Spanish Christian Sacred Sites: from library to interoperability Web Services (WMS – WFS).

Creation of an Interoperable Information Layer on Spanish Christian Shrines

Barral, A.B. (1), Ballari D. (1), Bernabé M.A. (1), Castejón M.T. (1), Manso M.A (1), Owens J.B (2).

(1) Grupo MERCATOR (Universidad Politécnica de Madrid) (2) Dep. of History (Idaho State University)

This study has a double purpose. On the one hand, the setting up of a database with geographical reference to the catholic shrines within the territory of the current Spanish State, and on the other hand, the availability of a layer of information -accessible and able to be visualized from a map server in accordance with OGC- which will show the location of these shrines and allow access to the information contained in the database associated to each one of them. Based on cross-information with other layers which show other phenomena taking place in the same territory, this purpose will facilitate the analysis of spatial relations in connection with the shrines, not studied previously.

The study describes the setting up of an Access database with information on 750 shrines, basically originated from two main sources [1] [2]. This part of the work, to which two persons devoted more than a year, managed to identify and geographically locate 92% of the shrines by means of their longitude and latitude.

Due to the fact that the purpose was to use this information within a GIS context, the database corresponds to a relational type, with the creation of different charts completing the information. In order to facilitate GIS queries, we have tried to reduce the attribute for each shrine to a single word, and these can be found in a chart of Controlled Words, from which a Thesaurus of terms related to shrines can be generated.

The incorporation of the database with geographical reference to a Geographical Information System allows appreciating spatial patterns associated with the establishment and development of devotional shrines, and this technique provides the analysis of these subjects with a precision that other studies have lacked so far. Later, as the database with geographical reference was available, a web map server was created, by means of the tool Open Source MapServer, a layer which would show the information on shrines in an interoperating way and which would enable visualization, having as base map any of the layers available: Maps 1:200.000, 1:400.000, 1:800.000 of Spain from the Ministry of Defence, the CTOPO30 layer, the MDT of Spain, shades in 25m/pixel format, the altitude layer with hypsometric inks as well as a collection of maps of the time where the information of the database could be displayed.

The design decisions, in terms of the elements of generalization employed, are heavily influenced by the scale of maps that appear on a computer screen. For example, when we enhance the points at which shrines are located, we have to pick up a symbol size which will be visible but will not create overlaps among nearby shrines. In terms of rivers and roads, we have had to simplify their lines, by reducing the amount of details, in order for these lineal entities to be clear.

Finally, the interface designed tends to facilitate the use of the WMS tool to those persons who use it for the first time. Also, particular/special attention has been paid to the ergonomics of the product presented.

KEYWORDS

Spatial Data Infrastructures, Christian Shrines, Geographic Information System, Metadata, Open Geospatial Consortium, Web Services, Web Map Server.

INTRODUCTION

The aim of the present study is to show the schema used in the process of creation of a database on Spanish catholic shrines currently in the territory of the Spanish state and, by using this database to build a web map server (WMS) in conformance with the OGC specifications, making the visualization and access to the available information on the shrines feasible. In addition, this service will count on search and information retrieval tools associated to point geometry representing the location of the shrines through the Internet.

In this study three distinct stages are described for the attainment of the objective:

- The first stage consists of the search, validation and contrast of the available information on Spanish shrines. In addition, in this process a thesaurus on this subject, non-existent up to the present time, has been generated. This thesaurus facilitates searches and cataloguing of information regarding Spanish catholic shrines. This stage ends with the development of a database in Access wherein as many as possible numbers of spatial-temporal, cultural, iconographic and cartographic attributes of the shrines are stored.

- The second stage consists of the transformation of the Access base content into a spatial database. The main drawback of the initial database is not being capable of direct use for a type GIS desktop application or the Internet. In this second part, a methodology has also been defined that facilitates the work of creation of metadata associated to the stored information about the shrines. The metadata created in this process shall be conformant with the ISO 19115 Standard [3] and Dublin Core Metadata [4], so that they may be used in the environment of the ECAI project [5]. In view of the fact that both historical and geographic information are being described, a methodology has been defined in parallel allowing to create, as automatically as possible, metadata conformant with the ISO 19115 Standard. This way those metadata will be stored in Metadata Catalogue Web Services conformant with OGC [6]. They will be used in WMS' through the Internet in an interoperable form with other sources of geo-spatial information also available in the Web.

- In the third stage, two ways of using the results of that database are presented, one through a traditional GIS and another one through a GIS in the Internet, with emphasis in the latter. The creation of a OGC-compliant map server [7] presenting the historical information in a geographic context is an initiative that leaves the way open to the finding of new relationships, not yet analysed between the shrine information layer and other geo-referenced information layers which are distributed in difficult-to-access, remote servers or with unusual information for the historian

The study ends with a short section of references and the acknowledgement to the supporters of this study.

FIRST STAGE: SEARCH, VALIDATION AND CONTRAST OF THE INFORMATION. CREATION OF THE DATA BASE

The process of creation of the shrine database was developed according to the following schema:

1. Search and acquisition of information
2. Contrast and validation of the information

Search of information. The sources from which the textual data of the database have been obtained come essentially from the following texts:

- *Diccionario de Historia Eclesiástica de España* (Dictionary of Church History of Spain), very difficult to locate in view of the scarcity of existing copies. [2]

- *De los Santos a María: panorama de las devociones a santuarios españoles desde el principio de la Edad Media hasta nuestros días* (From the Saints to Mary: an Outlook of Veneration to Spanish Shrines from the Early Middle Ages up to the Present), whose localization was not difficult. [1]

- *Diccionario Geográfico, Estadístico e Histórico de España* (Geographic, Statistical and Historical Dictionary of Spain), less important but of great help to contrast information in case of divergences. [8]

Optical exploration. The information was turned from a paper format into an electronic format with the aid of a system of Optical Character Recognition (OCR), editing and arduously handling the text, in view of the number of sentences in Latin, the use of archaic terminology and the Roman numerical dating, inducing the OCR to errors.

Quality control. In order to contrast and verify the information, the data coming from the sources were checked by a confrontation looking for repetitions (duplicated registers by different dedication names, toponymy discrepancies and syntactic errors).

Shrine coordinates. The UTM coordinates of the shrines have been compiles by the authors of this study starting from MTN 25, MTN 50 and the Digital Map of the Army (*Carta Digital del Ejército*). In some cases it has not been possible their localization in that mapping and it has been necessary to turn to expeditious approach methods. It has been necessary to homogenize this information, by using *CAMGEO* software of coordinate transformation, so that it might be visualized later through a WMS.

Graphic Data. The data introduced comprises: administrative borders, hydrography, communication routes, population centres, altimetry and a digital terrain model. They were obtained from three essential sources: CNIG [9], Intopsa and DITyC (UPM) [10], in different formats (*Microstation* or *ArcView*). All data were united in the same Reference System (UTM. Huso 30N. ED50)

Thesaurus. A thesaurus, i.e. a collection of words with synonym terms, dependent and hierarchical relationships making up a normalized and controlled vocabulary, is used to store and facilitate information retrieval. In view of the lack of a specialized controlled vocabulary of shrines, one was developed using the programme *THSRS* [11], very easy to handle, though having the disadvantage of not accepting certain letters of the Spanish vocabulary or its orthographic accents and "tilde" over the "n".

Creation of the database. We used the *Access* application wherein a number of tables were created making up the relational database. In all tables the field *Id_SANTUARIO* was established as the main key. They are as follows:

- Table *Santuarios*, containing 36 fields with basic shrine data (ID, name, dedication type, coordinates, municipality, province, etc), main key field being the ID of the shrine.
- Table *Datos_Complementarios*, with 11 fields, expanding the previous table.
- Table *Provincias*, with 4 fields related to identification of the province where each shrine is located.
- Table *Municipios_INE*, with 4 fields that facilitate assignation to each shrine of the municipality where it is located.
- Table *Fuentes*, with 7 fields containing the description of the source(s) where the information associated to each shrine has been picked up.
- Table *Imágenes*, whose content is the image in GIF or JPEG format corresponding to each shrine, either obtained from the web or contributed by the authors. The images have a great diversity of qualities depending on the different webs of origin.
- Table *Discrepancia*, wherein the existing discrepancies between the different queried sources or between the sources and the visits made have been logged.
- Table *Tesauro*, wherein a set of controlled words, of use to carry out GIS queries, have been stored, incorporating as much as possible each field of the database to a single word identifying the field attribute.

- Secondary *Tablas*, to gather in a few terms the fields that were very extensive in the thesaurus, with varying contents:
    - Table *Periodo Histórico.*
    - Table *Fiestas_por_Estaciones_del_año*
    - Table *Generalización_de_Advocaciones*

SECOND STAGE: METHODOLOGY FOR TRANSFORMATION OF THE ACCESS DATABASE

In this section we describe the methodology used to transform the *Ms Access* database to a spatial database such as *PostGreSQL + PostGis*. In the first place we describe the limitation that the initial design of the database associated to the Spanish catholic shrines implies. In the second place we present the essential characteristic that distinguishes spatial databases from the non-spatial ones. In the third place we explain the methodology used to transform the content of the table *Santuarios* along with its relationship to a spatial database.

The end result of the first stage of the present study, we have an Access database whose structure is shown in the figure 1. The majority of the information is stored in the table Shrines. The names of *Provincias*, *CCAA*, *Municipios_INE*, *Fuentes*, *Imágenes* and *Discrepancias* between sources remain outside, as well as other ancillary tables. These tables have been worked out using optimization criteria for the schemas Entity-Relationship on relational databases. As may be noted in the design of the table *Santuarios (Shrines)*, already mentioned in the previous section, the geographic location of the shrine is available (stored) in geographic coordinates and in UTM, either using the WGS84 datum or the European Datum of 1950. This design has the advantage of not needing any type of transformation; therefore no tool of that kind would be necessary either to use the situation of the shrines in different types of coordinates with different spatial reference systems.

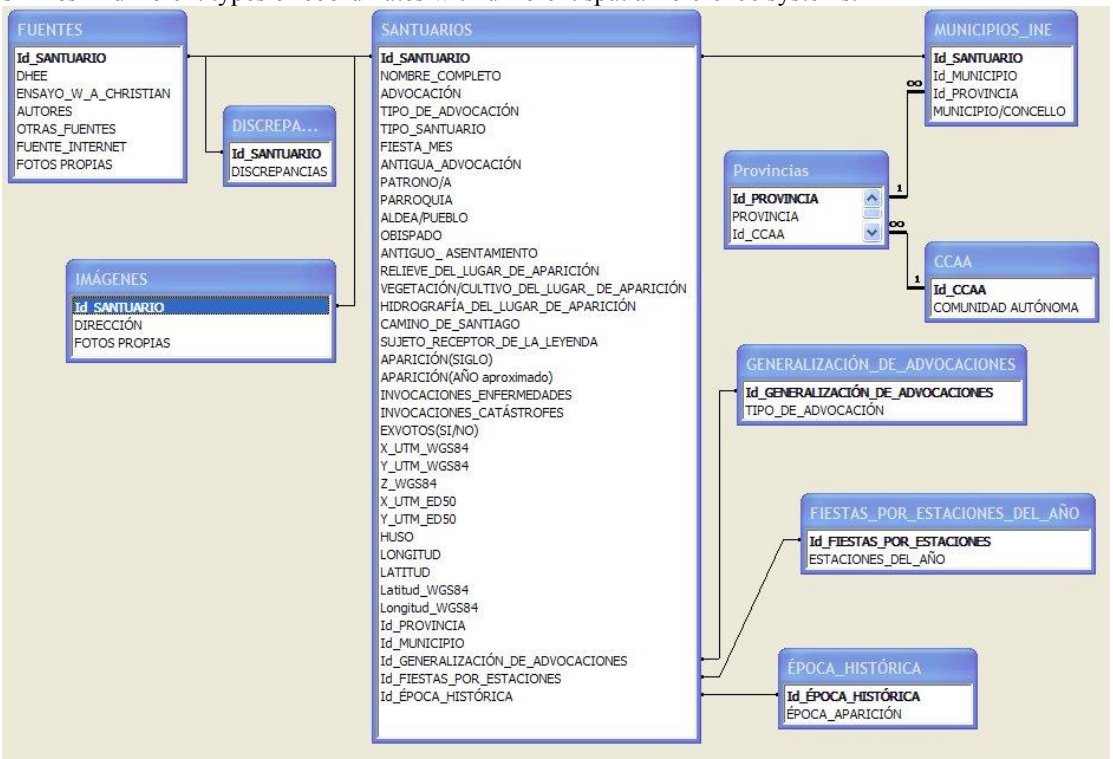

Figure 1: Schema of relationship between tables of the Shrine database

Contrariwise, the redundancy of information in databases favours inconsistencies due to partial updates of the information. Databases with spatial extensions allow storage in one single table field of the geometric information of the feature, points, lines, poli-lines, polygons or multi-polygons. This type of databases has libraries of functions and spatial operators specialized in coordinate transformation, spatial relational operations, topologies, etc., the first one mentioned being one of the

main advantages. The majority of existing spatial databases in the market, *Oracle Spatial*, *DB2*, *Informix*, *PostGreSQL + PostGis*, *MySQL* and other extensions to relational databases such as *ArcSDE* (Esri) or *SpatialWare* (Mapinfo) support the Simple Feature Specification [12]. This specification defines a text format for encoding of the geometries associated to the features under the name of Well-Known Text Representation (WKT) [13]. In this format, besides including the geometry coordinates, the Coordinate System should be identified. An example of function allowing the transformation of geometry in a text format into an internal format of storage of the PostGis database is as follows: GeomFromText('POINT (167.926 -44.675)',4326).

In order to transform the information stored in the Access database into a spatial database such as PostGreSQL + PostGis, a small application has been developed that allows: (a) to select the fields of the Access table that we want to transform; (b) to select the fields identifying the coordinates east and north; (c) to identify the Coordinate System; (d) to proceed to the exportation of the content on a text file with SQL sentences that create the table schema in the new database, insert the registers in the table and add a new register in the table catalogue containing columns with spatial geometry (PostGis geometry columns). The file resulting from this exportation may be processed (the stored SQL sentences executed) by the front end of the Database Management System (DBMS).

Next figure (2) shows the interface of the application developed:

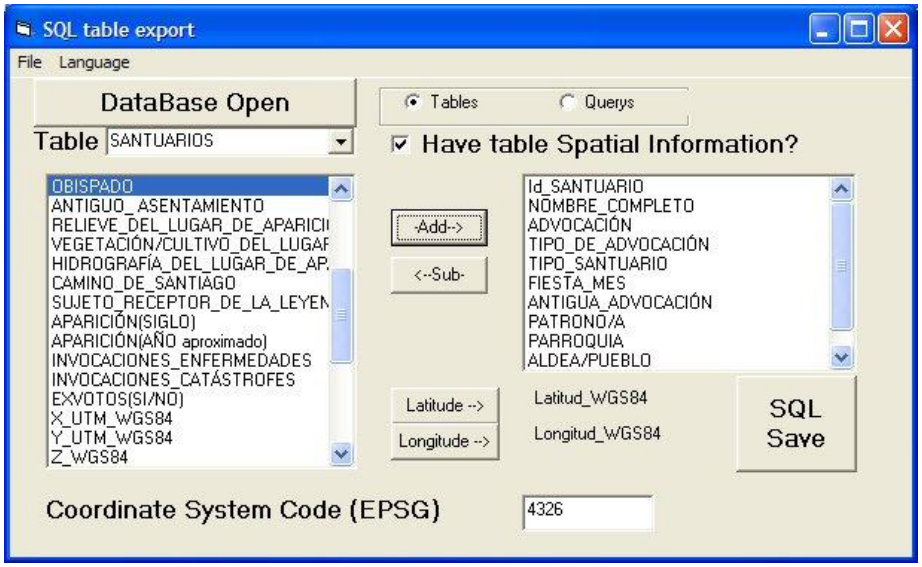

Figure 2: Interface of the transformation tool from Access to SQL PostGis

After transformation of the *Ms Access* database to the *PostGreSQL + PostGis* database, we can start using this information source as storage of data for web services such as WMS [7] and WFS [14]. Now we already have an information layer that may be used with GIS applications.

PREPARING METADATA

As we have already explained in the introduction, two sets of metadata have been created: Dublin Core format for the project ECAI and ISO 19115 NEM (Núcleo Español de Metadatos) [15] for the Spatial Data Infrastructure (SDI).

In the first place we describe the stage of analysis carried out. We have studied the content and meaning of the different fields of the database with the aim of identifying the fields of the register of destination information metadata. As a result of this study, we have two tables available, one for each type of metadata, wherein we identify and relate the metadata fields to fill in with literal texts and the tables contributing information to generate the metadata. The figures (3) and (4) illustrate the tables mentioned:

ECAI.Team	Ibero-Mundo Region
ECAI.Theme	Religion, sacred sites and religious geography.
ECAI.Notes	This dataset is a a contribution to the work of the Iber-Mundo Regional Atlas Team of ECAI
DC.Title	Santuario Romano Católico: Santuario.TIPO_SANTUARIO + Santuario.NOMBRE_COMPLETO + Santuario.ALDEA/PUEBLO + PROVINCIAS.PROVINCIA + CCAA.COMUNIDAD AUTÓNOMA + "SPAIN"
DC.Title.Alternative	Spanish Roman Catholic Shrines: Santuario.TIPO_SANTUARIO + Santuario.NOMBRE_COMPLETO + Santuario.ALDEA/PUEBLO + PROVINCIAS.PROVINCIA + CCAA.COMUNIDAD AUTÓNOMA + "SPAIN"
DC.Creator.PersonalName	Ana Belen Barral Rojo
DC.Creator.PersonalName.email	anabarral@yahoo.es
DC.Creator.PersonalName	Maria Teresa Castejon Cay

Figure 3: Table of relationships for the metadata Dublin Core-ECAI

MD_Metadata.identificationInfo>MD_DataIdentification.spatialRepresentationType	vector
MD_Metadata.identificationInfo>MD_DataIdentification.spatialResolution>MD_Resolution	1:1.500.000
MD_Metadata.identificationInfo>MD_DataIdentification.topicCategory	society + location
MD_Metadata.language	es
MD_Metadata.metadataStandardName	ISO 19115 Geographic information - Metadata
MD_Metadata.metadataStandardVersion	ISO 19115:2003

Figure 4: Table of relationships for the metadata ISO19115

From the standpoint of the Metadata ISO 19115, all shrines have much information in common: authors, purpose, date, responsible person for the data, etc. We have chosen to use the tool *GuardaMETA* to create the metadata. This tool has been developed by the group Mercator Research of the UPM [16] in order to facilitate the creation of metadata of sets, products or families of elements of a cartographic series or the elements of a set of features, as is the case of the shrines. This tool allows defining the information common to all elements only once and later to edit or import, from an external table, the individual attributes of the feature or element of a series in the metadata register. The figure 5 shows the main interface of the *GuardaMeta* tool:

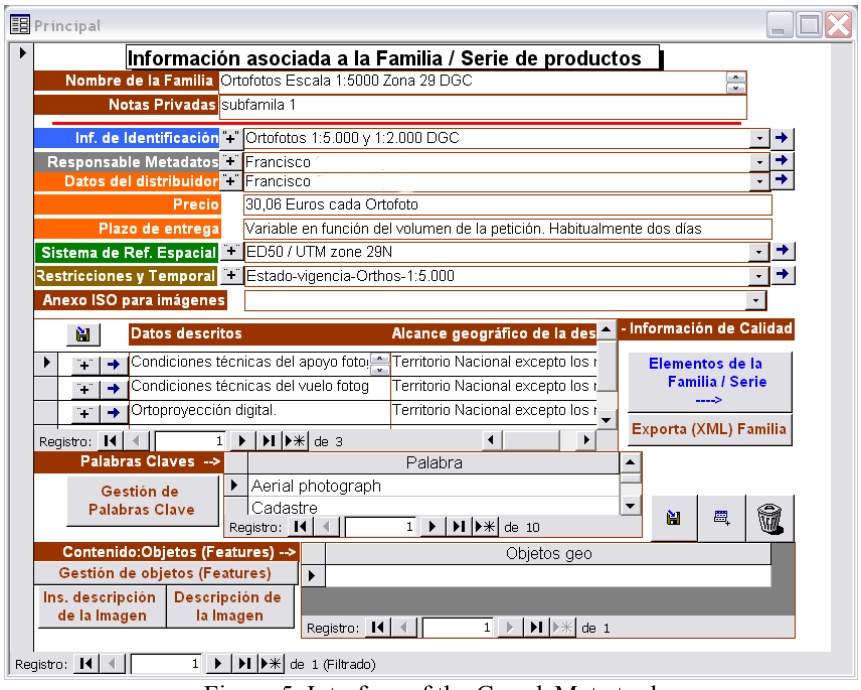

Figure 5. Interface of the GuardaMeta tool

In order to be able to use this methodology, it is necessary to have an Access table containing all the individual information of each element. That information has been identified in the stage of analysis mentioned above. In order to make out that table from the Shrine Access database, we have developed another computer application which automates the processing of information following the schema defined above to generate the new table. Once this stage finished, the whole information has been imported to the *GuardaMETA* tool, and from this time on we have 750 metadata associated to the shrines in the *GuardaMETA* database. We can now export the metadata of each shrine individually to an XML file.

For the creation of metadata in conformance with the *Dublin Core Standard*, to which some particular fields defined by the *ECAI* project have been added, we have followed a parallel methodology, though we have used a custom-designed tool. This simple tool directly generates the XML files with the metadata from the Access database.

THIRD STAGE: TRADITIONAL GIS AND WMS IMPLEMENTATION

The programme *Geomedia* was used to develop the traditional GIS. This methodology is well known, so we will only explain the implementation of the WMS.

In order to implement the web map server, the *MapServer* [17] software of the type *Open Source* [18] was used. This server had been originally developed by the University of Minnesota [19], together with NASA. At present the main actor in the development of the project is the Group DM Solutions [20], which maintains and increases its functionality.

MapServer complies with WMS Implementation Specification Version 1.1.1 of the OGC. It also complies with other OGC specifications, such as the Web Feature Server Implementation [14], Styled Layer Descriptor [21], Filter-Encoding [22], etc.

In order to create a map server with *MapServer*, the information layers the service will contain shall be defined in the configuration file "*.map [25]. For each one of them the following directions shall be noted:

- type of layer: Points, Line, Polygon, Annotation or Raster,
- directory where data or URL's of remote servers, one wants to include, are stored,
- its reference system and
- a style of visualization for each layer

In our case, a local layer was generated that was connected with the database *PostGis*, to draw the shrine point layer. An annotation layer was defined to visualize the names of the shrine (figure 6).

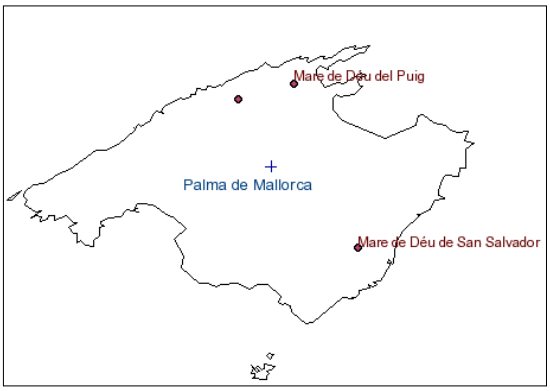

Figure 6. Point symbols of the shrines and toponymy

Figure 7. Layers and toponymy of provincial and municipal borders

Besides the shrines, different types of information were incorporated into the WMS in order to provide a basic geographic reference. Some of these layers are locally stored in the WMS server. That is the case of the provincial and municipal border layers, whereof it is also possible to visualize their toponymy (figure 7).

Other layers are requested to remote WMS servers (cascading WMS). In this case the access URL to that information layer is defined instead of the storage directory. The layers requested in this form are: topography, bathymetry, relief shading, roads, hydrography, cities and names of cities. The following is an example of access URL to a series of WMS information layers of Demis [26]:

"http://www2.demis.nl/mapserver/wms.asp?service=wms&version=1.0.0&request=GetMap&layers=Bathymetry,Topography,Hillshading&SRS=EPSG:4326&format=png&styles=,,&transparent=true"

In such cases the *MapServer* takes care of requesting the layer to the remote server and merging it with the remainder of the layers requested by the user (figure 8).

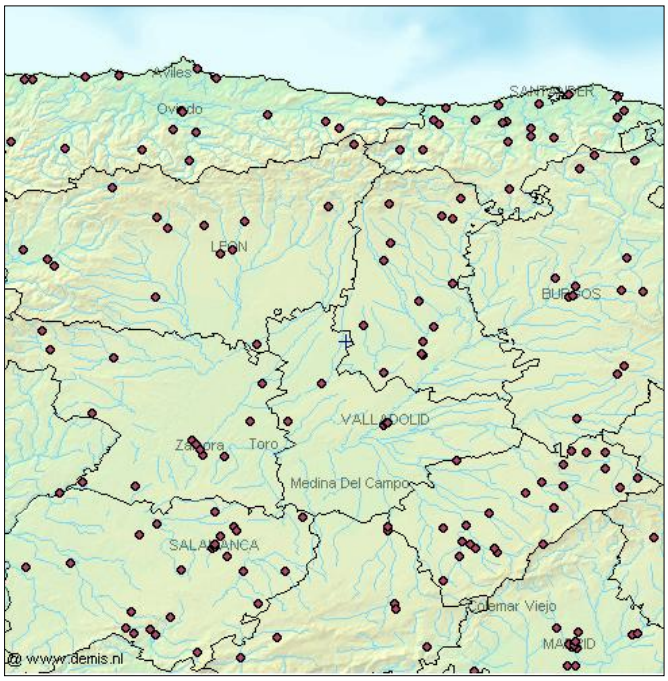

Figure 8. Joint visualization of the shrine layer and remote layers.

WEB WMS CLIENT'S FUNCTIONALITIES

The web client offers a transparent, friendly interface for visualization and query of the Spanish Shrines. The client's access URL is http://mapas.euitto.upm.es/santuarios.

The WMS client (figure 9) contains a series of tools, such as:

- The map may be zoomed in, zoomed out, recentred, etc. by means of its navigation tools. The user may select the layers to be visualized, this way creating his/her own map.
- The reference map indicates the visualized area in the general map.
- The legend shows the symbols used to represent each information layer.
- The scale bar helps knowing the map scale. The scale bar is updated with each applied zoom. Likewise the legend is also regenerated whenever a new layer is activated.

- The shrines may be consulted by selecting the query tool by a click over the shrine of interest. A window of the explorer will open with the information contained in the database on that particular shrine with its image. Queries may also be made by selecting an area on the map. The server will then return information about every shrine contained in that particular area (figure 10).

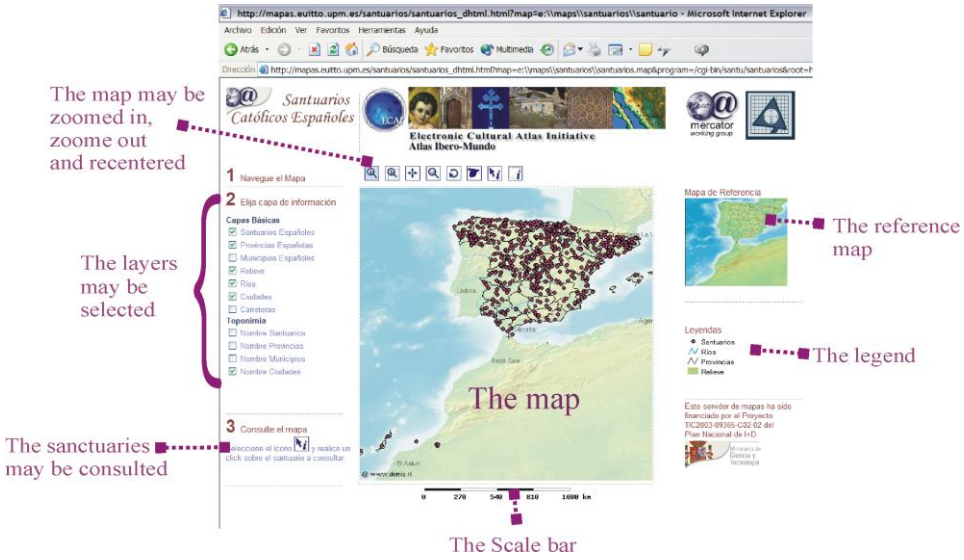

Figure 9. WMS client's interface

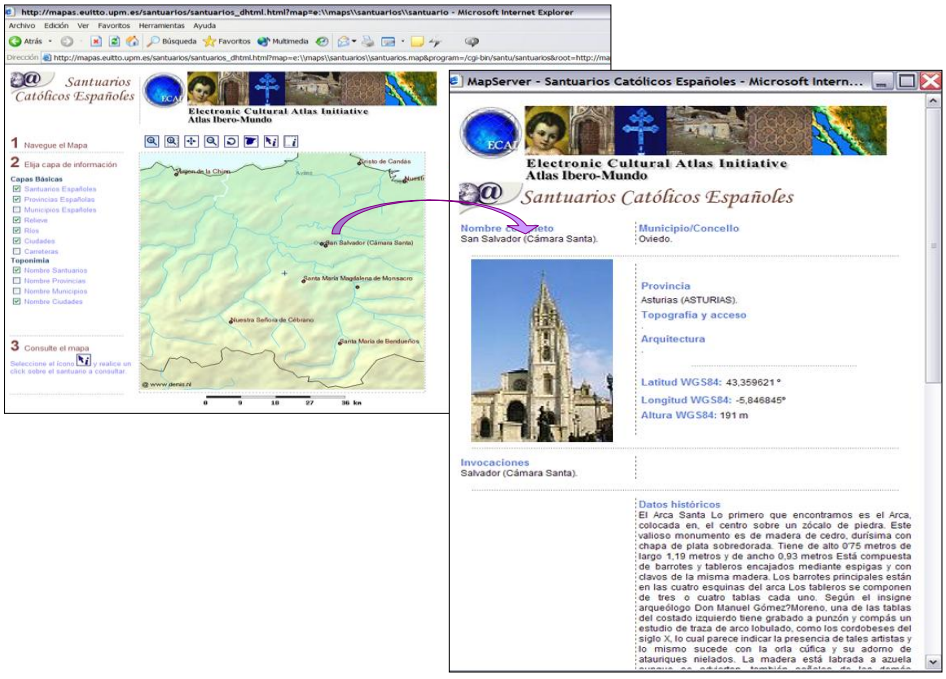

Figure 10. Query to the San Salvador Shrine (Cámara Santa)

SERVER INTEROPERABILITY

Being an OGC-compatible service, the map server of the Spanish shrines may be included and visualized as a remote layer in other WMS servers. Thus the interoperability of the service is proven. The access URL is: http://mapas.euitto.upm.es/cgi-bin/santu/santuarios?.
In figure 11 the shrines may be visualized together with the information layers of a WMS with data of La Rioja, Spain [23].

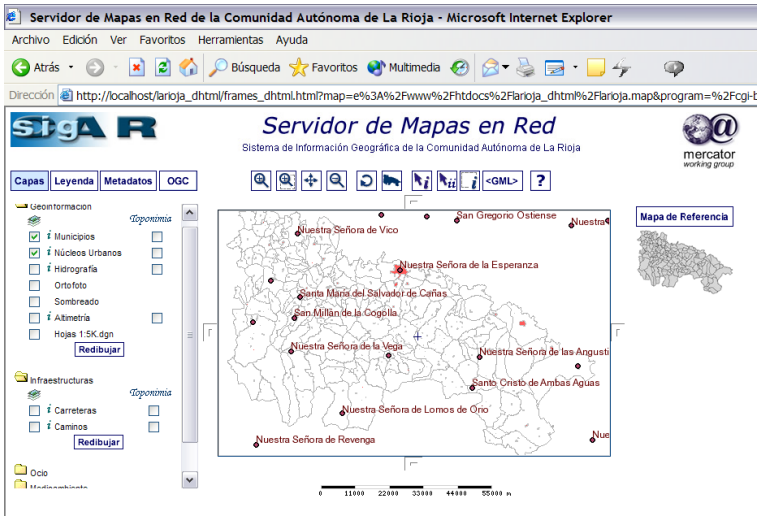

Figure 11. Interoperability of WMS of shrines with other WMS servers

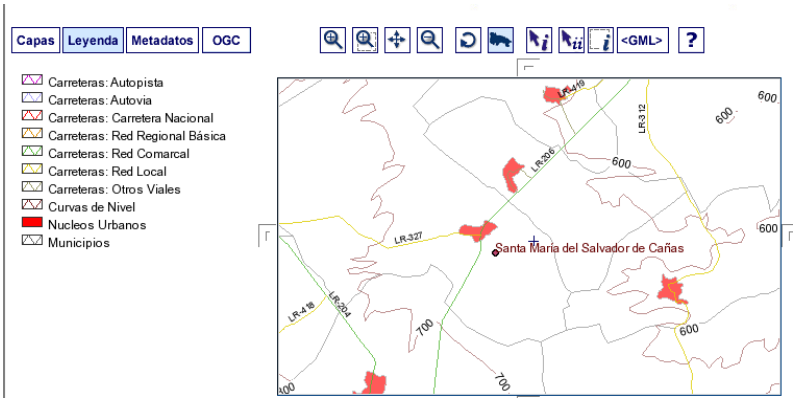

Figure 12. Visualization of shrines and their routes of access

In figure 13 the same information is displayed as in figure 11 but using another WMS client, in this instance the *Intergraph* web client [24], also conformant with OGC. Layers of the WMS server of La Rioja and shrines have been included. It may be noted that the interoperability provided by OGC specifications allows visualization of the information independently of the data formats, reference systems, platforms, WMS software, etc.

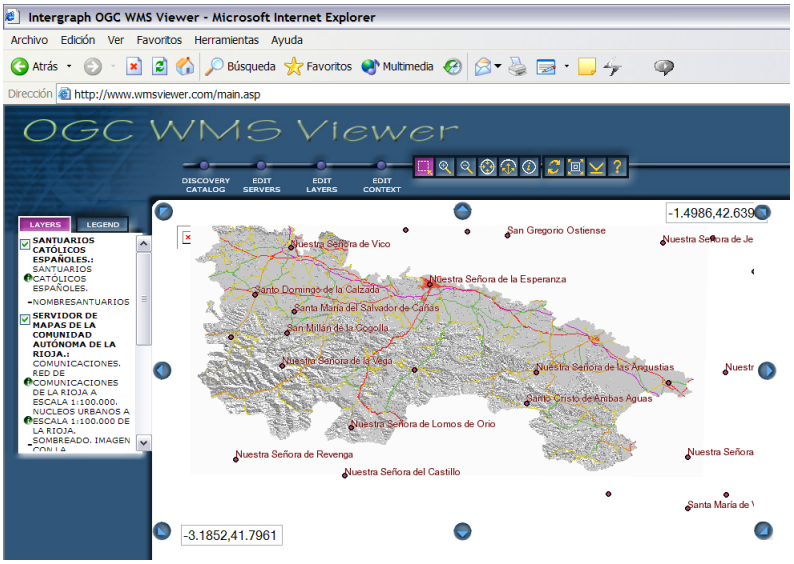

Figure 13. Visualization of shrines in Intergraph web client

ACKNOWLEDGEMENTS

The basic technology of this work has been supported by the Ministry of Science and Technology through the project TIC2003-09365-C02-02 of the National Plan of Scientific Research

REFERENCES

[1] Christian, W.A. De los santos a María: Panorama de las devociones a santuarios españoles desde el principio de la edad media hasta nuestros días. En Temas de Antropología Española. Madrid. 1976. pp. 49-105

[2] Aldea, Q., Marín, T., Vives, J., Diccionario de Historia eclesiástica de España, E. Flórez, CSIC, 4 vols., Madrid 1972-1975; suplemento, 1987

[3] ISO 19115 . http://metadata.dgiwg.org/standard/detail.htm (Visited 29/04/2005)

[4] Dublin Core Metadata Initiative (DCMI). http://dublincore.org/ (Visited 29/04/2005)

[5] Electronic Cultural Atlas Initiative (ECAI): http://www.ecai.org/ (Visited 29/04/2005)

[6] Open Geospatial Consortium "OGC" http://www.opengeospatial.org (Visited 29/04/2005)

[7] Web Map Service (WMS) OGC Specification http://portal.opengis.org/files/?artifact_id=5316 (Visited 29/04/2005)

[8] Madoz, P.: Diccionario geográfico estadístico e histórico de España y sus posesiones de Ultramar. Madrid, 1846. Ed. Pascual Madoz

[9] Instituto Geográfico Nacional de España (IGN) http://www.mfom.es/ign/ (Visited 29/04/2005)

[10] Departamento de Ingeniería Topográfica y Cartografía. Universidad Politécnica de Madrid. http://www.geo.upm.es (Visited 29/04/2005)

[11] THSRS Software http://publish.uwo.ca/~craven/freeware.htm (Visited 29/04/2005)

[12] Simple Feature Specification (OGC Spec.) http://www.opengeospatial.org/specs/?page=specs (Visited 29/04/2005)

[13] Well-Known Text Representation. http://dev.mysql.com/doc/mysql/en/gis-wkt-format.html (Visited 29/04/2005)

[14] Web Feature Service (WFS OGC). http://www.opengeospatial.org/docs/02-058.pdf (Visited 29/04/2005)

[15] NEM (Núcleo Español de Metadatos) http://www.idee.es/resources/recomendacionesCSG/MNE.doc (Visited 29/04/2005)

[16] Grupo MERCATOR. http://mapas.euitto.upm.es/grupomercator (Visited 29/04/2005)

[17] Map Server Software http://mapserver.gis.umn.edu/ (Visited 29/04/2005)

[18] OpenSource http://www.opensource.org/ (Visited 29/04/2005)

[19] University of Minnesota http://www1.umn.edu/twincities/index.php (Visited 29/04/2005)

[20] Group DM Solutions http://www.dmsolutions.ca/solutions/tsunami.html (Visited 29/04/2005)

[21] Styled Layer Descriptor https://portal.opengeospatial.org/files/?artifact_id=1188 (Visited 29/04/2005)

[22] Filter Encoding http://www.opengis.org/docs/02-059.pdf (Visited 29/04/2005)

[23] Unofficial prototype of the map server of the Comunidad Autónoma de La Rioja. http://mapas.euitto.upm.es/larioja (Visited 29/04/2005)

[24] http://www.wmsviewer.com/main.asp (Visited 29/04/2005)

[25] MapServer configuration file . http://mapserver.gis.umn.edu/doc40/mapfile-reference.html (Visited 29/04/2005)

[26] Demis http://www.demis.nl/home/default.htm

ADDITIONAL REFERENCES

Atlas de España. El PAÍS-Aguilar. DIARIO EL PAIS, S.A. Madrid. 1992.

Beiley y Gattrel: Interactive Spatial Analysis.

Carmona Muela, J.: Iconografía de los Santos. Istmo. Madrid. 2003.

Carta Militar Digital de España.Vector-Raster. Edita Ministerio de Defensa. Secretaría General Técnica. 2000.

Euro-Guía Ilustrada del Viajero. ESPAÑA Y PORTUGAL. Plaza & Janés. Barcelona. 1992

García Lázaro, Francisco J.: Los Modelos digitales escalares en Geografía Humana. Tesis Doctoral admitida en la U.N.E.D., en curso elaboración. Páginas 106, y de 113 a 116.

Guía CAMPSA: http://www.guiacampsa.com

Luque, I.; Gómez Nieto, M.A : Diseño y uso de Bases de datos Relacionales. RA-MA. 1997

Mapa Oficial de Carreteras de España del 2003 (edición 38). MOPU.2003.

Méndez Rodríguez, E.M..: Metadatos y recuperación de información. Trea. Gijón. 2002.

Montes, J. Mª: Libro de los Santos. Alianza. Madrid. 2001.

Oliver de Moraliane: Pequeño Diccionario de Mitología Vasca y Pirenaica. 1995.

Ponz, A.: Viaje de España (1772-1794). Madrid. 1947.

Programa CAMGEO: Instituto de Cartografía de Andalucía. Consejería de Obras Públicas y Transportes, Junta de Andalucía.

Publicación Electrónica del I.N.E. Padrón 2003 (Explotación estadística y Nomenclátor a 1 de Enero de 2003). I.N.E. 2003.

RENFE: http://www.renfe.es

Ruiz Bueno, D.: Actas de los Mártires. Madrid. 1987.

Vorágine, J. de la: La Leyenda Dorada. Alianza. Madrid. 1982.

VV. AA. Guía para visitar los santuarios marianos. 17 vol. 1992.

AUTHORS INFORMATION

Ana Belen Barral Rojo
anabarral@yahoo.es
Polytechnic University of Madrid.

Daniela Ballari
daniela@euitto.upm.es
Polytechnic University of Madrid.

Miguel A. Manso Callejo
m.manso@upm.es
Polytechnic University of Madrid.

Miguel A. Bernabé Poveda
ma.bernabe@upm.es
Polytechnic University of Madrid.

María Teresa Castejón Cay
tcastejon@mimosa.pstic.mec.es
Polytechnic University of Madrid.

Owens, J.B
owenjack@isu.edu
Idaho State University