Improvement of physical security at nuclear facilities using virtual reality

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Nuclear safety refers to a set of procedures implemented by countries and international organizations in order to assure a security

pattern concerning the handling, use and storage of radioactive materials [1]. The security of facilities that are used to store or generate such materials must be carefully considered.

Moreover, strategies must be created, tested and improved to keep these materials and all information related to the total amount of nuclear material, as well as its location, away from terrorists or hostile nations. The development of such strategies demands time, financial resources and the engagement of a large group of people. For this reason, they need to be tested in exercises simulating real situations to know if there is compatibility between the theoretical defense plans and the real conditions of the nuclear facility.

Therefore it is necessary to evaluate parameters such as the nuclear facility's ground topology; the visibility level of its area and borders; the number of members compounding the defense crew (security agents); equipment for detection of radiation and the time spent to reach a compromised position, just to give some examples [2].

Concerning this matter, the use of Virtual Reality (VR) techniques to plan the actions related to safety strategies can contribute to improve the simulated results as shown in (Xi et al., 2009), (Mol et al., 2008a), (Freitas et al., 2011), (Gonçalves et al., 2010) and (Aghina et al., 2007).

This work proposes the development of a computational model which uses virtual reality techniques and which can describe, in as many details as possible, a real nuclear facility and

allow for the performance of simulations of physical security strategies. The objective is to analyze the feasibility of using this software to develop games to create a model, described as virtual environment, which can

be used as a study auxiliary tool to define security strategies for nuclear facilities.

References

[1] INTERNATIONAL ATOMIC ENERGY AGENCY. **Nuclear security**: measures to protect against nuclear terrorism. Vienna: IAEA, 16 aug. 2006. 31 p.

[2] STACKPOLE, B.; OKSENDAHL, E. **Security strategy**: from requirements to reality, first. New York: Auerbach Publications, 2010. 346 p.

[3] XI, C. et al. 3-D Virtual reality for education, training and improved human performance in nuclear applications. In: NUCLEAR PLANT INSTRUMENTATION, CONTROLS AND HUMAN MACHINE INTERFACE TECHNOLOGY, apr. 5-9, 2009, Knoxville, Tennessee. **Proceedings...** Knoxville, Tennessee: NPIC-HMIT, 2009.

[4] MÓL, A. C. A. et al. Virtual environments simulation for dose assessment in nuclear plants. **Progress in Nuclear Energy**, Oxford, v. 51, n. 2, p. 382-387, mar. 2009.

[5] FREITAS, V. G. G. et al. Radiation dose rate map interpolation in nuclear plants using neural networks and virtual reality techniques. **Annals of Nuclear Energy**, v. 38, p. 705 - 712, 2011.

[6] GONÇALVES, J. G. M., et al. Virtual reality based system for nuclear safeguards applications. Vienna: IAEA. 7 p.

[7] AGHINA, M. A. C. et al. Full scope simulator of a nuclear power plant control room using virtual reality 3d stereo technics for operators training. In: INTERNATIONAL NUCLEAR ATLANTIC CONFERENCE, 2007, Santos, SP. **Proceedings...** Santos, SP: ABEN, 2007.