

National Park Information System

Alexander Almer¹, Herwig Zeiner², Christian Derler², Harald Stelzl¹, and
Patrick Luley¹

Abstract

The tourism in rural areas and national parks can be regarded as a very sensitive economic factor. On the one hand eco-tourism regions and especially national parks have to present their natural environment and fascinate landscape. On the other hand they have to guide tourist streams to avoid negative effects on their assets. This paper will briefly discuss the current situation of the digital presentation of national parks and includes also tourism aspects in the surrounding rural areas. It will discuss proposals for a novel interactive multimedia information system, while focusing on the various components of such a system.

1. Introduction

Tourism regions are currently exploring the potential of new digital presentation strategies that will maximise the promotional appeal of their region and assets, which include a unique landscape and scenery, a natural environment, an impressive cultural heritage, and a wide range of sport facilities and other tourist amenities. Tourism in rural areas and national parks can be regarded as a very sensitive economic factor. A fundamental prerequisite for long term economic success in a strong competitive market is to maintain the naturalness of the environment. The main aspect in this context is an effective management of tourist streams to avoid negative effects of mass tourism. For the creation of long-term perspectives in the field of “green tourism” an innovative information system has to allow the guidance of tourists in rural tourism regions and national parks.

¹ JOANNEUM RESEARCH, Institute of Digital Image Processing, Wastiangasse 6, 8010 Graz, Austria; email: alexander.almer@joanneum.at, harald.stelzl@joanneum.at, patrick.luley@joanneum.at, <http://dib.joanneum.at>;

² JOANNEUM RESEARCH, Institute of Information Systems & Information Management, Steyrergasse 17, 8010 Graz, Austria; email: herwig.zeiner@joanneum.at, christian.derler@joanneum.at, <http://www.joanneum.at/iis>

Currently, the Web presentations of most of the rural areas and national parks only sporadically use the possibilities of the new innovative geo-multimedia technologies. The different digital devices like info terminals, PDAs (Personal Digital Assistant), GPS devices, mobile phones, etc. are not included in the presentation concept of the tourism regions.

A sophisticated concept of an innovative information service needs to include the provision of information on the national park and the rural tourism region, which enables the planning of activities on vacation, offers entertainment and also allows business transactions based on a geo-multimedia application framework and the use of multimedia devices. The system based on this concept will integrate satellite images, GPS data, GIS information and information on leisure activities, offering multimedia and 3D-visualisation technologies and interactive navigation.

The concept that will be briefly described in this paper is based on the work within the framework of the project VITA, which was funded by the Austrian ministry of education, science and culture (Zeiner H., Lernbeiss H., Almer A., Stelzl H., 2002) and the ongoing EU-project ReGeo ("Multimedia Geoinformation for e-Communities in Rural Areas with Eco-Tourism"). The project ReGeo started in April 2002 and focuses on the development of a comprehensive regional information system based on a decentralised (virtual) geo-multimedia database. Partners in Germany, Poland and the Czech Republic will participate in this EU-project.

2. Concept of the Information System

The multimedia community has created different kinds of multimedia applications using e.g. pictures, audio and video. These kinds of applications have been successfully applied in a lot of non-spatial tourism information systems. The geo-community has also applied their technologies derived from e.g. satellite images and aerial images in a wide range of specialised applications. Through a lack of common metadata / data standards the full potential of integrating multimedia into advanced geo applications using geo-multimedia information has not been sufficiently exploited in regional information systems so far.

Tests of existing systems within the scope of a market analysis (Zeiner H., Lernbeiss H., Almer A., Stelzl H., 2002) showed clear shortcomings regarding data visualisation and the storage of spatial information. To avoid such shortcomings the following model is based on a geo-multimedia application framework, out of which end-user applications can be created on different output devices such as World Wide Web, CD-ROM, info terminals and mobile devices. The scheme for the geo-multimedia component is shown in the following figure 1.

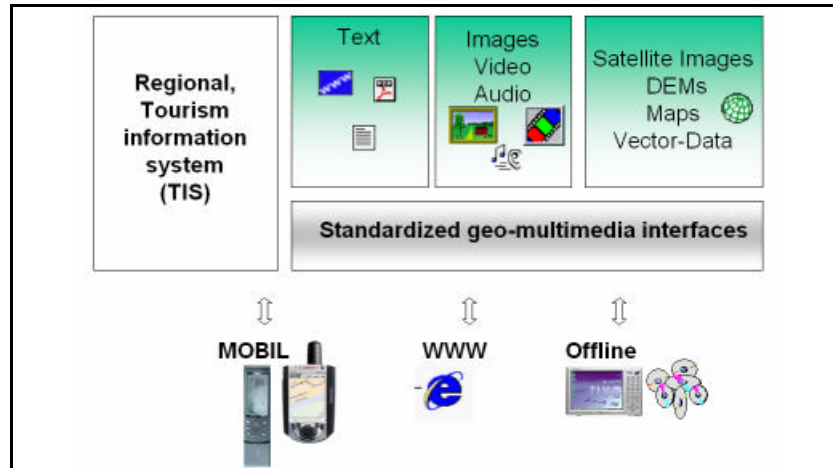


Fig. 1: Overview of the geo-multimedia component

The geo-multimedia component consists of three different parts. The content contains the different kinds of geo-multimedia data (e.g. text; images, audios, videos; maps, satellite images and DEMs). The geo-multimedia interfaces enables the access to the different types of content. The presentation layer depends on the actual media devices and the integrated content management system.

3. Geo-Multimedia Application Framework

Strong technical requirements are interoperability, access to data and meta data and exchange of the content. For search & retrieval of geo data it is important that the actual geo-multimedia data is annotated by content description, format, coordinate system, geo quality, use conditions, etc. Easy access to geo data requires the provision of adequate and affordable data. Major factors in the cost chain are the data collection, management and dissemination and multiple use of data. One aspect of access to geo-multimedia data is meta data management using meta-data description standards. One of the design goals is to describe the metadata of the multimedia content in a standardized way e.g. with Dublin Core (DC) and MPEG-7 (Martínez, J. M., 2002). The geographical metadata/data use the GML (Cox S., et al., 2001) format to exchange and transfer geographical relevant data. Furthermore, the application uses geographical web services. Geographical web services can be seen as an interoperable framework for web-based discovery, access, integration, exploitation and visualisation of multiple on-line geo data sources and assets (Graham S., et al., 2001). However, it is a goal that the software component can be embedded in a regional information system or a tourism information systems (TIS).

4. Visualisation of Geo-Multimedia Data

Fundamental to the presentation of national parks and tourism regions in the future will be the innovative use of visualisation 2D and 3D techniques including interactive cartographic maps and satellite/aerial images, 3D models, Quick Time VR objects for panoramic and cubic views and also virtual flights based on current standards like Web3d, 3D-Dreams, Shockwave3D and MPEG-4. The visualisation will be based on geo-multimedia content using the geo-multimedia application framework.

4.1. Pre-processing of Geo-Data

For the visualisation of a tourism region three-dimensional landscape models are very suitable, as they give the user a particularly realistic impression. In order to design such 3D models as realistically as possible, satellite image data is used.

One of the most important parts of 3D-landscape-modelling is the digital elevation model (DEM). The DEM is required for the geocoding of remote sensing data, as described below, and also plays a vital role in 3D visualisation. The required grid size of the DEM depends on the desired scale of the depiction.

For the application of remote sensing data it is essential to geocode them into a determined reference geometry. This is accomplished by a parametric imaging model of a satellite sensor. The imaging model is generated with the sensor data and optimised with the aid of ground control points (Raggam et al., 1999). Based on this model the satellite image is geocoded into the reference geometry by using a DEM. The geometric accuracy of the geocoded image is examined by comparing and superimposing with the reference data, i. e. with maps and digital orthophotos.

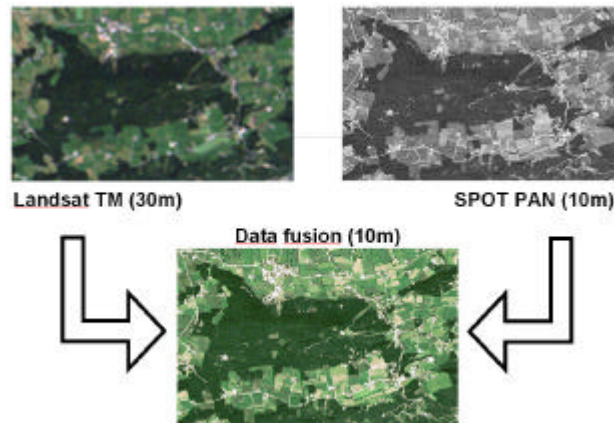


Fig. 2: Data fusion of Landsat TM and SPOT PAN data

For the landscape-visualisation a datafusion of Landsat TM data (30m multispectral) and SPOT PAN data (10 m panchromatic) was realised to obtain true colour images at a resolution of 10 m (see figure 2). The applied method is based on the principal component transformation and supplies high resolution true colour images.

4.2. Generation of Geo-Multimedia Objects

3D views are calculated from the combination of the fused 10 m RGB images and the DEMs. A precondition for this data generation is the exact geometric concordance of geocoded satellite images and the DEMs (Patterson, 1999). The predefinition of the contemplator's position results from the definition of the image acquisition parameters, i. e. camera position and view direction.

These parameters may be modified interactively in order to get the best visual 3D view of a landscape. After this definition the 3D views are rendered (see figure 3). This generation as well as the calculation of flights and virtual panoramas are treated in an animation software, which is highly suitable for the processing of geo data, in particular for the animation with large DEMs and satellite image textures.

For the generation of a virtual flight some thousand separate images are rendered and combined to an animation file (mpg-file). For a flight animation it is vital to define a flight path and to determine the variable view direction along this flight path and the equally variable flight height. Starting from a standardised frame rate of 30 images per second 1800 separate images have to be calculated for a one minute animation. In order to avoid flickering in an animation, antialiasing-techniques are applied. For the generation of an animation file separate images are coded into a compressed format. For this, the mpeg-4-format has proved useful, because it possesses a high compression degree and yet a high quality.

The generation of 180° or 360° panoramas offers an impressive possibility to visualise a region. These panoramas can be generated both from separate images and from virtual 3D views of satellite images (see figure 4). So a "virtual stroll" through the landscape, national park and the tourism region can be realised.

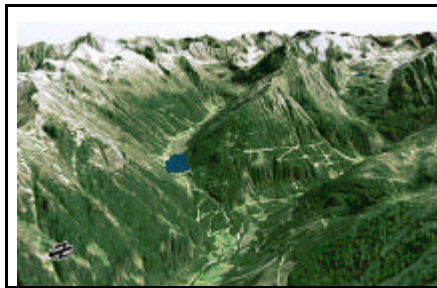


Fig. 3: 3D-view of alpine area



Figure 4: Virtual panorama with map

4.3. Visualisation Results

In the framework of the visualisation of landscape information large data from existing archives and newly surveyed data flow in, like photos, descriptions, GPS routes) as well as general tourist information. The above described multimedia objects emerge as novel sources of information, visualising outstandingly a region's topographic conditions. Above all the high degree of interactivity, which distinguishes the examples described below permits the user a completely new access to topographic and tourist data.

The presentation of landscape and tourist information can be done in several ways. The "traditional" way is the visualisation in 2D-maps or 2D-satellite images. The important point in multimedial presentation is the combination of different medias for a better information transport. So in the 2D-presentation the user can interactively load additional data into the map, which is linked to documents, images or web-sites.

The 3D maps also comprise a variety of additional information which can be loaded by the user (see figure 5). In this way natural sights, huts, villages and towns as well as points where photos are available appear on the screen by a mouse click.

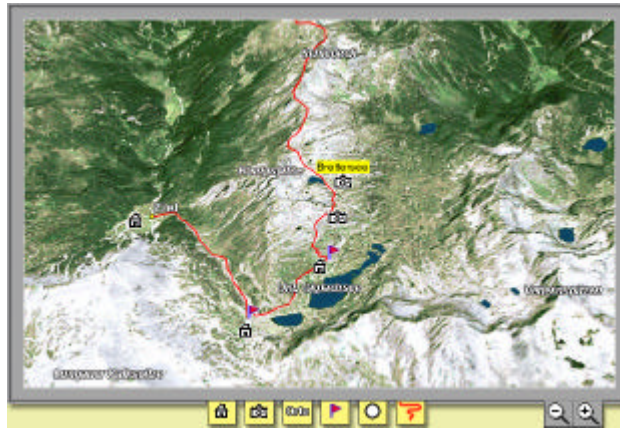


Fig. 5: Visualisation of a hiking tour in a 3D-map

Based on the described multimedia objects this geo-multimedia information system was combined with the region's existing information structures (s. figure 6). Geo-multimedia data complete the comprehensive and effective existing tourism information systems. The geo-coded gathering and administration of all infrastructure objects permits position and place referenced processing. This in turn allows the tourist optimum orientation and provides regional information.

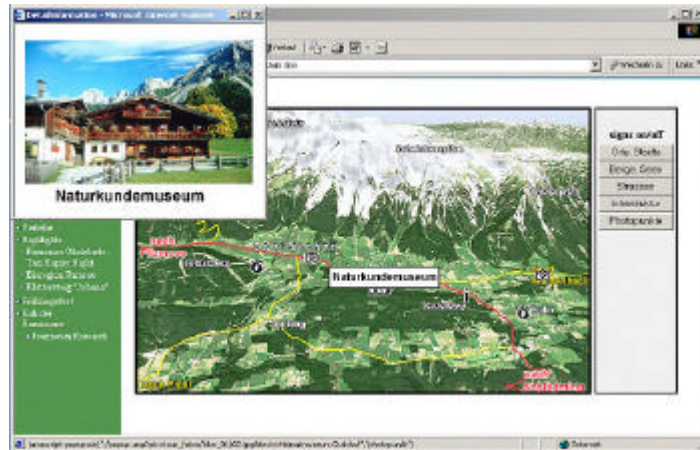


Fig. 6: Visualisation of tourist infrastructure

5. Mobile Devices

The recent developments in the sectors of information and communications technologies are influencing more and more the daily life of their consumer. Nowadays, a strong increase in the use of mobile devices like cellular phones, personal digital assistants, notebooks and GPS devices can be observed.



Fig. 7: Tourism information on a PDA

Tourism information and also information related to national parks is basically location based information and it is of high interest for visitors. The geo-multimedia information will be provided on different output devices like in the web, on CD-ROMs and on mobile devices with the integration of pictures, sound, text and video elements in order to record the effectiveness of such systems. Further information is obtained by cartographic illustration (see figure 7) of the site and its surroundings.

Conclusion

Increasing competition in the tourism industry demands new and innovative strategies for the presentation in order to reach the right tourist target groups. It can be vital for tourist areas to prepare information in a geo-multimedia information system and to present these data on different digital media. The implementation of such a system in national parks and tourism regions requires a close co-operation with the administrations of the parks and the tourism boards. The geo-multimedia application framework will be combined with existing tourist information systems (TIS). The user-related presentation (“customisation“) of information alongside the possibility to link this information to a geographic position (“Location Based Services“) and applications running also on mobile devices will play a crucial role in the acceptance of the digital tourism information services.

Bibliography

- Almer A., Stelzl H. (2002): Multimedia Visualisation of Geoinformation for Tourism Regions based on Remote Sensing Data. ISPRS - Technical Commission IV/6, ISPRS Congress Ottawa, 8-12 July 2002; in progress.
- Almer A., Nischelwitzer A. K. (2000): 3D Visualisation of Leisure & Tourism Information based on Remote Sensing Data. ISPRS - Technical Commission V/5, ISPRS Congress Amsterdam, 16-23 July 2000.
- Cox S., et al. (2001): Geography Markup Language (GML) Version 2.0. OpenGIS Project OGC Document Number: 01-029, Internet: <http://opengis.net/gml/01-029.pdf>
- Fritsch D. (2001): Positionsbezogene Dienste: Mit Mehrwert angereicherte Geodaten. Geo-Informationssysteme, 9/2001.
- Graham S., et al. (2001): Building Web Services with Java, Sams Publishing, 2001
- Hofmann-Wellenhof et al. (1997): GPS. Theory and Practice. 4. Edition. Vienna / New York: Springer Verlag.
- Martínez, J. M. (2002), “MPEG-7 Overview (version 7)”, ISO/IEC JTC 1/SC 29/WG 11/N4674.
- Patterson, T. (1999): Designing 3D Landscapes. In: Multimedia Cartography. Berlin / Heidelberg / New York: Springer-Verlag.
- Raggam, J. et al. (1999): RSG in ERDAS IMAGINE. Remote Sensing Software Package Graz. Field Guide. RSG Release 3.23. JOANNEUM RESEARCH Forschungsgesellschaft mbH., Graz, Austria.
- Zeiner H., Lernbeiss H., Almer A., Stelzl H. (2002) : Vernetzte Multimediale Informationssysteme für räumlich, zeitlich und thematisch strukturierte Daten. Founded by “Bundesministerium für Bildung, Wissenschaft und Kultur“. Project-report and project CD-Rom. Graz. January 2002.