Virtual reality for emergency preparedness: simulating evacuation from buildings

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Introduction

This research and development comprises application of virtual reality techniques to simulate nuclear sites, buildings and also public sites with crowded events, towards security and emergency preparedness. In this R&D, virtual environments are developed by reusing low-cost platforms, which have embedded some important characteristics to perform virtual modeling and simulation.

The evacuation from buildings and nuclear threat counteraction were simulated. Other virtual environments are being designed. In all of them, multi-user simulations may be performed, to help preparedness and planning.

Methodologies

First, virtual sites and buildings are designed, based on real architectural plants and on publicly available maps. The platforms' multi-user capabilities enable planning a broad range of simulations, concerning different emergency and/or nuclear threats situations. Users may be split into different teams, as: general public, buildings occupiers, invaders or responders. Autonomous avatars (virtual persons) are also used, as needed.

Results and Discussion

The following applications were developed: (i) the building evacuation simulation during emergencies [1], (Fig. 1); (ii) the evacuation simulation using autonomous avatars [2], (Fig. 2).
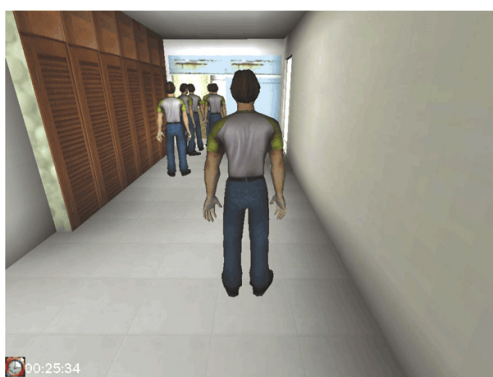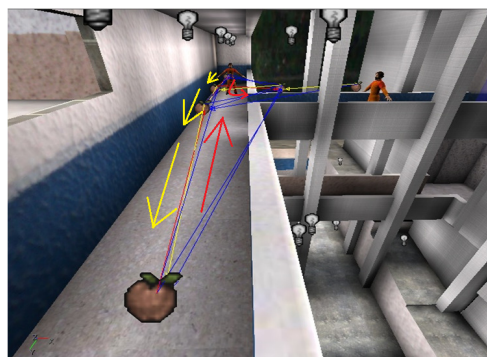

Fig. 1- A crowded exit virtual simulation.

Fig. 2- Paths with different priorities for the autonomous avatars.

In the first development, elapsed times agreed for virtual and corresponding real evacuation experiments (Table 1), with more than one person exiting at a time.

In the future, IEN/CNEN's staff will model wider and open areas for broader simulations.

Table 1- Comparative analysis between elapsed times in the virtual and real experiments.

Person	Exit times in virtual simulations	Exit times in real simulations
1	01:00	01:07
2	00:56	01:05
3	00:57	01:03
1	01:00	01:07
2	00:56	01:00
3	00:54	00:59
1	00:58	01:05
2	00:55	01:04
3	00:57	01:02

References

[1] Mól, A.C.A.; Jorge, C.A.F.; Couto, P.M.; "Using a Game Engine for VR Simulations in Evacuation Planning", *IEEE Computer Graphics and Applications*, 28 (3): 6-12, 2008.

[2] Mól, A.C.A.; Legey, A.P.; Freitas, V.G.G.; *et al.*; "Virtual Evacuation Simulation with Autonomous Avatars", *2011 International Nuclear Atlantic Conference (INAC 2011)*, Belo Horizonte.