The New World of 3D Displays

By Sri Peruvemba

It's possible you haven't heard yet, but 3D is back as a trend and most consumer electronics companies, designers, game creators, and movie studios are involved in making it happen. This time it works without glasses, and the effects are vastly superior to previous attempts. We're not talking about VR/AR/MR which is growing quite well, but 3 dimensional images on phones, laptops, large area signage, and other types of direct view displays.

With new 3D display technologies, we're seeing increased realism, no discomfort, and growing market pull as the world begins to see the possibilities. The market is growing both for hardware and software, although growth in hardware has lagged a bit due to prior false starts. Looking ahead, the newest trends impact every display technology, and multiple market research firms are forecasting growth of over 15% this year with even higher growth rates going forward.

Approaches to 3D

3D technology is entering the market based on a couple of different approaches.

Introduced at CES, the first laptop with 3D uses an autostereoscopic spatial 3D OLED display with a lenticular lens film integrated into the panel that splits an image into two (one for each eye). Two infrared web cameras then track each eye's movements in real time to present 3D images. With this particular laptop, users can even manipulate virtual objects.

A couple of different companies are using this camera-tracking approach. The upside is this technology is maturing rapidly and has practical applications. The downside is that such technology can only track one person's eyes at a time, so it's not viable for TVs or other multiple viewer applications.

To enable multiple viewers to experience 3D together, another approach uses 3D light field displays. This technology uses a lenticular filter to split an image into 45-100 vertical segments so viewers can perceive depth and movement as they view an image from different perspectives. This technology is shipping on a 65-inch LCD screen that projects the

perception of depth up to one foot backward and forward from the display, a distance that is expected to increase with continued developments.

Looking at these highly-immersive 3D displays, it's clear that as technology continues to advance, it has the potential to transform numerous applications.

A Straightforward Transition

Today's 3D technologies can work easily with any existing display type, whether it's LCD, OLED or emerging technology like microLED. All that's needed is one new film added to the others that already comprise the displays. The lenticular film adds very little weight, thickness, or cost (relative to the rest of the BOM), and it can be added with existing manufacturing processes. Because of this, today's 2D display factories can easily transition to 3D displays. Factories, production lines, materials, and processes for current display technologies can all be maintained as-is.

Beyond displays, the core area of 3D development is the software algorithms needed to transform images from 2D to 3D. These algorithms are continuing to get better and better through the work of a growing community of developers, both inside large OEMs and startups, and freelancers worldwide.

A challenge for the semiconductor industry is that many 3D displays will require additional processing horsepower to handle new conversion algorithms. This is especially true for live conversion needed for applications like video conferencing on a 3D display. Regardless of the application, the industry will need to deliver more performance at the lowest possible power consumption.

We haven't yet seen the 100" high-definition 3D displays needed to transform many industries, but the technology exists. HD displays are used only where the application demands it, and today that is generally on phones which can be as high as 400 pixels per inch (PPI). TVs are generally viewed from far away, so they are typically around 150ppi. There is no technical reason we can't deliver high definition large screens though, so as display makers start to see widespread demand, they will deliver them.

This increasing demand can breathe new life into the display industry. 3D offers display makers an incredible opportunity to differentiate. In saturated markets like Europe and North America where TVs had seen declining demand, I predict that current TVs will be replaced by newer 3D-ready TVs. Some entrepreneurs may even try to retrofit existing TVs for cost-conscious customers.

Rollout of 3D Across Industries

One of the first places we will see 3D take off is enterprise applications like modeling, design and engineering. In industries like automotive, designers already use simulated 3D modeling on 2D screens. 3D displays will make their product ideas come to life with true isometric depth. The need to create physical 3D models of cars or buildings with soft wood or clay will be a thing of the past, or relegated to children's toys.

Likewise, 3D is a logical next step for training and simulations in areas like aviation and medicine. Flight simulations and surgical simulations can be much more realistic, eliminating the need for bulky headsets or expensive airplanes or actual medical equipment.

Marketing is another prime opportunity. With 3D light field displays, customers can view a product from all angles without actually handling the physical item. In retail environments and tradeshows, companies won't need to pay for huge spaces to showcase numerous products; in a single display they can show models that closely resemble the real thing. Imagine viewing the newest shoe or piece of jewelry from all sides on a 3D display, rather than gazing at a static item through a glass showcase.

The largest opportunity for 3D is entertainment including gaming. Content development is a challenge, but developers are already working on films and games to satisfy the market. More and more films today are captured with depth cameras, making them ideal for 3D displays, and most games are rendered in 3D. All these films and games are viewed on 2D screens today. With 3D displays, movie makers and game developers can showcase content in the best possible light field (pun intended).

As consumers, today we can already use the latest smartphones to take pictures with depth capture, and the depth map of such images can be converted to limited 3D models. Many developers are creating 3D content using multiple cameras to capture images from different angles, which are then assembled by algorithms into more realistic 3D images.

Whether it's videoconferencing or the metaverse, there are many other areas where 3D presents a huge opportunity for companies and consumers. With increasing pull coming from a variety of markets and the speed at which technology is progressing, it won't be long before we can experience the digital world in a way that feels very much like the real world, with no glasses required.

Holographic displays, software algorithms and glasses-free 3D are just some of the hundreds of display related technologies you can learn about at Display Week 2023, being held in Los Angeles May 21 - May 26th. Visit the website to see the program: www.displayweek.org.