XR Health Training in the Education Vertical

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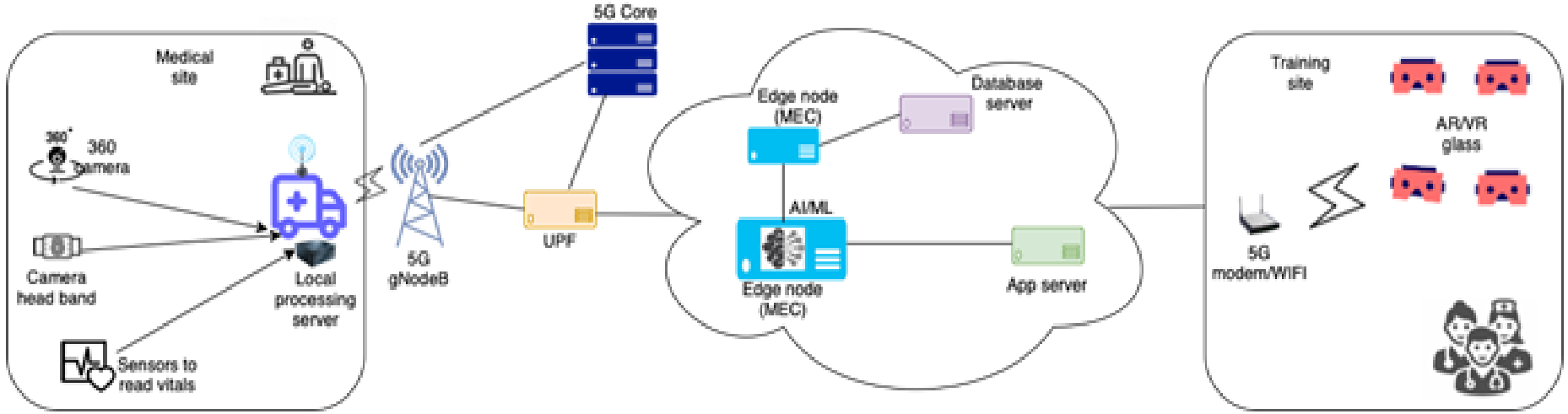
XR health training - background

- Healthcare education involves many practical medical tasks that need to be practiced by the students
- We focus in particular on training of prehospital nurses
  - Must possess a combination of cognitive and practical skills to effectively manage a wide range of medical emergencies
- This training is mainly carried out in two different ways:
- Practical training through supervised participation in real clinical prehospital care scenarios
  - This is a costly part of the education and the students can only take part in a limited number of scenarios
  - Trained scenarios can not be controlled and depend on what medical emergencies occur
- Practical training working in simulated scenarios with manikins
  - Authenticity of the scenario is critical for the learning experience

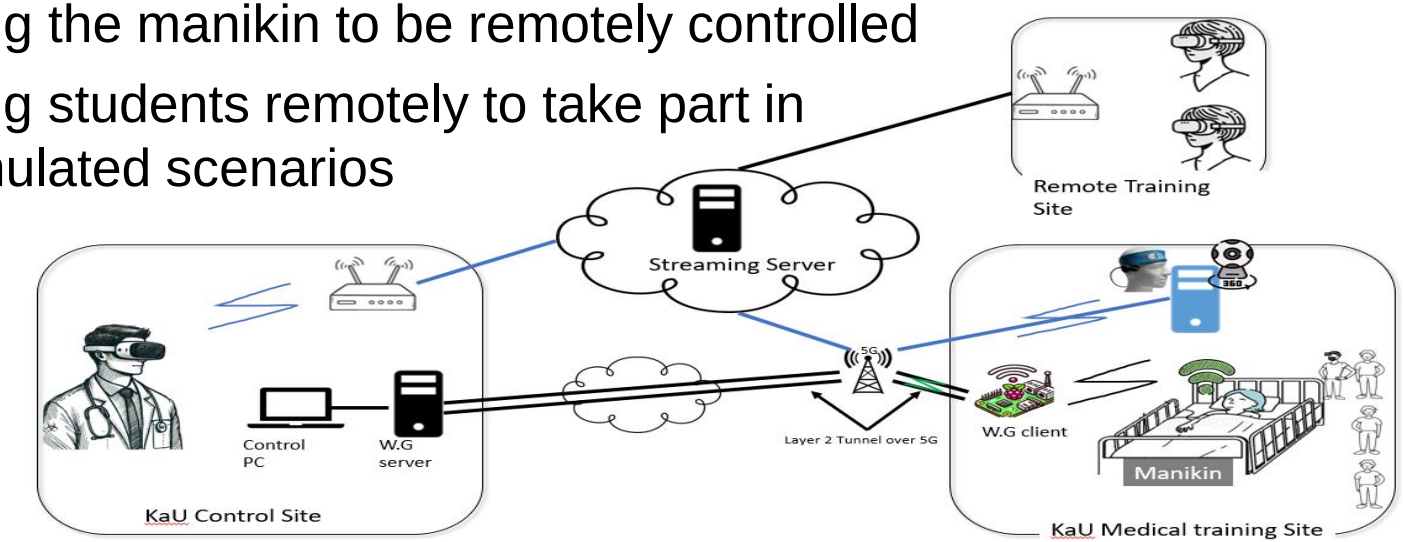
XR health training – real clinical prehospital care scenario

- Bring the training of prehospital nurses and other first responders to a remote location, such as a classroom, in an immersive way
- Nursing students wear recording equipment and sensors, streaming the scene, viewed by the wearer, to a server on board the ambulance
- The server itself may collate the streams and forwards them for remote viewing over a B5G/6G network connection
- An application server receives all the streams and performs pre-processing steps for scene creation and AI-based video and audio analysis
- Students wear head-mounted displays (HMDs) and the reconstructed scene is streamed to the HMDs of the students



XR health training – manikin scenario

- Practical training working in simulated environments with manikins is an important part of the education
- Manikins simulate human anatomy and physiology, allowing learners to extend their knowledge by experiencing lifelike situations
- With help of technologies towards 6G we aim to:
  - Extend manikin training beyond a confined location
  - Allowing the manikin to be remotely controlled
  - Allowing students remotely to take part in the simulated scenarios



Mapping to B5G/6G

6G-Path

- Use case involves several multi-modal traffic flows (manikin control, audio, video)
- Will be realized in the KAU testbed

- Exploit slicling capabilities
  - Manikin control and audio over a high-priority slice
  - Video flows over the default slice.
- Explore the use of L4S (Low Latency Low Loss Scalable Throughput) to control latency
- Edge deployment for use case related processing

KPIs

KPI	Description	Objective
Uplink capacity	High uplink capacity for upload of video and other types of streams.	> 20 Mbps
Packet loss rate	Low packet-loss to avoid interference in real-time streaming.	<=1% (frame loss rate)
Latency	Low latency is needed to provide an interactive, immersive experience and allow control of the manikin.	< 20 ms, extended to 50 ms if object detection is done at the Edge and head movement is tracked at the HMDs. 30 - 50 ms for the manikin feedback.

Service Quality KVIs

KVI	Description	How to measure/Target	Methodology
User satisfaction	The user's level of satisfaction with the XR technologies enabled by 6G to make a positive impact on training.	SUS	SAFT
Ease of use	The user-friendliness of the XR system enabled by 6G, including setup and interaction.	SUS	SAFT
Network and data reliability	The users' rating on the reliability of using XR technology in training sessions to make sure they are not interrupted due to network failures, providing a consistent and dependable learning experience with accurate and on-time information.	SUS	SAFT
Technology acceptance	Fraction of students/industry partners /teachers believe that XR technologies enabled by 6G bring a positive benefit to the training.	SUS	SAFT
Interactivity	The users' rating on the ability of users to interact with the virtual environment and respond to scenarios when using XR technology enabled by 6G.	SUS	SAFT
Increased training realism	Fraction of industry partners/UC partners/teachers/students who feel that the solutions contribute to increased training realism.	SUS and PGRS	SAFT

System Usability Scale (SUS)
Paramedic Global Rating Scale (PRGS)

Social Sustainability KVIs

KVI	Description	How to measure/Target	Methodology
Enhanced eHealth education	Fraction of industry partners/UC partners/teachers/students that believe that the students will see a more comprehensive image of the training process	PGRS	SAFT
Increased student engagement	Fraction of students/industry partners /teachers who believe that XR-based training increases student engagement during training sessions.	SUS and PGRS	SAFT
Increased accessibility to quality training	Fraction of students/industry partners believe that students will be able to access personalized environments to train according to their necessities with the help of XR technologies and 6G	SUS	SAFT
Improved health services	Fraction of industry partners/UC partners/teachers who believe that XR technologies enabled by 6G will contribute to improving the quality of the provided care and lead to increased patient safety through better-trained medical staff.	Opinionated Questions using 5-point Likert Scale	SAFT

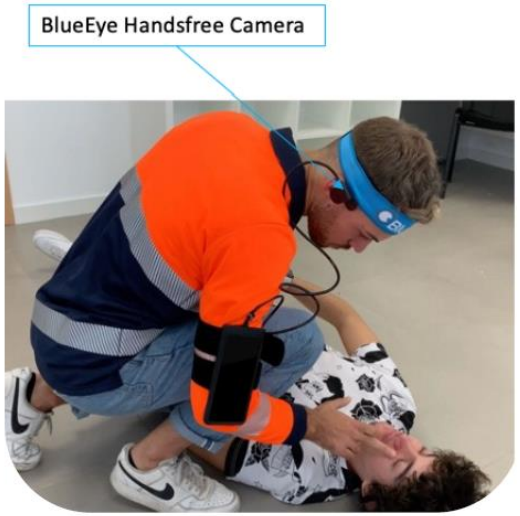
System Usability Scale (SUS)
Paramedic Global Rating Scale (PRGS)

Economic KVIs

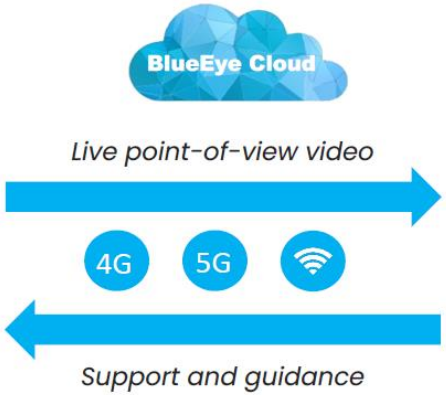
KVI	Description	How to measure/Target	Methodology
Reduced training costs	Fraction of industry partners/UC partners who believe that XR technology and 6G connectivity facilitate decreasing the overall cost of training medical professionals through stimulating realistic environments. (ex: reducing the number of hours that need to be spent in costly direct patient-to-student training scenarios)	Opinionated Questions using 5-point Likert Scale	SAFT
Increased scalability	Fraction of industry partners/UC partners who believe that streaming real-time data and scenarios to students via XR technology facilitates to reduction of long-term costs through scaling training to larger student groups without additional physical resources.	Opinionated Questions using 5-point Likert Scale	SAFT

UC Partners and Roles

- KAU Nursing Science
  - Use case owner
- KAU Computer Science
  - Testbed provider and use case coordinator
- Red Zinc
  - Technology provider



A paramedic attending a victim at an emergency site



A remote medical expert providing support to a paramedic

Q&A

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