

XR Labs - Belgian Defence – Belgian Federal Police

Abstract — These instructions give you guidelines for preparing 2-page extended abstracts for ITEC conferences. Use this document as a template if you are using Microsoft Word 6.0 or later. Otherwise, use this document as an instruction set. Please use this document as a “template” to prepare your manuscript. The abstract paper should be a summary of your work (including abstract, introduction, key elements, and conclusions).

1 Introduction

In 2009 a Belgian ship was hijacked by Somalian pirates. In a joint effort to resolve the situation, the special forces of both the Belgian Federal Police and the Belgian Defence trained together to enter the ship. To accomplish this, they made a real life replica of the ship in a sports hall using wood and carton based on the blueprints of the ship. However, building this replica, took a lot of time. Time that could otherwise be spent training.

This is why, in 2022 the Belgian Military and Belgian Federal Police officially joined forces to build a proof of concept of a VR-training simulator that would make it possible to more quickly react to these kinds of situations. The aim of the simulator is to make the interactions of the operators with the virtual environment as close to real life as possible. This collaboration was officialised by a protocol agreement between the two organizations. Which now makes it possible to work together in the field of innovation, and in particular around the topic of extended reality. The main goal of the collaboration is to share knowledge and insights to avoid the duplication of effort.

Although the collaboration officially started in 2022, the initial steps of the training project were taken in 2017, during a master thesis focussed on crime scene reconstructions in Virtual Reality. By taking 3D LIDAR scans of a crime scene, it is possible to afterwards revisit the crime scene, when back at the office. This makes it possible for the Law Enforcement Officers that were not present at the crime scene, to form a picture of the situation. This means that by using this technology, fewer people have to physically come to the crime scene, which ensures no unnecessary traces will be destroyed on the Crime Scene.

In parallel with this project, the foundations for the VR training simulator for the special forces were laid. Now a couple of years later with the official collaboration, the proof of concept of the simulator is taking shape, and the first training sessions of our special units are a fact. In 2019, a document regarding the Key User Requirements for an eXtended Reality simulator for the special forces was written in collaboration with the end users. The goal of the interdepartmental project is to have a working product at the end of 2023 that meets all the requirements that were described in the document.

During the construction of the training simulator, a strategy is also being developed on how to adopt this kind of technology in the future organization-wide. The Initial thought was that after the proof of concept was finished and enough knowledge about the technology was generated, an off the shelf system would be bought. However, we are now shifting towards a solution of co-development, where a system would be built together with the industry. The talk will go deeper into the reasons why we are looking for this kind of solution.

2 Rapid evolving technology

Since the technology is still evolving rapidly at the moment, buying a state-of-the-art system right now, would be outdated in a matter of years and probable even months. When investing in an off the shelf simulator, a vendor lock-in could pose a real thread. On the one hand, the firm can change strategy, or on the other hand it could even go out of business, which could have a big operational impact.

By being (co-)owner of the code base, the possibility exists to start a collaboration with another party in case of problems, if the previous one did not go as intended.

3 Sensitive data

Not only the rapid evolving technology could pose a problem, but also the nature of the confidential information could raise concerns when buying a “black box” system off the shelf. For example, in Belgium, we are looking into making 3D-scans of our critical infrastructure like our nuclear sites, airports, courthouses... This will make it possible to more quickly respond to, and train for domestic emergency situations. Think about a hostage situation, where the special units of the police can prepare their raid using the VR training simulator. Besides the domestic critical infrastructure, we also plan to create digital twins of foreign critical infrastructure administered by Belgium. Think of, for example, the Belgian embassies abroad. These digital twins would be useful in planning NEOs (Non-combatant Evacuation Operation), where our soldiers need to evacuate Belgian citizens in case. For example, the NEO in Afghanistan in 2021.

Of course, it will not be possible to make 3D-scans of every building. To address this, it will also be possible to very quickly generate basic 3D models of buildings based on their blueprints. The Royal Military Academy is

working on an algorithm that will automate this process (will be discussed in another talk during IT²EC). All these kinds of 3D models will make it possible to more quickly respond to and train for emergency situations, or situations that would be nearly impossible to train for without a lot of logistical overhead.

The information of 3D models could, on the other hand, also be very dangerous if it falls into the wrong hands. Besides the 3D models, also the gathered information about the performance of the operators (TTPs) could be sensitive in nature.

All information about a training session is saved and can be used during an After Action Review (AAR). During the AAR it is possible for the instructor to review the training session, making it possible for the instructor to give objective feedback to the trainees. In the near future eye tracking will be implemented in the simulator, which will enable the instructor to see, what the trainees were looking at, or have forgotten to look at during the session. Besides this, it will also be possible to measure the stress level of the operator when placed in a difficult situation.

4 Taylor made solution

A last issue when buying a system off the shelf is that current simulators are generally made for one specific use case. For example, there exist simulators for small arms training, sniper training, decision-making, First Aid, ... In the ideal world, we would have a modular simulator, like a sandbox environment, that makes it possible to combine these different disciplines in a training scenario, as it would be in the real world. For example, a team of assaulters will enter a building while a sniper team keeps overwatch and communicate information with the assaulters. From the start of the project, this requirement has been taken into consideration.

The main advantage of having a (limited) in house development team is that the training simulation can be tailor-made to the specific needs of the end user. In our case, the simulator is set up in a warehouse above the armoury of our special forces group. Being located so close to the end users, gives us the advantage that we have weekly user feedback. Our goal is to make the simulator as close to real life as possible. We are not really talking about hyper realistic graphics, but rather about the interactions of the operators with the simulator. What distinguishes the Belgian setup from other simulators, is that we try to incorporate as much of the real equipment of the operators.

Most often, other simulators use replicas of weapons, like airsoft or a more generic VR-gun. This leads to problems. Most of the times, these replicas aren't a one-to-one copy of the real guns. Most often, the weight isn't quite the same. Worse, the basic manipulations do not correspond to the real ones. For example for the SCAR the manipulation of the fire selector switch didn't correspond to the real one. At best the operators that use these kind of weapons in the simulation, will not completely be immersed in the simulation. Worst case scenario, they will train wrong manipulations, which could result in accidents in the real world. This is why we integrated the real weapons in the

simulation. In spare (demilitarized) lower receivers of the guns (SCAR), sensors were installed to detect the manipulations. The operators can come to the simulator with their personnel weapon, only swap the lower receivers and start the training. Using this approach, enables them to train with their proper guns, with their proper attachments on their proper spots. For example, the switches for their flashlights and lasers, can remain in the same location as they would in real life. Connecting these switches to a custom made module also makes it possible to use the lights and lasers in the simulation. Also other kinds of equipment, like communication equipment, will be integrated in the simulation.

“Train as you operate”

Author/Speaker Biographies

Major Koen Ceulemans (OF-3)

Joined Belgium Defence in 1999, went through the Royal Military Academy and became a lieutenant within the Para-commando Regt. Multiple deployments in Africa and Middle East. Since 2016 heavily involved with the transformation to Special Operations Regiment.

Since 2020 started to promote Innovation within the Special Operations Regiment and now seating as Innovation Officer for the Land component.

Nerd, geek, broadly interested in technology and an adept of lifelong learning. Loves to start DIY projects. Not an SME more a Jack-Of-All-Trades. Happily married and has fantastic twin daughters.

Jeroen Nelis (OF-1) started his career as a student at the royal military academy in 2013 where he had the opportunity to get his degree as an industrial engineer at the KU Leuven. During his master thesis he worked together with the Federal Judicial Police in Belgium on crime scene reconstructions in Virtual Reality. At this time he started working on a VR training simulator for the special forces. He was appointed as Subject Matter Expert in the field of eXtended Reality by the Vice Chief Of Defence. In October 2021 he started working as Innovation Manager for the Federal Police, where he is technical responsible for the projects of XR labs.