# VIRTUAL REALITY INMERSIVE OF GEOMATIC TECHNIQUES LEARNING

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## Abstract

A three-dimensional visual immersion system provides a different teaching-learning experience on virtual environments. Through immersive reality, the student realises at the same time each of the details or events that are occurring in the learning process in a 360 degrees scenario. The use of these techniques offers the sensation of presence in scenarios that otherwise, either by distance or difficult access, it would be very difficult to bring to the students.

The objective of this work is the elaboration of teaching resources to improve the efficiency in the learning of geomatics techniques taking advantage of these immersive techniques. The teaching resources will consist of the elaboration of situations that can be registered through immersive reality as well as the development of guides of teaching practices.

In this way, we have used a Samsung Gear 360 camera to get the different scenario recordings in 360 degrees. Finally, we have done editing tasks where different virtual elements have been added such as text, video, sound, etc. The result is the implementation of an immersive visualization module accessible to students through new technologies, which improves the acquisition of skills in the management of Geomatics instrumentation.

Keywords: Learning, geomatics techniques, immersive reality and visualization.

## 1 INTRODUCTION

The rapid development of new information and communication technologies (ICT) in the training environment is motivating profound changes at all educational levels Virtualization and simulation in the processes of teaching and learning can be a great help, both time saving and simplification of procedures.

The virtual concept was introduced at the end of the 20th century [1], on a scale that went from the real world, through augmented reality, along with virtual reality and reaching to the virtual world. This way of scaling the technologies may be opportune, if we also now add immersive reality; all of them are part of a mixed reality.

With the numerous applications and devices that recently use Augmented Reality (AR), 360 degree images, Immersive Reality (IR) and Virtual Reality (VR) enable new solutions in the learning and improvement of usability techniques and instruments of the geomatics area There are studies developed in these visualization techniques that help to improve the ability of students to know, learn and contribute value in sectors such as construction [2], building [3], heritage [4], wind turbines [5] or in other areas such as land modeling [6].

The difficulty, distance, accessibility, danger or displacement to certain spaces or places in which teachers and students cannot be in person and in the process acquire educational skills or experience necessary in the use of techniques and instruments in the Geomatics area, can be favored through the use of immersive reality platforms. The interpretation of the land, the use of different measuring instruments or the power to "be" in a topographic project, are aspects that enrich the students' experience. Active learning through observation in places and unique spaces through the immersive

reality provides an experience capable of improving the process of decision making that in some works and projects where geo-information is the key to success.

Immersive visualization systems have a growing importance in the field of education as teaching tools that motivate learning through two key concepts: the immersion and interaction [5].

Unlike traditional video, immersive reality video allows viewers to interactively control their field of view in a panoramic scene of 360 degrees [6 Screenplay and narration from the 360-degree video capture are essential to attract students to a default action and interact correctly in learning.

This work comes from an educational innovation project whose main objective is to evaluate the effectiveness of implementing real scenarios that can be observed in 360º and that are also adequate to complement the materials and guides of each subject. The evaluation of the immersive reality through 360 degree videos covers the knowledge, abilities, behavior and attitudes of students as well as the evaluation of its progression.

Immersion, from the Latin "immersio", is the action of introducing something or get into a fluid. It can also be the introduction of someone in a certain environment, whether real or imaginary. The project will serve as a support and improvement of the use of devices and instruments of measurement in the field of geomatics, to promote the use of technological resources linked to the IR in environments with appearance of reality through the combination of technologies computer and, moreover, to improve efficiency in the preparation of instrumentation geomatics and its corresponding application.

The main objective of this work is to develop digital teaching resources that serve as support for students who study subjects in which techniques and instruments of the area of graphic and cartographic engineering are used Another complementary objective is to create immersive scenarios based on the recreation of real work spaces through Immersive Reality. Objectively, it is a multimedia installation that reconstructs a panoramic video landscape in a cylindrical shape, covering a 360º visual field. The implementation of these resources as teaching materials is done on the Moodle virtual teaching platform and / or other virtual learning environments. The use and generation of experiences of immersive reality serves to stimulate and improve the teaching-learning process in different subjects of Bachelor and Master.

## 2 METHODOLOGY

The development of educational innovation project was carried out through six phases described below:

At an early stage we proceeded to the identification and selection of transversal or specific competences that are going to develop. From the teaching guides of the subjects of the degrees involved, the competences to work related to the area of geomatics were identified. This action has been directed to students of engineering degree.

In a second phase, action scripts were prepared for each of the designed practices. Then, the texts, as well as the different key visualizations, were written and made tests of spatial arrangement of the elements involved in the subsequent video 360 degrees to be made. The orientation of the scenario, the main objective, as well as the movement and coordination of the different actors involved in the subsequent shot of the movie take in 360º.

In a third phase, 360 degree videos were generated. The development of immersive visualization solutions and their edition through 360-degree images has been developed using the Unity3D software (fig.1). This software allows to add heterogeneous special information, which includes the own visualization of the video 360 degrees and the visualization of points of interest, superposition of images, videos, 3D objects and navigation.

Each proposed activity consists of an initial survey, an immersive experience, specific exercises and a final survey. The overall result of the different activities is included in an immersive open access visualization module that can be found on the research group's website.

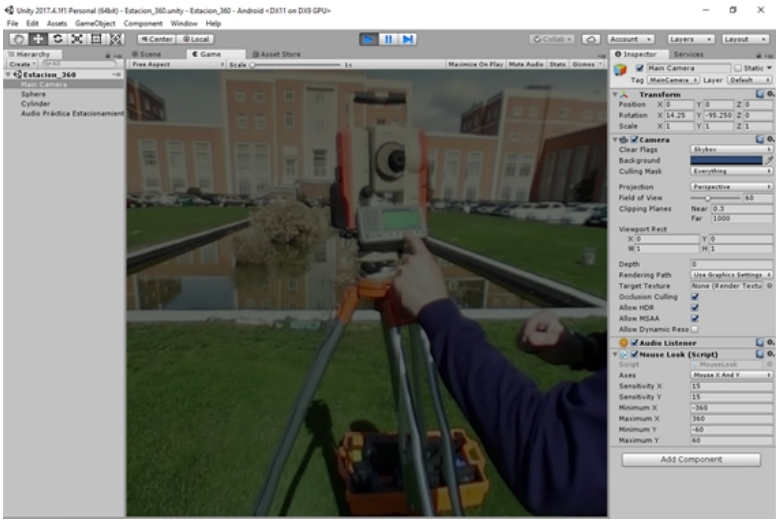

*Figure 1. Editing video 360 degrees to incorporate elements that interact with the students.*

In a fourth phase, a series of tasks related to the academic competences to be worked on and promoted have been designed. In this sense, a designed task is related to the difficulty of access to a place, by danger or remoteness, to certain singular spaces such as quarries, open pit mines or cultivated areas or not, with more or less vegetation One objective has been to create an immersive reality in the classroom, for example in a quarry. The quarries used have been located in Almonacid de Toledo (Toledo) and the quarry of aggregates in Caudete (Albacete). In a field visit to each one of them, possible optimal 360º video capture points that could represent and help to give the student the feeling of being in the same quarry face-to-face were analyzed. Several shots were taken with the idea of implementing an interactive application where each student could move from one view to another and, in addition to working on spatial vision and orientation, was able to mentally elaborate a virtual terrain model.

In a fifth final phase, after the immersive experience and to consolidate the training competences studied, a written and visual test was developed in which each student had to relate a series of contour models and select the correct model (fig. 2).

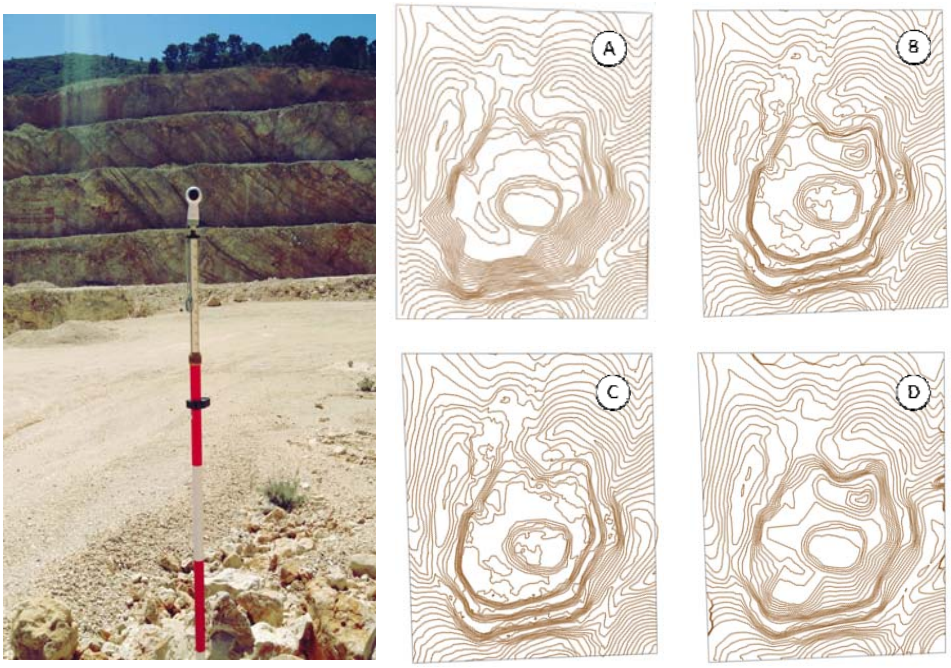


Figure 2 Example of ground recognition activity through immersive reality.

Initially, the proposed task was a challenge for students who demanded more interaction with the immersive reality (prolonged use of VR glasses) in order to gather the necessary information and solve the designed test.

Another activity included in the project refers to the use of IR to acquire skills and abilities in the use of techniques and instruments geomatics. Starting from a detailed script a real scenario was elaborated, where both receivers, total station and transported accessories were placed, such as the tripod, the field notebook, antennas, etc. (Fig. 3). The arrangement and the shot was made with a 360º camera taking into account the expected movement of the "actors". The height of the camera lens was set to the average height of the eyes of an operator (student) and the guidelines of the operators were visually directed to the lens of the camera to get more participation of the student in the immersive experience.

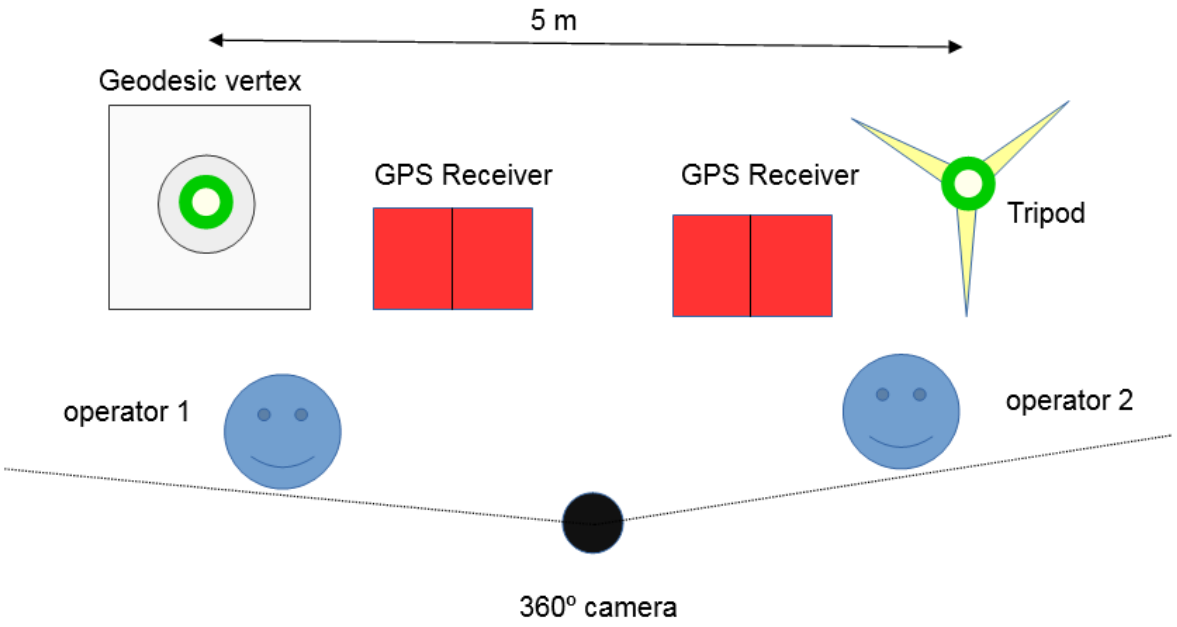


*Figure 3. Example of script preparation and scenario for a shot with camera 360 °..*

## 3 RESULTS

Taking into account that not all subjects are homogeneous in terms of their development, schedules, number of students, geographic locations, time of the year, etc., a virtual space shared (website) has been created that will serve as a guide for each one of the phases and / or tasks proposed in this project (sixth and last phase).

From polls conducted before the immersive experience and the elaboration of related activities, the results have been analyzed and compared. The groups used in this experience had 10-15 students.

The evaluation has been made from a group of students who have experienced and used the contents generated in this pilot project, and have been compared with another group of students that has followed the traditional methodology. Each task to be performed has followed the procedure described. This objective measurement is complemented by another subjective assessment, by means of a questionnaire, in which each student has answered questions related to their experience as a user of this technology.

As a general result, mention that over 90% of the students who have participated in the incorporation of new techniques applied in teaching in the area of geomatics, have highlighted that the different experiences in Immersive Reality have contributed both to improve the skills worked and to experiment in inaccessible or dangerous spaces. They emphasize the high accessibility to the shared contents, which makes each student to be able to establish the most opportune schedules to work the competences of each task.

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