

A Methodology to Virtualize Technical Engineering Laboratories: MastrLAB-VR

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Abstract : Due to the importance given today to innovation, the education sector is evolving thanks digital technologies. Virtual Reality (VR) can be a potential teaching tool offering many advantages in the field of training and education, as it allows to acquire theoretical knowledge and practical skills using an immersive experience in less time than the traditional educational process. These assumptions allow to lay the foundations for a new educational environment, involving and stimulating for students. Starting from the objective of strengthening the innovative teaching offer and the learning processes, the case study of the research concerns the digitalization of MastrLAB, High Quality Laboratory (HQL) belonging to the Department of Structural, Building and Geotechnical Engineering (DISEG) of the Polytechnic of Turin, a center specialized in experimental mechanical tests on traditional and innovative building materials and on the structures made with them. The MastrLAB-VR has been developed, a revolutionary innovative training tool designed with the aim of educating the class in total safety on the techniques of use of machinery, thus reducing the dangers arising from the performance of potentially dangerous activities. The virtual laboratory, dedicated to the students of the Building and Civil Engineering Courses of the Polytechnic of Turin, has been projected to simulate in an absolutely realistic way the experimental approach to the structural tests foreseen in their courses of study: from the tensile tests to the relaxation tests, from the steel qualification tests to the resilience tests on elements at environmental conditions or at characterizing temperatures. The research work proposes a methodology for the virtualization of technical laboratories through the application of Building Information Modelling (BIM), starting from the creation of a digital model. The process includes the creation of an independent application, which with Oculus Rift technology will allow the user to explore the environment and interact with objects through the use of joypads. The application has been tested in prototype way on volunteers, obtaining results related to the acquisition of the educational notions exposed in the experience through a virtual quiz with multiple answers, achieving an overall evaluation report. The results have shown that MastrLAB-VR is suitable for both beginners and experts and will be adopted experimentally for other laboratories of the University departments.

Keywords : building information modelling, digital learning, education, virtual laboratory, virtual reality

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