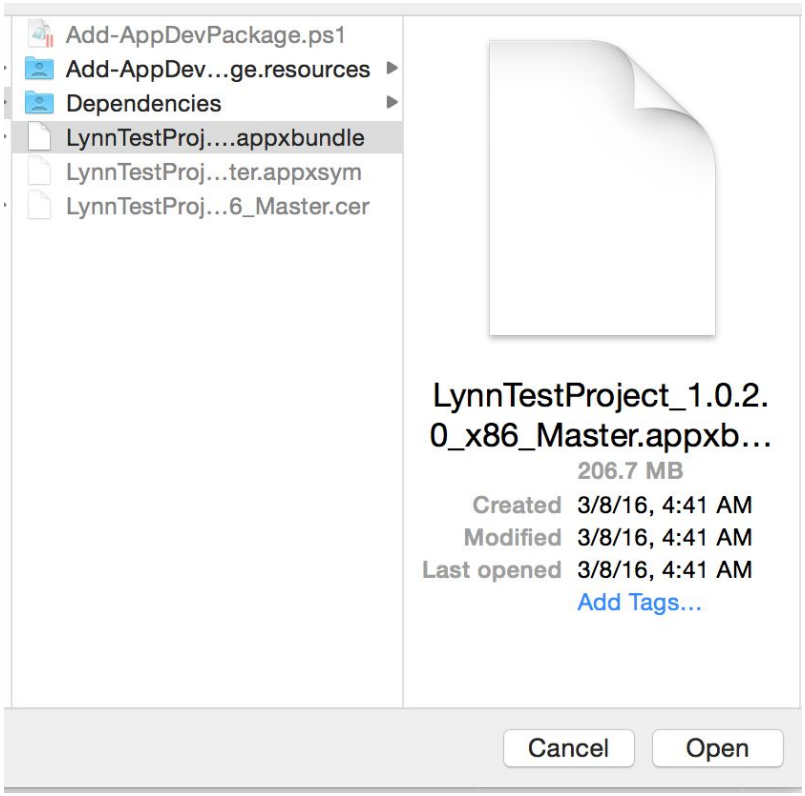


Installing Applications and Dependencies

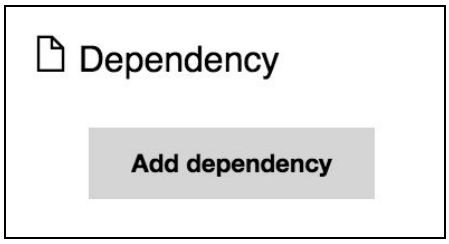
1. On the applications, select ‘Choose File’ under the ‘Install app’ header:



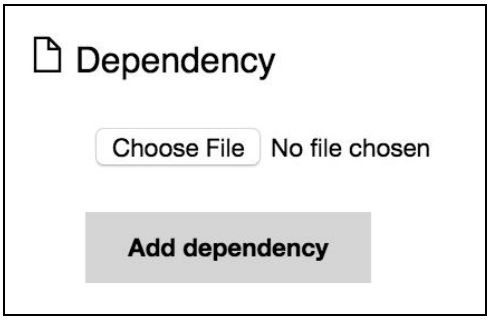
2. Locate the application (.appxbundle) on your computer and select it:



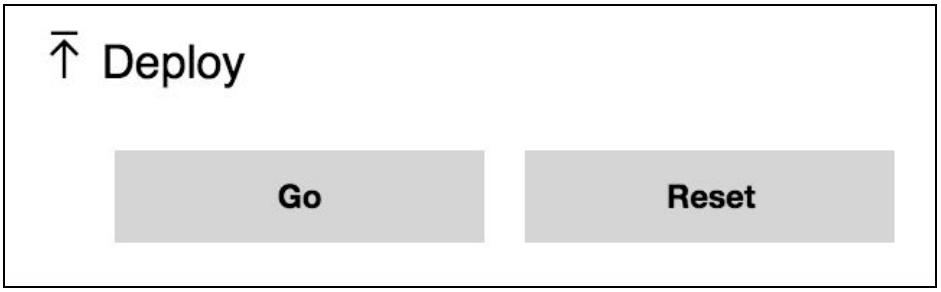
3. If there are dependencies to add along with the application, click ‘Add dependency’:



4. Select ‘Choose File’ and locate the dependency (.appx) on your computer:



5. Repeat steps 3 and 4 for each dependency that needs to be installed.
6. Click ‘Go’ under the ‘Deploy’ header to install the application and its dependencies to the HoloLens device. A progress bar will display below the ‘Deploy’ button to inform when the installation is complete.



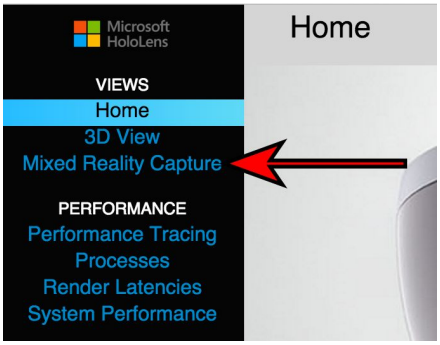
Removing Applications

To remove an app from the device, select it from the ‘Installed Apps’ list and click ‘Remove’.

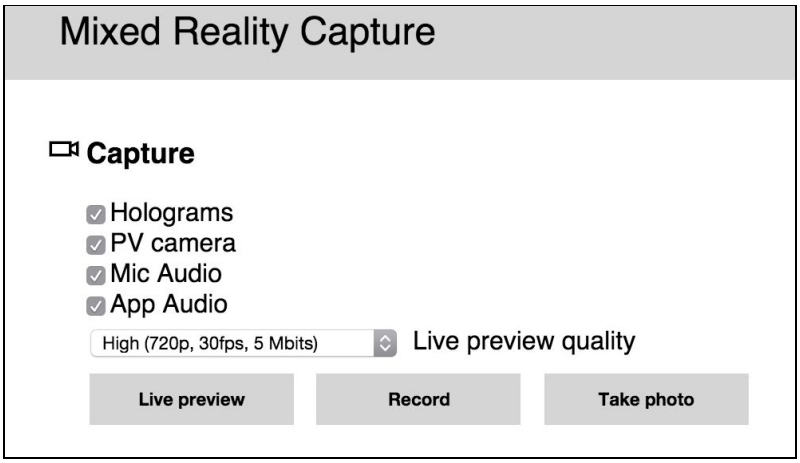
Mixed Reality Capture

Capturing Screenshots

The web interface contains built-in functionality to allow the user to screenshot a photo, video, or live stream out of the HoloLens device. To access this functionality, select the ‘Mixed Reality Capture’ menu item on the left sidebar of the Web Interface.



The ‘Mixed Reality Capture’ page allows the user to change multiple settings that will adjust what data is captured in the screenshot. Select ‘Take photo’ to capture a screenshot.

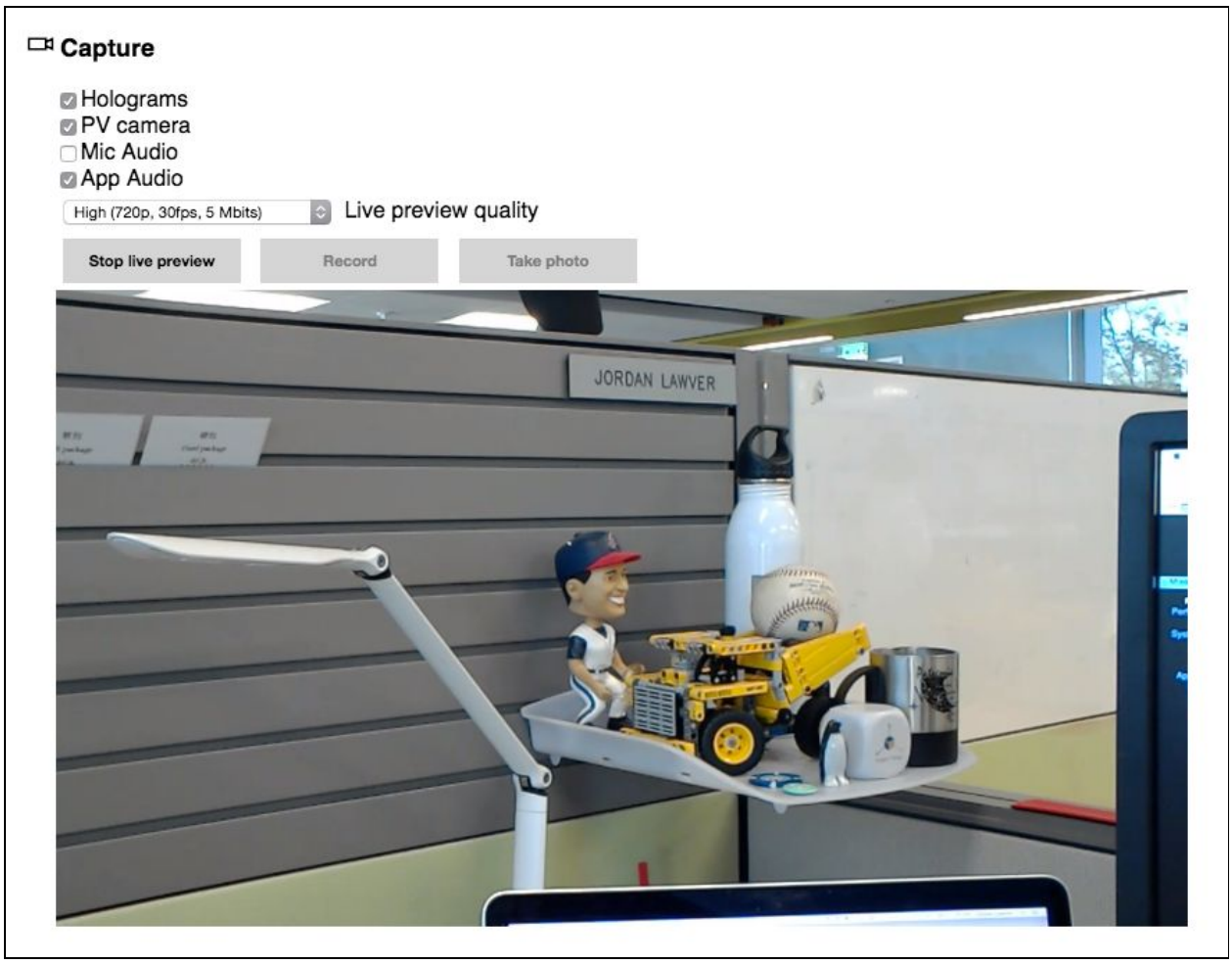


The captured photos (and videos) appear in the list below. From here, they can be played, downloaded, or deleted.

Capturing Videos

To capture a video, follow the same steps for capturing a screenshot but instead select ‘Record’. Once done with the video, click ‘Stop Recording’.

The video will show a preview and appear in the list of videos and photos.

Live Streaming

By selecting the ‘Live preview’ button one can view a live video of the camera stream from the device with the holographic data overlaid. Note that there can be up to a 3 second delay between the device and the “live” stream depending on network latency. The resolution of the video stream can be adjusted for choppy streams.