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## GIS SOLUTIONS FOR SUSTAINABLE DEVELOPMENT IN AGRITOURISM

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**Abstract.** The sustainable development and agritourism mainly developed in the last half of the century, but as mass social-economic phenomenon is among the basic activities in many countries, being one of the economic branches with the highest growth perspectives in the future.

The current growth of the Information Society requires the agritourism industry, as well as other financial and trading sectors to develop certain new methodologies based on Internet technology and on modern telecommunications technologies. At European level are already launched support projects for research and design activities in the field of integration and interoperability of suppliers, sellers and consumers of travel services in different geographical areas which ultimately generated open systems, system architectures and protocols which use the new technological facilities and set new business rules.

This paper aims at presenting a GIS/AVL solution in order to support the performance and development of travel services by means of current technologies, by providing maps and information and travel orientation services in a dynamic manner, depending on the tourist's location. He should be provided with a GPS technology location device and with a device connected to the Internet (laptop and Zapp cell phone or PDA device with GPRS).

The solution was integrated in a mobile communications platform based on GPS technologies (Global Positioning System), GSM, Zapp and Internet, and in

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a Portal Internet type application. The pilot area selected for the experiment has a special tourism potential, including the Suceava – Bucovina area, with the Bucovina, Câmpulung Moldovenesc and Vatra Dornei based monasteries. The solution was tested on the move in Suceava County, with good results.

For the implementation of the GIS Internet solution we used Studio.NET Microsoft platform, Microsoft MapPoint Europe2002 product, vectorial maps in ESRI format representing Suceava Municipality.

**Keywords:** mobile communications platform; GPS technology; GIS; tourism.

## 1. Introduction

Within this project are developed and capitalized revolutionary information and communications technologies, as re the satellite positioning technologies (GPS) and the voice and data radio communications ones (GSM, GPRS, WAP, Zapp). Outstanding results and solutions were obtained through the integration of these technologies in remote information services via the Internet or via the networks of mobile operators. AVL technology (Automatic Vehicle Location) represents the integration of GPS and GSM technologies for the automatic location of vehicles.

These conditions required the upgrade and expansion of GIS, from the desktop systems to geographical data and service (applications) servers, provided to the general public via the Internet. The need for mobility and remote communication stimulated the mobile operators to replicate at a lower scale the functionality of personal computers and of the Internet, to provide specific services, and the mobile device manufacturers to develop new types of equipment, some of the most remarkable being the assistant type devices (PDA) and PocketPC integrated with GPS positioning devices and GPRS remote data communication.

The mobile systems and applications serve nowadays the development of GIS, through the collection and transfer of data from the field.

The solution set out in this paper, drafted by ITC-Bucharest and SSIB Bucovina, focused on the extraction and provision of geographical information on the Internet as maps, and on the development of a relatively cheap GIS application, which would not increase the cost of final services to the users.

## 2. Tourism Services in the Modern Perspective

The touristic potential comprises all attraction factors of the most different nature (natural or anthropic) and the landscape elements where these factors are located, everything forming a touristic offer.

**The touristic offer** reflects the touristic potential and is subordinated to the touristic demand. **The touristic offer has a certain location which cannot be changed.** The touristic offer has a certain positioning and partial location,

reported to the territorial distribution of the touristic demand (of the region of origin) and acts on two areas: emission and destination. Various ratios of forces are established between the two areas (emission and destination).

With respect to the touristic areas, there are highly requested touristic areas and extensive requested touristic ones (or diffuse). The potential area of a touristic area “expands” as a result of the higher circulation radius following the upgrade of communication paths and introduction of ultraspeed circulation means. Also, through the expansion of urban centers, these turn from touristic emission centers into wide emission areas.

Also in the case of destination area, complex subordination relations are set up between the nodal center of the cluster, which can consist of a resort location, and the attraction centers and objectives existing in the neighboring area and which can be covered by the tourist in one day, starting from the nodal center.

In this case also intervenes: the relative distance in kilometers, the type of communication path, the means of transport, the time assigned for visitation. From this point of view, the destination area can also be delimited by certain areas of concentric nature.

In addition to the position and location of a touristic area, one should also consider the accessibility reflected in the tourists’ structuring, based on age ranges, incomes and even behavior thereof. The accessibility, connections in the area, type of transport, are mainly important, in particular for weekend tourism, at small distance, in the peri-urban area.

Among the current trends in the growth of international tourism we would like to mention the mass nature of tourism; the internationalization of tourism due to the traveling facilities from one country to another; the diversification of touristic motivation, reflected in new types and forms of tourism; the more and more frequent short-time and short distance recreational tourism, in the peri-urban area of large agglomerations, which generates a specific form of tourism – the weekend tourism.

A variety of tourism forms are practiced within Suceava County, in close interdependence with the existing touristic resources.

The *cultural-religious* tourism is characteristic for Bucovina, favored by the existence of monasteries and other cult establishments. Religious tourism can be seen in two forms:

- a) religious cultural tourism; religious;
- b) pilgrimage tourism.

Other different forms of tourism can also be noticed, among which the rural tourism (agritourism) with a significant share.

The cultural estate of Suceava County includes:

- a) 160 historical monuments and archeological reservations;
- b) 11 memorial buildings;
- c) 14 artistic monuments of memorial value;
- d) 5 architecture reservations.

### 3. Motivations for GIS Application in Agritourism Services and Sustainable Development

In this new millennium, the climate of modern business is determined by the revolution of information technology. The companies use technological innovations for economic benefits. Often technology is used in a formal manner, because it exists, is trendy and can potentially improve the image, without previously setting the **necessity to solve a problem** set in the functionality of the existing system.

Knowing the business specifics, on the one hand, and the facilities provided by technology, on the other hand, can lead to remarkable **solutions** for the improvement of business climate and new customer serving methods.

The analysis and solution implementation field was tourism.

A. Specifics of the tourism orientation information

**Tourism orientation** implies, for an area of touristic interest, the correlation of the following types of information:

i) **basic information** (address, geographic coordinates, vicinities) – positioning-related (tourist, objectives) on a map;

ii) **thematic information**, intended for highlighting the geographical potential, the cultural, ethnographic, social value of the objectives;

iii) **infrastructure information** (condition of the road/river/maritime/airway access roads, **telecommunications**);

iv) **information on related services** (healthcare, car service units, traffic police)

in order to optimize the selection of a route and also to assist the tourist under emergency situations.

B. Complexity of the touristic information

The touristic orientation information is a complex type of information because in fact includes several categories of information, generally originating from various sources. In order to achieve its purpose, such information should be the answer to a dynamic, customized demand.

**Or solution** intended to answer the requirements on the integration of geographic data with the non-geographic and location ones (acquired through the AVL technology) and on the data provision as a public service, in a dynamic manner, depending on the geographical location of the tourist and on the touristic interest thereof.

### 4. GIS Services on the Internet

GIS Internet applications are **new solutions** which enable the data analysis and processing to take place in the web browser, leading to flexible and interactive applications. There are three approaches in this respect: a) GIS extensions for the Internet browsers (*plug-ins*); b) assistant type software (*helper/wizard*); c) ActiveX controls and Java *applets* (small interactive software).

The new GIS Internet solutions are conditioned by the Internet connection bandwidth (limitation of data volume and processing speed).

The client solutions are divided into two classes:

- Thin client;

The data processing on the server and the provision of static, non-interactive images to the client;

HTML/ASP (*ActiveServerPages*), JSP (*JavaServerPages*) languages can be used.

The VBScript and JavaScript script languages at the client can provide low customization (resizing the image).

- Thick client;

The data processing on the server and the transfer to the client of vectorial data locally processed by a browser extension, loaded prior to running the application, or by “smart” vectorial data, namely in XML, GML, SVG (*Scalable Vector Graphics*) format. The vectorial data enable to perform at the client detailing, running operations, local change of the displaying parameters, local performance of interrogations (at the client).

This type of solutions use on the client’s side: a) browser extensions (plug-ins); b) ActiveX controls; c) Java applets in combination with server applications written in HTML/DHTML/ASP/PHP/ColdFusion or using Java technologies (Java, Java servlets application servers).

A more recent alternative for interactivity, the reduction of Internet traffic and server occupation degree, is provided by SVG standard.

SVG is a standard developed by WWW Consortium (W3C). It consists of a XML grammar for the 2-D graphic description (shapes, raster images, animation, text). Can be processed by usual XML basics– validation parsers, XML editors, browsers supporting XML. It is use to be transferred on the Internet in compressed form (svg). Enables the overlapping on raster images (GIF, JPEG, PNG). Enables the dynamic handling with Java scripts. Is extensible with server-side technologies (Java servlets, JSP, ASP, PHP, Pearl). Adobe Company developed a free SVG viewer for Internet Explorer. The smart maps developed with SVG enable the immediate connection of graphic elements to non-graphic elements.

#### A. GIS Internet solutions available on the market

The applications which provide geographical location services on the Internet can use GIS platforms in order to develop the applications and generate maps or customized vertical solutions:

The offering of traditional manufacturers of GIS development media (companies ESRI, MapInfo, Intergraph, AutoDesk) is intended for both the desktop type applications and GIS Internet. Certain manufacturers provide solutions for the integration of GIS applications in the tracking systems (MapInfo, AutoDesk). The offers can be summarized as follows:

- **GIS applications development platforms, which include;**
- Map/spatial data servers with the possibility of addressing map requests in languages derived from XML (*e.g.*, ArcXML);
- Authoring tools for the websites;
- Views for Internet browsers (as plug-ins or ActiveX controls);
- GPS tracking servers;
- Platforms for mobile devices.
- **“Vertical” products with dedicated functions (e.g., for transport), which include:**
- GPS tracking server;
- Customized functions.
  - B. Offering of Microsoft Company
    - MapPoint2002 application, which enables the expansion of functionalities by means of COM technology (*Component Object Model*) or the Internet posting by means of Microsoft ActiveX Document technology;
    - Structured service (XML Web Services) MapPoint.NET, hosted on Microsoft servers, for the integration in applications based on location services. Provide services for a fee.

## 5. Presentation of the General Solution

Our solution contains the following main components (Fig. 1):

- AVL mobile platform
- Internet portal
- GIS application server
- Several types of information access devices (PC, laptop, PDA, cell phone)

The used platform is Microsoft Windows 2003 or V. 2007.

### A. Mobile platform

The development of the following mobile hardware platform was required in order to **take over the location information:**

- Laptop provided with the serial interface RS232 and USB port;
- GPS Trimble Lassen SK II receiver connected to the serial interface RS232 of the computer, set to send messages in NMEA standard;
- ZAPP mobile terminal connected to the USB port of the laptop and supplied by means of this port, in order to ensure the mobile Internet connection based on CDMA technology and with TCP/IP protocol.

In order to **geo-encode the objectives** we used an AVL mobile unit which contains a GPS receiver, a GSM modem and RAM memory for the

storage of coordinates and further decoding thereof. The coordinates are received by couple unit located at the premises of our companies.

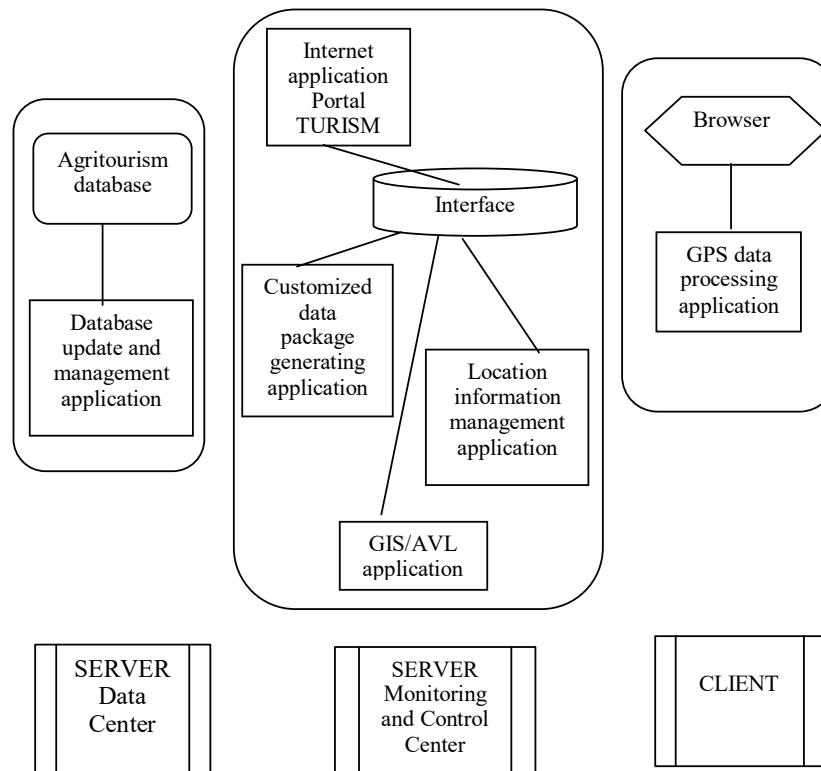


Fig. 1 – General functional architecture.

### B. The IT portal

The design of the touristic database for TurismAVL project started from the following premises:

- should contain the information required for online touristic orientation, supporting the tourists in their cars, in remote areas;
- should comply with VATGI European standard (Value Added Thematic Geographical Information) on the exchange of touristic information, in order to ensure the fundament of an open software platform enabling the integration of Romanian values in the international circuit;
- the structure of the database should adjust to the specifics and abundance of Romanian touristic information.

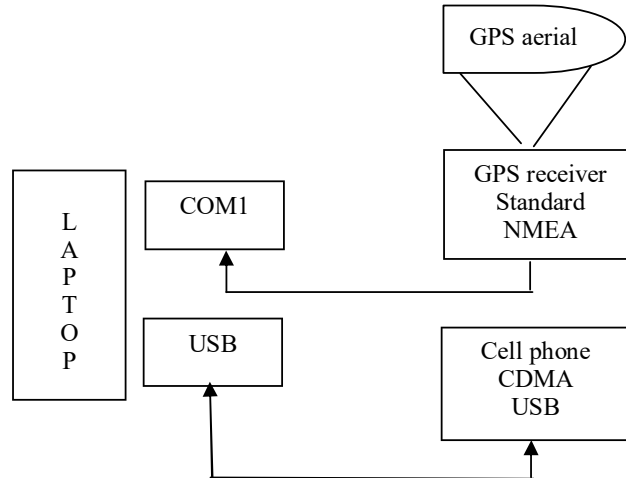


Fig. 2 – Schematic presentation of the GPS data reception hardware platform.

## 6. Grounds for the Selected Gis Solution

### 6.1. MapPoint Europe 2002 Product

The MapPoint product is a GIS desktop with reduced development facilities, but with facilities of *programmatic handling* of geographic and non-geographic information. The MapPoint Europe 2002 product contains detailed information of European states as well as maps of the other continents.

The geographic coordinates are in **WGS84** (World Geodetic System 1984) format.

MapPoint product contains a **layer** with localities, main and local roads, railways, main and secondary airports, over which the following can be overlapped; a **layer** with topographic (landscape) information, with demographic information and **several layers** of imported data or dynamically linked to the application.

MapPoint product provides the following types of maps through the overlapped several layers:

- Transport routes
- Non-geographical data (demographic, touristic objectives, geographically encoded user data)
- Transport routes and non=geographical data
- Political
- Physical

The possibility to import own geographical data is low, in particular due to the use of a proprietary format (\*.ptm). However, it is possible to import vectorial files of shape type in **ESRI format**.



Other characteristics:

- Geo-encoding takes place at the level of geographical coordinates, street addresses, postal codes, demographic data, political data.
- The import of user data takes place in the form of Excel sheets, Microsoft Access database tables or other types which enable the connection via the Universal Data Link (OLE DB, ODBC).
- For mapping can also be used incomplete, inaccurate or non-geo-encoded data. Generally, the data is successfully mapped up to 80%-90%; when the data cannot be mapped, MapPoint displays a list of possibilities.

Microsoft MapPoint2002 provides an objectual programming model and ActiveX control (**MapPoint Control**).

We should mention that Microsoft MapPoint is not a classic geographic system, and furthermore is dedicated for desktop. However, taking into consideration the specifics of the touristic application and the intended GIS functionalities, we **chose Microsoft MapPoint2002 product** due to the following reasons:

#### **Programmability**

- integration with the platform and other Microsoft products;
- possibility to use it as OLE server and develop an own GIS application server.
- programmatic control of the application: GIS location/positioning functions, types of maps, characteristics of maps, multi-symbol representation;
- extension of the functionality and/or automation of certain MapPoint functions by creating extensions based on COM technology (*Component Object Model*);
- easy integration with Microsoft products (*Access, Excel, Outlook, Internet Explorer*);

#### *Provided characteristics*

- does not require the development of maps, includes the map of Europe;
- possibility of geo-encoding the user data;
- static and dynamic connection to the user data;
- flexible search engine;
- route analyzing and optimizing algorithms;
- module of orientation and route planning extremely detailed, by hours, days, interim stops, cost computation, extremely useful for the touristic application;

#### **Connection to a GPS device**

- integrated communication with the GPS receiver, can be used for tests and data collection.

### Short time for processing

- Short time for computations, due to the fact that does not require special computation resources, the geographical data being integrated (does not refer to external geographical databases, does not perform conversions).

## 6.2. Mappoint Concepts

The MapPoint programming model is model-oriented, and contains objects and collections of objects, methods and features of the objects.

The most important objects are *Application*, *Map*, *Locations*, *DataSets*, *Pushpins*, *Route*, *Directions*.

### Pushpin

The localities and points of interest on the map can be marked by means of certain objects called “Pushpin”. This contains an icon, a label, a locality or a non-geographical data and an identifier defined by the user.

Can be used in order to mark a locality, which can represent a location on the map, an address or any location defined by latitude and longitude or can be a location defined by the user from a database imported in MapPoint.

Are organized in collections, can be accessed sequentially based on a meter of the collection. At its turn, is part of the *DataSets* collection, which contains all data imported from a database.

### Route

A route may include a specification, a set of indications, and/or the representation of a calculated route. The indications can be used in order to create an itinerary and contain information on the distance between segments, the traveling time, the route costs.

Routes can be optimized by time or distance.

## 7. Presentation of GIS/AVL Solution a ND Results

The GIS solution consisted of:

- identification of GIS services appropriate for the touristic services via the Internet under mobility conditions;
- development of a GIS application server (GIS dispatcher), taking over and servicing the GIS service demands from TurismAVL portal;
- development of the interface between the GIS dispatcher and the portal by means of a Microsoft SQL SERVER database;
- parametrization of the GIS service demand;
- development of an ActiveX component which can be loaded in the HTML client page, taking over the geographical coordinates from the GPS receiver;
- development of HTML pages, sending requests to the GIS dispatcher and displaying the maps;

- geo-encoding of touristic objectives of the pilot Bucovina area by means of the own AVL platform;
- development of ESRI vectorial maps in WGS84 format geographic coordinates, representing the street network of Suceava Municipality and the import thereof in the MapPoint product for touristic orientation in the town.

The GIS dispatcher is an own application which uses Microsoft MapPoint as OLE server.

The dispatcher sequentially services the requests from the portal clients, identifies the type of calling device (PC or mobile device) and provides a map specific for the requested GIS service. The maps are saved as GIF images, of sizes adjusted based on the calling device, which are included in the HTML page of the user.

The client's location takes place through the transmission in the GIS demand parameters of the geographic coordinates of the target area, corresponding to the tourist's position or center of the interest area.

The MapPoint database was not used for the display of touristic objectives because it is incomplete and cannot be dynamically updated, but **own data services**, dynamically linked to MapPoint. The display of objectives on the map was ensured by means of the symbols provided by MapPoint.

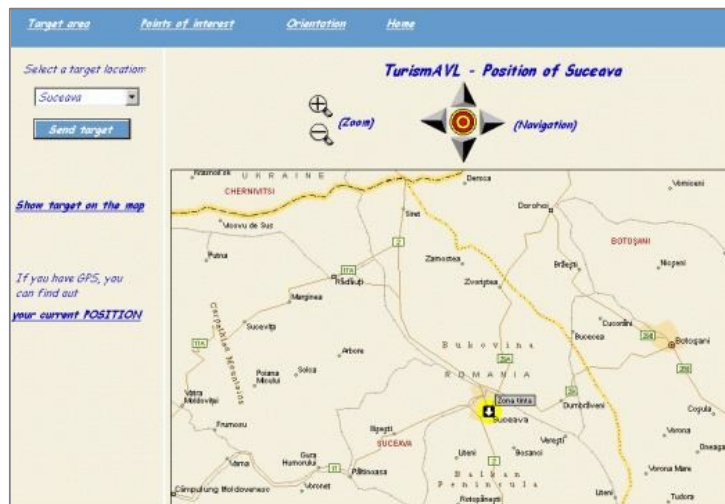


Fig. 3 – The first obtained map from applications.

#### □ Implementation manner

The GIS functions are developed with VisualBasic.NET and with the functions library Microsoft MapPoint9.0 Object Library (Europe), available by

means of the ActiveX MapPoint Europe 2002 control. Microsoft MapPoint9 Utilities 1.0 TypeLibrary is also used.

#### ❑ Implemented GIS services

##### A. Location Services

The service will have as result a map sector containing the *target area*, *target point*.

##### B. Data Services

Ensure the map representation of touristic interest objectives, by using data provided by the Web services implemented under TurismAVL project. The data is obtained through the interrogation of existing data within 50 km around the target area.

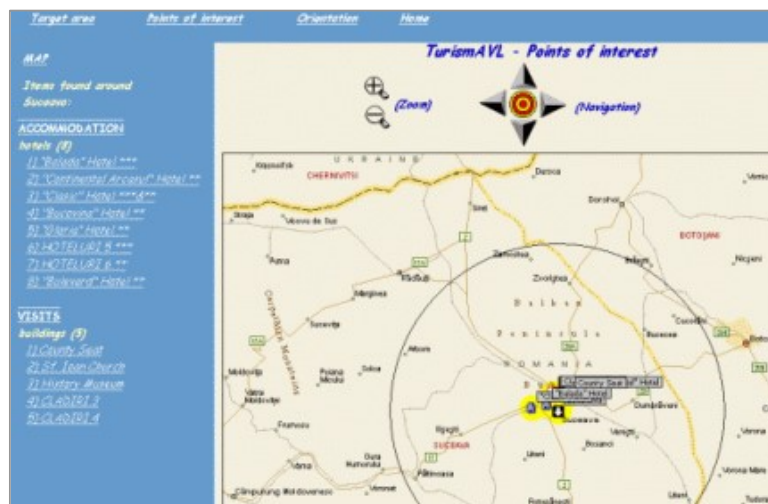


Fig. 4 – The second obtained map from applications.

The objectives are represented with symbols and sensitive areas when pointing the mouse, also called as “hotspots”. The objectives are marked on the map with various symbols, which will have attached labels with general information: name; distance from the *target point*.

##### C. Map Handling Services

A map centered on the target area is obtained in an implied manner. Through the map handling services, the user is provided with 2 types of ZOOM (detail/perspective) and map moving functions on the 4 cardinal points (PAN functions).



Fig. 5 – Other obtained map from applications

#### D. Orientation Services

Complex services for obtaining the best route to a certain touristic objective.

All points of the route should be known: the departure point, the destination point, interim stop points, stopping time, envisaged optimizing criterion.

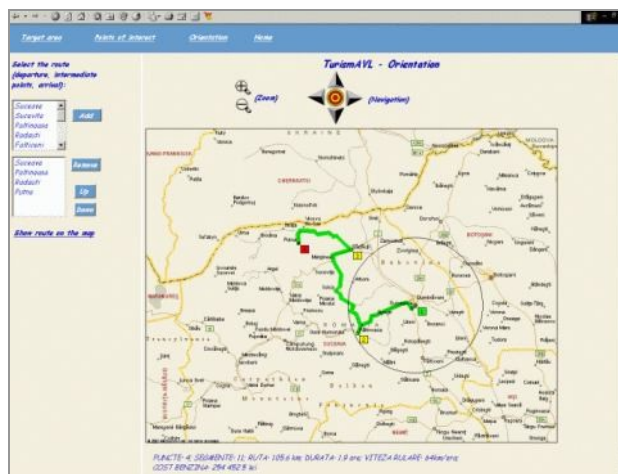


Fig. 5 – Other obtained map from applications.

## 8. Conclusions

The set out GIS solution is an applicative one, selected based on price and efficient development reasons. Based on Microsoft MapPoint as cheap solution, we depend on the data sources acquired by Microsoft company. Following the test of the system we could find certain accuracy deviations of the geographic data, but we can hope that in the future the data sources for Romania will be of higher quality and provided by local suppliers.

The application which integrates GIS solution is highly complex, but benefits from special support at Suceava County level, required for the geo-encoding of all touristic objectives and the supply of touristic databases.

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## SOLUȚII GIS PENTRU DEZVOLTARE DURABILĂ ÎN AGRO-TURISM

(Rezumat)

Dezvoltarea Durabilă și Agro - Turismul s-au dezvoltat cu deosebire în ultima jumătate de secol, însă ca fenomen social-economic de masă se numeră printre

activitățile de bază în numeroase țări, fiind una din ramurile economice cu cele mai mari perspective de dezvoltare în viitor.

Actuala dezvoltare a Societății Informaționale impune și industriei agroturismului ca și celorlalte sectoare financiare și comerciale, necesitatea dezvoltării unor noi metodologii bazate pe tehnologia Internet și tehnologii moderne de telecomunicații. La nivel european s-au lansat deja proiecte suport pentru activități de cercetare și proiectare în domeniul integrării și interoperabilității furnizorilor, vânzătorilor și consumatorilor de servicii turistice din zone geografice diferite care au avut ca finalitate crearea de sisteme deschise, arhitecturi de sisteme și protocoale ce folosesc facilitățile noilor tehnologii și stabilesc noi reguli ale afacerii.

Lucrarea își propune să prezinte o soluție GIS/AVL în sprijinul realizării și dezvoltării de servicii turistice utilizând tehnologiile actuale, prin oferirea de hărți și servicii de informare și orientare turistică în mod dinamic, în funcție de localizarea turistului aflat în mobilitate. Este necesar ca acesta să fie dotat cu un dispozitiv de localizare prin tehnologie GPS și cu unul de conectare la Internet (laptop și telefon mobil Zapp sau dispozitiv PDA cu GPRS).

Soluția a fost integrată într-o platformă de comunicații mobile bazată pe tehnologiile GPS (*Global Positioning System*), GSM, Zapp și Internet, respectiv într-o aplicație de tip Portal Internet. Zona pilot aleasă pentru experimentare are un potențial turistic deosebit, fiind vorba despre aria Suceava – Bucovina, cu mănăstirile din Bucovina, Câmpulung Moldovenesc și Vatra Dornei. Soluția a fost experimentată în deplasare prin județul Suceava, cu rezultate bune.

Pentru implementarea soluției de Internet GIS au fost utilizate platforma Microsoft Studio.NET, produsul Microsoft MapPoint Europe2002, hărți vectoriale în format ESRI reprezentând municipiul Suceava.

