AUTOSPACE

# Augmented Reality for Automobile Repair

AN IMMERSIVE  DESIGN FOR AUTOMOBILE MAINTENANCE

GROUP B4

# MEET THE TEAM

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# Our Design Process

EMPATHISE → DEFINE → IDEATE → PROTOTYPE → TEST

THE PROBLEM

# 3 of 4

## Car Owners in the UK

cannot carry out basic maintenance for their personal automobiles (Bradley, 2022)

# $912.88 Billion

## Global Market Share

for the automotive repair and servicing industry worldwide in 2023 (2023)

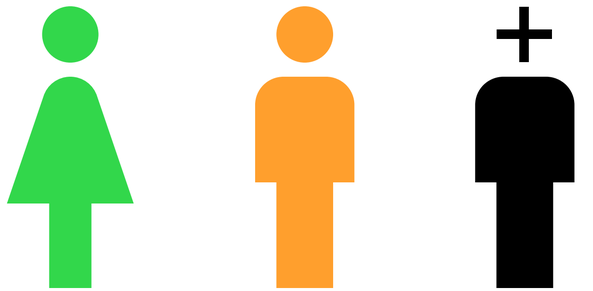
# 96%

## Human Error Correction

in work processes that use AR wearable devices in the Auto Industry (Vasavi, 2023)

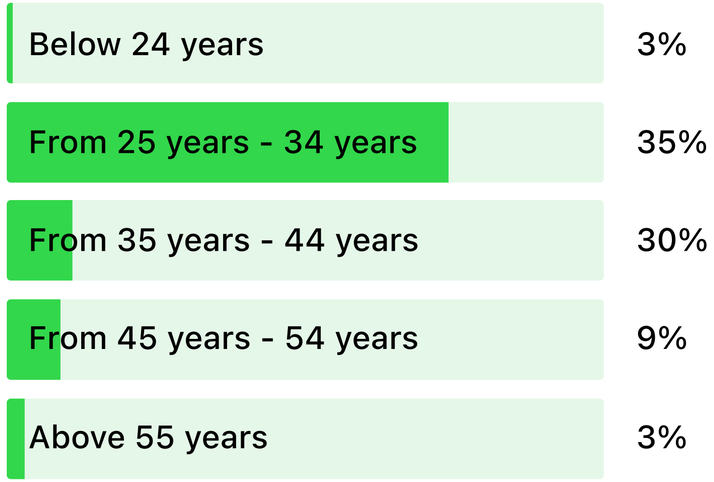
# Demographics

## Gender

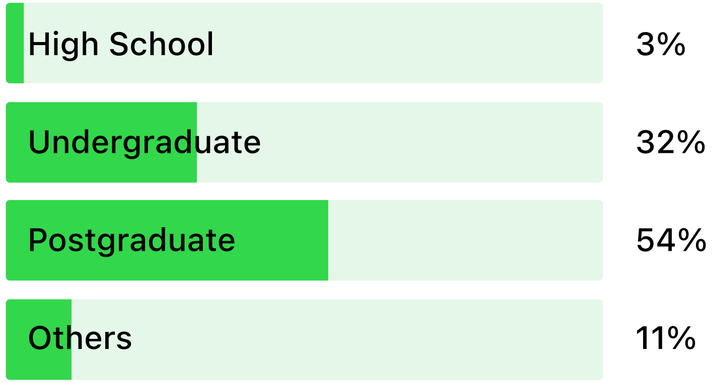


25% 70% 5%

## Age Range




## Level of Education




## No. of Responses Per Survey Type:

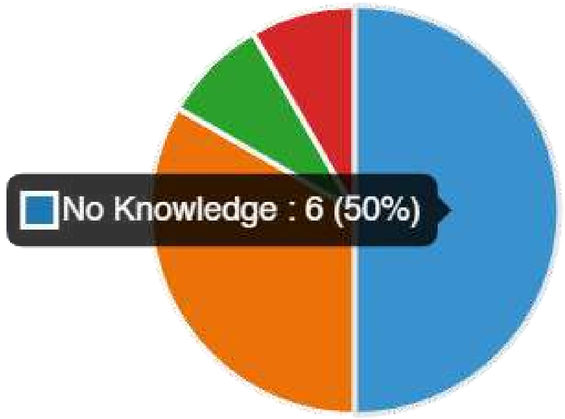
| 20 | 11 | 7 | 2 |
|---|---|---|---|
| Responses | Responses | Responses | Responses |
| Car Owners | Trainee | Trainers | No Car |

# Interviews & Surveys

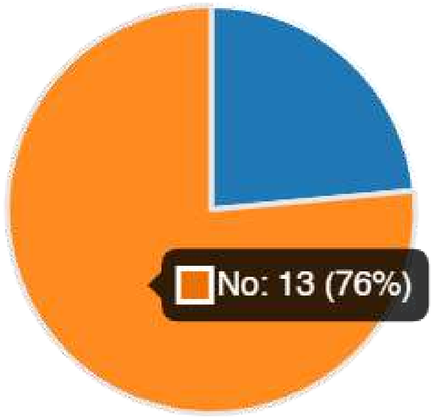
The focus was creating a solution to help car owners troubleshoot their personal cars and help automobile engineering trainees learn how to repair cars, improve their learning experience in automotive training and evolve with future trends.

**Have you ever used any immersive technology before? (AR/VR)**

- No Knowledge
- Beginner
- Intermediate
- Professional




**Have you used  immersive technology before? (AR/VR)**




- Yes
- No

# Key things we learnt from our survey

"Showing the user how things come apart and are put back together again. Step by step process in AR could be followed by a vehicle technician".

"Gamified learning, remote collaborative training".

"To detect oil and water levels, to know how to unscrew some technical parts like changing a dead headlamp".

"I would like to see chatbot would be helpful to give further information or clarification".

"Virtual Training and Car maintenance".

"Holographic assistance. Maybe guide me on checking car error".

# Quantitative insights from the Surveys

## Car Owners

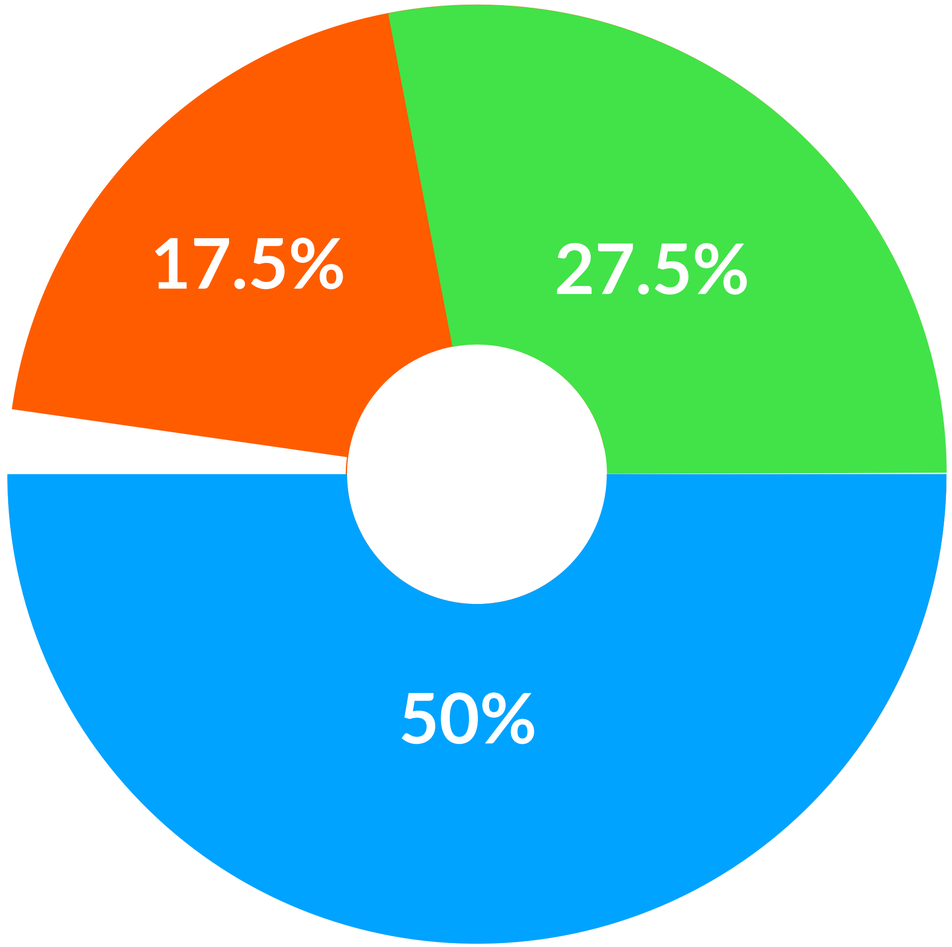
50%

## Trainers

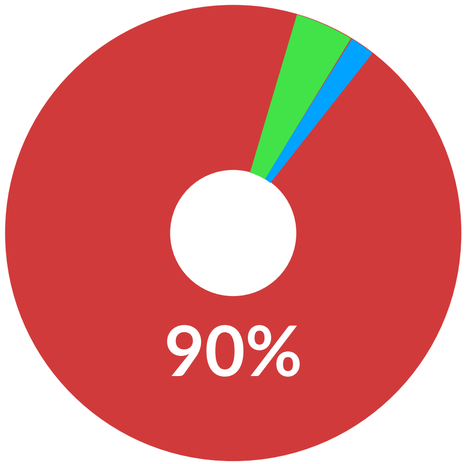
27.5%

## Trainee

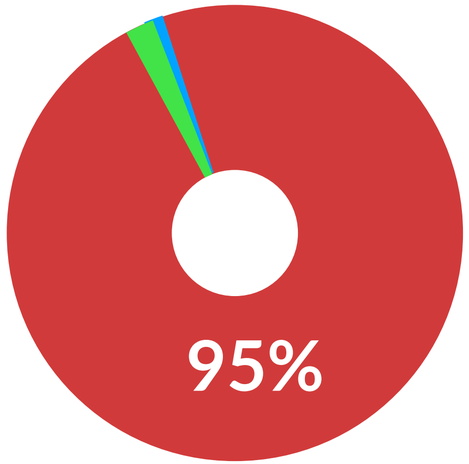
17.5%



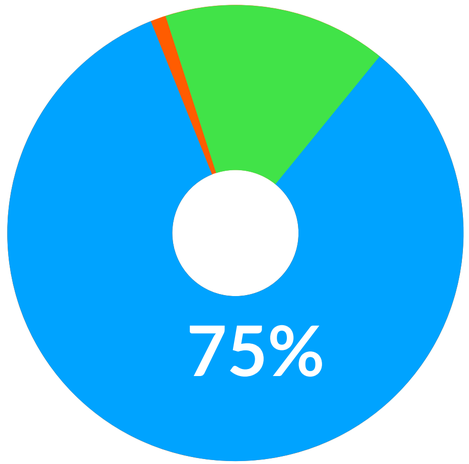
# Quantitative insights from the Surveys (Car owners)




**Car Maintenance Frequency**



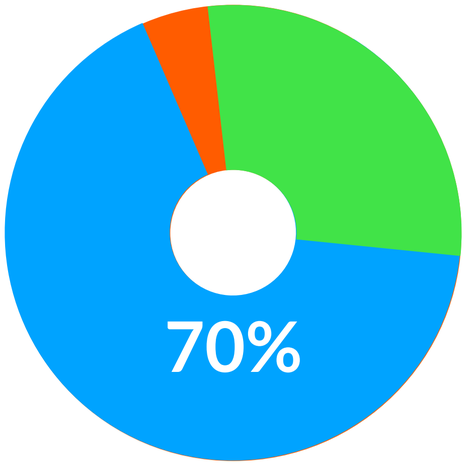

**Past Experience with AR/VR**



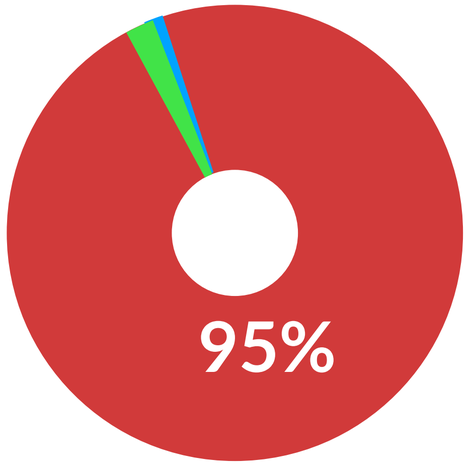

**Need for technical help**

Occassionally Rarely Never

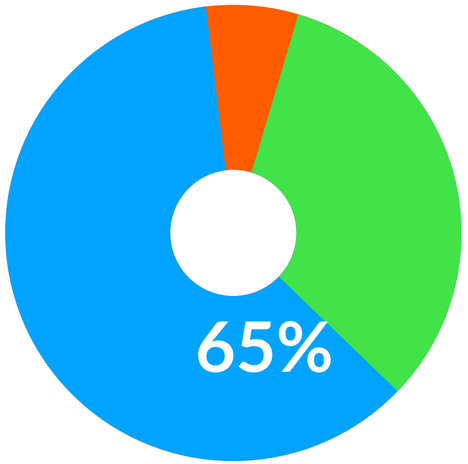
# Quantitative insights from the Surveys  (Trainee)




**Car Maintenance Frequency**




**Past Experience with AR/VR**




**Need for technical help**

Occassionally  Rarely  Never

# Main problem

Creating a solution to help car owners troubleshoot their personal cars and aid automotive engineering trainees in learning car repair skills is a commendable initiative. To address the challenges and provide effective solutions, it's essential to understand the major problems faced in the field of automobile repair and automotive training. Here are some of the main problems:

### CAR OWNER

- Significant Costs of Tools and Repair
- Advanced Technology on Modern Vehicles
- Poor Management Skills
- Economic Downturn

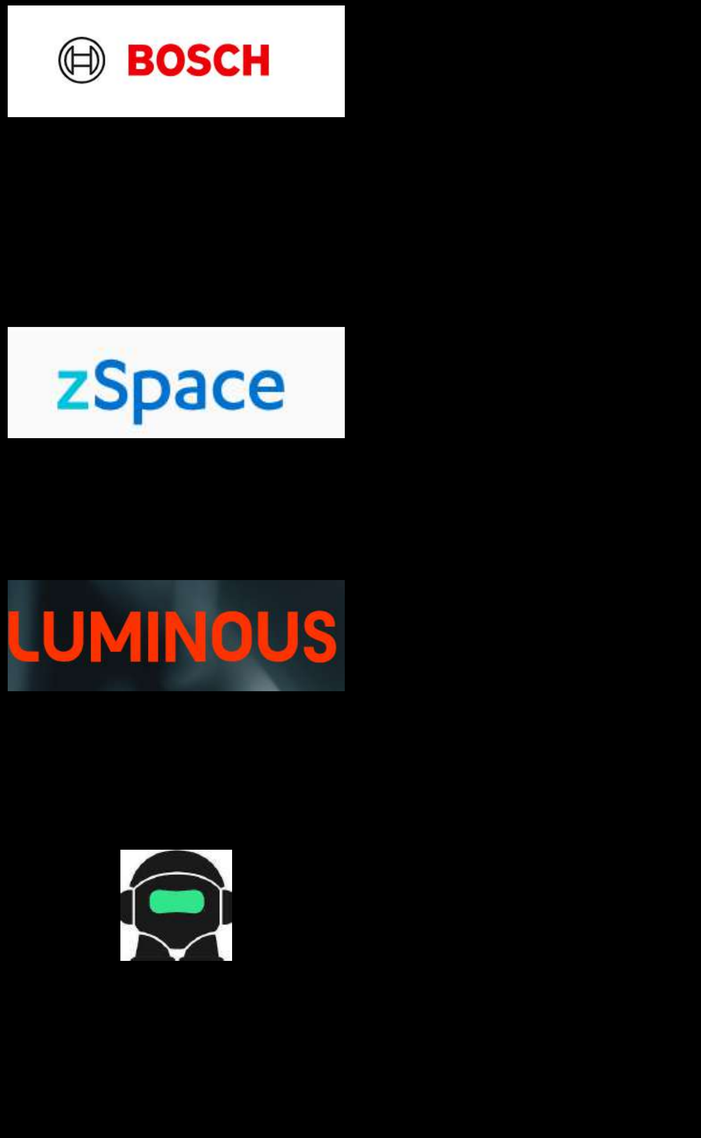
### TRAINEE

- Lack of Technical Knowledge
- Access to Vehicle Telematics Data
- Unavailability of supervisors
- Skill validation

# Existing solutions

We examined some of the service providers already rendering this solution to see where we are positioned and what we can emulate. Below are the list of competitors:

- CAP by Bosch
- Gtafe
- Luminous
- WorxAR



# What approach can we emulate?

BOSCH

Provides repair instructions and diagnosis on faults in automobiles.

zSpace

Luminous allows instructors to intervene and perform tasks while students watch.

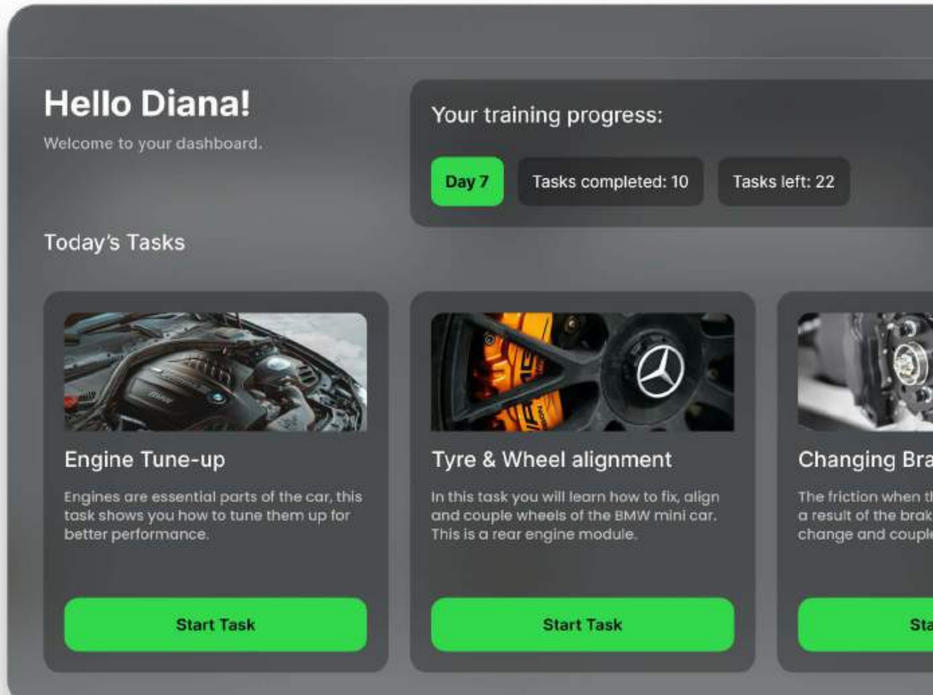
LUMINOUS

The information such as  diagrams, and animations within the trainee’s field of view.

The accessibility feature provides caption and allows compatibility with voice overs on mobile.

# Our Solution

Autospace is a platform that assist both car owners and mechanics in diagnosing and repairing automobiles effectively.


## Spatial AR (Trainee)

**Collaborative learning:** Collaborate with instructors for amazing learning experience. Share progress or seek advice on complex task.

**Progress tracking:** Track the progress on your task with our progress tracker.

**Immersive Step by step tutorial:** Get an immersive and visual step-by-step tutorial on how automobiles work.

**Detailed training report:** Receive a comprehensive information on your report, grade and feedback on assessments.

## Mobile AR (Car owner)

**Detailed Car Information:** Get essential details about your car like car name, engine and fuel capacity.

**Car Care Tutorial:** Get step-by-by tutorial on how to care for your car.

**Troubleshooting Instructions:** Get essential troubleshooting instruction to identify and resolve the problem.

**AR Recognition and Guidance:**

# Amanda

- 24 years old
- Single
- Expert (AR Familiarity)
- United Kingdom

## Personality

- Extroverted
- Technology
- Confidence
- Independence

## Bio

Amanda is a 24-year-old aspiring auto mechanic with a passion for fixing things and a natural mechanical aptitude, but she lacks formal training. Eager to launch her career, Amanda seeks an apprenticeship where she can gain hands-on experience under the guidance of seasoned professionals and progress her skills in auto repair. Her ultimate goal is to leverage this knowledge to advance in the automobile industry as a master technician.

## Motivations

Passion for fixing things

Money

Mentoring

## Goals

- To complete her onboarding training to secure employment
- To gain her skills and experience in automobile experience
- To build her career in the automobile industry

## Frustrations

- Unavailability of professional trainers
- Understanding the technical-know-how of the automobile repair
- The fear of making mistakes and incurring costs

## Amanda’s Needs

- A way to log completed training modules and track her progress
- A mentor who can periodically review her work and provide feedback
- Troubleshooting guides and step-by-step repair manuals to reference
- A comprehensive training program that she can follow independently

## Amanda’s Behaviour & Technologies used

- Watches training videos multiple times until she feels confident in the techniques
- Practices new repair procedures step-by-step before attempting them on real vehicles
- Sets goals for number of training modules to be completed each week
- Volunteers to take on new repair challenges to improve skills
- iPhone 14 pro max, iPad Pro, Play Station, PS, VR2, Alexa

## Amanda’s Scenario

Amanda, a passionate trainee in an automobile company, has been facing frustrations learning as a trainee due to the unavailability of professional trainers and the fear of making costly mistakes. She needs a training program provided by the company unaffected by the availability of the trainers. Her goal is to build her skills and experience so she can move from being a trainee to being a fully employed engineer at the company.

# Brad

- 38 years old
- Married
- Customer Service Advisor
- Novice (AR Familiarity)
- United Kingdom

## Personality

- Extroverted
- Technology
- Confidence
- Independence

## Bio

Ola is a 27-year-old postgraduate student living with his sister who stays far away from his university. He is completely blind and has been blind since birth. He relies on his sister's help to find his way to school and back and can't plan trips with his friends on his own without help. He interacts with his laptop and mobile phone for school tasks using voice controls, and screen readers, he knows braille and may take notes using a braille input device for his day-to-day activities.

## Motivations

- Family
- Financial Savings
- Productivity

## Goals

- To provide and ensure the comfort of his family
- To effectively manage his finances and cut cost
- To spend quality time with his family

## Frustrations

- Rising cost of living and inflation
- Delays in scheduling auto repair appointments
- Little or no knowledge of basic troubleshooting personal car

## Brad’s Needs

- He requires step-by-step technical guidance on how to perform basic car care and maintenance by himself.
- He needs to know when routine maintenance is due and track completion.
- He requires a troubleshooting reference to help identify and resolve common problems.

## Brad’s Behaviour & Technologies used

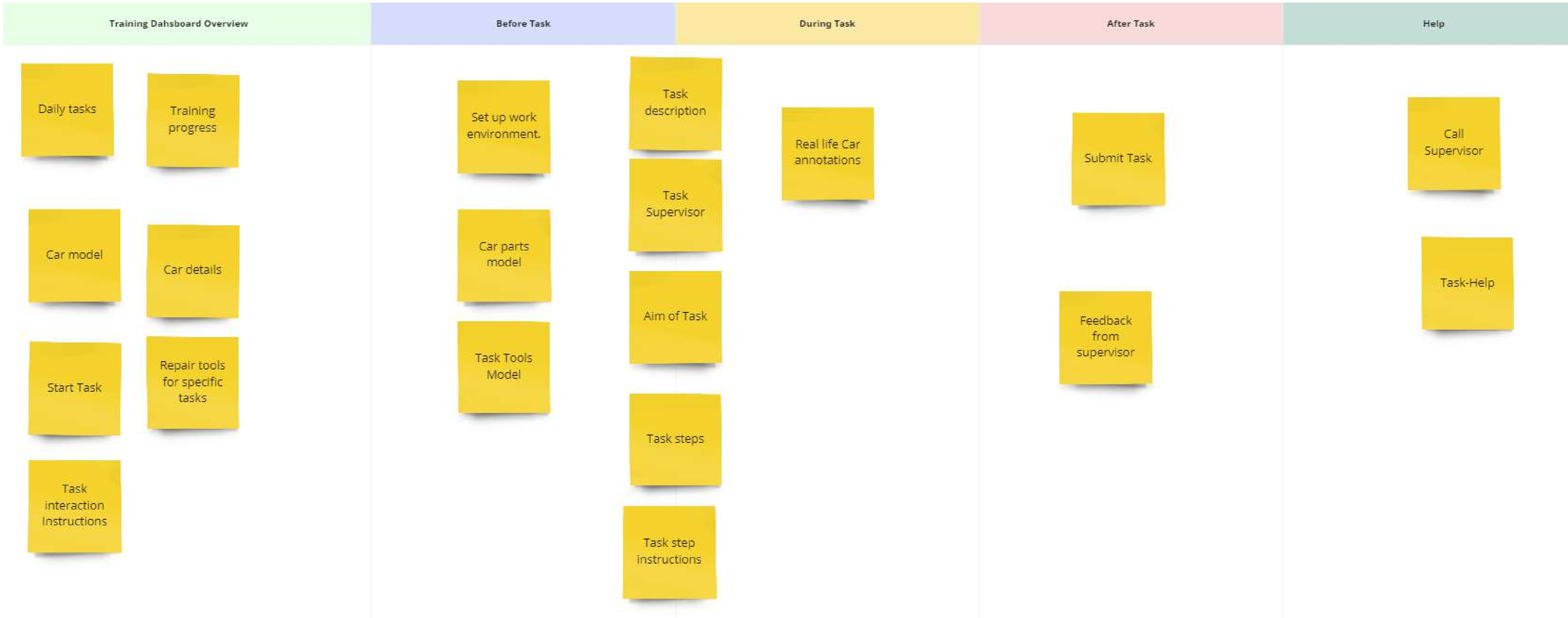
- Compares prices across retailers to find affordable parts/tools
- Watches DIY car repair videos multiple times to understand techniques
- Often calls the mechanic or friends when he needs technical help
- He attempts basic maintenance like oil changes.
- Brad’s Devices include iPhone and iPad

## Brad’s Scenario

Brad is a busy 38-year-old father and customer service advisor struggling with rising costs and wait times for repairs. Brad lacks automobile troubleshooting knowledge, so he needs access to step-by-step maintenance tips and resources that can teach him how to handle basic car issues himself without relying on mechanics' schedules to save cost.

# Card Sorting- Trainee

We conducted a card sorting activity with users to gain insights into their preferences and expectations for the Autospace app, with a particular focus on understanding the trainee perspective.



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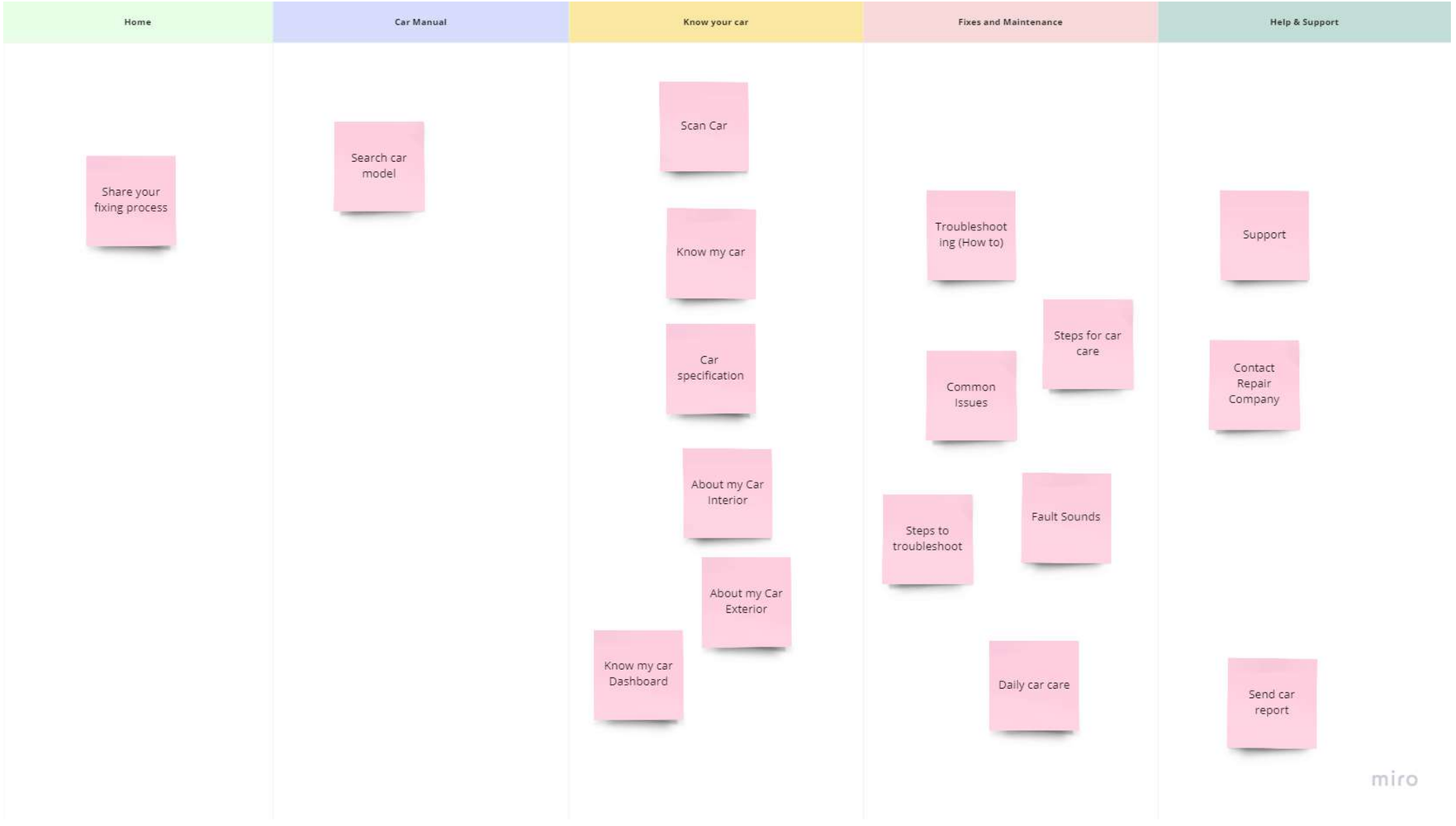
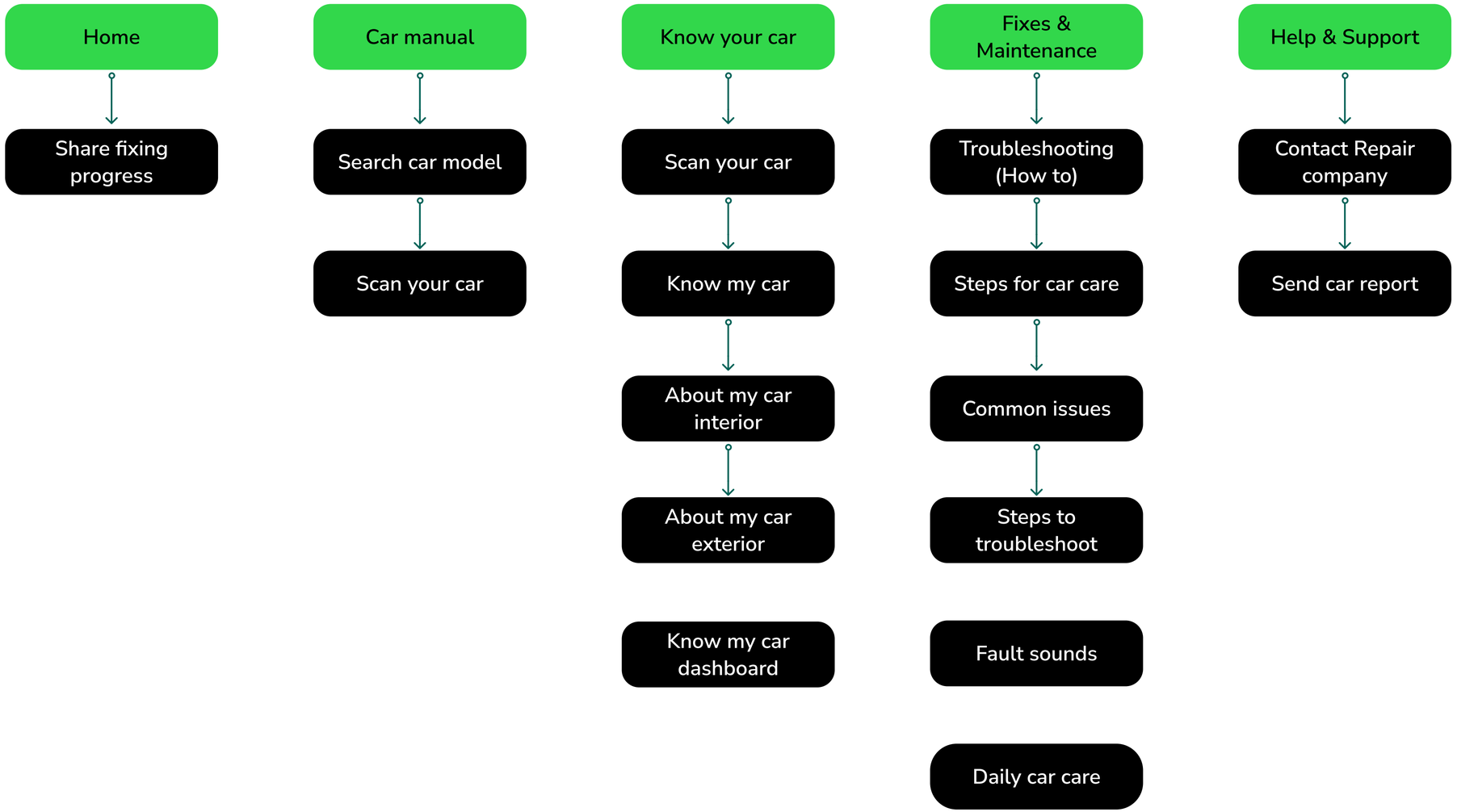
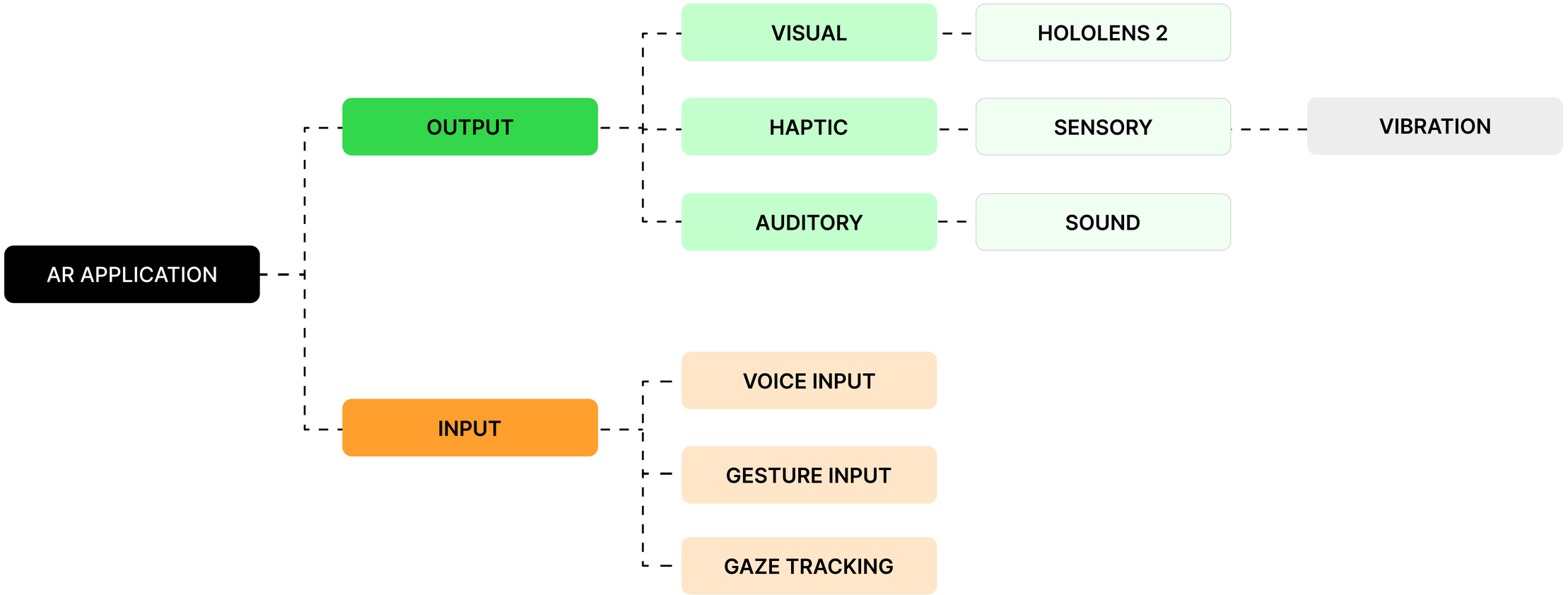


# Information Architecture- Trainee

# Information Architecture- Car Owner



# System Architecture



# Choosing the device to build for

Considering the features and interactions that would be needed for this experience we chose two devices:

## 1

We chose an AR device, that is easily accessible and compatible for companies, and also has the interaction methods required.

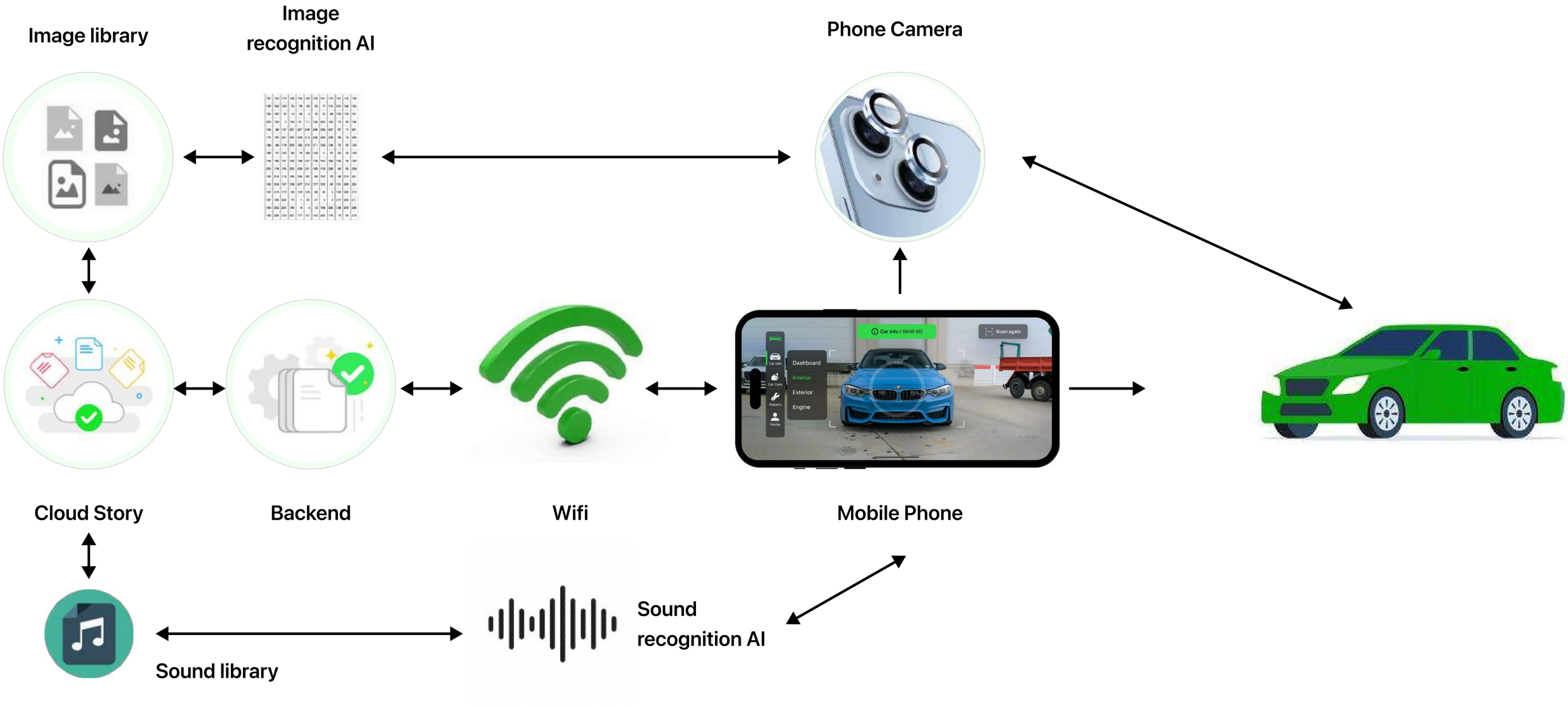
### Microsoft Hololens 2

## 2

A device that is easily affordable for regular car owners and doesn't require much learning.

### Mobile phone

# Gears & Sensors involved (Mobile)



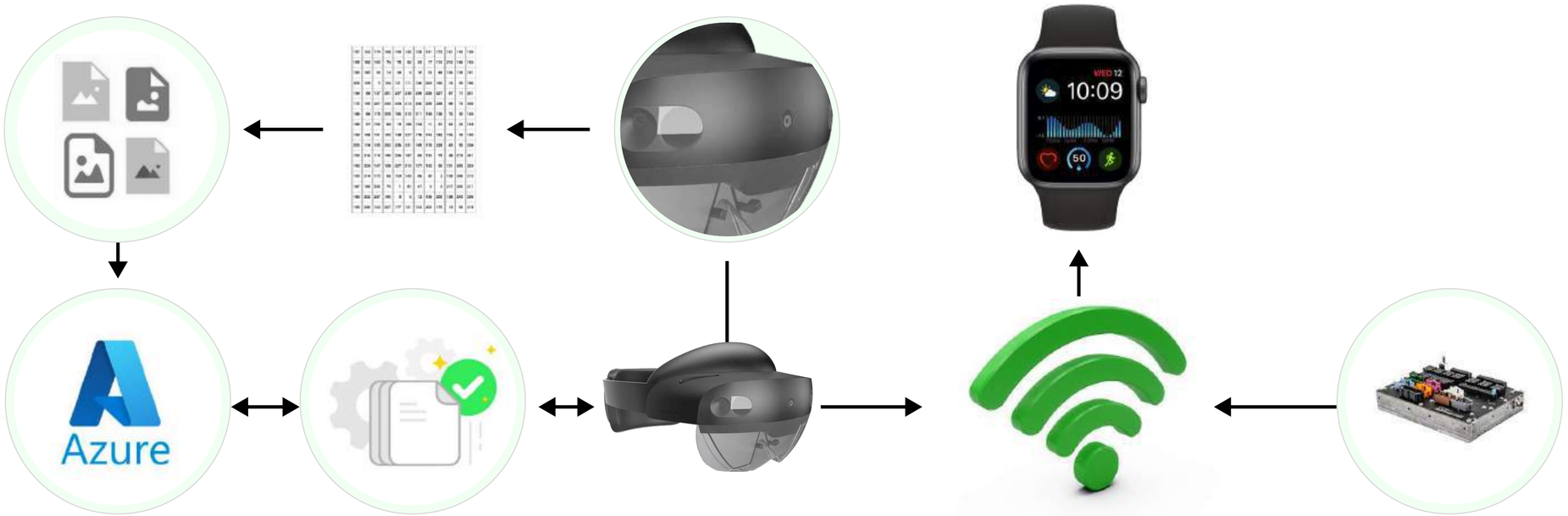
# Gears & Sensors involved (Mobile)

Image library

Image recognition AI

Hololens Camera

Smart Watch for haptics




Microsoft Azure Cloud

Backend

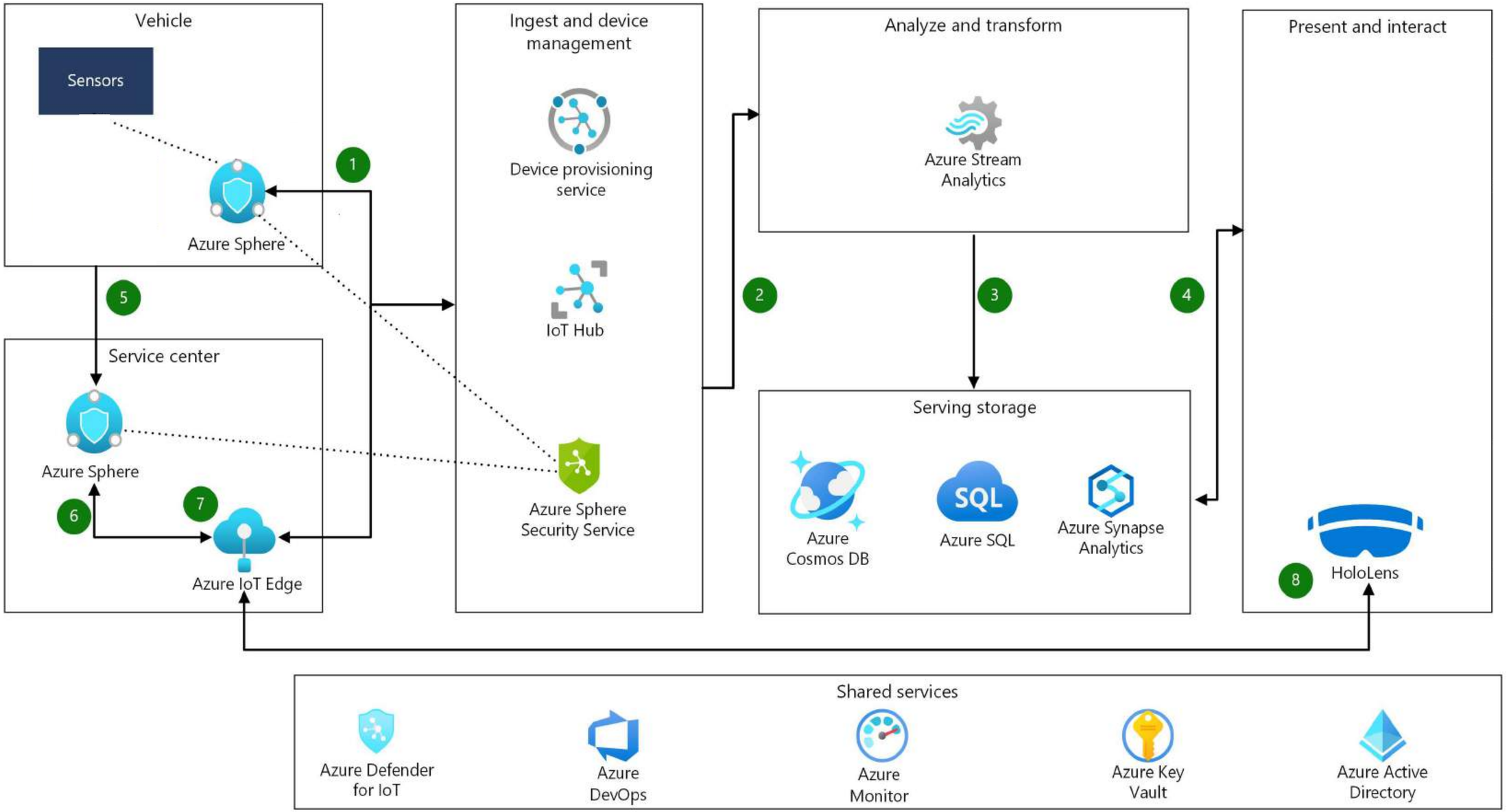
Hololens 2

Wifi

Electroinic Control Unit

Car Sensors

- PRESSURE SENSORS
- AIR-FLOW SENSOR
- ENGINE SENSORS
- VOLTAGE SENSOR
- OXYGEN SENSORS
- TEMPERATURE SENSOR
- SPEED SENSOR
- NOX SENSOR
- CAMSHAFT SENSOR


Vehicle
Sensors
Azure Sphere
1
5
Service center
Azure Sphere
6
7
Azure IoT Edge
Ingest and device management
Device provisioning service
IoT Hub
Azure Sphere Security Service
2
Analyze and transform
Azure Stream Analytics
3
Serving storage
Azure Cosmos DB
SQL
Azure SQL
Azure Synapse Analytics
4
Present and interact
8
HoloLens
Shared services
Azure Defender for IoT
Azure DevOps
Azure Monitor
Azure Key Vault
Azure Active Directory

# Controls

Here are the considerations for choosing the control methods:

- Our users want to touch holograms and perform precision holographic manipulations.
- All our users are mobile, covering a large space or moving between spaces.

## Touch and motion controllers interaction model for precision targeting and manipulation.

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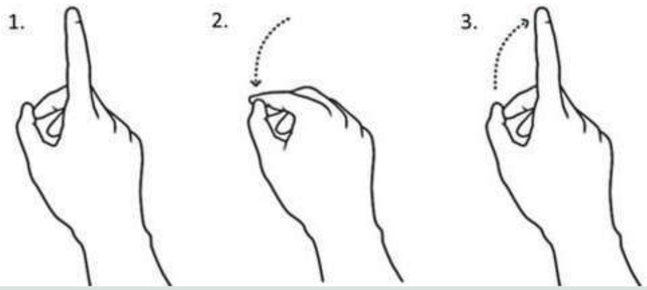
- Our users need to keep their hands free for real-world tasks.

## Hands-free interaction model, which provides a great hands-free experience through gaze and voice-based interactions.

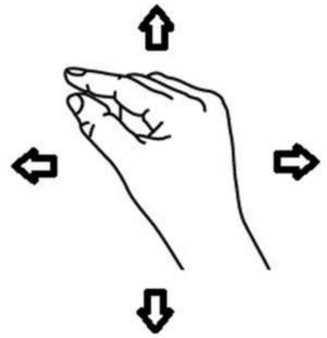
# Hand Tracking

**Air Tap**

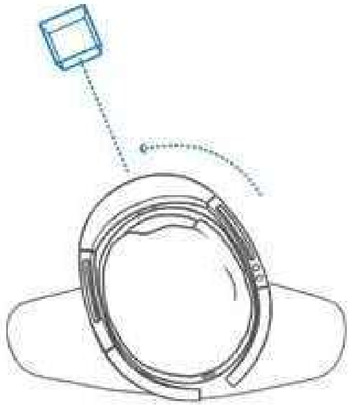



**Grasp** (Tap, pinch...)

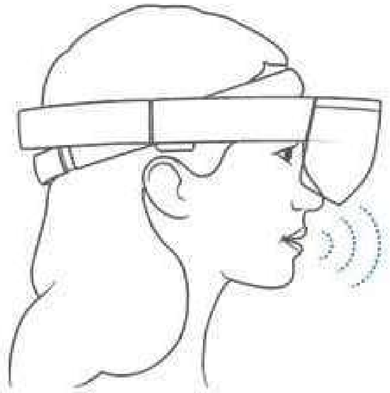
**Move** (touch & drag, grasp & drag)



# Head Gaze



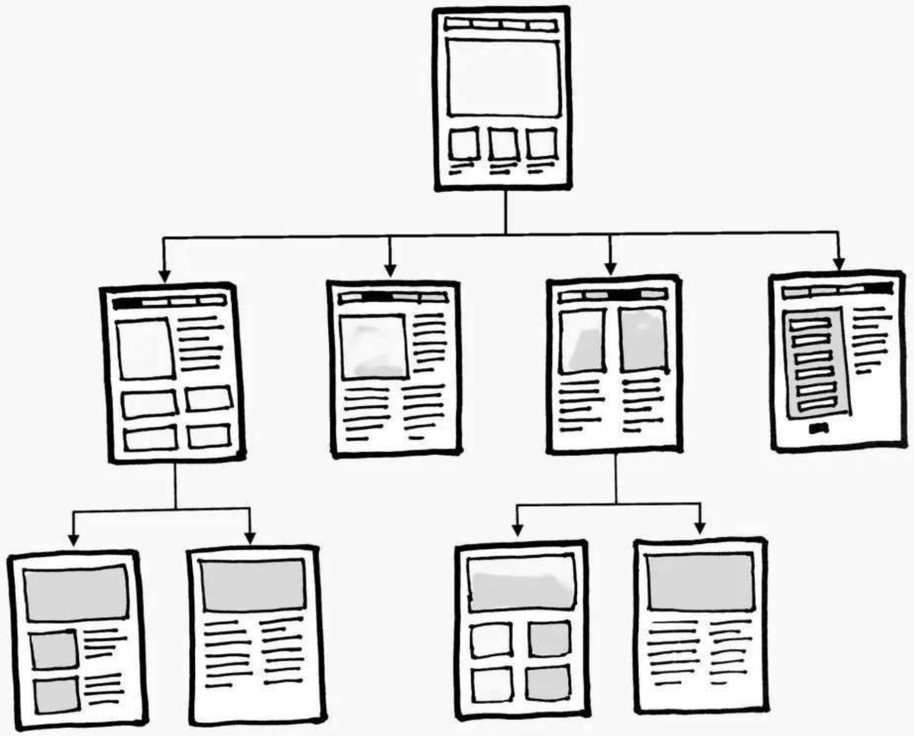
# Voice



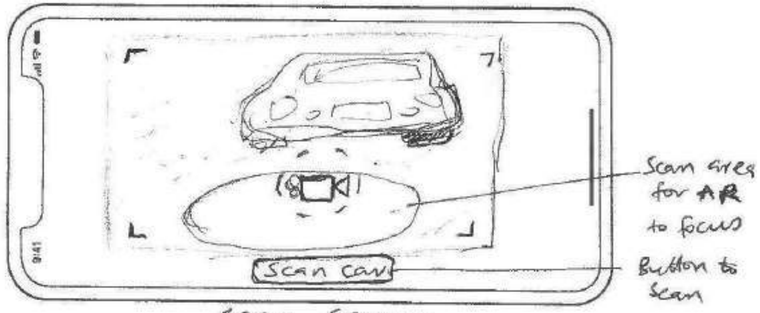
# Sketches

The sketches and storyboard were made considering the interactions needed, the environment and Jakob Nielsen 's 10 usability heuristics for AR interfaces.

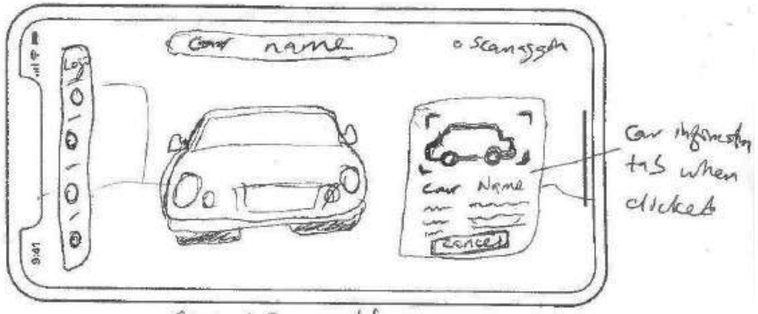
- Visibility of system status
- Match between system and real world
- User control and freedom for customisation
- Consistency and standards
- Error prevention
- Recognition rather than recall
- Flexibility and efficiency of use
- Minimalistic design
- Error recognition
- Help and documentation



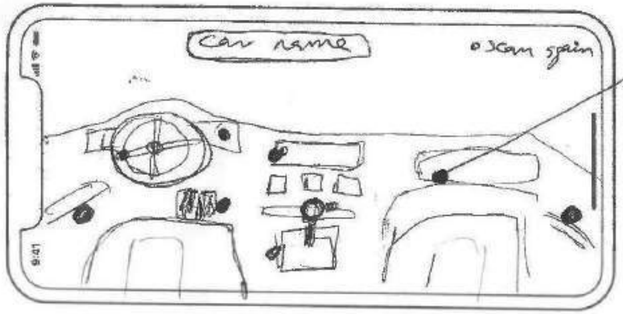
# LOW FIDELITY - MOBILE SKETCHES

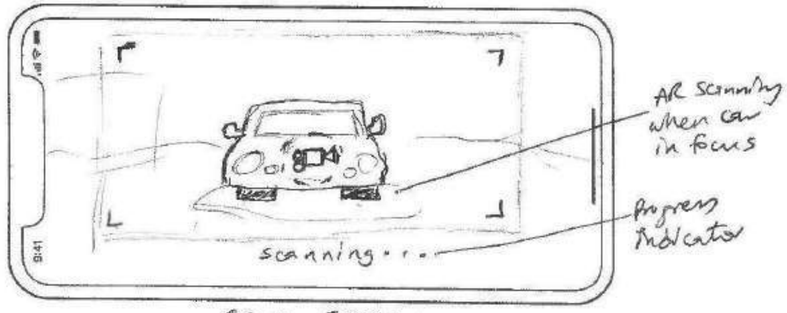



Scan screen

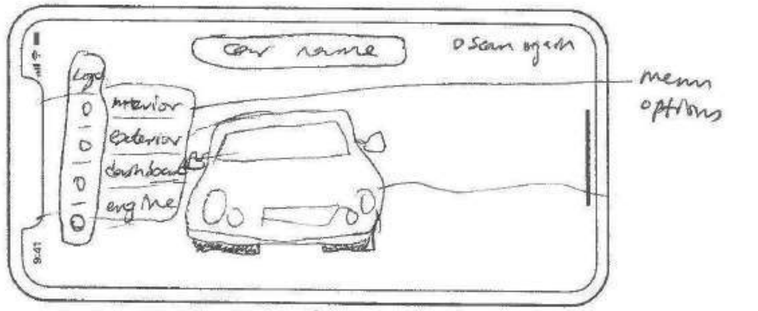



Car information

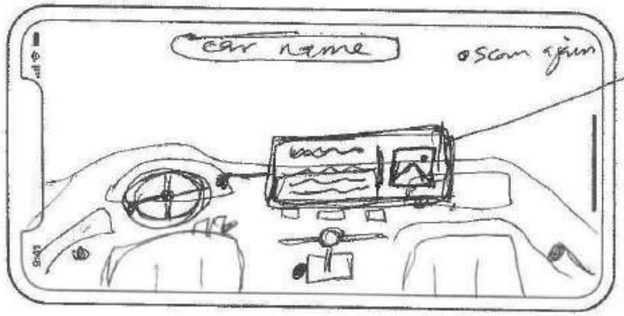


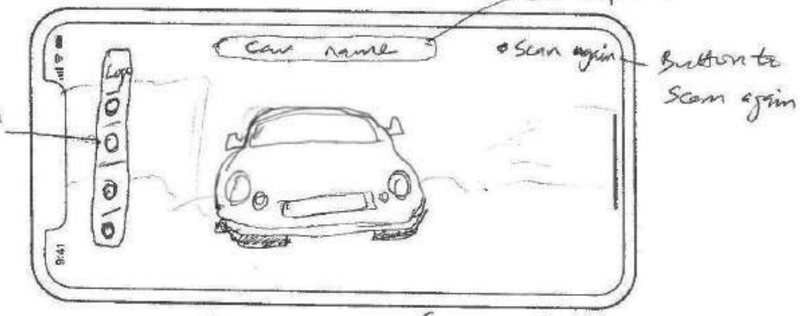




Scan screen

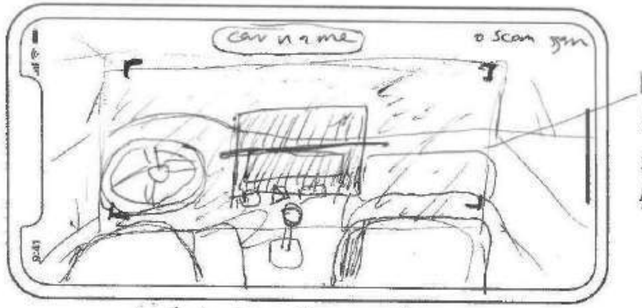



Menu screen

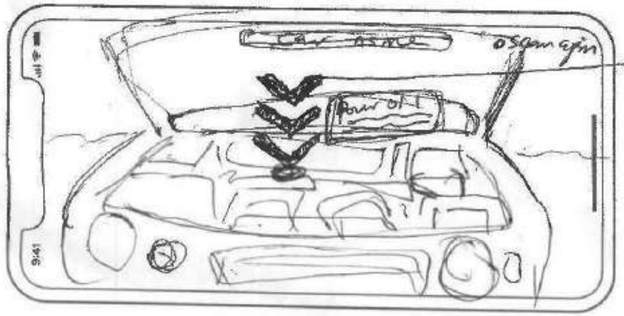


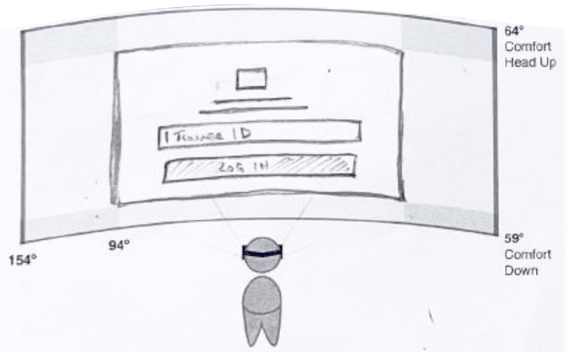

Home screen (scanned)




Interior scan screen



# STORYBOARDING- TRAINEE



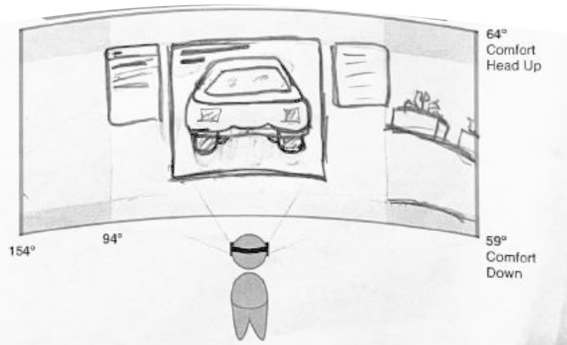

An egineering intern wears the hololens device and opens the app. This intern logs in with their company trainee ID!


On the home screen they can see three menus above [Profile, Dashboard, Report]

Dashboard: Intern sees their training progress, and the task they have for the day. ← to the left [Profile] - → to the right [Report]

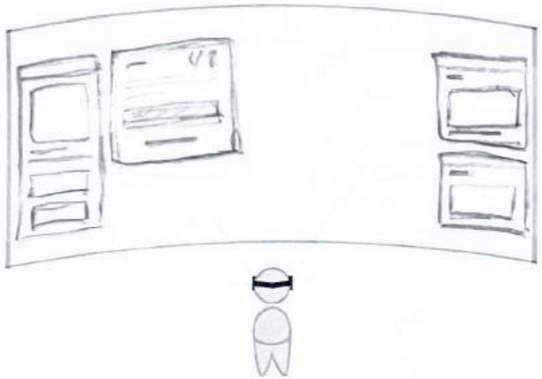
⇒ Can customise layout


On selecting "start task", the intern sees the description of the task, the supervisor in charge, the aim of the task, tools & item needed, and car to be operated on "Let's begin" button.



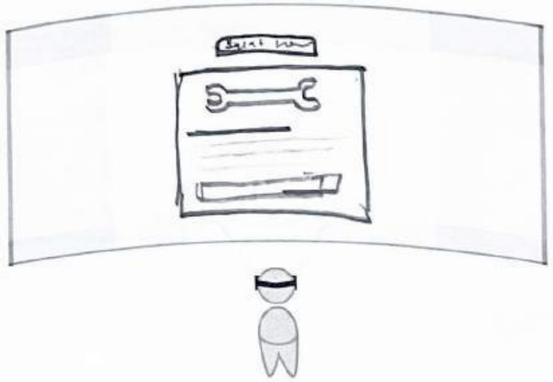

On hitting the "let's begin" button intern proceeds to the scene setting screen. Shows: ① the car plane ② the tool plane on the right and ③ instructions on the left

# STORYBOARDING- TRAINEE

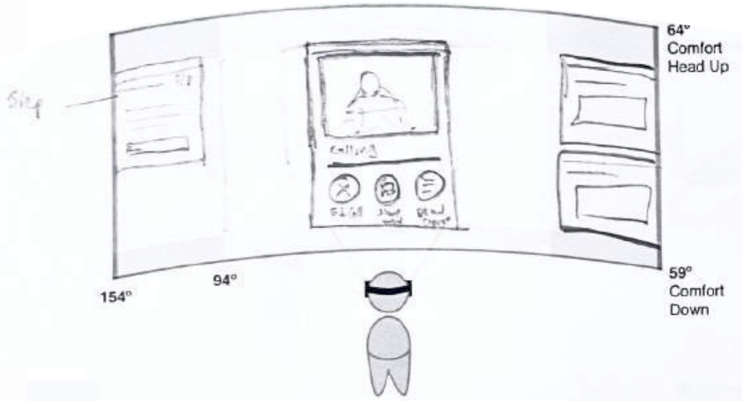


When a task commences, the different steps are shown and the intern can hit "Next" when she's done. To her right we have the tools for repair below & Car Component library above. On the left she can call her supervisor to join in.

When the intern selects the "Mount this part" they can see the different components of the car part being operated on, and a button to view that part on the Car [image recognition on the camera]
There's a CTA to go back to tasks.

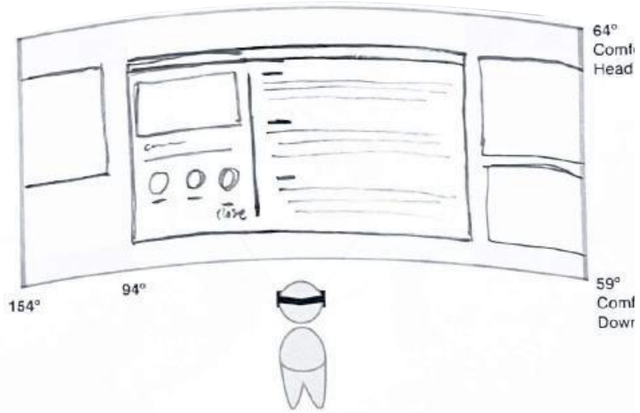


When intern selects the tool box she can see the tool needed for the current step in the task. She can the click the button to locate that tool in the workshop.
[image recognition]

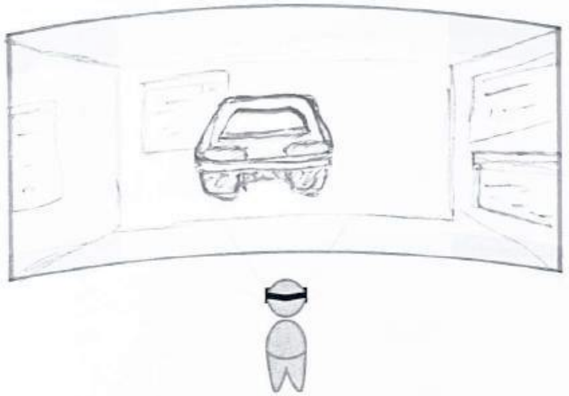



The intern chooses to call the supervisor whenever they need to. They see the supervisor and they can decide to share their AR view, turn on captions or end call.

# STORYBOARDING- TRAINEE



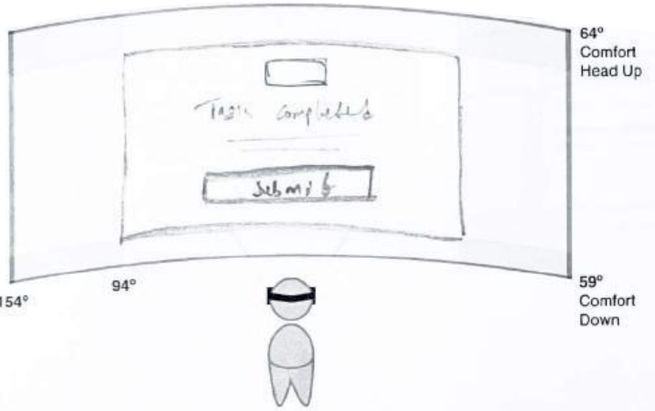

Here is the Caption view for the call



During Task: Intern can use the pinch and drag gesture to move items.

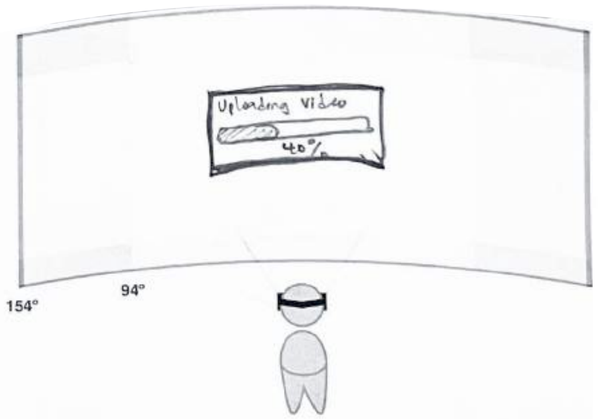
When they need to work on the automobile they can pinch and move tabs towards the walls.

Intern interacts with the interface using the rays and can select using the tap gesture where two fingers hit against each other

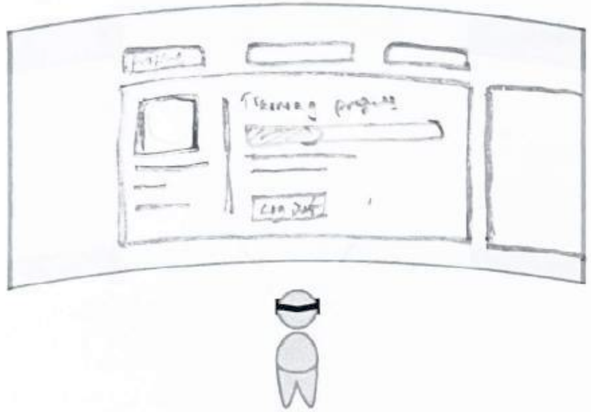



On task completion the intern submits this task for evaluation.

# STORYBOARDING- TRAINEE




On submission the video of the task performance gets uploaded to the system for the Company's approval.



This is the intern's profile. The intern can see her image, name of organisation, her name, and trainee ID. She can see her daily progress and log out.


Intern views the report page and sees each task, status and grad, with a button to view Intern Can download report to her email.

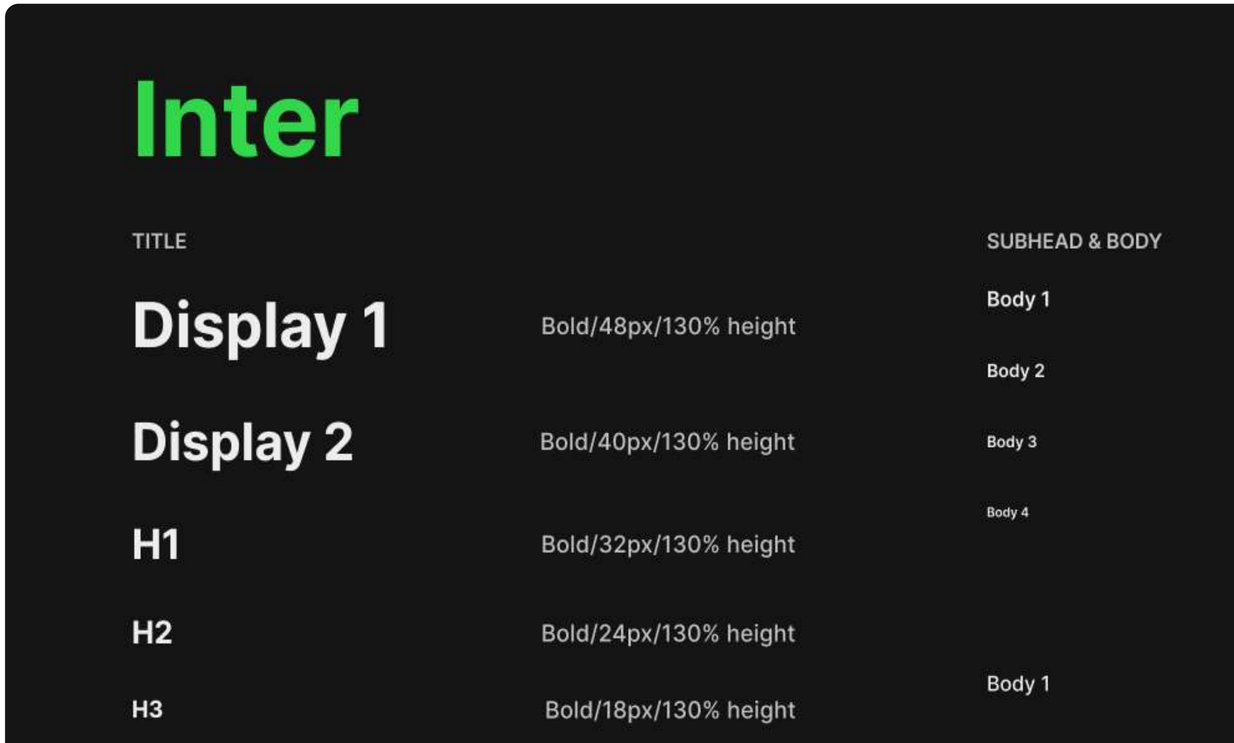

Intern hits the view button to see feedback on the training.

# Typography

## INTER

The Microsoft Hololens uses sans serif font because of legibility and readability, we have also decided to use the Inter font from the same sans serif family for the same reasons. We considered the following when creating hierarchy to comply with the Microsoft MKTR guidelines.

- The least font-weight used was **semibold** following the Microsoft MKTR guideline.
- Minimum font size is **18pt** as this is very visible for far and near interactions at any viewing angle.
- Text height of at least **6mm** with minimum text spacing of **130%**



# Colors

To select our colors we had to consider the following criteria:

### Visibility & Hierarchy

#32D74B #FF9F2D #D13A3A #000000 #FFFFFF

- All colors were selected to pass WCAG AA contrast guideline
- Colors were tested for color-blindness and they passed.
- A single color was chosen as primary color to ensure simplicity while other colors are for alerts and errors.

### Environment Hololens (Trainee)

The trainees will be working in a controlled workshop, as a result of this we decided that:

- Dark color scheme was used to be compatible with workshop's lightning conditions.
- Extremely bright colors were avoided to eliminate visual effect of a bright environment.
- A dark color was used for the holograph's background to ensure that objects behind it doesn't interfere with visibility.

# COLOURS

### Grey


### Primary


### Info & Warning


### Success


### Error


### Common


### Grey


### Primary


### Info & Warning


### Success


### Error

# Environment

We made a lot of considerations for our design taking the user's environment as an important factor.

## Car Owner Environment: Car park or Garage

### Attributes

Natural light (Atmosphere)

Multiple cars in view

### Considerations

Overlays implemented to darken images and contrast background for on-screen input.

Hight contrasting colors on UI.

## Trainee Environment Controlled learning workshop

### Attributes

Controlled lighting

Wide spatial view

Large space to move around.

Single vehicle in view.

### Considerations

Slightly opaque holograph

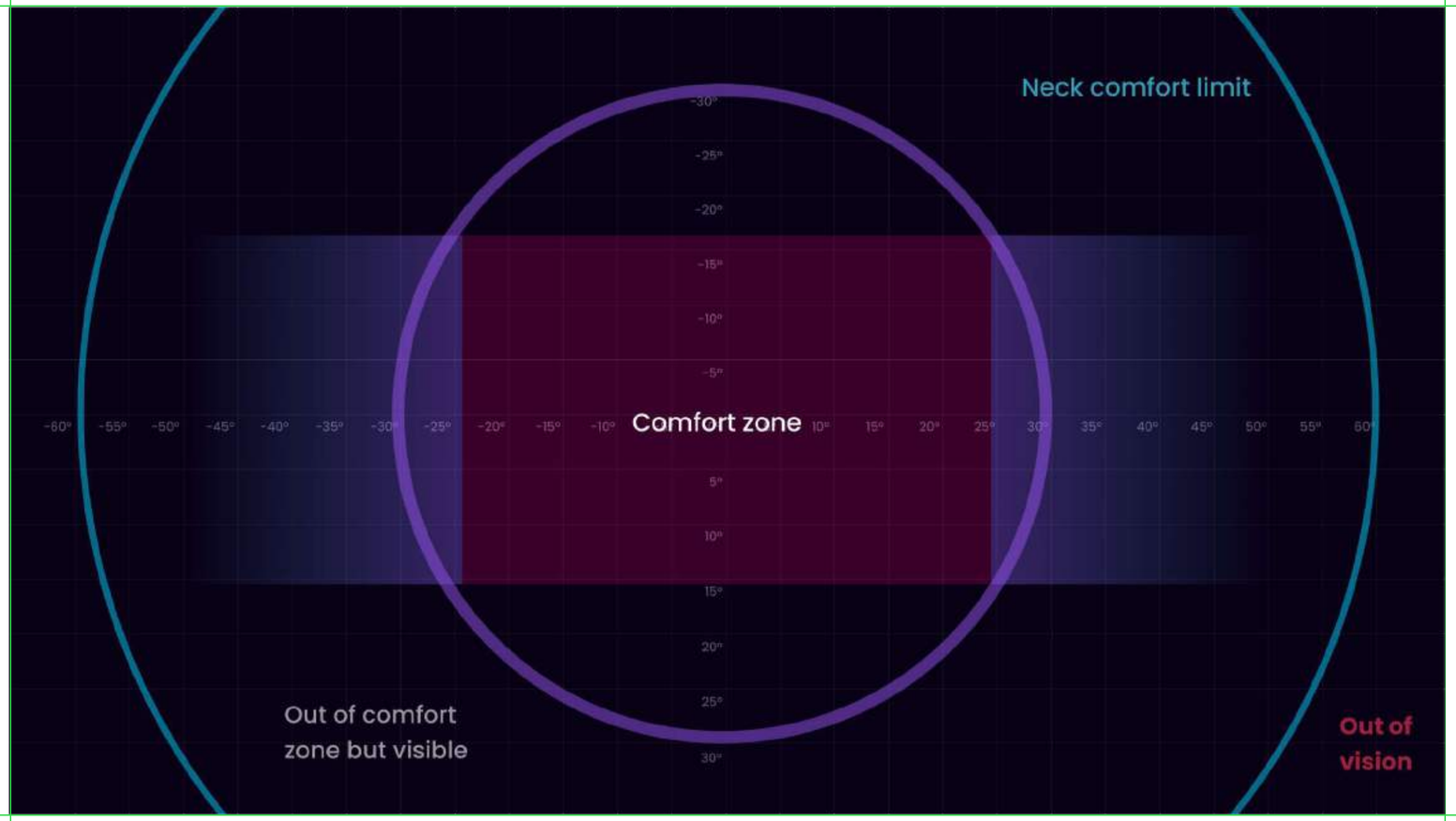
Dark themed UI

Provisions for far and near interactions.

Flexible user orientation.

# Frame Considerations

## Dimensions



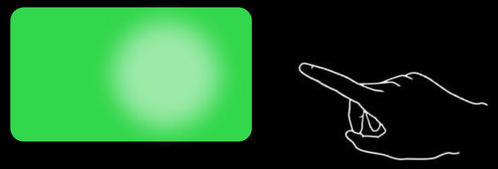

## Considerations

To avoid eye and neck strain, the application's content was designed to satisfy these conditions.

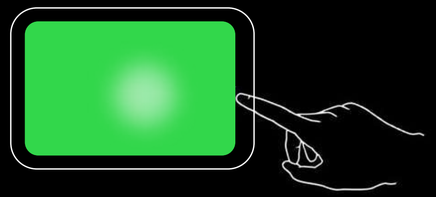
- No gaze angles more than 10 degrees above the horizon (vertical movement)
- No gaze angles more than 60 degrees below the horizon (vertical movement)
- No neck rotations more than 45 degrees off-centre (horizontal movement)

Mixture of gesture and speech interactions were incorporated into the experience to avoid requiring constant, repeated gesture input.

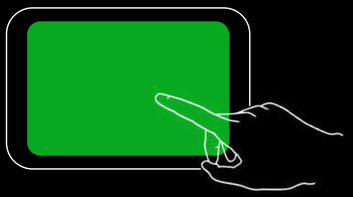
## Near interactions (45 cm)



Proximity of hand is highlighted



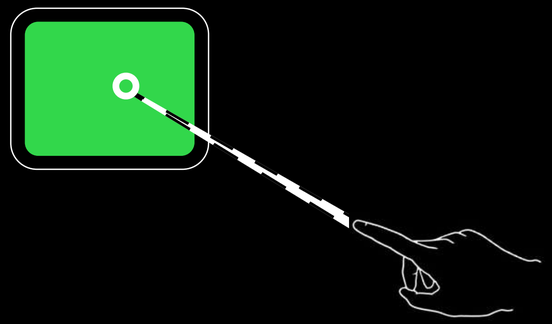
Proximity of hand reduces to precision and border displays.



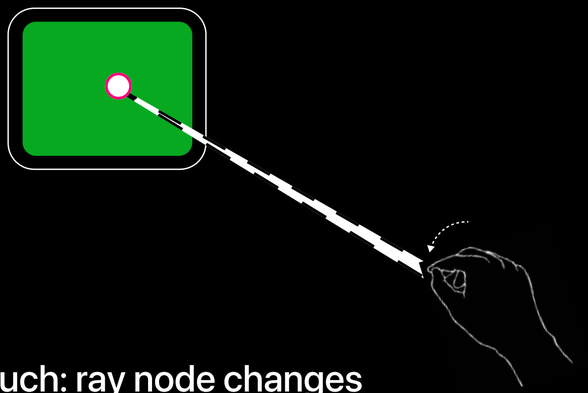
On touch: color goes darker

## Far interactions (2 m)

Default state



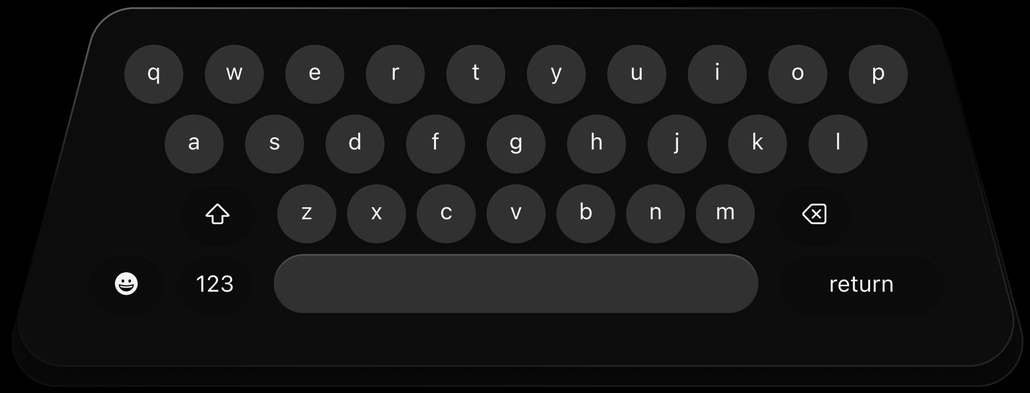
Targeted state: ray points to target and target is highlighted.



On touch: ray node changes and color goes darker

## Target size


## Keyboard design




## Menu


No hand menu

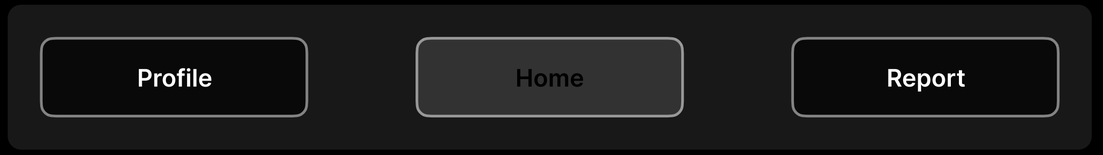
Reason:

The trainees will be working with their hands all through the training. To avoid interacting with menus mistakenly we have decided not to imlplement it.

## Adopted Menu

The menu bar was implemented as a **TAG-ALONG**

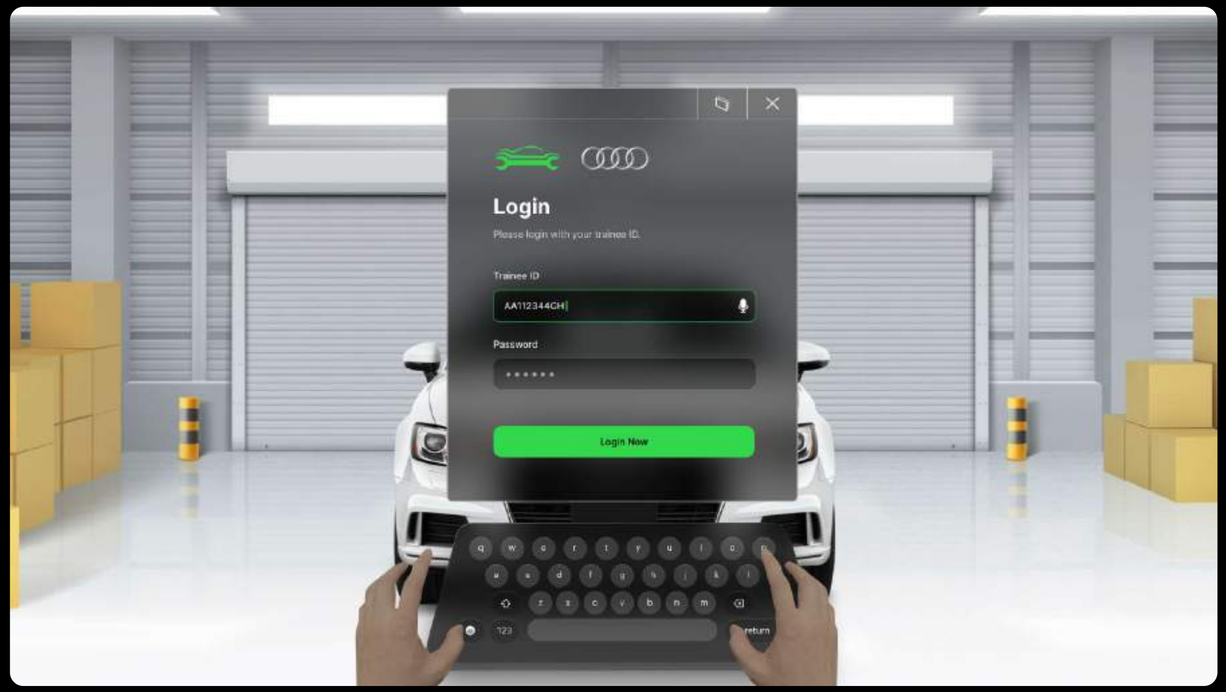
It stays in a range that allows the user to interact comfortably. It can be in or out of the user's line of sight as the user moves around the environment. The trainee can also pin it to the walls of the workshop.



# HIGH-FIDELITY DESIGNS

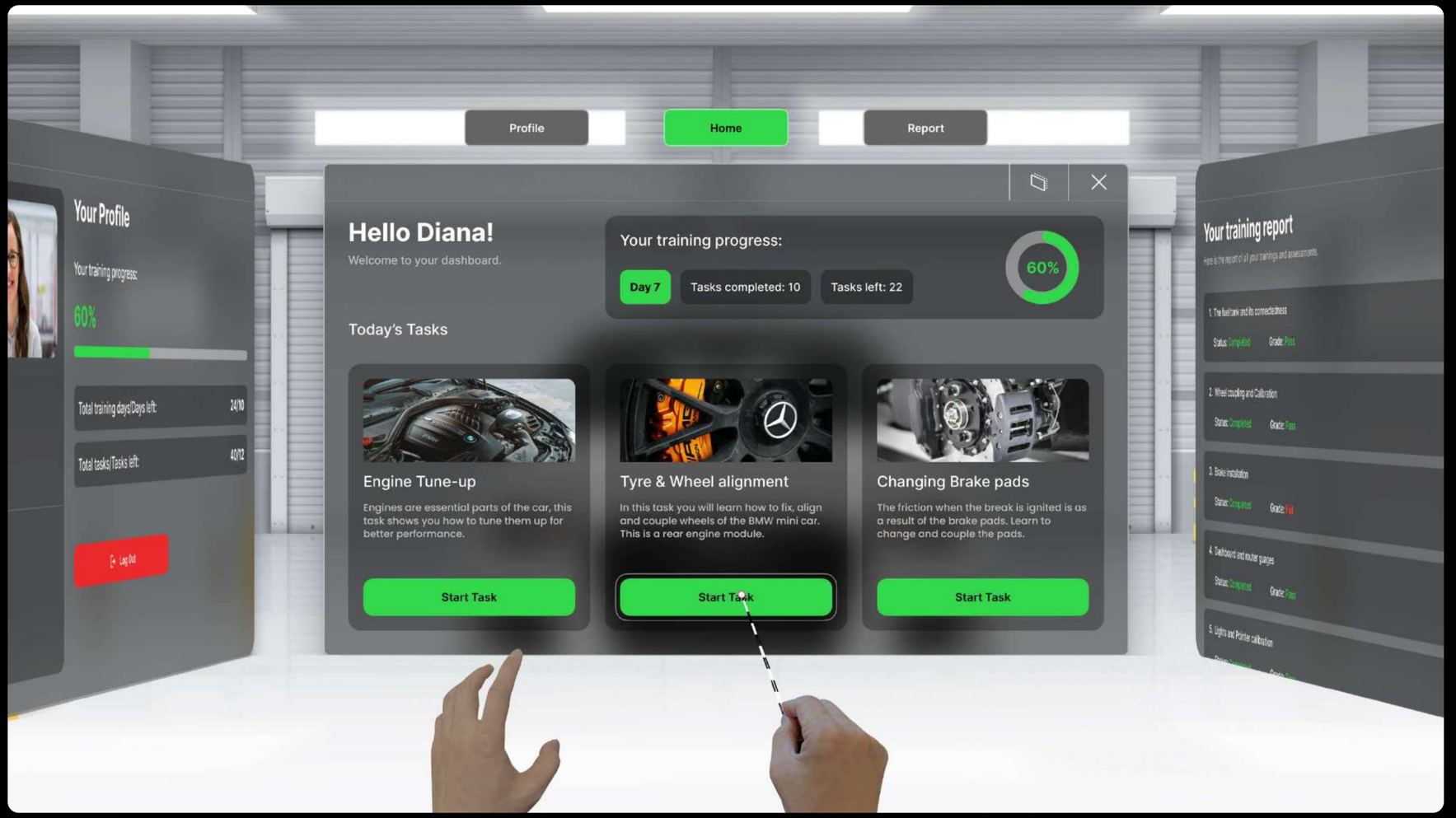

## App Launch

The trainee has been onboarded with her new company Audi.
Audi creates an account for her and gives her login credentials, she wears her gears and launches the app.




## Log In

On app launch the trainee can login with authentication details provided by the company using the keyboard near touch input.



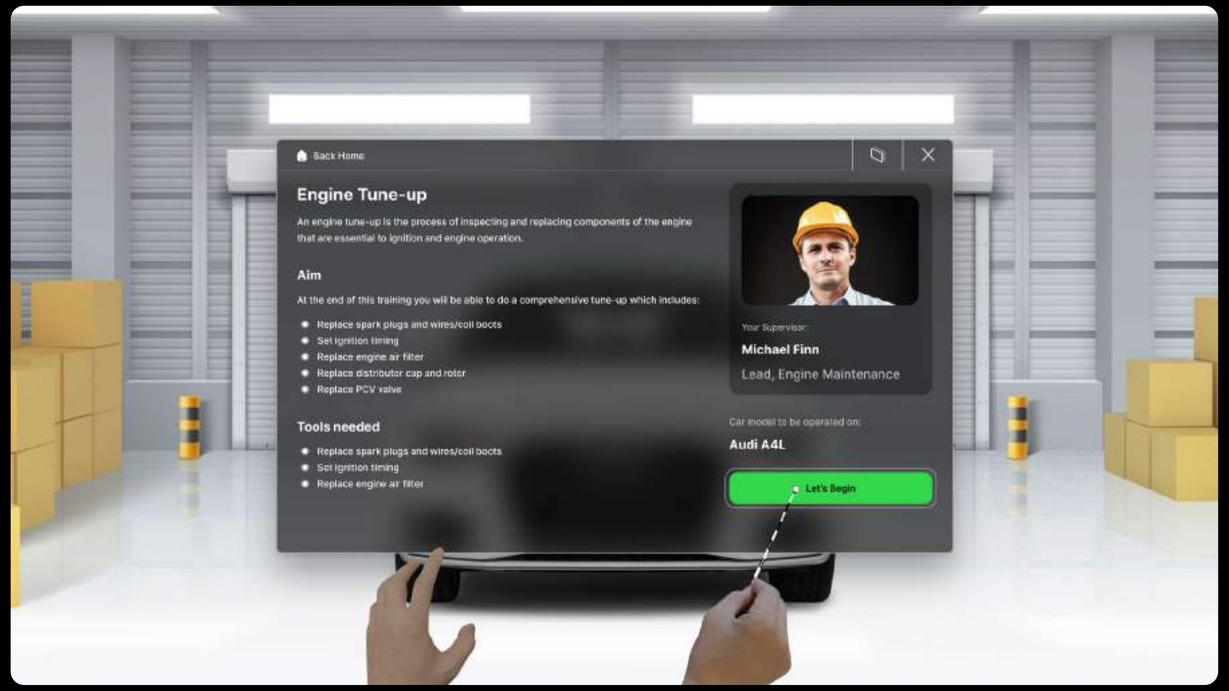

## Immersive Home

On login, the trainee can see a surround immersive holograph arrangement of the home. With focus on the one at the centre of view.

They can use the ray interaction to navigate through tabs.

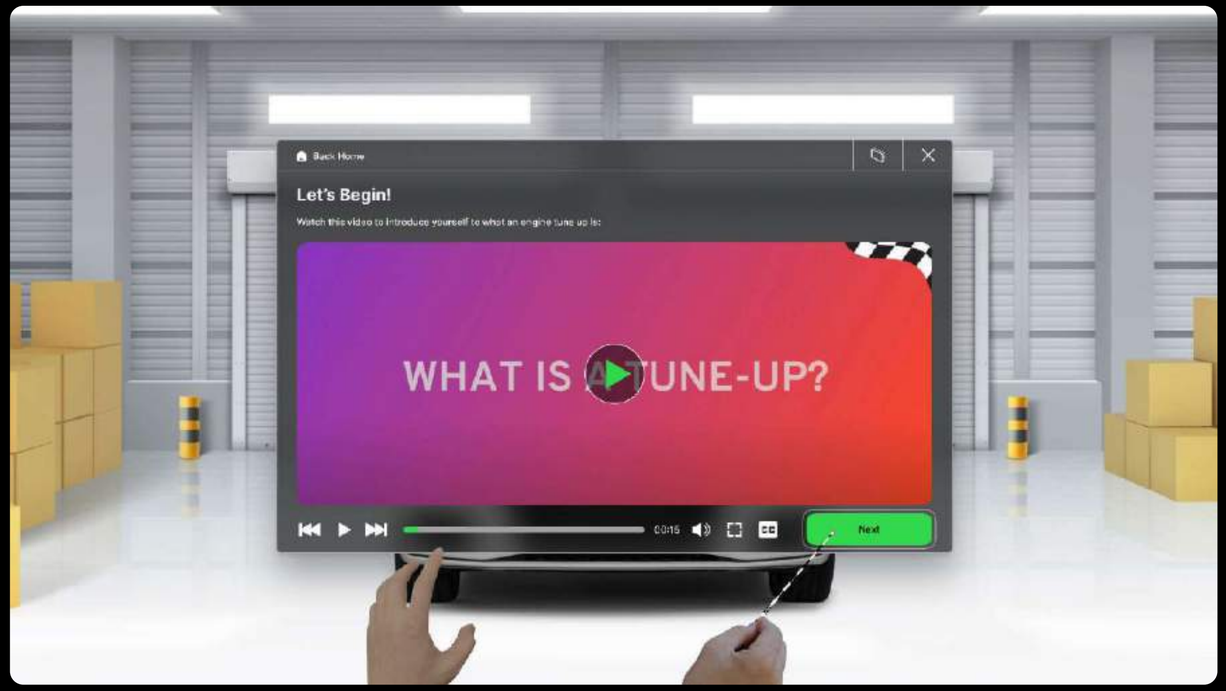
## Dashboard

Here the trainee can see their training progress and the tasks they have for the day. Keeping it simple to avoid overload.



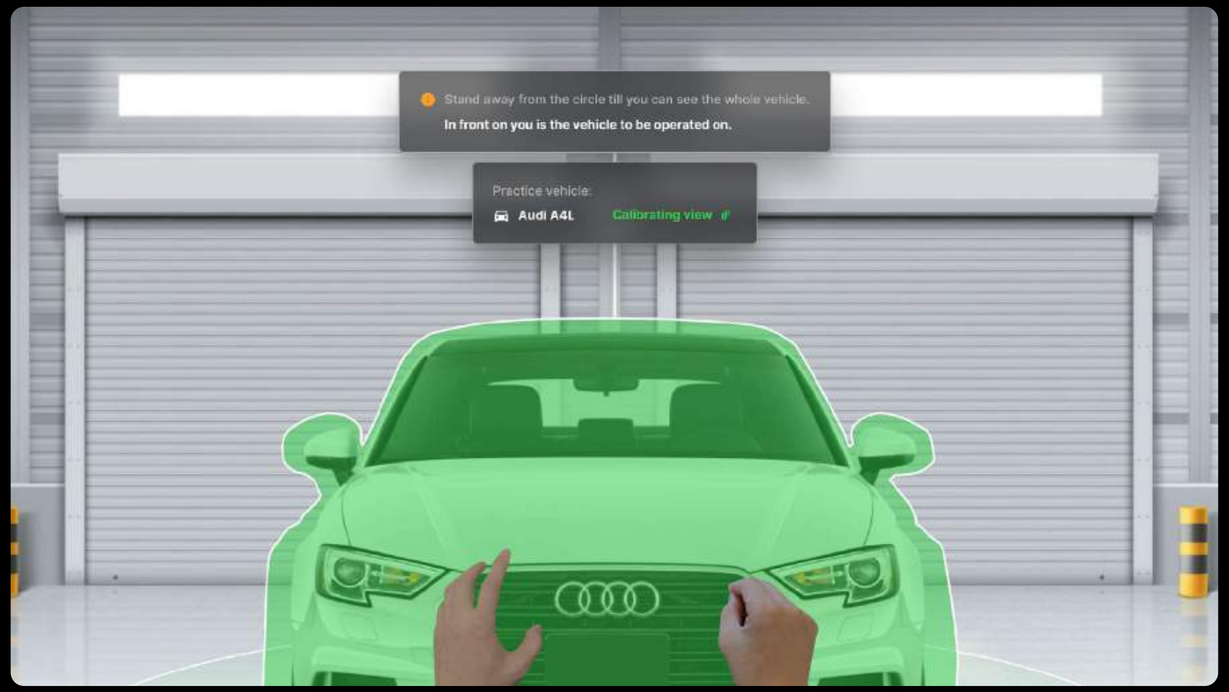

## Choose task

From the dashboard the trainee selects a task and they see the description of the task, the aim, the vehicle to be operated on, the tools needed and the supervisor in charge. They can then proceed.



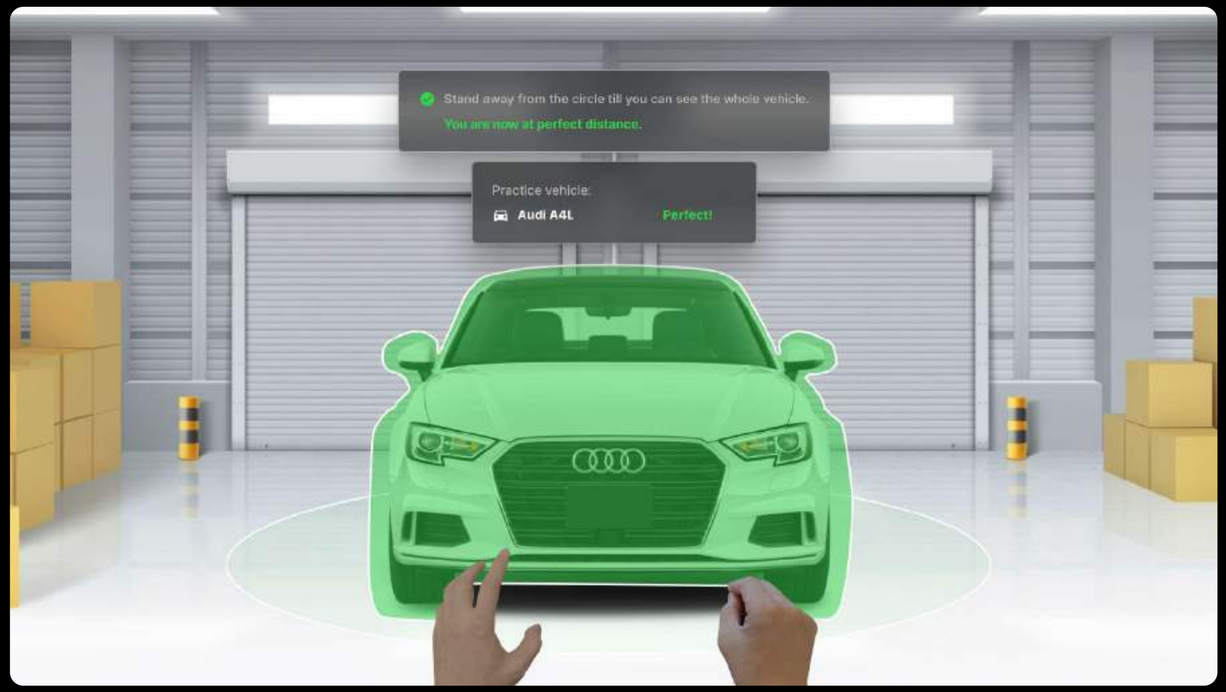

## Video preparation

The next step is for the trainee to watch a video introducing them to the task and how to carry it out.



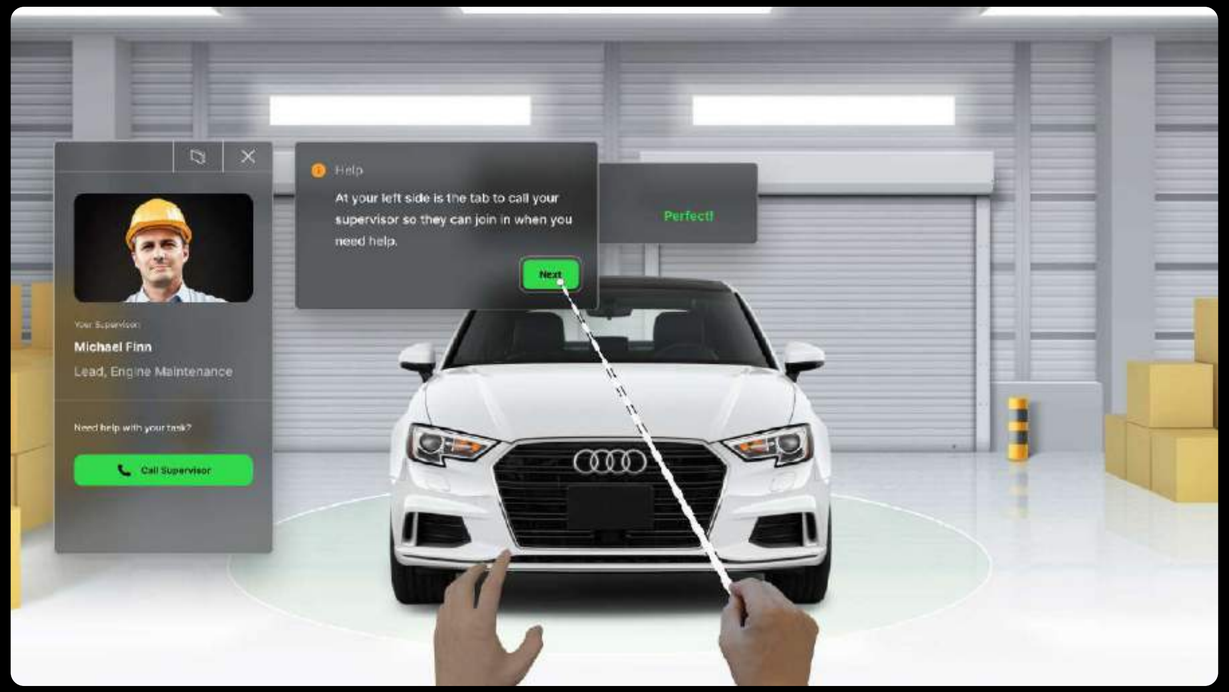

## Task preparation

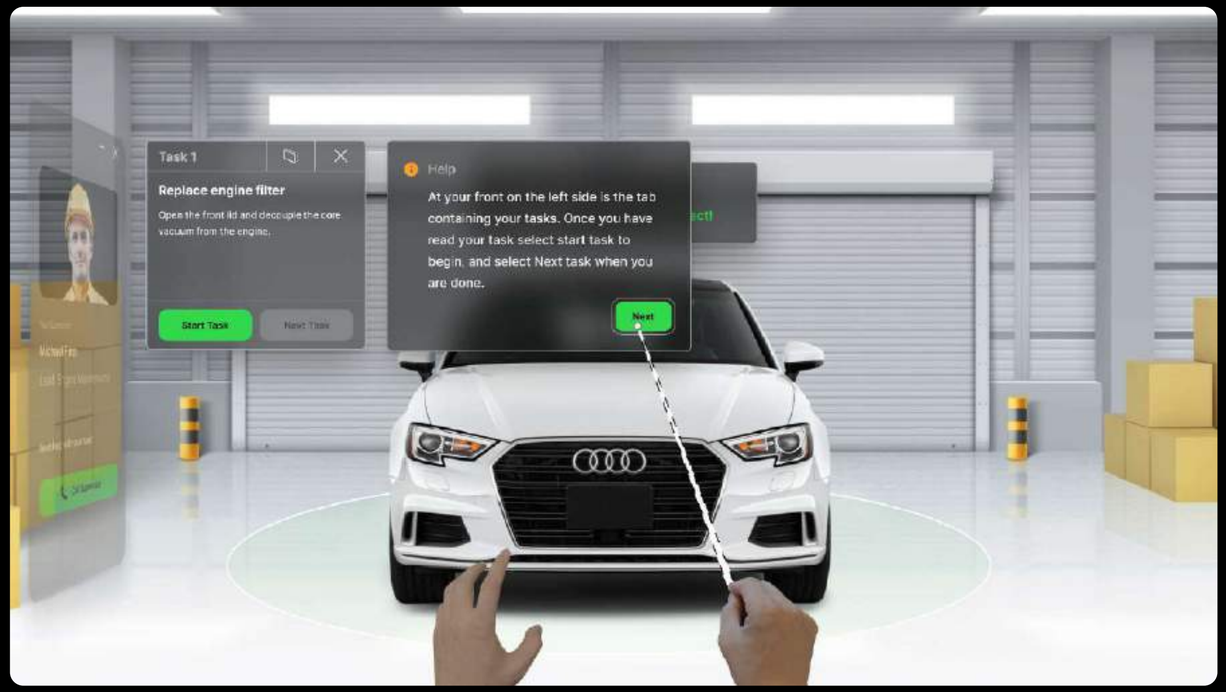
The trainee then prepares the scene according to the instructions, first they position themselves in a range that totally captures the vehicle to be operated as the view calibrates..




## HoloLens camera scanning image

The HoloLens camera scans the image and calibrates the view till the trainee is at good distance.



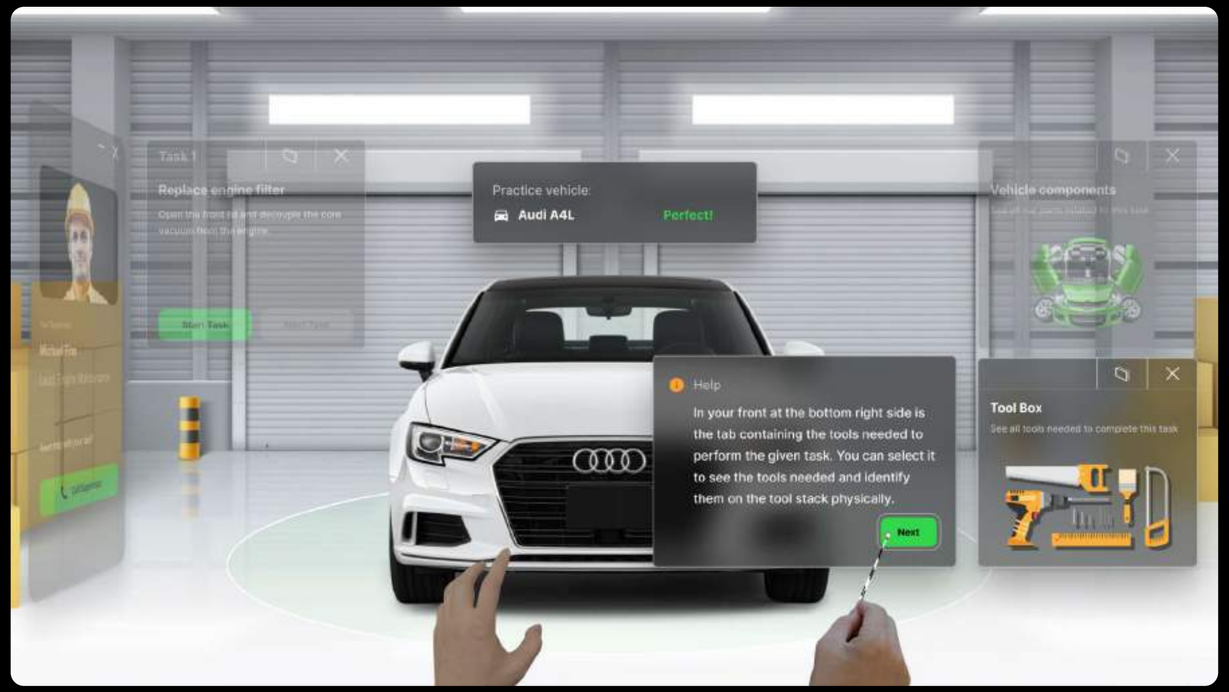




## Help and tutorials

On completion of setup the UI guides the trainee on each tab and what their function is.

It shows the:

- Supervisor tab to call for assistance.
- Task tab for the steps of the exact task

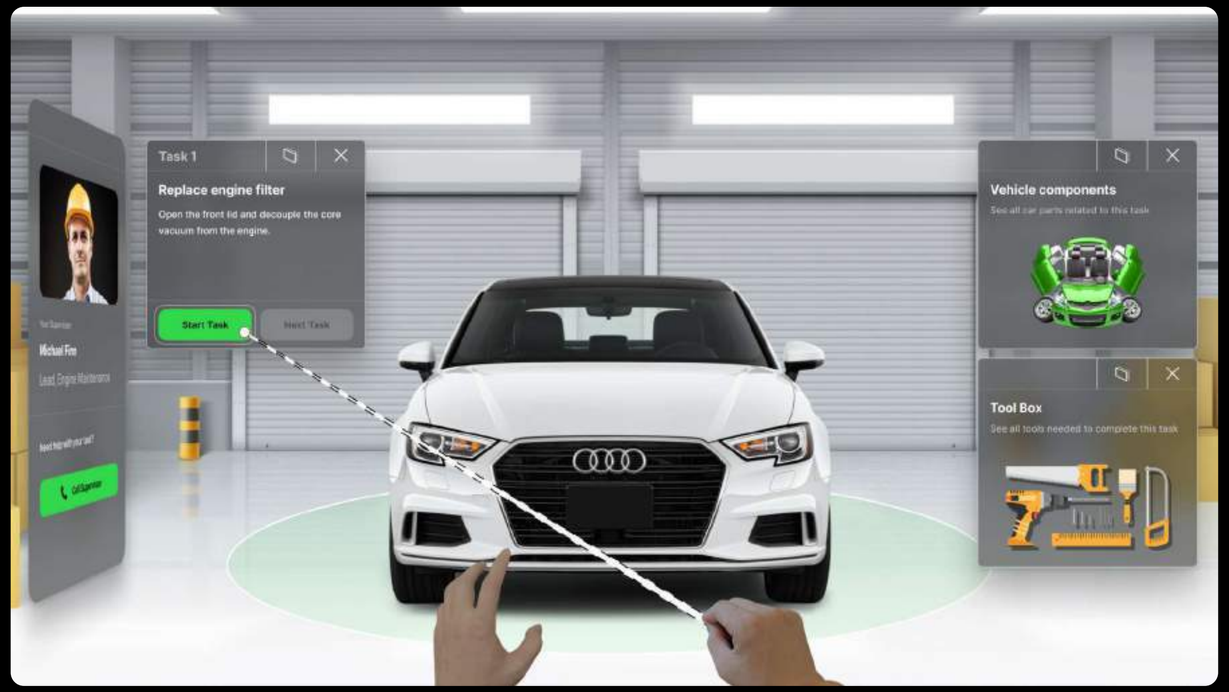



## Toolbox and car components tab

- Tool box tab where they see all tools needed for a specific step in the task.
- Car component part that shows the trainee the component to be operated on.

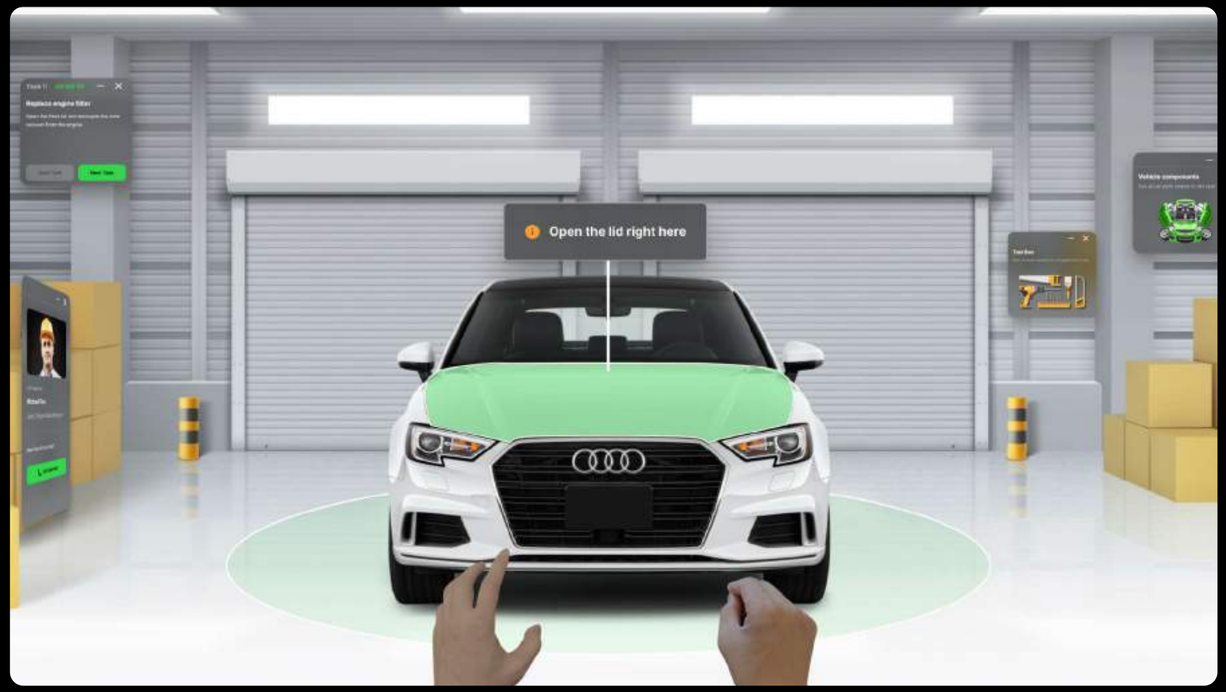
## Pin holographs to the wall

An intuitive message to let the trainee know that they can pin the tabs to the wall or minimise it while working so it doesn't interfere with their work.



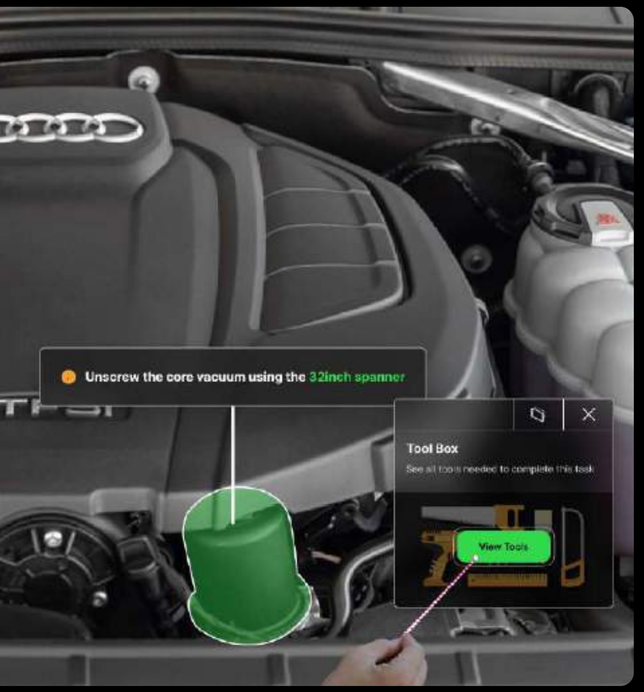

## Start task

The trainee starts the task, in a task they are multiple steps and the trainee has to perform the steps till the task has been completed successfully.



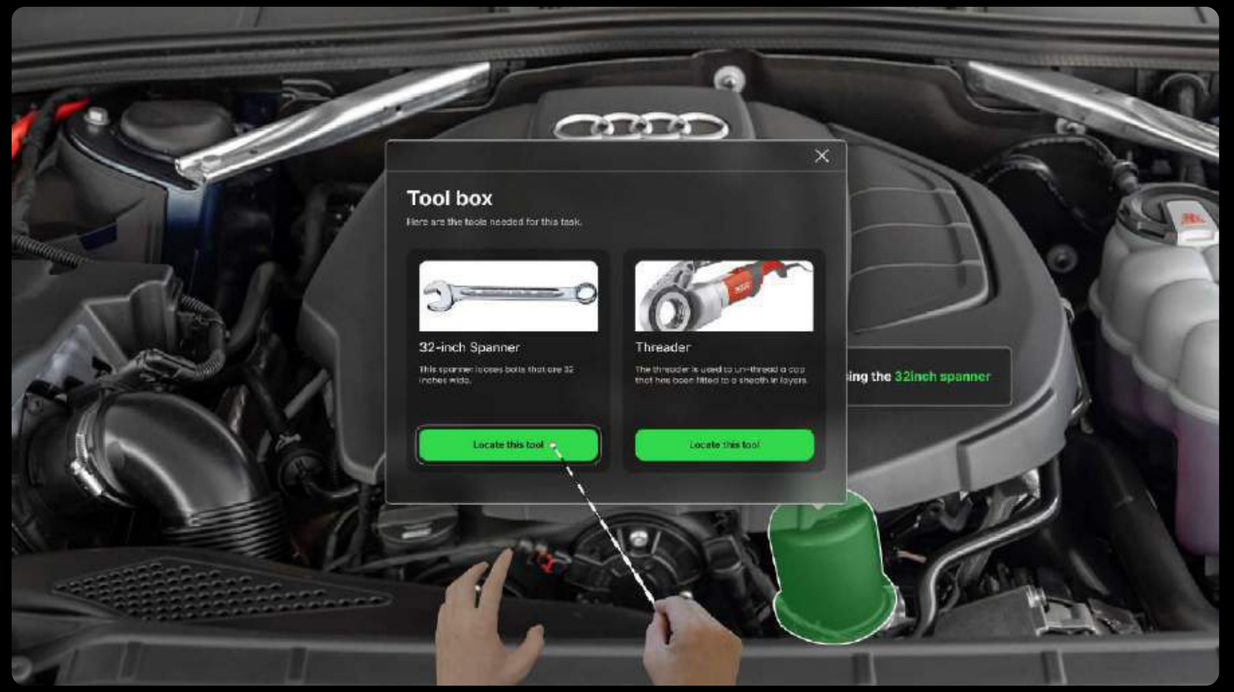

## Annotations & Tooltips during task

The trainee sees annotations and tool tips on the parts of the car to operate. The tabs have been pinned to the wall, now the trainee can see the car and work efficiently.



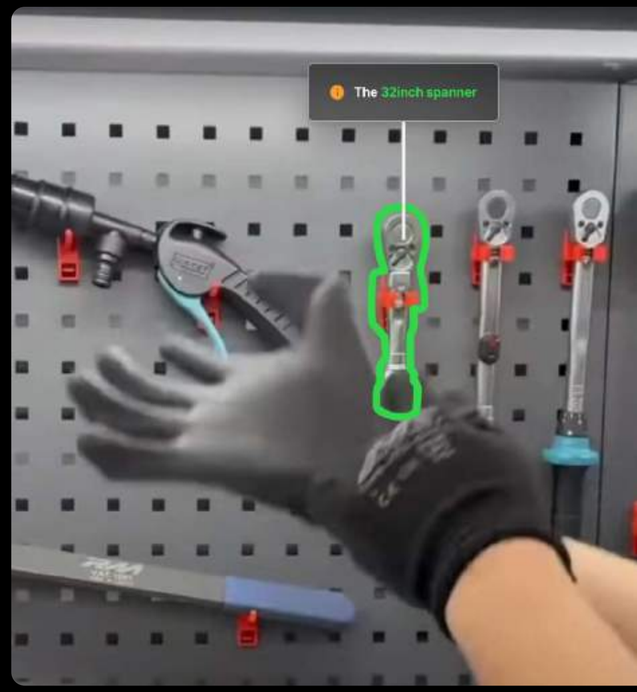

## Tool box

If a trainee needs to know what one of the recommended tools look like, they can go to the toolbox tab and view.



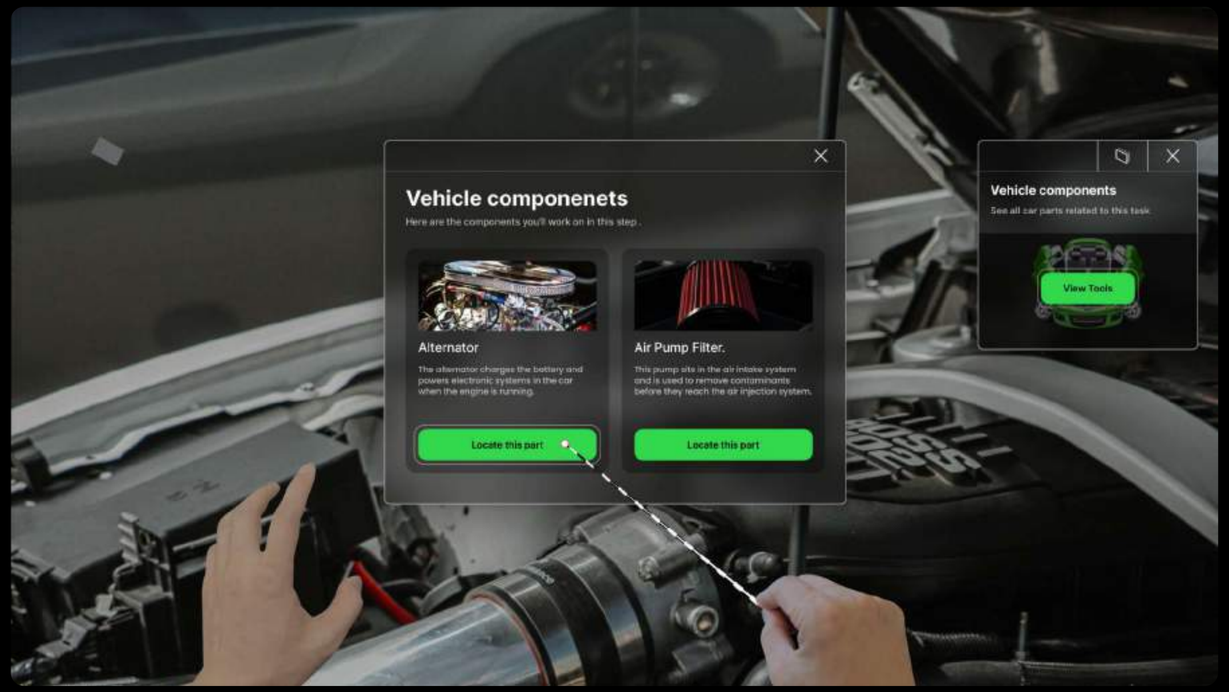

## Tool box

The trainee sees the tools needed for the exact step, and can select the needed one. they can select locate to find the tool in real life.



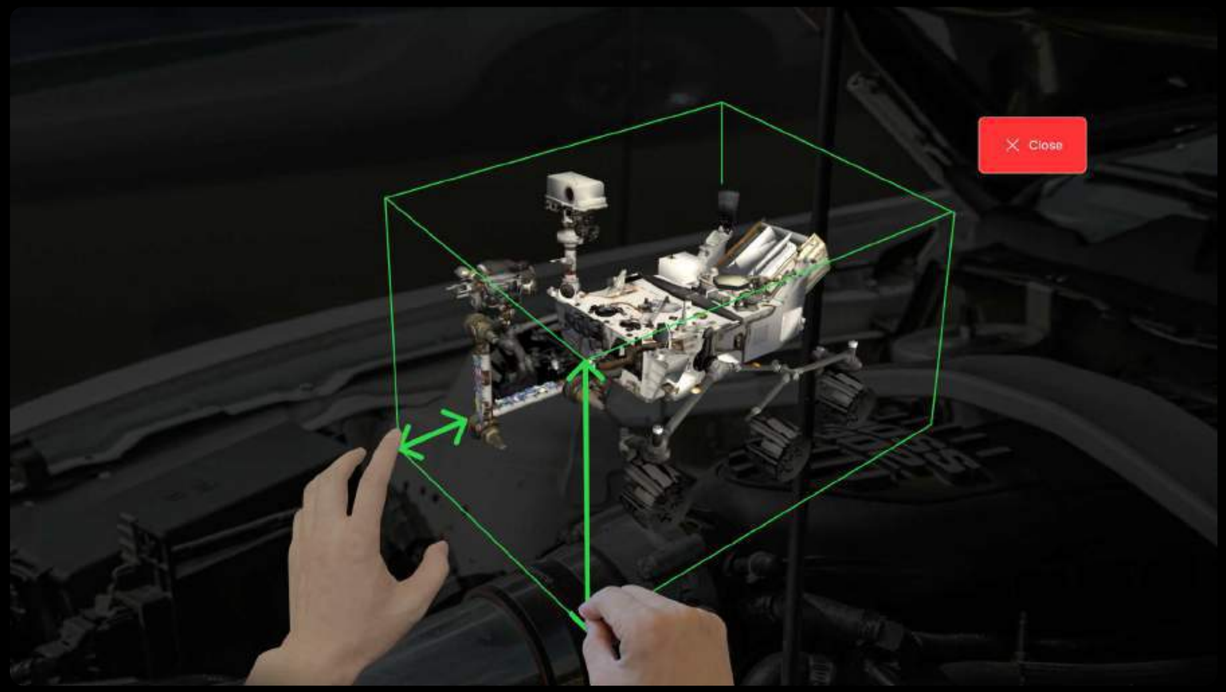

## Tool annotation

The trainee can then look to the tool section of the real world and the HoloLens camera sends the image to the cloud for recognition, it annotates once the tool is detected.



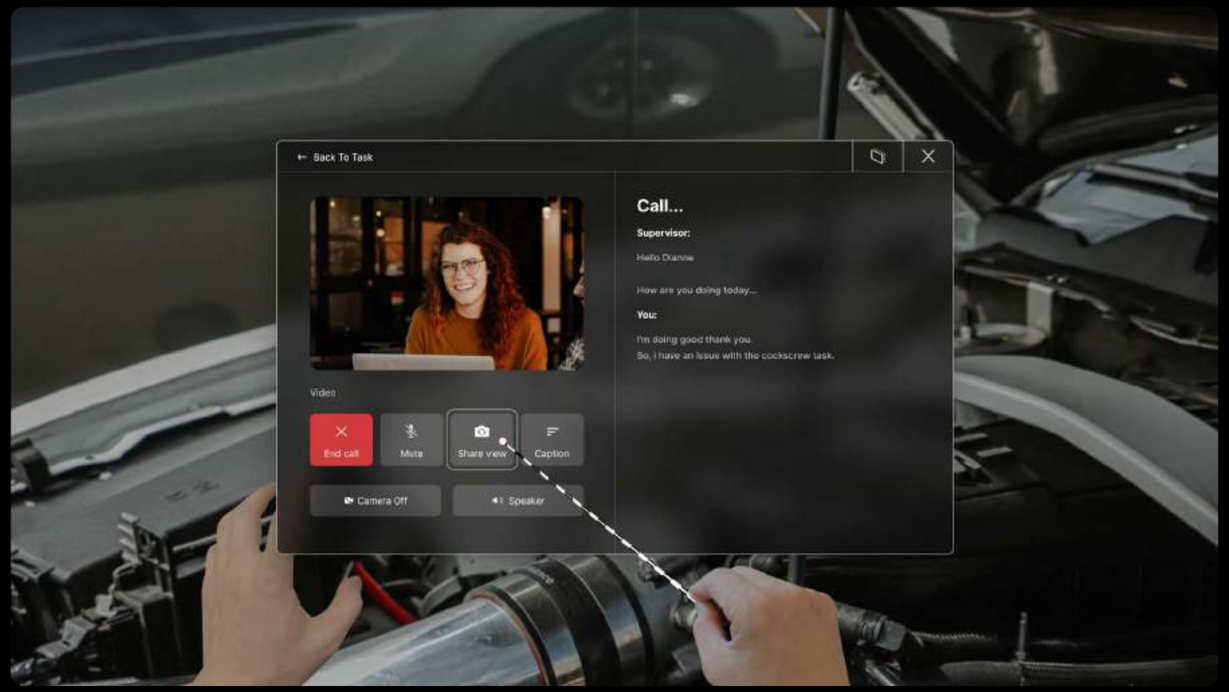

## View vehicle components

Once the trainee need to know about a part of the car required for him to operate on in the current task, he can open the car component tab and select the component out of the populated component pertaining to the current task.



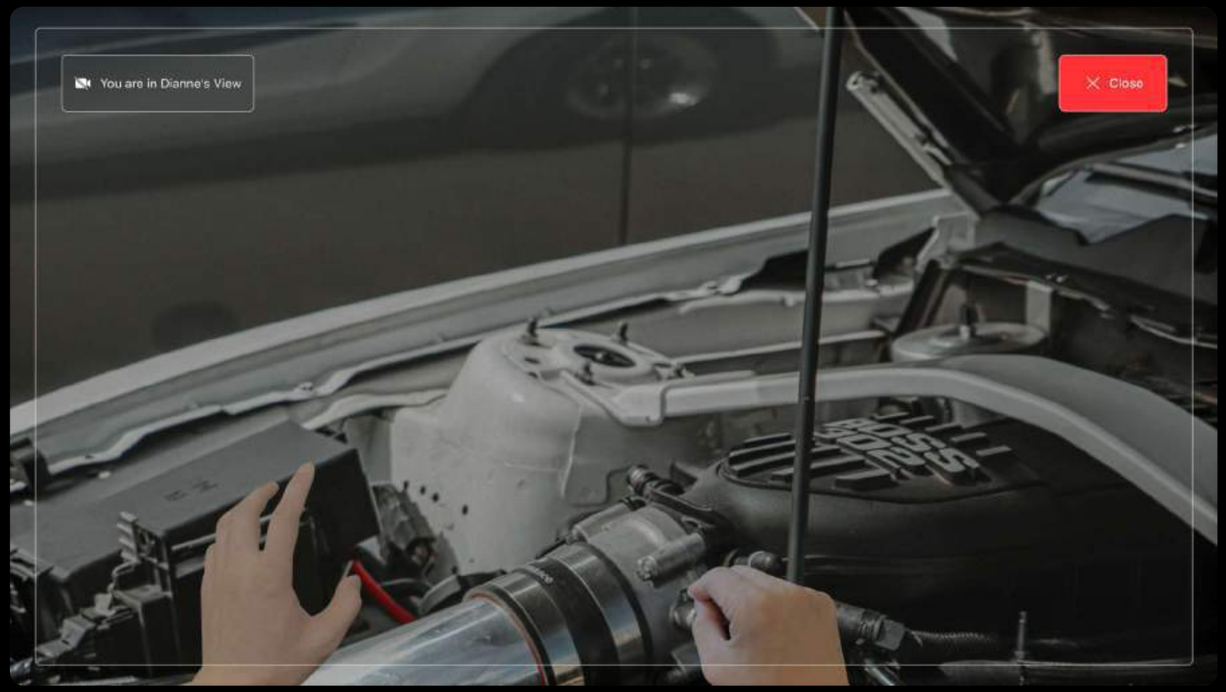

## The Ring visual cue

The trainee can then see the 3d model of this component and can use the ring visual cue interaction method to view the model in detail so that they can have an idea about the component before proceeding with the task.



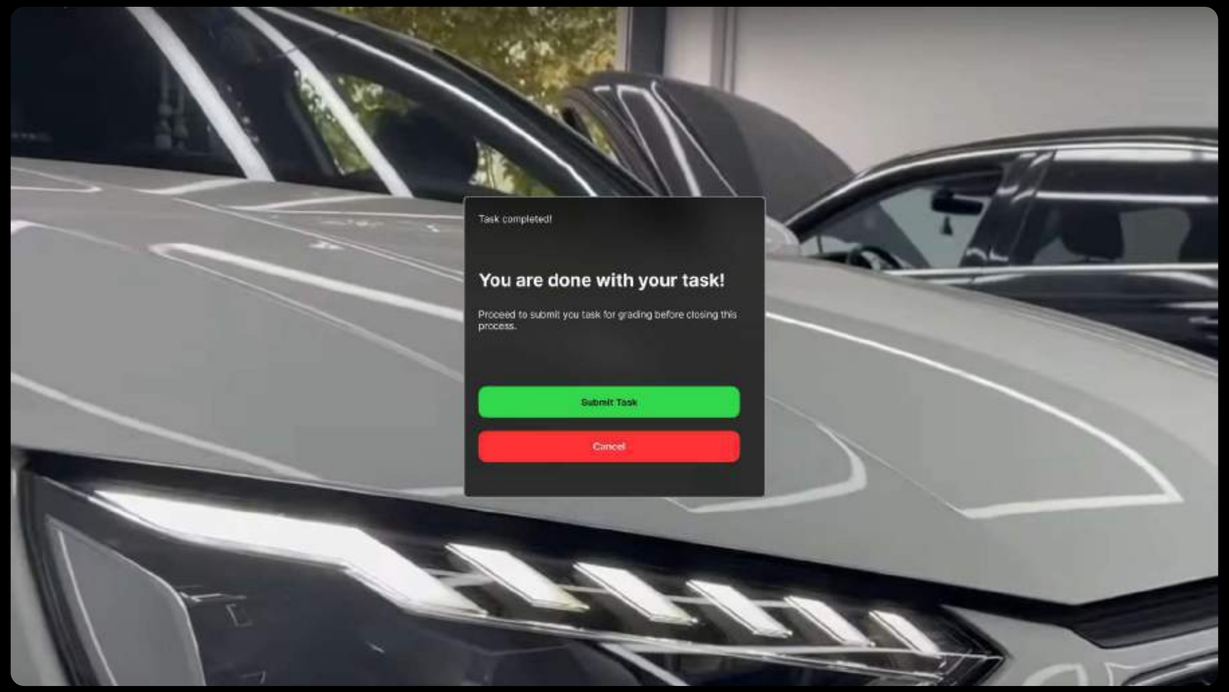

## Call Supervisor

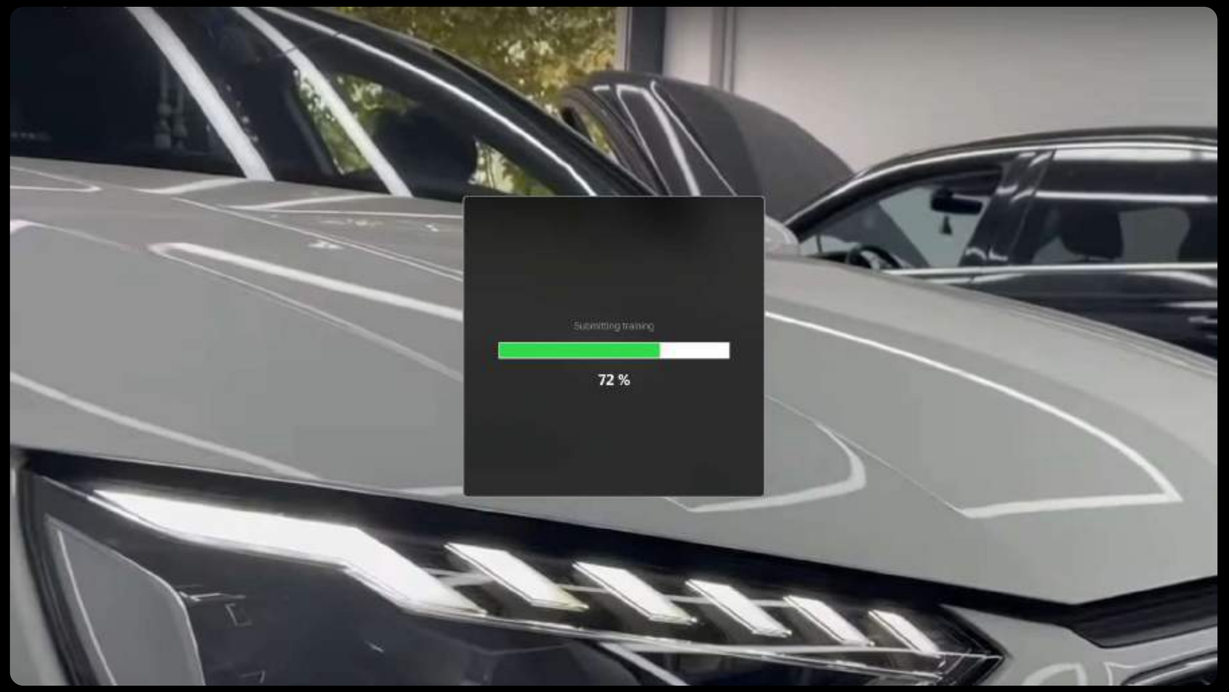
The trainee can reach out to the supervisor when they need help, and this supervisor can join on a call.




## Supervisor's view of trainee's camera

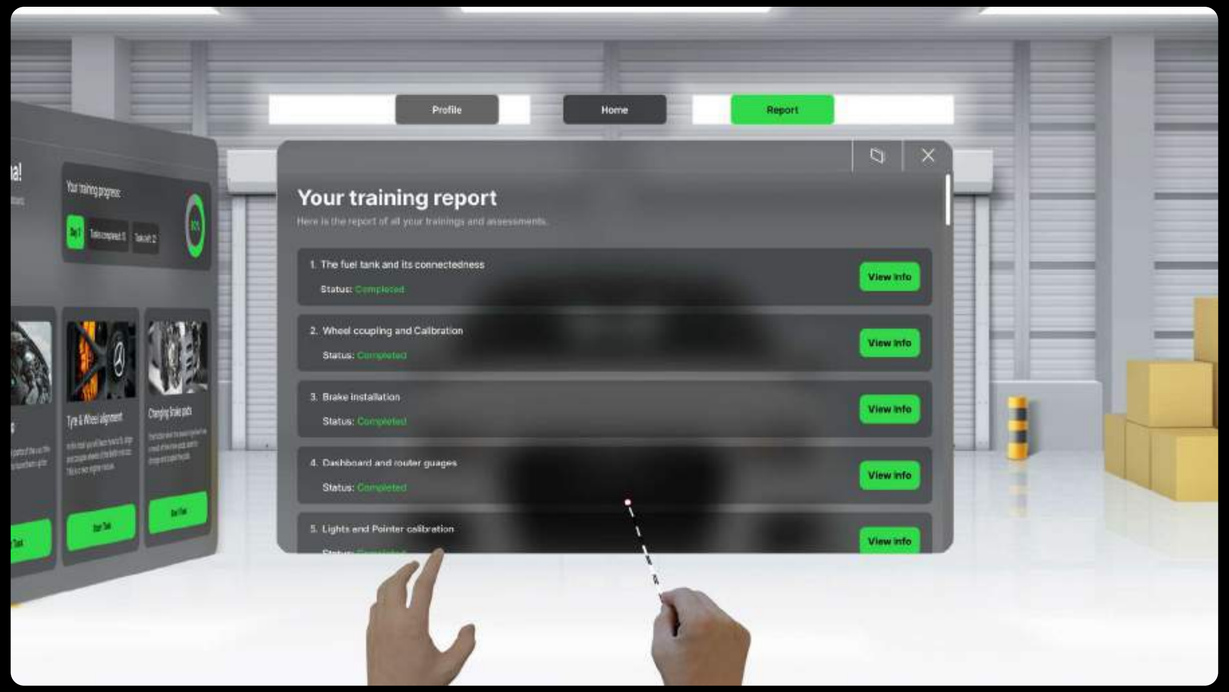
The supervisor can then open his app and tune in to the HoloLens camera view of the trainee to see the issue and guide with the current task.



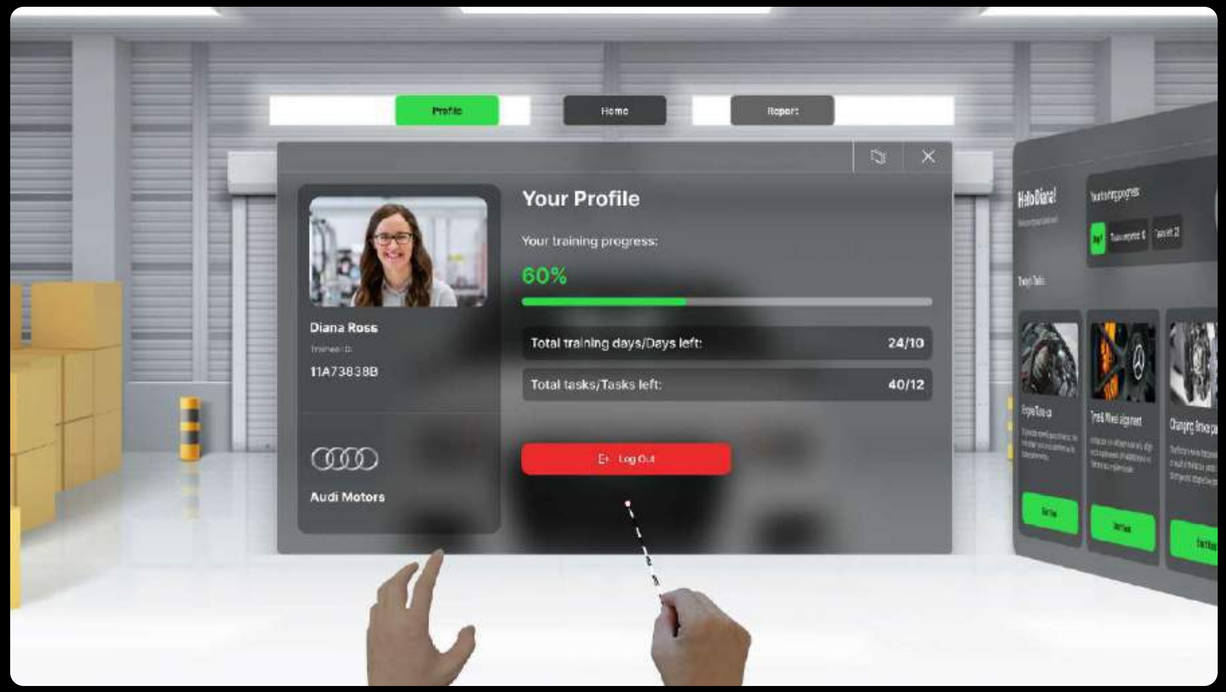

## Submit training

On completion of all the steps the trainee can then submit the training for grading.




## Training report

Here the trainee can see all the records of their past training and the completion status.




## Profile

The trainee can view their profile to see their personal details, their organisation details, and summary of training progress.

From here the trainee can log out

## Smart Watch for notifications and haptics

The smart watch provided for the trainee will be worn during the process of this training, and this smart watch will handle notifications, alerts and haptics.


## Types of notifications

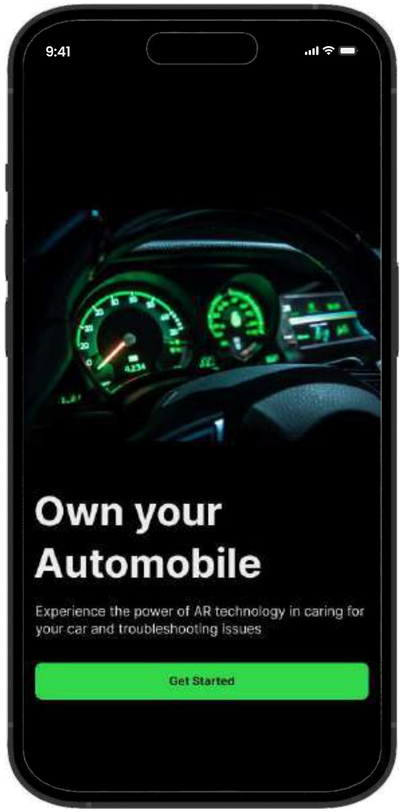
- Alerts
- Messages
- Haptic feedback

**Sound:** **Microsoft HoloLens spatial sound**

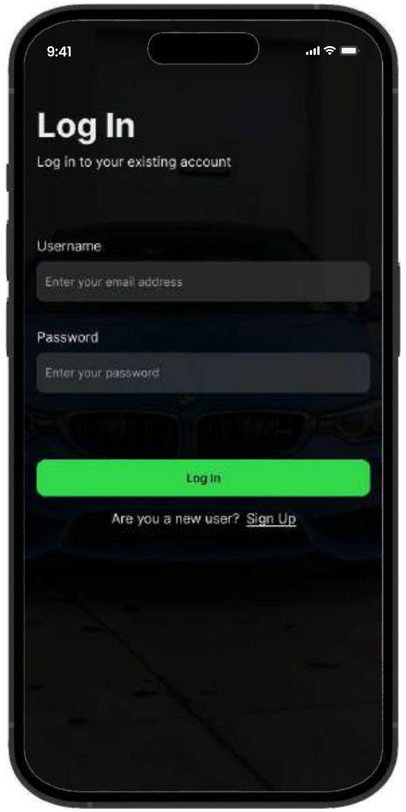
# Onboarding and Sign up

## Splash Screen


## Onboarding Screen



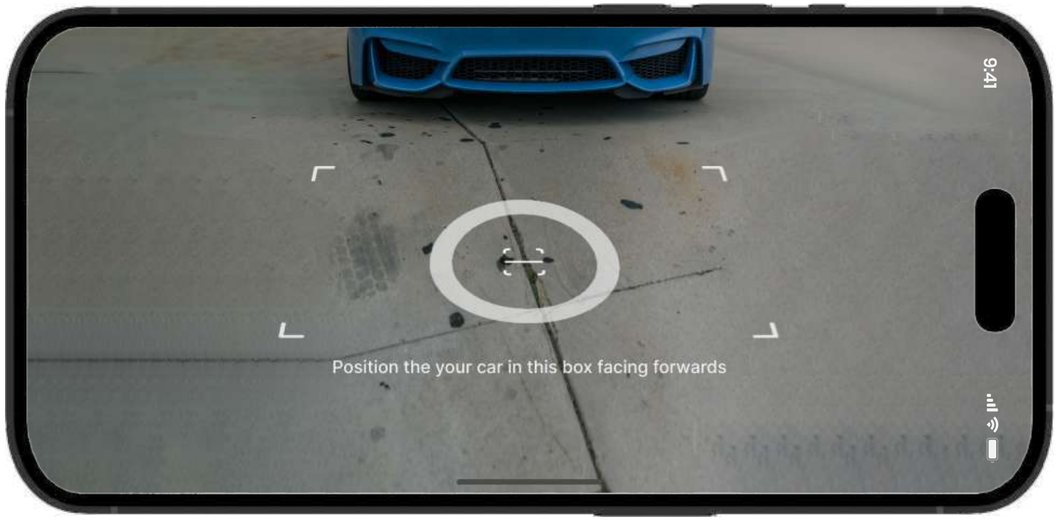

## Login Screen



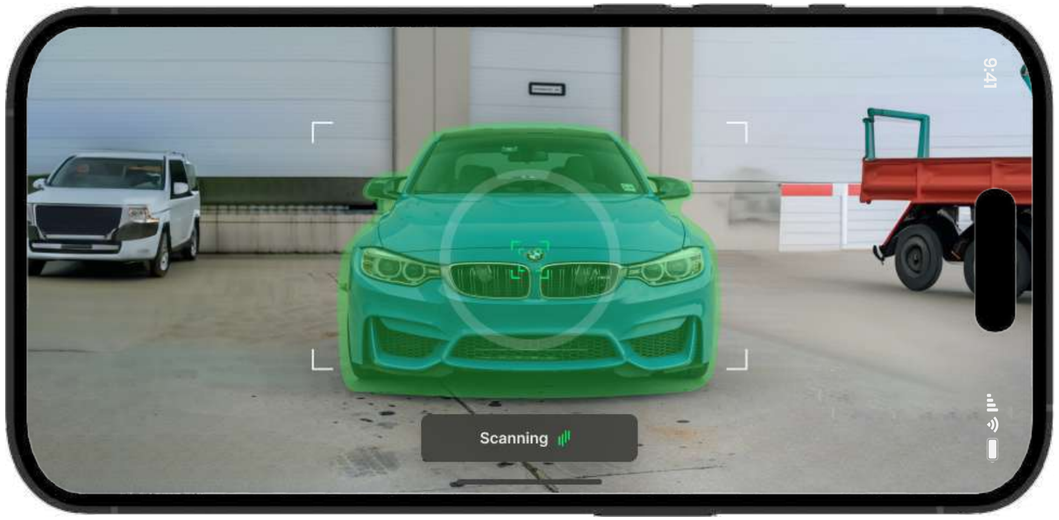
# AR Car Detection

The design was aligned with Apple Developer guidelines for AR

### Coaching Screen




### Initialization Screen




### Initialization Coaching

App has an initial coaching view with a placement indicator and clear instruction to show users what to do and where to position car to begin identfication process

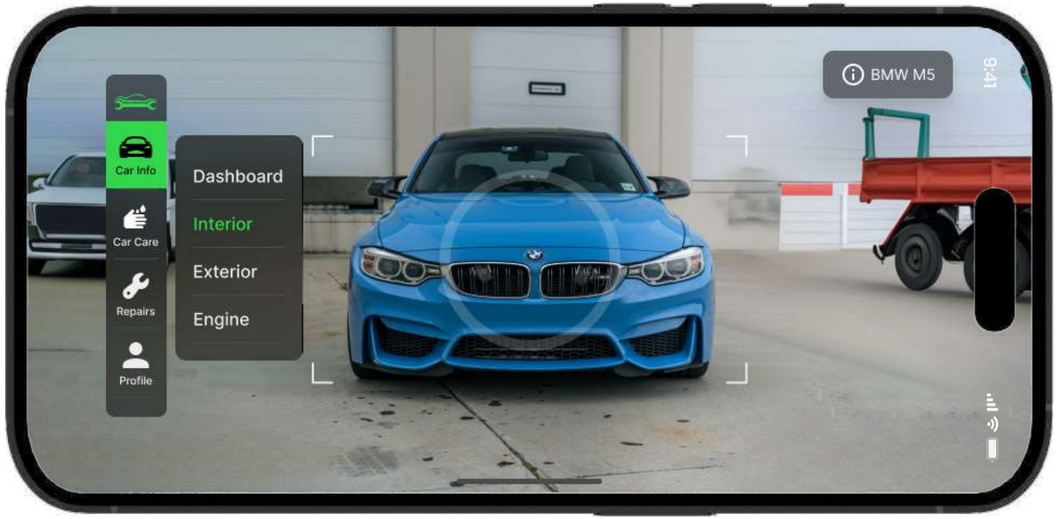
### Initialization Feedback

A spotlight indicator provides feedback when a car has been positioned and is ready for identification by scanning. An animated feedback indicates the scanning process.

# Navigation

The design was aligned with Apple Developer guidelines for AR

### Menu Screen


### Immersive and clear screen

To provide an immersive viewing experience and avoid cluttering. A minimalist approach was taken by displaying only important contents on the screen.

### Consistent Navigation

The navigation is consistent and fixed on the left side of the screen to assist users in finding and viewing content in screen space.

# Interior

The design was aligned with Apple Developer guidelines for AR

### Interior Screen


### Tutorial Overlay


### Indicators

Indicators were added to provide visual cues to users when viewing important information on the screen. This provides a guide that assist users in completing their task.

### User Guides and Tutorials

Guides and video tutorials provides extensive written and visual contents that gives users information about the car’s parts and their maintenance.

# Interior

The design was aligned with Apple Developer guidelines for AR on iOS

### Dashboard Screen


### Tutorial Overlay


### Indicators

App has an initial coaching view with a placement indicator and clear instruction to show users what to do and where to position car to begin identfication process

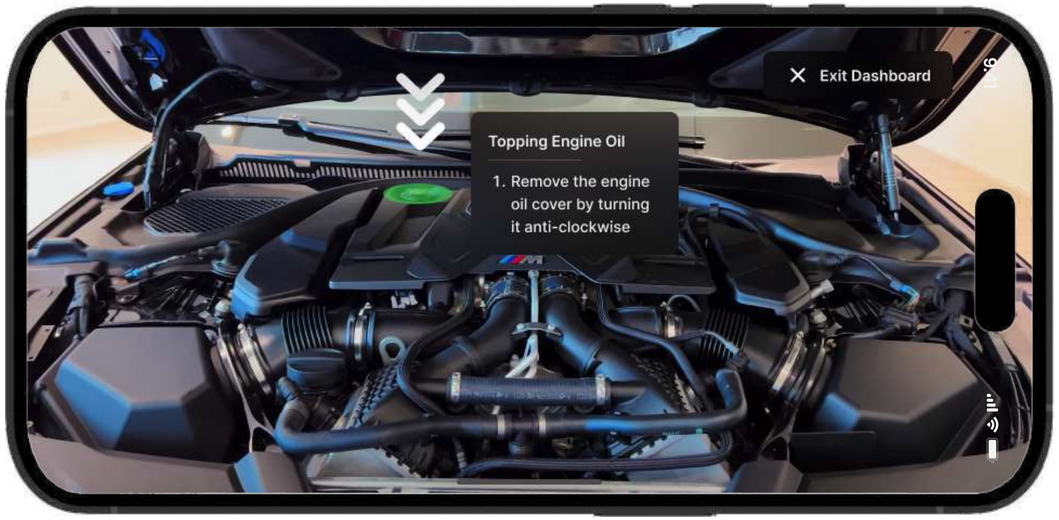
### User Guides and Tutorials

A spotlight indicator provides feedback when a car has been positioned and is ready for identification by scanning. An animated feedback indicates the scanning process.

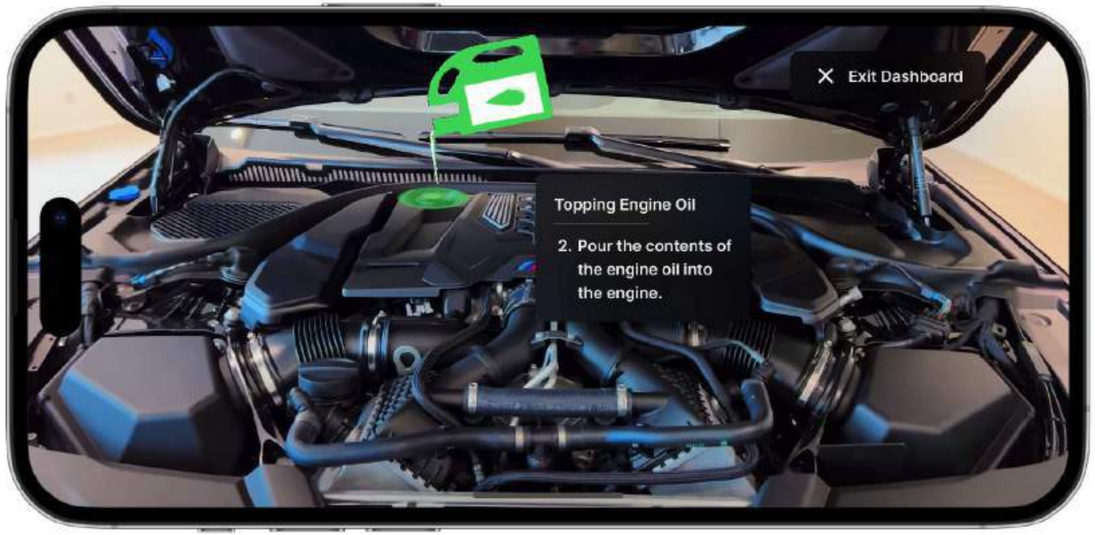
# Car Maintenance - Engine

The design was aligned with Apple Developer guidelines for AR on iOS

### Engine Screen




### Tutorial Overlay




### Pointers and Guides

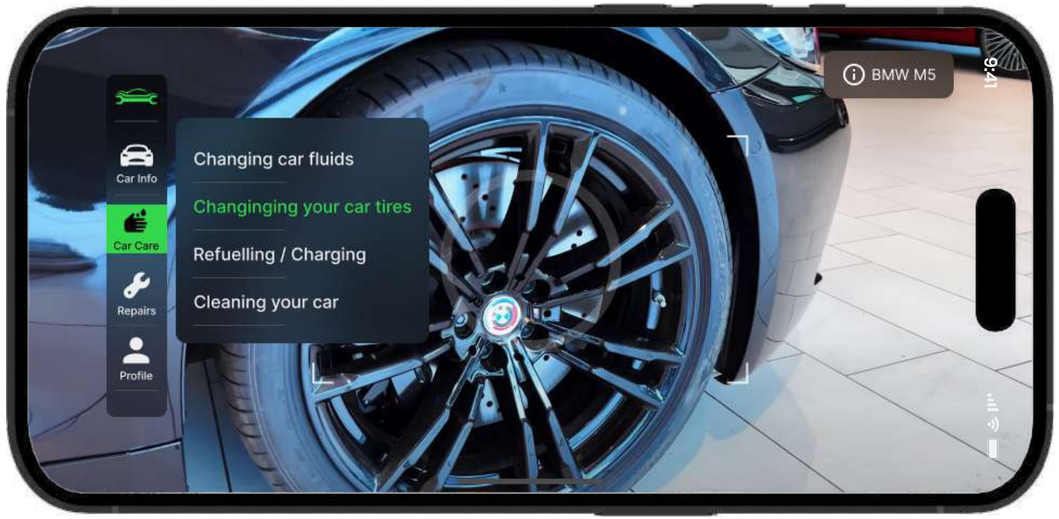
Pointers and guides draws users attention to a particular area of focus. It visually shows users what to do when completing a task.

### Animated Instructions

To explain complex task, animated instructions were incorporated. This visually simplifies the task and provide engaging step-by-step instructions on fixing users cars.

# Car Maintenance - Tyres

The design was aligned with Apple Developer guidelines for AR on iOS




**Car Maintenance menu**


**Tyre replacement AR Guide**

# Troubleshooting - Faulty Engine Sounds

The design was aligned with Apple Developer guidelines for AR on iOS

### Coaching Screen



### Audio Analysis

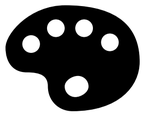
The application provides audio analysis that detect faults by analysing the sound produced by the car.

### Audio Troubleshooting

After analysis, the app gives troubleshooting instructions and video tutorials based on the results.

# ACCESSIBILITY CONSIDERATIONS

Voice Commands and Gestures for users who have difficulty with touch screens or physical buttons



Maintained a strong color contrast between text and background elements for users with low vision or color blindness.

Text Size and font for users to customize the text size and font within the app to cater to individuals with visual impairments.

Large text size of 18px minimum for visibility and clarity.

Audio cues were considered to help users know when they have performed any action.

Guides through the application and it’s navigations were implemented for users.

Captions or transcripts provided for Audio content for users who are deaf or hard of hearing.

We kept the app's user interface simple and intuitive. To prevent that may confuse or overwhelm users, especially those with cognitive disabilities.

Call to Action buttons and links which are clearly labelled and visually distinct to help users understand what actions to take.

The size of the target for all buttons, links, and pointer inputs were designed to a minimum of 44mm by 44 mm to enable users with motor difficulties to interact easily

# Evaluation and Methodology

To evaluate the experience of our application we tested with users and measured performance using the following criteria:

### Completion Time (Quantitive)

- Time it took the User to complete the task
- Usability Testing

### Effort per Time

Analysing the time taking and it’s effect on hand motion and strain.

### SUS (System Usability Scale)

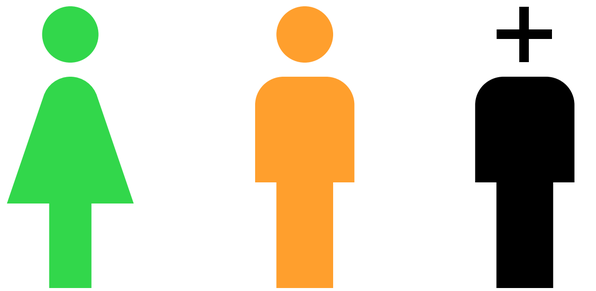
Leveraged the use of System Usability Scale (SUS) within the scope of Augmented Reality (AR) for assessing usability of the application

### Feedback (Qualitative)

Recommendations and Insight was generated from the interviews during the test for more improved version of the immersive technology.

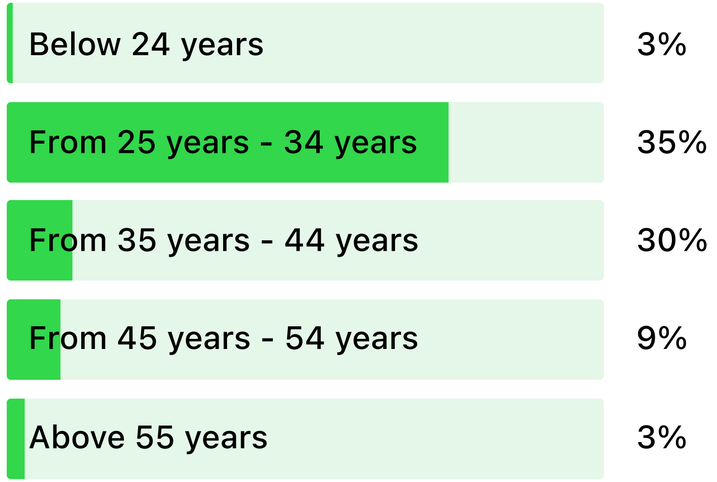
# Demographics

## Gender

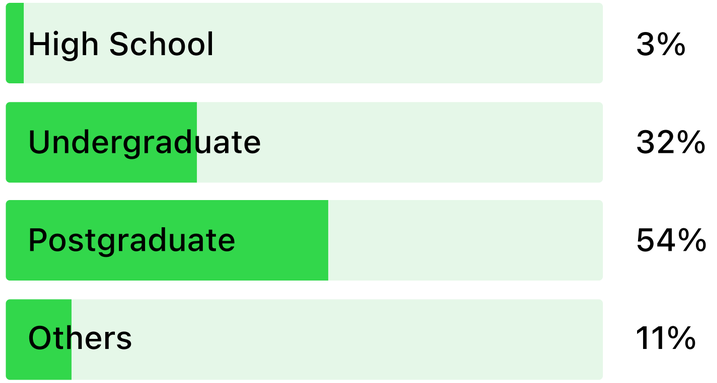


30% 70% 0%

## Age Range




## Level of Education




## No. of Responses Per Survey Type:

| 5 Responses | 5 Responses |
|---|---|
| Car Owners | Trainee |

# USER TESTING - TASK & TIME TAKEN (CAR OWNER)

| Tasks for Car Owner | Time taken in minutes. | | | | | Avg. time per task |
|---|---|---|---|---|---|---|
| Scan your car to initialize | 1.44 | 1.48 | 1.57 | 1.19 | 1.24 | **1.38** |
| Check for detailed Car information | 1.42 | 1.10 | 0.50 | 1.07 | 1.22 | **1.06** |
| Scan the Car interior for information | 1.23 | 1.11 | 1.08 | 0.56 | 1.17 | **1.03** |
| Locate menu on how to change car fluids | 1.27 | 1.36 | 1.48 | 1.27 | 1.33 | **1.34** |
| Check guide on how top engine oil | 1.07 | 1.13 | 1.31 | 1.27 | 1.47 | **1.25** |
| Check guide on how to change a tyre | 0.57 | 1.02 | 1.29 | 1.06 | 1.39 | **1.06** |
| Talk to a medical assistant | 1.22 | 1.31 | 1.29 | 1.24 | 1.18 | **1.24** |
| Read a book about caregiving | 0.57 | 0.59 | 1.04 | 0.58 | 0.57 | **1.02** |

# USER TESTING - TASK & TIME TAKEN (TRAINEE)

| Tasks | Time taken in minutes. | | | | | Avg. time per task |
|---|---|---|---|---|---|---|
| App Lauch | 1.90 | 1.80 | 2.10 | 1.68 | 1.49 | **1.95** |
| Login | 1.63 | 1.57 | 1.12 | 1.27 | 1.35 | **1.31** |
| Go to Dashboard | 1.38 | 1.42 | 1.48 | 1.24 | 1.32 | **1.37** |
| Help Task | 1.35 | 1.37 | 1.52 | 1.38 | 1.41 | **1.43** |
| Start Task | 1.33 | 1.42 | 1.50 | 1.47 | 1.57 | **1.53** |
| Show tool box | 1.34 | 1.02 | 1.18 | 1.35 | 1.26 | **1.26** |
| View Vehicle  Components | 1.35 | 1.46 | 1.45 | 1.38 | 1.39 | **1.48** |
| Call Supervisor | 1.03 | 1.06 | 1.12 | 1.11 | 1.02 | **1.05** |

# USER TESTING - SUS SCORE (MOBILE)

| Questions | | | | | |
|---|---|---|---|---|---|
| I think that I would like to use this application frequently. | 4 | 5 | 3 | 5 | 4 |
| I found the application unnecessarily complex. | 2 | 1 | 4 | 2 | 1 |
| I thought the application was easy to use | 3 | 5 | 3 | 4 | 5 |
| I think that I would need the support of a technical person to be able to use this app. | 1 | 1 | 3 | 1 | 1 |
| I found the various functions in this application were well integrated | 4 | 5 | 3 | 5 | 5 |
| I thought there was too much inconsistency in this application | 1 | 1 | 3 | 2 | 1 |
| I would imagine that most people would learn to use this application very quickly | 4 | 5 | 4 | 4 | 4 |
| I found the application very cumbersome to use | 1 | 1 | 4 | 2 | 2 |
| I felt very confident using the application. | 4 | 5 | 4 | 4 | 4 |
| I needed to learn a lot of things before I could get going with this system. | 2 | 2 | 4 | 2 | 1 |


**Individual SUS Score:**

**Mobile App**

- 80
- 97.5
- 85
- 82.5
- 90

**Average SUS Score:**

**87**

**This shows good usability!**

# USER TESTING - SUS SCORE (TRAINEE)

| Questions | | | | | |
|---|---|---|---|---|---|
| I think that I would like to use this application frequently. | 4 | 5 | 5 | 4 | 4 |
| I found the application unnecessarily complex. | 2 | 1 | 1 | 1 | 2 |
| I thought the application was easy to use | 3 | 4 | 4 | 5 | 5 |
| I think that I would need the support of a technical person to be able to use this app. | 1 | 2 | 2 | 1 | 2 |
| I found the various functions in this application were well integrated | 4 | 5 | 4 | 5 | 4 |
| I thought there was too much inconsistency in this application | 1 | 4 | 3 | 1 | 2 |
| I would imagine that most people would learn to use this application very quickly | 4 | 5 | 5 | 4 | 4 |
| I found the application very cumbersome to use | 1 | 1 | 2 | 2 | 2 |
| I felt very confident using the application. | 4 | 5 | 4 | 4 | 4 |
| I needed to learn a lot of things before I could get going with this system. | 2 | 1 | 1 | 1 | 2 |


**Individual SUS Score:**

**Hololens 2**

80

87.5

82.5

90

77.5

**Average SUS Score:**

**83.5**

**This shows good usability!**

# Blockers

The absence of any highlight visuals, audio, or text labels prevent me from knowing when their car is actively selected in the system.

The home screen seems to have too many icons and the car information bar seems to be obstructing the car

It sounds like there is an issue with the in-car indicators not being clearly explained to users

# Improvements

It would be helpful to have any visual, audio, or textual confirmation upon completion of the scanning process to provide feedback.

I would appreciate if the screen is as decluttered as possible.

I would be great if provide enhanced visual cues or voice-over explanations to demonstrate the meaning of each indicator.

## Blockers

Hard to absorb all the new information being presented in hands-on training

Intimidating to practice skills with more seasoned technicians observing

## Improvements

They requested for a way to export their performance in the case where they need it for other certifications

## What they loved

Simple steps to perform actions

Guidelines and tooltips helped increase learnability.

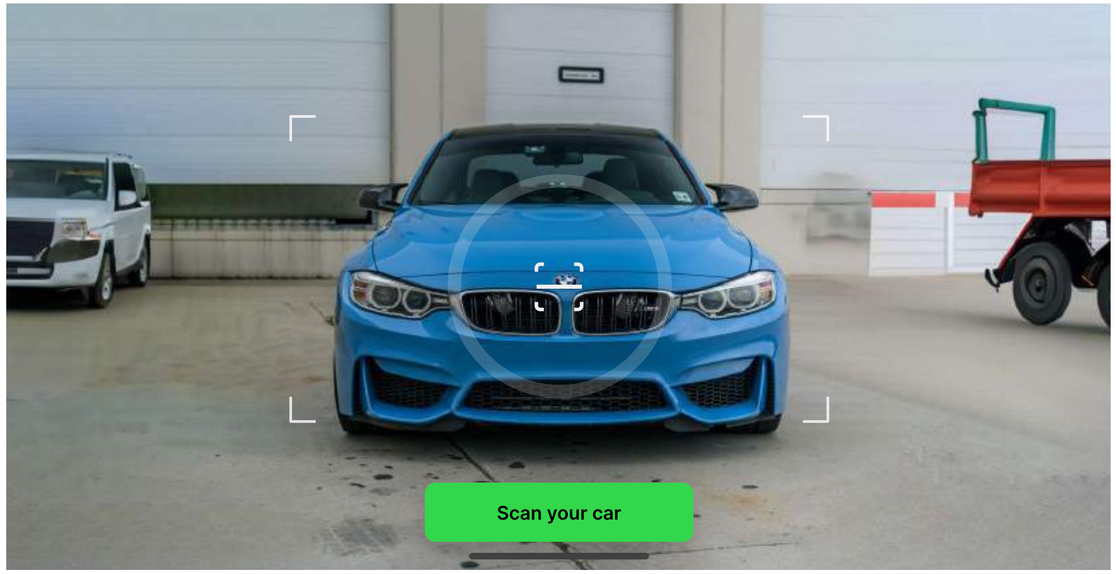
Minimalistic feel, and the fact that trainees can concentrate when they need to

Good use of colour

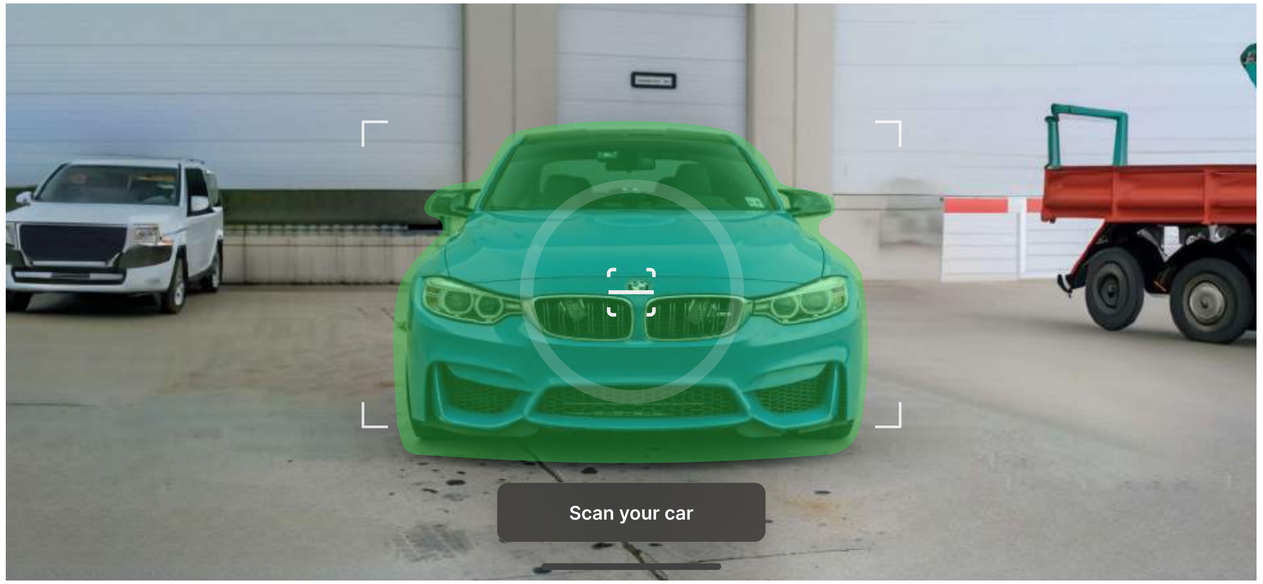
## SCAN SCREEN

The button color was updated from green to a translucent hue to align with Apple's design guidelines, while a green highlight was introduced to indicate when a car has been successfully positioned for scanning

**BEFORE**



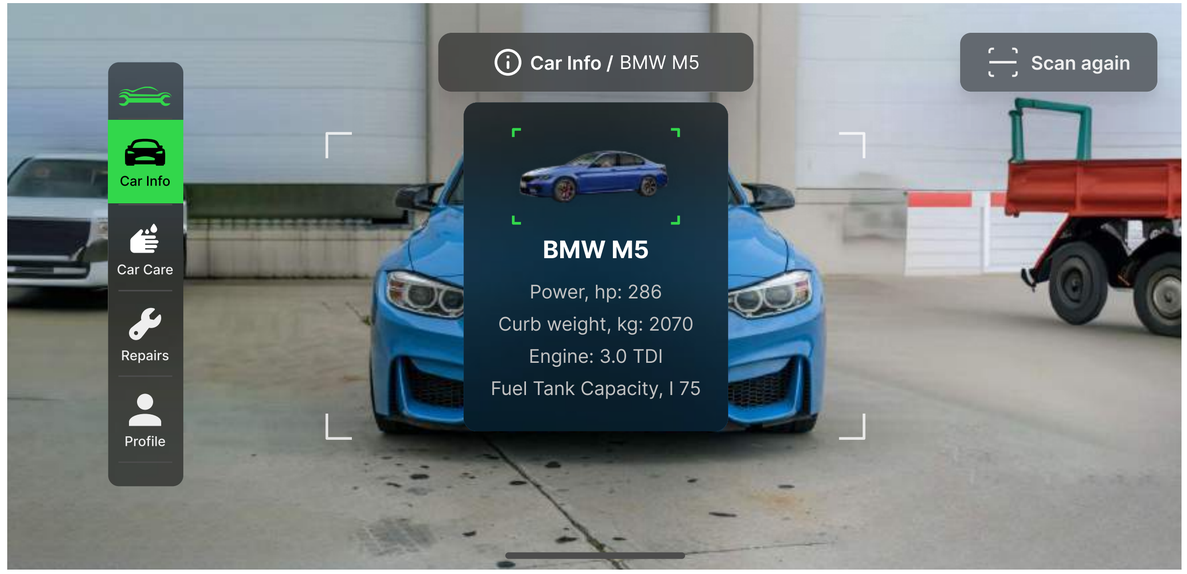

**AFTER**



## CAN INFORMATION SCREEN

The car info bar was relocated, and the top menu was streamlined to ensure a clear screen and prevent any obstruction to the focused object.

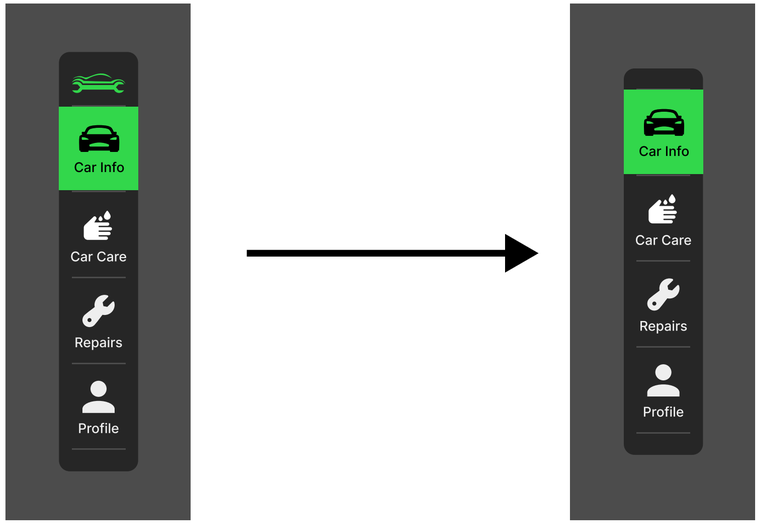
### BEFORE

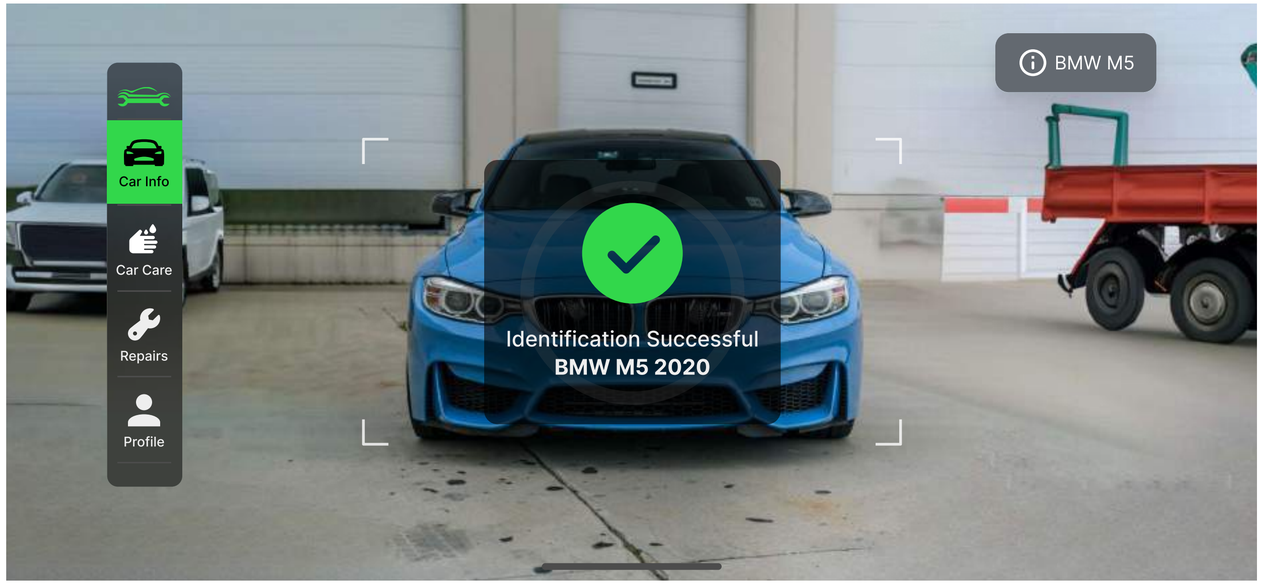



### AFTER

## CAN INFORMATION SCREEN

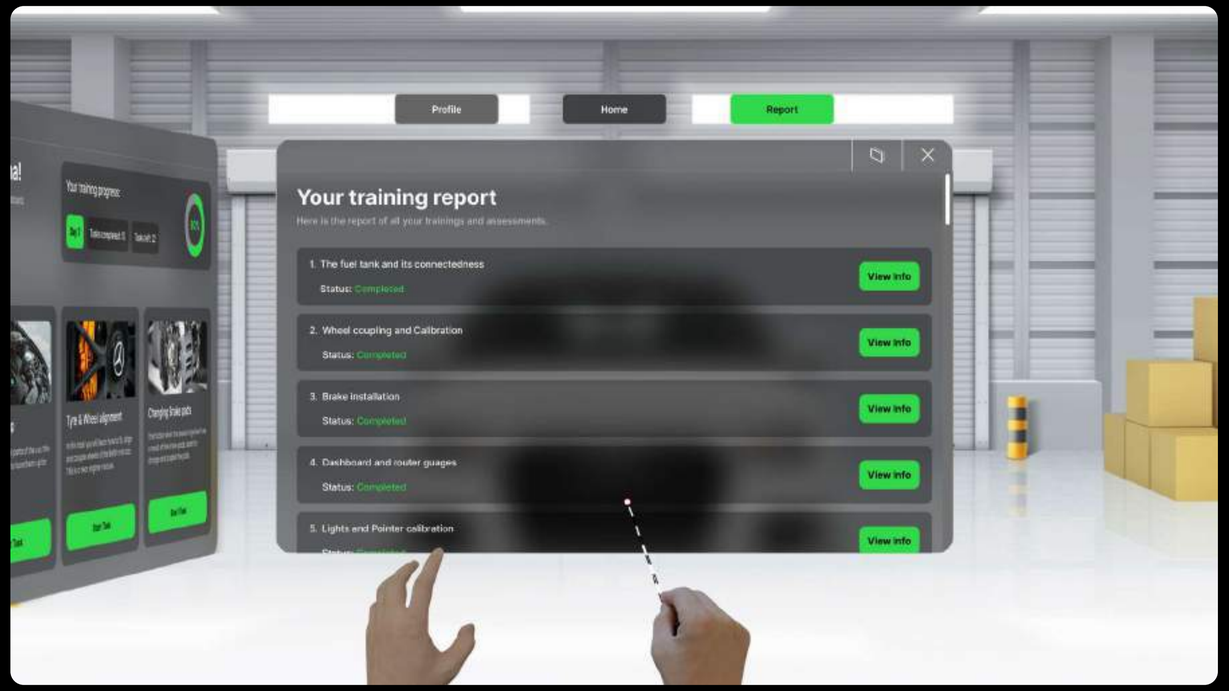
We've addressed user confusion by removing the Autospace icon from its previous position. Additionally, we've implemented a feedback feature to notify users when their car scanning is successful.

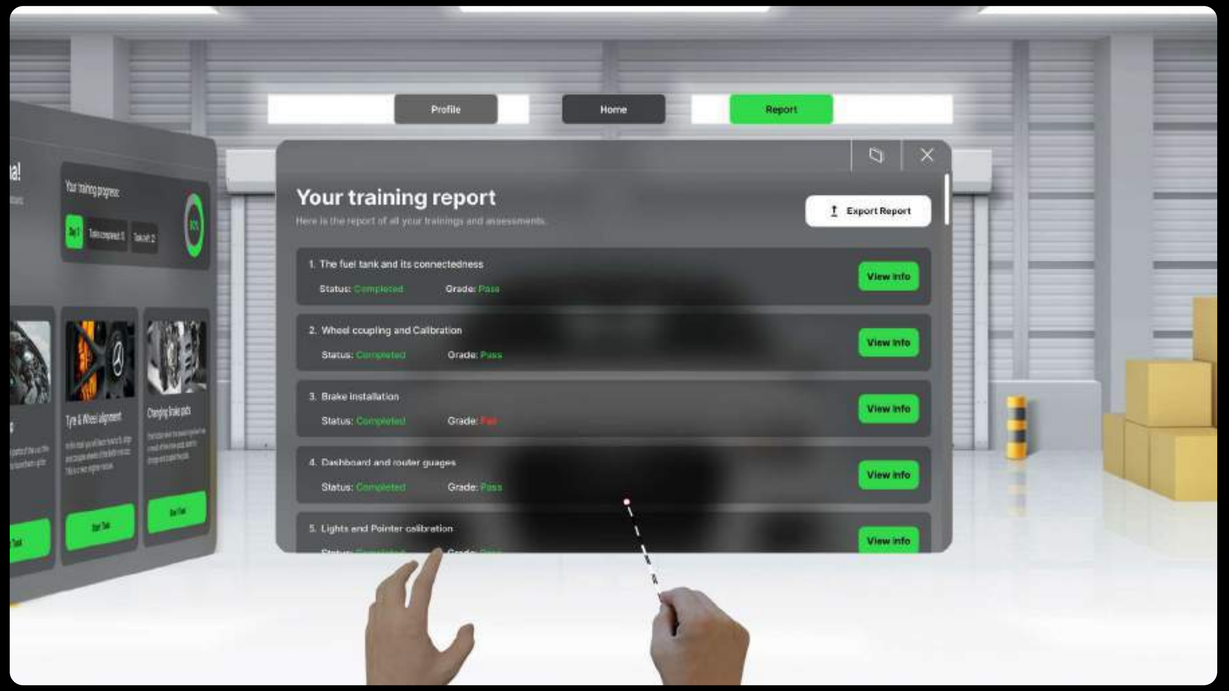


## THE REPORT SCREEN

Users requested that they need to be able to see their result for the training and export this for other certifications



# Limitations

Having concluded our MVP, we have considerations for the future on how to best improve our product and also add new features.

### Learning Curve

It features the additional need to help trainees gain the necessary skills and knowledge to make successful use of AR devices and applications.

### High Cost of Hardware and High Maintenance

Technical problems, such as tracking errors or connectivity problems.

### Cyber Sickness

Its a form of motion sickness caused by using VR or AR devices. Examples are nausea, dizziness, headache and eye strain

### Safety Concerns with Workplace Environment.

Safety measures.

### Technical Issues

Technical problems may occur during task application which may lead to  errors in result or connectivity problems.

### Accessibility Issues

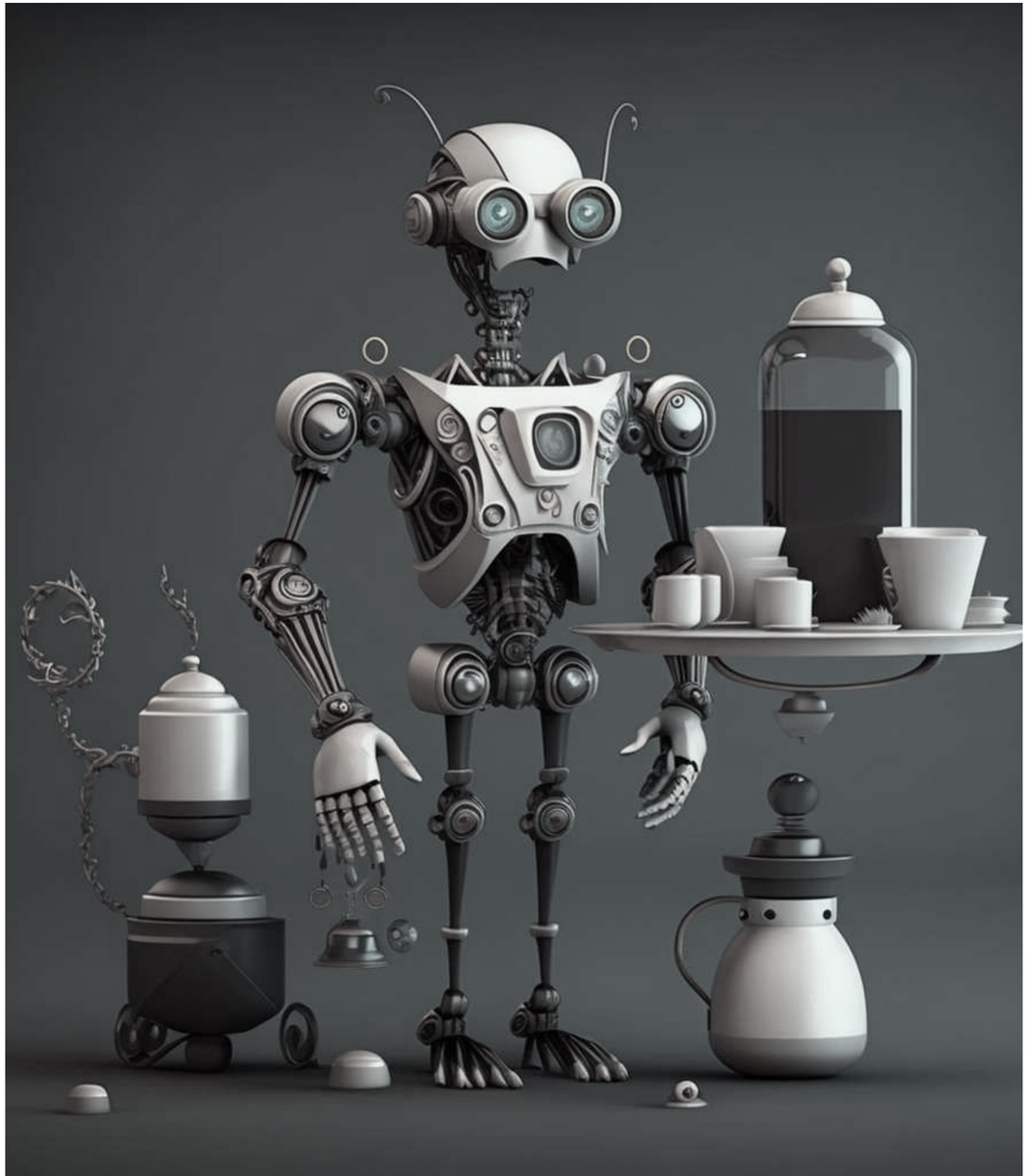
Individuals with disabilities may struggle with the AR device.

# Future Considerations

**Improved Gesture Control**

**Collaboration between teams in the organisation for auto employees.**

**The same software to be used by mechanics for actual fixing.**



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https://learn.microsoft.com/en-us/windows/mixed-reality/design/interactable-object

# Prototype Instruction:

### Prototype Link for Trainee

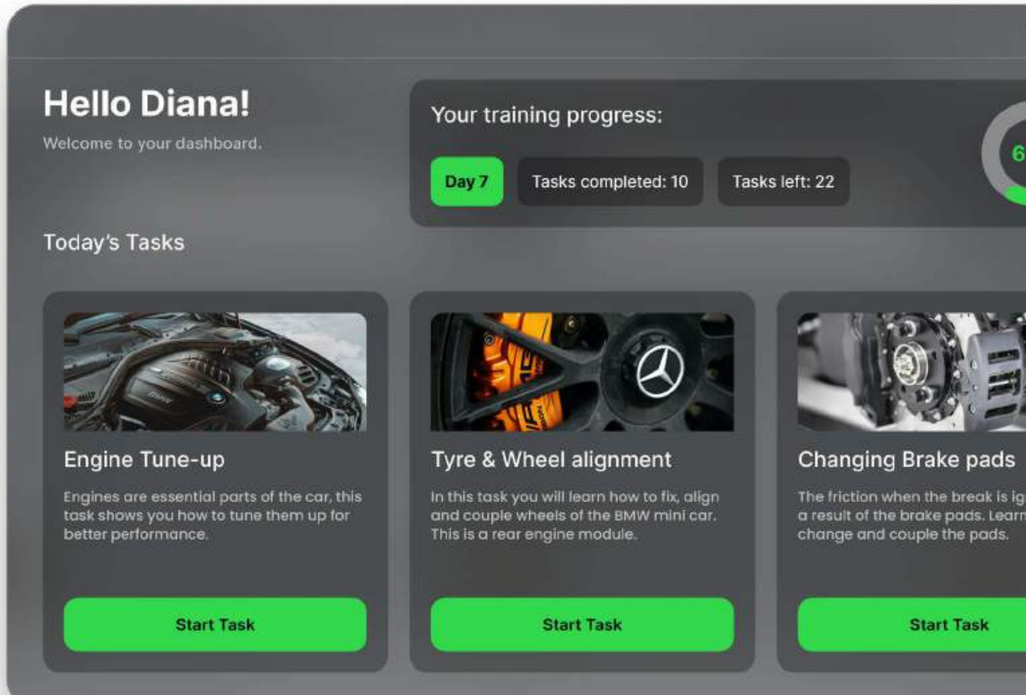
Click on the button below to access the prototype.

View prototype →

### Prototype Link for Car Owner

Click on the button below to access the prototype.

View prototype →

# Thank YOU!