

Field Survey Work with ArcGIS with Voice Technology

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Abstract

From 1993 to 2001, the Belgian National Geographic Institute (National Mapping Agency) produced topographic vector data covering the whole Belgian territory. This product, called Top50v-GIS, is conceptually designed for applications at a scale of 1:50,000. The data are now managed in a seamless Geodatabase (DBMS Informix). Since 2002, this geodatabase is updated by field survey, on Pen Computer, using ArcView coupled with GPS and "disconnected editing." Since the beginning of 2005, the field survey team is testing a solution of "Voice control" for this application. The goal of this paper is to give a progress report on the technology used within the framework of this application (demo, steps, advantages, and disadvantages).

Context « SGISR project » and data production

As Belgium's NMA (National Mapping Agency), the National Geographical Institute (NGI) is responsible for the production of geographical data for the whole of the Belgian territory. Based on this data, several topographical map series, with scales ranging between 1:10,000 and 1:250,000, are produced.

In 2001, NGI Belgium completed the first numerically produced edition of the 1:50,000 map series. The first numerically produced edition of the 1:10,000 map series would be completed in another couple of years time. Until then the focus had been on the production of a separate vector data set for each cartographic product. Now however, NGI Belgium was faced with the challenge of systematically updating its vector data sets.

At the same time, it was clear that the production of topographic maps was no longer the only important use of these data sets. The use of NGI vector data in GIS applications was steadily growing. This evolution called for a new way of structuring the data, which focused less on cartography and more on offering a geographically oriented model of the real world.

Another important decision was to move away from the principle of two parallel production lines, resulting in two separate data sets. It was felt that there should be one centralized process to update a single geographical database containing reference data. This reference data would then be used for several applications – cartographic and other – at different scales. This way, **updating information would be collected once and used many times.**

To develop these ideas into a solution for the needs of NGI Belgium, a project called Seamless Geographic Information System of Reference (SGISR) was started. Three main objectives were determined for SGISR:

1. Design of one integrated production line to collect, manage and update topo-geographic reference data.
2. Implementation of a centralized and spatially continuous GIS to store, manage, edit and distribute topo-geographic reference data.
3. Development of the necessary tools for the realization at NGI Belgium of applications with a conceptual scale between 1:10,000 and 1:50,000, based on topo-geographic reference data.

Top10v-GIS production line

- vector reference data
- conceptually 1:10 000
- production from 1991 to 2006
- ArcInfo coverages
- X,Y coordinates
- by mapsheet
- no update process

Top50v-GIS production line

- vectorial defense data
- conceptually 1:50 000
- production from 2002 to 2006 (second numeric edition)
- GeoDatabase (SDE/Informix)
- X, Y coordinates
- seamless
- update process by field survey (Voice control project)

Before 2006, "CARTO"

SGISR project

- vector reference and defense data
- production from 2007 ...
- GeoDatabase (SDE/Oracle)
- X,Y,Z coordinates
- seamless
- various update processes (update strategy)

After 2006, "GEO"

Parallel to this context of technical and methodological development (project SGISR), the production of the second numerical edition of the vector data on a conceptual scale of 1:50,000 (product Top50v-GIS) continues. In 2002, after the study of various possible solutions, the IGN decided to carry out the second numerical edition of these vector data by update of the existing data through a field survey.

This production process is also used to test some solutions necessary for the SGISR project:

- seamless GeoDB, disconnected editing (SDE/Informix)
- update "by field survey" (team CA50)
- vocal control of ArcView GIS

The goal of this paper is to give a progress report on the implementation of vocal control of ArcView commands for the team CA50 (production process Top50v-GIS).

The “Vocal control” project

In 2002, the team CA50 (charged with the update of the Top50v-GIS data by field survey) was equipped as follows: Fujitsu Pen Computer, GIS ArcView and GPS Garmin.

It was also decided that the CA50 team would collect the updates staying in the car (as much as possible).



In May 2004, the NGI established a ITT for the supply of a solution of “Vocal control of GIS ArcView commands” for the CA50 team. This solution must also be extensible, in a second phase, to other GIS for other NGI applications. This contract was awarded to the firm Voice Insight.

Objectives

In a first phase, this solution should allow:

- the feasibility of the “vocal control”
- an increase in the productivity
- an improvement of the safety conditions

for the CA50 team.

In a second phase, this solution could be extended to other NGI GIS applications.

Tests and improvements of the application

The tests concern 50 ArcView controls and NGI made controls used in the CA50 team application (see details in annex 1).

The improvements needed during the "test phase" can be classified in four types:

1. Comprehension problem

The first tests were carried out with only the microphone of the Pen Computer. Many problems of bad comprehension forced the user to repeat several times certain controls.

To solve this problem, it is necessary to use headphones with directional microphones.

Comprehension was clearly improved even if some problems of this type remain. The external noises and the radio do not seem too awkward.

2. Removed controls

Two controls are often activated without the user explicitly pronouncing it. To avoid this problem, a request for confirmation was added, which finally made the operators waste even more time.

These two controls were removed from the vocal application.

3. Unused "vocal controls"

Some (a few) controls are never used in vocal mode (for different reasons). Thus, it is not necessary to maintain them in the vocal application.

4. Rewriting of "controls sequence"

We realized, during the tests, that certain controls or sequence of controls were to be associated differently.

Examples:

Association of "the **target layer is**" with "**Beginning of sketch**".

Compared to the product initially imagined, it seems to us that we currently reached a very acceptable solution. But it is certain that the solution could still be improved. Collaboration with Voice Insight will continue in order to optimize the use of the vocal controls for the CA50 team.

Conclusions

The "vocal control" application proved to be usable (positive test of feasibility) in an NGI environment of production (updating by field survey, in car).

The solution such as currently configured makes it possible to conclude that:

- a strong proportion of the useful controls can be used in "vocal" mode
- the controls used in "vocal" mode do not involve reduction in the productivity
- the controls used in "vocal" mode involve an increase in the ergonomics of work and comfort
- the controls used in "vocal" mode involve an increase in safety
- the possible profits in terms of productivity are difficult to estimate at this time.

It would be thus necessary to continue the developments associated with this "vocal" solution to evaluate the possible profits of productivity and the portability towards other applications (updating of SGISR data, for example).

In conclusion, this first test shows that it is possible, in an NGI environment of production, to control a GIS (ArcView) by the voice. Feasibility is thus proven.

This experiment should be continued ...

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Annex 1 : Controls activated in "Vocal mode"

1. Vocal mode for the GPS

"Start the GPS"
"Stop the GPS"
"Refresh the GPS"
"Start automatic rotation"
"Stop automatic rotation"
"Start automatic centering"
"Stop automatic centering"

2. Vocal mode to manage « View/layer control »

"Zoom in [...] time" (from 2 to 8 times)
"Zoom out [...] time" (from 2 to 8 times)
"Pan X time [...]" (from 2 to 8 times)

Right
Left
Top
Bottom
East
West
North
South

"Rotate X time [...]" (from 2 to 8 times)

Right
Left

"Previous view"
"Next view"
"Fixed scale [...]"

3.000
5.000
7.500
10.000

"Start editing"
"Exit editing with save"
"Undo"
"Redo"
"Save"
"Refresh"

In addition to the ArcView controls, 2 new vocal controls are created to show or hide layers or groups of layers.

"To show [...]" / "To show the layer [...]" / "To show the group [...]"
 "To hide [...]" / "To hide the layer [...]" / "To hide the group [...]"

Object	Layer
sport complex	cplpoly
power station	elecpoly
dam	hydrostructure
quay	hydrostructure
conifers	landuse
mixed cover	landuse
rail	rail
road	road
path	otherway
slope	scapeline
hospital	strucpoly
...	...

Table 1 : The complete table is made up of 40 objects / layers.

3. Vocal mode to select

To make layers/types usable for selection

"Open [...]" for selection"

"Close [...]" for selection"

Selection of objects in a "Opened for selection" layer

"Single Selection" (= create new selection)

"Multiple Selection" (= add to current selection)

"To cancel the selection" (= clear current selection)

"UnSelect" (= remove from selection)

Street sections selection

"Select street"

This control makes it possible to select all the connected sections of a street.

Selection of objects on the basis of position of the GPS

"Select the nearest [...]"

"Selection distance"

4. Vocal mode to manage "attribute tables"

"Start editing"

"Open attributes"

"Close attributes"

"Stop editing"

5. Vocal control to remove an object or a selection

"Start editing"

"Remove [...]"

"Stop editing"

This control is valid for the 40 objects described in the complete Table1.

6. Vocal mode to manage "edition and geometry"

"The target layer is [...]"

"Beginning of sketch"

"End of sketch"

"Finish part"

Vocal macros

"To place a house on the right / left"

According to the width of the street (attribute width), the house is positioned (perpendicular) to the axis of the street. The left or right position is given compared to the gradient of displacement of the GPS (if the GPS is not active, it is necessary to refer to the vertex).

"Place a line of houses"

A dialog makes it possible to indicate the beginning and the end of the "houses" line.

7. Vocal mode to change an object of layer

"Copy like [...]"

Possible values :

strucpoly
industrial building
silo
career
hospital
school
fire station
abbey
specific building
cemetery
power station
religious building
...

"Copy like ordinary building"

"Copy like ROAD [...]"

Possible values:

road
road of unknown width
road of width 0
road of width 10
road
road of width 20
road of width 30
road of width 41
road of width 42
road of width 50

"Copy like [...]"

Possible values:

Otherway
dirt track
vat
path
nacelle
underpass
street in staircase

8. Vocal order to manage the "snapping/selection tolerances"

"Fix snapping tolerance [...]"

"Fix selection tolerance [...]"

Possible values:

10	
15	
20	