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# Experience Gained from the Use of Environmental Information Systems for the Public in the State of Baden-Wuerttemberg

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**Abstract:** For the protection of the natural environment and a sustainable development, joint responsibility and participation of the citizens are indispensable. In this connection, enlightenment and information of the public and the promotion of environmental awareness play a crucial role. This contribution shall present various environmental information systems for the public and report about the experience gained from their development and operation. The systems have been developed as parts of the Baden-Wuerttemberg Environmental Information System by Forschungszentrum Karlsruhe in cooperation with the State Institute for the Environment, Measurements, and Nature Protection. In particular, the Baden-Wuerttemberg Environmental Information Network with a portal to the State's distributed environmental data, the XfaWeb information system family providing technical documents issued by the environmental administration, and the PaUla portal for technical information on mobile devices shall be described. In addition, the Theme Park Environment supplying environmental information that has been processed for the public as well as environmental experience-oriented information and the MobiNaf mobile guide to nature, an electronic companion for excursions in nature shall be presented. Evaluation of these systems by analyzing access statistics, user interviews, field studies, etc. has shown that the public is considerably interested in environmental information. This interest refers to both technical data of the administration as well as information processed for the public and completed for own experience in nature.

**Keywords:** Environmental awareness; Environmental information systems (EIS); EIS for the public (PEIS); Environmental portals; Mobile EIS

## 1. INTRODUCTION

Sustainable ecological development requires the joint responsibility and participation of all groups of society. In this connection, access of the citizens to information on the environment plays a crucial role. In Baden-Wuerttemberg, a federal state located in Southwest Germany, free access of the citizens to information on the environment and regular information of the public are among the tasks of the EIS BW (Environmental Information System Baden-Wuerttemberg). The EIS BW is no monolithic system, it rather represents a network of various individual systems, the development of

which is coordinated under a framework concept by a research and development committee of the State Ministry of the Environment [Mayer-Föll et al., 2004].

Initially, the EIS BW nearly exclusively comprised systems that supported the administration in the planning and execution of environmental duties, monitoring of the environment, risk/accident management, and in information supply to decision-makers. With the increased significance of public participation, environmental information systems for the public (PEIS) have gained relevance in the EIS BW. According to their

purpose, two types of PEIS can be distinguished within the EIS BW:

- Systems that provide the public with access to technical information of the environmental administration (incl. systems supplying measured data).
- Systems designed to enhance the environmental awareness of the public.

In addition, the environmental information systems for the public may be divided into systems that predominantly represent portals to other information systems and systems that predominantly provide own contents. Up to now at least, systems designed for use in the field (usually with a small display and no or low-performance internet access) and systems designed for use at the workplace of the users (without these restrictions) have to be distinguished.

Within the framework of EIS BW, several environmental information systems for the public have been developed by Forschungszentrum Karlsruhe (Karlsruhe Research Center) in cooperation with the State Institute for the Environment, Measurements, and Nature Protection (LUBW) and other partners. The present contribution shall focus on these systems, including their evaluation and the experience gained from their use.

In the next section, three systems will be presented. They supply already available technical environmental information of the administration on the internet or improve the access to this information. In the following section, it will be reported about two systems that have been developed especially for the general public to enhance environmental awareness, with the information being processed accordingly. For reasons of space, the systems themselves will be described briefly only. For further details on the functionalities and technical concepts of the systems, it will be referred to other publications.

## **2. PEIS FOR ACCESS TO TECHNICAL ENVIRONMENTAL INFORMATION**

### **2.1 BW Environment Portal for Central Access to the Distributed Technical Information of Public Authorities**

The BW Environment Portal (<http://www.umwelt-bw.de>) that is part of the Baden-Wuerttemberg Environmental Information Network (EIN BW) offers the public a central access point to the

environmental information available on the distributed web sites of the state authorities. The system has been conceived to comply with the obligations resulting from the (amended) EU directive for free access of the public to environmental information. According to this directive, those bodies that are obliged to inform shall actively and systematically inform about the environment in a manner that is understandable to the public and in electronic form, if possible.

The key component of the BW Environment Portal is a database containing metadata on the web sites of state authorities with environmentally relevant information. These metadata control the crawler that indexes these web sites for full-text search in the portal (apart from an overall full-text search, also a full-text search restricted to the individual environmental issues is offered). In addition, these metadata are used for generating further access paths to the distributed environmental information of the State via a technical structure of the environmental sector and a list of information suppliers [Schlachter et al., 2004]. At the moment, support of searches is being further extended. For instance, during a full-text search for a term entered, similar terms are offered from an environmental thesaurus for an extended search (i.e. the technical term "waste" is given when searching by entering the term "refuse").

At present (January 2006), the BW Environment Portal contains information from 132 web sites of 35 information suppliers (authorities). Approximately 475,000 documents (HTML, PDF) have been indexed for full-text search. In 2005, the first complete year of operation, approximately 16,000 page impressions and 55,000 hits (file accesses) were counted per month on the average.

### **2.2 XfaWeb Systems for Supplying Technical Documents**

The XfaWeb systems are a family of technical environmental information systems that make major technical documents issued by the State Institute for the Environment, Measurements, and Nature Protection available on the internet (<http://www.xfaweb.baden-wuerttemberg.de/>). The systems are dedicated to waste treatment, treatment of contaminated sites, soil protection, administrative management of chemicals, nature protection and landscape conservation, and environmental research. The information is supplied to the staff of the administration and of engineering offices as well as to the public interested in

technical details. The systems offer various access paths to the technical documents, in particular an access via report series / report structure, a full-text search, a keyword search, and technical access (access by structuring the field of application). A comprehensive framework has been developed for the automatic decomposition and processing of the documents for the web and the automatic generation of access paths [Geiger et al., 2005].

To evaluate the XfaWeb systems and for further developments, users and persons in charge were interviewed using specific questionnaires. Furthermore, an analysis of use was made. In the past years, the number of daily users ranged between 1000 and 3000, the number of page impressions per day usually varied between 10,000 and 50,000.

Development of the first XfaWeb system has started in 1995 already. As the bandwidth of user accesses to the internet was limited at that time, development work was aimed at (automatically) decomposing the extensive documents into smaller units. For this purpose, a decomposition according to the chapter structure was chosen. For automatic decomposition, the reports available in MS Word had to be pre-processed (marking of chapter headings, etc.) with a certain expenditure. When the bandwidth of accesses to the internet was increased and also PDF files could be used (e.g., indexed for full-text search), pre-processing of reports hardly asked for was no longer considered worthwhile. Consequently, reports less frequently used are stored in the systems as PDF files only. As far as information on environmental objects, such as nature protection areas, was concerned, better linking and integration with related information in other systems, in particular with documents in other systems, technical data in databases, geodata in geographical information systems, and photos in photo archives was desired.

A concept has been developed for a successor of the XfaWeb systems as well as for a general EIS BW technical document management system. The EIS BW technical document management concept is based on continued decentralized administration and updating of the documents. In addition, central access to all documents is provided via a central technical document service. The decentralized systems offer pertinent access services via web services. For integration, certain mandatory and optional metadata of each document have to be supplied, such as an unambiguous and persistent identifier and the title of the document. The central

technical document service is accessible via web services and can be used in environmental portals and dedicated information systems.

### **2.3 PaUla Portal for Technical Information on Mobile Devices**

Access to technical information also is of interest when working in the field. Staff of environmental or ecology-related authorities is partly working in the field, for instance, when they have to decide on immediate measures to be taken in the case of road accidents of vehicles transporting hazardous goods or when inspecting factories. In addition, employees of engineering offices and the broad public can benefit from such information on e.g. environmental objects in the free nature.

For the supply of technical information on PDAs, the PaUla portal was developed. The portal supports users in downloading large information files, such as maps and large reports, on PDAs with their PC prior to field work. Additionally, users may access the extensive, publicly available information of the XfaWeb systems (see Section 2.2) during field work via a mobile telephone connection (<http://www.xfaweb.baden-wuerttemberg.de/xfaweb/ppc/>). In this case, the HTML pages of the XfaWeb systems are decomposed and processed for the small displays of PDAs [Geiger et al., 2005].

The experience gained so far from using the PaUla Portal has shown that the demand for such a mobile access to technical environmental information based on state-of-the-art ICT is rather small at the moment. The necessity of having to download prior to field use extensive information material, such as maps, since the bandwidth of mobile telephone connections is limited, reduces the acceptance of such systems. Moreover, the number of environmental field staff or persons from the public having such equipment is rather small up to now.

## **3 DEDICATED PEIS FOR ENHANCING ENVIRONMENTAL AWARENESS**

### **3.1 Theme Park Environment for the Broad Public**

The target group of the Theme Park Environment (<http://themenpark-umwelt.baden-wuerttemberg.de>) is the broad public and in particular children, young people, multipliers, such as teachers, decision-makers as well as the ecologically interested public in general. The Theme Park is aimed at conveying knowledge on the environment

to citizens in an appealing and easy-to-understand manner. The citizens shall be made aware of the relationship between the environment and their lives. The system shall explain the objectives and necessity of environmental policies and enhance ecological awareness.

The Theme Park Environment (Fig. 1) consists of four areas: By accessing “Our Environment” (“Unsere Umwelt”), the diversity of nature and the environment in Baden-Wuerttemberg are shown by soil landscapes, geotopes, moors, and protection areas. The access “Environmental Issues” (“Umweltthemen”) explains fundamental ecological policy aspects in the fields of soil and soil protection, biological diversity, etc. Under “Observe the Environment” (“Umwelt beobachten”), state-wide permanent soil monitoring is presented. “Experience the Environment” (“Umwelt erleben”) provides access to detailed information on various places in the State for own nature experience, including information on how to get to these places, opening times, contact persons, etc. The start page addresses current ecological or environment-related issues with links to the corresponding web sites [see Döpmeier et al., 2005].

Since October 2004, the Theme Park Environment has been offered on the internet, first for evaluation and since July 2005, for operation. At the moment (January 2006), the system comprises about 950 composed web pages, about 4000 content objects, about 1000 image objects, and about 140 slide shows.

To promote the usage of the system by the target groups intended and to evaluate the system, a press release was issued when the Theme Park Environment was made available in November 2004. Flyers were sent to representatives of the target groups and to teachers in particular. For public feedback, the system offers a questionnaire. Since the launch of the Theme Park, usage of the system has increased strongly. From August 2005 to December 2005, about 5,400 users, 323,000 page impressions, and 434,000 hits (file accesses) per month have been registered on the average.

Analysis of use shows that as soon as such a system has reached a certain publicity, there obviously is a certain basic usage of the system. After advertisements and in particular when environmental issues are discussed in the public, however, accesses increase strongly, provided that the issues are addressed by the system.



**Figure 1.** Main page of the description part “environmental hazards and protection” of the moor object “Weingartener Moor” within the Theme Park Environment

### 3.2 MobiNaf Mobile Guide to Nature

Even more than the development of the Theme Park Environment, that of the MobiNaf Mobile Guide to Nature is based on findings from environmental psychology and pedagogical studies, according to which an emotional attachment to nature and the environment based on concrete environmental experience is the key to an ecologically compatible behavior and ecologically oriented decisions [Schultz, 2000] [Haklay, 2003]. The Mobile Guide to Nature is intended to meet especially children, young people, and young adults (and with them their parents) in their “enthusiasm” for computers, to animate them to directly experience nature, and to support them in this experience by supplying context-related information.

The current prototype of the Mobile Guide to Nature supplies information on route planning,

orientation aids in the territory, and data on stations in this territory (points of interest) to users for excursions in the nature protection center of Karlsruhe-Rappenwört. For context-related supply of local information, the mobile devices are equipped with GPS. A major part of the development work was devoted to making best use of the limited screen size of PDAs for the presentation of the information and to reach a good usability for users.

To evaluate this system, extensive field studies with various user groups, in particular school classes and families, were made, see Fig. 2 The participants were interviewed before and after the excursion, a camera was used for filming the excursion, and the electronic guide to nature was compared to a printed one.



**Figure 2.** Field studies with the Mobile Guide to Nature during tours in a nature protection center

### 4. GENERAL EXPERIENCE AND CONCLUDING REMARKS

Evaluation of the information systems described has shown that the public is strongly interested in environmental information. This applies to both expert information from technical authorities as well as to information that is processed for the public and easy to understand.

Experience gained from the use of the EIN BW portal has shown that users very much appreciate the system’s comprehensive survey of the State’s environmentally relevant information offers on the internet and the central search and navigation options for these distributed information offers. In addition, integration of the municipal administration level (districts, cities, municipalities) in the portal is desired.

As pointed out in Section 2.3, the demand for mobile access to technical environmental information based on state-of-the-art ICT as offered by PaUla is rather small at the moment. Acceptance will grow and the demand will probably rise with the increasing dissemination of high-performance mobile devices and improved bandwidth of new mobile telephone services, such as UMTS. With them, downloading of extensive information files at the workplace or home PC or the taking along of comprehensive paper documents will no longer be required.

Evaluation of the usage of the Theme Park Environment for the broad public has shown that information above all on areas for own experience and background information in the fields of "Our Environment" are requested. Returned questionnaires and contact forms revealed a broad spectrum of technical questions and in particular wishes for additional information on places described in the system.

First evaluation of the field studies of the MobiNaf Mobile Guide to Nature has revealed that there is no significant difference between the current prototype of the Mobile Guide to Nature and the printed guide as far as its benefit for users is concerned. This is measured by e.g. the success rate when making navigation decisions during the tour. However, children at least have a stronger motivation to use this Mobile Guide to Nature [Ruchter et al., 2005]. A detailed evaluation of the field studies is currently being made.

To sum up, extensive search and navigation options for the distributed information offers of the individual authorities and integrated presentations of environmental issues and environmental objects are important to the users. Such integrated presentations require standards and agreements between the individual systems on the semantic and technical levels. On the semantic level, for instance, standardized and unambiguous object identifiers of environmental objects as well as a common thesaurus had (and still have) to be defined and used. On the technical level, web services are considered suited for integration and are developed step by step.

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