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SUMMARY OF DOCTORAL THESIS

INFORMATIONAL SYSTEMS FOR ARCHEOLOGY. APPLICATIONS OF GEOSPACIAL TECHNOLOGY IN ARCHEOLOGY. DISTRIBUTED DATABASES

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1. Argument

Research in the archeology field proves to be increasingly difficult and more complex without the support of the interdisciplinary knowledge. Sciences like mathematics, chemistry, geography, biology have always been closely related to archeological research. Modern sciences that benefit from technology and are rapidly developing such as informatics and topography cannot be separated from archeological research. Researchers from various specialties have realized the need for collaboration and have created multidisciplinary archeological centers.

At an international level and due to technological progress, informational and informatics archeological systems have been developed. These systems were meant to maintain, process, analyze or preserve archeological research results. The establishment of an international set of concepts and terms for archeological management makes the necessity of maintaining a large volume of data even more pressing, especially for the Romanian archeology.

At the same time, the requirement of publishing an increasing number of archeological data became a lengthy and costly process. Therefore, there was a need for methods that could make this process more efficient from several points of view among which economics, ergonomics, space and time. There is a need to carefully select critical data and rigorous research and publishing, respectively storage of historical data, is the only method of accomplishing that.

The practical implementation should not be difficult because we are just establishing some mandatory steps that were already being used in archeological research even though generic management terms were not utilized in the past. On the other hand, we cannot neglect the place that documentation holds in an archeological project, its publication and the analysis of data by an increasing number of specialists since a large volume of unchecked data can produce errors.

Starting from this dire need for standardization of procedures and terms utilized in archeology, together with the linguistic diversity, specifics of local and national archeological research and last, but not least, the pride of some historians and archeological researchers we can conclude that there is little hope that this huge volume of data can be stored, analyzed, preserved and published, at least for the next 50 years. The procedures and documents that are required for archeological projects have reached a high degree of standardization and economic development of various regions that have developed over archeological sites helped this process but the views regarding standardization of categories are still varied. Some researchers claim that such standardization is not possible while others claim that standardization of certain categories and typologies is necessary and possible.

The final result of any archeological project has to be a research paper which draws conclusions about the meaning of all scientific data collected. It also entails the establishment of an archive, both

physical and digital, which would allow access to that information for an unlimited amount of time and also public access to the results of the archeological digging.

Due to the above reasons we considered necessary to develop some rules for organizing and structuring the information in a software application that would allow collecting and linking as much archeological data as possible based on the contributions of researchers involved in publishing the results. We also thought that complex search results combined with the study of dedicated specialized applications that have high development costs could be the field of very useful interdisciplinary research for archeologists.

All of these aspects are presented in this dissertation and the result is a solution for easy, fast and efficient access to a large volume of archeological data.

1.1. Introduction

Archeology has always been an interdisciplinary field of science which developed in close relationship with anthropology, paleontology, geology as well as other sciences. After the 1940s archeology began interacting also with various other natural and exact sciences.

The current dissertation brings unique contributions to the field of geospatial technology and distributed databases in archeology by creating an application named ArheoNET. This application allows the aggregation of data that is stored in several public or private databases, with known structures and which can be accessed over the internet.

The study in this paper presents some of the most relevant research in this field of archeological database, compares the results of costly applications in this field and proposes an original solution through the ArheoNET application.

Figure 1 represents the application from a theoretical stand point. The main components are the following:

- The ArheoNET software application
- Two categories of databases: internal, that stores its own data and external, that manages private or public data that is the result of various archeological research
- Web interface that allows users to have easy access to information through an internet browser
- Connection module and networking options that will allow access to external databases
- Public data, located in the internet cloud[1], which can be collected due to existing links between servers in the network.

[1] Cloud computing represents the software and data resources obtained through the interconnection of computer networks.

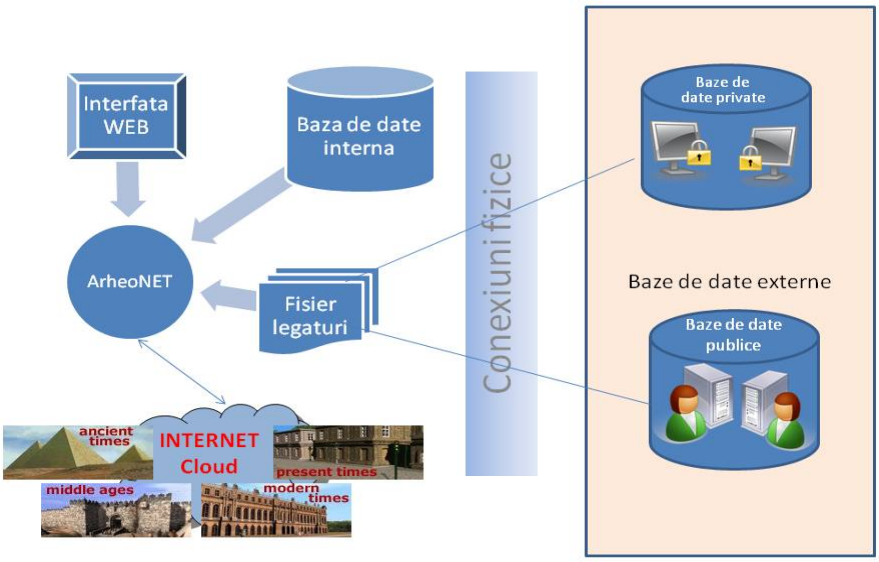

Figure 1. Structural diagram of the ArheoNET application

The dissertation is organized in five main parts. In the first part, presented in the second chapter, we describe, compare and contrast features, structures, and organization of archeological informatics systems like ArcTron, Oxford ArchDigital and Galileo Siscam. In the second part we study the concepts of informatics and informational systems that represent the foundation of this application. In the third part we discuss the concept of distributed databases in archeology. We start with relational databases and end with the principles that allow the ArheoNET application to connect to archeological databases that are private, public or internet links. The fourth part includes the case studies as well as ways of retrieving archeological data that is specific to a certain period based on user specified criteria. In the fifth part the ArheoNET application is described in detail including architectural design, the way it was built, functionality and results that can be obtained. The conclusions of the research, advantages of using this application as well as proposals and future developments are also summarized.

The research paper contains additional materials in the annex that allow a better understanding of interdisciplinary elements used such as informatics concepts and networking protocols, including the source code developed by the author.

1.2. The necessity and timeleness of the research theme

Geospatial technology and archeological database principals have always been an area in which the researchers involved in the conservation and rehabilitation of territories were interested. The goal of projects in that space is to precisely identify, using modern technology, the area of historical monuments and the surrounding space that should be protected.

Projects finance by the European Union during 2007 -2012 foscused on research regarding conservation of historical monuments, current methods of determining their exact location as well as

defining the area that needs to be protected. Working on these projects were teams of specialists, PhD. students or graduates, focused on various fields like archology, geography, IT, and architecture. Some of the main objectives of these projects were linked to the prospecting, identification, record keeping, and conservation of the archeological patrimony and the historical monuments using modern informatics systems.

The databses used to inventory and determine the goespacial location of these monuments utilized GIS and GPS technology. GIS (Geographic Information System) is one of the main tools for the creation of digital terrain maps while GPS (Global Positioning System) helps obtain the onsite coordinates for the researched monuments or archeological sites.

The current software applications allow easy location of monuments in a certain area, of archeological sites and the protected zone around them. That is not the case with the software that is trying to capture archeological objects, their placement in various archeological categories and correlation to the archeological data since there are various opinions about the right way of doing it.

The analysis of archeological landscape has developed at the same pace with the informatics systems of database management that involve GIS (geographic information system).

2. Organization, analysis and comparison of informatics systems in archeology

2.1. Introduction

The applications in the IT field become more and more specialized therefore they become indispensable to the progress of certain fields of science. Archeology and history are sciences that started taking advantage of the benefits of the informatics systems in the last few decades. The Geographic Information System (GIS) has quickly been adopted in archeology and it helps in data interpretation using the graphics and reports that can be generated very quickly. GIS is a system that aggregates data, programs and computers/servers in order to process, analyze and generate reports based on geographic data. The data processed by the GIS can be in a text, image, geographical coordinates or map format that has as a source a database that is updated interactively. Implementing a GIS represents a financial investment due to the high cost of software and hardware platforms.

The research in this dissertation looks at how you can apply a GIS in archeology, history and research. The advantages of implementing an informatics system are considerable especially in a field like archeology and they include:

- Data processing in a very short time
- Recording of data in a database which can be saved in different locations
- Better management of high resolution images
- Set up of detailed maps containing information requested by the user in a short time
- Processing of digital data in a bi-dimensional system

In order to offer a more holistic image of the systems and software applications that are related to the one presented in this dissertation we compared several software systems and presented a comparative study of the ArcTron archeological information system, the Oxford ArchDigital archeological system and the archeological system based on the Galileo Siscam technology.

2.2. Comparison of systems and advantages of the current application

The ArcTron informational system is organized in specialized modules that are well defined for certain applications. Due to this kind of architecture the ArcTron system can handle a wide variety of requestds with very good results. Certain modules in the application can be used independently and other ones are dependent on each other. This can have both advantages and disadvantages depending on how the application is used.

The following are the advantages of the application:

- It uses the CAD technology and the maps and plans are automatically generated which gives them a standard format to be used in several applications that use the same infrastructure.
- The aSPECT3D module can be used independent of the other ones and has a lot of features that allow easy data input into certain categories. This allows for easy search processes and very economical server usage. The feature that allows rotating and viewing a sectional of the objects from the data base facilitates the researchers' work.
- The option of using different filters that list general or partial information regarding the objects searched makes listings in reports much faster.
- There is no concern about protecting the copyright since the database does not allow public access to the information and images.
- The objects contained in the database are described using a multitude of fields which allows search and reporting based on this variety of criteria.
- The reports have a fast search option that utilizes pre-defined reports therefore alleviating the work of the user.

The main disadvantage of this system is the high cost and the fact that one has to purchase the CAD software as well. Other disadvantages are: the rapid searches only check three fields, there is no internet access to the application and it contains a module of users' security and administration.

The Oxford Archdigital informational system is made out of three modules that are interconnected and do not require a complicated administration. One of the big advantages of this application is the fact that it is a system based on user access from the internet that has connection to the internal database. Because of this structure users' administration and security of data are very important. The system protects the copyright through various techniques that are applied to images that are displayed in the search.

Compared to the Arctron system, this application offers the uses pre-defined search methods and for advanced searches it also uses synonyms for objects or characteristics.

Due to its architecture this application does not need two databases (mirroring or for public and private access) because the various types of information are stored in differently structured files. Any change to the information in the database is registered and special audit programs can be run at various intervals.

Another advantage is the fact that there are no GIS servers used for placing objects in space which results in very accurate maps without them being costly.

The disadvantage of this system is that it contains specialized high cost scanning modules, tridimensional viewing modules and modules to research damaged parts of certain objects or buildings.

The informational system based on the Galileo Siscam technology stands out due to the digital and the tridimensional representation modules. Just like the ArcTron system it utilizes the CAD software which makes it an application that requires quite a bit of financial investment due to the need to purchase a license.

This application allows users to connect both through internet as well as a local connection. The data security methods used in this application are not available.

Some advantages of this application are: specialized techniques for discovering archeological objects, advanced methods for the diagnosis of objects and structures as well as a specialized multimedia module that offers users tridimensional representations. These can be enhanced by adding animation for a better representation. There is a special module that offers a feature for an easy presentation of the materials that can be used in media to advertise the areas that contain archeological findings.

Some of the disadvantages of this application are: limited search engine, a database that is not split into categories, the lack of an administration module as well as the high cost of acquiring the application.

Some of the advantages and disadvantages of all these applications were taken into consideration while doing this this research and developing the ArheoNET application.

This informatics system is dedicated to users from the archeology field and has the following goals:

- Providing access to some of the legislation in this field
- Allowing input of data for archeological objects
- Facilitating access to the database content
- Connecting to certain external databases

The data stored in this application can be viewed in different ways such as listings or map representations.

One of the advantages of this system is the fact that it was built as an open internet access application as opposed to the ArcTron and Galileo Siscam systems. Data security measues had to be implemented in the ArheoNET system due to the fact that users can access the application database from the internet (on a limited or unlimited basis depending on their rights).

Similar to the existing systems (ArcTron, Oxford Archdigital and Galileo Siscam) this application allows input, storage, searches and display of data.

ArheoNET was initially designed on a local server for testing purposes. At this time it can be accessed from any computer that has intrenet connection since it is located on the server belonging to a hosting company.

3. Informational and informatics systems for archeology

3.1. The notion of informational and informatics system

A good understanding of the role and place of informatics system inside and informational system in archeology is very important. In this research we included examples of the informatics system that we created as well as fundamental knowledge and main aspects of the analysis, design and implementation of a software application.

We defined the main sub-modules that make up the archeological research and briefly presented their role and place:

A1. Legislation sub-module

A2. Archeological site organization sub-module

A3. Methods of prospecting archeological sites sub-module

A4. Digging sub-module

A5. Dating of archeological objects sub-module

A6. Digital simulation of surface, terrain, 3D aspects sub-module

A7. Storage of archeological discovery sub-module

3.2. The informatics system of the ArheoNET archeological application

The set-up of a database that includes all these elements allows updating of the fields in real time (as long as there is a permanent connection to the main database) as well as the ability for users to add information (digital images, maps, etc.) that can be immediately available to researchers.

This approach gives equal importance to the archeological objects discovered allowing for all the elements discovered to be treated with the necessary attention through recording all of their details. This database can be included in a GIS informatics system like the one created and described in the next few pages.

The current informatics system was created for users who work in the archeological field and its main purpose is to allow input of information related to archeological sites and easy representation.

The data that is gathered in this system can be viewed through various methods among which a map representation.

One of the advantages of this system is the fact that it was architected as an open application that can be accessed from the internet, unlike the ArcTron or Galileo Siscam systems which cannot be accessed by external users. Because any user can access the database (on a limited or unlimited basis depending on access rights) the application has to contain also data security.

Just like the other existing systems studied (ArcTron, Oxford Archdigital and Galileo Siscam) this application is offering data input, storage of data in the database, methods of analyzing and displaying the results.

The informatics system described in this research has the following components:

1. Data input
2. Processing and analysis of data
3. Database (spatial)
4. Data representation
5. Security elements
6. System networking

Each of these modules also has sub-modules.

Data input

In order to input data into an archeological system one has to have basic knowledge in the archeological field. The users that have administrator rights will have unlimited access and they can perform tasks like data input, adding and deleting data, import of data from other applications and databases. This module can be developed to allow direct processing of data obtained from topographic measurements by using a special interface. In the case where the users do not have information related to the location of the object (latitude and longitude) they can access the map included in this application and through zooming into the area where the object was discovered they can select a point and its coordinates can be used in the form that allows adding of an archeological object.

Processing and analysis of the data

The data contained in the database can be accessed and more information can be added, some of the information can be deleted or the whole file related to an object can be repealed. The same data can be accessed through searches in order to generate report of maps.

The database

The local database was built on a MySQL 4.1. platform. It contains several tables, some of them are interdependent and other ones are connected in order to facilitate the data input process. The archeological objects stored in the database each have 2 fields (latitude and longitude). The archeological object can be represented on a map using these 2 fields. These parameters give the database the spatial components.

The database also contains special fields found in separate tables from the rest of the information where one can store images related to each archeological object. The applicaton has the ability to integrate files that have various extensions and they can be attached to an archeological object from the database.

Data representation

This module has the purpose of representing the information requested by the user. The results can be displayed in various formats depending on the user requirements. They can be in the format of a report or a map. Data representation can be affected by the rights that the users have. A user who has visitor rights cannot change or delete information related to an archeological object. This kind of user may only be able to access limited number of images (two or three) with a smaller resolution. These restrictions will be implemented in accordance with the rules and regulations of the organization that uses the application. These restrictions can help filter the access to the database and are meant to ensure that users that have full rights do not have to wait in order to access information that can be necessary to their project.

Security elements

This module has the main purpose of controlling the access of users to information from the database of the application. The sub-modules give the administrator the ability to add, modify or delete users that can access this application. The application uses a separate table where users are registered in order to offer security to information access as well as easier administration.

Another reason for having this module is to be able to implement the watermarking technique for all the images in the database. This ensures copyright is protected for the people who created the digital image and the users cannot utilize this application as source of information without disclosing its source. There is an exception to this rule for images that are loaded from a link.

System networking

This application can be made out of multiple databases. The server that contains the web application and the local database has to be in a central location with permanent connection to the internet. Due to the fact that it is always connected to the internet any users can utilize this application as long as they were registered by the administrator and they have an internet connection themselves.

4. Principles of developing distributed databases in archeology

4.1. Relational databases in archeology

The data obtained through archeological digging can be of different types. Among the most frequently used ones are: written notes, drawings, sketches, blueprints, maps and photos. In order to better administer this data and allow easy access to the information one has to transfer them to a digital format and connect them to specialized applications. These applications allow users to easily administer and track the artifacts.

Usage of the relational databases is one of the most efficient methods of organizing the information.

In order to create a data model the following three steps need to be executed:

- Analysis – has to contain the interdependence of the segments that constitute the production process and the possible interaction between the users. The analysis should not be made targeting a certain database model.
- Design – defines the logical structure of the database and its type which can be: hierarchical, network, relational, relational object, object oriented, semi-structured, associative, entity-attribute – value and context[2]
- Implementation – creates the physical structure of the database starting from a database model defined in the design. Here is where the database tables are defined as well as the types of columns and the connection between the columns belonging to different tables. Deepening on the size of each column, the table has a certain dimension and needs corresponding space allocation on the drive.

The databases used in archeology are specific to this field and they can be very specialized depending on the requirements of the software applications and the users. Large relational databases that contain a lot of information and users need optimization.

The successful implementation of such a new application is dependent on good theoretical knowledge in the field of archeology as well as a good understanding of the process of gathering data. In the case of an existing application that needs updating one needs to consider whether the database can or cannot be modified to fulfill the new requirements.

4.2. Distributed databases in archeology

Nowadays the archeologists work with different digital documents such as pictures of the objects discovered, maps, images of the archeological sites, databases that are specific to archeology, 3D reconstructions, scanned or written documents, etc.

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[2] http://unixspace.com/context/databases.html

One of the fundamental problems that archeologists face is the lack of standardization in this field. Because of that, the majority of the applications are specific to a certain project and it is very difficult to connect multiple applications between them.

The current application represents a model of standardizing operation procedures in an informatics system for archeology. The closer the structure of such a system is to the standard that exists in the archeological and informatics fields, the easier it is for the system to connect to other similar systems.

4.3. Connecting to archeological databases.

The solution proposed in the ArheoNET application allows interconnecting of various databases, gathering, visualization and retrieval of information from various servers and locations through the internet. The more an application can connect to multiple internal and external databases the more important it becomes in the collaboration between archeologists. In spite of the fact that the principles and methods of performing research in archeology are still debated and controversial, this application allows collaboration between national and international organizations, archeologists studying various historical areas or specialties, belonging to different countries that can find some common ground for collaboration. The results of individual research can be used by all and be accepted.

The methods of connecting to databases, through networks known under the name of „cloud", are varied due to the variety of ways of accessing the data and the location in which it is stored.

The current application was architected as a platform that allows connection to various media: internal, private external and public external (internet).

4.3.1. Connecting to the internal database

The internal database contains information regarding archeological objects from the application, some elements of archeological legislation as well as a representation of the distribution of archeological objects on the Romanian territory. All of these elements are memorized on the server on which the application resides and the connection to the database can be made through any internet browser from any distance.

In order to connect to the internal database one only needs to have the user name, the password and knowledge of the structure of the database.

The internal database is made out of 20 tables, represented in Figure 2, with the main table being the one called "obiect_arheologic".

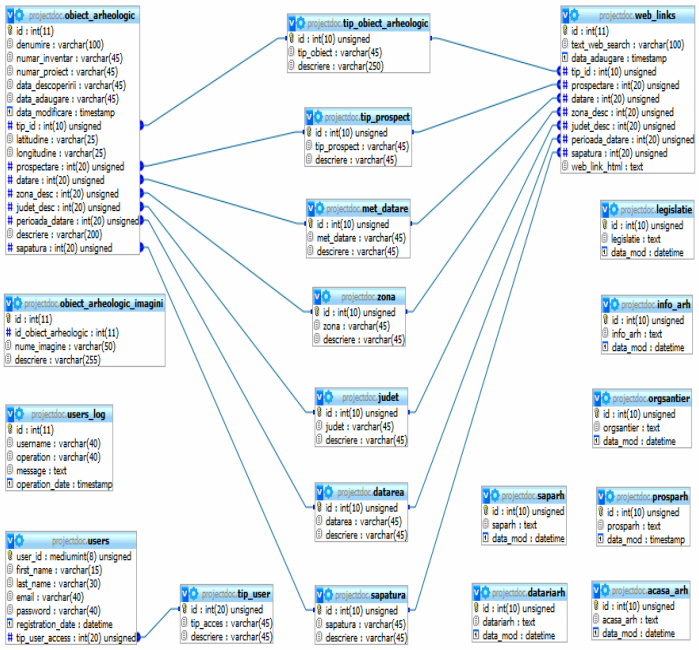

Figure 2. Structural diagram of the internal database for the ArheoNET application

In this relational database we can input data related to artifacts that were discovered, placing them in various categories such as: the area or county where they were discovered, the type of object, the type of prospect, the type of digging used as well as dating method chosen.

The tables are defined using the normalizing principle, respectively the normal format 1 (FN1) of relational databases, having as main connections the primary keys fields from each table. The type of connections used are 1:n and n:n. Details about features and ways of utilizing the database are referenced in the chapters that look at case studies. In those chapters we also present the results obtained through using the application.

4.3.2. Connecting to external private databases

A private external database is a database that belongs to another application that is on a different server and has no direct connection. The first condition for being able to connect the database is having an internet connection for both applications. The internet connection has to be dedicated in order to allow a permanent connection.

The second condition is that each application has a static dedicated IP address (that does not change). Each computer which is connected to the internet is identified through a unique number known as IP (Internet Protocol) address. This address is given by the internet provider[3]. Due to the fact that IP addresses are in a limited number there is the possibility of recycling the address and giving it to a different computer at the time when the computer is shut down. When IP addresses change, the connection between the applications stops. In order to prevent this from happening the

[3] Apects related to the networking principles are presented in detail in chapter 3.4 and Annexe in the main paper.

internet provider has to allocate an IP address that is dedicated to the computer that contains the database.

The third condition is that the application which initiates the connection has to know the IP address, the user name and password and the structure of the remote database.

The fourth condition is that both the database and the remote application need to allow a connection from outside the system. Databases that are built in MySQL transmit and receive information through port 3306[4]. If this port is not open in both directions on both applications the connection between the two databases is not possible.

If all of these conditions are met, the applications that initiated the connection can establish a link to the remote database.

The application described in this research can connect to five databases located in various places:

- The first database is local and is on the server where the application runs
- The second database is on the server of the hosting company godaddy from USA
- The third database belongs to the ViArchMap application and is on a server from Romania
- The fourth database belongs to the "Simboluri" application and is also on a server from Romania
- The fifth database belongs to the Arheosit database and is on a server from Romania as well.

The connection to the second database was created in order to demonstrate that such a connection is possible and viable. The structure of this database is similar to the structure of the local database since the main reason for this first step was establishing a connection between two informatics entities that are not on the same server.

The initial step was to place the application on the godaddy.com server in a new domain. Once the application was installed on the new domain http://www.projectdoc.info/index projectdoc.php, there was internet connection on both sides, there was a static IP address but a connection to another database could not be established. After contacting the godaddy.com company and having numerous discussions and changes of settings on both sides the conclusion was that the hosting provider godaddy was blocking outbound data traffic from its server to the internet through port 3306 due to security reasons. Confirmation of this restriction is documented on the internet as well[5].

The structure of this database is similar to the main database, representing an early version of the ArheoNET application. At this time this database is just an example of the ability of the ArheoNET application to connect to a remote server. In order to demonstrate the functionality we can

[4] Blocking of port 3306 used in MySQL http://timewasteblog.com/2006/12/16/godaddy-wont-alow-to-connect-outside-mysql-server/

add an archeological object to the application on godaddy.com and that object can then be found through the search module of the ArheoNET application by selecting the ”godaddy” database.

The third database is also in MySQL and belongs to the ViArchMap application developed as part of the doctoral dissertation by lecturer Phd. Domsa Ovidiu, published in 2010 and it can be accessed at the following address: http://188.26.122.230/viarchmap/.

This relational database is made out of 15 tables. The main fields can be found in the “Obiecte” table which is linked to 11 of the remaining 14 tables.

The fourth database is in MySQL as well. This relational database is made out of 5 tables. The main fields can be found in the “Simboluri” table. The purpose of the database is to structure, organize, store and retrieve data (text and image) regarding astral symbols and belongs to the doctoral dissertation developed by Suciu Cristina and published in 2010.

The fifth database is in MySQL also. This relational database is made out of 5 tables. The main fields can be found in the “sit” table. The purpose of the database is to structure, organize, store and retrieve data (text and image) regarding photographs of archeological sites identified in doctoral dissertation by Baltat Daniel, presented in 2012. It can be accessed at the following address: http//imageart.ro/arheosit/index.php

4.3.3. Connecting to public external databases

For this category there is a table in the application that contains the results of internet searches. The results are stored in link format. The search is performed based on predefined criteria. The advantage of this option is that the users don’t have to search the internet but rather can select results of previous searches stored in these links allowing the users to save time since they don’t have to go through tens or hundreds of results.

Every link from the database is saved and given a name that has to be relevant for the users so they can realize if that result is what they are searching for or not. The search method has as basis the archeological classification or criteria that archeologists, who will save the information, can define independently using the application.

The methods used to connect to external databases will be illustrated in the case studies below. These case studies have different characteristics to help demonstrate the applicability and usefulness of the ArheoNET application. Based on data collected and placed in the database we analyzed and built documentary materials regarding various time periods, opinions and diverse ideas related to the same references as well as illustrated them in a variety of ways.

5. Case Studies

5.1. Introduction

The current study started from a curiosity regarding narratives from foreign travelers regarding the Romanian territory, the Romanians and the realities of the medieval time. The collaboration regarding the studies was possible through dialogue and consultation with several historians. Among them we mention teachers like Cetean Daniela, Domsa Traian and lecturer PhD. Domsa Ovidiu who helped in collecting and adding to the database studies, materials, images and bibliographical references that can become a model for the future historical or archeological research. We focused on the Alba Iulia city and the Fenes village, located close to Zlatna, Alba county (Latin name of Ampleum) which is little known and the information found about it on the internet is inconsistent.

The information presented in the following chapters is rich, the sources are varied, and the chroniclers who described and presented materials from that period are numerous. The need to organize this data, to structure it and present it determined the efficient organization of the data. In this case we will find information published in various internet sources, some unpublished data which was input into the local database as well as references to information from books and science articles published in electronic format.

All of this material was structured based on historical testimony presented in the following pages and they are illustrated through screen captures from the application. The multitude of information that can be stored digitally cannot be totally exemplified in this paper. Therefore, we invite the readers to access the ArheoNET application from the location described in the Annex. The examples presented through the images from this application are the most relevant ones.

5.2. Archeological research from the Stone Age of the Fenes village, Alba County

5.2.1. Traces from the New Stone Age. Superior Neolithic

The first traces of human life in the area of the Fenes village should be sought during the New Stone Age, keeping in mind the climatic conditions favoring the development of human beings.

Situated in an Eocenic gulf, with numerous organogenic limestone, massive sandstones and green argillaceous shale, the Ampoiu area was crossed by the Ampoi River, after the alpine folding. On its slopes, some calcareous Jurassic cliffs emerged and they seemed to be coming out of the surrounding scenery lending a pleasant appearance to this area. These cliffs are known as “calcareous moments” and the natives from the area of Valea Mica call them “chunks”, the ones from the Fenes or Galati area call them “bubbles” while the ones from the Zlatna area called them “peaks”.

The Ampoiu area was quoted in scientific literature as having human settlements dating from the transition period from the Neolithic to the Bronze Age and those settlements belonged to the Cotofeni culture. Some people started researching the landforms from that basin since they could have offered proper conditions and provided shelter for prehistoric settlements.

As a result of that research they discovered Cotofeni settlements situated on the plateaus surrounding the "calcareous moments", on terraces and in caves, some long term settlements which had the purpose of protecting the entrance into the gorges and some temporary ones used for shepherding.[5]

Using the ArheoNET application we can extract data related to the altar from Fenes as well as another alter from the ViArchMap database. In Figure 3 we can see the results of the "altar" word search in the databases connected to this application. On the left hand side there are the listings of the two alters: one from the ViArchMap application and the second one from the ArheoNET application. The two components also give details related to chronology, category and typology.

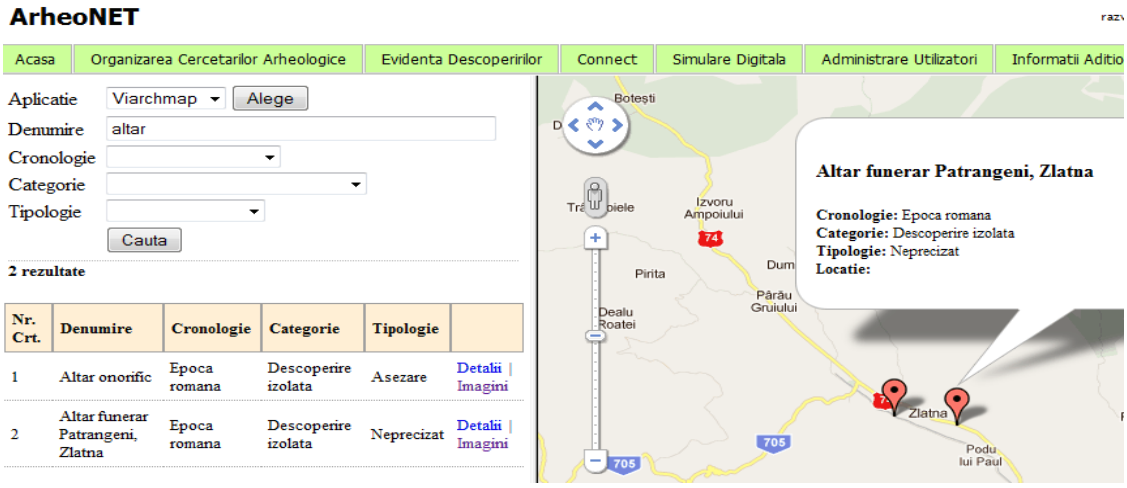

Figure 3. Results of the "altar" word search in the ArheoNET application

When accessing the links for details and images we can get information and pictures stored in the databases. On the right hand of the screen the two alters are placed on a map according to the coordinates (latitude and longitude) where they were discovered.

5.3. The Alba Iulia princely court and stories from foreign travelers

The subject of the stories from foreign travelers is a complex one and there is a large number of people who visited Alba Iulia during the time when it was the capital of the principality. Therefore, we chose the second part of the 16th century when the principality was established and the capital started to develop. The travelers, as agents of civilization[6], built an intercultural dialogue.

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[5] I.T. Lipovan, *Aşezările purtătorilor culturii Coţofeni din bazinul Ampoiului*, I, Apulum, XX, 1982, p. 14.

[6] Mihaela Grancea, *Călători străini prin Principatele dunărene, Transilvania şi Banat (1683-1789). Identitate şi alteritate,* Editura Universităţii „Lucian Blaga", Sibiu, 2002, p. 5.

They pass along some stereotypes that are related to the environment where they come from, the way they position themselves relative to religion, the events that they describe, as well as the level of their understanding of the realities that they refer to. The foreign travelers belong to different cultures, they have various professions and a variety of reasons for coming to the princely court. The current research is focused on half a century of stories from foreign travelers, some of which were diplomats, others clergy from the Catholic Church and the rest of them military personnel, musicians or scholars.

Even though there was a large number of people who came to Transylvania during that time period we only mention the most important ones and those who wrote about the princely court.

For a methodical approach of this theme it was very useful to consult the work of Nicolae Iorga *Istoria românilor prin călători* and *Les voyageurs français dans l'Orient européen* as well as the work of Paul Cernovodeanu *Societatea feudală românească văzută de călătorii străini (secolele XV-XVIII)*. The original writings of foreign travelers we researched in Andrei Veress' book *Documente privitoare la istoria Ardealului, Moldovei şi Ţării Româneşti , Acte şi scrisori*, volumes I-IV, published in Bucharest during 1929-1932 which covers the second part of the 16th century. For the writings of the Jesuits it was really useful to consult the work of Andrei Veress, *Fontes Rerum Transylvanicarum, Epistolae et acta jesuitarum Transylvaniae temporibus principium Bathory (1571-1613)*, 1st and 2nd volumes that were published in Budapest in 1911 and 1913.

An important role in the analysis of the stories of foreign travelers and the way they reflect the image of others starting from their own socio-cultural and professional environment was played by the well documented and up-to-date research of Mihaela Grancea *Călători străini prin Principatele dunărene, Transilvania şi Banat (1683-1789). Identitate şi alteritate*, published in 2002. We also consulted another recent research that was published in 2005 and was coordinated by Ileana Cazan and Irinia Gavrila – *Societatea românească între modern şi exotic văzută de călători străini (1800-1847).*

We have to mention that there are few studies for the subject discussed in this paper and this was one of the reasons that determined us to choose it. Even though the topic was interesting to historians, the princely court from Alba Iulia, as reflected in the stories of foreign travelers, was only the subject of a few research studies. One of the research studies was written by Iacob Marza in 1975 – *Alba Iulia în viziunea călătorilor străini (secolele XVI-XVIII)* and it only mentions five travelers for the 16th century [7]. Another research study on the same subject is Florin Stan's book published in 2001 - *La curtea princiară de la Alba Iulia în vremea Bathoreştilor.* [8]

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[7]Giovan Andreea Gromo, Antonio Verancsics, Franco Sivori, Giorgio Tomasi şi Pierre Lescalopier. Vezi I. Mârza, *Alba Iulia în viziunea călătorilor străini (secolele XVI-XVIII),* în *Transilvania,* 5, 1975, Sibiu, anul IV, p. 27-28.

[8]See Florin Stan, *La curtea princiară de la Alba Iulia în vremea Bathoreştilor (Cour princiere à Alba Iulia pendant la seconde moitiè du XVIe siècle)* , în *Magazin Istoric,* 2001, 35, nr. 4.

5.3.1. About the princely court of Alba Iulia

The political history of Transylvania after 1541 was dominated by the fight to strengthen the internal autonomy. This fight was taking place during collations between the Ottoman Empire and the Austrian Empire, while the Ottomans were strengthening their position in the southeastern part of Europe and expanding towards its center. This consolidation of the autonomous principality[9] was accomplished inside the country through establishing some government mechanisms, continuing the system of the three privileged nations. They also added another privilege, that of the four received religions.

Starting with the year 1541, once the autonomous Transylvanian pricipality was established, Alba Iulia will show signs of being the capital. During the ruling of princes like Ioan Sigismund Zápolya (1541-1551; 1556; 1559-1571), Sigismund Báthory (1581-1597; 1598-1599; 1601-1602), Gabriel Béthlen (1613-1629), Gheorghe Rákoczi I (1630-1648) şi Gheorghe Rákoczi al II-lea (1648-1660), the fortress of Alba Iulia will flourish by becoming an important institutional center especially in areas of public interst like: city planning, administration, culture, and social work.

5.3.2. The place where the Diets were held

The Diet was one of the most important public legal institutions of the Principality of Transylvania and it organized the autonomous life in the area for three centuries. It consisted of the three privileged nations and the four received religions. During the time of the Voivodeship the privileged nations were gathering in meetings called Congregation generalis under the leadership of the Voivode.

Once the Principality of Transylvania started developing, this institution would get new names reflecting the increased power that it possessed. The Diets were political gatherings that had the power to make decisions in the legal, justice and administrative matters of Transylvania. The place for these gatherings was the country's capital, Alba Iulia, but some of them were also held in other cities where the prince was at the time – Cluj, Turda, Sighisoara, Medias, Bistrita, etc. [10]

5.3.3. Alba Iulia, diocese center

It was decided that the diocese was born in 1009 when the bishop Azo de Ostia, who established the episcopates suggested by the regality, visited for the first time as the official delegate of the Pope. Documents or later references do not mention this particular starting point though. Inside the state, the Transylvanian diocese is one of the 15 dioceses that belonged to the medieval Hungarian kingdom.

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[9] About the development of the Transylvanian autonomous principality see Octavian Tătar, *Putere şi politică. Aspecte instituţionale în Principatul Transilvaniei,* Alba Iulia, 2010.

[10] For detailed informations regarding the diets that were called in Transylvania see Gheorghe Bichicean, op. cit., pp. 128-140

This diocese was under the archdiocese from Kálocsa, together with the dioceses of Cenad, Oradea and Zagreb and they were all presided over by the archbishop from Esztergom (Strigoniu).

At the end of the 13th century, the diocese was formed out of the protoieries of Alba, Chizd, Cluj, Crasna, Dăbâca, Hunedoara, Ozd, Sătmar, Solnoc, Târnava, Tileagd, Turda, Ugocea, together with the saxon and szekler deaneries. [11]

5.3.4. The place where the princely council met

Following an European model that was also used in Moldavia and Wallachia, a Princely council was established to lead the Transylvanian principality. This was a consultative political institution that was performing the function of advising the prince when he was making important decisions regarding the country. The prince was relying in his government on this Princely council that was made out of council members elected by the Diet and then confirmed by the prince. The council members, who were all representatives of the three priviledge nations, had to commit themselves to the prince and the state. They were all representatives of the three privileged nations.

The Princely council met at Alba Iulia and it was made out of 22 members[12], 7 representatives of the three privileged nations from Transylvania and one representative of the general chapter from Alba Iulia. Later the number will be changed to 12, four representatives from each of the privileged nations, chosen by the prince.[13]

5.3.5. The Princely Chancellery

One of the most important institutions that the prince used to rule the country was the Princely Chancellery. This institution evolved and closely followed the transformation that the Transylvanian Voivodeship experienced in its evolution towards becoming a principality. Before 1556 the Chancellery had two components – the big Chancellery (cancellaria maior) and the small Chancellery (cancelaria minor).[14]

The first one took care of legislative, executive issues as well as ones that came from the head of the state while the second one took care of the rest of the paperwork. In the beginning, the chancellors were part of the clergy. They were gradually replaced by lay people, noblemen who studied and had influence on the culture during that time.

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[11] Adrian Andrei Rusu, *op.cit.*, p. 31.

[12] The number of council members varied from one time to another. After 1548, at the Reunion from Turda, the priviledged nations reduce the number to 12, 4 for each nation but actually they were less than that. Apud, Istoria românilor, V, p. 688

[13] Gheorghe Bichiceanu, *op.cit.*, p.124.

[14] *Istoria românilor*, V, p. 693.

The chancellors were people who were very close to the prince and he trusted them. The great majority of them were named by the prince. They were often envied due to the power that they held. Considering the role of the chancellors they were often also performing as princely advisors.

5.3.6. The princely palace

The main building, the palace, was reflecting the status of the principality and was built just like the fortresses in the Middle Ages. The palace was the heart of the Transylvanian principality. It was the place where politics was made, where issues regarding coal and salt mines were discussed, where religious trends were encouraged or blocked, where the youth was educated for military or diplomatic careers, where marriage alliances were formed, where the best pieces of jewelry were enjoyed and sold, where the news arrived first about the Ottoman – Iranian war and the Spanish Empire in America.

The princely palace went through various phases of reconstruction or extension that turned it into a tight place without ever becoming unitary. One of its unique characteristics was also the interior fortress inside the larger fortress, which gave the impression of a citadel.

Through the ArheoNET application we can access information about the Princely Palace from Alba Iulia in the form of links or images. This information is stored in the database and figure 4, exemplifies it below:

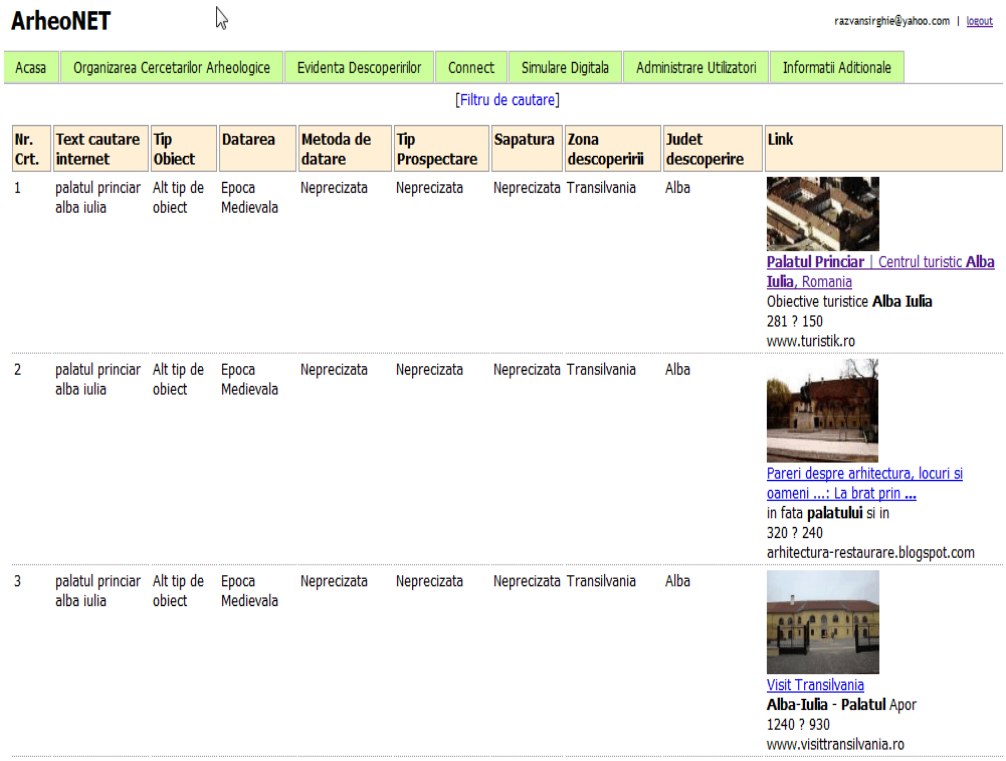

Figure 4. Images resulted from the search of the word "palace" in the link application

5.4. Princes, princesses and their company as reflected by foreign travelers

At the princely court the most frequently mentioned aspects in the travel journals of foreigners are the ones related to the life of princes and their company. For the period mentioned, the second part of the 16th century, we looked at the most significant three rulers that are mentioned in the travel journals: Sigismund Zápolya, Ştefan Báthory and Sigismund Báthory. It is normal for travelers to mention in their writings the life of these princes since most of them had missions at their court.

The majority of the foreign travelers came to the court of Transylvanian princes due to diplomatic, military or religious missions. We will present them in a chronological order rather than the frequency with which they are mentioned in the different writings. We have to mention again that the period referenced is the second half of the 16th century, a complex time in history that begins with the change of Transylvania into an autonomous principality under the suzerainty of the Porte.

5.4.1. Ioan Sigismund Zápolya

Ioan Sigismund Zápolya, born in Buda in 1540 and deceased in Alba Iulia in 1571, was the king of Hungary under the name of Ioan II and Transylvanian prince since 1570 [15] under the name of Ioan Sigismund. He was the son of Ioan Zápolya and Queen Isabella of Hungary, daughter of King Sigismund I of Poland. [16]

The images for Ioan Sigismund that can be found in the database of the ArheoNET application are represented in Figure 5. In order to view them the user has to access the "Evidenta Descoperirilor" menu and then select the "Vizualizare link-uri web". In the search engine of the application the user can search for "Ioan Sigismund Zápolya".

[15] As defined by the treaty of Speyer in 1570, the Transylvanian ruler was called „Transylvanian Prince" –*Johannes, serenissimi olim Joannis, regis Hungariae, Dalmatiae, Croatiae…filius, dei gratia princeps Transylvaniae ac partium regni Hungariae recognoscimus…* Apud Octavian Tătar*, op.cit*., p. 62-63.

[16] Cf. *History of Transylvania,* coord. G. Barta, I. Bona, B. Kőpeczi, L. Makkai, Akadémiai Kiadó, Budapest, 1994, p. 247.

ArheoNET

razvansirghie@yahoo.com | logout

Acasa | Organizarea Cercetarilor Arheologice | Evidenta Descoperirilor | Connect | Simulare Digitala | Administrare Utilizatori | Informatii Aditionale

[Filtru de cautare]

Nr. Crt.	Text cautare internet	Tip Obiect	Datarea	Metoda de datare	Tip Prospectare	Sapatura	Zona descoperirii	Judet descoperire	Link
1	principi Ioan Sigismund Zápolya	Alt tip de obiect	Epoca Medievala	nici una	niciuna	Neprecizata	Transilvania	Alba	 **Ioan Sigismund Z?polya** - Wikipedia **Ioan Sigismund Z?polya** 150 ? 202 ro.wikipedia.org
2	principi Ioan Sigismund Zápolya	Alt tip de obiect	Epoca Medievala	nici una	niciuna	Neprecizata	Transilvania	Alba	 **Ioan Sigismund Z?polya** - Wikipedia **Ioan Sigismund Z?polya** 200 ? 270 ro.wikipedia.org
3	principi Ioan Sigismund Zápolya	Alt tip de obiect	Epoca Medievala	nici una	niciuna	Neprecizata	Transilvania	Alba	 Intemeierea unei noi religii mondiale la Turda (Radu Cerghizan ... **Ioan Sigismund Z?polya** 3374 ? 3654 istoriaturzii.wordpress.com

Figure 5. Images resulted from the word search "Ioan Sigismund Zápolya" in the links application

The research paper presents in a similar way data and ways of getting information about Stefan Báthory, represented in figure 6, and respectively Sigismund Báthory.

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[Filtru de cautare]

Nr. Crt.	Text cautare internet	Tip Obiect	Datarea	Metoda de datare	Tip Prospectare	Sapatura	Zona descoperirii	Judet descoperire	Link
1	principi Stefan Báthory	Alt tip de obiect	Epoca Medievala	nici una	niciuna	Neprecizata	Transilvania	Alba	 Kaczynski, ?nmorm?ntat l?ngă un ilustru transilvănean **stefan bathory** **stefan bathory** 630 ? 1260 www.septemcastra.ro
2	principi Stefan Báthory	Alt tip de obiect	Epoca Medievala	nici una	niciuna	Neprecizata	Transilvania	Alba	 **stefan_bathory**.jpg **Stefan Bathory** s-a nascut pe 189 ? 247 www.simleusilvaniei.ro
3	principi Stefan Báthory	Alt tip de obiect	Epoca Medievala	nici una	niciuna	Neprecizata	Transilvania	Alba	 **Stefan Batory**	Ask.com Encyclopedia **Stefan Batory**	Ask.com 377 ? 499 www.ask.com

Figure 6. Images resulted from the word search "Ștefan Báthory" in the links application

In the paper we also mentioned the narratives of foreign travelers who documented in their writings details related to the princely court of Alba Iulia, the customs and the political environment

of that period. These travelers were the following: Atilio Amalteo, Jacques Bongars, Pietro Busto, Ferrante Capeci, Cosimo Caponi, Alfonso Carrillo, Alessandro Comuleo, Giovan-Andrea Gromo, Ioan Leleszi, Pierre Lascalopier, Antonio Possevino, Franco Sivori and Giorgio Tomasi. The ArheoNET application allows users to add images and links as well as search the database for information on all of these travelers. The travel accounts become an important source and, without competing with the official documents, they still contribute to a general image of that time. The main source of information used was the biographical data from the collection "Calatori straini" and we also tried to offer the bibliographical information.

6. The architecture, structure and modules of the ArheoNET application

6.1. General components

This informatics system is for users in the archeology field and its purpose is the following:

- to provide information regarding legislation in the field
- to allow input of information related to archeological objects
- to allow visualization of information from the database
- to connect to other external debases

Like the other existing and studied systems (ArcTron, Oxford Archdigital and Galileo Siscam) this application has to allow data input, storage of information in the database, data processing and viewing of the results. This application was built on a local server and can be accessed at the following address: http://188.26.122.230/arheonet/home.php.

6.2. The architecture and structure of the application

The ArheoNET application is made out several logical entities:

1. Informational structure
2. Data input, change and deletion structure
3. Listing and interrogation structure
4. Display structure
5. User administration structure

In the paper we described in detail the interrelationship between the logical entities of the application. The relational database of the ArheoNET application is made out of 20 tables. The main menu of the application calls the program "home.php" which in turn accesses the web page "menu.php". In this page we defined the structure of the main menu as well as the different components of the sub-menus. In figure 7 we can see the main menu of the ArheoNET application:

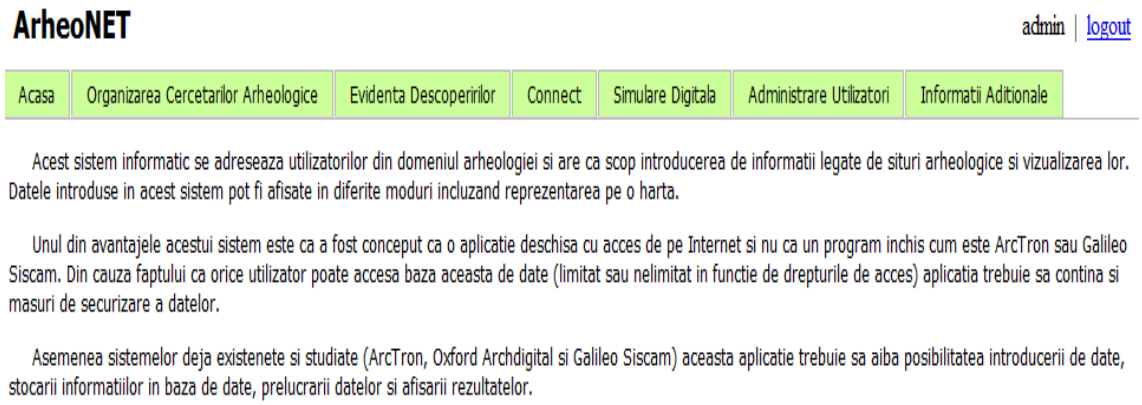

Figure 7. Main menu of the ArheoNET application

Informational structure

The informational system can be accessed from the main menu by selecting "Organizarea Cercetarilor Arheologice". Inside this structure the user can request information related to Romanian legislation in the archeological field, how to organize an archeological site, information related to the type of digging, the type of prospecting and the dating methods used in archeology. Users with limited data access cannot use the editing function from this menu.

Data input, change and deletion structure

Data input can be accessed from the main menu "Evidenta descoperirilor". Information related to archeological objects is stored in the obiect_arheologic table of the database. This table is linked to all the other tables in the database except for the "users" and "user_tip" tables. In order to input another discovered object the user can select the main menu "Evidenta Descoperirilor" and then "Administrarea Obiectelor Arheologice".

Listing and interrogation structure

The listing option has several choices. The user can list all the objects from the local database or objects from all four databases that the application can access (godaddy.com, ViArch MAP, Simboluri and Arheosit).

Display structure

The purpose of this structure is to display the objects from the database in a distributed format on the map of Romania. In order to do so the application is accessing the following options from the main menu: "Simulare Digitala" and then "Harta Romaniei". The integration of this map in the application was made using the "mapsprojectdoc2.php" program.

User administration structure

In order to manage user access we have to choose the "Administrare Utilizatori" option from the main menu. Only the administrator can access this function due to data security reasons. This structure uses two tables from the database: users and tip_user. Depending on the role of the users in

their organizations they will receive appropriate rights for this application as well as the databases that the application can connect to.

In order to provide the best data security for the remote databases, including copyright, we had to implement the digital watermarking technology on the majoirity of the reports and pictures displayed in this application.

6.3. Application modules

The application has several modules that contain archeological documentation and legislation, application administration, input of data and reports.

Organizing Archeological Research

This module offers the users the opportunity to read about concepts as well as references on laws in the archeological field. The users have the option to change or add new information to the existing one, depending on the rights that they have. This module covers five distinct fields:

1. Legislation
2. Organizing an archeological site
3. Digging methods
4. Prospecting methods
5. Archeological dating methods

Recordkeeping of discoveries

The module "Evidenta Descoperirilor" is the most important one of this application because it covers three areas:

1. Administration of the local database records
2. Connecting to remote databases
3. Interrogation of databases that the application can access

The following sub-modules cannot be accessed by users with limited rights:

- Administration of archeological objects
- Administration of web links
- Reports

The rest of the options can be accessed by all the users. This application does not have very strict security measures implemented yet since they would be dependent on the requirements of the users. Increased data security measures can be implemented later.

Testing of the database connectivity

By accessing the "Connect" option from the main menu the administrator can test and confirm the connectivity of this application to the remote databases.

When the application connects to the database for which the test is performed the authentication is confirmed and it consists of user name and password. Once the two applications connect the

message represented in Figure 8 is displayed on the screen. Only the administrator can access the "Connect" menu due to application security.

The users have to contact the administrator if they notice any issues related to this application's connectivity to the remote databases.

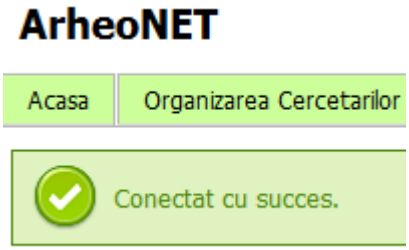

Figure 8. Proof of connectivity to a remote database

6.4. Digital simulation

At this time the application offers the display of items that are stored in the local and remote databases on the geographical map of Romania by using a special license given by Google. Figure 9 shows the digital map:

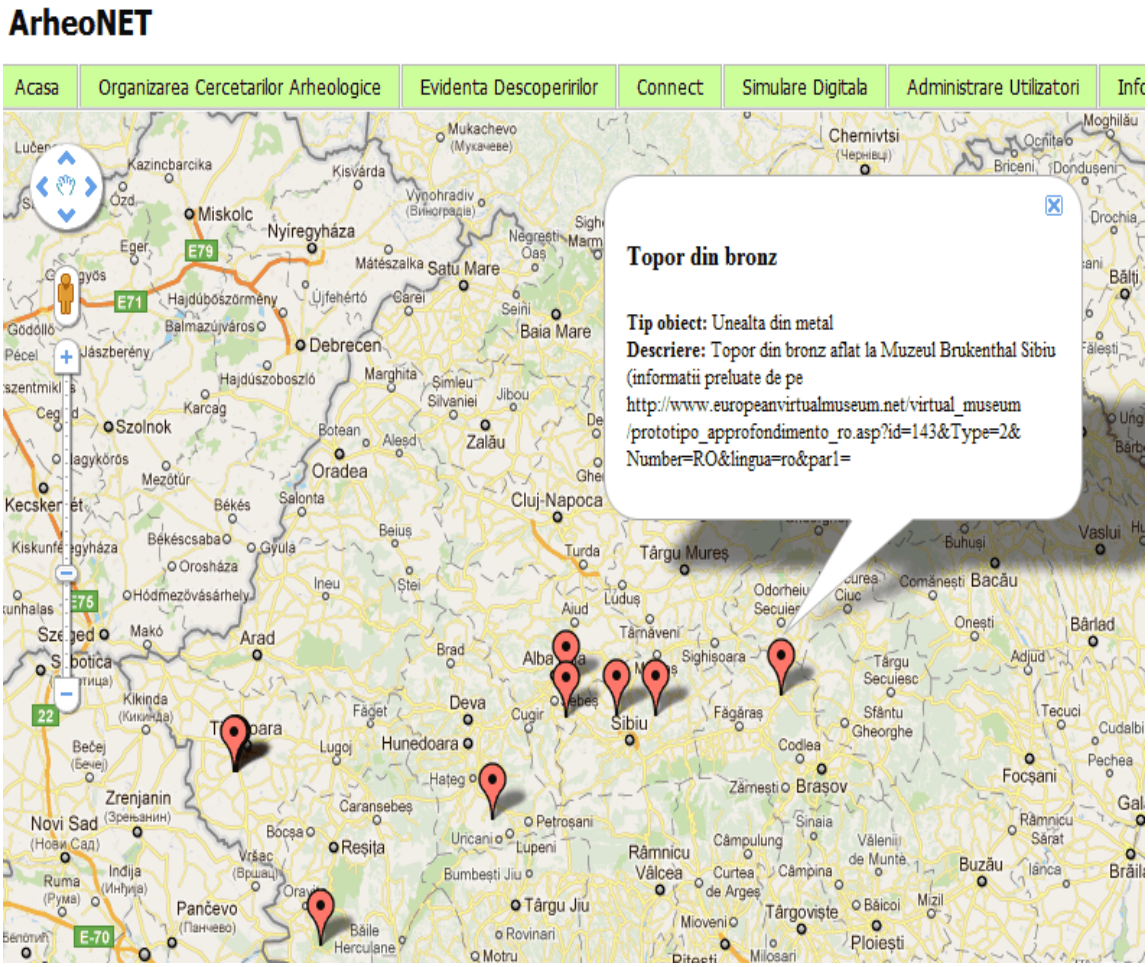

Figure 9. Digital simulation

The map has two options on the right hand side:

- map representing the administrative or terrain units
- satellite map with the option of showing the names of the localities

The map can be increased or decreased in size by using the "zoom in/zoom out" options and allowing the user to display at street level. When one of the objects represented on the map is selected we can view information related to the type of object and its description that was stored in the database.

The ArheoNET application can also access the Arheosit database (presented in Figure 10). The Arheosit application can be accessed using the following URL: http://imageart.ro/arheosit/index.php. In Figure 10 we display the results of the search for Constanta county. On the right hand side is the digital representation on the map of Romania while on the left hand side the user can access additional information resulted from the search.

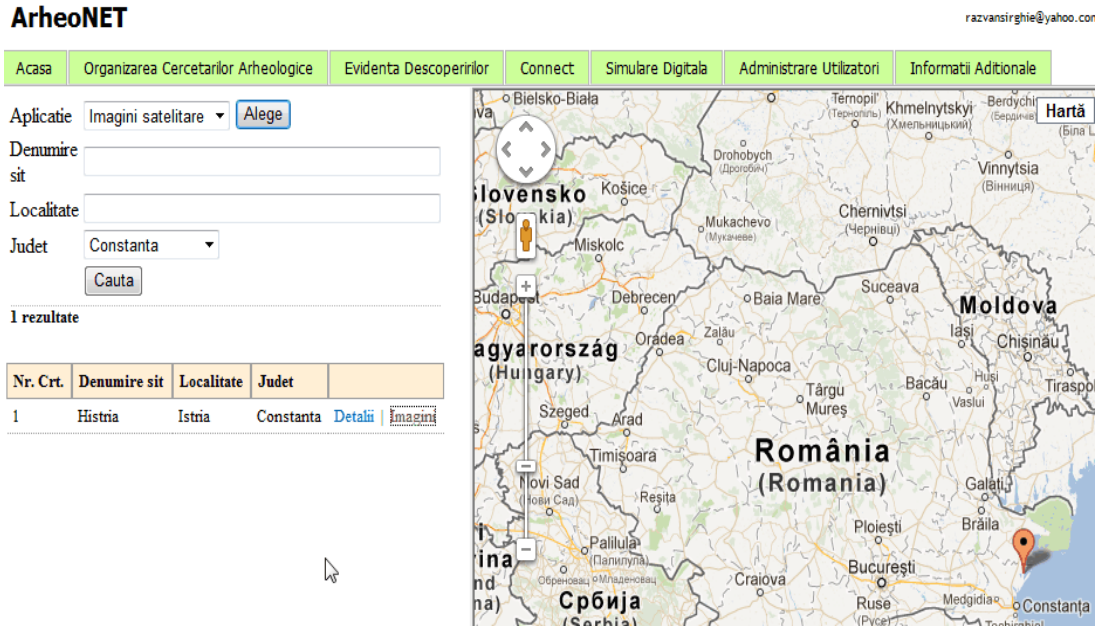

Figure 10. Display on the map of Romania of search results from the Arheosit database

The images in Figure 11 show the results of Constanta county search in the Arheosit database.

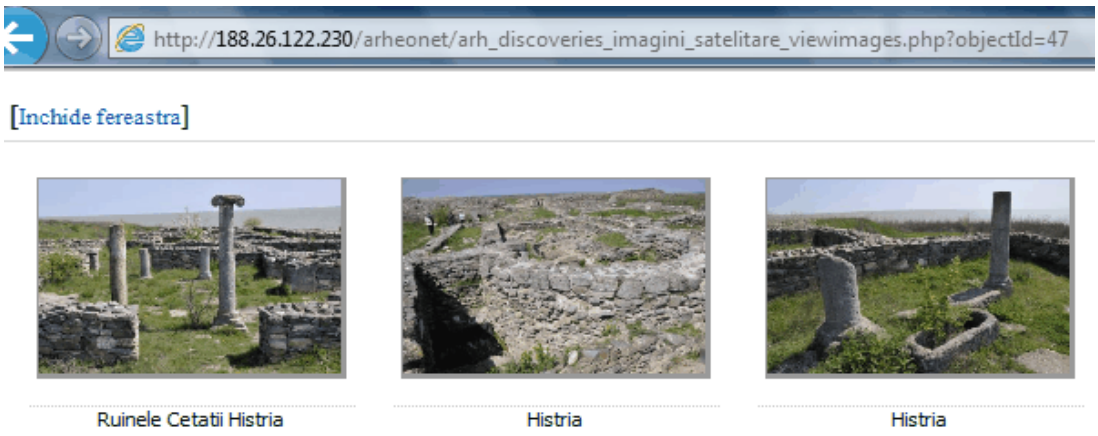

Figure 11. Images stored in the Arheosit database and displayed through the ArheoNET application

Another search criterion that the user can access is through the "Denumire Sit" (Site Name). Figure 12 displays the search results of the Sarmizegetusa site in the Arheosit database.

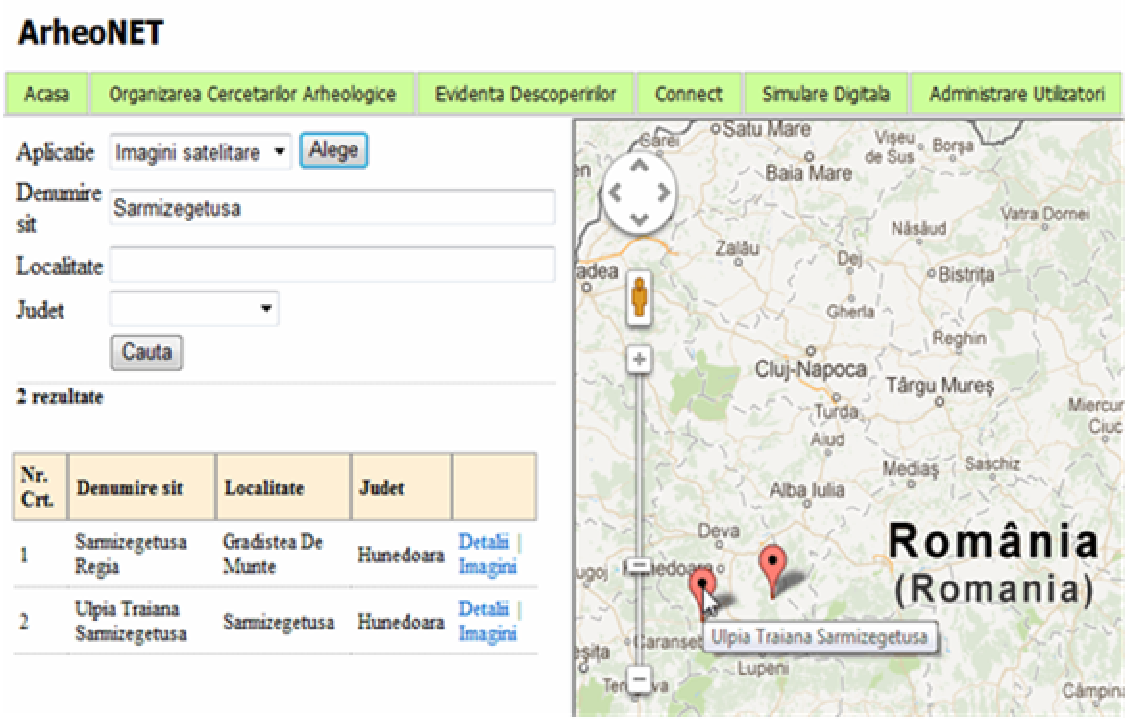

Figure 12. Display of search results from the Arheosit database using the ArheoNET application

The Arheosit application can be accessed just like the other three databases by using the "Listare din mai multe baze de date" option from the "Evidenta Descoperirilor" menu. Using this selection the users can display search results of items stored in all the connected databases. This listing option is not available to all users because it is resource intensive and time consuming in the case of large databases.

6.5. Application administration

The administration module of the application can only be accessed by a limited number of users. At this time this module is not restricted since it should be customized based on client requirements. When selecting the "Administrare Utilizatori" option from the main menu the user can choose the following sub-modules:

- Utilizatori noi (New users)
- Listare utilizatori (Listing of users)
- Rapoarte (Reports)

When choosing the "Adaugare Utilizatori" sub-module the administrator can add new users. In order to add users the following information is required: first name, last name, e-mail address,

password and type of user. The program needs all this information in order to add a new user to the database. The administrator who is adding new users has to categorize them by using the "Tip de Utilizator" option. The three types of users that are currently available are: "administrator" with full rights, "utilizator" with restricted rights and "vizitator" with read only access.

In time the list of users can grow a lot and become difficult to read. Therefore, we implemented other search options in order to allow the administrator to retrieve results that are specific to his interest.

By selecting from the main menu the option "Informatii Aditionale" the user can reach the application administrator and send his inquiries to the following e-mail address: arheonetrs@yahoo.com.

7. Theoretical and practical conclusions. Recommendations. Future of the research

Worldwide research regarding modernization of the digital techniques and technology for the analysis and organization of historical data manifests itself in a variety of ways in the period at the beginning of the third millennium. The current research paper tries to answer some of these challenges from a theoretical but mainly practical point of view. This work represents a first step in creating a series of modern methods and tools for the analysis and research in the fields of history and archeology. The current paper and research brings a new and global perspective regarding aspects of history and archeology. It does so by utilizing techniques and technologies offered by the information systems, integration of digital space and internet specific elements applied to current historical and archeological studies.

The research and contribution in this doctoral thesis can be summed up in four main phases. The most important thing considered when developing this research was finding the best way for one application to integrate a large volume of data with different typologies, architectures and a variety of historical and archeological models. As a result, the analysis phase was very important and was also the longest and most labor intensive one due to the variety of principles that form the basis of current historical and archeological research.

The next phase was building the structure of the database and software application considering the vast area of study, starting from archeological data that has a certain structure and characteristics and covering data from the medieval era. The implementation using real data and testing phases of the application were the most difficult ones due to the variety of the database types, time periods, structures and typologies used. If the Roman era was covered by data from private databases, artifacts and buildings specific to Romania and integrated with astral symbols specific to a longer period of time, the medieval area was covered through types of data that are referring to important people of the time. This was done in order to demonstrate the efficiency that the ArheoNET application can offer

when selecting data from the enormous amount of information published on the internet. The originality of the research is evidenced by the development in the following areas.

Designing the ArheoNET application

The basis of the design for this application was the study of current archeological information systems like: ArcTron, Oxford ArchDigital and the Galileo Siscam technology. After studying their modules and sub-modules and performing an analysis and comparison we developed the first theoretical concept and draft plan of the application. During the development of the application we had to add and change the initial draft in order to address and overcome challenges that rose from connecting to the other databases that this application communicates with. Its current structure, organized in modules, allows changes and additions to current programs in order to easily update the information or to allow further improvements requested by the users.

Application and database development

The development of the application had as a starting point the idea of allowing easy input of data for discovered archeological objects. The various categories and typologies used in order to precisely categorize archeological objects as well as the interrogation methods for the databases make this application unique. Besides creating the modules regarding the input, change and search of data we considered that it would be useful to have modules related to legislation, archeological site organization, dating and prospecting methods as well as system administration. The characteristic of relational database is provided by the connectivity between the various tables which also offers the possibility of using the same categories and typologies in various windows for data input. The platforms used for the implementation of the system did not require special licenses. We used open source software like Apache for the web server, MySQL for the database and PHP for programming. Using the Google Map program for the map display on the two applications (local and godaddy.com) required two licenses but these were free as well. Utilizing these platforms and reusing some of the application modules already implemented is a frequently used technique for such multifaceted systems.

Connecting the application to external databases and performing searches

There are two kinds of external databases that the application can connect to: private and public. After studying these databases that are used by other applications we had to implement data security measures in order to avoid attempts of deleting or changing items that are stored in them. The private databases have a different structure than the internal database. In order to provide a similar display of information that belonged to these other databases we had to implement special data conversion programs.

Significance of the ArheoNET application for archeology

The originality of this system is given by the fact that it aggregates several applications offering the archeologist or user not only the ability to input, change, delete and search the local database but also retrieve information from remote databases. Due to this feature the users do not need access to the other systems and they can view data from various applications on one screen.

Significance of the ArheoNET application for history

Placing discovered objects into common categories and typologies is a very difficult and controversial issue nowadays. On a worldwide level there is no consensus regarding a universal typology of discoveries from a chronological or classification point of view. In this application we defined our own categories and classifications. From a linguistics point of view we still need to reach consensus.

If this system is used to inventory archeological objects from new research as well as those already found in museums or storage facilities a special module could be added for bar code scanning in order to monitor the location of each object. Currently we have standalone scanning devices and smart phones that have special applications for scanning that would just need to be connected to this application.

In order to increase the speed, make the work on site more efficient and collect data in real time a good development for this application would be to make it available on mobile devices like iPhones, Smartphones or tablets. This would allow real time access to the discovered objects and they could be placed on the map with their exact coordinates and images taken right from the collection sites.

Virtual libraries will become the main source of information and communication between users and the world of data regardless of the era that we want to connect or communicate with. We will have the opportunity to describe historical events, using reliable primary or secondary sources of information, in order to describe and illustrate historical evolution. Even more, it will allow the authors to describe and view different interpretations of the same historical event.

As a summary, the ArcheoNET software application can view and interact with components from various databases. This is a great tool for historians and archeologists who can implement a new method for storing and preserving the historic past. The advantage here is that it does not require huge physical space for the storage, maintenance and preservation of data.

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