Technology– MED1stMR

MED1stMR is both a scientific research project and a technology project in which six technical partners collaborate in an agile development structure to develop a highly innovative mixed-reality training solution for medical first responders. As part of the project, over 200 paramedics and emergency medical technicians from across Europe will evaluate the solution in six weeks of training to provide feedback for the final development. This will adapt the training solution to the needs of the end users and create a solid foundation for commercial success after the completion of the grant project.

"Product development across 9 European countries and 18 partner organisations is challenging, but by using an agile end-user-centered research methodology, end users are continuously involved in the developments. This effectively brings together science, technology and the perspective of medical first responders right from the start," says Helmut Schrom-Feiertag of AIT in Vienna, the project's coordinator. Cross-sector end-user workshops, co-creation and design thinking methods were used to develop a common understanding of user requirements for the development of the solution. The user requirements are implemented on an ongoing basis by the technology partners, who are top companies in their industry.

The solution includes several technology components:

- **Mixed reality training environment** based on state-of-the-art XR technology with detailed performance measurement for improved team debriefing. Optical tracking for accurate positioning and motion analysis of up to 4 trainees simultaneously.
- Creation of realistic **3D environments and objects** matching the scenarios *(accident vehicles, injuries in different stages of treatment, realistic medical equipment such as ventilation bags, various uninvolved observers, realistic uniforms, etc.)* to increase the trainees' **situational awareness**.
- High-end **medical simulation manikin** for haptic and realistic experience in the virtual environment - *multisensory feedback for pulse measurement, ventilation or similar.*
- **Wearable biosignal measurement device** for easy real-time measurement of stress and its progression during training for conscious awareness of stress levels.
- A trainer **dashboard** for evidence-based decision-making, with visualised **real time performance data**.
- **AI-supported scenario control** to relieve trainers in the control of the training and real-time adjustment of the stress-triggering factors.

VR training offers controlled, easy-to-create environments in which training can be executed repeatedly under the same conditions. However, the sensory component is also relevant for a more realistic perception and higher learning effects. Therefore, Mixed Reality technology (instead of pure Virtual Reality) has been prioritized for MED1stMR. By integrating medical simulation manikins, the experience for the trainees becomes more real and thus more immersive. The high-end simulation manikins in front of the trainee can be treated as in a real training but are visible as virtual avatars with simulated injuries and behaviours. This multisensory experience increases the learning effects and the acceptance of the system. To further support medical first responder in training and to personalize the training, MED1stMR also integrates wearable technology to monitor the physiological data of the trainees. The smart devices developed as part of the project can detect biosignals and provide the trainer real-time stress level information during training. This allows the trainer to make evidence-based decisions about how to proceed with the training and adapt the scenario live through an editor. Stress-inducing factors can be increased or decreased to provide ideal training conditions. First responders should not only train how to communicate, organise and perform rescue operations in disaster situations but also practice how to deal with individual stress levels in response situations. In order to improve the effectiveness of mixed reality training for crisis situations, physiological signals are also used for scenario control supported by artificial intelligence. This relieves the trainer, who can thus focus on the learning successes.

Taking stress into account in training promotes the resilience of the valuable emergency forces. This technology allows exercises to be conducted in a realistic and cost-effective way. Large-scale real-life exercises will not be replaced by this technology, but real-life exercises are cost- and resource intensive and based on that very rare. Therefore the MED1stMR solution enables additional realistic exercise sessions to better prepare first responders for emergencies.
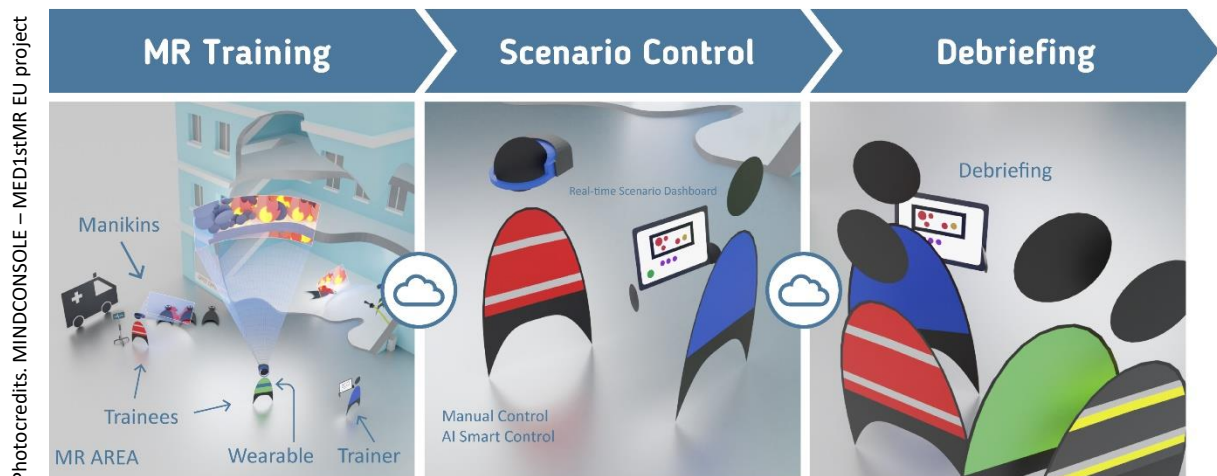
The developments in this multidisciplinary project require close cooperation and coordination of the technology partners to realize high innovation and usability:

Technology partner	Tech-Role in MED1stMR
AIT - Austrian Institute of Technology Center for Technology Experience, Austria	User-centered Design & Prototyping
Refense, Switzerland	VR-Environment, Tools & Equipment
MINDCONSOLE, Austria	VR Assets (Avatars, injuries, uniforms, vehicles etc.)
D2D Medical-X, Netherlands	Medical simulation manikin for sensory and haptic Mixed Reality experience
PLUX Biosignals, Portugal	Smart wearable for stress measurement
IDENER, Spain	Data Processing, Backend & Tools based on artificial intelligence for smart scenario control

A list of all 18 project partners: https://www.med1stmr.eu/consortium/

Press Pictures: https://www.med1stmr.eu/press-material/

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