

# Integration of a Solution GIS Internet-Modular Type for a Collectivity

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**Key words:** architecture three third, navigator, HTML, dynamic Language, java, Internet.

## SUMMARY

The Geographical information Systems are today in dissociable of the management of the territory. Every collectivity that has means to carry such a tool is going to try to develop the adapted applications has its own needs. Solutions are numerous on the market. One especially notes a growth since some years of software of GIS planned to function on Internet. It is certain that this concept is very appealing because it permits a fast information exchange, and especially a storage of data on an available unique station simultaneously by several users. Again it is necessary that the application centers with requirements of the aforesaid users. These can be the territorial civil servants charged of the management of possessions of a township, as they can be simple individuals anxious to find on the WEB services that can propose those of a town hall or a union of initiatives...

A possible solution dresses a particular shape: it is about an application modular GIS, where each conceivable theme been the object of a survey to part. Interests are numerous. They found on the universality of themes that one meets in each township of small or middle importance. While constructing the thematic modules referring to possessions gérableses of a collectivity type, one can already propose a solution ready at any customer. According to its choices, this one can integrate in a «setting» containing between other tools of cartographic navigation and the global interface of the GIS, all themes wanted, with the possibility to add some thereafter. It thus designs module by module its own application.

However these modules must answer certain criteria. They must be inter alia independent all while being complementary. They must also be able to be adapted individually according to requirements' not envisaged with the base. We try to have only one interface for all our themes. Another problem is posed by the time of software reaction. Some tests achieved on Internet sites of townships provided of a GIS indicate a certain slowness even with a connection high flow like the ADSL. The reliability of this work was reached by an application which aims at the realization of a WEB interface of the Arzew township (Northern West of Algeria).

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## **1. INTRODUCTION**

E-government has been on the agenda of many developed and developing countries recently. Although the common sense exists, a formal definition of “e-government” is not in place yet. World Bank defines e-government as the use of information and Communication Technologies (ICT) to transform government by making it more accessible, effective and accountable (World Bank, 2002). E-municipality can be defined as a municipality realizing all kind of communication, business and service offer in electronic environment. An interoperability infrastructure is at the heart of e-government (OeE, 2003).

The ability by which the different applications can talk and cooperate with each other is known as interoperability. It is this infrastructure which would make the interaction between government and citizens (G2C), government and business enterprises (G2B), and inter-agency relationships (G2G) more friendly, convenient, transparent, and inexpensive (World Bank, 2002). Due to the lack of interoperability, traditional governments and municipalities face serious problems. These are mainly poor quality and high cost of services, and low economical revenues. E-government, and e-municipality has been proposed for solving these problems. Web services have emerged as the next generation of Web based technology for interoperability. Web services are modular, self-describing, self-contained applications that are accessible over the Internet. Based on open standards, Web services enable constructing Web-based applications using any platform, object model, and programming language (Barefoot, 2002). A service is a collection of operations accessible through an application-programming interface that allows users to invoke a service, which could be a response to a simple request to create a map or a complicated set of image-processing operations running on several computers (Hecht, 2002).

The motivation of this work was to determine the potentials of the Web services technology for an interoperability infrastructure for e-government and e-municipality (H.AKINCI, ISPRS 2002). . For this aim, we have first investigated the activities of the municipality of Arzew, Algeria and determined the problems of the traditional system. Then we have determined, developed, and implemented a number of these services. We have concluded that Web services are very promising for the e-municipality infrastructure. Since e-government and e-municipality share similar structures and problems, the findings of this work would also be valid within the context of e- government.

## **2. PROBLEMS OF TRADITIONAL MUNICIPALITIES**

In Algeria, the traditional governments have many problems that stem from both insufficient and improper use of ICT. "Insufficient use" refers to the traditional means such as manual archiving systems. "Improper use", on the other hand, refers to the lack of an interoperability

infrastructure within and among the government agencies. In this work, a number of such problems have been identified for the Municipality of Arzew(Northern West of Algeria). Although they have been determined for a municipality, they are also valid for such sectors as Wilaya, and Daïra in the Country. World Bank (2002) has also identified similar problems for many developing and even developed countries around the World. To identify these problems, some of the activities of urbanism, Map and Cadastre of the Municipality were closely investigated. The selected activities were the ones that involve spatial data and are most characteristic within the context of e-municipality or e-government (Table 1). Identified problems were classified under five different though interrelated categories. These are the lack of auto-control mechanisms, high economical losses, high cost of services, poor service quality, and low efficiency.

ACTIVITY
Preparing zoning plan form
Making zoning plan
Evaluating zoning plan modification suggestions
Giving construction permit
Making building control
Giving building usage permit
Making base maps
Determining district boundary
Determining street and alley
Creating buildings table
Preparing expropriation maps
Implementing zoning plan applications

**Table 1:** The different activities of the Municipality.

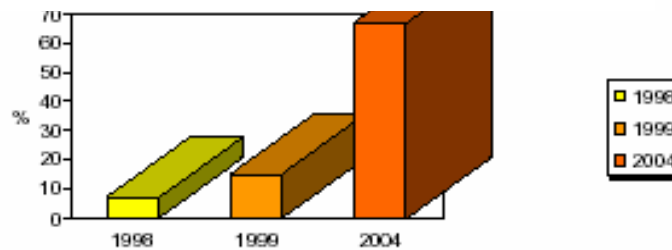
### 3. WHY A GIS VIA INTERNET

When one tackles the delicate subject of the GIS via Internet, the stakes differ, although in the long term the software seeks to recreate the functionalities of the traditional GIS. But for the hour technologies employed do not make it possible yet to work on line as on an independent station. Thus the drawing tools remain vague (not fixing, not of precision), topology is non-existent, and finally the use of the GIS is limited. However, in spite of these defects, the Geographical Information systems based on Internet/Intranet technologies generated 6,9% of the software activity on the market world of the editors of GIS in 1998. They take importance more and more, and should reach proportions equivalent to two thirds of the activity on the market world in 2004 (Eric, R.A.D.A 2001).

The imperative reason of the use of Internet lies in the exchange of information. An exchange which can be managed either in Intranet, between communal services for example, or in Internet for a diffusion of the data towards a larger audience, often of the professionals, but

also general public. The choice of the tools and the topics is tributary of the public concerned. The applications suggested will be addressed is with specific services interested by a particular field, and which will aim at the management of objects (roadway system, networks, street lighting, etc), that is to say to private individuals in search of information. Many criteria are thus to take into account to choose an editor of GIS on line. They relate to on the one hand the software themselves, their accessibility, their functions, and on the other hand the applications which they propose. One should not lose sight of the fact that the interest lies in the design of separate modules sets of themes but being able to function sets.

Survey achieved by Eric Fremont DESS R. A. D. I February 2001



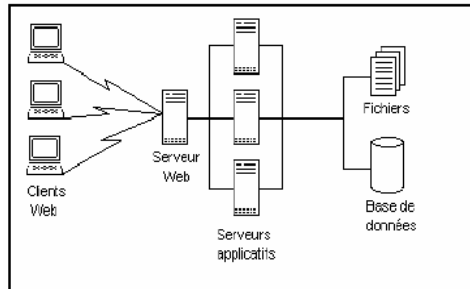
**Fig 1:** Integrating the Web technologies on market mondoaille of the GIS software

Tools GIS-Internet thus develop, but one finds mainly on the market the large distributors of software which are ADDE (CLARITAS MAPINFO), GEOCONCEPT, ESRI (ARCVIEW), to which is added AUTODESK (AUTOCAD MAP) as well as other editors like STAR INFORMATIC (STAR NEXT) and INTERGRAPH (GEOMEDIA) which is one of most powerful market. We have study the characteristics which these solutions exempt to us. But is not to in no case to choose an editor of GIS that this part is interesting, because the choice of the company was for a long time made on AUTODESK MAPGUIDE. On the other hand, it is very important to have a knowledge of the state of the art for several reasons: to know which are the hot lines of the market of the GIS, not to recreate what others already made, and to propose solution at least such an interesting, if it is more original only the potential competitors.

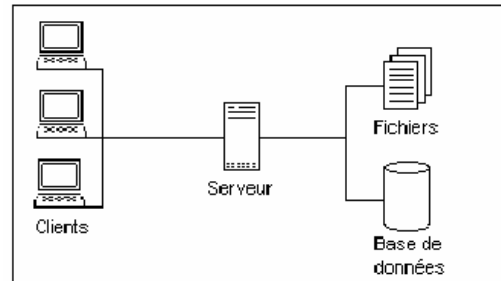
#### **4. TECHNICAL ASPECT OF THE ACCESSIBILITY OF THE GEOGRAPHICAL INFORMATION SYSTEMS VIA THE WEB**

Since the end of the Seventies, a new concept appeared in the data-processing field: the GIS (Geographical Information system). It exploits the fact that the great part of the handled data, in all the professional environments, has a geographical component, often in two dimensions with co-ordinates (x,y) and sometimes even with third (Z). First software GIS thus proposed to exploit this component to post the data in the form of "Map" and thus to handle them in an intuitive way. Indeed, it is much simpler, ergonomic and effective to select data, by a simple click mouse, rather than to seek these same data in an illegible table composed of many lines and columns. These first tools were first of all single-unit and stored information in the form of flat files (ASCII or different) then, in the medium of the Nineties, the solutions to store

them in relational data bases appeared. Consequently, the geographical data were shared by several users into simultaneous (clientservor mode) and the problem of their volume, often important, was solved, since mutualized and managed within the same centralized space. the Internet at the end of the Nineties. The first architectures three-third (Data Server/Web Server/navigator Web) were installation and with them the first software solutions to publish the cartographic data on the Net (Intra, Extra or Inter)



**Fig 3:** Architecture 3 Thirds



**Fig 2:** Architecture Customer / Server

#### 4.1 Stakes Of Architecture "3 Thirds"

This architecture has many advantages :

- modularity to absorb the rises in load or the requirements systems;
- safety by proposing a redundancy of the servers.

But, again, with the limited flow of the traffic supported by the first networks, the problem of the volumetry of the cartographic data appeared! The most effective solution to circumvent it was to generate, on the server side, a map in the form of image and to transfer it to the navigator Web. Some formats (JPEG, png and GIF) ensure of good compression and thus image ratios of low volume.

This principle is still, at the present time, most widespread: it is that proposed by largest editors GIS of the market. But it is far from being satisfactory. Indeed, the image posted on the Web customer is a "died" image, it does not have there possible interactivity: if you click on a road, you will not be able to know his name, its flow in cars/heure, its length... etc.

It is however that the added value of an application GIS! To be able nevertheless to post this information, a complex and heavy process is set up :

- to locate the click mouse on the customer side,
- to transfer this localization on the server side ,
- to identify in the data base the object which corresponds to this localization,
- to regenerate a new map,
- to retransfer the whole on the customer side and finally réafficher the map.

## 4.2 Solutions of GIS-Web

### 4.2.1 The Html Solution

This process is initially assured by the simplest programming language under Web HTML (Hypertext Markup Language)

### 4.2.2 The Dynamic Languages Solution

Another process of programming is added to the HTML in order to reinforce it by other functions to enable him to adapt to applications GIS. This process presents the dynamic languages (PHP3, PHP4...).

Among the principal advantages of this language for applications GIS under the Web :

- To give the possibility of the interactivity enters the cartographic images,
- To ensure connection to a relational data base (MySQL),
- adapts easily with the query language SQL.

### 4.2.3 The Java Solution

the found solution, to counter to the maximum these problems and to obtain an acceptable result, often consists in investing in the material by multiplying the Web servers applicatifs, while choosing top-of-the-range solutions (processors the last cry, RAM pushed to the maximum...), the whole for a simple report: A data-processing architecture complexes to set up and to maintain for a result just satisfactory at an often enormous cost!!.

The last software of large editors GIS obviously seeks to reduce to the maximum all these problems. But it appears also recently, with the advent Java, a new reflexion and new solutions for the GIS on Internet.

## 5. TOOLS USED

What is necessary to carry out a GIS? A geographical information system is, made up of a data base related to graphic entities. It is starting from these géoréférencés points, lines, polygons and symbols that the user will be able to question his base and to modify it. The majority of the software of GIS integrate at the same time the aspect "Data" and the aspect "cartography". In ARCVIEW or MAPINFO, to take only these examples, tables and themes are contained in the software. It is not the case here, where work is divided into three stages. Initially, it is advisable to create the data base. It is under the software MICROSOFT ACCESS, one of the tools most usually used that this operation is carried out. Included/understood in the PACK OFFICE with amongst other things WORD and EXCEL, one finds it on all the stations functioning under WINDOWS. They is advantageous for the exchange of the data. In parallel, it is necessary to be able to create or publish files of drawings representing the geographical areas and the elements with which will be associated the alphanumeric items. It is under AUTOCAD MAP, a standard of the CAD to which

AUTODESK added a module of GIS, that we can visualize and modify the cartographic data. These the first two stages different of nothing compared with the development a traditional GIS.

Even if these tools alone make it possible to set up a draft of GIS(AUTOCAD MAP makes it possible to create bonds between the geographical data and the attributes), the applications remain limited. This is why GEOMAP is used. More powerful and more practical, GEOMAP is composed of two modules. GEOMAP GIS ADMINISTRATOR makes it possible to create applications already done everything for the users. These applications include/understand the definition of the objects which one finds in the data base and the cartography with their bonds, as well as the requests which will be made. One defines also cards of consultation or creation of these objects which are used as interface with tables ACCESS. With GEOMAP GIS CUSTOMER, the user could be useful itself of these new functions under AUTOCAD by charging the application defined by "the administrator".

But let us not forget it, the principal interest of this study is to create a GIS based on modules sets of themes and consultable on Internet. This is why a version of GEOMAP GIS CUSTOMER is adapted to be used under AUTODESK MAPGUIDE. This software is specific edition of GIS on line. Like AUTOCAD MAP, it can function without GEOMAP. It makes it possible to define the posting of the layers of data, graphic semiology used, in short the vision which the Net surfer of the GIS and all the orders will have to which it will have access (simple consultation, modifications of the data, etc.) Like GEOMAP, it consists of several modules: MAPGUIDE SERVER which analyze the requests of the users and manage the access to the data, MAPGUIDE AUTHOR which makes it possible to create the maps, and MAPGUIDE VIEWER which, charged on the station customer, makes it possible to dynamically post the maps according to the requests since the site on which they are available. Lastly, to personalize the interface WEB of our GIS, an interface HTML will have to be created. Software of creation of sites can be used, like Microsoft Frontpage, but it acts here rather of the direct use of languages such as the HTML and the Javascript. Now that the presentations are made. This being it is useless to be delayed on ACCESS and AUTOCAD which are each one in their field of great classic; It is useless also to be delayed on the functions which will not be useful for the continuation of the assembly of the modules. The functionalities offered by the software, and especially their operation determine the nature of the solution. It is thus necessary to take time to know these tools, their relations, and the vocabulary which is attached there.

## **6. CREATION OF THE MODULES**

We defined the tools, define the method now. Without seeking to want to create modules with the chain, we will be delayed on the technique of design. Each topic with its characteristics, but the principle remains. We will consider two points: the construction of the module, (elements, assembly starting from the various software), and the integration of this entity within an application designed to receive all the possible topics.

The module set of themes must be ready with employment, marketable in the state and usable directly by the customer. But it must also be adaptable according to definite needs'. Contrary

to the applications which one could discover in the first part, it is also necessary to be able to fulfill the requirements customers for individually. It is thus necessary to imagine a base of work likely to meet the daily needs with 90% (what would be enough for certain communes), but extensible at 100% for more ambitious communities.

The modules must be independent and complementary. Each module corresponds to a precise topic. Its integration or not in the GIS should not affect its correct operation. But the fact of integrating it can allow, while supplementing the application by new data, to create interactions between the modules and to look further into the space analysis .

The modules must be used for management. They must also be able to be used for the diffusion ' information for the public. How to design the same module of which a part of the data is devoted to a task, the other with a second? From there we can work with the design of our modules with clear objectives. We will start by drawing up a diagram of constitution, then we will be able to study some examples.

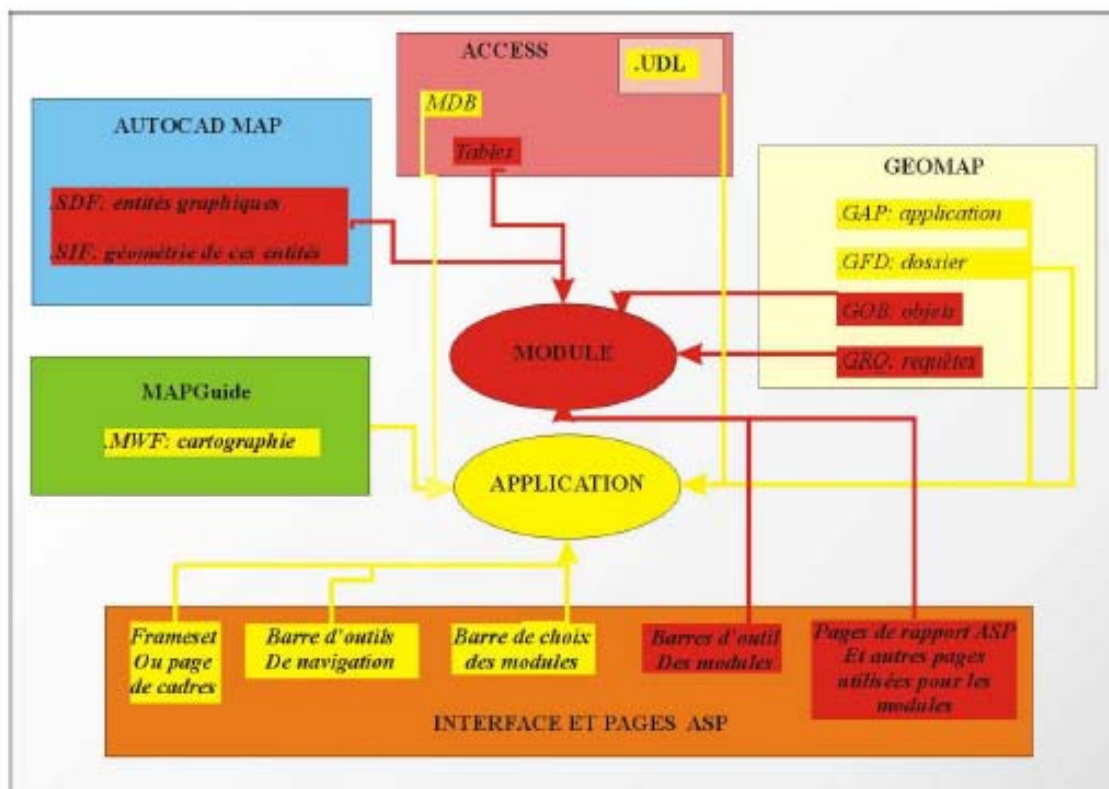


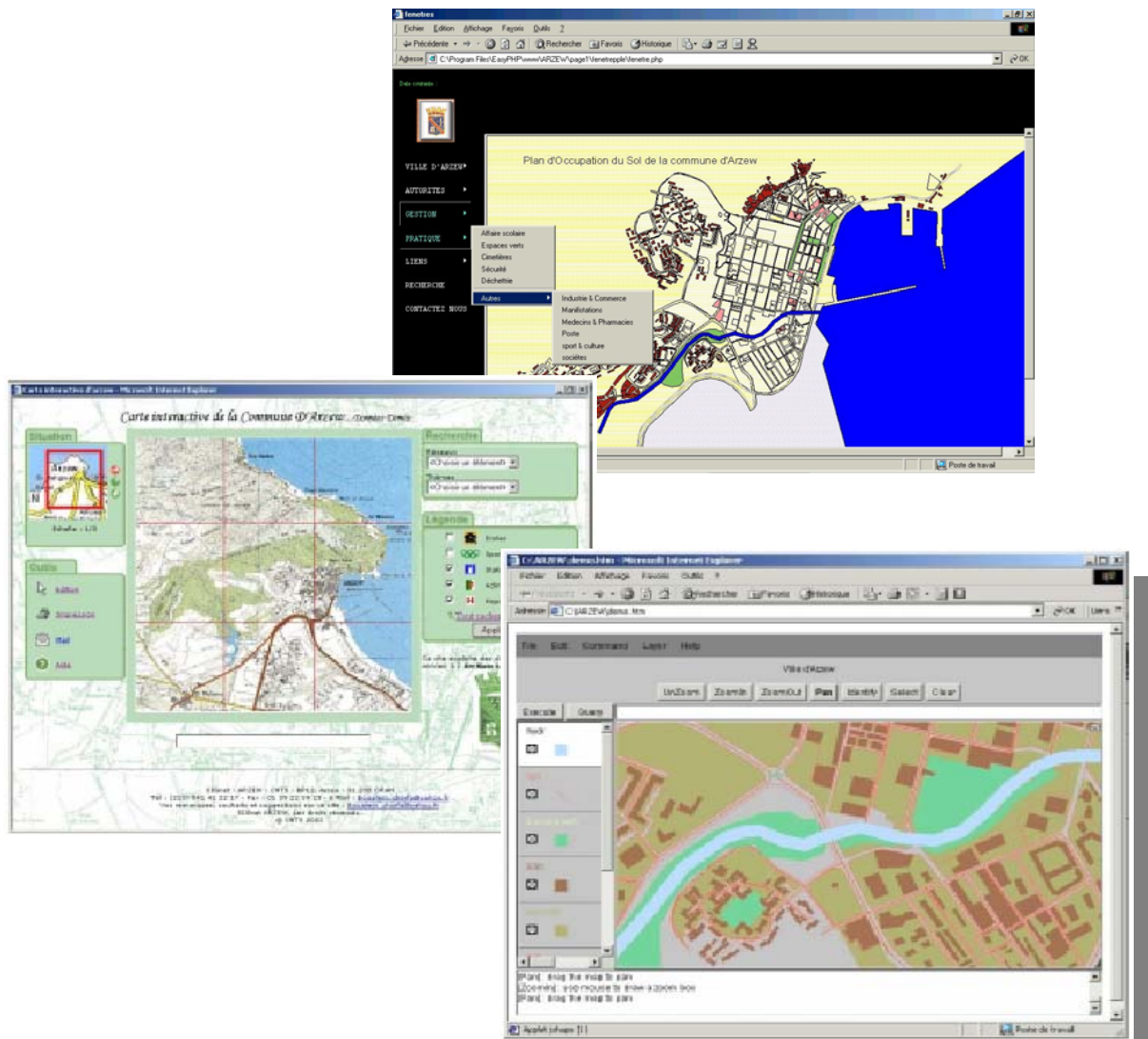
Fig 4:: Elements of modules and the application

## 7. SETTING ON LINE OF A MODULE

The addition of a module to an application already on line is the last stage. One supposes the finished modules and comprising all their elements. The manner simplest to add it to the GIS



and to envisage at the beginning a diagram of files on the hard disk, each file containing a type of element of the modules: objects GEOMAP in a file, requests in another, symbols in a third, etc. Thus the references to the various access paths will be always the same ones. At the time of the update of the application, it is also necessary: · To modify file MWF, and to add the necessary copies · Modifier the bar of choice of the modules in the application · Ajouter the bond to the data source in file GEOMAP After the update the user should not realize anything, if it is only with the alarm clock, its GIS will be a little more complete...



**Fig 5** :Some Interface Of The Application Of The Commune Of Arzew

## 8. CONCLUSION

We left at the origin a request. The request made by the small ones and common averages eager to be provided with a sufficient GIS to manage their territory while remaining

accessible by uninitiated persons. One answered by the idea of the modular GIS. It is not new, but it needed to be exploited in a particular direction to be adopted by the municipalities considered. Throughout this study one follows the theory which carries out to the design of an application based on this idea, of the outline of existing with the creation of a standard module, while passing by the description of the software and languages necessary. One can draw several conclusions from this work. Initially, the installation of a GIS is not done it - even. Especially when one wants to make the universal solution of it, whereas very often work starts with a meeting between the customer and the professional to fix a schedule of conditions. It is thus difficult to fulfill the requirements of several customers by the same tool, even if it is what one sought to do here. It is seen that one can obtain a result, but it is necessary to keep in mind that to remain in the market, it is necessary to know to create applications which can adapt on request. Second observation brings us to think that Internet is a very powerful mean of communication, which more and more will be employed, that it is in GIS or in other fields. But its possibilities are with my direction still far from being exploited to the maximum, and one can find here a crenel very interesting on the development of the "on-line" GIS.

This would be only this idea of service of town planning which uses at the same time the cartography and the data bases, usable at least by professionals such as the geometers. But the development of Internet and data processing can give us good hope. It is enough to see the various programming languages intended to instigate the Web pages. While plunging oneself in the ASP, the Javascript or Vbscript, and with a little imagination, one can succeed in making GIS on Internet a nearly indispensable element of any communal site worthy of this name. To finish, I would say that this study enabled me to be placed in advantageous position vis-a-vis at my professional future. Initially by the obligation to launch out in the training of new software and languages, then by the total reflexion on the installation of the GIS, and finally by the awakening of all the openings offered in this field, with the proviso of wanting to immerse itself not only in the world of geomatic, but in the world in general...

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