Development and practice of a virtual nuclear simulator (ViNuS) in radiation protection training

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Abstract

In (medical) nuclear environments, engineers are operating or supervising/coaching workers during handling of strong and/or open sources in their daily practice. The ALARA principle forms the basis of their decisions, not only to evaluate the risks and consequences for their own operations but also for all others present in this environment. Therefore, training these skills is necessary but challenging. We will employ a virtual reality (VR) environment to accomplish a stepwise approach between theory and real practice. The 'Virtual Nuclear Simulator' (ViNuS) project aims to develop a flexible VR environment for master students nuclear engineering with an initial focus on 2 radiation protection cases: (1) nuclear decommissioning, and (2) nuclear medicine. We will build scenarios on working with localized (open) sources and contaminated surfaces. Our system comprises off-the-self hardware and user-friendly software focusing on (i) the generation of scenarios, (ii) the speed and quality of rendering the virtual environment, and (iii) the interaction between users and the visual content.
Through a modular approach, we foresee the translation to other practices or target groups in the future.

Classical education approaches face a lot of **limiting factors**.

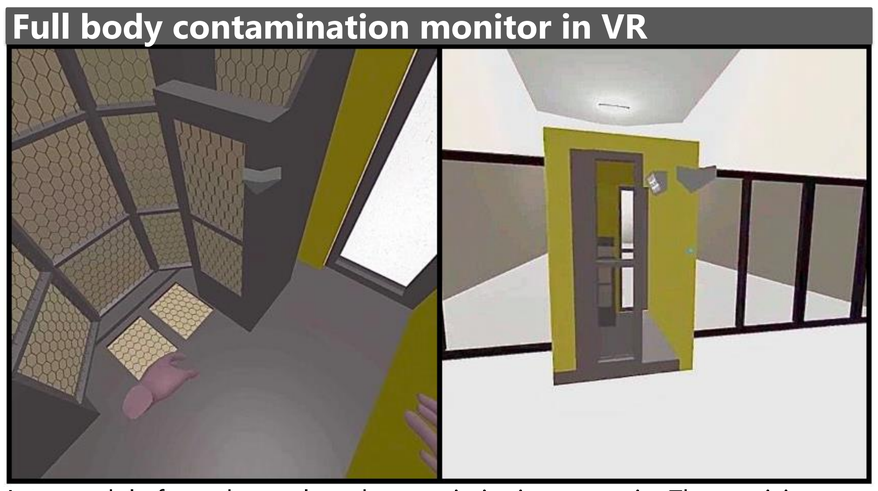
- ❖ Nuclear safety procedures and time-consuming access procedures
- ❖ Busy nuclear-medical centra
- ❖ Problems with privacy and confidentiality
- ❖ Huge cost of nuclear waste
- ❖ Safety aspects
- ❖ Lack of nuclear lab-experience

Future proof innovative educational project in RP training

NuTeC **EDM**

Stakeholders
Creating a strong and flexible VR learning environment

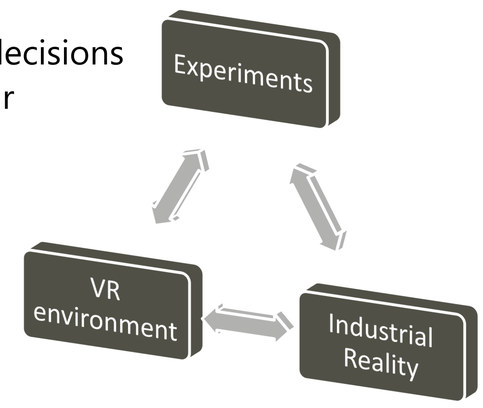
Full body contamination monitor in VR



Intromodule from the nuclear decommissioning scenario. The participant must go through a full body contamination monitor to make sure that he/she is not contaminated prior to entering the controlled area.

Goals of the project

- ❖ To get students acquainted with the safety culture through **VR technology**
- ❖ Place students in decision-making **scenarios**
- ❖ Confront the students with the **consequences** of their decisions
- ❖ Provide the students to learn to **work safely** in a nuclear environment without the risks of being there
- ❖ Create combined **learning modules** by linking the VR modules with complementary laboratory exercises
- ❖ Scenarios based on **industrial reality :**
  1. Nuclear decommissioning case
  2. Nuclear medical case
- ❖ **Future proof** : flexible, easy adjustable, universal



Hardware and software

The VR environment is written **in C#** using the Unity development platform. This allows to **easily create** interactive 3D environments. Based on the initial **scenarios,** an additional authoring tool will be created to ensure further environment customizations for non-developers that want to use the system.
For running the VR environment, we currently make use of the Oculus Quest 2. It allows the system to be deployed at **any location** since the headset does not need to be attached to any pc. However, it should be possible to use **any commercial VR device** with the training environment we created.

Work packages & timeline

WP 1: Basic structure VR environment

1.1 Select **learning objectives** & **scenarios** (NT)

Start October 2020

WP 2: Development & extension VR environment (EDM & NT)

- 2.1 Nuclear decommissioning
- 2.2 Nuclear medicine

WP 3: Evaluation and adjustment with pilot group (NT)
(WP 2+3: Month 6-18)

WP 4: Development combined learning packages (EDM & NT)

- 4.1 Nuclear decommissioning
- 4.2 Nuclear medicine

WP 5: Test and adjust with target group (NT)

(WP 4+5: Month 16-24)

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IOP Project UHasselt ViNuS, DIOS Stimuleringsfonds Life Long Learning goes international