# DESIGN **RESEARCH**

## Design Brief

PROBLEM Customers cannot predict the type of business they are doing one month from now. Makino produce long lasting tools for a single purpose that cannot be upgrade or changed. The time to make this change is running out. Customers will begin to reject this traditional type of business.

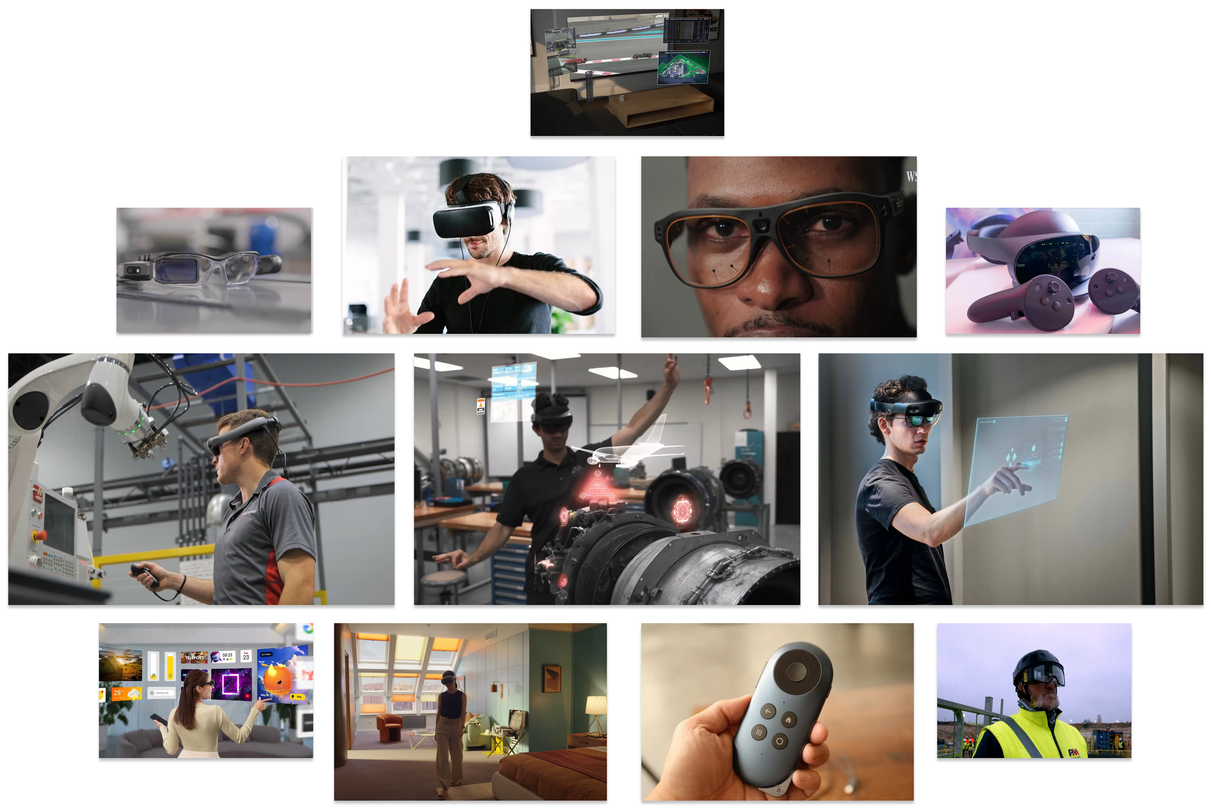
SOLUTION Unlimited configurations, one machining system.

OUR TASK Think about how the operator controls and monitors the future machines and production system.
How will the current machine controller look in 20 years time?
Design the solution using this brief and come up with a new and innovative concept.

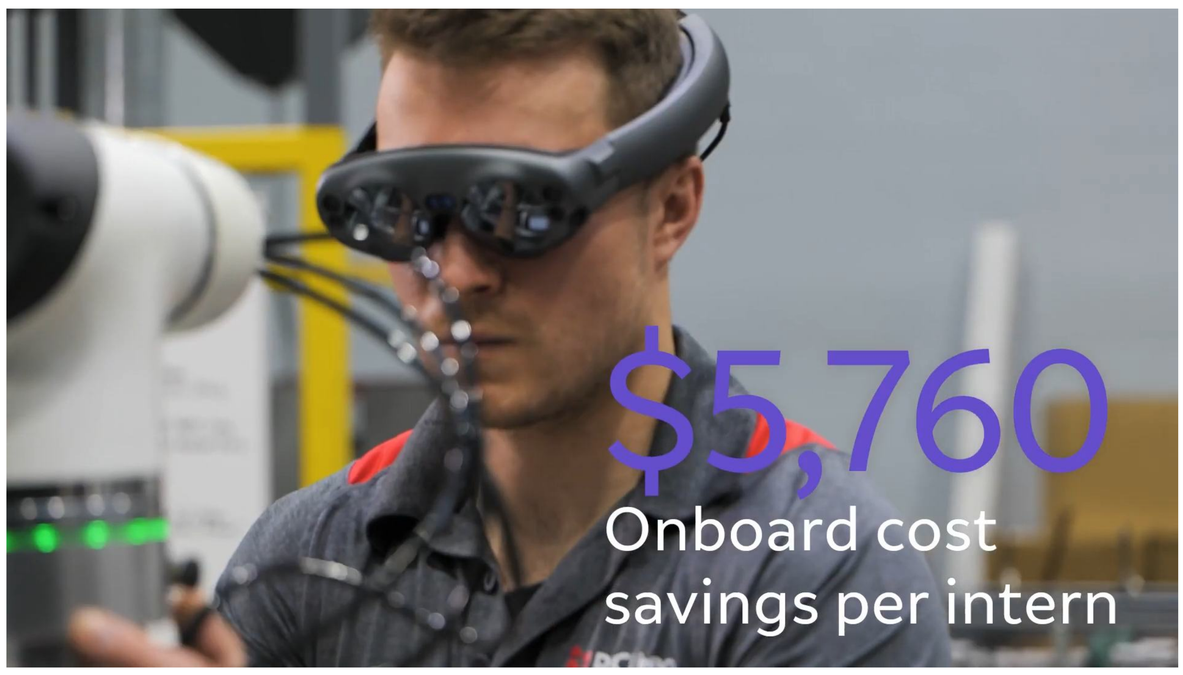
## Exploration

On receiving the design brief for the project, I researched a variety of methods in which I could provide a solution, many of which incorporated the utilisation of eye-tracking software and gesture control technologies. This ultimately led me to explore the use of augmented reality(AR) and virtual reality(VR) headsets in industrial settings.

This solution appeared to be the most effective for several reasons. Firstly, AR headsets occupy minimal space by converting physical displays into digital displays in the user's field of view, reducing manufacturing costs. Additionally, AR headsets significantly reduce the training time required for new employees,  providing an advantage for Makino by enhancing efficiency and productivity.



## Further Research




I then conducted further research into existing solutions for this task, developing on the weaknesses of what was already available. Magic Leap is a company which specialises in creating high fidelity AR headsets primarily for mainly industrial applications. Their AR headsets can be used to quickly train interns and new employees, through playing a tutorial-based training tools that not only reduce costs by eliminating the need for experienced machinists to provide training but also expediting the learning process. Adopting a smilar approach would enable Makino to enhance its brand by enriching the onboarding and induction process for new employees, whilst simultaneouly boosting the overall workplace productivity through greater time efficiency.

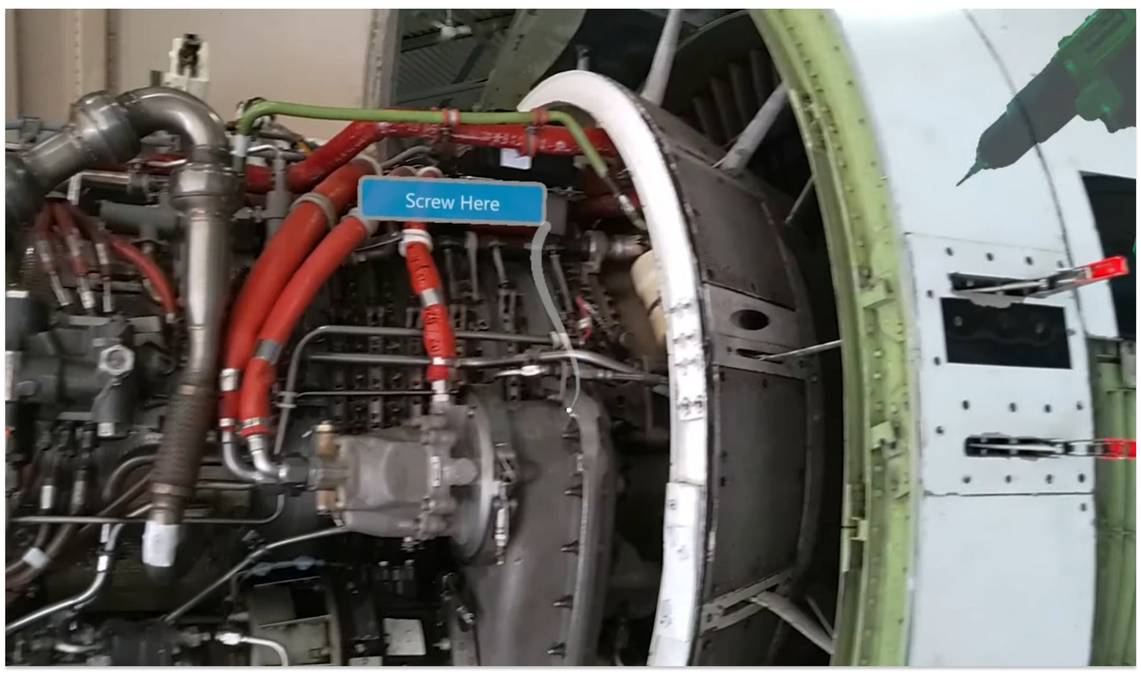
Tim LeCrone @ Magic Leap

*"73% Reduction in training time"*

Whilst researching, I also came across another company, OVA, which highlighted an additional benefit of using AR headsets - remote diagnostics and maintenance. AR headsets allow technicians to provide real-time support and guidance without being physically present. This not only reduces downtime, but also lowers costs associated with on-site visits. By leveraging this technology, Makino can improve its maintenance processes and once again improve its overall efficiency.

TeamSense

*"The average manufacturer faces 800 hours of unplanned machine maintenance and downtime a year"*




 NATHAN JESANI-LEE CHRISTOPHER-JADON AWOMOLO

# DESIGN **DEVELOPMENT**

INFINITY
Change Your Perspective

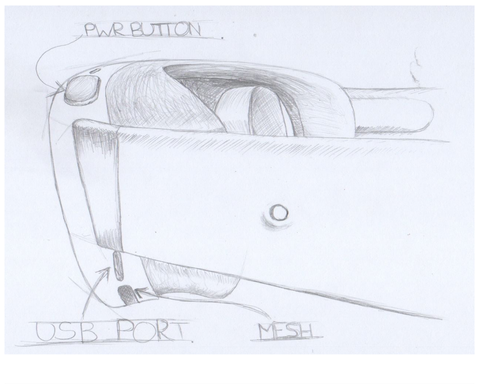
## AR Headset Design

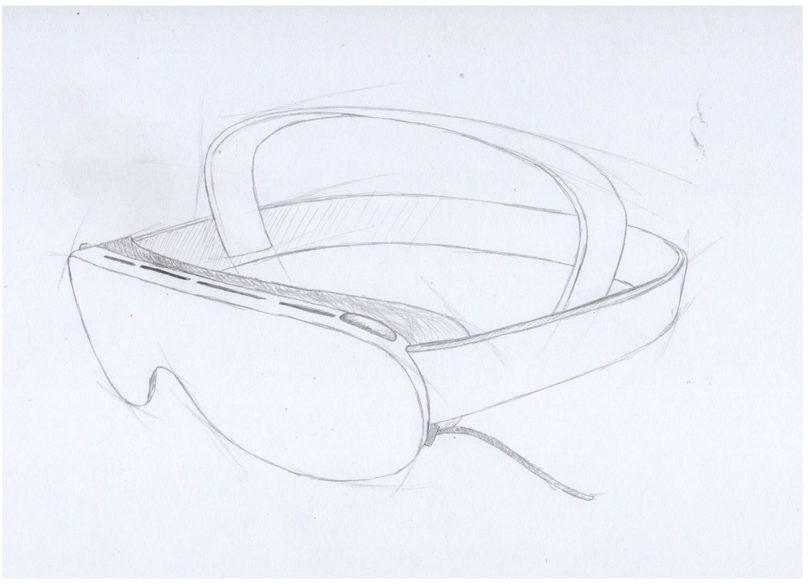
My AR headset drew inspiration from the Bigscreen Beyond and the Apple Vision Pro, fusing the compactness of the Bigscreen Beyond with the sleek, minimalist design of the Vision Pro. I also used mesh materials and fabric to enhance airflow and reduce heat retention, improving user comfort during extended use.

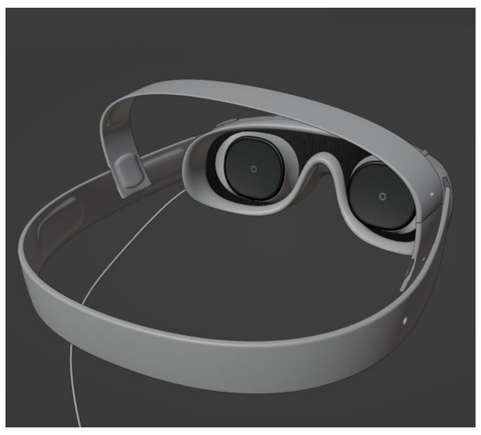
Having this, I sketched a base design of the AR headset, as well as a close-up of one of the sides of the headset.

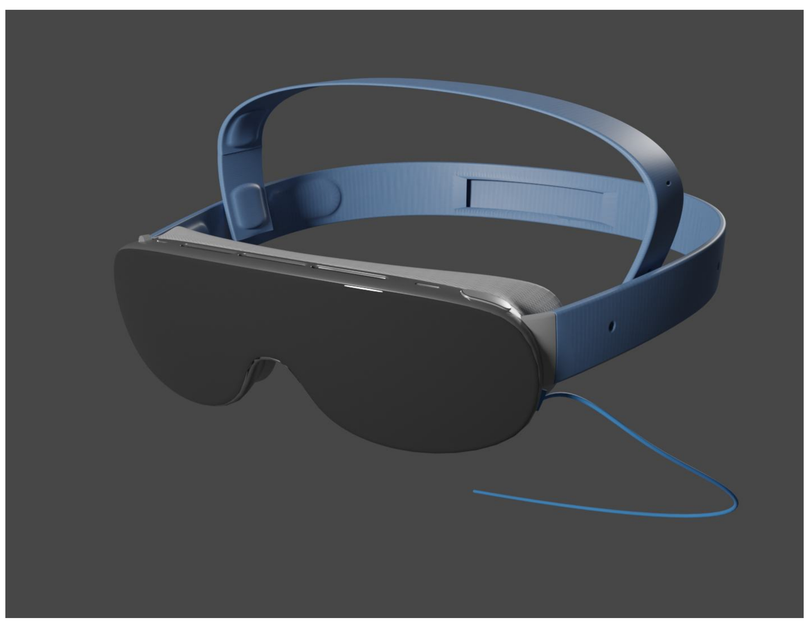
When researching, I found that most VR and AR headsets had connectivity issues, and therefore I decided to address this by including two USB-C ports - one for display and one for charging or connecting to a machine controller.

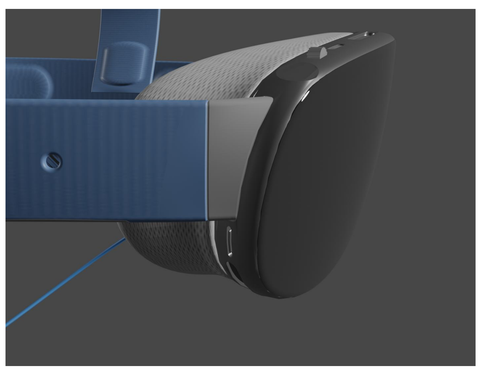
Additionally, the headset features adjustable interpupillary distance (IPD) to accommodate a wider range of users and a physical immersion slider to fine-tune the level of sensory immersion, ensuring that the user's senses are not completely hindered.









## Machine Controller Design

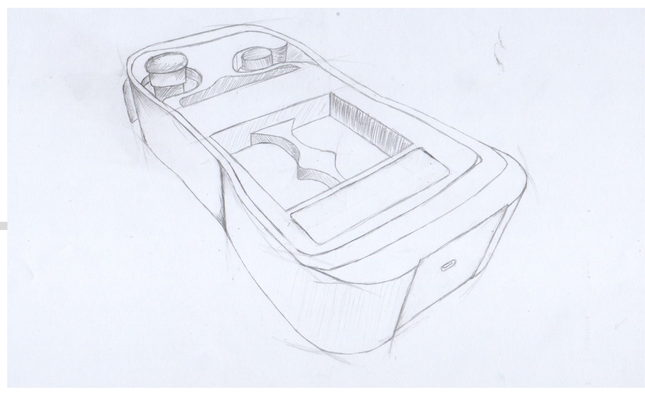
Inspired by the Rokid Station controller, I initially designed a small, round controller with three buttons (confirm, back, emergency stop) and a joystick. However, feedback indicated that my design, like the Rokid Station, was more suited to consumer use than industrial use. Therefore, I decided to rethink the design of the controller and redirected my focus to industrial controllers.

I researched existing machine controllers, noting their rugged edges and irregular yet ergonomic shapes. This analysis led to a base sketch of the machine controller featuring a simple start and emergency stop button.

With the basic shape established, I used Photoshop to ideate the placement of different buttons, considering their advantages in industrial settings. This proved to be very effective as it allowed me to visualise different configurations and optimizing the controllers layout.

Following this, I created a 3D model of the controller in Blender, considering the placement and functionality of each button. During the process, I realised the need for a joystick for the controller, which I incorporated into the final design. This change had several aftereffects, including the lack of space for the company logo on the controller. However, I decided to proceed with this design as it was a minor issue in comparison to the improvement of the overall design.

Initial Design for Controller



Base Sketch for Controller

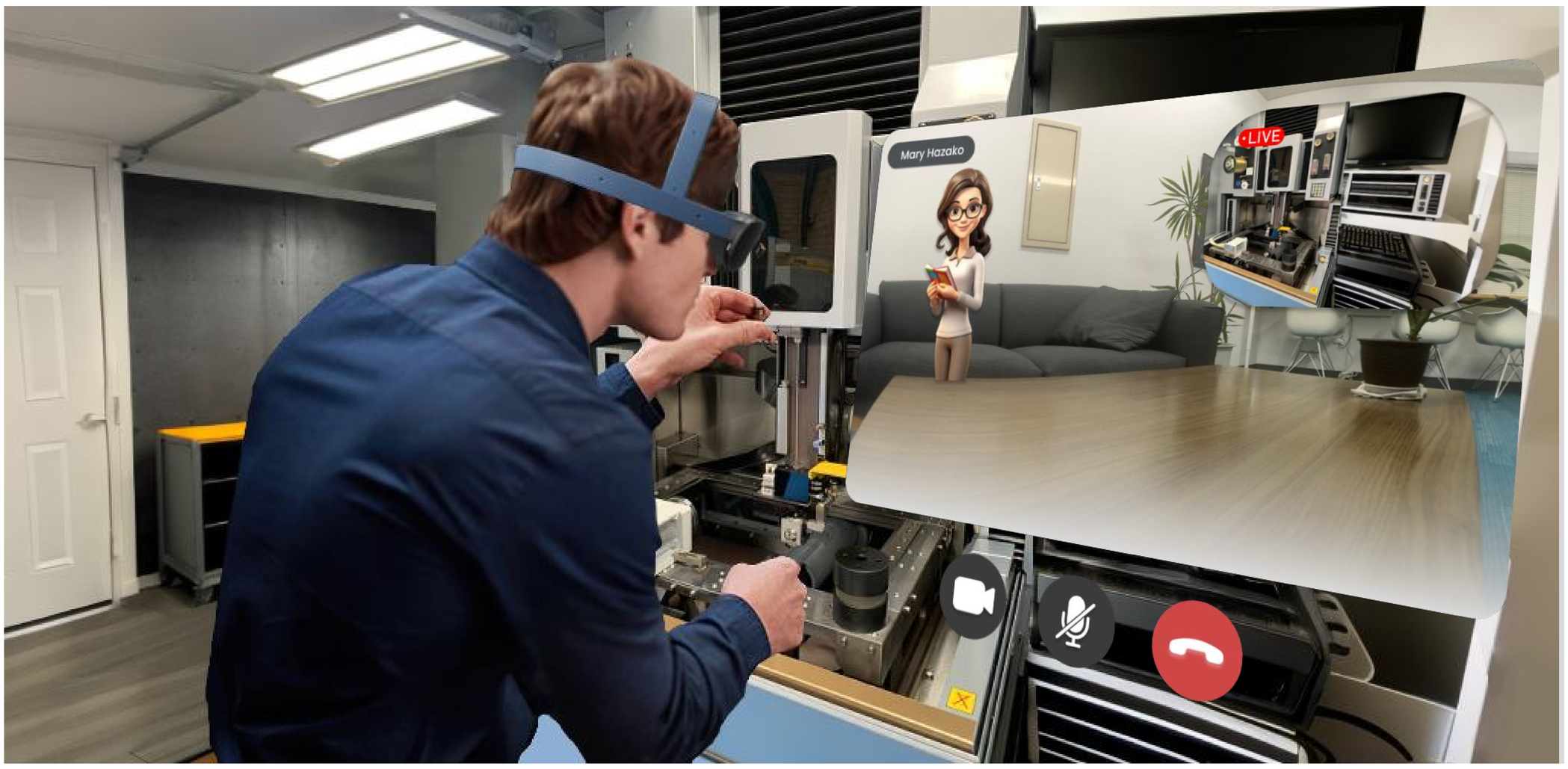

TALENT MATCH GLOBAL

# DESIGN **CONCEPT**



The final version of the controller was modified to accommodate the moving joystick, allowing for a more dynamic selection of elements, with the placement of the select and back buttons near the joystick for a more intuitive experience. Additionally, the buttons were made modular to enhance functionality and customisation, making the controller suitable for both left-handed and right handed users. *(See appendices)*


The AR Headset can also be used to serve as an extension of existing machines, displaying relevant information to the user. This allows for real-time data-visualisation, enhancing operational efficiency and decision making.




The controller can also be used to assist with remote diagnostics, reducing the time it takes to solve issues by eliminating the need for on-site technicians. Additionally, the implementation of gesture controls instead of a physical controller could enhance efficiency, particularly in space-constrained environments.

 NATHAN JESANI-LEE CHRISTOPHER-JADON AWOMOLO

# RESEARCH **BIBLIOGRAPHY**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Augmented Reality for aircraft maintenance, remote support and training
https://www.youtube.com/watch?v=whgnEf7Rf00


## Terms

### Augmented Reality/Virual Reality
an interactive experience that combines the real world and computer-generated 3D content

### Magic Leap
An American AR headset company
https://www.youtube.com/watch?v=uR_XOiakAME

### OVA
https://www.youtube.com/watch?v=O7dXn9u2WEc

### Bigscreen Beyond
A VR headset developed by Bigscreen, noted as "the worlds smallest VR headset"

### Apple Vision Pro
An AR headset developed by Apple

### Interpupillary Distance
The distance in millimeters between the centers of each pupil

### Rokid Station
A portable controller made for Rokid's augmented reality glasses

### Blender
A free and open-source 3D computer graphics software tool set

### Photoshop
A raster graphics editor

# RESEARCH **APPENDICES**