Mixed Reality at LifeArc:

Expanding mixed reality technology to augment laboratory-based research

How LifeArc are building from their expertise in virtual reality technology to completely transform the way scientists work within their laboratories

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The Laboratory of the Future

Information available at your fingertips	Effortless data flow in and out of the lab	Easy collaboration, even remotely	Sophisticated new robotics/ technologies	Remote repairs or advice for machinery	Scientists who are empowered and enabled

The Solution

Potential solutions investigated included:

1. Projectors, smart screens and interactive glass
2. Radio-frequency Identification (RFID) labels
3. Barcodes
4. Image recognition
5. Voice assistants
6. **Augmented reality headsets**

Market Research

We wanted to find an AR wearable device which conformed to laboratory safety regulations, was functional, adaptable, and affordable. We trialed two different devices in our laboratories.

***Table 1**: Potential solutions were analysed and compared using a decision matrix, wherein each device was given a colour rating based on the four features assessed: functionality, connectivity, portability/wearability, and price. The top two options, the Vuzix Blade and the Microsoft HoloLens 2, are shown; however, a total of 15 devices were researched.*

Name	Functionality	Connectivity	Portability	Price
Vuzix Blade Upgraded	Vuzix voice control, touchpad, camera, built-in speakers, transparent Waveguide display, ANSI Z87.1 (safety) certified, prescription lenses available, 8GB storage, 1GB RAM.	Bluetooth 4.1, 2.4 GHz WiFi, micro-USB, microSD, companion app, Vuzix app store (Zoom, Alexa, Document Viewer, - no Teams yet)	Untethered, micro-USB charging, 470 mAh, 3350 mAh power bank available, 90g	£900 + prescription lenses cost
HoloLens 2	Eye and gesture track, voice control, camera, built in speakers, Windows Hello, 4GB DRAM, 64GB storage	Windows Mixed Reality, app development, Microsoft Edge, WiFi 5, Bluetooth	Untethered, USB PD for charging, 2-3 hours lithium battery, USB type-C, 566g	£3349.00

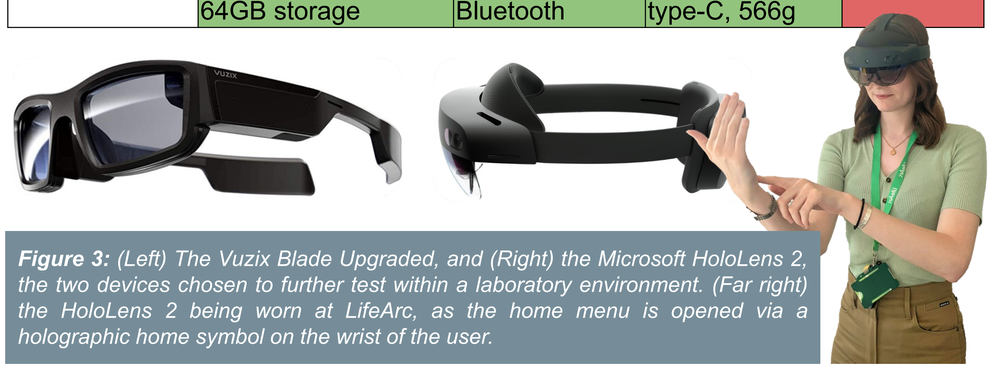

***Figure 3:** (Left) The Vuzix Blade Upgraded, and (Right) the Microsoft HoloLens 2, the two devices chosen to further test within a laboratory environment. (Far right) the HoloLens 2 being worn at LifeArc, as the home menu is opened via a holographic home symbol on the wrist of the user.*

Reflection

Virtual reality is already well established as a computational tool within scientific research, and its sister technology augmented reality looks set to transform laboratory research. This pilot study has given strong evidence of how needed this technology is - particularly in a climate in which collaboration is severely impeded - and has paved the way for future solutions that may appear on the commercial marketplace within the next few years.

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Virtual Reality vs. Augmented Reality

LifeArc are experts regarding the use of virtual reality (VR), a fully **immersive experience** based in artificial 3D environments. At LifeArc, these virtual environments are used to host meetings, discuss and visualise chemical or biological data, and conceptualise information in an intuitive way not afforded by other tools.

Augmented reality (AR) allows for the user to be **completely aware** of the real-world environment around them. Instead, this environment is enhanced by overlaid visual or audio information. AR is suitable for use in laboratory environments.

***Figure 1**: Clockwise from top left; Oculus Quest 2, HTC VIVE Pro 2, a demonstration of Virtualitics for the visualisation of data, and a screenshot of Nanome used for immersive molecular modelling.*

***Figure 2**: Clockwise from top left; Smartphone with AR application Pokemon Go, Magic Leap One, and two illustrative photographs of AR being used in manufacturing and surgical applications, from Microsoft.*

VR is a well-established field, especially within the gaming industry or for simulated training programs, with VR devices such as those seen above available from as little as £299.

Although a newer field, AR is set to take off across countless industries, with technology giants such as Apple, Google, and Microsoft all actively developing hardware.

Testing and Feedback

In the laboratory the devices were used for tours, project updates, and meetings. Outside of the laboratory, virtual workshops were hosted, and the HoloLens 2 was used for a collaborative whiteboarding session.

Positives:

- The Vuzix Blade is safety certified.
- Both devices are wireless and easy to wear, though the Blade is lighter.
- Both devices showed immense potential for collaboration: audio and visual were clear, though the HoloLens 2 was favoured as Teams could be used.
- HoloLens 2 offered a better viewing experience of documents with access to files via SharePoint.

Negatives:

- The Blade did not offer a convenient way to view documents/files, although the device is developer friendly.
- HoloLens is expensive and not yet an option for company-wide distribution.
- Cultural change to be made before the tool is widely accepted and used.

! Sophisticated technologies such as continuous flow chemistry often require additional training and servicing: AR allows for both of these things to be done remotely. Also, some lab machines are capable of network integration, a capability that AR can truly make use of.

***Figure 4**: (Left) The Vuzix Blade Upgraded remote collaboration capabilities demonstration using the Vuzix Remote Assist application, with potential screen sharing. (Middle) A LifeArc scientist uses the Microsoft HoloLens and Teams to discuss a recent experiment. (Right) The VapourTec R-Series continuous flow reactor, just one example of how AR technology can help truly exploit the potential of other laboratory technologies.*