Even in photographs the image appears to be 3D

TOUCHING THE FUTURE

Glasses-free 3D screens and images which appear to float in mid-air are nothing new, but five tech titans now have an image beamed into the air itself by Japan's Touchless Aerial Display PoS – the first cash register of its kind worldwide.

By Caroline Reid and Christian Sylt.

Few features of sci-fi films are as common as holograms. For decades we have watched visions of a future where images pop up out of nowhere to inform passers-by where to go or what to do. They are almost as common a cliché as flying cars but whilst airborne vehicles are beginning to fly off production lines you would be hard pressed to find a hologram in public. Until now.

Unsurprisingly, the Japanese are leading the way in this field but they aren't doing so in order to replicate their favourite films. Instead it has been driven by necessity.

Since the onset of the pandemic, a phobia of touching surfaces has swept across Japan. It is still common to see hand sanitiser dispensers standing next to cash machines and piles of plastic gloves alongside the utensils in restaurant buffets.

There is such a stigma about high traffic touch points that bricks and mortar businesses are at risk of decline in favour of their online counterparts. It spurred a group of retail and tech giants to take action and their solution brings us one step closer to a sci-fi future.

From the outside, the 7-Eleven Kojimachi in Tokyo looks like every other Japanese convenience store. Its shelves are packed with colourful produce and the walls are adorned with posters of cute characters promoting the latest offers. However, when you come to pay, something important seems to be missing.

There's a bar code scanner and a card reader but no touch screen to select options and find out how much the items cost. It even lacks an LCD readout telling you how to pay. Instead, customers seem to peer into thin air above the till area before prodding at nothingness and walking off with their shopping. Security doesn't stop them, so what's going on?

It all becomes clear when you approach the till area as a screen suddenly materialises in the air above the bar code scanner as if by magic. Just like a physical touch screen, the buttons can be pushed by pointing your finger in the spot where they are floating. It is thanks to some technical wizardry.

The problem with flatness

Glasses-free 3D screens and images which appear to float in mid-air are nothing new. They have been common in theme parks and theatre for decades and are usually created by a technique called Pepper's Ghost which dates back to 1862. This involves a brightly-lit hidden image being reflected on to a pane of glass seen by the audience in a dark room. The viewer can't see the glass so the reflection on it appears to float in mid-air.

> *"With the spread of Covid-19, people have been forced to live with inconvenience in terms of touching things ."*
> **Asukanet**

However, the illusion is shattered in photographs as Pepper's Ghost and images on 3D screens appear to be flat. The Japanese convenience store system, known as a Touchless Aerial Display Point Of Sale (PoS) Register, doesn't share that problem as the image even appears to be floating in photos. That alone is evidence that there is more than meets the eye to this system. It is the first cash register of its kind worldwide and it was the product of five tech titans.

At the heart of it is the ASKA3D plate from imaging giant, Asukanet. A glass or resin panel creates an effect like Pepper's Ghost when an image is projected through it. The difference is that it isn't being beamed on to glass. Instead the image appears in mid-air the same distance from the panel as the LCD monitor is from it on the other side.

Mitsui Chemicals leads the project and makes the Structbond sealant which holds the ASKA3D plate together without compromising its transparency. Electronics specialist, Kanda Kogyo makes the touchless aerial display module and Toshiba Tec creates and installs the rest of the cash register. They came together to solve a global problem.

"With the spread of Covid-19, people have been forced to live with inconvenience in terms of touching things," says a spokesperson for Asukanet. "The development of the product began with the idea that the introduction of the aerial display solution could alleviate some of their concerns."

Five engineers from Mitsui Chemicals worked on the project with another eight from Asukanet and

two from Kanda Kogyo. The spokesperson says it took them "about one and a half years from the conception to the actual store implementation. We were able to reach the point of testing in actual stores at a very fast pace."

The bulk of the R&D work had already been done on the ASKA3D plate as Mitsui Chemicals explains. "There are some special techniques in the manufacturing process of the 3D plate to produce its super fine and complicated structure. It took more than five years to develop the manufacturing process method and condition, including the development of the equipment for the process."

A processor at the heart of the system connects to a monitor which projects on to the ASKA 3D plate to create the aerial image. An infra red sensor bar below it tracks the position of customers' hands and feeds that information back to the processor via a USB interface.

Asukanet won't divulge the magic formula for creating the aerial images but says that "light emitted from a source under the ASKA3D Plate forms an image in mid-air, and the system allows the user to interactively manipulate the image surface." A spokesperson for Kanda Kogyo adds that "when an object is placed in the IR sensor area, infra red rays are reflected and detect the position."

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Optimising the image quality was the biggest challenge which is why the system went on trial at six 7-Eleven stores from February last year. It paid off as the Kanda Kogyo spokesperson says that it led to the system being "considerably improved, but this process is still ongoing for further improvement."

The next step is to use haptic technology to give customers the same kind of tactile experience they get with a physical touchscreen. Asukanet says that "while we have provided value in the form of contactless and space saving, we believe that we can provide a variety of value in the future according to the needs of our customers. For example, we believe that there are infinite ways to improve the value of the customer experience by providing a user interface that is more suited to the aerial display solutions, or by adding the sensation of touch using haptics technology."

Elsewhere in Japan, AI is used in PoS systems to identify and tally loose items on a conveyor belt which even eliminates the need to scan them in.

Although the aerial display can only currently be found in Japan, Mitsui Chemicals says it is planning a wider roll-out. "We plan to launch the system internationally. We will use the Japanese market as a reference to expand overseas. We believe that if there are many markets where the device is necessary, the introduction will grow dramatically." If that goes to plan, the world of sci-fi films could look a lot more like sci-fact. ■

The 3D images generated by the aerial Point Of Sale system can even be seen in photographs