

## Virtual Reality System for Training of operators of power live lines

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### Abstract

This article presents a training system for live-line operators of power distribution system. Most work in power systems must be free of interruption, so it is carried out by live-line techniques. However, these techniques have increased the number of accidents by electric shock. Because most electric accidents are due to live-line work, it is important to train live-line operators. The developed training system is based on non-immersive virtual reality. The training is focused on the maintenance of high and medium power live-lines in a distribution system. Most work in power systems must be free of interruption, so it is carried out by live-line techniques. However, these techniques have increased the number of accidents by electric shock. The proposed training system provides repeated and cost-effective training for a small space. It also guarantees safety during training operations. The article, describes the architecture of the developed system, the creation of the virtual work environment, and the collision detection among virtual objects are also described. The components involved in the virtual live-line work environment are modelled as 3D shapes to give them a more realistic appearance. Autodesk •3D Studio MAX (release 8) was used to model the objects. 314 3D objects. The interactivity of the virtual 3D scenarios was developed with the tool Cult3D (release 2005). This tool defines valid clicks to run an animation, the type of navigation permitted (zoom, handling of objects), and selection of object from the menu of tools, materials, equipment. The interface was developed using ergonomic concepts. The interface is divided into three main areas: (1) information of the maneuver step to perform; (2) tools, materials and equipment menu; and (3) the virtual environment. This is the workspace where users interact with the system of training. 3D elements are mouse-sensitive objects that tell the user which areas are applicable to click on the current step. The system, called as Alen3D, is currently training thousands of live-line operators from the 13 divisions of distribution system of the Mexican electric utility company. It consists of 100 maneuvers for maintenance of high and medium power line-live and a database of 314 3D objects. In total, there were approximately 1,600 minutes of animation, 800 objects were modeled (includes scenarios, avatars and structures) and 1,200 interactive scenes. The general aim of our work is to provide operators of complex industrial environments with a suitable training to certify operators in knowledge, skills, expertise, abilities and attitudes for operation of power systems.