Project number: 2022-1-RO01-KA220-HED-000088037

Notes

Desktop version of the warehouse inspection scenario: Can be obtained at the LOGMASTER LMS

In order to get the **VR application** : please contact unitylab@hs-heilbronn.de.

People who would like to receive the case studies please write a mail to unitylab@hs-heilbronn.de

LOGMASTER VR Real Life Case Studies
Technical Datasheet
version: 1.0
November 26, 2025

Summary

VR Real Life Case Studies (V 1.0.0) is a Unity-based immersive training application designed specifically for master's degree students in logistics and supply chain management. The platform combines a single-player warehouse inspection scenario with a collaborative 1-on-1 office negotiation role-play, enabling students to identify real-world safety and efficiency hazards and engage in professional problem-solving discussions. Deployed on Meta Quest 3 and Quest Pro headsets, with an additional Windows desktop variant for the warehouse module, the application delivers experiential learning aligned with the European Logistics Association competency framework.

1. Technical Specifications

1.1 Technology Stack

Component	Details
Primary Game Engine	Unity3D
Warehouse Scenario	Unity with OpenXR framework for broad VR platform compatibility
Office Negotiation Scenario	Unity with Meta XR All-in-One SDK for enhanced inside-out body tracking and realistic avatar presence
3D Assets	All models and animations sourced from Unity Asset Store for consistency and rapid development
Networking Backend	Photon Fusion Cloud (no custom server)

1.2 Supported Platforms

Platform	Details	Status

Meta Quest 3	Standalone VR headset	Recommended primary target
Meta Quest Pro	Standalone VR headset	Supported
Windows PC	Desktop application (warehouse scenario only) – available on LMS	Supported

Table 1: Supported platforms and deployment targets

1.3 Minimum System Requirements

VR Headset (Quest 3 / Pro):

- Operating System: Meta Horizon OS (current stable release)
- RAM: Standard device configuration (Quest 3: 8 GB; Quest Pro: 12 GB)
- Storage: Minimum 2 GB free space for app installation and screenshots
- Network: Wi-Fi connectivity required for office negotiation scenario only; warehouse inspection operates offline
- Firmware: Latest available recommended; backward compatibility assured for recent stable versions

Desktop (Windows PC for Warehouse Scenario):

- Operating System: Windows 10 or newer (64-bit)
- Processor: Modern 64-bit dual-core CPU (e.g., Intel Core i3-4xxx series or equivalent)
- RAM: Minimum 4 GB
- Storage: Minimum 2 GB free space for application and screenshots
- Graphics: Integrated graphics acceptable for warehouse rendering
- Input: Keyboard and mouse

1.4 Network Requirements

Scenario	**Connectivity**
Warehouse Inspection (VR + Desktop)	Offline; no internet required
Office Negotiation (VR Multiplayer)	Internet / Wi-Fi required for both players

Table 2: Network requirements by scenario

Multiplayer Network Details:

- Both participants must join with the same session name to enter the same Photon Fusion room.
- Stable Wi-Fi recommended; no specific Wi-Fi 5 or Wi-Fi 6 requirement enforced, but both standards are supported.

- Latency expectations: Standard internet latencies are acceptable; typical LAN (<30 ms) or broadband (50–100 ms) provide good voice and avatar synchronization.
- Firewall: Outbound connections to Photon Cloud endpoints over standard HTTPS and UDP ports must be permitted; specific port opening is not required for typical corporate or educational networks.

1.5 Permissions and Device Access

Permission	Scenario	Purpose
Internal Storage Access	Warehouse (VR + Desktop)	To save and manage training screenshots on the device
Microphone Access	Office Negotiation (VR)	To enable live voice communication between the two participants

1.6 Supported Languages

- **UI Language:** English (all menus, instructions, and in-app text)
- **Voice:** Direct player-to-player audio; no speech recognition or transcription is performed
- **Regional Availability:** No language-specific restrictions; suitable for international educational deployment

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2. Software Architecture

2.1 Application Modules

The application is composed of two primary modules and shared infrastructure:

Warehouse Inspection Module (Single-Player, VR + Desktop)

- **Purpose:** Users explore a simulated warehouse environment and identify safety and efficiency hazards.
- **Hazards Covered:** Missing personal protective equipment (hard hats, visibility vests), blocked pathways, over-stacked pallets, dangerous shelf edge conditions, poor shelf labelling, inefficient worker navigation.
- **User Actions:** Teleport navigation (VR) or WASD + mouse (desktop), placement of markers, and screenshot capture of identified issues.
- **Data Output:** Session screenshots stored locally with timestamps.

Office Negotiation Module (1-on-1 Multiplayer, VR Only)

- **Purpose:** Two players assume predefined roles (logistics service provider and customer/principal) and conduct a professional discussion to review findings and agree on actions.

- **Session Control:** When one player selects a role, the other role is reserved for the second participant; role selection is enforced to ensure balanced participation.
- **Shared Content Display:** Master-solution screenshots and, where available, session screenshots from the warehouse scenario are displayed on a virtual meeting room screen for collaborative review.
- **Participant Presence:** Realistic animated avatars with head, hands, and upper-body tracking; lower body remains fixed to office chair seating.

2.2 Data Flow Architecture

Warehouse Module Data Flow:

User Navigation & Interaction

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Local Screenshot Capture (Session Directory: YYYY-MM-DD_HHMM)

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Local Device Storage (VR: App Directory; Desktop: User-Selected Folder)

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Automatic Cleanup (Screenshots older than 30 days deleted on next session launch)

Office Negotiation Module Data Flow:

Player 1 Joins Photon Session

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Player 2 Joins Same Session (identical session name)

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Photon Fusion Synchronizes User Pose, Avatar Animation, Voice

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Thumbnail Selection via UI Triggers Screenshot Display

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Photon Fusion RPC Transmits Screenshot Data (auto-compressed if >512 KB)

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Shared Virtual Screen Displays Screenshot for Both Players

2.3 Communication Protocol

Multiplayer Networking:

- **Framework:** Photon Fusion 2 with authoritative state synchronization

- **Data Transmission:** Remote Procedure Calls (RPCs) for event-driven communication (e.g. screenshot selection, role assignment)
- **Screenshot Transmission:** Screenshots are automatically compressed and chunked to comply with Photon's RPC message size limit (512 KB per message); this ensures stable and consistent image sharing across unreliable network conditions
- **Voice Transport:** Live audio streamed via Photon Fusion's voice integration; no recording or persistent storage on backend

Photon Cloud Integration:

- Session management, player matchmaking, and state replication handled by Photon Cloud infrastructure
- Standard encryption and security protocols applied by Photon
- No custom backend server required

2.4 User Presence Synchronization

Component	Technology	Details
Head Tracking	Inside-out tracking (Meta Horizon OS)	Real-time head pose synchronized via Photon Fusion
Hand Tracking	Inside-out hand tracking (Meta Horizon OS)	Hand/controller positions streamed for gesture communication
Upper-Body Animation	Meta XR Movement SDK (Negotiation only)	Torso, shoulders, and arms driven by body-tracking data; realistic animated avatar
Lower-Body & Locomotion	Fixed seating (Negotiation); Teleport (Warehouse)	Negotiation: seated; Warehouse: teleport-based movement to reduce motion sickness
Voice Presence	Live audio stream	Direct player-to-player voice transmitted in real-time without recording

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3. Data Protection and GDPR Compliance

3.1 Data Minimization Principles

The application is designed to minimize data collection and processing in alignment with GDPR Article 5 (data minimization) and Article 6 (lawful processing):

- **No Personal Data Collection:** The application does not require or store names, email addresses, student IDs, or other directly identifying personal information.
- **Session Identifiers:** Users join sessions using free-choice nicknames and session names (e.g., pseudonymous codes such as "LSM_Cohort2_Group3").

- **No Profiling or Tracking:** No behavioral analytics, learning outcome predictions, or user profiling is performed.
- **No Central Analytics Server:** All data remains on local devices or within Photon Cloud memory; no aggregation or evaluation backend is deployed.

3.2 Data Categories and Processing

Data Category	Scenario	Type	Purpose
Screenshots	Warehouse (VR + Desktop)	Training content	Hazard documentation and review
Session Metadata	Both	Session identifiers	Room assignment and role selection
Voice Audio	Office Negotiation	Live stream	Real-time communication
Avatar Pose Data	Office Negotiation	Transient state	Presence synchronization

Table 3: Data categories processed by the application

Important: Screenshots contain only virtual warehouse imagery and do not include real-world video, biometric identifiers, or personal information. Voice audio is transmitted live and is not recorded or stored persistently.

3.3 Data Storage and Retention

Screenshots (Primary Data Asset):

- **VR (Meta Quest):** Stored in application-specific directory; organized by session start date and time (YYYY-MM-DD_HHMM format).
- **Desktop (Windows):** Saved in a user-selected folder (default: application directory); path displayed in the warehouse scenario menu.
- **Retention Policy:** On the VR headset, screenshot directories older than 30 days are automatically deleted when the warehouse scenario is launched. On desktop, deletion is manual and under the control of the device owner or institution.
- **Access:** Screenshots remain private to the device owner; no automatic upload or cloud synchronization occurs.

Voice and Network Data:

- **Storage:** Voice is transmitted in real-time through Photon Cloud and is not stored by the application.
- **Photon Infrastructure:** Standard Photon Cloud processing applies; users should consult Photon's privacy policy for details on transient data handling and retention.

Session Metadata:

- **Scope:** Session names, role selection, and basic connection state are held in memory during active sessions.

- **Persistence:** Not saved by the application after the session ends; cleared when the app closes or Photon Cloud session expires.

3.4 Security Measures

Transport Layer:

- Multiplayer communication uses Photon Fusion over Photon Cloud, applying industry-standard TLS/encryption for data in transit.
- No additional custom encryption layer is implemented; security relies on Photon's infrastructure.

Device-Level Storage:

- Screenshots and any residual application data reside solely on the VR headset or desktop PC.
- Access control and encryption at rest follow the underlying device and institutional security policies (e.g., device password, file system permissions, MDM).

No Central Server Vulnerabilities:

- Absence of a custom backend server eliminates centralized data breach risks.
- Distributed storage model ensures that compromise of any single server does not expose user data.

3.5 Data Subject Rights and GDPR Compliance

Right of Access:
Institutions and users can inspect locally stored screenshots by navigating to the storage folder indicated in the warehouse scenario menu. No centralized data portal or request mechanism is required.

Right to Erasure ("Right to be Forgotten"):

- VR screenshots: automatically deleted after 30 days; users may also manually delete the app directory to remove all locally stored data.
- Desktop screenshots: device owner or institutional administrator can manually delete the folder or files.
- Voice and session data: cleared automatically when the session ends; no persistent records are maintained by the application.
- **Request Process:** For data deletion requests, users or institutions should contact the responsible device owner or course organizer, who can remove the corresponding files or device from use. No formal data controller process is required from a central service.

Right to Rectification and Portability:
Given the minimal data collection model (no personal identifiers or stored personal data), rectification is not applicable. Data portability is not applicable as there is no centralized personal data store to export.

No Automated Decision-Making:
The application does not perform automated profiling or decision-making based on user activity or performance.

3.6 GDPR Compliance Statement

The **VR Real Life Case Studies** application complies with the requirements and principles of the General Data Protection Regulation (EU) 2016/679 through the following measures:

1. **Lawful Basis:** Data processing (screenshot storage) is justified under Article 6(1)(e) (processing necessary for the performance of a public task) in the context of educational delivery aligned with the European Logistics Association competency framework.

2. **Data Minimization and Storage Limitation (Articles 5(1)(c) and (e)):** The application collects only screenshots and transient session metadata strictly necessary for educational use; no personal data is collected or stored. Screenshot retention is limited to 30 days on VR devices and is managed manually on desktop systems.

3. **Purpose Limitation (Article 5(1)(b)):** Data collected is used exclusively for the stated educational purpose (hazard identification and negotiation role-play); no secondary use, profiling, or analytics is performed.

4. **Transparency and Privacy (Articles 13–14):** Users are informed (via the application manual and scenario instructions) that screenshots are stored locally and can be reviewed or deleted by the device owner.

5. **Security (Article 32):** Data is secured through device-level access controls and the absence of a centralized vulnerable backend; Photon Cloud infrastructure applies standard transport encryption.

6. **Data Subject Rights:** Institutions deploying the application are responsible for addressing any data access or deletion requests from participants by managing the local device files or engaging with Photon Cloud's support (for any residual session metadata).

7. **No Data Transfer Outside EU/EEA:** All data remains within the device or within Photon's EU-compliant cloud infrastructure; no transfer to third countries is performed if the allowed regions are limited to EU countries. For more information, please contact unitylab@hs-heilbronn.de.

8. **Accountability and Documentation:** Institutions deploying this application should maintain a Record of Processing Activities (ROPA) documenting the use of the application in their training program and may reference this datasheet as evidence of compliance with data minimization principles.

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4. Deployment and Operational Considerations

4.1 Installation

VR Headset (Meta Quest 3 / Pro):

- Application is available through Meta's App Lab or custom deployment via Meta developer account.
- Installation via Oculus app on PC or direct installation link on headset.

Desktop (Windows):

- Standalone executable distributed as LOGMASTER_desktop_1.0.0.zip.
- Extract and double-click LOGMASTER.exe to launch.

4.2 User Controls

VR Warehouse Scenario:

- Joystick: Turn character left/right
- Trigger: Teleport to position
- Y / A button: Open menu
- X / B button: Set marker and capture screenshot
- Meta button: Recenter view (hold); open Meta menu (press briefly)

Desktop Warehouse Scenario:

- W, A, S, D: Move forward, left, backward, right
- Right mouse button: Zoom in
- E: Open/close menu
- Left mouse click: Set marker and capture screenshot
- Volume: Slider in menu on right side

VR Office Negotiation Scenario:

- Head and hand tracking: Automatic presence synchronization
- Voice: Enabled by default
- Controller UI: Select and display screenshots on shared screen

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5. Limitations and Future Enhancements

5.1 Known Limitations

- Warehouse scenario may experience brief performance drops shortly after loading; it does not prevent learning objectives but may affect immersion.
- Office negotiation scenario requires Meta XR plugin and is therefore limited to Quest 3 and Quest Pro; not compatible with earlier Quest models.
- No built-in tracking system for duplicate hazard documentation; users must manage their own screenshot organization.

5.2 Planned Enhancements

- Addition of a tracking system to log identified issues and prevent duplicate documentation.
- Enhanced NPC diversity and behavior to simulate varied warehouse roles and tasks.

- Integration with institutional LMS platforms for streamlined session management and analytics (future).

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6. References and Support

Technical Documentation:

- Photon Fusion Documentation: https://doc.photonengine.com/fusion/

Project Resources:

- LOGMASTER Project Website: https://logmaster.ac
- LOGMASTER LMS: https://lms.logmaster.ac
- European Logistics Association (ELA): https://www.elalog.eu

Support and Inquiries:
For technical support, deployment guidance, please contact the development team of Heilbronn university of applied sciences: unitylab@hs-heilbronn.de

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