



The multi-sensory suit being trialled by SCDF is the first of its kind, and is part of an extended reality system. Users wear a virtual reality headset. There are also physical elements, such as heating elements in the suit and a tube that emits smells. A replicated spreader cutter interacts with magnets on a dummy car frame to simulate the resistance of cutting through the metal of a real car. PHOTOS: LIANHE ZAOBAO

SCDF training suits being trialled use virtual reality to create immersive scenarios

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The distinct smell of a burning car hits their nostrils as the ambient temperature soars.

As they approach the crackling flames, the heat rises like a wall in front of the Singapore Civil Defence Force (SCDF) trainees.

Unfazed, they use a spreader cutter to cut through the car's body, straining against the weight and resistance of the tool before freeing the person trapped inside.

But while this scenario looks, sounds, feels and smells real, the trainees are actually immersed in virtual reality (VR) in an air-conditioned room.

Short of having them taste the acrid smoke, the new suits being developed for SCDF training simulations are deeply immersive, engaging four of the five human senses.

The multi-sensory suit being currently trialled by SCDF is the first of its kind, and is part of an extended reality (XR) system.

XR refers to an environment that involves both VR and physical elements.

The system for SCDF is being jointly developed by the Home Team Science and Technology Agency (HTX), SCDF, and the National University of Singapore (NUS) Connective Ubiquitous

Technology for Embodiments (Cute) Centre.

In the case of the system being developed for SCDF's training, a VR headset immerses users in a virtual environment that engages their senses of sight and sound.

But there are also physical elements, such as heating elements in the suit and a tube that emits smells generated from a device attached to the suit.

A replicated spreader cutter, which is weighted to feel like the real thing, interacts with magnets on a dummy car frame to simulate the resistance of cutting through the metal of a real car.

At present, SCDF procures scrap vehicles for training purposes.

This is costly, as there is a limited number of times a scrap vehicle can be cut through.

With the XR system, trainees will be able to get a better feel and understanding of what to do before being tasked to do it on a physical scrap vehicle.

Lieutenant-Colonel Foo Yiing Kai, commander of Punggol Fire Station, said the system complements rather than replaces field training.

"This VR and XR technology will definitely enhance the training efficiency, because we can reach out to more trainees," he said.

"The trainees can learn the correct way of doing things before they are put forth to do the actual execution in the field training ar-



A separate virtual reality system is being developed for firefighting training. It can simulate virtual environments ranging from HDB flats to warehouses. Fires grow and spread when left unattended, mimicking real firefighting operations.

ea. And then from there, they go on to stations to do the real work to save lives and property."

Associate Professor Yen Ching-Chiuan, co-director of the NUS Cute Centre, said the centre has worked on projects involving multi-sensory simulation, such as a game called The Lost Foxfire that uses heat and smell to help players find and stop a fire in virtual reality.

He explained that the centre was able to develop for the XR system an essential oil that smelled like smoke from a burning car.

"It's a custom-made scent... after a car accident, there's usually gasoline smell, so you have to try and capture that scent and put it in an essential oil," he said.

Trials on the XR system began in March, and are expected to last for about six months, before moving on to a second phase to develop more on performance monitoring. This involves tracking areas that trainees can improve on.

The XR system will help to train SCDF officers in managing road traffic accidents and hazardous material scenarios, and can have

up to four users at one time.

A separate VR system is being developed specifically for fire-fighting training.

Jointly developed by HTX, SCDF and Netherlands manufacturer RE-liON, the system to train fire-fighters uses a haptic feedback suit and can have up to 16 users at one time.

Haptic feedback refers to the vibration of parts of the suit, which will indicate either a hit or movement to an out-of-bounds area in the virtual simulation.

The system is able to simulate virtual environments ranging from Housing Board flats to large warehouses, and is complemented by replica hose nozzles and flashlights.

In virtual training simulations, fires grow and spread to other locations and objects when left unattended, and the user's vision is also obscured by smoke and darkness, mimicking real firefighting operations.

Dr Saravana Kumar, deputy director at the Human Factors and Simulation Centre of Expertise at HTX, said there is potential to also repurpose these technologies for use across the rest of the Home Team.

He said: "It could be used in the case of crime scene investigation training, where you know they'll be exposed to the smell of blood. Or even for search and rescue training, with the smell of burnt corpses for example."

"There is potential to repurpose such technologies for other use cases across the Home Team departments, because multi-sensory training is a cross-cutting kind of capability."

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