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Driving training and evaluation using the Big-Rig HD1 driving simulator

Capacitación y evaluación de conducción a través del simulador de manejo Big-Rig HD1

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Abstract

In this research project drivers' driving skills are evaluated using the BIG-RIG HD1 simulator. This evaluation is focused on two levels, which are: driver training through the BIG-RIG HD1 simulator and field evaluation using a standard two-axle motorized vehicle, and with this check the skills acquired in the simulator during the training. To facilitate the development and follow-up of the project, we chose to work with students from the Polytechnic University of Tlaxcala, West Region of Engineering in Logistics and Transportation who do not have the skills to drive a vehicle. A total of 30 students were trained from Monday to Friday for four months, of which three month consisted of training using the simulator and the last month the evaluation was carried out in a motor vehicle. The results within the positive factors presented by the driver are: 1) Familiarization with the functions of the vehicle. 2) Identification of pedals and vehicle components. 3) Vehicle running without stoppages due to the change of speeds. 4) Gear changes to the appropriate revolutions. Regarding the negative aspects, the following were observed: 1) The driver has anxiety before starting the vehicle. 2) Excessive pressure. 3) The maneuvers in reverse still turn out to be complex. 4) The maximum driving speed ranges between 35 and 40 km / hr.

Train, Evaluate, Simulator, Vehicle

Resumen

En este proyecto de investigación se evalúan las habilidades de manejo de conductores empleando el simulador BIG-RIG HD1. Esta evaluación está enfocada en dos niveles los cuales son: la capacitación de conductores mediante el simulador BIG-RIG HD1 y la evaluación en campo mediante un vehículo motorizado de dos ejes de transmisión estándar, y así comprobar las habilidades adquiridas en el simulador durante la capacitación. Para facilitar el desarrollo y seguimiento del proyecto, se optó por trabajar con alumnos de la Universidad Politécnica de Tlaxcala Región Poniente de la Ingeniería en Logística y Transporte que no cuentan con las habilidades para conducir un vehículo. En total se capacitaron a 30 alumnos de lunes a viernes durante cuatro meses, de los cuales, tres meses consistieron en capacitación mediante el simulador y el último mes se realizó la evaluación en un vehículo motorizado. Los resultados dentro de los factores positivos que presenta el conductor son: 1) Familiarización con las funciones del vehículo. 2) Identificación de pedales y componentes del vehículo. 3) Marcha del vehículo sin paros a causa del cambio de velocidades. 4) Cambios de marcha a las revoluciones apropiadas. En cuanto a los aspectos negativos se observaron los siguientes: 1) El conductor presenta ansiedad antes de encender el vehículo. 2) Presión excesiva. 3) Las maniobras en reversa aun resultan ser complejas. 4) La velocidad máxima de conducción oscila entre los 35 y 40 km/hr.

Capacitar, Evaluar, Simulador, Vehículo

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Introduction

Automobiles are a technology that facilitates the movement of people, provides access to markets, jobs and even is used for public services such as taxis, ambulances, fire trucks or police vehicles. Each car trip ends in an economic transaction or some other benefit that improves the quality of life, which is why to this day it has remained one of the technologies with the greatest impact on the world economy.

In Mexico there are more than 38 million vehicles; 43.5% of households have a car (INEGI 2015), however, for most people it is difficult to acquire driving experience, due to the fact that they present behaviors such as anxiety and stress when maneuvering a car, which produces a lack of concentration to become familiar with the different components of the vehicle. The use of simulators in any discipline, allows to obtain knowledge of the behavior of a certain system, for example, the operation of a vehicle, where the learning of the different actions is monitored by the instructor. This type of tools can be of great value in the performance of new drivers, reducing risks, streamlining tasks typical of the field (Aranzazu, Villada, Ocampo & Reyes, 2018).

For this reason, the training and training of drivers through simulators is necessary because they allow acquiring knowledge and driving skills, thus avoiding risks that threaten physical integrity and traffic accidents, which is achieved by reproducing real sensations that stimulate senses such as sight and hearing.

For the training of students with no driving experience should take into account a virtual model of vehicular dynamics so that through this and the use of technology are generated scenarios with virtual content that simulates acceleration, braking and maneuvers made by the driver, to guarantee fidelity with the actual driving experience (Schwartz, 2011; Nuñez, 2018).

For this training should be considered the three types of simulators (desktop, panoramic without cabin movement, panoramic with cabin movement) in which, according to Allen (2003), a computer is mainly used to which a steering wheel is incorporated and Acceleration and braking pedals.

The aim of the driving simulators is to represent the driving practices of the driver, basic skills such as the operation of the vehicle, its system of handling and traffic control, as well as representations of traffic flow conditions and the environment (Figueira, 2012 Vlakveld, 2005; Yamada, 2002) and, in turn, as mentioned by Rimini-Doering, (2001); Ranney (1999); Gillberg (1996); Lee (2003), evaluate the effectiveness of the signs and infrastructures for its design and configuration, incorporating other factors such as driver behavior and fatigue studies without involving potential risks.

In this project we are especially interested in the process of training and evaluation of young drivers with no driving experience, taking into account basically two levels: the training of drivers using the Big-Rig HD1 simulator and the evaluation in the field by means of a motorized vehicle of two. Standard axes to check the skills acquired in the simulator.

The development of this research is divided into the following sections, we describe the technical characteristics of the simulator HD1, operation information is provided and. The methodology addresses the different stages that were considered for the training and evaluation process. Finally, a section of conclusions will offer a discussion about the results obtained.

Big-Rig HD1 driving simulator

For the research, the Big-Rig HD1 simulator was used, which complements the theoretical aspects of the training with the firm purpose of identifying the principles of road driving.

It consists of the following elements:

– Panoramic visual system that virtually reproduces the environment around the driver, including different driving scenarios through three monitors with a 180 degree range of vision. The operation is through a Silicon Graphics computer that receives the signals from the PC computer and builds a graphic simulation of vehicles traveling in a virtual road scenario.

– Audio system to recreate real driving situations, both environmental and those of the vehicle. Which has stereo type speakers with subwoofer and 50W audio translator with amplifier.

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– Modeling system for the dynamic response of vehicles, which produces, through the motorized force system of the steering wheel, the different disturbances and movements applied by the operator and the interaction of the unit with the pavement. These controls are connected to sensors that, when activated, send signals to a computer.

– System of internal components of the user, those components such as clutch, brake pedal, steering wheel and switches that are responsible for the drive and sensitive reproduction of all controls driven by the driver; by means of a computer PC that sends the signals of the vehicle to a central computer Silicon Graphics model ONYX 2 Infinity Reality.

– Interaction system and menu with sequence of tasks. During the simulation the user is informed in real time of the mistakes he makes during the training by means of sound warnings and on-screen messages, in order to warn the trainers of the errors that they make, including the inappropriate change of speeds, ignoring the preventive signals , do not adjust the safety belt and exceed speed limits. (See figure 1)

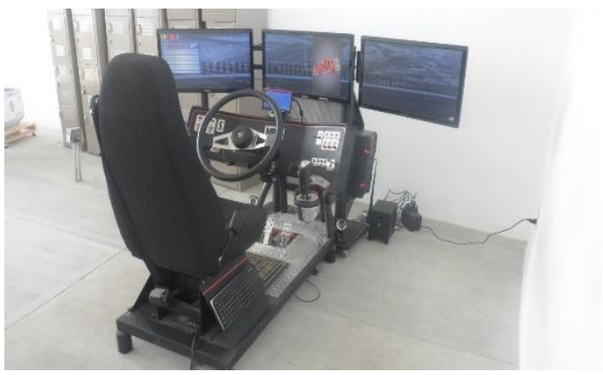

Figure 1 Big-Rig HD1 driving simulator

Methodology

For the development of this research, five processes are defined: initiation, planning, execution, monitoring, and control and closure.

In the initiation of the project, the project formalization act was created in which the people involved in the project were defined, tools to be used, and the scope of the project.

In planning, the schedule of activities and the responsibilities matrix were created.

For the execution process, 30 students were trained from Monday to Friday for four months, of which three months would be in the laboratory and one month in the field. To facilitate the development and follow-up of the project, it was decided to work with the students of the Universidad Politécnica de Tlaxcala West Region of the eighth semester of the Logistics and Transportation Career that do not know how to drive a vehicular unit.

To monitor and control, it was supervised that the activities were carried out within the dates that were established and a change control bin was carried out. Finally, in the closing process, the Project was finalized in a first stage, completing all the activities.

In relation to the methodology of the research, a pre-experimental design with a quantitative approach of correlational type is used, which will consist of taking a sample of the group of people who do not know how to drive a car; train them through the simulator and evaluate them with a motor unit.

Characteristics of the scope of the investigation:

1) Space: Universidad Politécnica de Tlaxcala West Region.
2) Temporality: September - December 2017
3) Universe: 30 students who do not know how to drive vehicles.
4) Characteristics of the participants: Male and female gender older than 20 years.
5) Sample size: 30

In this case, the sample is not probabilistic and directed, in which the total of 30 people who do not know how to drive were taken.

It is considered non-probabilistic because students are not taken at random, but it is aimed at those students of eighth semesters of engineering in Logistics and Transport who do not know how to drive a vehicle.

To obtain a minimum margin of error and a higher confidence level and for the size of the universe, it is considered taking the universe total as a sample.

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Results

Theoretical training

Figure 2 shows the initial training that consisted of a theoretical course in the first week, with a daily module of 90 minutes in which the main topics to be pointed out were: circulation, speed, road signs and vehicle functions.

Figure 2 Vehicular theoretical training

Training in the Big-Rig HD1 Simulator

It begins with training people through the simulator in a standard transmission vehicle (See Figure 3). In this stage, the training was conducted in groups of six people per day with modules of 60 minutes each, where the instructor performed sixteen practical tests with different environmental conditions, among which:

– Maneuver equipment.
– Labyrinth with obstacles.
– Reaction time test.
– Change lane and pass.
– Parallel parking.
– Driving on highway and highway.
– Driving in urban areas with traffic and pedestrians.

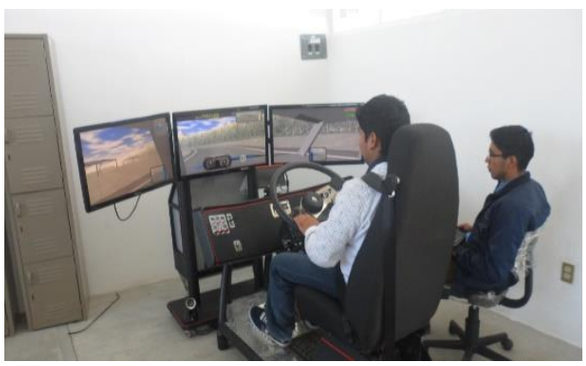

Figure 3 Training in the Big-Rig HD1 simulator

Motorized vehicle evaluation

After the eleven weeks of laboratory training, the apprentice drivers carried out the field tests with a motorized vehicle with two standard transmission shafts; on the free Federal Highway to four lanes Mexico-Veracruz. In this stage, the evaluation was given to groups of six people per day with modules of 60 minutes each, in which the instructor and the evaluators analyzed the behavior in the vehicle and the real environment through different driving behaviors. (See figure 4)

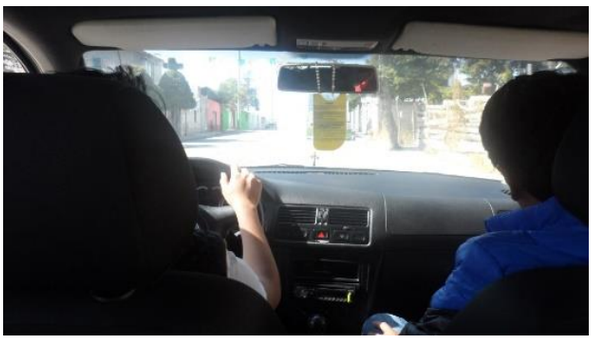

Figure 4 Motorized vehicle evaluation

Conclusions

One of the key issues in relation to training with driving simulators is the amount of realism that is necessary to make the system real. Obviously, achieving absolute reality is practically impossible because, even if the simulation were perfect, there would always be subjective knowledge on the part of the user of this virtual reality that can qualify what, on the other hand, his senses may be experiencing. In the case of the driving simulator, the amount of realism required is that which leads the subjects who drive through it to maintain a realistic behavior, in accordance with the usual parameters in the real situation. The objective of this work is to perform a validation of the driving simulator to train and evaluate drivers

In general, the results in the evaluation in the field by means of a motor vehicle can be presented in positive factors and negative factors. Among the positive factors that the novel driver presents are: 1) Familiarization with the functions of the vehicle. 2) Identification of pedals and components of the vehicle, 3) Running the vehicle without stops due to the change of speeds. 4) Gear changes to the appropriate revolutions. 5) Correct use of rear-view mirrors. 6) Identification of signs on the road.

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In the negative aspects presented by the drivers were the following: 1) The novice driver has nerves before starting the vehicle. 2) Excess brake pressure. 3) Do not use directional. 4) Does not stop the vehicle completely before turning on the streets. 5) Reverse maneuvers are complex. 6) The maximum driving speed ranges between 35 and 40 km / hr.

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