NEW TECHNOLOGIES IN SECURITY
ON THE EXAMPLE PRIVILEGED VEHICLES DRIVING SIMULATOR

Privileged vehicles driving simulator it is training system build by Police Academy in Szczytno during research project founded by National Centre for Research and Development. System can significantly raise the level of training for privileged vehicles drivers. A wide range of scenarios and available physical models of cars with all possible failures makes possible the creation of an almost unlimited number of on road situations. It is extremely important that all of these events can be practiced without the slightest risk of endangering human health or damage to real vehicles.

Key words: security, simulator, training.

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Introduction

Simulators, already widely used in aviation, are increasingly utilized also in the process of training and psychophysical testing of vehicle drivers. Vehicle simulators are an excellent supplement for real vehicle training, providing unique capabilities [1]:

– safe training of a vehicle driving person's behavior in dangerous situations;

– no possibility to create a real threat to other road users;

– the ability to drive and conduct training in a variety of terrain and weather conditions;

– regardless of external factors;

– repetition of exercises to be completed ensuring comparability of the results for trainees.

One of the groups of people who should have special skills in driving cars, are drivers of privileged vehicles used in the course of their duties, among others by the Police, Government Protection Bureau, State Fire Brigade, Military Police and other services [2].

Design

To meet the needs for professional training for drivers, ETC-PZL Aerospace Industries in cooperation with the Police Academy in Szczytno and the Institute

of Medical Technology and Equipment ITAM Zabrze, completed a research project under the name of «the simulator of driving privileged vehicles during typical and extreme actions» [3]. The result of the project is a simulation training system designed for training and perfecting the training of officers of various departments in driving privileged vehicles. It can also be successfully used for the training of employees of companies engaged in protection of personal and property protection and civil drivers. The simulator in addition to improving driving technique allows for, first of all, training in simulated driving conditions under different hazards (a vehicle under fire, explosion of a «car bomb», system fire or cistern fire and many others), as well as learning tactical team driving in a column or in conducting pursuit – block activities.

Fig. 2. A cabin of a delivery truck. Source: Obtaining data from the privileged vehicles driving simulator.

Fig. 1. A cabin of the car with the motion system. Source: Obtaining data from the privileged vehicles driving simulator

Construction of the simulator

The simulator consists of the following modules:

– instructor and operator's station;

– car cabin placed on motion platform of 6DoF with vision system of 2400 FoV horizontally and 400 vertically;

Fig. 3. A simplified driver station. Source: Obtaining data from the privileged vehicles driving simulator.

– fixed cabin of a delivery truck with vision system of 2000 FoV horizontally and 400 vertically;

– three simplified driver seats, each one equipped with three monitors, a

steering wheel with pedals and a gear--change lever;

– communications system;

– computer system.

Such modular design allows for expansion of the system with additional stations. The basic version of the simulator allows training up to five drivers at the same time (two in fully equipped cabins and three in simplified stations).It allows you to develop driving skills in columns, convoys, co-operation in accomplishing tasks and communications among the trainees. Thanks to the capabilities you can easily train the co-operation between several drivers.

Fig. 4. A sample scene of a tanker fire visualization. Source: Obtaining data from the privileged vehicles driving simulator.

Course of training

The training can be held in 3-D, fully realistic virtual environment, which may include real or synthetic area, and all trainees operate in a joint virtual environment exercise. The vision generated by the computer system is seen by each exercise participant according to their current location. The virtual environment includes buildings, along with full infrastructure and reflects the most common conditions met on roads. Cha-racteristic elements of the landscape are reproduced including vegetation, streets with their infrastructure and surrounding buildings, other road users (vehicles, pedestrians), as well as participants in public gathering or sport events in the form of groups of people or crowds. In addition, all other simulated components of the virtual environment, such as:

– the seasons of year (summer and winter conditions);

– time of day (day, night, dawn and dusk);

– weather conditions (rain or snow, and haze with different levels of intensity, wind speed and direction, etc.).

An extremely important role in the simulation is also laid on the software module forming artificial intelligence which can be under full support and maintenance of trainer. This is very important to ensure perfect realism during training [4]. It is responsible for the interaction of individual simulated objects, in particular, driven vehicles and road traffic. Artificial intelligence algorithms are also used to simulate the pedestrian traffic, including pedestrians in groups. The system allows not only the creation of a large number of scenarios of events, but also allows them to be adjusted every time to the individual level of knowledge and experience of the trainees. It can provide different driving training experiences every time trainees participate in the exercises. In addition, the instructor can modify the pre-prepared script also during the exercise by the so-called «injects». This capability has been provided because is very important to have tools to adjust level of difficulty according to the trainee skills during training [5].

The simulator implements a special module responsible for simulating the dynamics of the vehicles movement and their collisions with the surrounding objects, including pedestrians or animals. The instructor can choose from several types of vehicles most often used by different services, thereby changing the dynamic characteristics of the simulated vehicle. When traveling, the vehicles may meet with failures introduced by the instructor or the system operator. The list of possible failures includes more than 30 damages to the vehicle, including a breakdown of ABS and ESP systems, braking system, tires air pressure drop, steering clearances, fire, etc.

The impression of realism in driving is achieved by a high level of fidelity of reproduction of the environment, space with sound, motion system providing relevant experience of movement, as well as using real means of communications. Each exercise on the simulator is preceded by the process of preparing the script and putting it into the system. It includes, among other things, determining the place to carry out the activities and the initial course of events, time of year and time of day and weather conditions.

Each time the degree of complexity of the action can be adjusted to the level of training of the persons taking part in the exercise. The instructor has the ability to change, among others, weather conditions, the degree of aggressiveness and direction of movement of participants of the meeting, as well as the staging of unexpected events, such as every type of accident, traffic accidents, initiate arson and fires, and also terrorist activities, including the use of explosives. During the exercise instructor monitors its progress and generates additional tactical elements of the situation, which directly affect the current situation in the run of exercise, dynamically changing situation, risk assessment and make the right decisions is very close to real conditions. Each exercise is recorded, making it possible to carry out a full analysis of its course and assessment of effectiveness of actions taken by individual participants of the exercise.

Fig. 6. Preview of a course of the exercise at the instructor's station. Source: Data from the privileged vehicles driving simulator.

Additional capabilities
In addition to the training the simulator can also perform research func-

Fig. 5. An instructor's station. Source: Data from the privileged vehicles driving simulator.

tions, allowing you to track in real time the behavior and reactions of trained drivers. This is possible thanks to the installed in the simulator an oculometric system (tracking driver's eyes), and a vital signs monitoring system (e.g. oxygen saturation, pulse, sweating), in which the simulator has been equipped. This allows you to assess the predispositions of individual drivers to the profession and see how they react in dangerous situations inherent in their profession. The simulator has an open architecture allowing for its development through the expansion of the area database, the introduction of new facilities, creating additional scenarios, as well as increasing the number of stations and types of vehicles.

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Гудзбелер Гр., Непелскі М. Нові технології в безпеці на прикладі симулятора управління привілейованими транспортними засобами.

Симулятор водіння – це система навчання в поліцейській академії в Щитно, що дозволяє значно підвищити рівень підготовки для привілейованих водіїв транспортних засобів. Широкий асортимент сценаріїв і доступних фізичних моделей автомобілів з усіма можливими аваріями дозволяють створити практично необмежену кількість дорожніх ситуацій. Це надзвичайно важливо, що всі ці події можуть бути здійснені без найменшого ризику небезпеки для здоров'я людини або збитку, заподіяного транспортним засобам.

Ключові слова: безпека, симулятор, навчання.

Гудзбелер Гр., Непелски М. Новые технологии в безопасности на примере симулятора управления привилегированными транспортными средствами.

Симулятор вождения – это система обучения в полицейской академии в Щитно, что позволяет значительно повысить уровень подготовки для привилегированных водителей транспортных средств. Широкий ассортимент сценариев и доступных физических моделей автомобилей со всеми возможными авариями позволяют создать практически неограниченное количество дорожных ситуаций. Это чрезвычайно важно, что все эти события могут быть осуществлены без малейшего риска опасности для здоровья человека или ущерба, причиненного транспортным средствам.

Ключевые слова: безопасность, симулятор, обучение.