ARCHAEOLOGICAL MAPS GEO-REFERENCING AND INTERROGATION BY ADVANCED COMPUTER GIS SOFTWARE

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Abstract:

The rapid development of information technology has affected many of the archaeological science related disciplines and approaches. The use of information technology in Archaeology is functional mainly in three thematic classes: field research, data interpretation, archaeological heritage management and protection. The three classes are heavily influenced by aspects of the data encoding, database, computer-aided statistics, image processing, CAD tools, multimedia, virtual reality and artificial intelligence. Other fields of application concern the use of geomatics and recent tools and technologies such as laser scanners, satellite positioning, digital photogrammetry, digital mapping and geographic information systems. The latter technology, the GIS, was placed at the heart of the archaeological map computerization project.

It's a well-known fact that one of the main features of GIS is to integrate two-way alphanumeric information into geometric elements. The information, structured according to the traditional entity-relationship model (ERD), refers to the individual archaeological sites, each one localized and represented in a vector format. This project aimed at abstracting the management and retrieval of data from a common DBMS, involving two lines of implementation, each one independent from the other in terms of purpose, but each one referring to the same API level and technology behind the management system.

The first line of development relates to the integration of archaeological data in a GIS using traditional client-server architecture. The second line relates to the construction of a stand-alone GIS application.

1. INTRODUCTION

The development of the archaeological map IT components focused on just two lines of implementation: integration of content into a client-server architecture, and implementation of stand-alone devices. The whole process of design has been characterized by an innovative software development method,

which aims to research and modeling algorithms that enable a rapid response to database queries, as well as the engineering of a data abstraction level that would allow the manipulation and insertion of data in a simple but yet powerful way, in terms of consistency in the data, for instance in case of additions/changes to the existing data structures, as well as integration of the database into applications designed for data processing, visualization and management.

During the development process, the database was designed as a complex flow of information with precise characteristics: to be unbound and open to any additions or remodeling that can happens, e.g., with subsequent researches and discoveries. As it's well known, these "changes" are very common in the work of archeology, but with this new approach, they can be include along with information already been filed, granting the integration of new discoveries or developments in historical research without altering the existing database structures and relations.

The objective has been achieved by adopting a system of intermediate data abstraction via the adoption of object data boxing of the data resulting from common SQL queries, building an higher-level data structure completely modular, which exposes an API layer (called E-GEO) to the applications that need to access data. In particular, the choice in this direction was made in order to simplify both the creation of applications that are designed to communicate with the database, rather than using the traditional queries, by adding and obtaining data with a container modeled into objects, whose purpose is to operate as a data collection structure of data from and to the database, without the need for the user or the programmer to be aware of the structure of the same database.

The mechanism of abstraction provides several advantages: it freed completely from a specific low level syntactic language like the family of query languages adopted in database systems, being a detail completely hidden from the user or the programmer who implements software solutions, this mechanism also meets all the requirements of data consistency across the user during the editing and maintaining process of the raw data, and last but not implements a caching mechanism that significantly increases performance in case of repeated access to a common set of data, relieving the spatial component of the underlying database from an inevitable overload that would occur with a traditional approach to data obtaining based on fully data processing for each request.

This approach has proved successful in the database population by users with inhomogeneous tasks (new entries or changes/adjustments of the existing data), as well as the development of the applications suitable for processing and displaying the data to the end user.

Figure 1: Block scheme of the software structure

2. PRACTICAL APPLICATIONS

2.1 City of Reggio Calabria Geo-Referenced Archaeological Map

The E-GEO API framework was successfully implemented in one of the projects sustained by the City of Reggio Calabria about the wide spreading of city archaeology knowledge, through the adoption of some standalone kiosks located in different points of the city, and completely open to the public.

Figure 2: Kiosk in the city of Reggio Calabria

This project was divided into several phases: the first phase was intended to obtaining the basic data; the second was the creation of the software layer interfacing with the E-GEO API (and internally with the data base) and its population; and the third phase concerned the structuring of geographic component; the fourth phase centred around the study and design of an user interface with the goal of ensuring usability, attractiveness and immediacy of information content. The completion of these phases led to the Geographic Information System. [1]

The data and the various attachments are stored in the form of E-GEO objects that represent the archaeological findings; they are also interconnected with each other in case of multiple occurrences of one or more factors that characterize the discovery. The insertion phase has been managed through a custom developed software, using a convenient form interface available only to administrators and designated employees, this approach was chosen for two main purposes: to increase the productivity of populating the database and improve the management of discoveries.

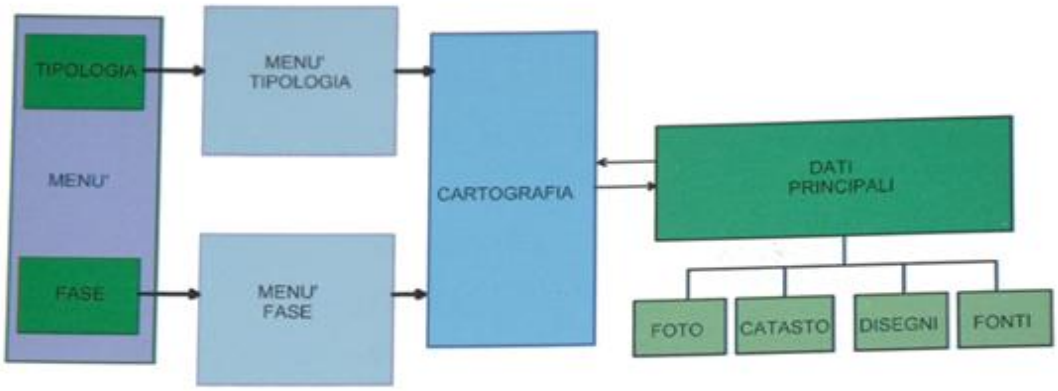

Figure 3: Software flow in obtaining data

The application allows viewing all data in the database in a gradual and smooth way, entirely managed by the user. The navigation mode is governed by a series of filters that make possible to carry out different questions of archaeological data. Based on the queries made through the filter and thematic flags, the data structure and attachments are obtained by successive selections. At this point the data will be displayed to the user, and there will be a limited number of tools to ensure a complete interaction with the maps. Once the site of archaeological interest is displayed, the software will retrieve and display key data, showing the map of the selected site and some information such as type, stage, district, street, interpretive summary of the site, presence and location of storage, acquisition mode and date of discovery, and finally the possible constraints imposed on the archaeological site.

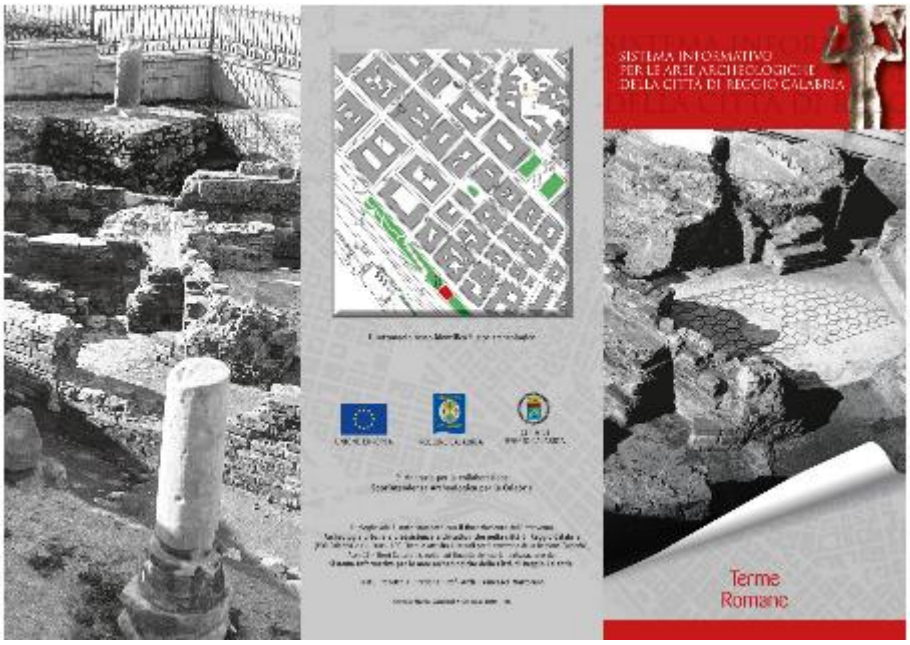

Figure 4: Software in action

The KIOSK software development was based on proven open source support technologies, i.e. MapWinGis Framework and ActiveX as the geographic component [2], PostgreSQL database with geospatial extension, and between them the E-GEO API layer.

The front-end software implementation was made using .Net Framework/Mono technology and languages.

3. CONCLUSIONS

The need of a computerized approach to archaeological data georeferencing was born from a complex and enormous amount of information and data, both static and variable. This required a system that could synthesize and collect the data in an easy and accessible way. This led to the development of the E-GEO API, which can convey the enormous amount of data to a high reusable way, from applications for the citizens (e.g. the kiosk project) to high amount of data processing for academic purposes. This was achieved thanks to a long and complex gathering of data in the localized area of interest and the study and development of appropriate software to manage this amount of data, which led to the creation of E-GEO. This will undoubtedly expand the versatility and usability of large amount of data, permitting new scenarios like displaying data in new, modern and streamlined manners, as well as enhancing the recovery's plans of historical city centers.

4. REFERENCES

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