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Simulation tool for fire and rescue services

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Abstract

The authors of the contribution present the possibility of using modern simulation tools based on computer software - applications for the needs of emergency responders, especially for fire fighters. They point out different features of simulation technologies and recommend their implementation in the process of lifelong preparation, training and education of the members of Fire and Rescue Services as the new trend for the comprehensive improvement of preparedness and safety of fire fighters and rescuers. The contribution also presents basic research supported by institutional grant project of the University of Žilina. In agreement with research results, the authors propose a new simulation model design. This model can be used for designing and programming serious games and software for education of fire fighters. It is the first time the simulation model has been designed with active cooperation and support of the Fire and Rescue Services in Slovakia.

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1. Introduction

Simulation means scientific or technical imitation of certain action, process or object, in most cases using IT technology. In Slovak context, simulation is often confused with modelling. Creation of realistic or close to real model indeed is the basis of every simulation but these terms are not identical. Simulation enables change of entry parameters. A particular model can be simulated in several ways. Nowadays, computer simulations are complementary to real

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simulations on a reference object (e.g. extinguishment of a vehicle fire, evacuation of people, fire in a tunnel). Computer simulation enables us to simulate various scenarios, evaluate and optimize them, and the results can be subsequently applied in a real life incident. Simulation undoubtedly is an efficient tool for supporting preparation, education and decision making skills in various real-world contexts. An extremely important task in training of Fire and Rescue Services is to teach individuals and rescue teams how to do their job correctly and safely.

Examples of using simulation in training:

- Fighting fires - extensive forest fires, fires in confined space, open-space fires, training of firefighting activities, evacuation, extinguishing strategy, extinguishing fire outbreaks
- Rescue works - technological accidents, natural disasters, environmental incidents and environmental protection
- Fire brigade management and training of cooperation among fire brigades, units of Integrated Rescue System, possibly in several countries
- Coordination of rescue activities - with mass accidents, premedical first aid, medical evacuation, behavior of crowds
- Activities related to rescue work - evacuation management, removal of barriers and roadblocks, rescuing people, mopping up activities, incident monitoring
- Release of hazardous substances, detection of chemical substances, contamination and decontamination
- Others - explosion, detection of fire outbreaks by thermal imaging cameras, detection of hazardous substances, bomb systems, terrorist attack

The simulation technologies (ST) can be applied in various stages of preparation, training, continuous education or regular tactical drills. The advantages of using simulation with these activities are [1]:

- Creation of complex and real environment - possibility to simulate various emergencies, incident conditions, circumstances, etc.
- Dynamic environment - enables participants to practice the ability to react quickly and effectively in the course of an incident
- Realistic training - enables fire fighters to prepare for particular events and situations
- Increased awareness and efficiency - connecting theoretical and practical knowledge, preparation of crisis scenarios
- Availability - location, place, remote access option, repeat option, etc.
- Flexibility - multiple use, repeatability, phaseability, verification of variants and data
- Simulations for innovations - new trend development, verification of new procedures, etc.
- Affordability - inexpensive hardware and software
- Time requirements - shorter preparation and validation
- Occupational safety and health - simulation cannot cause any harm to anyone

The advantage of application of simulation technologies and tools is the existence of various supportive analyses that are able to determine load or other problems in the work of a fire fighter on the basis of environment and a virtual model of a human body. This can substantially accelerate situation assessment, rescue and relief work, deployment of forces and means, cooperation of rescue services, etc. Simulation centres, polygons and various training centres have recently started to gain popularity [2]. To increase their quality and operational capability, Fire and Rescue Corps are trained in various simulators and polygons to develop their firefighting and rescue skills. Besides necessary simulators, useful software tools and applications [3] are starting to be introduced into practice. They help fire brigades and Rescue Services in their everyday work. The Fire and Rescue Corps use applications e.g. for sharing information in real time (during incident), for searching additional information necessary for intervention (maps arrangement of hydrants, demographic data), for work planning and organizing, Fire Corps training and others.