SINERGISE

Giselle WebGIS
Desktop Editor

1   GENERAL OVERVIEW

The client GIS application is used for maintenance of the database (for instance LPIS, Cadastre,…). Although it does not need to be installed on the client machine (it is executed using Java™ Web Start), it functions as a full-featured desktop application.

Main application screen contains several panels and dialog areas. In general, application screen (looking at Figure 1) is divided to Map view panel (1), Layer control panel (2), Options menu (3), Query functions and tools menu(4), Query Locate results panel (5), Case management panel (6) and additional panels for any specific application (7).

Figure 2: LPIS client application, displaying several selected land parcels, overlaid on orthophoto imagery. The panel on the left displays all parcels for a selected farmer.
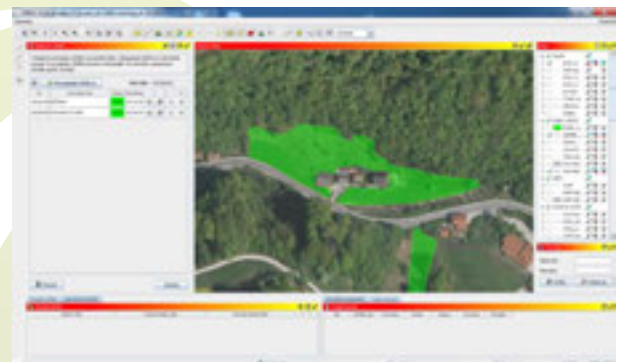

Figure 3: another LPIS cleint application, displaying selected parcel, overlaid by an ortophoto imagery.
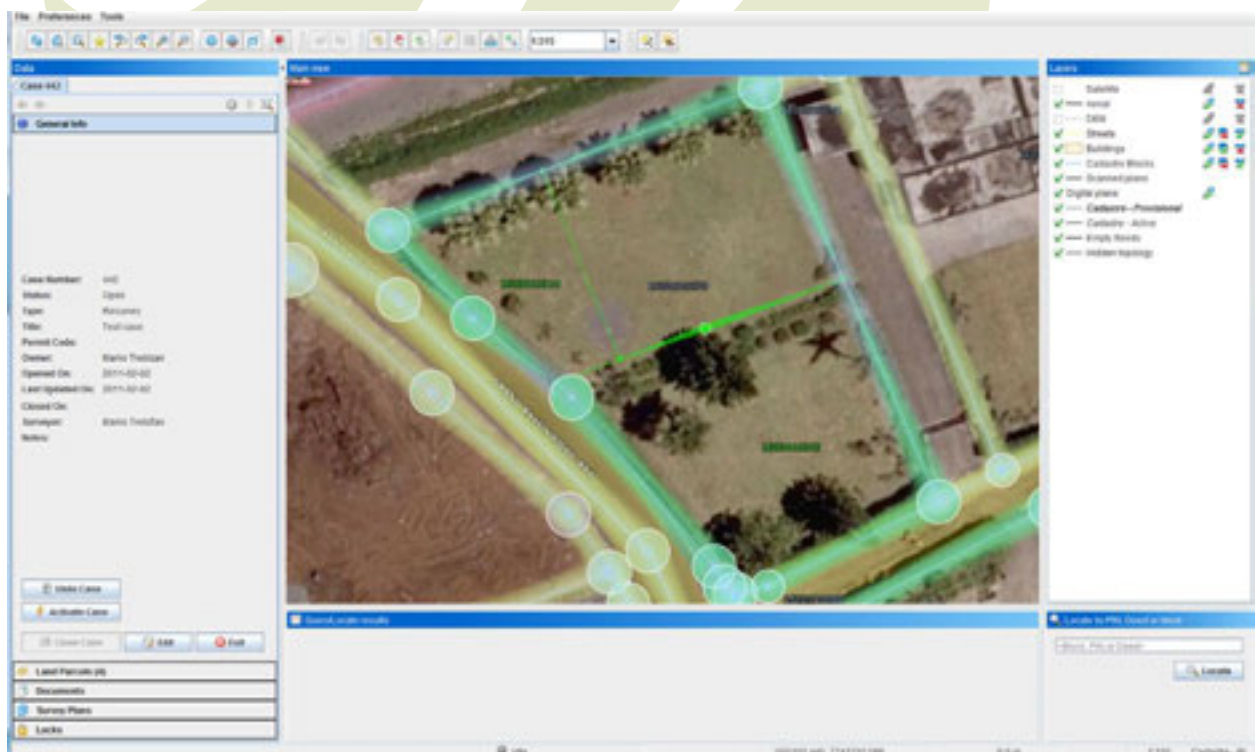

Figure 1: an application for editing and maintaining cadastral data, displaying parcels, ortophoto imagery and case magamenet panel.

2.   MAP VIEW PANEL

The map view panel always shows the latest information from the database and reflects any changes made in the user interface.

User can interactively change its extents by using functions like:

- zoom in/out (by rolling the mouse wheel forwards to zoom in, rolling mouse wheel backwards to zoom out)
- setting an area of map view to zoom to (zoom using box): by clicking once to define top left corner of the area to zoom to, then still holding the left-button down, drag open a box to the bottom right of the area to zoom into and release

- clicking and and holding the right mouse button down and drag the map view – as an interactive pan/scroll
- zoom to full extend of selected features
- map can be positioned on a specific grid reference, by choosing upper left and down right point of the map window or by choosing the coordinates of center of map

Map view supports all allowed layers, raster and vector spatial data, including ortho-imagery and satellite imagery.

Figure 4: map view displaying three different kinds of data: on the left is ortophoto, in the middle raster spatial data and on the right vector spatial data.

3. LAYER CONTROL PANEL

The Layer Control allows users to control the display and appearance of the map/view display. It lists all the layers relevant to application, as shown below, in the order of display (that is the satellite/ortophoto data are displayed first (bottom), with the other enabled layers drawn over (top). If layer is checked, it is shown on the map, otherwise it is hidden.

Figure 5: Layer control contents for two different applications: on the left is a cadastral application and on the right is a LPIS application with more layers

3.1. Layer Panel options

All the layers that the user has permission to access are automatically displayed in current session. User can change the order of the layers or otherwise costumise the outlook of layer panel (delete or rename for current session). User defined combination of layers and display styles can be stored either on the server or on the local computer and the next time user runs application previous settings are be displayed. Also, setting can be restored to default configurations.

User can define many settings for a particular layer, for instance setting minimum or maximum scales at which a layer is visible (Figure 6)
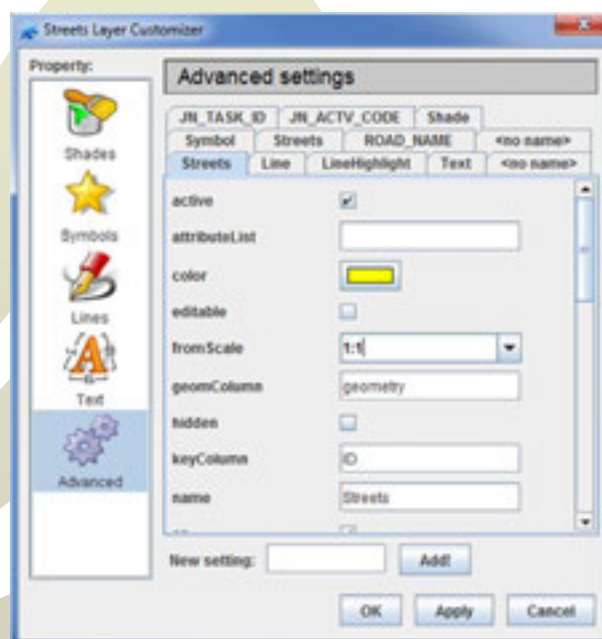

Figure 6: advanced setting for layer, where user can set on which scales layer is visible, among other things.

Only one layer may be "selected for query" at one point. The layer is made "selected for query" by clicking on the name and is shown in bold, un-setting the one that was previously in this state. On Figure 7, right example is RABA_SDO the selected layer for which the generic query functions will apply.

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- whether a layer is turned on or not (if it is not turned on, it is hidden)
- what the layer looks like (colour, etc.)
- the layer's name representation
- whether the layer is enabled
- whether the layer is shaded or not
- whether the layer's labelling is on or not

Figure 7: Layer control functions: if checkbox is checked, layer is turned on. Color shows how elements of the layer will be shown on map. If the name is bold, layer is selected for query. The first icon (1) shows enabling/disabling drawing of line boundaries, second icon (2) shows enabling/disabling shading of layer features and third icon (3) shows enabling/disabling of text annotation.

Figure 8: individual layer lines, shading and text labelling.

Most shaded layers are normally transparent to allow them to be seen over the base aerial ortho-photography and each other. User can define levels of transparency for all layers (vector and raster).

Labels only display at certain scales that they are configured to show at.

Clicking right on the layer name (of some layers), brings up a general menu for that layer manipulation:

- zoom to the whole loaded extent of the layer (to see all the information of the layer; note that maximum drawing scale may prevent the layer from being rendered in the resulting view)
- zoom to the maximum layer scale (maximum scale at which the layer will be rendered)
- rename the selected layer (in your own session)
- delete the selected layer (from your own session)
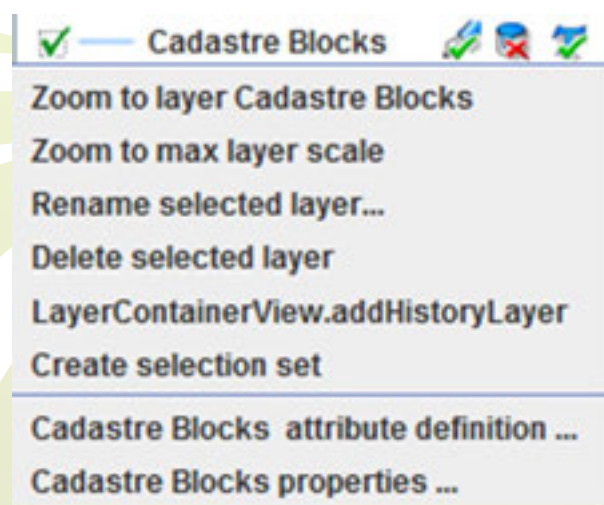- create a selection list for objects in that layer

Figure 9: Layer control information

The possibility to define new editable layers and to have full access to its definition is also considered a basic functionality of the system. Adding a new layer requires little more than the definition of a new table in the database or connecting to an existing one. All basic data structures (text, numeric, date, time and logical field types are supported)

3.2. Layer symbol settings

User can apply his own styling to all spatial datasets (Figure 10). Basic options include:

- color selections for lines, symbols (edge and fill color) and shades,
- translucent and transparent fill style (for all vector and raster layers),
- choosing colour according to entity (Figure 10 b)
- different options for point symbols (Figure 10 a) ; some symbols are predefined but users can also import their own SVG or PNG images;
- text color with glow (Figure 10 c)
- transparency of any symbolisation type (line, symbol) can be adjusted to any desired level
- features inside a single layer can have different styles – any style setting such as colour, line width, etc. can be read from the database. This enables advanced styling methods such as chloropleth, proportional or graduated symbols, and labels.
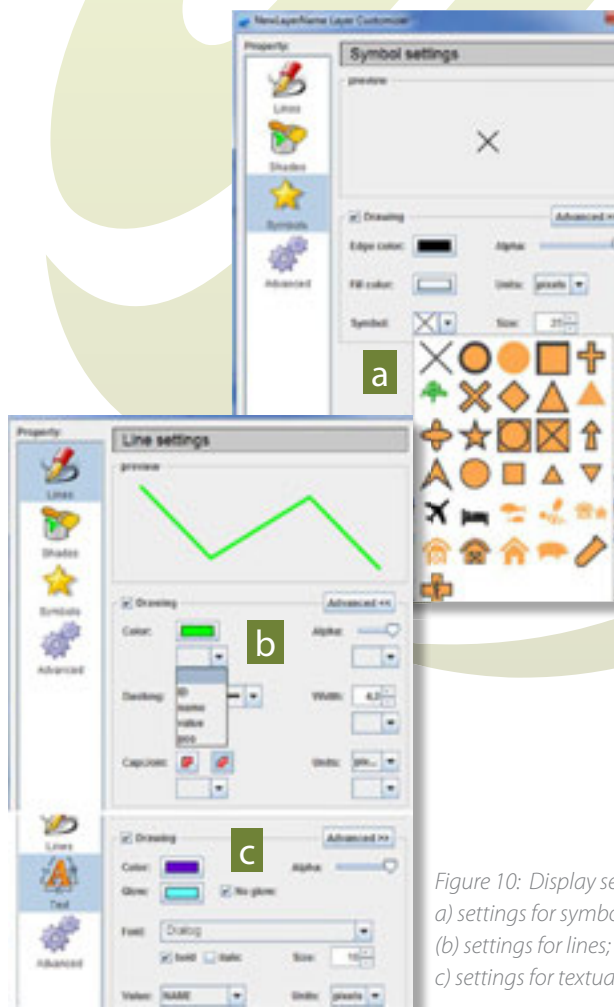
3.3. History layers

User can also make a historical recordings of a layer, for any time. Historical parcel boundary data can be maintained indefinitely and user can monitor changes on any spatial dataset.
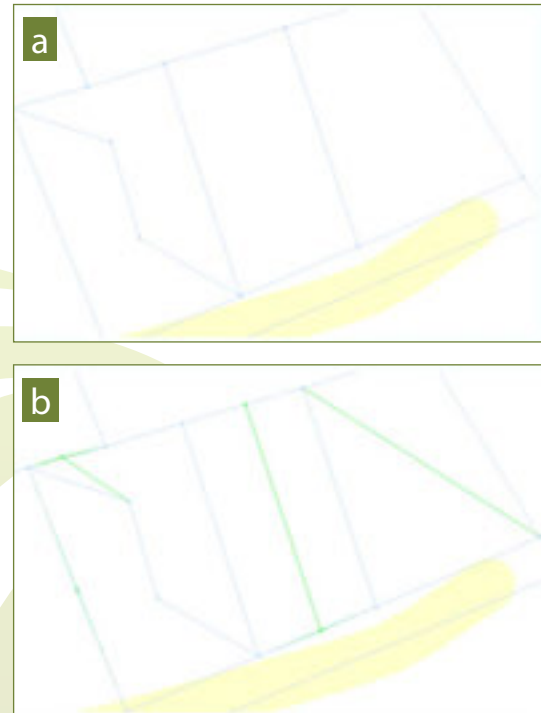
Figure 11: a) history of the layer; b) current state of layer

Figure 10: Display settings for layer:
a) settings for symbols;
(b) settings for lines;
c) settings for textuall labels

3.4. Advanced configuration editing

Most of the system's functionality can be specified through a customizable XML document (see Listing 1), which contains settings for data sources, default display properties of layers, user interface functionality etc. Part of this configuration can be edited by the user through the 'layer properties' dialog (see Figure 6).

Listing 1: Sample configuration of layers, displaying:
- different layer types [red]
- different access (read/write) rights [blue]
- data source definition [green]
- snap properties definition [brown]

System administrators can edit XML configuration for different types of users via the ConfigManager application (Figure 12). Its main purpose is to edit configurations that are used by the client application; however, it can be used to edit any configuration that is XML based. The configuration can be stored either in a file, or can reside inside a database.

ConfigManager has two modes of operation: it can either validate the XML contents against a schema (stored in a database or loaded from a file), or it can treat the XML just like any other tree structure that can be edited in a hierarchical way. In the first case, the validation mechanism restricts the user from making any mistakes when editing a configuration, and warns the user if a loaded configuration has errors. In the second case, when schema validation is not used, the user is free to shape the XML tree in any way she wants.

ConfigManager also allows for simple reuse of elements (or sub-trees): user can select an element from an existing configuration and copy it into another configuration using drag-and-drop. Another method of reuse is a special repository of XML fragments (called prototypes), which contain sub-trees of valid configuration elements. They can be named and later used in various configurations as well.
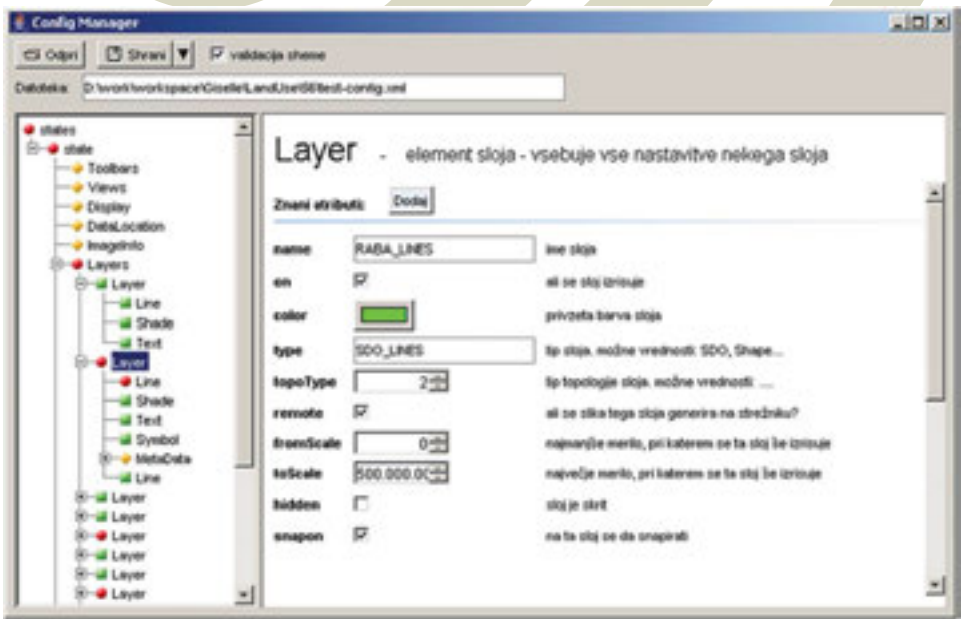

Figure 12: Config Manager application provides a user-friendly interface for advanced editing of the system configuration.

4.   EDITING SPATIAL DATA

Graphical editing of spatial data is fully topological and provides the user with a rich set of functions for changing existing spatial features boundaries and data capture of newly declared features . It includes the following functions:

- create points, lines and polygons - all geometry types with multiple entities,
- snapping (see Chapter 4.1)
- change border,
- join polygons,
- split a polygon,
- make a hole in a polygon,
- fill a hole in a polygon,
- change polygon attributes

4.1. Snapping

Snapping is an important and well supported tool in our applications. It is possible to snap to points, lines and to select on which layer we want snapping to happen. In some cases, external digital plan can be imported (as an ESRI shape files, for example) and user can snap according to it.
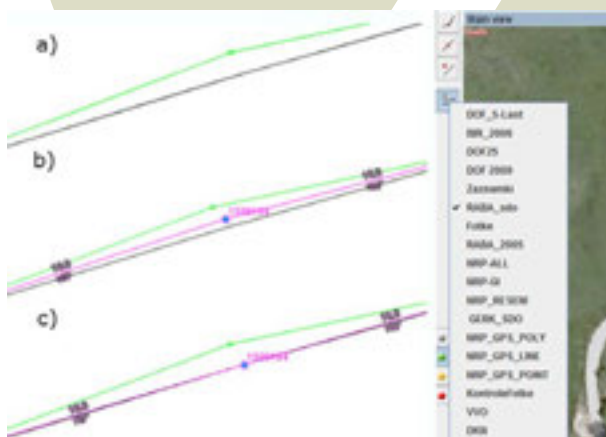

Figure 13: Snapping: left - the point according to the digital plan: a) the point to be moved; b) bringing the point closer to the plan; c) when close enough the point automatically "jumps" to the plan; right – snapping according to chosen layer

4.2. Attribute characteristics of spatial features

Attribute characteristics of spatial features are edited via a fully configurable user-friendly attribute form (see Figure 12).
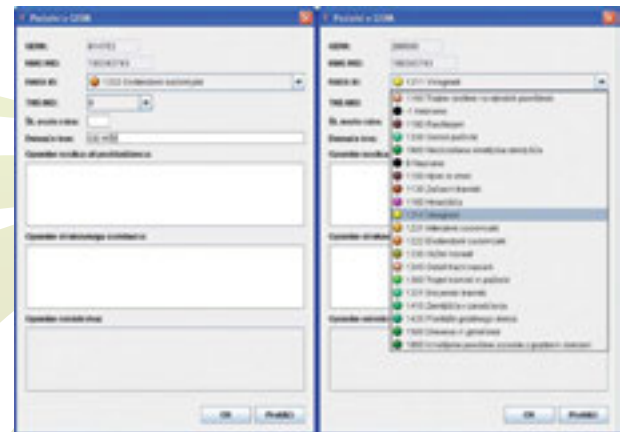

Figure 14: Editing of characteristics with pre-defined constraints

The flexible configuration of the user interface is very important, because it allows fine-grained control over the display and behaviour of the attribute forms and enables procedural changes and updates of the attribute data constraints to be implemented efficiently, while ensuring validity of the entered data. The properties of the individual fields, which can be adjusted painlessly via XML configuration include the following:

- label text,
- visibility,
- enabled/disabled state,
- data type (string, integer, double, date,…)
- length of data type (string) and range (integer, double)
- read-only,
- not-null,
- default value
- regular expression constraints (allow only certain characters, define custom rules for special strings e.g. postal code)

- list-of-values constraints (values, as well as their colors and description can be read from the database)
- dependencies – constraints for individual fields can change according to values of other fields (e.g. comment should not be empty when selected parcel type is 'OTHER'; crop type can only be selected when the parcel type is arable land)

For any feature data can be edited, global updates can also be applied to attribute data.

4.3. Integrity checks on spatial data

For integrity checks on spatial data and identification of topological anomalies we have a tool called TopoCheck. It is an easy to use, powerful, cross-platform, fast and accurate utility tool for validation of spatial datasets, along with their attributes and metadata. It identifies problems early and facilitate their early correction before they cause problems further along.

It includes following features:
- support for SHP and Oracle SDO formats
- data-mining tools for formulating attribute types and rules
- attribute data checks- code lists constraints, invalid values, empty fields, etc
- data-mining tools for metadata formulation
- validation tools for metadata checking (e.g. iSO fields)
- topology checks- loop-backs, kick-backs, slivers, overlaps, gaps, slivers, unclosed
- polygons, duplicated features, segment orientation and more
- generation of SHP file with analysis results

It detects problems such as :
- loopbacks and self-intersections,
- unclosed polygons and rings,
- internal polygons with incorrect rotation,
- duplicated points,
- spikes and kickbacks,
- small Areas (polygon less than a specified size in square metres)
- slivers or gaps,
- overlapping polygons,
- duplicate Polygons (polygons with identical attributes).

4.4. Adding special features and labelling

If user wants to add a special feature (for instance a fence to be removed), he can simply create a new layer, add desired geometry to that layer and save layer to his configuration. So far, this markups of special features are temporary but can be make permanent if needed.

Any spatial feature can be labelled with text, but label is treated as an attachment or a bookmark to the feature. In order to create a label, user must make a selection set of the layer and add field 'label'. Because of this, user can control labelling styles and display characteristics.
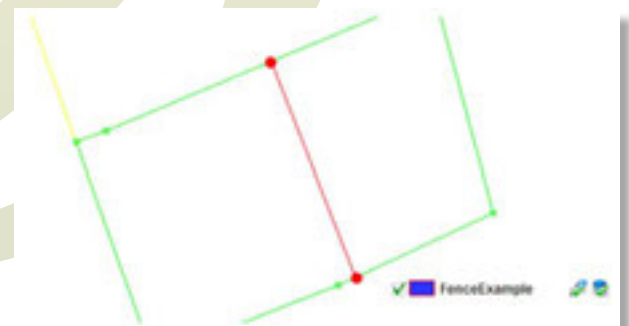

Figure 15: annotation of special features on the map

5. DATA MANIPULATION

GIS supporting Desktop GIS Application can easily be configured to use any spatial data source, such as ESRI shapefiles, Oracle SDO, ESRI ArcSDE database extensions, MySQL spatial, MS SQL Server, PosGIS, Web Feature Server etc.

Several types of data sources can be accessed at the same time, enabling use-cases where spatial datasets in one data storage (e.g. Oracle SDO) need to be linked to attribute data in another data source (e.g. MS SQL Server). For export, user can define a set of SQL query/file name pairs.

User can import and export spatial and attribute data from other systems. When importing a new layer the wizard for layer creation offers many options for layer type. To name a few formats:
- ESRI shapefiles
- Rasters: tif, jpg
- OGC Web Map Service
- Spatial databases: Oracle SDO. ESRI SDE, MYSQL,MSSQL, PostGIS
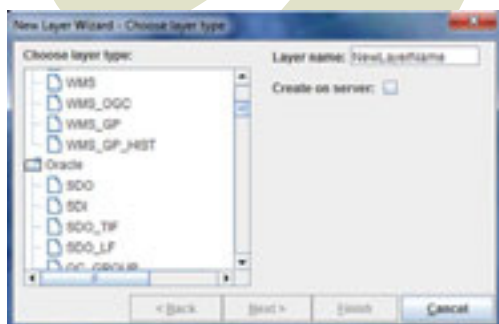
Figure 16: Importing new spatial and/or attribute data into new layer

Geocoding is supported and can be adapted to any suitable spatial dataset. It is built in as an easy to use tool where user can search many different entities which are, if found, positioned and displayed on the map in an appropriate scale.
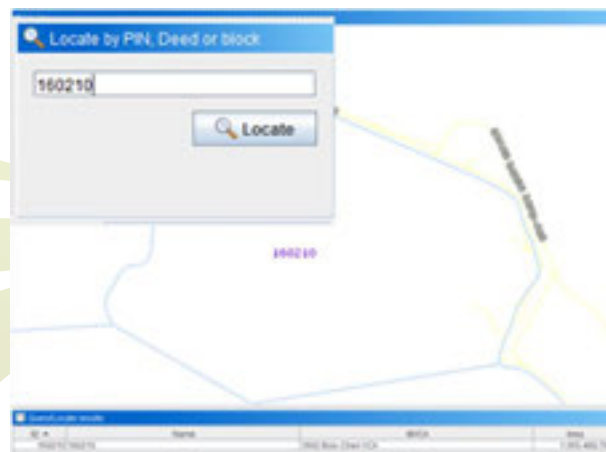

Figure 17: Geocoding can be perfomed for different entities.

5.1. External documents

External documents (images, hyperlinks, ESRI shape files, other files) can be added to any feature or to larger entities within application.
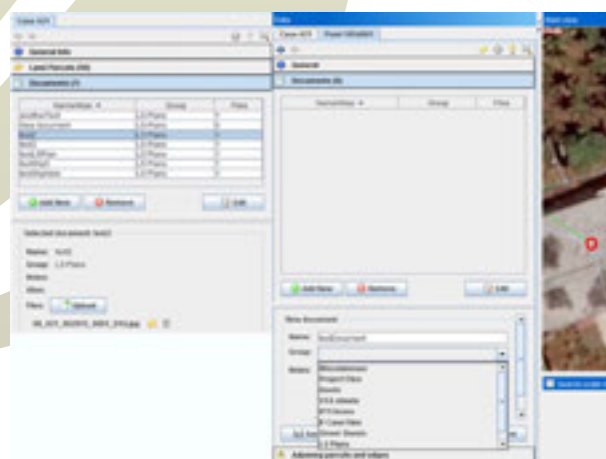

Figure 18: adding documents; on the left, document is added to a case and on the rightdocument is being added to a spatial feature (point). User can choose between many types of documents, some are specific for every application.

6.   QUERYING DATA

User can query both attribute and graphical data. Basic queries can be performed either by entering the ID of a spatial feature or by clicking inside the feature on the map. In the first case the map display is repositioned and rescaled on MBR of the requested feature, the parcel is highlighted and its attribute data are shown in a table view. In second case only highlighting is made and attribute data are shown.

Beside that, a tool named QueryBrowser, can be used for definition and execution of queries. User can choose a field upon which quey is made, logical operator for querying and value, for example ID > 1000. Results are displayed in a table and highlighted on the map (Figure 16). To make a query for any field in any layer, user first clicks on the layer and after opening QueryBrowser, he or she can choose between all fields contained in that layer.

Query results can be selected, highlighted, exported to MS Excell or saved and restored (Figure 20).
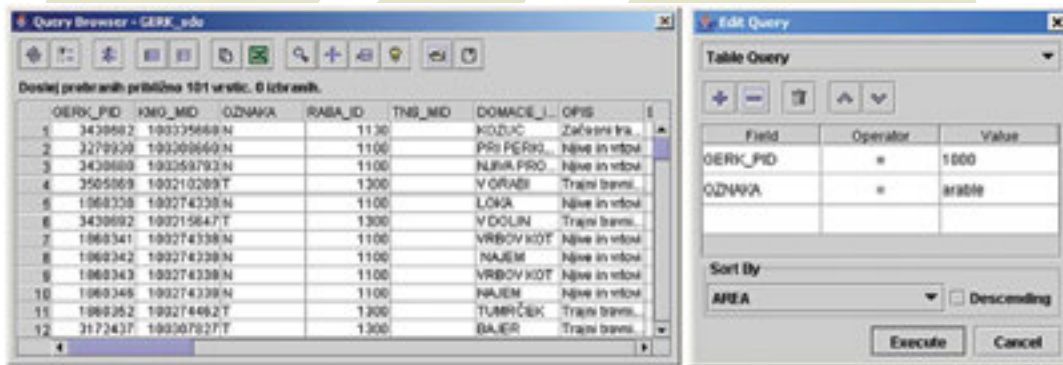

Figure 19: QueryBrowser results (left) for layer RABA_sdo and query definition dialog
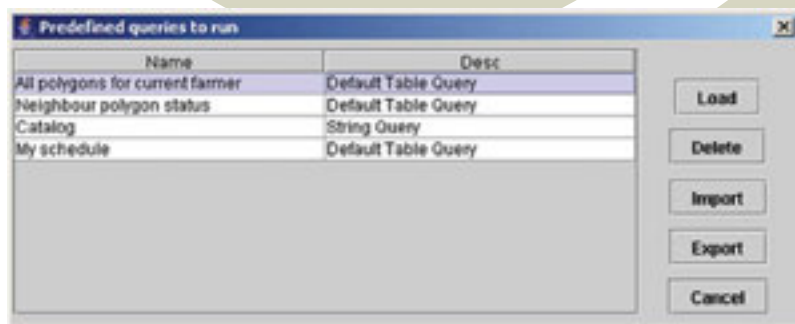

Figure 20: Storage and execution of pre-defined queries

User can also save his commonly used locations with a tool named Bookmarks. After clicking on the icon bookmarks he can either return to previously saved locations or add a new one (Figure 21).
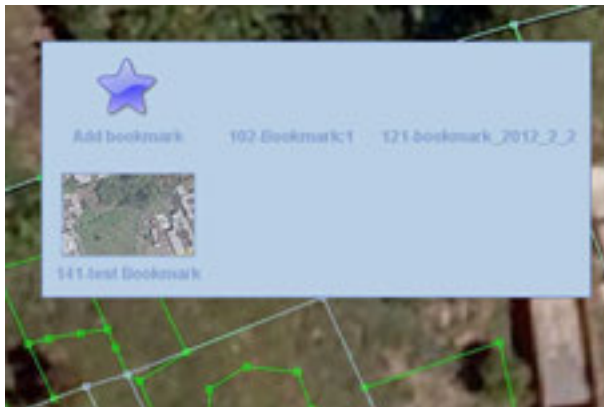

Figure 21: saving a location user can return to by adding a bookmark.

6.1. Layer selection set and filters

Additional useful features of the client application are filters and selection sets (see Figure 22). The former can be used to render individual features differently according to their attribute characteristics.

The latter allow selection and manipulation of multiple features based on several criteria (SQL query, graphical definition of extent, selection by ID…).

Figure 22: Selection set editing (left) and filter definition (right) GUI dialogs

6.2. Selection of features based on spatial functions

One simple way to detect features in the selected area is to use spatial tools. User simply clicks on the map and draws a polygon.

Results are either features which are contained, included, overlapped, intersected or adjacent to the drawn polygon.

Figure 23: spatial tool for finding polygons which are included in the bigger drawn polygon.

7. MAP OUTPUTS

User can save current map as hardcopy, either as image file or PDF file (Figure 24). Scale can be chosen automatically (best fit) or manualy (specific user defined scale). Documents can include relevant information, such as titles, logos, text, legends, watermarking, etc.

7.1. Large – scale Batch output of maps

Besides producing individual maps, hardcopy maps and associated pre-printed application forms on a large scale via an automated process can also be produced. Our solution utilizes the processing power of the server clusters to produce PDF documents, which can easily be transferred to any location and printed at an appropriate time. Printed maps can include orthoimagery. The creation of the intermediate PDF file can also be omitted and the documents can be output directly to the printer. All tools that produce hardcopy documents are printer independent.

The printed documents can contain both attribute forms and maps. The page sizes within a single document can be changed, so that attribute forms are printed on A4 paper and land parcel maps on A3 paper. The spatial features, contained within a selected attribute data are automatically laid out in a way that minimizes paper use and ensures optimal scale of the maps.

Apart from the batch printing process, which can be executed using the generic application for running advanced scripts, it can be possible to print an application form on-line from a plain HTML viewer upon request. After entering a farmer ID (or logging into the web application with appropriate credentials), pressing a button can generate a PDF containing a set of maps using a predefined template. First map is an overview map and others are optimized based on scale and spatial feature boundaries. The map generation after the pre-print is important in cases when changes were made after receiving pre-prints.
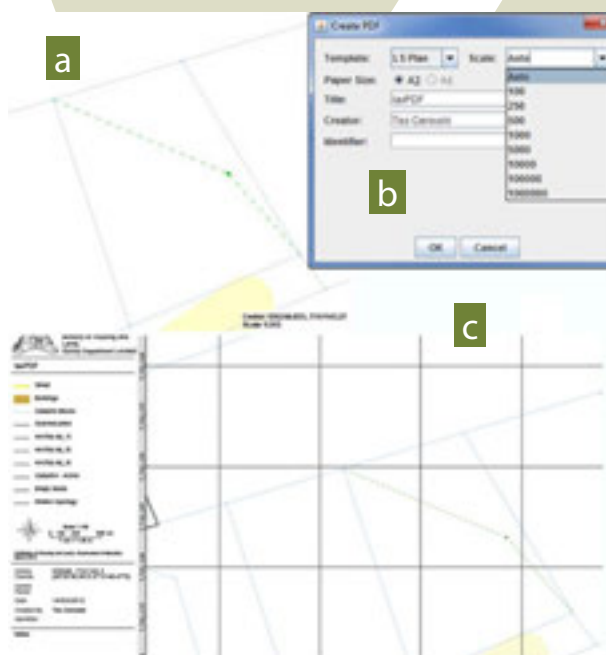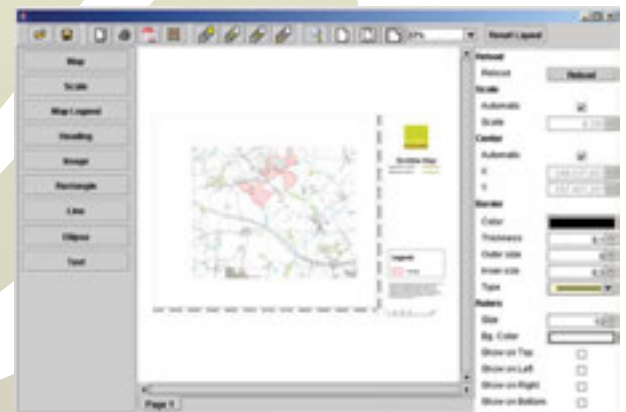

Figure 25: Print Template Editor enables the possibility to design the print-out, setting the position of the maps, their scales, legend, title, add corporate branding etc.

Figure 24: example of map outputs; a) image file, b) creating a pdf and c) pdf with additional data
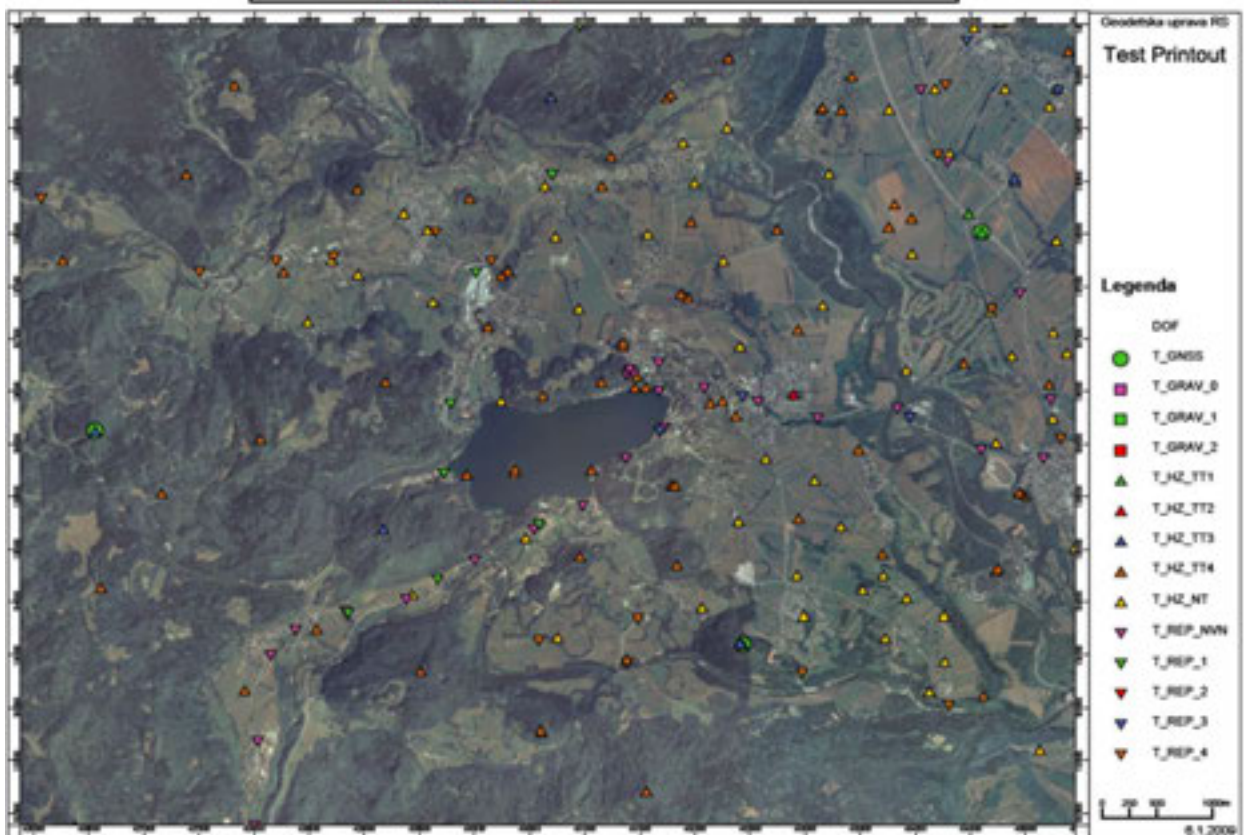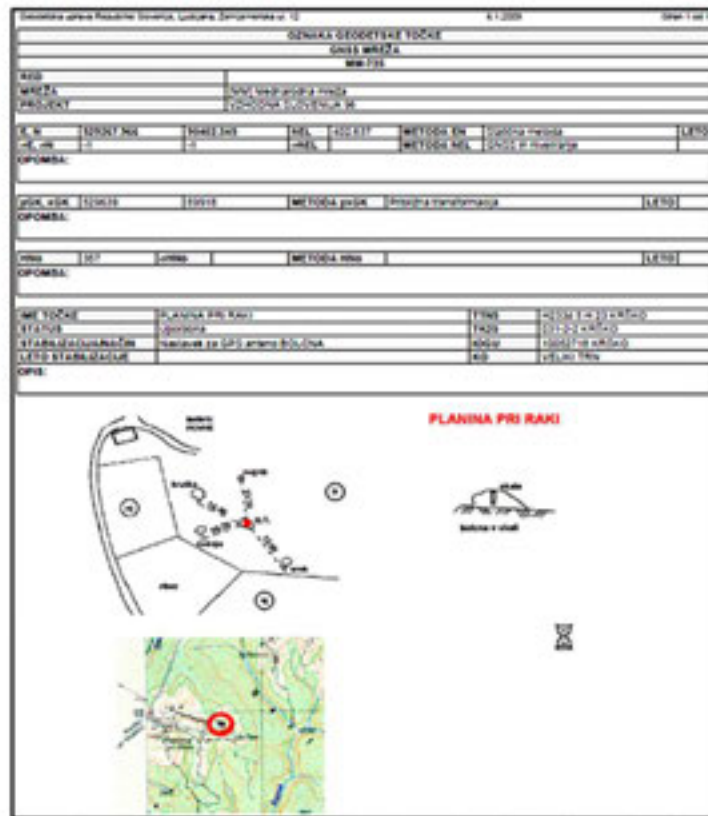
Figure 26 and Figure 27: Showcase of printout or PDF file contains attribute data with detailed position of an object observed, and overview map of specific area with geodetic points (The Surveying and Mapping Authority)

8. OTHER TOOLS

8.1. Coordinates converter

This tool is used for converting from one type of coordinates to another. It transposes coordinates in longitude and latitude to any other system.
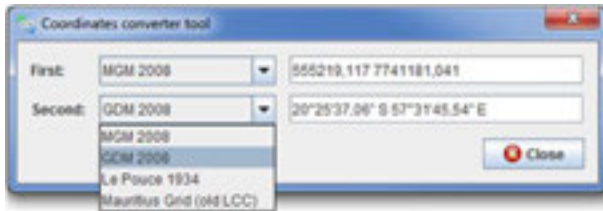

Figure 28: Coordinates converter: user can switch between MGM, GDM, Le Pouce and Mauritius Grid
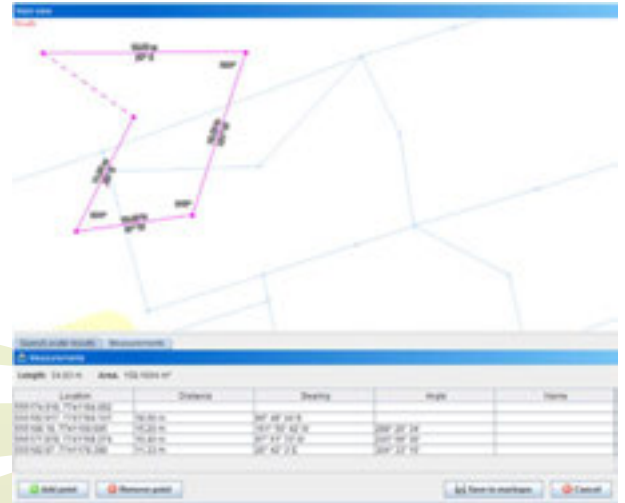

Figure 29: measurment tool

8.2. Measurment tool

This tool is used for measuring distances and areas. By simply clicking on the map user can add additional points. After measurement is finished, results of length and area are shown in the results panel. Data in the results panel are editable (user can change value of any field - consequently the graphic display on the map view will change as well). That is how user can also create spatial features if he or she has external data of how the feature should look like – for instance values of points and bearings or angles. So, in the functionality this tool can be understood as Co-ordinate geometry tool.

Measurement can be saved to additional layer and added to layers panel. Data can be edited in both metric or some other units.

8.3. Precision base styling

Precision based styling is a special tool for spatial features (lines and points). If points and/or lines have defined precision, transparent buffers are drawn around each line and point, proportional to their precision value. With help of this tool it is easy to see which spatial feature has bigger uncertainty and therefore which data can be only estimated.
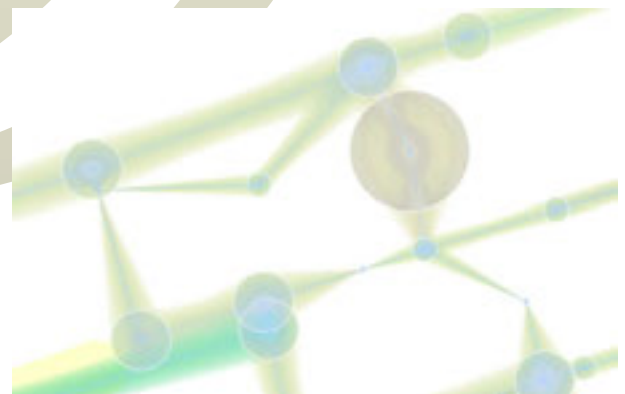

Figure 30: Precision based styling for lines and points; different points and lines have different precisions .

8.4. Advanced tools

Data preparation, data cleaning and analysis of very large data sets can be a time consuming process. Our grid processing capabilities make such operations faster by distributing the tasks to many computers. The programmer writing such scripts does not need to be aware of such run-time environment.

A special application is available for running these automatic scripts, scheduling their execution and monitoring their progress (Figure 18).

Scripts that are used for IACS, include:

- Import of the initially captured data;
- Data integration and clean-up procedures;
- Large-scale creation of pre-printed application forms;
- Automatic creation of intersections of different datasets;
- Large-scale advanced validation and error correction of the spatial features and topology.
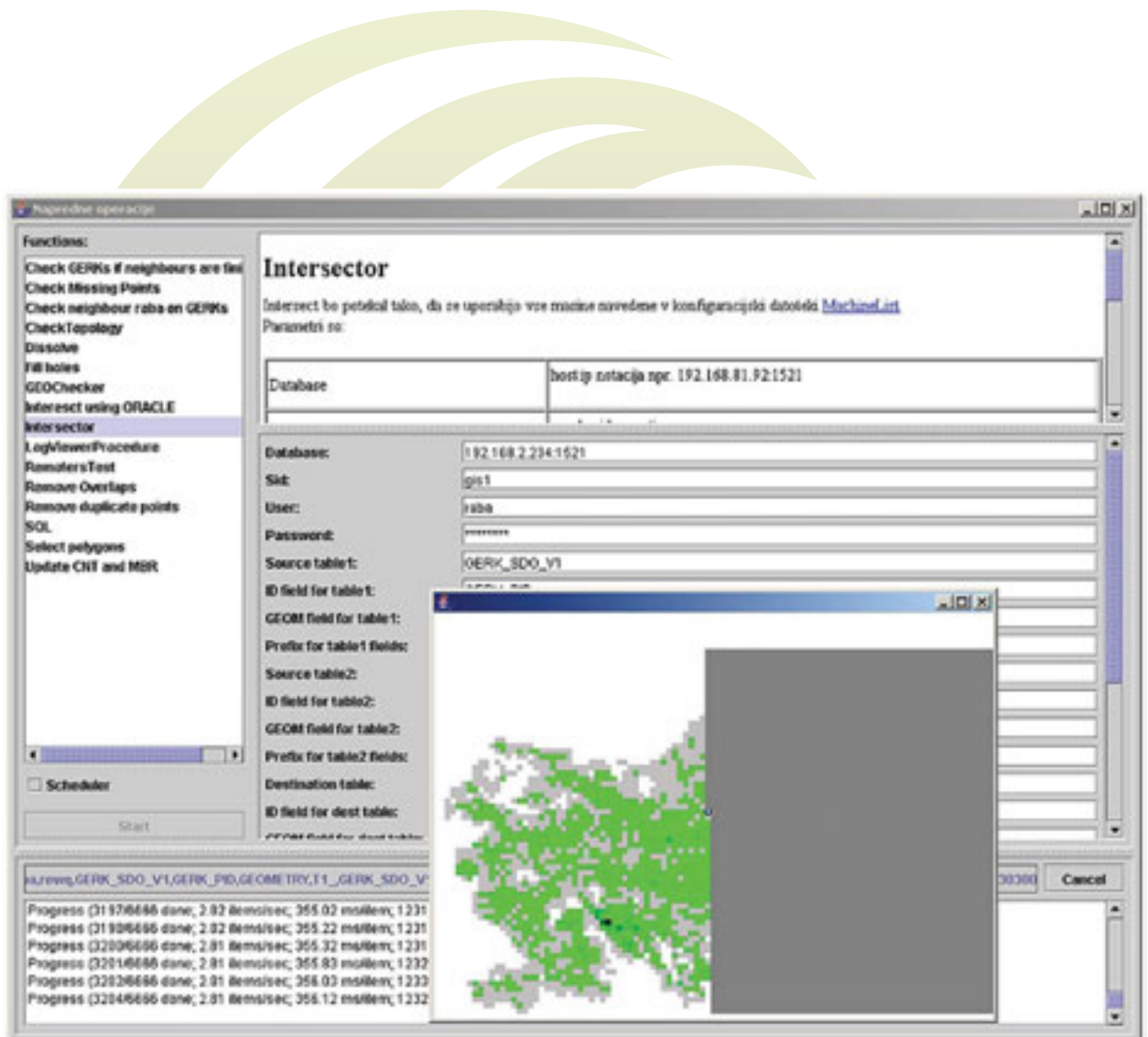

Figure 31: Application for running lengthy procedures, showing progress and status of the procedure.