A Conceptual Framework for the Management of Archaeological Data

Lemonia Ragia
Technical University of Crete
Department of Architecture
Chania, Greece
Lemonia.ragia@isc.tuc.gr

Chrisa Tsinaraki
Technical University of Crete
Lab. of Distributed Multimedia
Information Systems And Applications
Chania, Greece
chrisa@ced.tuc.gr

Abstract

This paper presents a Framework for archaeological data management for the island of Crete, Greece. We propose a WWW based prototype as the basis for our concept and implementation. We create a geodatabase schema which supports the description and the constraints of our archaeological data. The aim of the geodatabase is not only to locate the distribution of the archaeological findings but also to incorporate the textual evidence with all the relative facts and findings in order to contribute to the scientific work of an archaeologist. We implement our Framework using real data from the archaeological department Chania, Greece.
Keywords: Archaeology, Database, Management, Services.

1 Introduction

Archaeological evidence, excavations and findings reveal that Crete is an old civilization. Archaeological fieldwork has developed to be a traditional work in Crete and proved to be very significant. Archaeologists discover new potential areas for excavations very often and many excavations have already made in the whole island the last two decades. The findings are derived from different chronological periods or civilizations. The volume of the archaeological data is large. This paper demonstrates an approach on how to organize and manage the data. We would like to incorporate the textual evidence with all the relative facts and findings in order to contribute to the scientific work of an archaeologist. We use also images taken from a modern digital camera.

The idea of managing archaeological data is already depicted by other approaches [6][3][1][4]. This scientific work uses as a basis a Geographic Information System and GIS standards. In addition, they give emphasis in the visualization of the archaeological data. The idea of using a geodatabase their relationship is shown in [5].

We would like to demonstrate an approach for archaeological excavations creating a geodatabase with a World Wide Web interface. The advantage of this approach is that we use a friendly, nice user interface. We use additional instruments and a high definition camera. We use the total station NIKON NIVO 5.0 for the surveying of the terrestrial area where an excavation is in progress and the digital camera RICOH 500 SE which is connected to a GPS for capturing any documenting every finding.

We present an Interface which is similar to GIS system but it works with Internet and is actually independent of any GIS system. It is another kind of georeferenced Information System for archaeological purposes.

2 Case Study

All the archaeological data are digitally recorded. All the objects are referred geometrically. Two basic features of the geometry are points and lines. The main object in our scenario is an archaeological site which is geometrically represented by a polygon. A polygon is described as a set of points with its coordinates in 3D in the Greek coordinate reference system EGSA'87. Every archaeological site belongs to an area zone characterized by some parameters which symbolize the possibility of a bigger potentially interesting area for archaeological diggings.

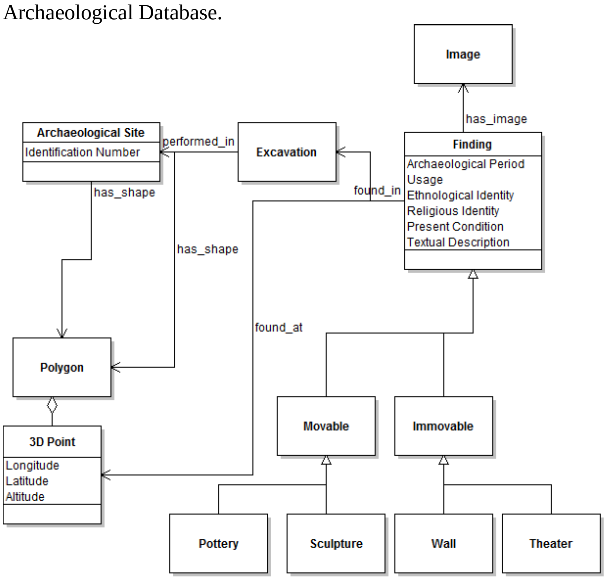
An archaeological site takes an identification number where an excavation should take place. Then the findings are the archaeological records divided into two categories, movable and immovable objects. All the findings are captured by the camera with the GPS. The immovable objects can be a (part of a) theater, wall, cemetery etc. The movable objects can be pottery, sculptures, clay containers and other artifacts. All of them are depicted into categories depending on the chronological period (e.g. Early Bronze Age, Early Minoan). They are divided into another two categories which show the present condition (standing or not) and need of restoration. Another classification of the archaeological finding is their usage (e.g. palace, theatre, storeroom, stadium, crypt). Finally there is another classification according to the Cretan ethnology (e.g. roman, turk, venetian) and religion (e.g. Orthodox, Islam, Judaism). All the textual data are taken into an index which represents to which archaeological site or finding they belong to.

We use relationships in our geodatabase to add valuable perspectives in our approach. Given a polygon and the relationship *found_in* the user can search and select all the findings within that polygon that may be displayed with their attributes. The selection of other types of information like textual, photographic or historical context can be derived using corresponding indexes to the given polygon. It is important to say that similar types of information and records can be sought and displayed. The task here is to modify the database and keep it updated regularly.

3 Database Design

In this section we present the design of the database that we have developed for the representation and management of archaeological data. The database design is depicted in the UML [2] class diagram of Figure 1, which provides an overview of the main classes and relationships of the database.

Figure 1: UML Class Diagram describing the design of our Archaeological Database.



According to the class diagram of Figure 1, the *Archaeological Site* class is used for the representation of archaeological sites. An *Archaeological Site* instance has a unique *Identification Number*, represented by the homonym attribute, as well as a shape that is an instance of the *Polygon* class, associated with it through the *has_shape* relationship.

The *Polygon* class is used for the representation of polygons and its instances comprise a set of 3D points, represented by the instances of the *3D Point* class. A *3D Point* instance has three attributes, *Latitude*, *Longitude* and *Altitude*, which represent its coordinates in three dimensions.

Since the excavations take place in archaeological sites, the *Excavation* class, which represents them, is associated with the *Archaeological Site* class through the *performed_in* relationship. The *Excavation* class is also associated with the *Polygon* class through the *has_shape* relationship, thus representing the excavation shape.

A successful excavation leads to findings; The findings are represented, in our database, by the *Finding* class and its subclasses. The *Finding* class is associated with the *Excavation* class through the *found_in* relationship for the representation of the original location of the findings. It is also associated with the *Image* class through the *has_image* relationship for the representation of the pictures of the findings. Moreover, the *Finding* class is associated with the *Point* class through the *found_at* relationship for the representation of the original finding location in the excavation (essentially, the original location of the centroid of the finding). Notice that this location is not permanent, since a finding may be moved for restoration or in order to be exhibited in a museum, an exhibition etc. The archaeological period, the usage, the ethnological and religious identity and the present condition of a finding are described, respectively, by the *Archaeological Period*, *Usage*, *Ethnological Identity*, *Religious Identity* and *Present Condition* attributes. Finally, the findings may have textual descriptions that are represented by the *Textual Description* attribute.

The findings are classified, according to their mobility, in movable and immovable objects, represented, respectively, by the *Movable* and *Immovable* classes. Both these classes are further specialized and we provide some examples of the *Movable* class specializations in the UML class diagram of Figure 1, like the *Sculpture* and *Pottery* classes, as well as some *Immovable* class specializations like the *Wall* and *Theater* classes.

4 Framework for Archeaological Services

We have experimented and implemented our Framework using archaeological data from the archaeology department West Crete, Greece. For lack of space we can display only one picture with an example. The main advantage of our concept is that when the user clicks on an object on the right site of the Figure 1 then the user can click on the left site of the picture of the Figure 1 and see all the relevant information. For example when a line is depicted then the user can see the Identification Number of the object or objects that belong to, the coordinates of the two points of the lines with all the additional information which are relevant to the line.

Another example is when a reconstruction is on progress the user can click the object and the user can see all the images with the GPS coordinates related to this object and keeps track of the reconstruction process.

Another important additional functionality we work on is that the user can pick an object and add other information is related to this object. This demonstrates the interoperability of the system that allows the user to import and export information.

5 Conclusion

Management of archaeological data is very important to make Greek culture more available. We present here a concept that organizes systematically the archaeological excavation and their findings and automates the workflow of archaeologists. The developed prototype is an open GIS system where the user can use as platform the World Wide Web and all the data are georeferenced. We are working currently to extent the concept to more advanced functionalities, to deal with 3D data, to cooperate with Google Maps and for the interoperability with other GIS systems.

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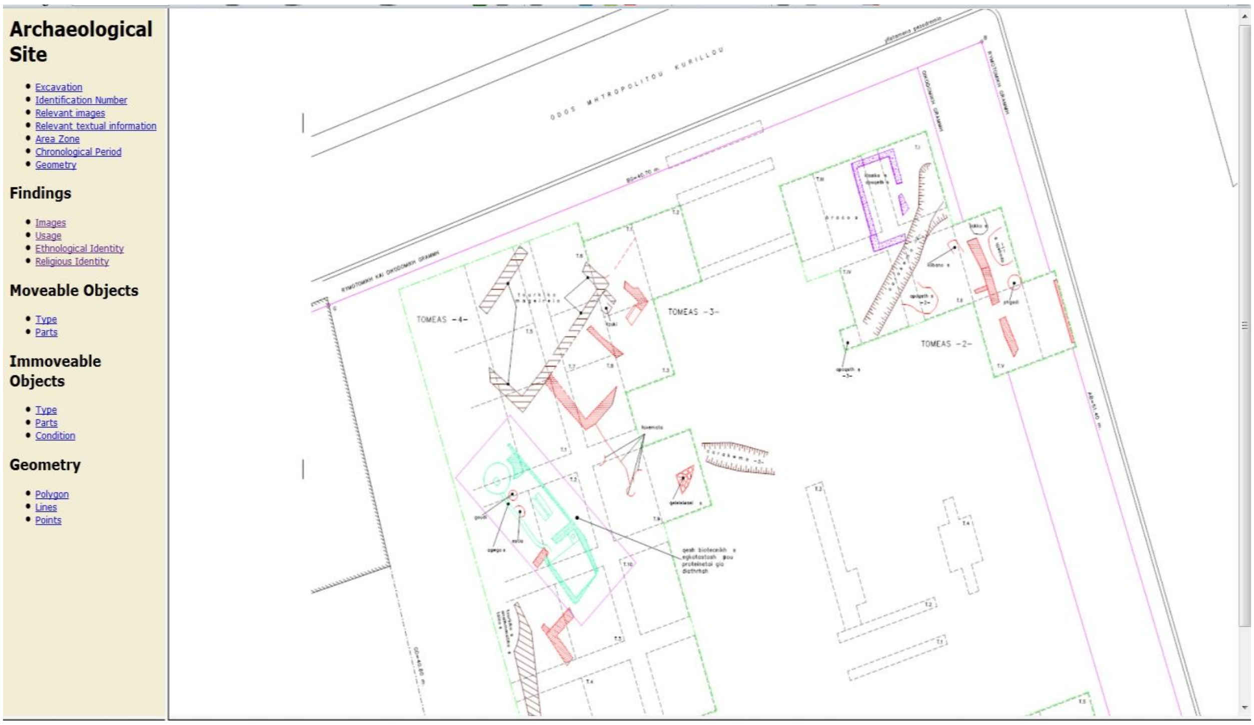

Figure 2: A snapshot of the WWW interface of our geodatabase. @ Archaeological department Chania, Crete, Greece