



EXPLANATION OF G.I.S. PROJECT “ALAMEIN” FOR WEB PUBLISHING

Compilato: Andrea De Felici

Rivisto:

Approvato: Daniele Moretto ARIDO’S President

Versione: 1.0

Distribuito: 28/06/2013

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1. **INTRODUCTION**

The issue of this document is to describe the main features of a generic G.I.S. system and to show the benefits of this computer tool in managing the main themes of the ARIDO project, showing data sources, working procedures, the current status of the project and its possible future development.

In this document we tried to use a plain and understandable language, suitable for a generic web page.

These notes are only a draft version and it could be updated with additional examples.

2 WHAT'S A G.I.S. SYSTEM?

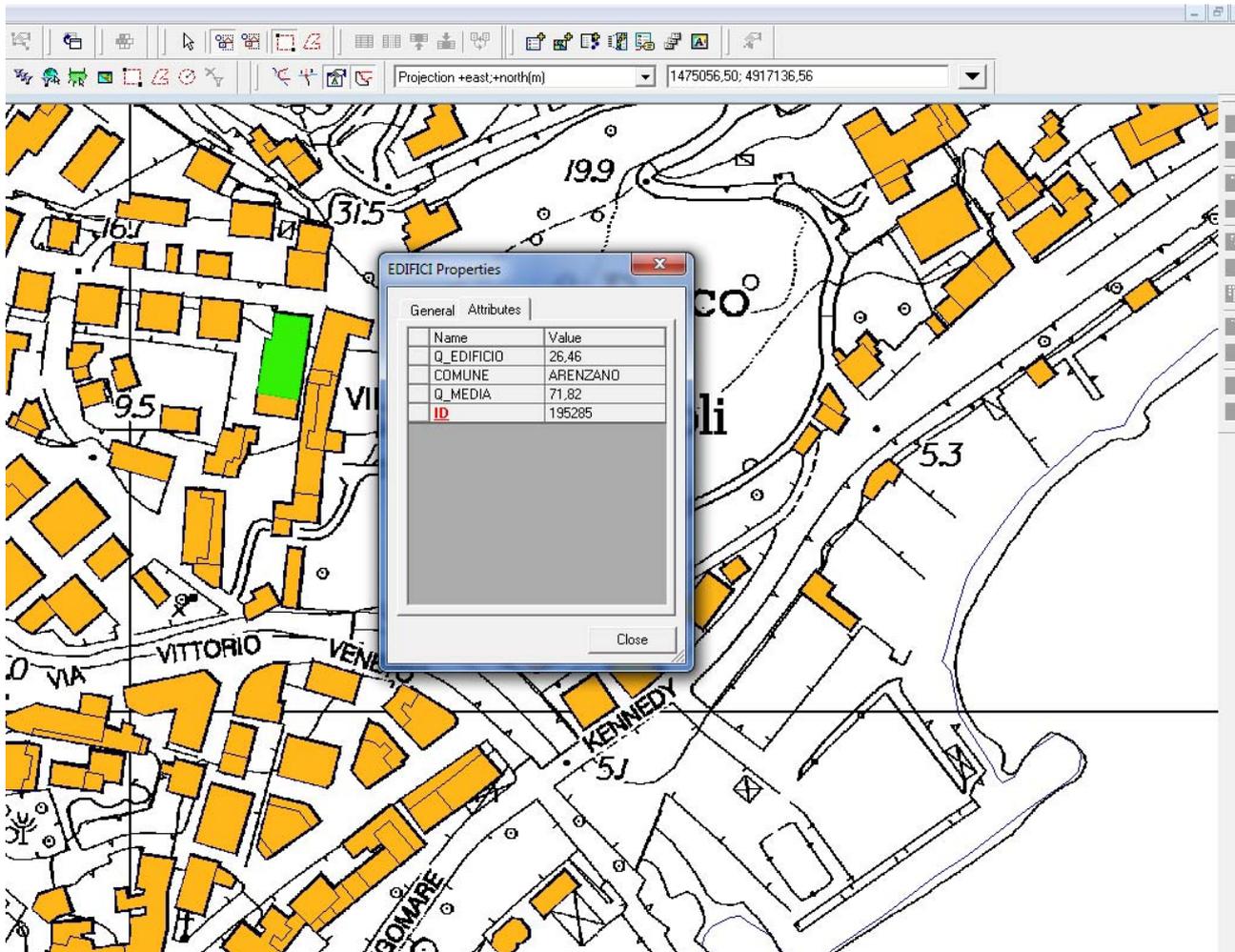
We can say it's the new frontier in studying and managing the territory.

The main problem in the past was that the only map was not enough to gather and manage all the informations available for given geographical area or subject and you had to refer to other sources (i.e. books, magazines, etc.), for example:

"...we are interested in a certain castle, represented by a symbol on the map: the map itself can only tell us about castle's height and name; no other information are available on the map ... if we would know anything about castle's age or owner or view some of its pictures, we should use other sources of information..."

These problems can be ride out using a G.I.S. system, allowing us to integrate in the same software environment all kinds of geographical information, such as maps, satellite images, aerial photos, digital terrain models, together with alphanumeric data (registry tables, hyperlink to some pictures, etc.), all linked to the objects present in the digital map.

With this kind of softwares you can simply click on the object you choose on the screen to know all the information related to it, as you can see in the picture below:



..the building selected (the green one) shows all its features in a G.I.S. environment...

Moreover, you can do much more with a G.I.S. :

- Perform complex queries, using both geometric and alphanumeric criteria (i.e. highlighting on the screen all the buildings between 25 and 40 meters tall, which are 250 m far from the railway and less than 50 m far from the shoreline..)
- Creating and printing maps at the proper scale
- Drawing new geographical objects, integrating pieces of information coming from different sources
- Place correctly on the ground old scanned maps, or satellite images (“georeferencing objects”)
- Collect and update geographical data related to map objects
- Etc ..

So, we're not using a simple holder of geographical data, but an advanced tool allowing every geographic feature to have "topological properties", that is every object is "conscious" of its position in relation to the other objects present in the map.

Owing to their great potentiality, G.I.S. systems are widespread since the sixties, in every branch of territorial planning, including public administrations, military, scientific and environmental authorities, and so on. Even today, G.I.S. systems are considered the main informatic tool for territorial analysis.

Needless to say, to exploit this tool efficiently, you have to use only affordable and updated information, otherwise you could achieve wrong results, no matter how modern and powerful the software you are using is!

So it's of main importance taking care of your geographical data, trying to update them as often as possible.

3 **“EL ALAMEIN” GIS PROJECT**

During past years expeditions in the battlefields and contacts with many people, ARIDO association collected a huge number of geographical data about the Western Desert, such as hystorical maps, aerial photogrammetries, GPS surveys, photos of relics, reports and so on...

Such informations, for their abundance and diversity in terms of precision and sources could be fully exploited just within a G.I.S. project, which also represent a sort of “challenge” for the project, because of the wide diversity of the data available.

To start with, the first decision was to choose a G.I.S. software that was both powerful and free and the best answer was to use Quantum GIS (www.qgis.org), 1.8 release. Quantum GIS is an open source software well supported by many developers and capable of ever increasing and updating features.

The second choice was to establish the most appropriate geographic reference system for our cartography: since data missions are mainly collected with GPS devices, we decided to choose the World Geodetic System 1984 (WGS84) – UTM projection, UTM 35 – North zone, that is to say.

The third step was about the adoption of a suitable geographic database to store our data: “ESRI Shapefile” - “DBF” was our temporary choice, for its ease and because it’s a sort of standard for geographic data exchange. Anyway, due for its limits it will be replaced with the powerful (and harder to manage!) open source geographic database named “PostGIS / PostgreSQL”.

After that, we started to insert some preliminary informations in the G.I.S. system, selecting the most representative ones among the huge quantity of data, in order to test the effectiveness of our G.I.S. system.

As for that, we loaded some GPS waypoints collected during the survey that lead to the discovery of the P40 relic, owing to their importance within the project.

To import any geographical data into a G.I.S. project you have first to convert them in “geographical entities”, actually “logical categories” used in G.I.S. environment to classificate geographical objects of the real world. These entities are characterized by certain features, particularly “geometry type” (polygon,line, etc.) and “attributes” (non – graphic data linked to the object, such as “name”, “age”, and so on...).

Object of the real World are represented by simple geometries in G.I.S. environment



**Object:
TANKS**



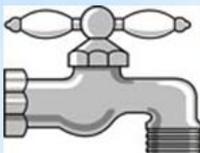
Area



**Object :
PIPELINES**



Line



**Object :
TAPS**



Point



Example of “geographic categories” and their geometric representation in a G.I.S. system

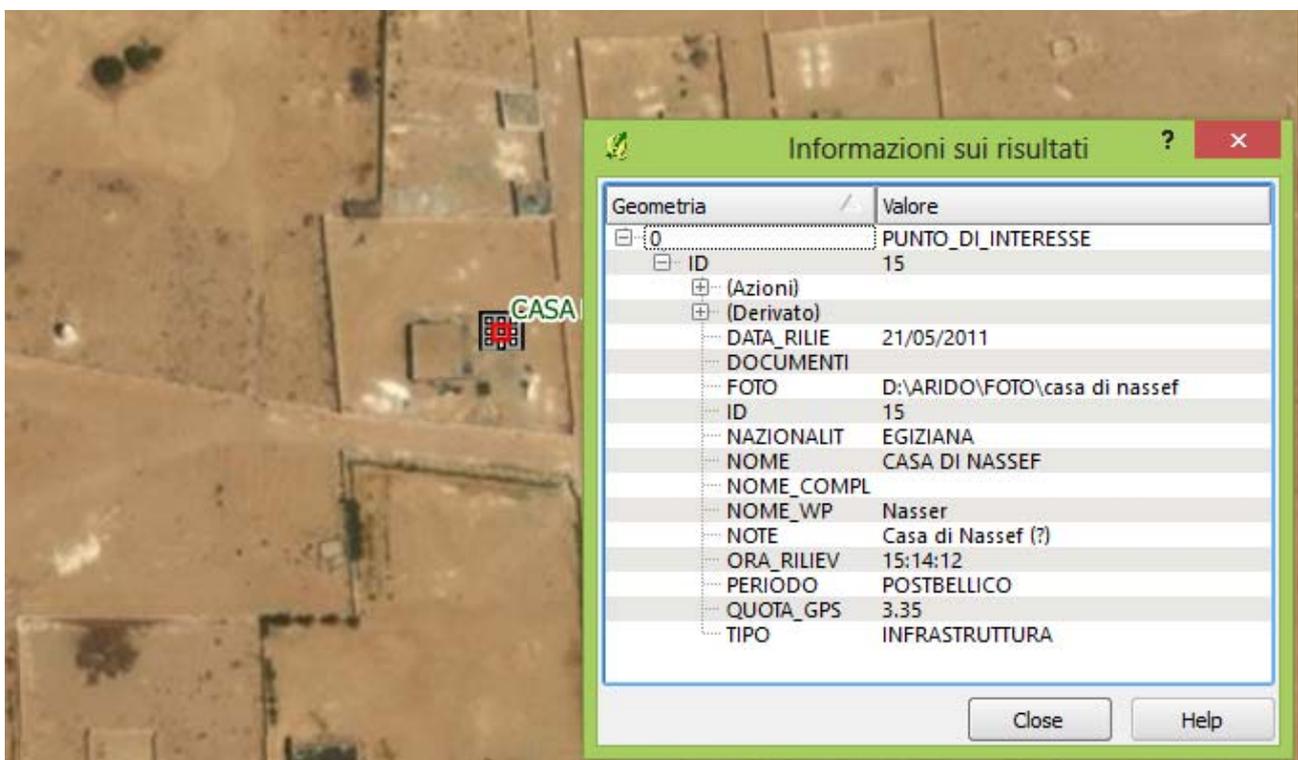
A careful analysis of our data (mainly GPS waypoints) led to the creation of the following geographic entities:

ENTITY NAME	GEOMETRY
CIMITERO_AREA	AREA
CIMITERO_PUNTO	POINT
PUNTO_DI_INTERESSE	POINT
POZZO	POINT
TRINCEA	LINE
OSPEDALE	AREA

This is to be considered a temporary list, to update step by step, every time we run into new kind of geographic information in the course of this project.

The next step was to populate the G.I.S. system with the informations linked to that waypoints, using the following procedures:

- Object placement, by means of automatic process (in case of point geometry) o drawing it “by hand” (in case of other type of geometry)
- Concurrent addition of the attributes of every geographic object (name, height, nationality, unique identifier , etc..).



Example of attributes input while drawing “punto_di_interesse” entity (source: GPS data) using QGIS software with “Google Earth” background

Depending on geometric type of each object, we followed a different procedure in acquiring the entities:

POINTS: all these objects were simply inserted by a G.I.S. automatic process that draw the point from GPS data.

AREAS and LINES: also these kind of data are formerly GPS waypoint (hospitals, cemeteries, etc.), but they have also many other informations linked to that, such as

their planimetry. It's difficult to insert that planimetries into G.I.S. environment because that data are not georeferenced (i.e. there's no correspondance between the vertex of every shape and their actual geographic coordinate), anyway it was possible to draw them into G.I.S. environment as "poligons" or "polylines", exploiting a particular G.I.S. feature that allows to load in the project satellite images from Google and Bing services, so it was often easy to recognize the objects' shape immediately "on the ground".

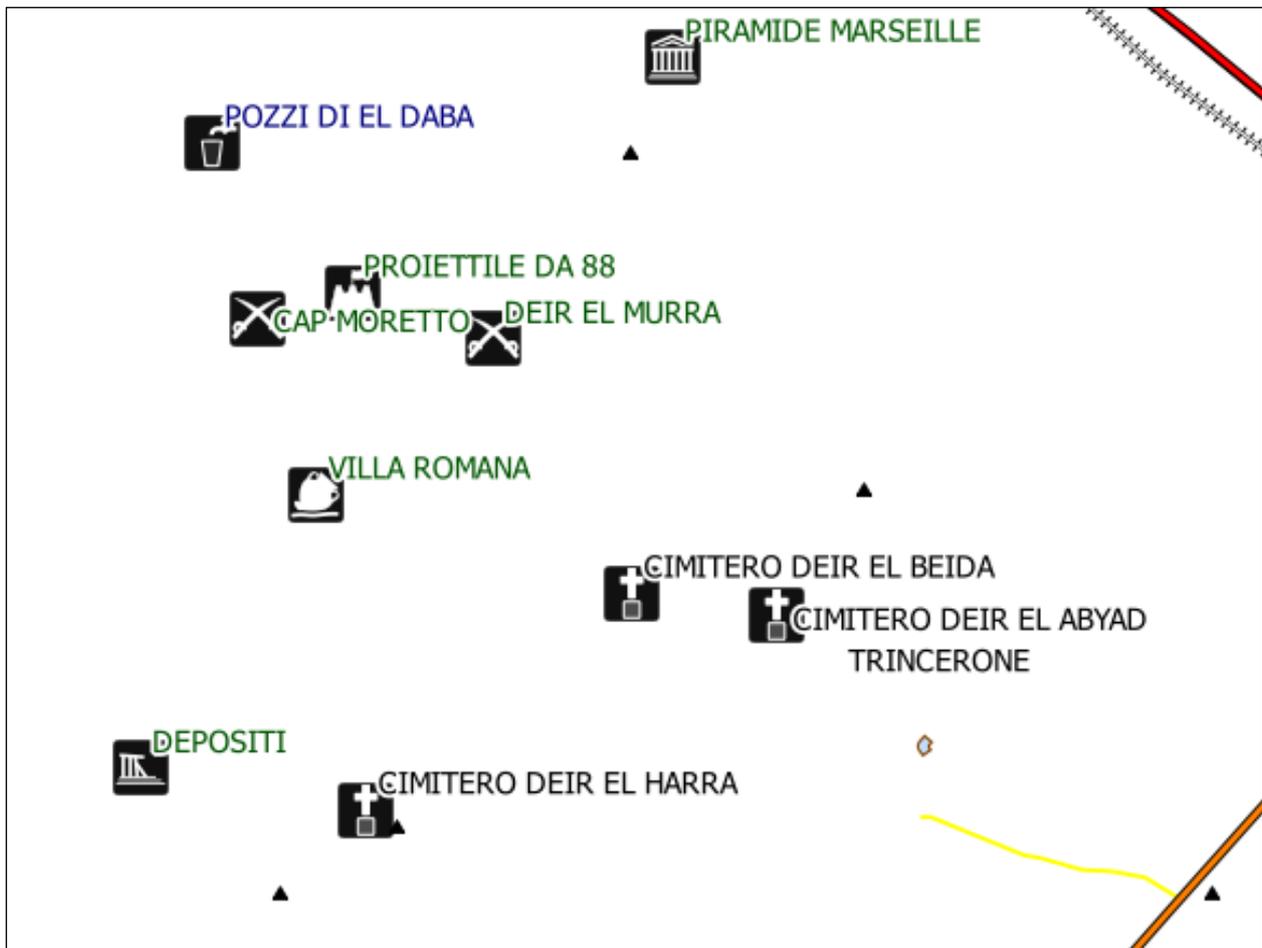


Example of drawing an "areal cemetery": you can realize its shape checking it on BING satellite images

This is a temporary solution, anyway, owing to the lack of precision in "georeferencing" BING and Google Earth satellite layer, leading to unaccurate positioning of our geographical objects (several tens of meters of difference between the drawn object and its real location).

For this reason, we're planning a new method of surveying that geographic features for next expeditions.

After this first “data capture” phase, we tried to achieve a prototype of “thematic map”, appointing a proper symbol to each geographic element. For this purpose, we took advantage from the symbols’ library supplied by Quantum GIS.



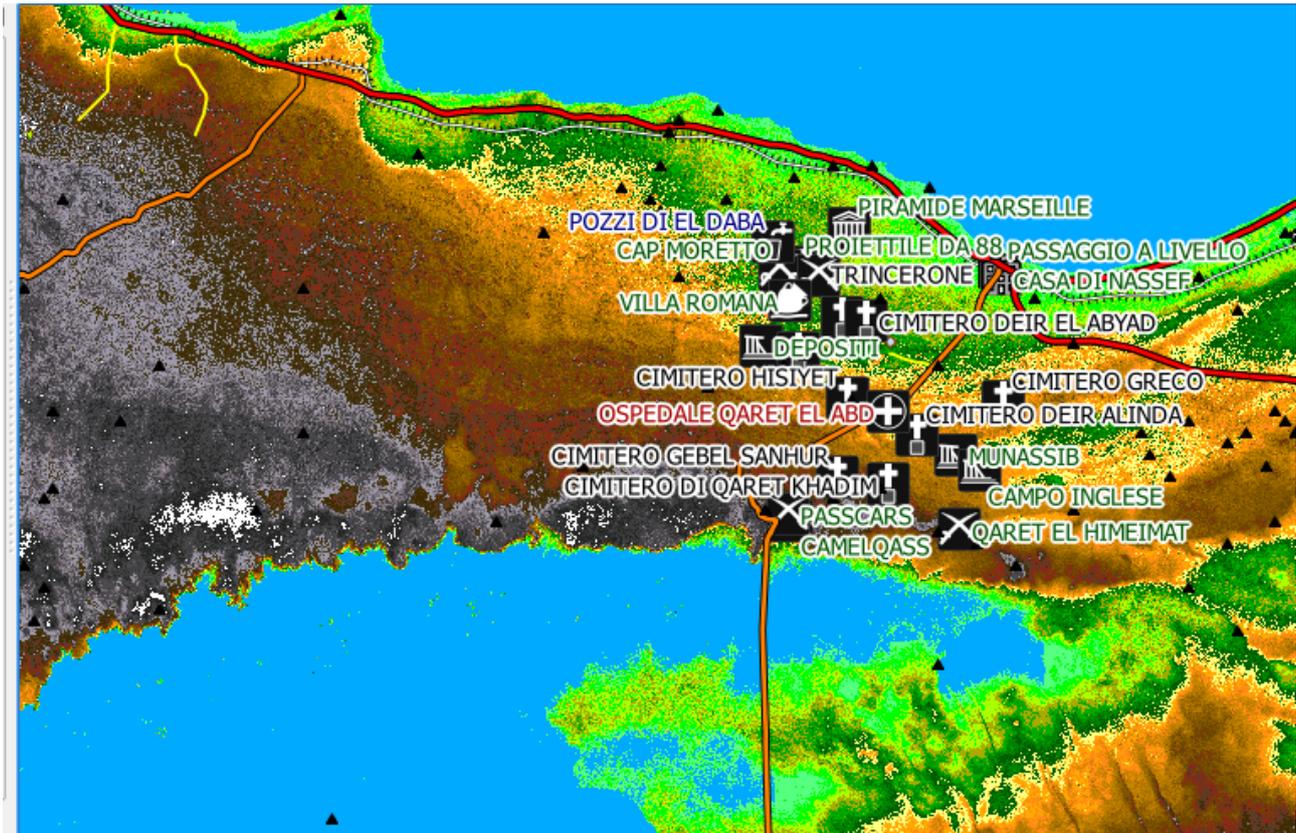
Example of symbology chosen to represent several GPS waypoints in Quantum GIS environment (you can also see roads and railways on the right)

To complete the geographical background of this G.I.S. project, we resorted to several territorial data about El Alamein area available on the Web for free, such as:

- Landsat 7 satellite imagery at medium resolution (www.landsat.org)
- Digital Terrain Model (20 m of resolution) from ASTER satellite data (several NASA sites and United States Geological Survey)

- Road network and other informations available at “Open Street Map” (from several sites, such as: <http://garmin.openstreetmap.nl/>, <http://www.openstreetmap.org/>, etc..)

That data were not only simple background, in fact the Digital Terrain Model was used as input to generate the aspect map of our study area.



The area of interest with the Digital Terrain Model (source: ASTER satellite mission) in background: the different colours are dependent on the height value (you can see the “El Qattara” depression down in the picture)

Our G.I.S. project is further developing; the next objectives are the following:

- To insert further significant GPS waypoints from past expeditions
- To georeference over 200 aerial frames from an August 1942 Italian reconnaissance over the battlefield, by means of a technologically advanced “Image Processing” software
- To acquire and georeference scanned historical maps

- To improve the initial database and migrate the data previously stored in Shapefile structure towards a PostGIS spatial geodatabase
- To perform spatial data processing and printing thematic maps
- To create a WebGIS project (?)



Example of preliminary overlay of an aerial photograph, dating 1942 (near El Alamein station) in our G.I.S. environment

Summary: the project is at its beginning, actually and it will request a lot of task and enthusiasm from us all!