Microsoft HoloLens

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Microsoft HoloLens is a pair of mixed reality smartglasses developed and manufactured by Microsoft. HoloLens are the first computers running the Windows Mixed Reality platform under the Windows 10 operating system. The 1x1x1 inches HoloLens is a [mixed reality](https://en.wikipedia.org/wiki/Mixed_reality" \o "Mixed reality) [augmented reality](https://en.wikipedia.org/wiki/Augmented_reality" \o "Augmented reality) [head-mounted display](https://en.wikipedia.org/wiki/Head-mounted_display" \o "Head-mounted display) [smartglasses](https://en.wikipedia.org/wiki/Smartglasses" \o "Smartglasses) which weighs about 6.9 pounds. The main parts of the HoloLens include the processor, the computer, the headband and the lenses.

The HoloLens is a [head-mounted display](https://en.wikipedia.org/wiki/Head-mounted_display" \o "Head-mounted display) unit connected to an adjustable, cushioned inner headband, which can tilt HoloLens up and down, as well as forward and backward. To wear the unit, the user fits the HoloLens on their head, using an adjustment wheel at the back of the headband to secure it around the crown, supporting and distributing the weight of the unit equally for comfort, before tilting the visor towards the front of the eyes. The headband is designed like a performance car with great weight distribution for a comfortable fit. Weight is distributed around the crown of your head, saving your ears or nose from undue pressure. The adjustment wheel in the headband ensures a comfortable fit for a wide range of adult head sizes.

The premier device for Windows Mixed Reality is the Microsoft HoloLens. The HoloLens contains more computing power than the average laptop. It is passively cooled without fans. With no wires, external cameras, or phone or PC connection required, you can move freely and self-contained. The platform works by enabling applications in which the live presentation of physical real-world elements is incorporated with that of virtual elements (*referred to as "holograms" by Microsoft*) such that they are perceived to exist together in a shared environment. Microsoft HoloLens (running under the [Intel 32-bit](https://en.wikipedia.org/wiki/IA-32" \o "IA-32)) is made up of specialized components that together enable holographic computing. The optical system that works in lock-step with advanced sensors. This makes light work of processing a large amount of data per second. All those components and more enable you to move freely and interact with holograms. Interacting with holograms in mixed reality enables you to visualize and work with your digital content as part of your real world. Holograms are a more natural way to interact. Built-in sensors let you use your gaze to move the cursor so you can select holograms. Turn your head and the cursor will follow. By using simple gestures, your apps can be opened. You can also use voice commands to navigate, select, open, command, and control your apps. Speak directly to Cortana, who can help you complete tasks.

Holograms transform the ways you communicate, create, collaborate, and explore. Your ideas are closer to becoming real when you can create and work with holograms in relation to the world around you. You can see holograms from your colleague’s perspective even if she’s on the other side of the world. Explore ideas in the real world, inside and out. You can go beyond what a 2D render can do by working in 3D. Make smarter decisions and prototype faster when you can inspect every vantage point.

The next important component would be the processor. Microsoft Hololens have Microsoft's next-generation Holographic Processing Unit (HPU) will incorporate an AI coprocessor. This coprocessor will be for implementing deep-neural networks. Microsoft developed its own custom HPU multiprocessor when designing the current HoloLens goggles. The HPU can process the information from the device's on-board sensors. Microsoft officials have been talking up the company's focus on moving more processing power to the "intelligent edge," as of late. HPU sensors can process terabytes of information which makes it one of the most advanced processors in this era. It also has the Intel Atom processor. That processor runs as a ho-hum 1.04GHz, and while it is 64-bit capable, the OS itself is only 32-bit. That leads to RAM of which there is only 2GB on board. Storage on HoloLens is an ample 64GB although the user only gets around 54GB after the OS.

Apart from that, the optics play an important role in this device. HoloLens is a passthrough device. That is, you see the real world through the device’s clear lenses, and images (holograms) are projected out in front of you, up to several meters away.

The components of the HoloLen’s optical system break down as follows:

Microdisplay → imaging optics → waveguide → combiner → gratings

In this case, the entrance pupil is your eye, and the exit pupil is the projection. The key to the whole display system working correctly is exit pupil expansion, using what’s called an “eye box.” In order for a device like HoloLens to work, you need a large and expandable eye box.

The term interpupillary distance (IPD), which is, simply put, the distance between your pupils. This distance is different for everyone, and that’s problematic in VR and AR. You have to have a way to mechanically adjust for IPD, or the visuals don’t work very well. HoloLens has two-dimensional IPD, which means that you can adjust the eye box horizontally and vertically. Microsoft claimed that this capability gives HoloLens the largest eye box in the industry. Microsoft started with what it calls “light engines,” or more simply, “projectors.” In the HoloLens, these are tiny liquid crystal on silicon (LQoD) displays, like you’d find in a regular projector. There are two HD 16:9 light engines mounted on the bridge of the lenses (under the IMU,which we’ll discuss later). These shoot out images, which must pass through a combiner; this is what combines the projected image and the real world.

HoloLens uses total internal reflection (TIR), which, depending on how you shape the prism, can bounce light internally or aim it at your eye. With IR, this can be leveraged for eye tracking. According to the presenter on stage, “The challenge doing it this way is that the volume gets large if you want to do a large FoV.” The solution Microsoft employed is to use waveguides in the lenses. He said it’s difficult to manufacture these in glass, so Microsoft applied a surface coating on them that allows them to create a series of defraction gratings.

All in all, Microsoft took a huge leap to the future with this particular device in the name of hologram. Holograms are not something that we are all familiar with but with a deep sense of gratitude to Microsoft, our dreams are being changed to reality. Microsoft successfully brought us a glimpse of a holographic future. This device is considered to be a second generation model which is now on its way to the third and it is definitely worth the money to all tech geeks out there