Terrestrial laser scanning and risk awareness: The 3D Riskmapping project approach for training

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Abstract. This paper describes the training approach adopted by a multidisciplinary group of institutions in the preparation of educational material for the appropriate use of terrestrial laser scanning techniques for risk characterization of our built environment. This project, supported by the European Leonardo Da Vinci project throughout its Flemish Agency involves 8 partners from 6 different countries with members of the industry, as well as academic institutions. The official project portal can be found at: http://www.3driskmapping.eu.

Keywords: Laser Scanning, Risk, Heritage conservation, Environment, Industrial surveying, Surveying techniques, Training, Didactic material.

1. INTRODUCTION

Terrestrial laser scanning offers advantages for the recording and mapping of our built environment without necessarily entering into direct contact with the fabric and surfaces of objects.

This is in particular interesting to fields where capturing the three-dimensional shape is of paramount importance, such as the industry, heritage and environment prediction. The three-dimensional mapping of built environment is increasingly used for creating immerse training applications and for risk characterization.

This book compiling the initiative presented in this workshop is aimed at providing additional training tools for either students or professionals working in the field of surveying our built environment. It particularly deals with the use of mid-range terrestrial laser scanning (Fig. 1).

Additionally, the didactic material will address the need of adequate risk characterization in anti-disaster recording of buildings, chemical plants and infrastructure.

Figure 1. Teaching laser scanning, preparing tutorial material, author

Current situation and the project partnership

The application of laser scanning has not been fully exploited in understanding risk associated to our built environment. In part, this is due to, first, lack of appropriate didactic material available at academic institutions, and second, lack of three-dimensional teaching on environmental surveying, illustrating the potential benefits of using full three-dimensional equipment. Currently, laser scanning, being a highly innovating surveying technique, is only sparsely taught and neither appropriate manuals nor comprehensive guidelines are available.

The project presented in this paper was launched in autumn 2006 and runs for two years. It is aimed at producing a 'Learning on demand' tool for the use of three-dimensional spatial information based on laser scanning for risk characterization of our built environment. The deliverables of this project include a number of 'ICT-supported training tools' that can be used and adopted by academic institutions in their current and future curriculum (Fig. 1). In addition, the resulting material can be used for awareness and preparedness for anti-disaster mapping. The resulting package will consist of a theoretical basis on laser scanning and laser scanning data processing completed with a number of case studies in the form of online tutorials, lesson e-books and a decision flowchart for procuring 3D spatial information surveying projects with laser scanning.

The project partners consist of a multidisciplinary group of expert users, information and technology providers (Fig. 2).

Figure 2. Integrating thermography into laser scanning for condition assessment of historic buildings, side-line presentation during test training course, author.

DIDACTIC APPROACH

The partnerships approach is based on the following objectives:

- Understanding of 3D spatial information acquired by advanced three-dimensional recording techniques: laser scanning;
- Linking the needs of using 3d spatial information of the built environment for risk awareness in order to obtain high-precision measurements. In some cases, it is the Contact Volume Editor that checks all the pdfs. In such cases, the authors are not involved in the checking phase.

Deliverables; didactic material

- Online tutorials
- Decision flowchart
- Lesson e-books
- Best practice examples
- An information hub or reference system
- Compiled data offline (DVD - CD-ROM)

Online tutorials

- Available on the Internet (for educational institutions - commercial use currently under discussion with partners and EC)
- Process of procuring the technology for risk characterization projects;
- Application of technology for recording three-dimensional spatial information for risk characterization projects: process of collection and registration;
- Application of software for three-dimensional spatial information collected with the technology;
- All these tutorials are based on commercial off-the-shelf (COTS) equipment and software;
- Tutorials cover different applications.

Decision flowchart

An interactive flowchart will be developed, in which the user is procuring 3D Spatial Information Surveying projects to find adequate solutions. This decision-making tool is based according to application needs; each phase will provide information to the user on how to effectively and adequately apply a 3D surveying technique.

Lesson e-books

Based on the tutorial, a theoretic part of the tutorial, including:

- The process of procuring the technology for risk characterization projects;
- Application of technology for recording three-dimensional spatial information for risk characterization projects: process of collection and registration;
- Application of software to provide three-dimensional spatial information.

Information hub and reference system

A resource hub compiled by the partners: with relevant information and links for the target group beneficiaries in the application of these technologies for risk awareness, first version available at:

http://www.3driskmapping.eu/v3page.php?ID=7

Best practice example

Based on the tutorial: examples carried out in cooperation with information providers will be available to users. They will follow a strict format and will allow reviewing online or printing.

Compiled data offline (DVD - CD-ROM)

DVD (CD-ROM) with printable version of the flowcharts, tutorials, lessons, best practices and information hub. This last deliverable is for dissemination to areas with limited Internet access and/or broadband.

2. PREPARATION OF DIDACTIC MATERIAL

The papers presented in this volume will illustrate the type of didactic material gathered to teach students how to use laser scanning wisely and with the notion of risk. The selection of examples as online tutorials correspond to successful projects carried out by the project partners.

The online tutorials, which are the base of the didactics being currently prepared under this project, follow a pragmatic approach, where the following characteristics are present:

- Real data of a structure with a clear level of risk;
- Use of most advanced laser scanning tool to address the project needs;
- Sufficient material to illustrate common problems when scanning;

Additionally, the partnership has selected instruments and software that are widely used in the field of laser scanning, although in the very beginning the project partners reviewed open-source solutions, it was clear that at this stage they do not offer enough accessibility and reliability for the applications of this technology.

Case studies

The following examples were chosen to serve as material to prepare the didactic tools:

- Industrial application (scanning hazardous environments): petrochemical platform (Globe - BnS);
- Heritage case study (anti-disaster record): St. Jacobs church (inside-outside relationship) (KaHosl - PCA);
- Public Infrastructure case study (anti-disaster record; deformation monitoring): dam of hydroelectric power plant (BOKU - UPV).

TESTING

A preliminary number of tests has been organized to get direct feedback from the development of the training material, this includes:

- Preparation of practical exercises to support thesis at master level using laser scanning for risk characterization: two students have prepared thesis based on the material prepared, this has provided important information about the development of the contents and relevance of the material compiled;

- A class demonstration with lectures was organized with master students of industrial engineering and conservation of built heritage: this provided feedback about the relevance of the material for specific applications.

Additional activities are to be organized in the partner institutions to evaluate the relevance, structure and didactic approach of the material, this will help validated the project aims.

FUTURE TRENDS

As the project evolves, the partnership has realized important issues that should be address by laser scanning developers of hardware and software, these issues involved:

- Disposal of more training material that addresses real field scenarios;
- More adapted material addressing the performance of laser scanning in different environments and accessibility conditions;
- The need of more information about the work phases involved in getting spatial information for laser scanning, in particular when building and repairing structures;
- Cheaper solutions for academic institutions.

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