Survey on Converting the Virtual Reality to Augmented Reality through Holograms

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Abstract - **Mixed reality can be used to create new experiences that will contribute to advances in productivity, collaboration, and innovation. We engage with researchers across many disciplines to push boundaries in the state of the art at the intersection of software and hardware. Microsoft HoloLens goes beyond augmented reality and virtual reality by enabling you to interact with three-dimensional holograms blended with your real world. Microsoft HoloLens is more than a simple heads-up display, and its transparency means you never lose sight of the world around you. High-definition holograms integrated with your real world will unlock all-new ways to create, communicate, work, and play.[8]**
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1. INTRODUCTION

Microsoft HoloLens is the first holographic computer running Windows 10. It is completely untethered–no wires, phones, or connection to a PC needed. Microsoft HoloLens allows you to pin holograms in your physical environment and provides a new way to see your world.[4][5]

Microsoft HoloLens features see-through, holographic, high-definition lenses and spatial sound so you can see and hear holograms in the world around you. Complete with advanced sensors and a new Holographic Processing Unit (HPU) that understands the world around you, Microsoft HoloLens is able to run without any wires while processing terabytes of data from the sensors in real-time[3]

Figure 1: Microsoft HoloLens[4]

It basically Works on 3 Concepts:
- A. Holograms
- B. Virtual Reality
- C. Augmented Reality

1.1. Holograms: A hologram is an object like any other object in the real world, with only one difference: instead of being made of physical matter, a hologram is made entirely of light. Holographic objects can be viewed from different angles and distances, just like physical objects, but they do not offer any physical resistance when touched or pushed because they don't have any mass. Holograms can be two-dimensional, like a piece of paper or a TV screen, or they can be three-dimensional, just like other physical objects in your real world. The holograms you'll see with Microsoft HoloLens can appear life-like, and can move, be shaped, and change according to interaction with users or the physical environment in which they are visible [16].

1.2. Virtual Reality: The definition of virtual reality comes, naturally, from the definitions for both 'virtual' and 'reality'. The definition of 'virtual' is near and reality is what we experience as human beings. So the term 'virtual reality' basically means 'near-reality'. This could, of course, mean anything but it usually refers to a specific type of reality emulation [17].

We know the world through our senses and perception systems. In school we all learned that we have five senses: taste, touch, smell, sight and hearing. These are however only our most obvious sense organs. The truth is that humans have many more senses than this, such as a sense of balance for example. These other sensory inputs, plus some special processing of sensory information by our brains ensures that we have a rich flow of information from the environment to our minds. Everything that we know about our reality comes by way of our senses. In other words, our entire experience of reality is simply a combination of sensory information and our brains sense-making mechanisms for that information. It stands to reason then, that if you can present your senses with made-up information, your perception of reality would also change in response to it. You would be presented with a version of reality that isn't really there, but from your perspective it would be perceived as real. Something we would refer to as a *virtual reality*. So, in summary, virtual reality entails presenting our senses with a computer generated virtual environment that we can explore in some fashion. In technical terms, Virtual reality is the term used to describe **a three-dimensional, computer generated environment** which can be explored and interacted with by a person. That person becomes part of this virtual world or is immersed within this environment and whilst there, is able to manipulate objects or perform a series of actions[17].

1.3. Augmented Reality: A*ugmented* R*eality* is a type of virtual reality that aims to duplicate the world's environment in a computer. An augmented reality system generates a composite view for the user that is the combination of the real scene viewed by the user and a virtual scene generated by the computer that augments the scene with additional information. The virtual scene

generated by the computer is designed to enhance the user's sensory perception of the virtual world they are seeing or interacting with. The goal of Augmented Reality is to create a system in which the user cannot tell the difference between the real world and the virtual augmentation of it. Today Augmented Reality is used in entertainment, military training, engineering design, robotics, manufacturing and other industries [18].

2. BACKGROUND

Technical Description is the key part of any technical discussion because it defines objects and processes. It breaks a complex item or topic into manageable components. It describes and illustrates the various elements contained in the whole object, process or concept.

2.1. A Inside a HoloLens : There's a whole bunch of other hardware that's designed to help the HoloLens effects feel believable [1].

Inside the Hololens
▸ 1.Camera
▸ 2.Computer
▸ 3.Lenses
▸ 4.Vent
▸ 5.Sensor
▸ 6.Buttons

Figure 2: Inside the HoloLens Headset[5]

2.1.1. Camera: the project HoloLens depth camera has a field of vision that spans 120 by 120 degree, so it can sense what your hands are doing even when they are nearly outstretched [3].

2.1.2. Computer: HoloLens is not just a visor connected to a computer, it is a computer on its own. HoloLens contain CPU, battery, GPU and first of its kind HPU (holographic processing unit). 18 sensors flood the brain of the device with terabyte of data every seconds.[3]

2.1.3. Lenses and Display: Microsoft HoloLens has two display. They are transparent so that wearer can see the real world behind virtual object.

2.1.4. Vent: the device is more powerful than a laptop but won't overheat- warm air flows to the sides, where it vents up and out.[4]

2.1.5. Sensor: Sensor track where the wearer is looking and adjust the display. Motion sensor detect wearers movement. The sensor can also see wearers hands, the hands are an input system: user can interact with whatever he sees by just touching it. Wearer also give gesture as input sensor enables the tracking of user movement.[5]

2.1.6. Buttons: On the right side buttons allow user to adjust the volume and to control the contrast of the hologram.[6]

2.2. How HoloLens works: The HoloLens projected screen moves as you move your head and you control apps either with voice commands or by using the equivalent of a mouse click - the air tap. You didn't have to worry about getting it in the right place or moving it at the right speed; as long as we make sure that our other fingers and thumb were out of the way, HoloLens got the gesture every time. The goggles will track your movements, watch your gaze and transform what you see by blasting light at your eyes.[6]

In HoloLens the holograms are responsive to you and the world around you. Microsoft HoloLens enables you to interact with content and information in the most natural ways possible. It is responsive to you in many ways: -

Gaze: Built-in Sensors let us use our gaze to move the cursor so you can select holograms. Turn your head and the cursor will follow.

Gesture: It uses simple gestures to open apps, select and size items, and drag and drop holograms in your world.

Voice: It uses voice commands to navigate, select, open, command, and control our apps. Speak directly to Crotona, who can help us complete tasks. The more she learns about us, the better she gets.[1]

3. FEATURES

3.1. Transform your world with holograms: We envisioned a world where technology could become more personal—where it could adapt to the natural ways we communicate, learn, and create. Where our digital lives would seamlessly connect with real life. The result is the world's most advanced holographic computing platform, enabled by Windows 10. For the first time ever.[19]
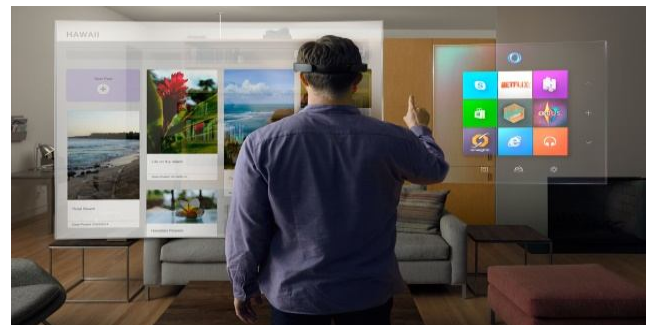

Figure 3: Transform your world with holograms[19]

Microsoft HoloLens brings high-definition holograms to life in your world, where they integrate with your physical places, spaces, and things. Holograms will improve the way you do things every day, and enable you to do things you've never done before.[19]

3.2. Empowering you to achieve more: Microsoft HoloLens puts you at the center of a world that blends holograms with reality. With the ability to design and shape holograms, you'll have a new medium to express your creativity, a more efficient way to teach and learn, and a more effective way to visualize your work and share ideas. [19]
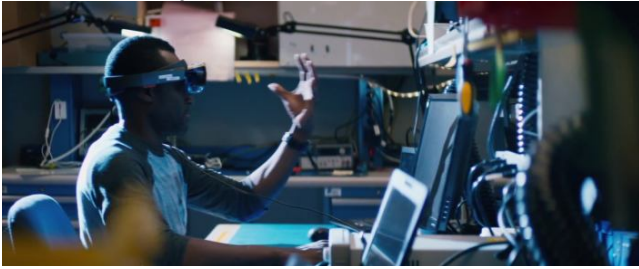
Figure 4: Empowering you to achieve more[19]

Your digital content and creations will be more relevant when they come to life in the world around you.[19]

3.3.   Go beyond the screen: As holograms, your digital content will be as real as physical objects in the room. For the first time, holograms will become practical tools of daily life. Shape holograms to fine-tune a design. Interact with them to learn something new. When you share your ideas, show and tell from multiple perspectives.[19]

Figure 5: Go beyond the screen[19]

Microsoft HoloLens enables you to make decisions more confidently, work more effectively, and bring your ideas to life right before your eyes.[19]

3.4.   A new reality: Microsoft HoloLens goes beyond augmented reality and virtual reality by enabling you to interact with three-dimensional holograms blended with your real world. Microsoft HoloLens is more than a simple heads-up display, and its transparency means you never lose sight of the world around you.[19]

Figure 8: A new reality[19]

High-definition holograms integrated with your real world will unlock all-new ways to create, communicate, work, and play[19]

3.5.   New ways to teach and learn: It's easier to show than to tell, so do both. With Microsoft HoloLens, friends and colleagues can help you with difficult tasks using Holo Notes in Skype.[4]
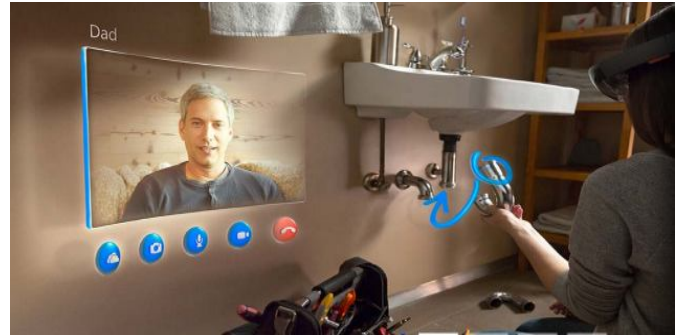

Figure 9: New ways to teach and learn[19]

3.6.   New ways to create what you imagine: See your imagination come to life as a hologram. Effortlessly create your own holograms and share them with others. Use holograms to visualize how something will look in the physical world whether it's a new piece of furniture in your home, a toy for your kids, or a new creation for work. [3]

Figure 10: New ways to create what you imagine[19]

HoloStudio will even let you turn your holograms into physical objects with 3D print compatibility.[6]

3.7.   Explore places you've never been: Scientists at NASA's Jet Propulsion Laboratory will soon be exploring Mars using holograms of Mars Rover images. They will work as if they can walk on the surface of Mars, an experience previously impossible. As a result, they will be able to learn at a faster pace than ever before. Go somewhere you've never been and get to know it from every angle. See holograms from your colleague's perspective if he's in the next room or on the other side of the world. Explore a new dimension that is grounded in, but not limited to, the physical world.[6]

Figure 11: Explore places you've never been[19]

4. APPLICATIONS

Digital Genomics is the most trending topic in the past few years. Some of the companies using this and are hugely successful are as follows:

4.1.   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.[20]

4.2. *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.[20]

4.3. *Gamification of Tasks:* We all need a little extra motivation at times when it comes to exercising. The HoloLens has the potential to turn such tasks into a game. Think how much more fun you'll have throwing jabs and hooks at a punching bag when your HoloLens is superimposing a boxer (or threatening mugger) over the bag. Or, imagine getting on your treadmill and replacing the world around you with interesting, interactive, scrolling scenery as you jog. By turning monotonous tasks into a game, HoloLens could make life much more exciting and help you build healthy, productive habits.[20]

4.4. ***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.[20]

4.5. *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![20]

4.6. *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.[2]
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.[2]

4.7. Virtual Reality User Interfaces: People spend a lot of money on the latest, biggest, clearest flat screen televisions. But with the HoloLens you could use a number of virtual screens of any size, saving you hundreds or thousands of dollars. You could[2] even watch movies or browse the internet through a virtual screen no matter what part of the house you're in (say, lying comfortably in bed). Physical screens and monitors may eventually become things of the past, as we transition to interfaces that exploit physical intuitions about the world and naturally fill the space around you.[2]

4.8. *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.These are just a few of the uses I can see coming for Microsoft's new HoloLens headset. As with many new smart devices, the potential is enormous. But it will be up to developers and intrepid consumers to try it out and see if it lives up the hype.[2]

5. CONCLUSION

Holographic computing experiences with Microsoft HoloLens are different from existing experiences, such as augmented reality (AR) and virtual reality (VR). HoloLens looks incredibly exciting, but what we've seen so far is a glimpse into the future. The team is working with creators and developers all over the world on exciting new holographic experiences. Holograms are the next evolution in computing[5]

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