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HOLOLENS

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Abstract: Microsoft HoloLens, the company's holographic, augmented with reality headset (or mixed reality if you're being picky), took us all a surprise when it was unveiled at a Windows 10 event at the beginning of year 2015. The HoloLens headset is a bold piece of hardware and the most exciting evidence yet that Microsoft is taking wearable tech very seriously. It also comes with a bold price the Development Edition launched on 30th March with another round of orders opened to anyone with a Microsoft account and US and Canada address on 2nd August. Whether you ordered one in the spring or in the summer, both come with a price tag of \$3,000. Ouch. Microsoft is promising a future filled with holograms, but not as we'd imagine them you'll only be able to see them with the HoloLens strapped on. Read on for details, specs, explanations and analysis of every last inch of Microsoft's HoloLens headset and its Holographic platform. The set-up consists of holographic lenses and a depth camera as well as speakers above the ears and on-board processing via an Intel 32-bit architecture, an unspecified GPU and HPU (holographic processing unit). That's backed up by 2GB of RAM and 64GB of onboard storage. There's also a vent to keep the headset from overheating. On the connectivity front, it'll support both Bluetooth and Wi-Fi, as had been expected. There's a host of sensors built into the headset as well, which include an ambient light sensor and four environment sensing cameras that work in combination with a depth sensing camera to create the spaces that you'll be able to work within.

Introduction

Microsoft HoloLens, known under development as **Project Baraboo**, is a pair of mixed reality smart glasses developed and manufactured by Microsoft. HoloLens gained popularity for being one of the first computers running the Windows Holographic platform under the Windows 10 operating system. The HoloLens can trace its lineage to Kinect, an

add-on for Microsoft's Xbox gaming console that was introduced in the year 2010. The pre-production version of HoloLens, the Development Edition, shipped on the 30th of March 2016, and is targeted to developers in the United States and Canada for a list price of \$3,000. Samsung and Asus have extended an offer to Microsoft to help produce their own mixed-reality products, in collaboration with Microsoft, based around the concept and hardware on HoloLens. On October 12, 2016, Microsoft announced global expansion of HoloLens and publicized that HoloLens would be available for preorder in Australia, Ireland, France, Germany, New Zealand and the United Kingdom.

Design

The HoloLens is a 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.

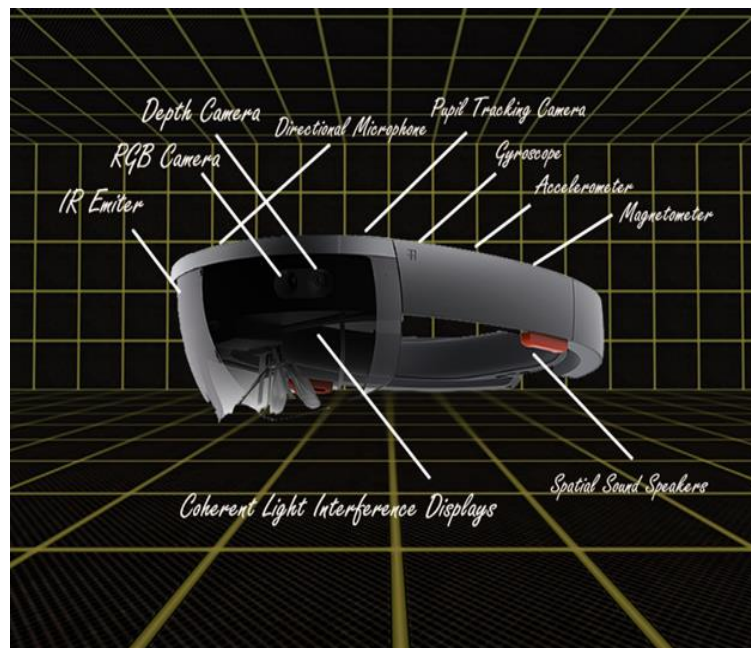
In the front is much of the sensors and related hardware, including the cameras and processors. The visor is tinted; enclosed in the visor piece is a pair of transparent combiner lenses, in which the projected images are displayed in the lower half. The HoloLens must be calibrated to the interpupillary distance (IPD), or accustomed vision of the user.

Along the bottom edges of the side, located near the user's ears, are a pair of small, red 3D audio speakers. The speakers, competing against typical sound systems, do not obstruct external sounds, allowing the user to hear virtual sounds, along with the environment. Using head-related transfer functions, the HoloLens generates binaural audio, which can simulate spatial effects; meaning the user, virtually, can perceive and locate a sound, as though it is coming from a virtual pinpoint or location.

On the top edge are two pairs of buttons: display brightness buttons above the left ear, and volume buttons above the right ear. Adjacent buttons are shaped differently—one concave, one convex—so that the user can distinguish them by touch.

At the end of the left arm is a power button and row of five, small individual LED nodes, used to indicate system status, as well as for power management, indicating battery level and

setting power/standby mode. A USB 2.0 micro-B receptacle is located along the bottom edge. A 3.5 mm audio jack is located along the bottom edge of the right arm.



Developing applications for HoloLens

Microsoft Visual Studio is an IDE that can be used to develop applications (both 2D and 3D) for HoloLens. Applications can be tested using HoloLens emulator (included into Visual Studio 2015 IDE) or HoloLens Development Edition.

2D applications

HoloLens can run almost all Universal Windows Platform apps. These apps appear as 2D projections. Not all Windows 10 APIs are currently supported by HoloLens, but in most cases the same app is able to run across all Windows 10 devices (including HoloLens), and the same tools that are used to develop applications for Windows PC or Windows Phone can be used to develop a HoloLens app.

3D applications

3D applications, or "holographic" applications, use Windows Holographic APIs. Microsoft recommends Unity engine and Vuforia to create 3D apps for HoloLens, but it's also possible for a developer to build their own engine using DirectX and Windows APIs.

Interface

HoloLens, through the use of the HPU, uses sensual and natural interface commands—gaze, gesture, and voice—sometimes referred to as "GGV", inputs. Gaze commands, such as head-tracking, allows the user to bring application focus to whatever the user is perceiving. "Elements"—or any virtual application or button—are selected using an air tap method, similar to clicking an imaginary computer mouse. The tap can be held for a drag simulation to move an element, as well as voice commands for certain commands and actions.

The HoloLens shell carries over and adapts many elements from the Windows desktop environment. A "bloom" gesture for accessing the shell (performing a similar function to pressing a Windows key on a Windows keyboard or tablet, or the Xbox button on an Xbox One Controller) is performed by opening one's hand, fingers spread with the palm facing up. Windows can be dragged to a particular position, as well as resized. Virtual elements such as windows or menus can be "pinned" to locations, physical structures or objects within the environment; or can be "carried," or fixed in relation to the user, following the user as they move around.^[61] Title bars for application windows have a title on the left, and buttons for window management functions on the right.

In April 2016 Microsoft Created the Microsoft HoloLens App for Windows 10 PC's and Windows 10 Mobile devices, that allows developers to run apps, use his or her phone or PC's keyboard to type text, View a live stream from the HoloLens user's point of view, and remotely capture mixed reality photos and videos.

Uses of HoloLens

Remote Instruction

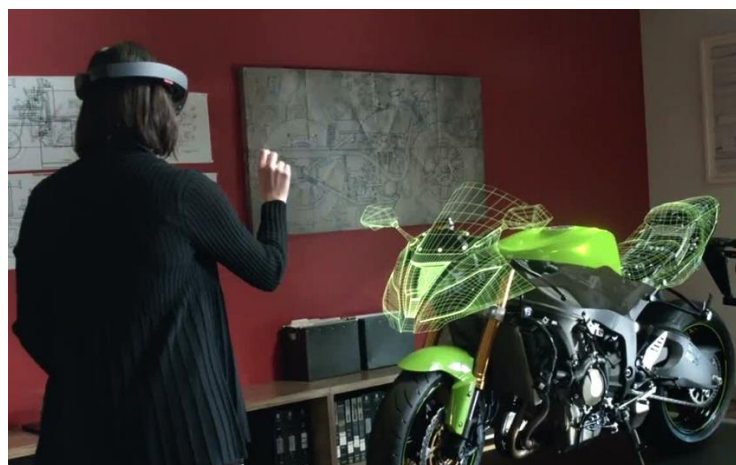
This use was demonstrated in the Microsoft HoloLens introductory video. Imagine getting step-by-step instructions on things like home repair from an expert. Visual diagrams would actually show up in space around the user indicating exactly what you need to do next. This application could even extend to the battlefield, where detailed medical instructions could be given to untrained personnel in the midst of combat.

This level of illustrated instruction could make getting the support you need much easier, and could even mean the beginning of a new industry of remote consulting experts.



3D Computer-Aided Design

Imagine building a 3D model of pretty much anything you can imagine in the physical space around you. It's similar to what's seen in the movie Iron Man as Tony Stark interacts with holographic objects to build his devices (check out the video below...the only thing missing is the glasses) It's also one of the ideas that has captured the imagination of many when it comes to the HoloLens. Using the HoloLens to construct and design new products could be an important commercial use of the device, especially in the age of bring your own device (BYOD) policies in the workplace. All you need to do is send the design to a 3D printer, and your holographic model goes from concept to reality.



Gaming

Gaming is another potential use that was shown off in the introductory video from Microsoft (whose recent history of innovation and improvements is impressive,) and the possibilities of using the HoloLens for gaming are fascinating. Several journalists were able to get a hands-on look at how this would work during the product's launch event, and although the demo was rather basic, a fully immersive gaming experience is something gamers have been clamoring for for quite some time. Imagine playing a game like Minecraft using holographic models in your living room. HoloLens promises to make that happen.



Decorating

Unlike Google Glass, HoloLens is first being geared for use mostly inside the home or office and not necessarily on the go. One way it can be helpful is by visualizing how new decorations would look in your house or apartment. No more trying to picture how that new paint color for your wall will look with your new couch; you'd actually be able to see it projected holographically and make the best decision for your living space. And instead of awkwardly holding a picture up while trying to gauge how it looks in a certain location, your HoloLens can show you exactly how it will look placed in any number of locations!



Holographic Attractions and Entertainment

Going to a haunted house during Halloween season is plenty fun, but if you wore a HoloLens, creepy attractions could become even scarier by integrating virtual elements that can't exist in the real world. On a similar note, supporters of 3D movies have wanted to make the audience feel like part of the action for years. HoloLens could help them bring virtual elements into the space of the user.

This sort of thing could open up a whole new genre of mixed-reality entertainment, leveraging both real and virtual content to achieve the effect on the user. Roller coasters, haunted houses, movies, and laser tag could all be the basis of entirely new kinds of experiences.



Heads Up GPS

This would require further development on the HoloLens and even legislative approval (while smart devices are becoming even smarter, using devices like Google Glass while driving is still illegal) but a heads up GPS display would be incredibly helpful for drivers and pedestrians alike. You could see instructions and diagrams laid out on the road in front of you, giving you unambiguous instructions about where to go next.



Advantages and dis-Advantages

HoloLens is compatible with any different user that decides to use it. It can be used for anything; from video games and Netflix, to business meetings and visual calls with clients from anywhere in the world with Internet connection. The interactions involved with the HoloLens consist of touch, sound, voice, and gestures. The product is currently in the prototype phase but is expected to be released to the public as early as 2015, and to groups such as NASA as early as July 2015

IMAGE: MICROSOFT

Business managers must take serious account into integrating new technologies such as this into the workplace. The **positives** and **negatives** must be analyzed, as although the Microsoft HoloLens may allow for growth and productivity, it may also deteriorate these aspects. As pertaining to business operations, it is evident that the use of this technology will allow for further visualization and a greater depth of worker collaboration for the working world. This factor, along with the creation of a more innovative environment, proves to show the **advantages** of this technology. The potential for great efficiency with the use of this technology is a clear **benefit** in the business world, as well the benefits of employee training. This technology allows for a greater ease when training new employees, as the abundance of knowledge found within is readily accessible. The benefits for its users in comparison to other products greatly outweigh the rival products, making HoloLens a product of great advantage, There are however, many recognizable **disadvantages** of business managers integrating this technology. Some of these disadvantages consist of the size of the headset, safety, dependence on the technology, and the growth of workplace distractions. With the headsets vast amount of features and allowance for the personalized control of the wearer, it is very possible for employees to get easily distracted while on the job. This potentially would not aid businesses to achieve effectiveness and high productivity. Furthermore, the costs of the HoloLens need to be considered, as with the expensive investment that may occur with newly developing and disruptive technologies.

Future Uses

These are great technology and will definitely be used for future. Here are some thoughts.

Pros

- The holographic communication is 100% the future, no matter it is for VR, AR or on any capable device.
- The quality of this setup is really good. Full body, no gaps, good color, low latency.

Cons

- This is an expensive setup. Observed from the video that there are 24 cameras in 8 locations. This system might need a dozen of computers to actually process these inputs and build and optimize 3D meshes
- It also need complicated positioning and calibrations.
- No word about the data bandwidth needed for this quality. The TED demo has longer latency than this demo.
- Requires good and even lighting
- Can't handle the mirrors in the scene (I guess, no proof)

Hopefully Microsoft will make the holographic video an open standard so other players could communicate between each other.

Conclusion

It's apparent that there is a long way for the HoloLens to become mature, but there is so much potential that the HoloLens could offer, and its possibilities for applications can be limited only by our imagination. As the more applications being explored and the production cost being reduced in the future as the technology improves, it would become prevalent in our lives. The Microsoft HoloLens started as an idea and evolved into a creation that will soon change the lives of its users. With such outward potential, it is hard to say where the limits of the HoloLens stop.

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