CULTURAL HERITAGE ATLAS IN "TERRA DI LAVORO": THE INFORMATION SYSTEM

The Second University of Naples (Faculty of Arts), with the financial support of the MURST [1] project aimed at the technological promotion of scientific networks, has been working for the last three years on a cultural heritage atlas of the most interesting areas of the Caserta district, focusing on the so called "Terra di Lavoro".

The research projects aims, through the development of an understanding of the territory, to promote the area both culturally and economically through the use of the Internet.

A data model has been designed to classify the cultural heritage in its entirety, from antiquity to through to modern times. Its permits the detailed recording of all aspects of a complex landscape, from artifacts and through to monuments.

The data model permits the virtual repatriation of cultural resources that have either been transferred or destroyed throughout the last centuries. It further permits the expansion of the scale of investigation, from the reading of the landscape through the time to the archaeological excavation of most significant areas[2].

A standardization and homogeneity of the information has therefore been necessary, as the landscape is the unique context in which this work is placed. Consequently, the landscape history, including also its temporal dimension has been recorded in a geo-database. The most appropriate tool with which to undertake this was a Geographical Information System (GIS), due to its capacity to allow data entry and information retrieval. Furthermore, the system can be implemented as the foundation for virtual visits to the historical landscape, and also allow an interaction between cultural heritage and the economic environment. Two levels of reading and data access are permitted through the internet: a diachronic path for common users and open access to expert users to the complete information system, allowing both users to retrieve information and to create customised itineraries.

The main goals of the project are:

- The recording of all known landscape information in a geo-database;
- The development of an information system for the acquisition of knowledge and the preservation, exploration and exploitation of the cultural heritage;
- Publication of the database engine on the internet for virtual exploration and the promotion of tourism;
- The joining of the perception of landscape with the memory of the past.

Work Framework

The project is due to be undertaken over 5 years and has been structured as follows:

- DATA COLLECTION [Collecting data from: archives, iconography, cartography, historical and bibliographic sources; classification of the archaeological and artistic heritage]
- DEVELOPMENT OF THE INFORMATION SYSTEM AND I/O STRUCTURE [design of the entity/relationship structure and definition of codification; collection and processing of images; digitization of maps and construction of topology; the associating of spatial data with attribute data]

[1] Ministero dell' Università e della Ricerca Scientifica.

[2] *Calatia* (Maddaloni, CE) is the best example. See the report of the excavations: QUILICI GIGLI, RESCIGNO 1996, 94-102; RESCIGNO 2003, 99-104; and the plan reconstruction *Calatia* 2003.

- MANAGEMENT INFORMATION SYSTEM [assemblage of the atlas; processing, publication and didactic work]
- PROJECT DISSEMINATION [interfacing data with the country life; use of the data for promotion and planning in the territory]

The project is in its third year and attention has so far been focused on the first two aspects. The development of the information system has been dictated not only by technological developments but also by the collection of information. Work has now commenced on the fourth phase of the project and the development of a prototype to edit entire image files via the internet. The aim is not only the dissemination of data but also for the system to allow remote data-input, a useful tool for each researcher involved in cataloguing and working in museums and archives.

Academic background

Due to the wide range of the research, two teams have been created in order to catalogue two different groups of cultural resources: one group focuses on the period from proto-history to the high Middle Ages, the other from the lower Middle Ages to the modern era[3].

Geographical background

With the exception of a small area close to southern Lazio, the study area is formed by a district of Caserta, or the "Terra di Lavoro" as it was known in antiquity due to its agricultural tradition. However, despite its rich cultural heritage the area is not well known. In the early eighteenth century, many archaeological artifacts and artistic treasures were taken abroad from the region leaving it now at a strong disadvantage. Furthermore, the proximity of Naples and the "Campi Flegrei" has drawn away the attention of scholars, with the result that there still does not exist a synthesis of the region.

Historical background

The study area, centered around the ancient city of Capua, has steadily been settled since the early Iron Age (9th century BC). The region was occupied by the Romans after the Etruscans and Samnites, the ancient populations who came down from the mountains. They organised the land with the "CENTURIATIO". After the Barbarian invasions and the rule of the Longobards, Casilinum became the main town of the region. The new Capua was built there and it subsequently dominated the entire district until the foundation of the "Reggia of Caserta", the Royal Palace of Borbone, in the middle of the eighteenth century.

Economic background

The project, supported by MURST, is undertaken on a limited budget as is now unfortunately common in Italy.

The GIS is the basic tool that will help safeguard and add value to the local cultural

[3] R. Cioffi and S. Quilici Gigli form the scientific board of research the project; R. Lattuada and N. Barrella have scientific control of the history of art; T. Cirino, R. De Santo, A. Di Benedetto, P. Fusco, A. Ricci, O. Scognamiglio co-ordinate the administrative activities of several contract lecturers; S. Quilici Gigli and C. Rescigno have scientific responsibility for the archaeological content; L. Casavola, T. Caputo, P. Carfora, S. Ferrante, I. Gatto, V. Lapenta administrate the activities of several contract lecturers. G. Luongo, L. Petacco and L. Sasso D'Elia are responsible for the system design; technical support is given by *Sysdeco srl* and by C. Civale.

heritage. Indeed, recent statistical studies have revealed that only projects that study large territories are adequately able to promote cultural and economic development[4]. The knowledge of landscape's history indeed has an economic impact; knowledge itself is one of the first acts in territorial marketing.

The data will be used in county planning and for the promotion and developmentof the region. Areas of tourist interest will be highlighted, exploiting the historical heritage and its links with modern day life.

Further financial resources are required in order to upgrade current technology, however a website including a web-gis is the first step to involve the cultural heritage in a wider aspect.

Available data

Data collection is still in progress, however the number of records and the histograms illustrate the considerable work which has so far been undertaken.

- '*Beni' (*archaeological and historical-artistic evidence): 2318
- *Images:* 6768
- *Textual sources:* 1638
- *Inscriptions*: 137
- *Toponyms*: 878
- *Legal field reservation*: 210

Excavation records:

- UUSS: 1214
- RA (Records of evidence): 932
- TMA (spot-date tables): 488
- *Crate records*: 2602

Functional characteristics

All the data was collected in a unique processing centre. Its functional characteristics illustrate the technological resources currently available and, furthermore, the technical limitations of the project.

STRUCTURE

An NT server manages the local domain or 'Cluster'. Network connections are made possible through a LAN with TCP/IP protocol; remote login is also available. A Unix machine is used as the Web Server Apache, with, at the moment, an Internet configuration as seen in fig.

The hub links the Server and the following devices:

- 3 workstations.
- 3 notebook computers[5].
- 1 RIDE data storage (ab 1 TB)
- 1 ISDN router modem.
- shared printers and Plotter (maximum A0 format).
- 3 scanners (1 of which is A3) and an cartographic A0 scanner.
- 1 digital aero-photogrammetric restitution workstation

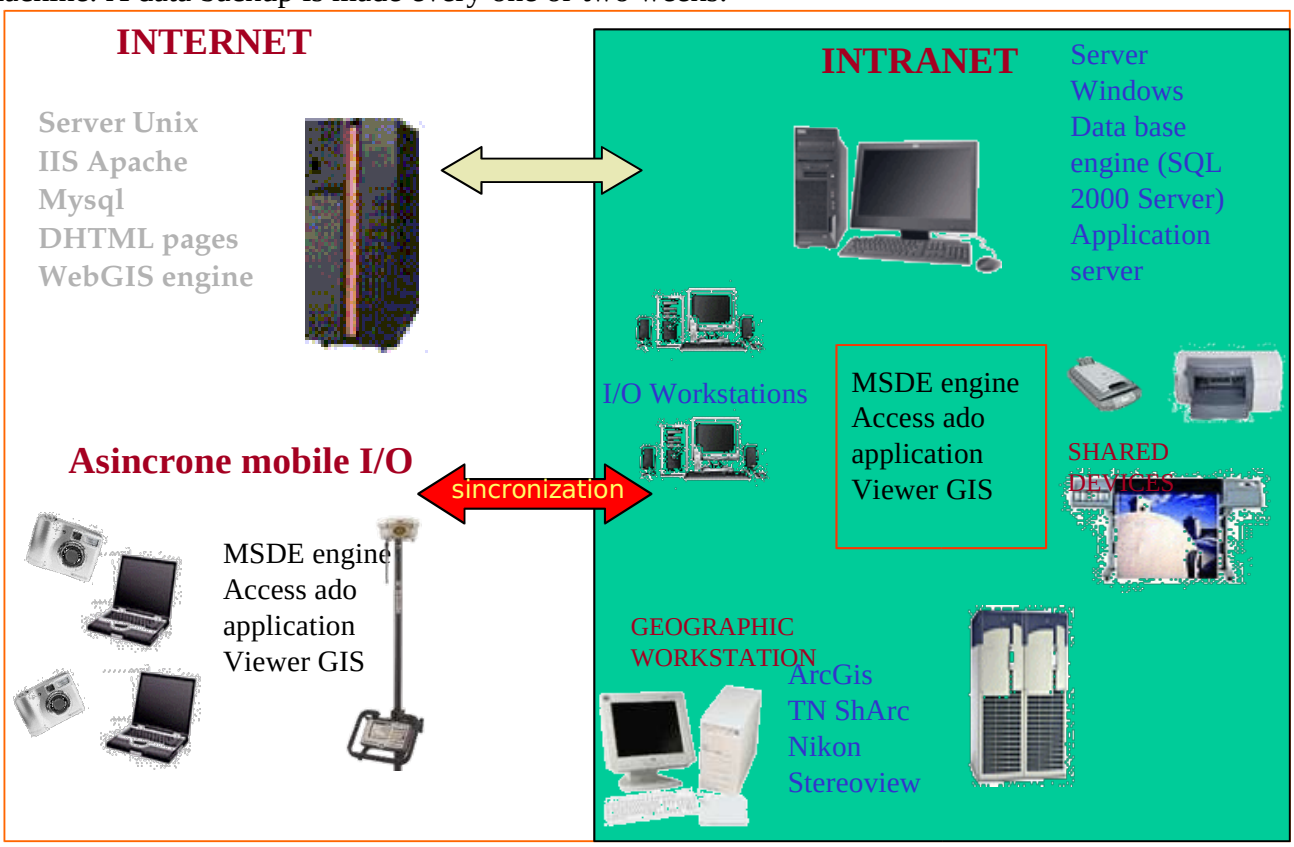
[4] The Faculty of Arts of the Seconda Università degli Studi di Napoli works with the university Faculty of Economics in order to assess both economic and cultural goals.

[5] The LAN permits the docking of further portable workstations in order to update the database with data collected in the field.

All workstations use the Microsoft Windows 2000 Professional operating system; a future upgrade, when the Unix server is connect to the Internet, will allow the workstations to also operate with Linux.

SECURITY

The system has three security levels (administrators, experts and standard users) and has a trust relationship managed by the Windows 2000 domain. Furthermore, a RIDE hot swap data storage allows maintenance, such the replacement of a damaged hard drive, without turning off the machine. A data backup is made every one or two weeks.



SOFTWARE

All workstations are equipped with Microsoft Office 2000.

Microsoft SQL Server 2000® is use to manage across the network the database stored in the NDS; each workstation has installed a Microsoft Access 2002 project - *Cluster.ade* – allowing data input and output [6].

The GIS workstation is linked to the A0 scanner and the plotter. Available software for data elaboration includes Corel Draw®, AutoCad Light 2000®, ArcView 3.2®, TN SchArc 4®.

Data storage is also made available through a DVD writer that allows recording of up t 6.5 GB of data per disc.

The geographical database

The database had to be created with the following features:

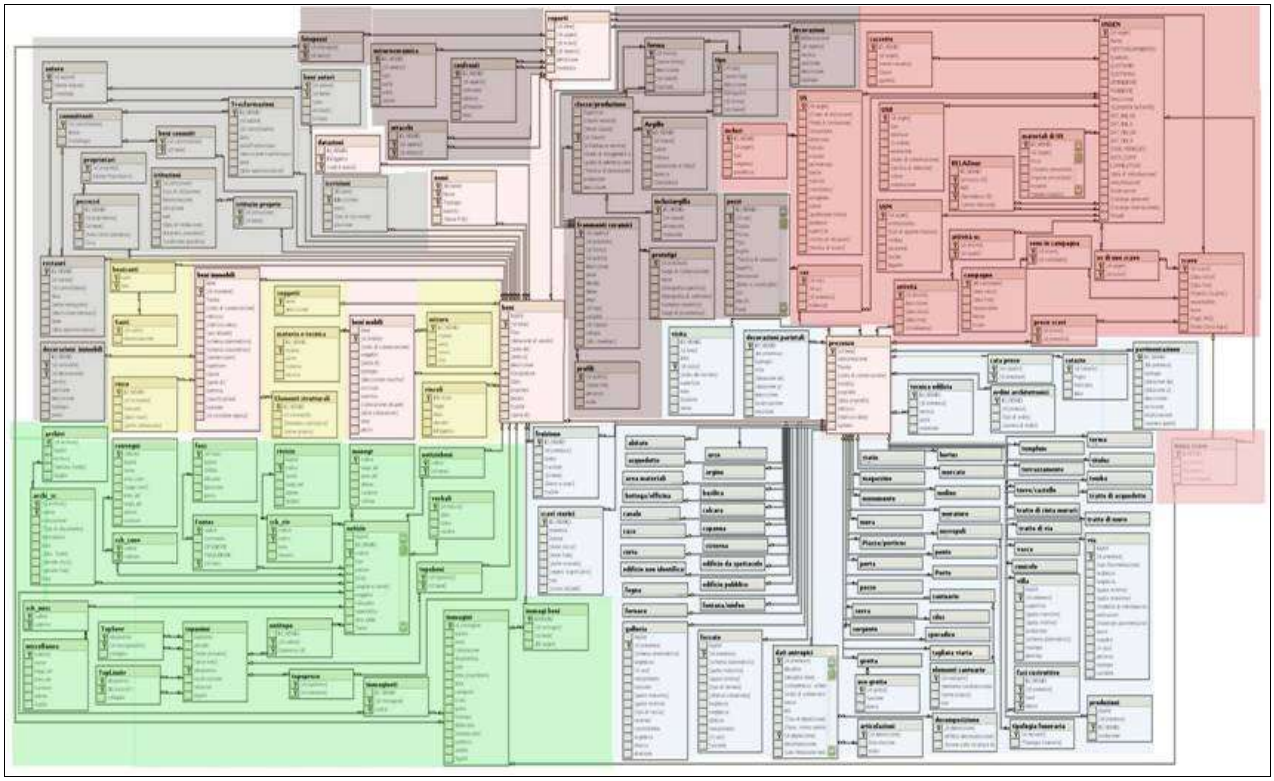
- the information system had to allow for the input of different data types, using schemes and programs already known to the researchers;
- the information system had to allow for updates and increases;

[6]Using an .ade project it is possible to control the VBA code and easily manage the data-flow generated by the workstations.

- the information system had to allow for the division of different types of data, in order to allow the better division of work amongst experts;
- the information system had to be suitably flexible in order to allow for unpredicted changes, influenced by changing research trends;
- the information system had to be designed to allow both consultation by expert users and also by normal users, as well as those seeking touristic information.
- an information system equipped to help in territorial planning by local communities, such as within town planning.

As no software existed for this complex task, and the development information systems was not a remit of this project, commercially available software was used, but with a strong personalisation. The system developed has a modular structure and an open architecture. Conventional registration systems were tested which allow sophisticated queries, but in our system the record is able to provide new hints and interpretations for every new inquiry. No codification, no matter how sophisticated is able to allow this. It is for this reason that it was preferred to acquire records in their integrity.

A multi-medial information system has been planned in order to receive different kinds of records and to connect them to each other. Further, standard classification and common information retrieval methods that are functional to statistical and catalogue researches are also included. Furthermore the system developed also allows a higher number of records and data of different types to be connected to each other. Lastly, geographical and spatial data can also be linked in.



These interactions are made possible by a relational DBMS, supporting the transactional management; for both economic and practical reasons, an SQL server was used, despite a future intention to use a different system with a better performances. Reality has been reflected as much as possible in the complex data system, reducing to a minimum all data processes and maintaining an open framework. The 2-dimensional and 3-dimensional developments are

dictated and structured by a theoretical model, whose strongest influence is the territorial representation.

A number of standalone database were also used, each focused on one element of landscape/territory (subject to future expansion with further class of data). In order to maintain a data link, a link DB was activated which will able tracking of the growth of the databse.

Fig. D illustrates the SQL server relational structure: the different colours indicate the database sections to be discussed later.

The core of the system is the idea of a cultural asset, which only has an ID number, designed with a one – to – many relationship. This system allows the simple identification of records, through the codes of the names and the authors. Tables, describing the type of records, are placed in a "one to one" relation with them; the archaeological fixed records and the less ancient fixed records are geo-referenced, therefore permitting a 2D and 3D representation. Whilst artefacts (such as pictures and sculptures) and archaeological finds cannot be represented geographically, they can however be identified through the related record. This information is important to maintain and associate as it is fundamental to the territorial knowledge.

The schema permits the entry of bibliographic information, as well as photographs, images, texts, news, and other forms of data. The system also permits the comparison of newly collected data with original data. This schema is managed by dedicated software, which divides information in three different blocks:

1. description of the information
2. sources and authors
3. other database links (an area expected to further expand)

The first application manages the historical and artistic records; it links the iconography with the artefacts, for instance linking Saints with other relationships, such as dedications, places and the monuments built for them.

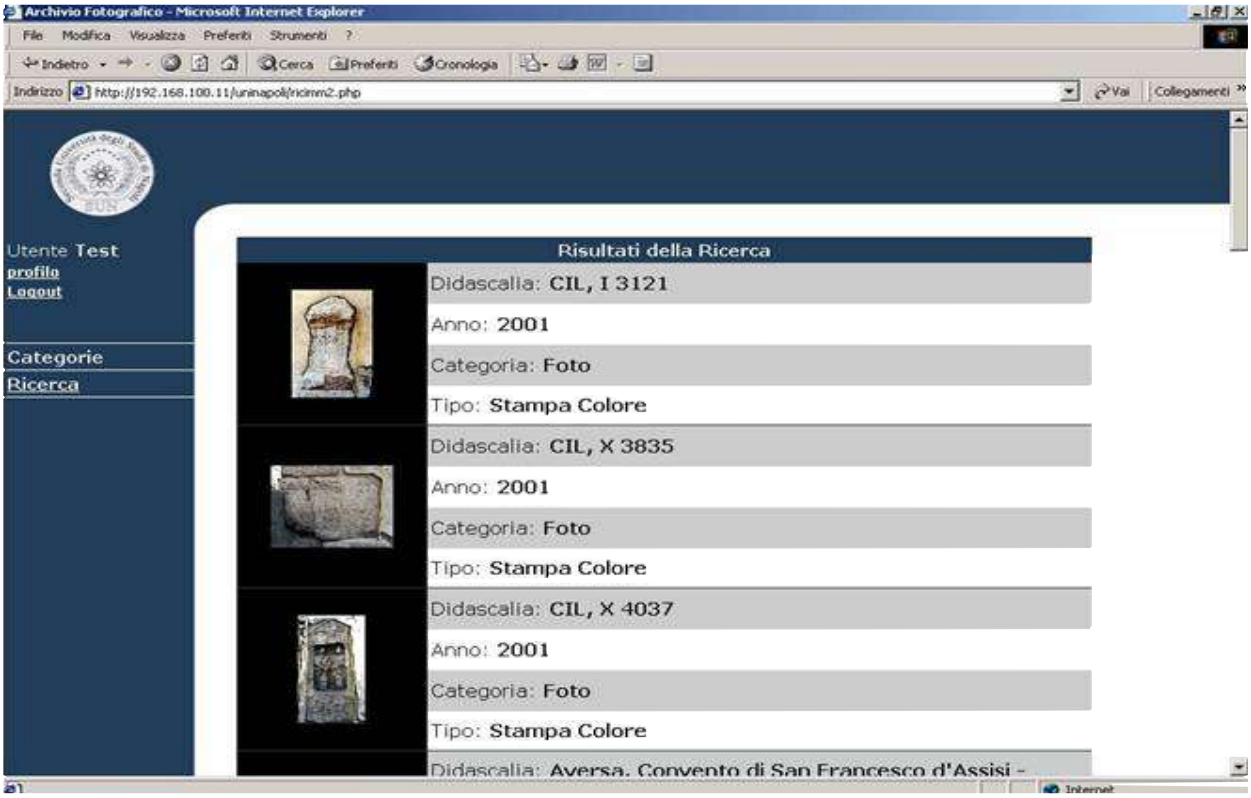
The application for the territorial survey is very complex, due to the amount of archaeological evidence. However, this section has been discussed elsewhere by the authors in "The Valley of Sinni" research publication[7].

A further application has also been developed to manage the excavation results. The system has been designed to contain information such as US data, information concerning the content of individual crates, lists of materials by categories, documentation and the associated drawings.

Concerning the study of ceramics, the application is able to compare the object's characteristics with the others in the database catalogue. The logical schema contains standard classification criteria of category/production, type and event linked to the of clay and surface's analysis. It is further possible to create new typologies, using the prototype's category, that allows the definition of new shape/production characteristics, to be used for comparison.

A viewer GIS application was developed by Sysdeco srl, using ESRI Java technology; this forms an important element of the system, which is not focused on a GIS (spatial data are provided by a geographical station and by a customised software) but on a database. ESRI Map Objects and Java technology have been used to manage the system; bi-directional queries are also possible

[7] L. Sasso D'Elia, Genesi di un sistema informativo per la raccolta di dati di Topografia antica, in L. Quilici, S. Quilici Gigli (edd), *Carta archeologica della Valle del Sinni, «Atlante tematico di topografia antica», Suppl. X, I, Roma 2003,* 53-61; L. Petacco, La matrice culturale del S.I.T, tecnologie computazionali nella ricerca topografica,*ibidem,* 63-71.



from the SQL Server database to the GIS and vice versa. In the future this desktop application can easily be transformed into a WebGIS using the Java MapObjects and also for developing a client application (WWW)[8].

A future alternative to GIS representation can be VR visualisation, which can be easily added into this systems architecture.

The effective flow of data through the network is a further issue that was confronted, which was outsourced to Sysdeco srl, for I/O independent application development, and to be used through an user friendly standard browser. In accordance with the data architecture, a new XML browser based interface was built. The Unix Server provides PSP transactions for all clients, allowing data input, querying and updating (fig. E).

To fully understand and appreciate the information system, direct experience of the system is required, which will soon be made possible via Internet access.

Future directions

Future work will include a GIS module for the information system. The research team also collected significant amounts of cartography, including historical maps, aerial photographs and varing types of vector data. It will therefore be necessary to process this data and normalize them in a geo-database, allowing interaction with the alphanumeric database. A further aim is that the GIS viewer will allow complex spatial analysis and virtual representations with 3D models.

Equally, the Client XML model will be extended, which so far has only been used for image files, to allow access to the complete database, providing an easy access by means of the Intranet/Internet without the requirement of any additional software.

Web pages will be developed with XML technology, with the aim of sharing the cultural heritage atlas with the wider public and allowing information retrieval at different levels of complexity.

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[8] By the way Java applets can be execute by client application or by browser so net publishing is only a policy question.

The retrieval of information in a geographic dimension may allow the construction of virtual visiting paths, thematic and/or chronological and cultural itineraries tailored to the requirements of different kinds of visitors: from citizens/tourists to scholars or town and territory planners.

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