



# Research Topics for EON Research Grant Program (RGP)

July 2021

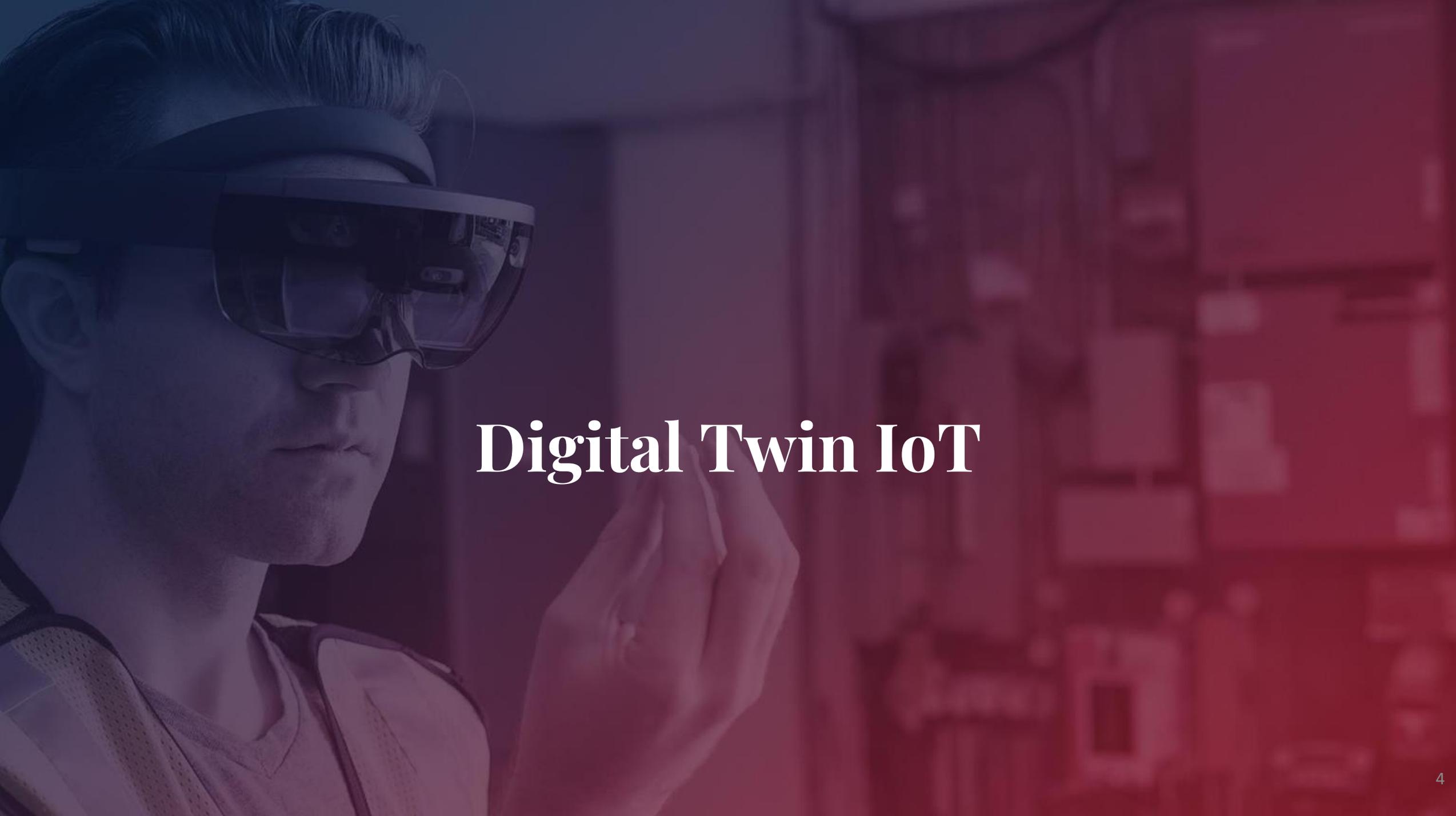


# Background

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- As a part of the **EON Research Grant Program (RGP)** form, ten research topics are proposed in this document that are inline with our **R&D interest at EON Reality**.
- The Applicants must specify **which of these topics they are interested in**.
- This serves as an **appendix to the grant**, and the applicants can cross off multiple areas that they are interested in for their research work.
- Based on that, we will also **justify why they are interested in the topics** they have selected.
- Applicant shall briefly explain with 300 characters why they are interested in the chosen topics and what their research experiences are.



A person wearing AR glasses is shown in profile, looking towards the right. The background is a blurred grid pattern, suggesting a digital or control room environment. The overall image has a dark, monochromatic color scheme with a blue-to-purple gradient.

# Digital Twin IoT

# Digital Twin IoT

## Integrating Merged XR and Spatial Meetings with IoT

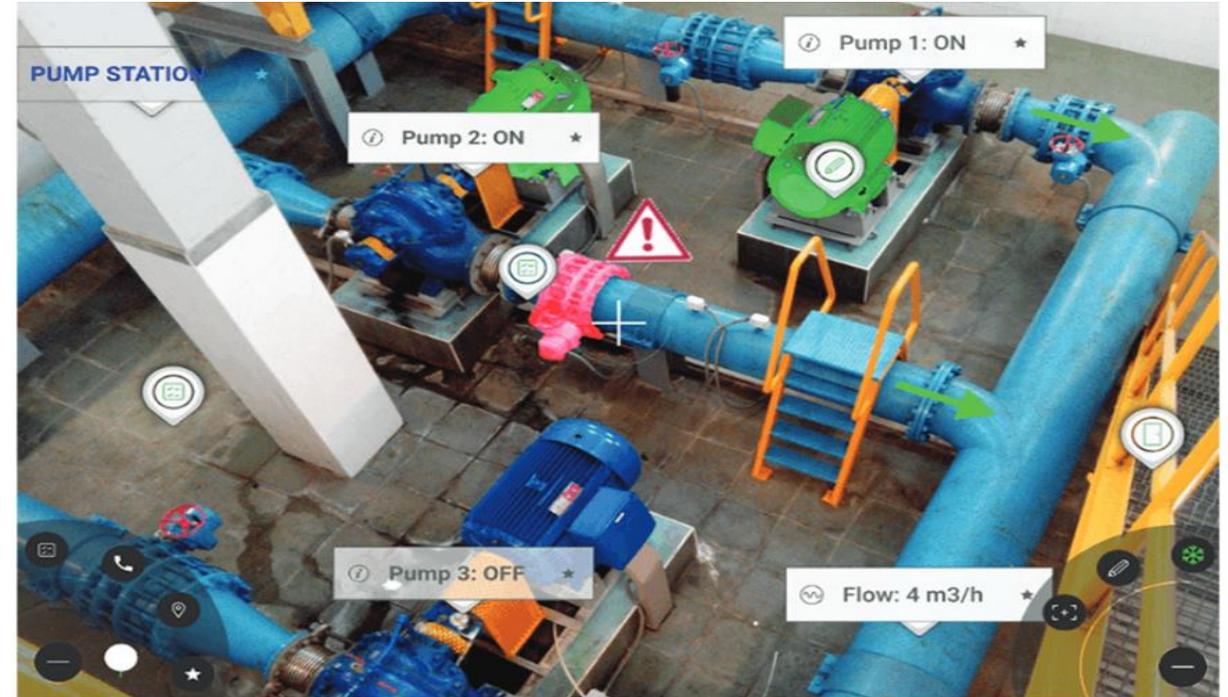
EON Reality is interested in the development of technologies that can advance its vision of **integrating AR/VR environments with data generated from sensors** and software for smarter **training, learning and real-time response**.

### Use Case Visualization - Power Plant Pipes

Merged XR shall be utilized to **visualize in real-time IoT sensor data** inside a power plant to the maintenance crew.

For example Merged XR shall **overlay a glowing red rendering of a pipe** (digital twin) on top of the physical pipe as an indication that the **pipe is too hot**.

Also a **temperature panel shall pop up** displaying the **actual pressure and temperature readings** inside the pipe.



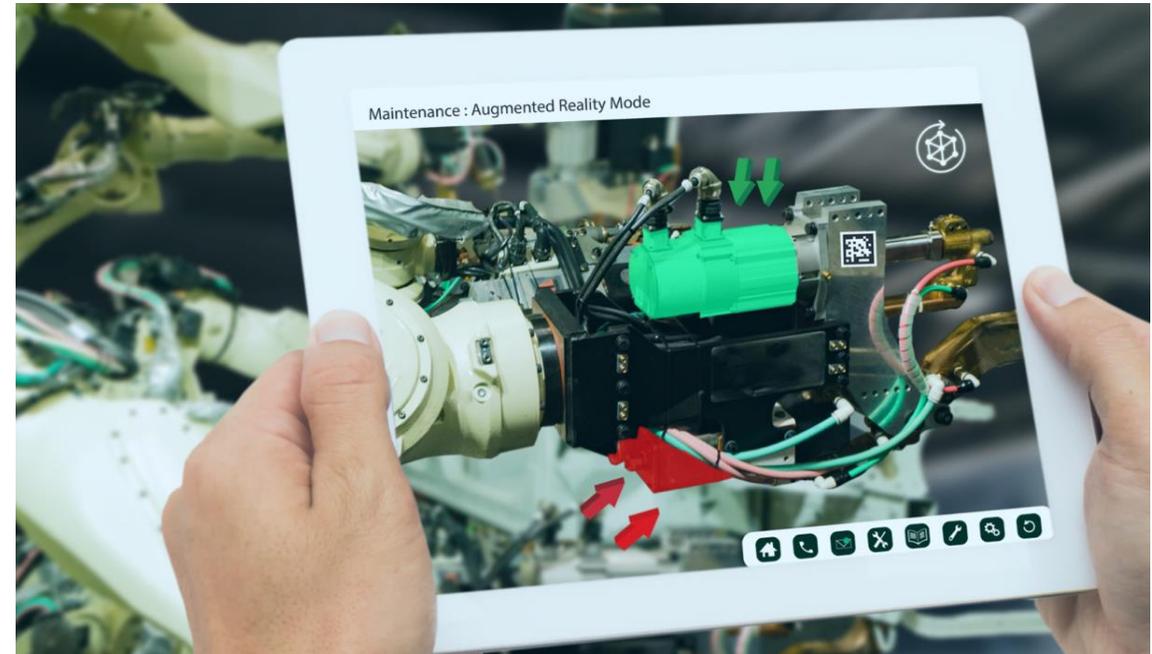
Use Case Visualization - Power Plant Pipes

# Topic 1: Digital Twin IoT

## Integrating Merged XR and Spatial Meetings with IoT

### Use Case Visualization - Hydroelectric Plant Power Generator

Hydroelectric **power generators** are equipped with **various sensors to detect abnormalities** such as **vibrations**. Merged XR shall be utilized to **visualize in real-time these sensor data** by overlaying **colored rendering** of the generators (digital twins) as a form of **visual alert** (for example blinking in red). A **virtual panel shall pop up** showing the reading of the **frequency of the abnormal vibration**.



Use Case Visualization - Hydroelectric Plant Power Generator

A person wearing a VR headset is shown in profile, looking towards the right. The background is a server room with rows of server racks. The entire image has a dark blue and purple color overlay. The text "Safety and Security Warning System" is centered in white, bold, serif font.

# Safety and Security Warning System

# Safety and Security Warning System For Merged XR and Spatial Meetings

## Use Case – Location Based Alert System

Merged XR shall be **utilized for safety training to alert workers for issues** such as HAZMAT and radiation.

User shall **easily scan and create a digital twin of the work site** with Merged XR, and **leverage AI-based label identification** to automatically label warning zones by scanning the Hazard Class Labels within the work site.

The system shall **be trained to recognize different HAZMAT labels** with high accuracy and robustness, including **flammable, explosive, poisonous and radioactive materials**.

Whenever the user is within the **proximity of a hazard material, warning sound and information panel** shall be automatically triggered, and the **digital twin shall glow red** intermittently in such region.

The system shall be expanded to **incorporate wireless-based self-positioning technologies** such as **Wi-Fi networks and Bluetooth beacons**. T

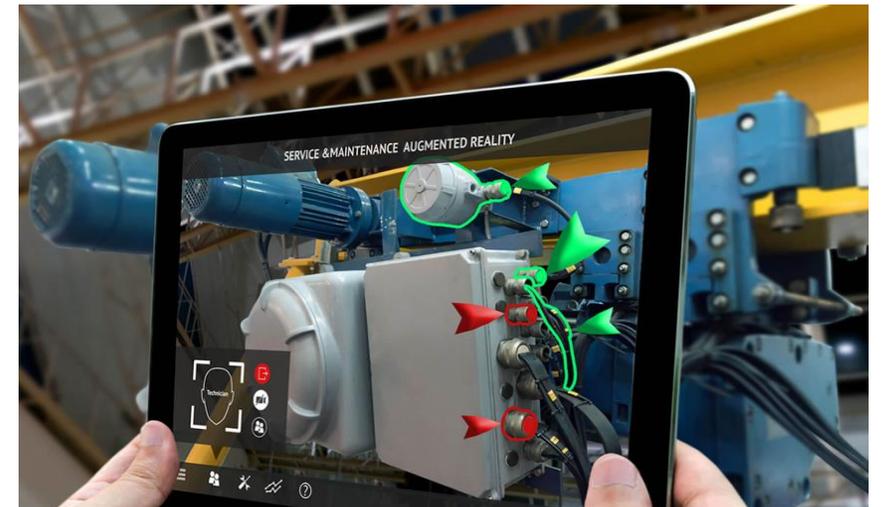
This will **enable passive warning** without the user actively holding the Merged XR device.

For example even **if the user puts the device inside a pocket**, the warning shall be triggered in the form of auditory alarm sound and haptic vibrations.

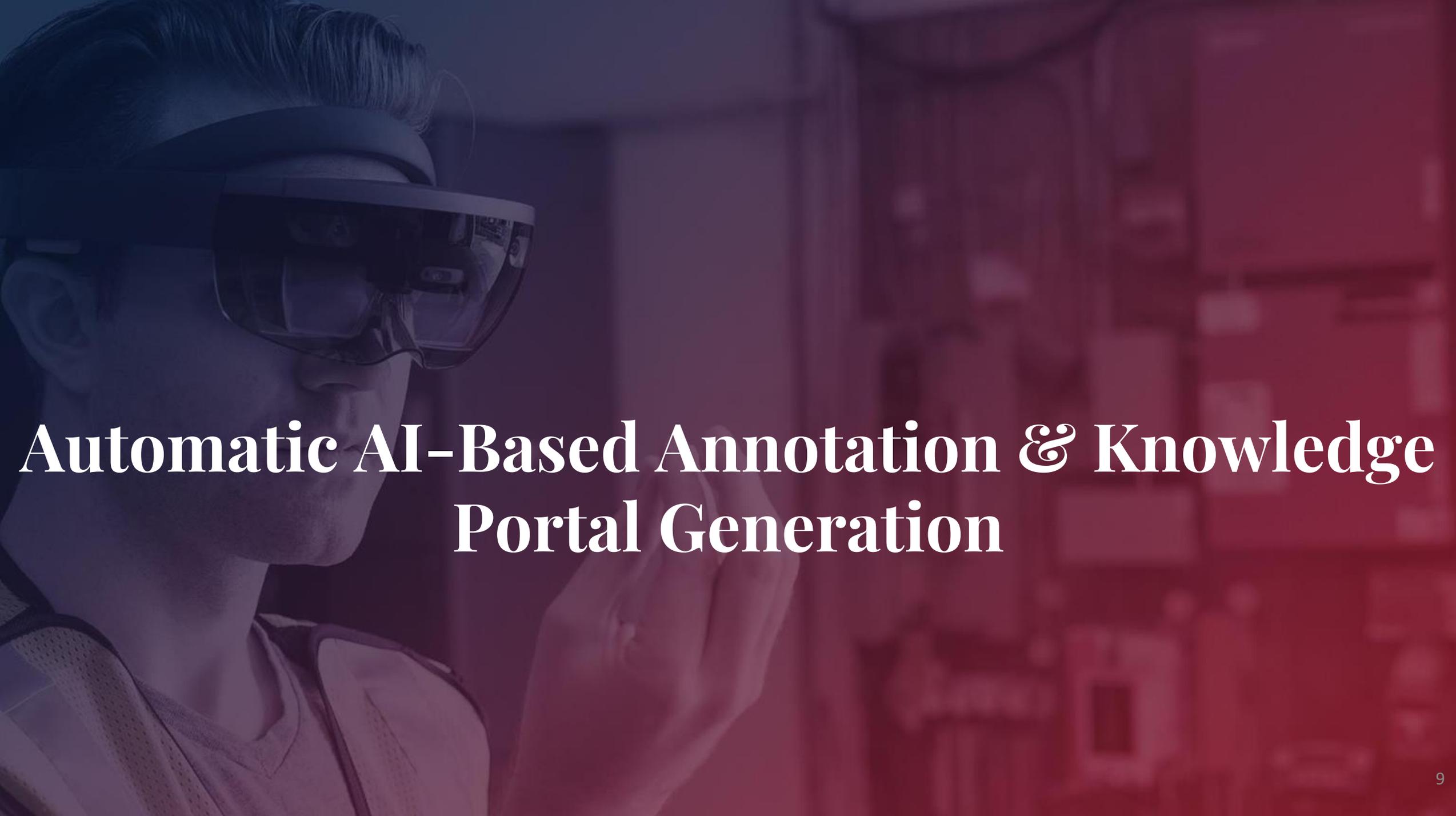
A variety of facilities can benefit from this technology: **laboratories, factories, manufacturing and construction sites**.



Location Based Alert System



For Laboratories, Factories, Manufacturing & Construction Sites



# Automatic AI-Based Annotation & Knowledge Portal Generation

# Automatic AI-Based Annotation Generation

## Simultaneously Autogenerate Annotations & Knowledge Portals for the Entire Digital Twin Environment

EON Reality is interested in the development of related technologies and tools that enables **AI-based automatic generation of annotations and Knowledge Portals**.

We envision the **automatic deployment of an AI portal** as soon as an area is scanned to create the digital twin.

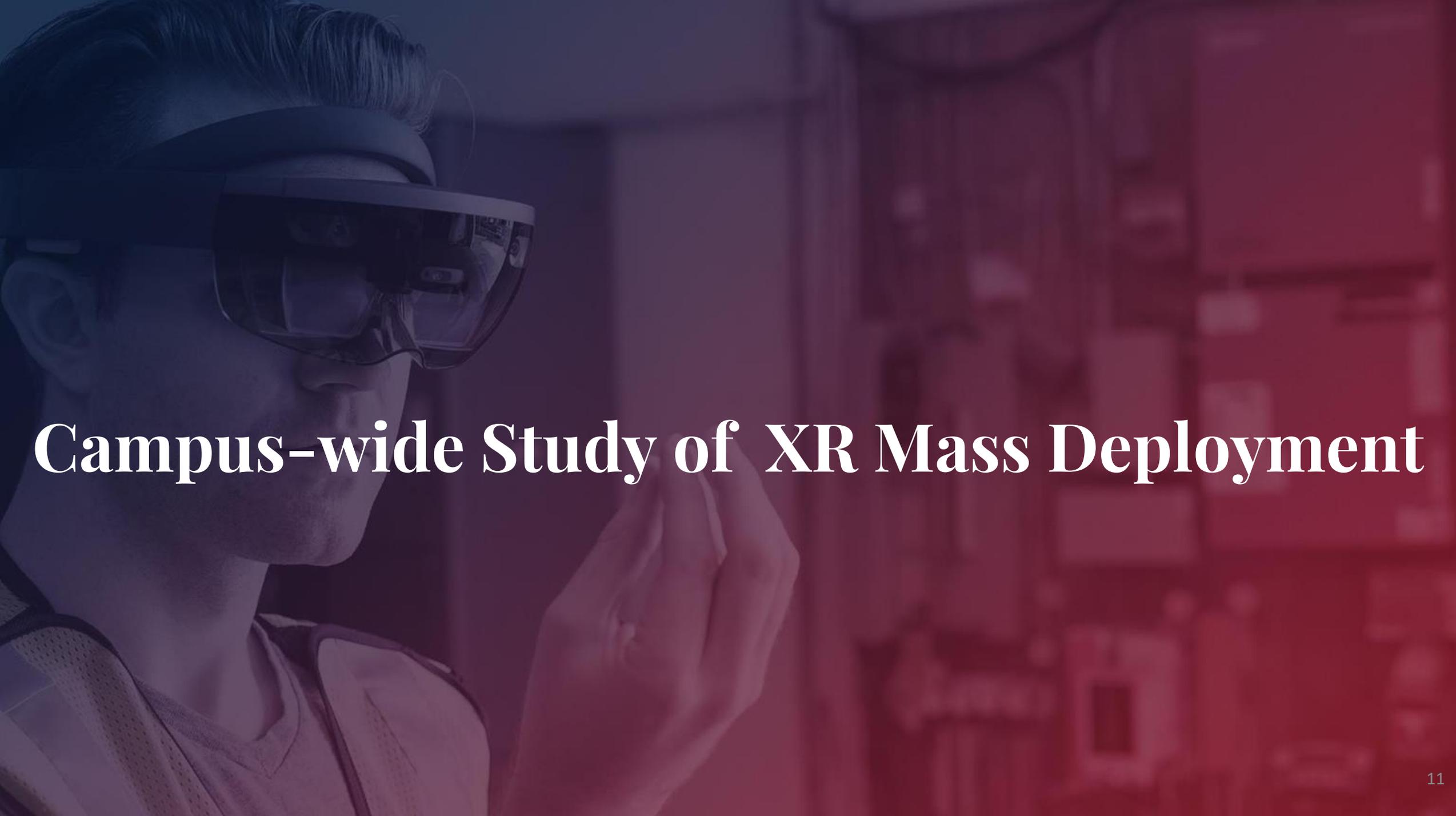
Our system currently allows manual scanning of objects using a AI portal for identification, and we wish to extend this feature to be a **fully automatic process by identifying multiple objects of interest** and create small bounding boxes around them with **AI Selected Annotations and Knowledge Portals**

The **user simply chooses those annotations** that are relevant to the task.

The **AI engine** shall proceed by **actively filling up content for the majority of 12 Knowledge Portals** for each object with minimal human intervention.

Each **Knowledge Portal** shall provide meaningful information regarding the object, in the forms of **image (2D & 360)**, **video** (YouTube), **text (web & PDF)**, **audio (voice narration & auditory sample)**, **quiz (multiple choice)**, **translation**, etc.





# Campus-wide Study of XR Mass Deployment

# Campus-wide Study of XR Mass Deployment For Learning, Training & Performing

EON Reality wishes to engage in a **comprehensive longitudinal study (largest to date)** of approximately **6,000-50,000 students** to **assess the learning & performing outcomes** using XR technologies.

The study shall focus on the **efficacy of learning** which may differ based on **age, gender, department, discipline** (history vs engineering or health), and other circumstantial factors that may affect learning efficacy.

One of the key research outcomes shall be the **development of an evidence-based learning framework** and **tool for delivering effective digital learning experiences**.

These research **outcomes shall be published** in **peer-reviewed journals**.



A person wearing AR glasses is shown in profile, looking towards the right. The background is a blurred, reddish-pink virtual environment. The text "Building the Knowledge Metaverse" is overlaid in the center in a white, serif font.

# Building the Knowledge Metaverse

# Building the Knowledge Metaverse

## AI-based Fusion & Big Data Crowdsourcing

EON Reality is interested in the development of technologies, **tools and protocols** relating to the **effective crowdsourcing of data from user-generated experiences**. As **users scan and create the knowledge portals** of the same area or artifact (for example Piccadilly Circus), we are interested in **stitching and fusing these individual XR experiences**, in the follow aspects:

**3D/visual (fuse the 3D scan data)**

**The Knowledge Portals**

**The Dataset**

The **goal is to create a richer experience** and a broader knowledge base from existing ones, by stitching them together to form a global knowledge metaverse.

This is very much the **same way how Google Street View works with user-added 360 bubbles**, but instead of these bubbles being just scanned 3D environments, they are also filled with **XR Spatial 3D knowledge** using the Knowledge Portals.

Wherever the user might be, he can actually **probe the reality and inanimate objects in XR and have them come to life** and filled with knowledge.

This R&D project is to **build the knowledge metaverse** so anyone can walk down any street and see information popping up and probe them.

We shall use **data from the EON XR global competition in the 73 countries** we are present in

We are initially **targeting 10 million experiences among the 42 million users** that have downloaded the EON viewer over time.



A person wearing a VR headset is shown in profile, looking towards the right. The background is a blurred museum or gallery with various exhibits. The image has a dark, semi-transparent overlay with a reddish-purple tint. The text is centered in a white, serif font.

# Methods for Cultural Heritage XR Mass Digitization

# Methods for Cultural Heritage XR Mass Digitization Using Citizen Science Crowd Sourcing

EON Reality is interested in the development of enhancements and technologies that will allow EON-XR to become a participatory **platform for cultural heritage initiatives**.

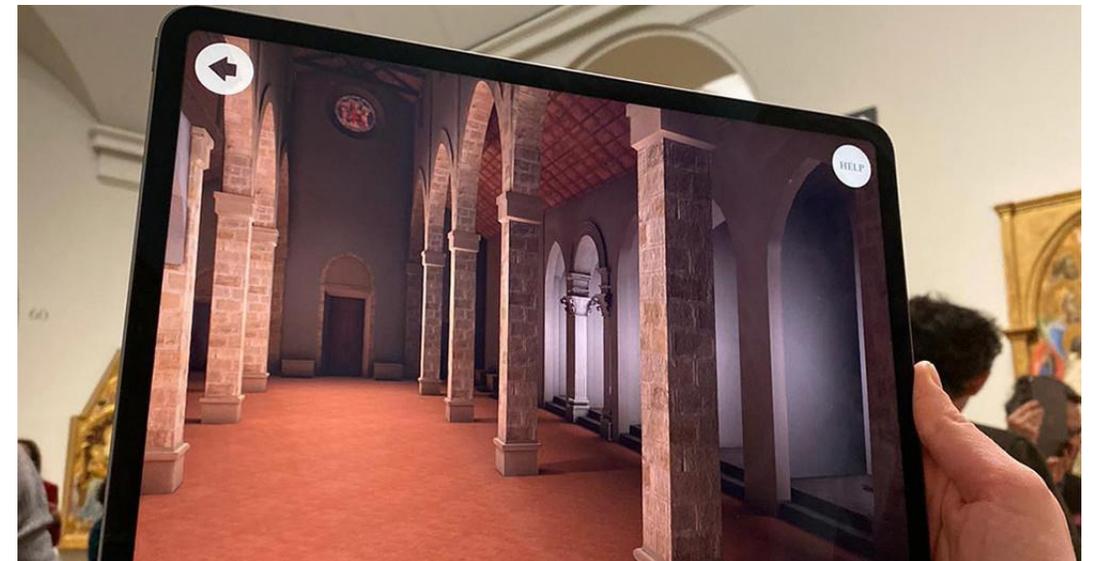
Of particular interest to EON Reality is the **creation of a citizen science approach and protocols for digital storytelling** using the EON-XR Platform.

The goal is to **focus on art and cultural heritage** in general (buildings, etc..) by taking advantage of the experiences we're currently creating as a **part of the global XR competition where we aim to create 10 million experiences** on EON-XR as part of a citizen science initiative.



**Two key outcomes:**

- 1. Develop a cultural heritage repository** that is easily distributed and universally accessible to both users and creators.
- 2. Development of key XR protocols** for various users ranging from **museum institutions, historians, archeologists, paleontologists**, etc. in creating digital artifacts from physical ones, with the view of fast tracking the **mass digitization of cultural heritage** artifacts and environments.





# Enhanced Tourism Experience Using Merged XR

# Enhanced Tourism Experience Using Merged XR

EON Reality is interested in the development of technologies and tools to **enhance the user experience in museums and places of significant interest** by integrating smart and AI-enhanced AR/VR elements.

**Collaboration with teleportation capabilities** or spatial meetings to **enhance the tourism experiences** and museum experiences.

## Use case - Statue & Building

A **tourist at a famous statue** in need for a guide, he holds up Merged XR and immediately **sees a virtual guide (avatar)** pops up with proper attire that matches the historical background.

The **virtual guide offers a guided tour in any of the 100+ languages** backed by the EON AI-based translation engine.

The virtual guide **walks together** with the user along a **visual path** picked by him.

As he **highlights objects in the physical environment**, they also start to glow in reality through Merged XR.

**Information about the tourist site starts to pop up** in the form of **auditory** narrations and **visual elements** (photos, paintings, videos), in addition to the **12 Knowledge Portals** that EON Merged XR already offers. More info pops into view as the user follows down the path.

An additional **enhanced ability to do time travel**, information of a statue or building superimposed **showing what it looked like 500 years ago** (requires corresponding 3D models).



A person wearing a VR headset, looking forward, with a hand raised in a gesture. The background is a blurred cityscape.

# Developing Advanced Features for Virtual Teleportation

# Developing Advanced Features for Virtual Teleportation

Merged XR and Spatial Meetings already offers these aspects, including:

## Multiple avatars

The ability to have **voice to speech**

The ability to **point out things (visual highlighting)**

The ability to **generate paths on the ground**

The ability to **generate 3D recorded sequences**

This **research topic aims at further enhancing the realism**, including:

**Personalized avatars** (using scans of user's face & body)

**Realtime physics**

**Inverse Kinematics** and realistic movement of virtual avatars

**Live translation/interpretation** in 100+ different languages

**Enhanced visual quality** for teleportation for **realistic representations on both sides** using the state-of-the-art scanning technologies LIDAR



A person wearing a VR headset is shown in profile, looking towards the right. The background is a blurred museum gallery with various exhibits. The entire image has a dark red overlay. The text is centered in a white, serif font.

# Methods for Cultural Heritage XR Mass Digitization

# Integrating Numerical Simulation Data On Merged XR

To integrate **numerical simulation** such as **Finite Elements Method (FEM)** and **Computational Fluid Dynamics (CFD)** into Merged XR. The goal is to **immediately make decisions and judgment calls** based on additional **numerical data** that typically is not available in a XR application.

## Use Case - Decision Making Load Tolerance

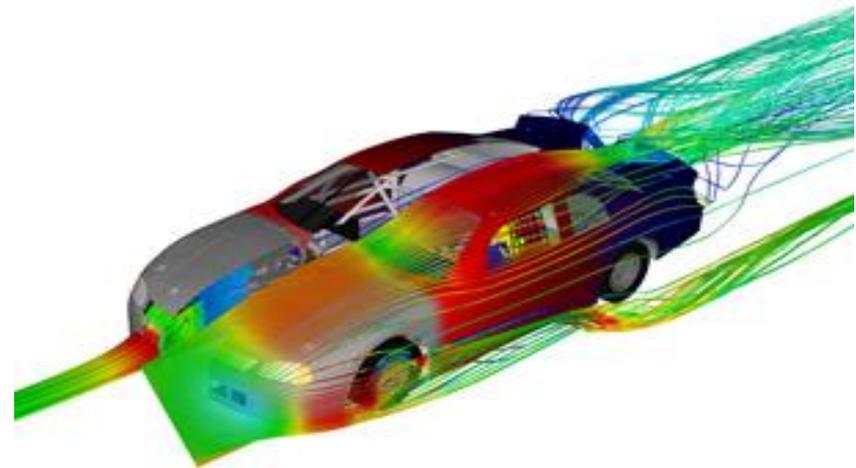
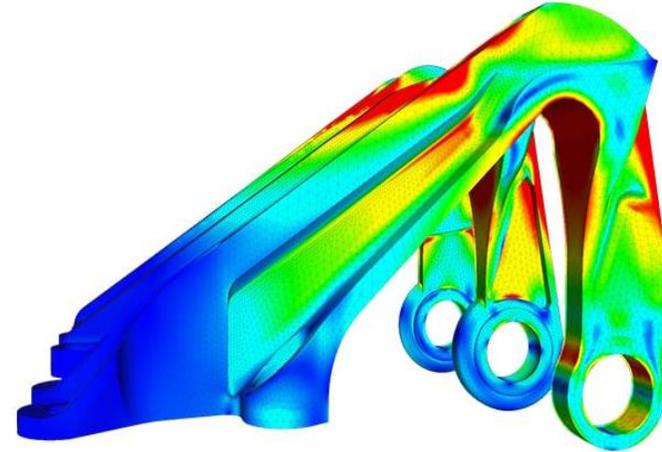
User looks at a **structure trying to make a decision how to apply a load** to that structure but is **uncertain** regarding whether that **structure can tolerate the load**. By superimposing pre-existing data such as a FEM model, the **XR app is able to show the stress tolerance or plasticity level**.

The Original experience creator can then **create a Knowledge Portal** containing such data.

## Use Case - Vehicle Aerodynamics Suitability

An other Example is when the **User looks at a prototype vehicle** that has a **wind tunnel study data with aerodynamics analysis**.

The information is superimposed and animated, to **help the user make a determination of the suitability of that vehicle** for the specific purpose.



A person wearing an AR headset, looking at a digital interface. The background is a blurred grid pattern, suggesting a digital or virtual environment. The overall image has a dark, blue-tinted overlay.

# Eye Tracking of Digital Twin in Merged XR

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## For XR Assessment and Warning System for Safety & Security

Idea for a potential new patent: **eye tracking for student & worker assessment.**

**Headsets** and various devices are starting to **offer eye tracking features** that enable the user to **track the eyes/gaze in a merged XR environment** where a physical environment is superimposed with a digital twin.

The **eye/gaze tracking data thus can track** which **part of the digital twin** the user is looking at.

For example, if the user looks at an **annotation that contains 12 Knowledge Portals**, we can **track the information that the user is looking** at within that Knowledge Panel.

With the **AI portal**, we can then **connect this tracking info with big data**, and assess **what the user has looked at**, and also provide **feedback on what he missed** and what they did not look at.

This can be very **useful in training with a warning system** for safety & security.

For example, with the tracking data **we can monitor when the user doesn't see a gap or a slippery floor** or misses flammable objects.

This can also **provide advanced XR assessment** of users learning, training and performance.



# Eye Tracking of Digital Twin in Merged XR

## For XR Assessment and Warning System for Safety & Security

This can also provide **advanced XR assessment of users learning, training and performance.**

When conducting the assessment, we can get a very comprehensive view of **what the user saw**  
**which annotation**  
**which knowledge portal** the user has absorbed  
**amount of time the user spent,**  
**if user just skimmed through** it or not

This will provide a **deep understanding of the Users Learning, Training or Real Performance** during execution of procedure.

The **user will after each a session get an assessment score** that may look like this graph, which gives a grade on each of the various zones in that experience consisting of various annotations.

Within each annotations, a **breakdown on each knowledge portals** and time duration.

The user gets a **10/10 if he really did a deep dive**, spent time on it and reviewed it.

With the collected tracking data, we could then introduce **AI-based recommendation mechanism** using the score from each user to **suggest which experience to choose next for maximized performance** and user retention





# Thank You!

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