

# A VR based safety training in a petroleum refinery

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## Abstract

We present the prototype *omVR*, which is a Virtual Reality based safety training system in a petroleum refinery. It provides an improved technique for personnel safety training and allows users to navigate through parts of the refinery and interact with the environment. *omVR* is the implementation of a training scenario, which is too dangerous, difficult, or expensive to play in real life.

In our application the trainer has the possibility to control the scenario from a remote application. This trainer module communicates with the trainee visualization program, which uses head mounted display and results in a high degree of immersion.

## 1. Introduction

In virtual reality, safety training truly becomes alive and gives the trainee the feeling of being involved in the virtual training world [2,3,4,7]. Traditional training, like courses, seminars, etc. suffer primarily from two problems: On the one hand they tend to focus on theoretical issues rather than on practical training. On the other hand practical training in hazardous environments increases training costs due to safety considerations and related production stops.

## 2. Application

The *omVR* application was developed at the Johannes Kepler University of Linz (Austria). The goal was the implementation of a prototype to show and investigate the advantages of a VR based safety training system for refineries (see figure 2).

*omVR* has been designed to foster natural interactions in the training environment by a maximum transfer of training skills. The historic methods of field training, which entail high costs and dangerous situations, can now be performed within the safe and economical *omVR* environment.

One goal of *omVR* was the simulation of the employee's behavior in the case of H<sub>2</sub>S emissions during the daily check. Moreover, the trainer has the possibility to control the VR scenario by using a remote application and thereby simulate different scenarios. *omVR* provides training exercises and simulated refinery environments for training specific tasks, situations, and environments that would not be feasible due to limited resources, time concerns, and hazards in usual training setups.

Finally, it is possible to train appropriate behavior and decision making under stressful conditions posed by scenarios that represent extreme risk situations [8].



Figure 1: A omVR training session

## 4. Implementation

The *omVR* architecture consists of two different modules (see figure 1):

- The *omVR* trainee module, implemented on a graphics workstation, runs the virtual reality simulation (see figure 3).
- The *omVR* trainer module allows the trainer to control the 3D refinery scenario.

Our application uses a head mounted display (HMD), which results in a high degree of immersion. The simulation application is based on the IRIS Performer 2.2 graphics library [5] and on MR Toolkit 1.5, which provides the interface to the tracking device [6]. The trainer module was written in Java and has two main functions: First, it allows the trainer to control the VR scenario. Second, it creates a protocol for each session.

Because our virtual reality safety tutorials are designed modularly, modifications are easily made as workplace situations change.

## 4. Benefits and advantages of *omVR*

Beginners are typically overwhelmed by the amount of information and the complexity of the task to be trained. As a result the trainees often do not react in the right way. In our virtual environment users are able to skip advanced training sections, which enables them to concentrate on the essential parts of the lesson. Hence the motivation of the

trainee increases and thereby training efficiency is improved.

At the moment, the *omVR* application is under examination by Austria's biggest oil refinery, named OMV [1]. The company tested it with many employees and it has been accepted with big enthusiasm as a new training system.

The relationship between the trainer module and the simulation of the virtual world becomes the heart of the educational system and the trainer module carries an automatic score table. Thus there exists a list of all the possible events and tasks in the scenario. The trainer can give orders, activate events and control objects in the 3D world. According to the actions of the trainee, he/she will be awarded with bonus points or penalized with minus points.

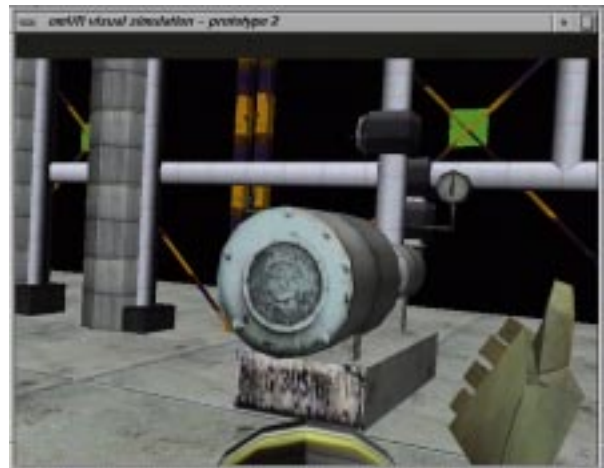


Figure 2: The trainee has the feeling to be involved in the virtual world

The benefits and the advantages of the *omVR* training system are:

- It allows the training of situations that would otherwise be too dangerous.
- Scenarios can be realized, which are too complex for conventional teaching methods.
- Trainees get a better understanding of the operation sequence.
- The focus is on *learning by doing* – learning from mistakes.

Employees are able to explore the effect of their decisions without risk.

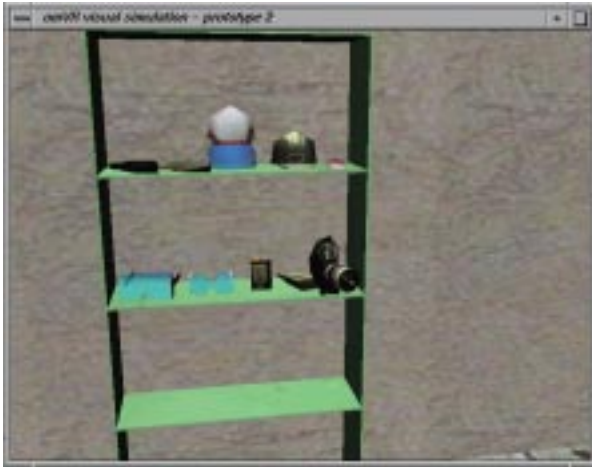


Figure 3: The equipment of the trainee is located in a cupboard

In virtual reality, employees have a first hand experience of the inherent dangers of their working environment and of how to react correctly.

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