KNOWLEDGE OF THE TERRITORY:

A DATABASE WITH USER FRIENDLY INTERFACE

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The problem

Knowledge of a geographical area is performed through heterogeneous means such as:

- **cartography**
- **aerial photos**
- **remote sensed imageries**
- **descriptive texts**

The way to link these means to the area is not homogeneous.

Linking documents to related territories

CLASSIC APPROACHES

The most common method to relate *maps* to specific land areas is to use toponomastic references and to publish a union chart for maps made up of many sheets.

This method has drawbacks because:

- **the regular grid of the maps doesn't pay attention to geographic boundaries**
- **only the most important locality is referred**
- **the names of the localities may change during time**
- **the importance of the localities may change**
- **the names may have different spellings in different languages**
- **the indexer may have a different system of valuation than yours**
- **the locality that you are interested in may be on more than one sheet**

Linking documents to related territories

CLASSIC APPROACHES

Aerial photos **are generally referred to in terms of the coordinates of the axis of the photo (or strip of photos) and its width (expressed in Km).**

This method is suitable for trained people, but rather troublesome for common users.

The plan of the flight is reported on a topographical basis of the land area.

Linking documents to related territories

CLASSIC APPROACHES

The considerations made for aerial photos also apply to *remote sensed imageries*.

They are normally referred to by means of a coded path and row numbers of the satellite.

The passages of the satellites are generally reported on a specific chart.

Linking documents to related territories

CLASSIC APPROACHES

We pointed out that each kind of information needs a *concise report* that must be consulted to access specific documents.

In particular:

- **the reports use different methods to refer to land areas**
- **they must be available for inquiry at user sites**
- **the user must be acquainted with the different access keys**

Linking documents to related territories

OUR APPROACH

We designed a Database containing documents of different kinds, stored in tables with different structures.

Each document is provided with a geographical description.

Then documents are made up of:

- ***a traditional textual part*, with variable attributes depending on the kind of the document (it can be queried in the normal way)**
- ***a geographic part*, that specifies the boundaries of the land area which the document relates to. This geographical attribute is common to every kind of document.**

So it is possible to access documents of different kinds in a uniform way.

We called the documents *"Information Entities"*.

Linking documents to related territories

OUR APPROACH

The simplest way to fulfil an inquiry using the geographic information is to look for

intersections

of the land area the user is interested in, with the geographical boundary of documents.

Inquiry areas can be dynamically defined through coordinates.

Linking documents to related territories

OUR APPROACH

We also defined an information layer containing the *"Referential Entities"* i.e. an archive of most commonly used inquiry areas, each provided with its name and geographical boundary.

The kinds of the referential entities depend upon the users' needs.

Typically they may be:

- **local administrations**
- **natural parks**
- **health departments**
- **orographic basins**

The structure of the database

We followed the standard methodological steps:

- **analysis of user requirements**
- **conceptual design**
- **logical design**
- **physical design**

The *analysis of the project* was conducted under the directives of the

“Centro Interregionale di coordinamento e documentazione per le informazioni territoriali”

an organization responsible for documentation exchange between Italian Regions about land information.

The structure of the database

The *conceptual schema* was developed using a CASE tool (IEW by Knowledgeware).

We experienced:

- **its effectiveness in sharing the information within the development team;**
- **its usefulness in getting readable documentation;**
- **its lack of implementation of IS-A hierarchies which necessitated making some design choices even at a preliminary phase.**

The implemented prototype

Information entities:

- ***maps*, constituted by adjacent sheets**
- ***aerial photos* (single shots or stripes)**

Referential entities:

- ***administrative boundaries* (comuni)**

Utility information:

- ***names and addresses of firms* involved with maps and photos**
- ***places* where documents are available**
- ***corporations* who are owners of the documents**

The implemented prototype

Data are organized on a regional basis but information of different regions may be collected in order to:

- **supply the central administration with a global view**
- **share information with neighbouring regions**

The implemented prototype

Three main operating environments were developed:

- **the *database managing* environment provides functions to:**
  - **input new information**
  - **modify/delete existing information**
  - **update maps (make historical copies)**

- **the *inquiry* environment provides facilities for:**
  - **geographical query,**
    started by the name of a piece of referential information
    based on intersection of areas
    requires a specific exit routine
  - **hierarchical query, suitable for experts on the topology of the land**

The implemented prototype

- **the *graphic enquiry* environment:**
  - **is a quick interactive enquiry tool**
  - **shows a simplified topological map of the region**
  - **shows the localization of land areas pertaining both to information and to referential entities**
  - **allows an easy visual definition of inquiry areas**

The implemented prototype

The technical environment of the prototype was constituted by an IBM compatible Personal Computer 80286 equipped with:

- **extended memory of 2 Megabytes**
- **hard disk of 40 Megabytes**
- **colour monitor**
- **Enhanced Graphic Adapter (EGA) card**
- **three key mouse**
- **MS-DOS ver. 3.0**
- **ORACLE ver. 5.1B**

The managing and enquiry environment were implemented using ORACLE FORMS with a large use of triggers to support non-skilled users.

The graphic interface was developed using Microsoft C and ORACLE's Pro*C.

The implemented prototype

The analysis of user requirements and the system tuning were conducted in collaboration with the Regione Lombardia that acts as beta site for the system.

The interest was mainly in *cartography*.

So far the database has ben made up of a small number of aerial photos and of:

- **15 regional maps, composed of**
- **about 700 sheets**

Conclusions

The experimentation showed that our approach leads to a system with a good degree of applicability to heterogeneous data involving land areas.

We chose:

- **to relate information to territory using *pertinent rectangles* and**
- **to use *rectangle intersections* as query items.**

We suspect that a more accurate definition of the boundaries of the items:

- **would involve too expansive system overheads,**
- **would be useless when operating with the graphic interface.**

Conclusions

Our approach seems to work well enough as regards to:

- **uniform management of data from different sources**
- **simplicity of input of data**
- **dynamic definition of referential areas**
- **visibility of information from outside the environment it was developed for**
- **information updating problems (no need for indexing)**

Future work

The main developments will be in the upgrading of the graphic interface.

The main topics are:

- **visualizing images associated with documents**
- **overlaid graphic visualization of retrieved documents boundaries**
- **possibility to memorize selected documents (notebook)**
- **definition of boundaries which are more accurate than rectangles (?)**
- **connection of a DOS station to a mainframe running ORACLE**
- **new implementation of the graphic interface using X protocol**