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Microdisplays For Next-Generation Computing



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Photo: GETTY

I see a wave coming -- a new platform that will likely change the way we communicate and even react and behave toward one another.

Forget laptops, tablets, phones or smartwatches. Say goodbye to keyboards and mice, and say hello to a bold new breed of wearables that will interpret eye blinks, voice commands and hand gestures. A tiny camera will follow your fingertips and body movements, letting you move images and text around like those depicted in *Ready Player One*. We may even go farther than the virtual reality (VR) depicted in *The Matrix*.

AR/VR: Evolutionary and revolutionary

The AR/VR hype is over. As a board member and chair of marketing for the Society for Information Display (SID), I've witnessed several serious players develop useful apps over the past year that make these devices valuable.

We are at the tip of the iceberg in terms of market potential. Augmented reality (AR) and VR headsets will grow leaps and bounds in the next decade. We've already seen major breakthroughs in size, weight and performance. Microdisplays, optical engines and haptic feedback gloves will be key drivers in this arena.

Innovative new headsets revealed at CES and other venues have sparked interest in "super-smart" eyewear. These wearable computers will offer eye-opening functionalities, allowing the wearer to interact with smartphones, health-tracking options and many other features. The new devices will be supported by a growing ecosystem of components.

Google spearheading tomorrow's tech

Google is making a headlong rush to bring the 22nd century to phones and other portable devices. Its next generation of "assistants" will bring the power of AI to your portable device. Imagine an assistant that can understand and process your verbal request in real time, delivering answers up to 10 times faster. The voice-enabled assistant is fully customized to the way you live, work and even drive your car.

In facial recognition, devices now recognize, greet and provide information unique to you. They can even recognize hand movements to turn music on or off or lower the volume.

GPS-enabled maps are now so smart that instead of depicting your walk via a dot on a screen, you'll see a street-level photo with arrows showing you where to go. The only thing better would be Star Trek's Data walking alongside you.

Big players diving in with new wearables

Microdisplays have taken center stage. Global tech giants are committing major resources in time and money, "moving the goal post" to boost performance and driving the technology in bold new directions. Newcomers are making surprising new strikes, challenging legacy technologies.

In the VR headset arena, the technology continues to expand, thanks to enabling technologies and eye-opening new developments in components. VR will soon become a go-to technology in personal computing. In fact, my survey of over 100 industry professionals who work for the key OEMs, chip and display suppliers shows the market will grow from 500,000 units in 2019 to 50 million units in 2024.

Additional data points:

- **15 million VR headsets** were estimated to ship in 2019.
- IDC estimated that number was closer to **8.9 million**.
- Statista's estimates were much larger at **34.83 million units**.

I believe microdisplay tech will slingshot the demand for an increasing variety of near-eye displays and other wearables and that the global market for microdisplays will reach 50 million units by 2024. This includes AR/VR systems, smart glasses, helmet-mounted displays (HMDs) and head-up displays (HUDs) -- virtually every app where high-resolution is needed.

As I look around, I see wearable sensors and innovative user interfaces making big tech gains. The same holds true for near-eye displays, optics and energy storage devices. All continue to evolve in performance and acceptance. That said, I'm convinced some improvements will have to occur before consumers accept this tech on a broad scale. Components need to shrink, and power efficiencies must rise to allow for longer playtimes before recharging. In addition, components will need to be "ruggedized" to work in diverse environments.

I also predict that widespread market acceptance of this tech will be tightly tethered to costs, which must come down. But thanks to industry MVPs like Google, Apple, Microsoft and Facebook, their big investments will drive down costs. Other players doing some of the heavy lifting include eMagin, Kopin, Sony, Olightek, and Himax. There's also a huge micro OLED interest in China. These heavy hitters, as well as some hot newcomers, will help find the cost-

performance sweet spot to fulfill the vision of AR/VR as the next-generation computing platform for business and entertainment.

Top Gun military apps

I believe high-performance microOLEDs for AR HMDs are a must for today's military pilots. In fact, some of the best HMDs today are for military applications. One example is the \$400,000 mixed reality (MR) helmet from Collins Aerospace. Designed for pilots flying the new F-35 aircraft from Lockheed Martin, this MR helmet is nothing short of visionary.

Key players in this fast-growing industry -- Rockwell Collins, Elbit and Lockheed Martin -- are continually leapfrogging each other to boost performance. Military applications place a high premium on brightness and contrast for see-through AR HUDs. In many situations, AR information must compete with the high-ambient light of the outside world, especially in daylight.

Here's a rundown of three microdisplay technologies:

- Micro OLED displays: Ultra-thin, with high brightness and contrast, micro OLEDs will impact VR, military, industrial, medical and smartglass applications.
- LCoS displays: Inexpensive to produce. Delivers ultra-high brightness and design familiarity. Lack the speed needed for AR.
- MicroLED displays: Still in their infancy; unlike LCoS, micro LEDs need no separate backlighting to deliver darker blacks and brighter whites. But micro LEDs for microdisplays are a long way off.

Conclusion

Microdisplays will change our perception of AR/VR, HUDs and HMDs. Imagine being free of keyboards, mice and the need to fill our pockets with tech devices. All of our information and entertainment needs may soon be presented to us by the utterance of a word or the glance of an eye.

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