# SUN XR

Social and hUman ceNtered XR

What is SUN XR?

The Social and hUman ceNtered XR (SUN XR) project aims at investigating and developing extended reality (XR) solutions that integrate the physical and the virtual world in a convincing way, from a human and social perspective. The virtual world will be a means to augment the physical world with new opportunities for social and human interaction.
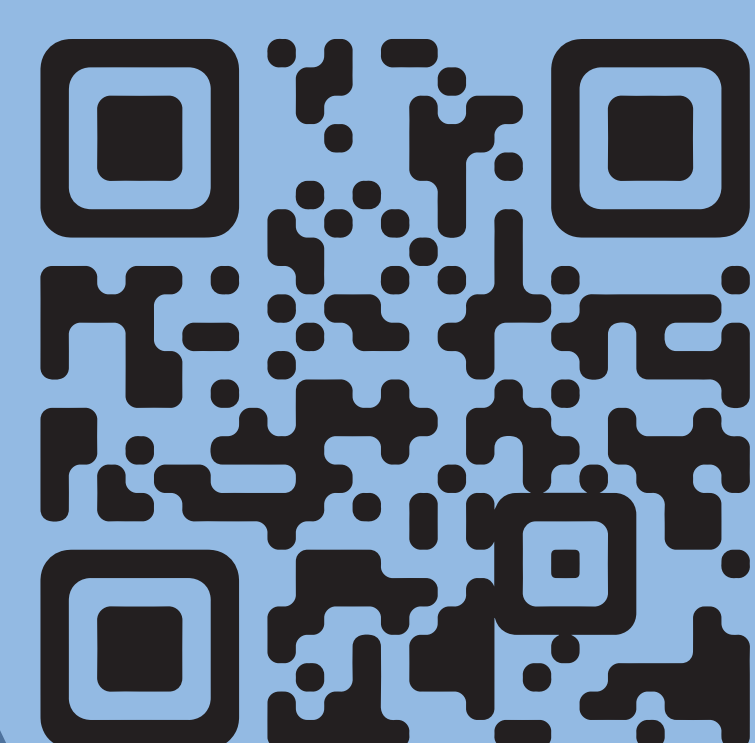
The project will contribute to human-centred and ethical development of digital and industrial technologies, through a two-way engagement in the development of technologies, empowering end-users and workers, and supporting social innovation. It will include end-users from the very beginning through the co-creation of scenarios, and later on gathering their feedback through the pilots demonstrating new uses of XR in the field of industry (ameliorating safety and capability of workers), rehabilitation, and inclusive communication.

In SUN's vision, eXtended Reality builds upon Augmented and Mixed Reality, which in turn build on top of Virtual Reality. With XR, physical users can feel/touch virtual objects and actions in the physical world impact the virtual one. Interaction between the physical and virtual worlds becomes more realistic.

Piloting

01 eXtended reality for Rehabilitation

The aim of the proposed rehabilitation scenario is to motivate the patient to exercise efficiently by providing feedback in relation to performance, while the physiotherapy exercises are performed in any setting, e.g. clinical, at home, indoors, outdoors or even in public areas. This scenario is based on the use of a digital tool employing XR to assist and monitor the individual motor learning in the context of a supervised personalized remote exercise rehabilitation program for the management of injuries/pathologies. The digital tool will also enable supervised personal training

02 eXtended reality for safety and social interaction at work

XR can create more immersive experiences for people at work in order to make their job safer, by providing new ways to be aware of possible hazards and receive more effective, engaging and entertaining training on safety procedures. This is to alert and prevent serious accidents provoked by the co-occurrences of different causes, which can be avoided by conscious collaboration. With XR headsets, workers will be able, for example, to better understand difficult-to-grasp concepts or topics such as protocols and procedures for safety and security.

03 eXtended reality for people with serious mobility and verbal communication diseases

Some people with various motor disabilities or after strokes have huge difficulties in communicating with each other and even to address their vital needs. The project will join the challenge to find a dedicated communication pathway for those people introducing the possibility to interact with some specific social cues and transform them in clear communication or actions.

Solutions

CURRENT LIMITATIONS

POOR SCALABILITY AND HIGH COST
- STARTING FROM SCRATCH FOR EVERY NEW PHYSICAL ENVIRONMENT
- SIGNIFICANT EFFORT AND HIGH COST

POOR MIXING OF PHYSICAL AND VIRTUAL WORLD
- LACK OF CONVINCING INTERACTION BETWEEN PHYSICAL AND VIRTUAL ELEMENTS
- ACTIONS IN THE PHYSICAL WORLD SHOULD HAVE EFFECT ALSO IN THE VIRTUAL WORLD

NON NATURAL HUMAN INTERACTION
- NATURAL HUMAN ACTIONS SHOULD BE CORRECTLY INTERPRETED FOR THE VIRTUAL WOLRD
- OBJECTS MANIPULATED IN THE VIRTUAL WORLD SHOULD PROVIDE A REALISTIC FEELING

DEVICE RESOURCE CONSTRAINTS
- DIFFICULTIES IN HANDLING TOO COMPLEX 3D MODELS, WITH EMBEDDED PHYSICAL AND SEMANTIC PROPERTIES
- LIMITATIONS IN PROVIDING REALISTIC, HIGH-QUALITY, REAL-TIME VISUALIZATIONS

SUN'S SOLUTIONS

SCALABLE AND COST-EFFECTIVE
- USE AI TO INCREMENTALLY LEARN AND ACQUIRE FROM THE PHYSICAL WORLD
- LEARNED ITEMS WILL BE MAINTAINED IN THE SUN PLATFORM AND MADE REUSABLE

CONVINCING MIXING OF PHYSICAL AND VIRTUAL WORLD
- OBJECTS IN THE PHYSICAL WORLD WILL HAVE DIGITAL TWINS WITH PHYSICAL AND SEMANTIC PROPERTIES
- AI TO GIVE VIRTUAL OBJECTS THE SAME BEHAVIOUR THAN THE PHYSICAL ONES

PLAUSIBLE HUMAN INTERACTION
- WEARABLE HAPTIC INTERFACES
- MULTISENSORY FEEDBACK WITH 3D OBJECTS
- GAZE AND GESTURES BASED INTERACTION VIA AI AND COMPUTER VISION

SURPASS DEVICE RESOURCE CONSTRAINTS
- AI AND GENERATIVE SOLUTIONS TO PROVIDE HIGH-QUALITY RENDERING ALSO IN PRESENCE OF COARSE-GAINED, LOW RESOLUTION AND MISSING PARTS

"The SUN XR project aims to overcome existing limitations in XR development by offering scalable and cost-effective solutions, achieving seamless and convincing interaction between physical and virtual environments, enhancing human interaction, and addressing resource constraints of end-user devices through the implementation of wearable sensors, haptic interfaces, and artificial intelligence-based solutions. "