

Developing a novel system for Documentation of Cultural Heritage Monuments recorded with Terrestrial 3D Scanners

Martin Doerr¹, Ioannis Chrysakis¹, Anastasia Axaridou¹, Maria Theodoridou¹, Christos Georgis¹, Emmanuel Maravelakis², Antonios Konstantaras² and Michalis Xinogalos³

¹ Foundation for Research & Technology – Hellas

² Technological Educational Institute of Crete

³ Astrolabe Engineering

Abstract

Terrestrial laser scanning is a new fast developing technology that allows for the recording and visualisation of the 3D geometry of monuments. The problem lies on the various types of hardware equipment and software systems used in the whole workflow of the 3D scanning process. These often results in a large volume of interim and final products with little if no standardization and multiple different metadata. This paper describes the development of a novel system for 3D Documentation, Promotion and Exploitation of Cultural Heritage Monuments via 3D data acquisition, 3D modeling and metadata recording using terrestrial laser scanners.

Extended Abstract with figures

The creation of 3D models for ancient monuments is a not an easy task, due to the difficulty of creating a dimensionally accurate 3D model and a 3D virtual representation of the monument. Common practice for surveying monuments include non-automated procedures, using conventional measurement methods such as measuring tapes or - at best - total station equipment. The result in this case is not a complete 3D model of the monument but a synthesis of measurements from target points focused on 2D drawings and orthophotos of the monument.

In the last 5 years Terrestrial Laser Scanners (TLS) have been introduced in order to enhance the development of 3D models of monuments and the promotion of cultural heritage. Terrestrial laser scanning provides highly accurate 3D images enabling designers to experience and work directly with real-world conditions by viewing and manipulating rich point-clouds in CAD software. There are many possible outputs available from point-clouds and basic measurements to ortho-images, derived 2D/3D drawings, meshing/surfacing and solid modeling. However, it is important to approach a scanning survey in an informed way, as there are many pitfalls, especially for new users.

The process of scanning, data processing and documentation of cultural heritage monuments, includes several stages in order to create a complete

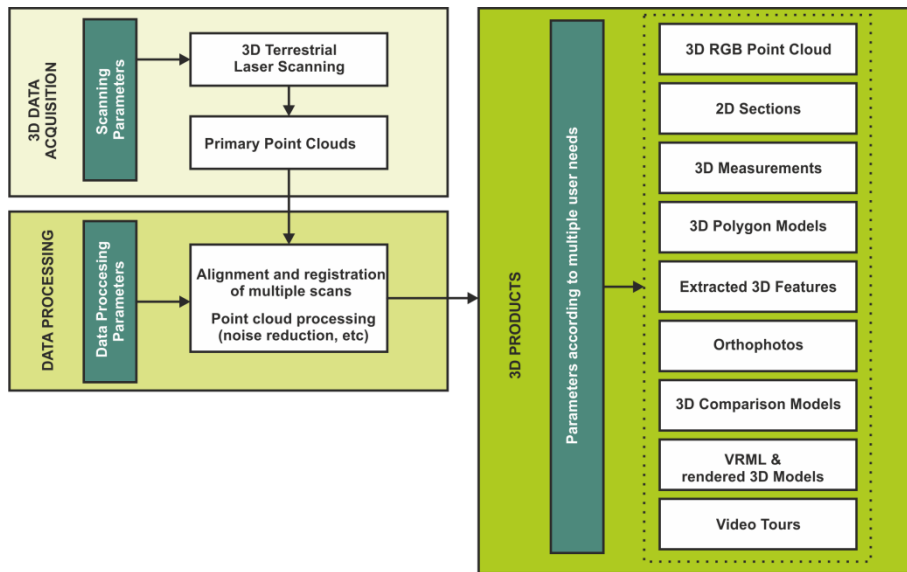
3D model. During these stages, all personnel involved (TLS users, programmers, archeologists, architects, civil engineers), are following specific steps for the transition from one stage to the other. These steps follow a workflow model, which involves several different applications (software and hardware) and the definition of many parameters which can change dramatically, according to the requested final products. Often, lack of data from the initial stages is identified in the final stages, causing a significant delay.

Furthermore, even if TLS has clear advantages against conventional 3D model techniques, as far as accuracy, speed, reliability and quality of 3D data obtained is concerned, it has only a small infiltration to the market. This is due to the complexity of the overall 3D scan process and the lack of standardization of the different requested products. The solution to these problems can be given by a versatile, user-friendly and flexible metadata recording system. Until now there is not such system in the market, even if the recording of metadata during both the process of data acquisition (3D scanning) and the process of 3D data processing is crucial. Since now, during the whole process, there is no solution for annotating and documenting not only the ancient monument or the different parts of the monument, but also the process of 3D scanning itself and the produced results.

This paper presents a novel system for 3D Documentation, Promotion and Exploitation of Cultural Heritage Monuments via complete 3D data acquisition, 3D modeling and Metadata recording. (3DSYSTEK)

The proposed system 3DSYSTEK covers these needs. It will combine:

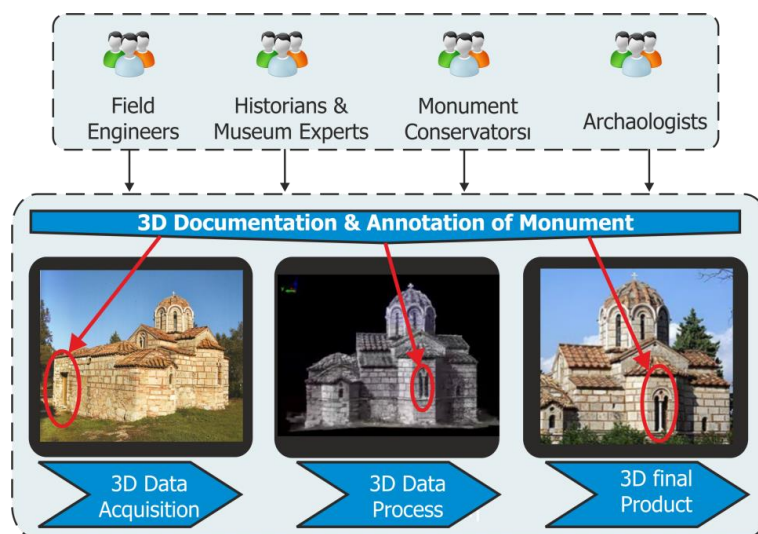
- 3D terrestrial laser scanning procedures
- 3D modeling procedures
- Recording of Metadata in all phases (3D data acquisition, 3D data processing, production of final products)
- Recording of annotations that can be used in all phases
- The production of automated product results, including all intergraded Metadata, according to the user needs.



A typical workflow of a 3D scanning process



Production of a 3D model from Terrestrial Laser Scanning



Annotation requirements during the whole 3D scanning process