

# 3D MODELING OF THE OLD TOWN OF XANTHI IN GREECE

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### ABSTRACT:

Xanthi is a medium populated town that lies near the north borders of Greece. The old town of Xanthi is situated in the centre of the urban area and is one of the best-preserved traditional towns of Greece. Most of the old houses belong to:

- the so-called “traditional type”,
- neoclassical influenced houses and
- buildings strongly influenced of 19th–20th century European architecture.

There have been several succeeded restoration attempts for many of them. The municipality of Xanthi has made a great effort during the last decade in order to promote the old town and has succeeded so far. However in order to make sure that this important cultural heritage is under continuous monitoring, an accurate documentation of the old town’s territory should be realized. The aim of this paper is to describe an efficient way for the documentation of this unique cultural heritage.

The following steps describe the proposed documentation

- Recording of the architectural features and historical data of the houses and main civil buildings (which is also part of the student’s exercises).
- Restitution (using classical architectural and modern close range photogrammetric procedures) of the most representative buildings
- The integration of all the graphical and textual information in a GIS environment

The products that may derive out of this effort (maps, VRML files, surveying of houses, etc) can be used for several different documentation processes, aiming to the further protection of the old town.

## 1. INTRODUCTION

It is an important issue to record the cultural heritage, which concerns countries as well as individuals. It is important that every educational institution, which is in some way connected with a country’s cultural heritage, should make great efforts in the direction of a complete recording in the best possible and effective way, to document important monuments of the past history.

The city of Xanthi, has the advantage of the existence of one of the most well preserved traditional towns in Greece, hence it was the most appropriate city to host the department of Architectural engineering of the Democritus University of Thrace. The professors of the Department have the opportunity to teach and analyze in the best and most direct way the special morphological features of the well-preserved buildings, belonging either to the vernacular, traditional, neoclassical or modern influenced architectural type.

On the other hand the students, during several different courses of the 1<sup>st</sup> and 2<sup>nd</sup> years of their studies, learn how to use architectural-conventional and photogrammetric techniques for the survey of the general lay out of buildings, as well as for their details up to 1:1.

Part of their training, is the use of photogrammetric techniques for the documentation of the façades of the most interest



Fig 1. Students working in the field

buildings and the use of the indirect photogrammetric products for the most appropriate realization of the final drawings.

The Department provides to the students the necessary support including surveying instruments Total Stations (fig. 1), simple measuring devices (LEM 30 laser distance meters), digital

cameras and the appropriate software, which is installed in our four computers labs' for this purpose. For more specific uses, two Digital Photogrammetric Stations (Z/I ImageStation SSK) are also in use.

The products derived from the students' work, are used in an integrated environment that holds the most important information concerning the buildings of the old town i.e.

- plans, sections and façades,
- architectural details,
- conventional and rectified images.

It is our future target to create a GIS containing all the above information of every unique building of great architectural and archaeological importance. The base map of the GIS has been digitized out of 1:500 cadastral maps and illustrates in great detail and accuracy the most important topographical features that are necessary for our approach.

## 2. PHOTOGRAMMETRIC DATA AND PROCESSING

One of the best ways to perform the recording of buildings' façades is by using digital photogrammetric techniques. It depends on the buildings' characteristics, i.e. the relief and overall complexity, whether a stereoscopic or a monoscopic approach will be used for this purpose. In most of the cases, typical rectification of a single or multiple overlapping digital images is adequate to provide a single rectified or mosaic images that will be then digitised in a CAD environment to provide the full scale plan of the building's façades. In some other cases, where fewer measurements are preferable, or the façade is constructed of several vertical non-coplanar faces, sophisticated photogrammetric applications are used combined with simple distance measurements. 3D-builder and a demo version of PhotoModeler provide an accurate enough, basic DXF file that is used as control point's file for the image rectification in the Microstation's IRAS/C application environment. By this way, less time is spent in the field, while the final product is more than 3-4cm accurate, which is enough for the reproduction of the façade plans (fig.2). In cases where more precise measurements are desired, Total Station is used combined with stereoscopic techniques and Digital Photogrammetric Station.

The cameras that provide the digital images come from the department's equipment and in many cases the students own them. Low cost compact digital cameras of varying resolution are mostly used (from 2MPixels to 5MPixels), which are able to provide enough geometric resolution for the final desired



Fig. 2. The restitution a building's façade

rectification product. The produced rectified images of 0.5cm ground resolution is printed in 1:50 scale.

The 3D models of stand-alone buildings are produced using either the 3D Builder or the PhotoModeler applications. Lately thirty licences, for academic use, of the famous CAD software ArchiCAD were provided to our department from the local



Fig. 3. Original and Rectified images using vanishing points rectification

GRAPHISOFT reseller (Top Software Ltd., Greece) that helped a lot for the best teaching methodology. The exported VRML format is used just for study reasons in urban planning scale and for navigational purposes. For this reason, there is no need for high-resolution texture images causing low computer performance.

In addition, a simple rectification application, working under the Win32 platform, has been created that is based on the perspective geometry and vanishing point theory (Fangi, G., et. al, 2001). A single distance measurement and the appearance of two pairs of parallel axis lines on the buildings' images are enough for the production of the final rectification image (fig. 3).

All the above-mentioned software applications and hardware configurations are available to our department's students in the labs' computers and the students are encouraged to use them for their needs. Although they are not obligated to use photogrammetric techniques for the recording purposes of the building façades they are encouraged to do so. In the past years, the number of the students that are using photogrammetric

restitution for architectural recording reasons is definitely increasing.

### 3. ARCHITECTURAL DATA

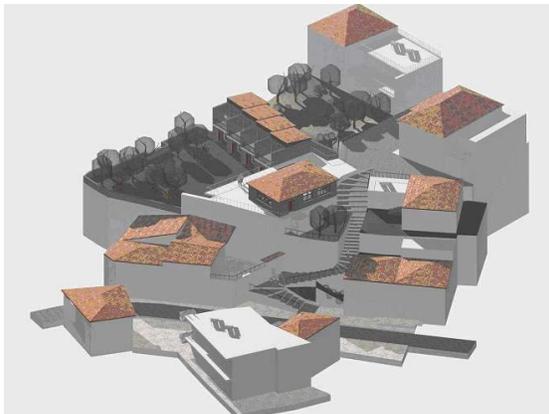


Fig. 4. 3D representation of a neighborhood

In Xanthi, several distinct building periods exist, starting from the years around 1830 (excluding constructions coming from earlier periods such as the ancient, byzantine and others of which just a few elements of their existence are preserved).

Near the end of the Ottoman Empire period, there was a particular high financial development for the town and its people (during the decades of 1870 till 1910). Not only houses but also public buildings, churches, hotels and recreation halls, were built during this period in the traditional town. In many of these buildings that still exist, the primary usage of the construction has changed and several public services (i.e.

Both the traditional and the European building type influences the basic form of residences, which is directly depicting the prosperity of the population whose main occupation was the tobacco trade. This combination of the two types of houses is expressed with the formulation of a plan with a central hall, which is directly connected to the main entrance and the stairs to the next floors of the building. The rest of the rooms are developed around or along the greatest dimension of the building. The location of the stairs is modifying the two types and can be found in different places

- For the traditional houses, aside or along the front view of the house
- For the neoclassical house, in the center of the construction strictly symmetrically and extending the main entrance.

A separate type of houses is comprised of the residences in the Muslim regions. The houses are mainly single floor buildings with great surrounding walls and an inner yard.

The innovation of the architectural construction in the traditional town is expressed through the introduction of new building types such as those of similar and in touch houses, built in the same period with those found in Constantinople and Thessaloniki.

During their courses and following the general culture aspects that the students should be getting, it is a primary goal of their studies to identify the recognition processes and recording issues of the above mentioned particular morphological types, besides their ability to document and represent them graphically. This effort can be done in a very efficient way using modern techniques for maintaining either graphical data such as images, sketches, drawings 3D models (fig. 4) or textual information concerning the type of construction, primary use and historical data. For this reason, a special registration form (fig.5) is demanded for a complete building documentation. In

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Νομική Προστασία	ΥΠΟΥΡΓΕΙΟ ΠΟΛΙΤΙΣΜΟΥ		
Αξιολόγηση		Προτεινόμενη Προστασία	
Χρήση	Αρχική ΚΑΤΟΙΚΙΑ		
	Σημερινή ΚΑΤΟΙΚΙΑ		
Κατασκευαστής	Φίλων Οργωνομάς	Όψη	Στέγη
	ΠΕΤΡΑ ΤΣΑΤΣΑΣ	ΒΑΜΜΕΝΗ	ΚΕΡΑΜΟΣΚΕΠΗ
Παραπομπή	ΚΑΤΟΙΚΙΑ ΜΕ ΝΕΟΚΛΑΣΣΙΚΑ ΧΑΡΑΚΤΗΡΙΣΤΙΚΑ. ΚΑΤΑΣΚΕΥΑΣΤΙΚΕ ΤΟ 1896		
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Μορφολογικά Στοιχεία	ΚΑΤΑΣΚΕΥΗ ΜΕ ΝΕΟΚΛΑΣΣΙΚΑ ΧΑΡΑΚΤΗΡΙΣΤΙΚΑ, ΛΟΓΙΑ ΣΤΟΙΧΕΙΑ ΣΤΙΣ ΟΨΕΙΣ		
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Παρατηρήσεις			

Fig. 5. The registration form

cultural societies, town hall services, museums and galleries) are hosted in many of them.

this special form, besides the basic information concerning the location and ownership, every historical, morphological and

general information is embedded in order to obtain the most representing presentation of every house together with its graphical, photographic and photogrammetric information. All the above-mentioned information is the final input that is going to be imported within the surveying information of a GIS.

#### 4. CONCLUSION

The described effort has been successful due to the following of reasons:

1. A complete collection of architectural and historical data is under construction helping not only the educational purposes of our Department but it can also be used in many other cases such as the creation of cultural map, providing important information to potential visitors of the city.
2. The students have the ability to work with photogrammetry in order to produce digital media of building façades and 3D buildings' models. The students are getting to know the advantages of modern recoding techniques in the best possible way, by working in the field.

It is very important that so far a total number of almost 80 traditional houses have been recorded in a period of the 5 years of our Department's existence. An operational GIS is under development using AutoDesk Map environment. The final application will include images, drawing files and textual information but also a detailed Digital Terrain Model of the whole city and surrounding of Xanthi draped with digital orthoimages. The final product will be used not only for internal use but it will be also available to any individual or institution that would like to extract important architectural and archaeological information from the application.

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