

Citizen-Centred Information Dissemination with Multimodal Information Channels

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Abstract

Citizens call for timely and high-quality environmental information for reasons of comfort and health care. This interest recommends an easy-to-understand and easy-to-access presentation of such information. Rather than presenting raw data in an extensive fashion, one ought to engineer customisable information services, that can be tailored to individual user groups, be it for reasons of content or be it for reasons of citizen's reachability. In APNEE, we have been designing information services that draw upon various information channels, i.e. mobile-technologies, interactive portals for the Internet, as well as street panels for municipality usage scenarios. In a nutshell, the APNEE system promotes user-friendly information management and dissemination via multiple information channels, and can be applied in multiple information domains or be part of relevant applications or service back bones. Based on such high quality dissemination services, even environmental information will turn into an attractive product once perceived and provided as indicators for emerging interests of citizens towards levels of comfort.

1. Motivation

Several directives and regulations have been devised to improve levels of comfort and other conditions for quality of life. People will improve levels of comforts ultimately only due to their change of behaviour. But, any imposition on people has proven to fail rather constantly. Citizens require more information regarding the quality of the environment they live in, and as they become more aware of environmental issues, this request continues to rise, thus raising information requests. The question arises of how to design and implement citizen-centred

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information services, since the level of sensitivity corresponds proportionally to the quality of information services and the ease of use from a users point of view. To meet such levels of quality, information services have to meet higher levels of intuitivity for use and pro-activity of services.

The current paper presents a uniform portal for information mediation created in the context of the APNEE project (APNEE 1999). It serves the application domain of air quality in different European regions. This environmental domain possesses some “problematic” characteristics (Karatzas/Moussiopoulos 2000): the confusion and frustration of users, already reported for systems offering information on environmentally sound technologies or related topics (United Nations 1998). However, once properly addressed and resolved, such solutions enrich the value and the transferability of such information portals.

APNEE studies the feasibility of different broadcasting methods and evaluates them with regard to acceptance, potential impact on citizen behaviour, future markets for on-line environmental information services for city authorities, telecommunication service providers and other entrepreneurs in the information society. In addition, cartographic animations provide an easy to use presentation of information available via the internet. Navigation further capitalises on such a cartographic presentation through means of interactive maps that guide users through available information.

2. APNEE approach

APNEE employs several communication channels to transmit information on air quality to selected citizens in urban regions in a customised fashion. Customisation refers to the tailoring and processing of information content, i.e. the kind of warnings or recommendations for further actions, with respect to the user group registered, to the technical capabilities of the end-user devices targeted, and of course to the geographic location. Two dimensions for the improvement of information services are conjectured: Firstly, sophisticated means for information visualisation are required to elevate the intuitivity of information encounter. Rather than presenting raw data of some environmental management systems, a new interaction metaphor for navigation and access in information spaces is employed. Special attention has been turned to means for visualising data in a cartographic stance and for providing interactivity amid exploration. Moreover, a fuzzy-oriented query facility supports requests posted by citizens with different background knowledge. Secondly, information services had to mature from a passive delivery task towards a pro-active, customisable service, that orchestrates data for a specific purpose and employs appropriate information modality whilst reaching citizens, that might have even subscribed to specific profiles.

While the information portal of APNEE is also being a “multimedia” product, it should consider the following sources of knowledge (INUSE 1996) for reasons of citizen acceptance:

- A working knowledge of the social and organisational context and constraints on the system, i.e. what is the environment in which the product will be used, what are the information access points, who are the information stakeholders, owners, producers and consumers, etc.
APNEE has been addressing this requirement through a new concept of requirements analysis, where requirements are analysed in terms of use case scenarios and service prioritisation.
- A working knowledge of the expected users of the system: users normally are very diverse with respect to their level of education, and their level of acquaintance with, and acceptance of, “high-tech” consumer products, and require information services transparent to the technologies used.
APNEE addresses these requirements in terms of a central knowledge base of user subscriptions and their respective profiles. It distinguishes professional experts in the environmental domain as well as citizens who subscribe to services tailored to their personal preferences, e.g., people suffering from asthma.
- A working knowledge of the range and types of intended tasks or usage scenarios of the system, i.e. which human activities or social processes will be supported by the system and what are the intended benefits?
APNEE has addressed this requirement during its requirements analysis by drafting various application scenarios considering a large array of environmental regulations as well as services of city authorities and health care professionals.
- A working knowledge of the types and range of media or information coding systems available. This will include the types of acceptable input (e.g. numerical, textual, handwriting, speaking, gesture and movement), the types of acceptable output (e.g. textual, graphical, acoustic, tactile), as well as mixed forms (e.g. screens used both for data display and input selection).
APNEE addresses this requirement in terms of its central knowledge base of available communication channels and messages to be broadcasted in case of a warning.

3. Transferring APNEE-like information portals to other application domains

The spectrum of the information channels materialised in the frame of APNEE make the portal an ideal platform for various information domains that call for multi-channel information applications.

A major advantage of APNEE furnishes the combination of pull and push techniques, where the latter can be used for all early warning domains (cf. Figure 1):

- Pull services: interested persons request information on demand, information will be returned on this request immediately by sending information.
- Push services: "push" content to interested persons who subscribe to such a service on timely or event specific basis.

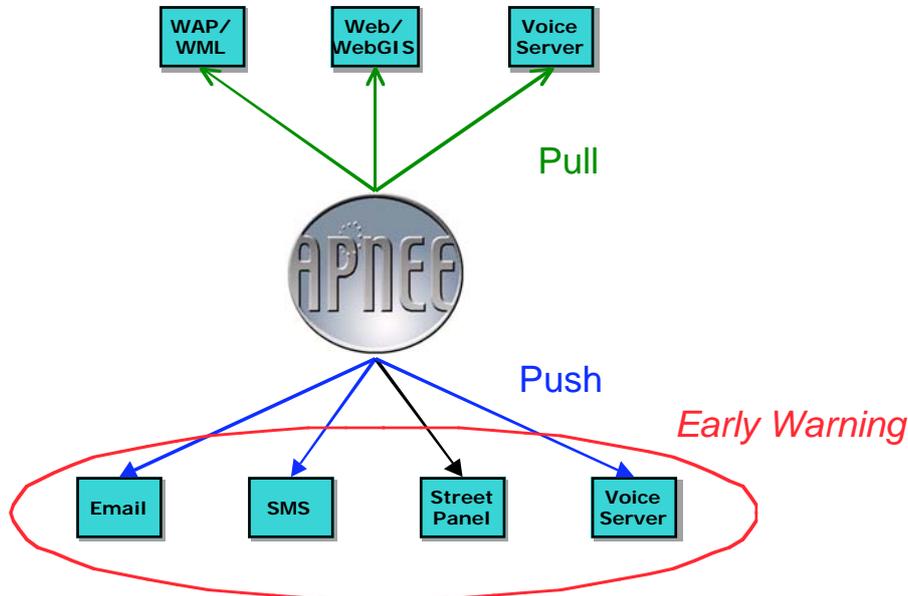


Figure 1
APNEE Push and Pull Services

Push services of APNEE are directly adaptable to other application domains calling for early warning means, which by nature represent emergency situations: water flooding, earth quakes, fire, and tornado warning. In addition, commercial applications, e.g., traffic information or personalised health information, can be served.

4. Cartographic Visualisation

In the remainder of this paper we will focus on a geographical information portal. Major emphasis has been put on ease of use and customisation service. Cartographic visualisation allows citizens to access information in an intuitive way and map layers allow a customisation of information content as well as presentation, an approach resulting in a high level of user acceptance (Kingston at al. 2000).

As indicated earlier, the pivotal objective of the APNEE portal is to provide accurate and timely air pollution information to the average citizen. One of the interfaces to accomplish this task is the GIS interface.

When presenting the average citizen with scientific data, it is important to make the information understandable and easily available. This is most important when presenting pollution forecasts, which may have an impact on the daily routines of a citizen. Tufte (1983) shows how the understanding of scientific data and their meaning are greatly enhanced through careful adoption of graphics. The graphics must encourage data comparison, present the data at different levels of detail, avoid data distortion, etc. Most of these issues might be accomplished by static graphical presentation alone, but the nature and size of the data presented in the APNEE project promotes the use of data mining techniques to create a "visual reality" (Shneiderman 1993, 421-423). The use of direct manipulation and interactive query tools has proven highly instrumental when once navigating such complex information spaces as represented by APNEE (Shneiderman 1994).

This, along with the fact that APNEE will disseminate geographical information to the citizen, makes a well-designed GIS system a natural incarnation of the user interface. Also, the use of GIS to reach the end user has been implemented with success in other EU funded projects, such as IRENIE (IRENIE) and GeoNet 4D (Peinel/Rose 1999). The APNEE system is built upon several components and resembles the Smalltalk Model-View-Controller (MVC) paradigm (Nichols 2000). The model consists of a database and GIS system (GRASS) along with well-defined methods to access the data.

The advantage of this design is that the APNEE system easily adapts to new ways of presenting data. People with disabilities, for example, visually impaired, might be given a specialised interface to the air quality information. If a new push technology is invented or has to be employed, a new "view" might easily be added to the existing APNEE umbrella of different dissemination techniques. Therefore, the APNEE system is highly (re-) configurable and scalable.

Following this requirement, the map server has been built in a modular fashion with an open environment towards the OpenGIS standard in order to incorporate alternative browsing styles if necessary.

OpenGIS is defined as "the ability to *share heterogeneous geodata and geoprocessing resources* transparently in a networked environment". The OpenGIS consortium has specified several standards for the realisation of a standardised and flexible exchange of geographical information. A decision was made to use the OpenGIS® Web Map Server Interfaces Implementation Specification (OpenGIS 2000) as a starting point for the GIS Internet communication.

The WebGIS interface enables the user to access air pollution information through smart maps. The main idea is that the server side provides all GIS functionalities and the client, for instance a Java applet, simply displays the map as

image. The communication between applet and GIS will be done according to the Open GIS specifications.

There will be two different WebGIS interfaces being implemented in APNEE:

1. A simple HTML interface providing enough functionality to give a fast overview. It is easy to load and print while the screen only shows a simple map with a specific theme. That means the user cannot modify the content of a layer dependent on the needs and cannot carry out any simulation or model, e.g. dispersion models, emission models, exposure models, etc.
2. An advanced Java applet with direct manipulation features, and data mining and dynamic queries applied to the currently selected map layers.

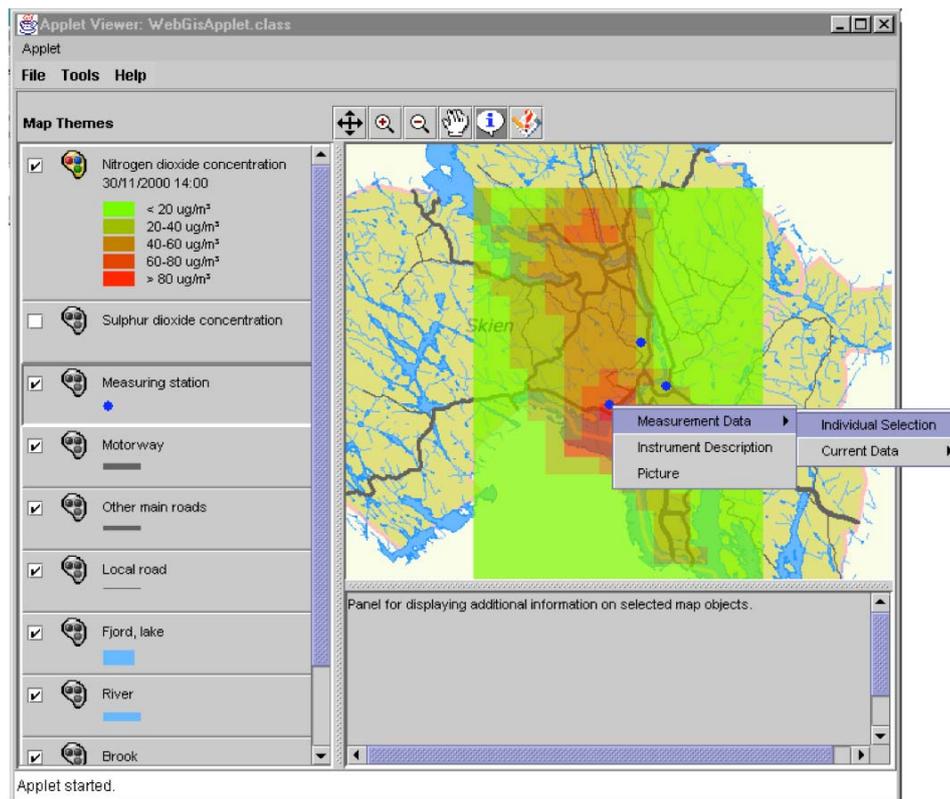


Figure 2
Screenshot of the APNEE WebGIS Interface Prototype

The system administrator generates predefined maps by using a map generation tool. This tool offers the possibility to generate maps containing different layers, and to

define the drawing features for each layer, i.e. shape, size, colour of the signature. Additionally there is an option to specify whether and how the user can modify the layer content, and which information should be shown if the layer objects are defined as sensitive areas.

Since objects on a layer can be sensitive areas, the maps become re-active. If the mouse enters such a region, a short information to this map object will be shown and a flipped icon of the mouse cursor indicates that additional information on this object are available.

5. Conclusions

The APNEE approach is on the upper limit of the communication and information usage capabilities that current technologies address (available for citizens at “shopping level”). Moreover, the information web that APNEE is dealing with is only a part of the “information package” that impacts and interests a city inhabitant.

Many of the business models, technologies and assumptions made during the first thirty years of electronic information are now inapplicable. Most people today prefer information applications that are closer to the television, motion picture, and entertainment model as opposed to the pure information model. It is clear that audio, video, and other types of multi-object information structures are prevailing.

Within this business and technological environment, the development of information portals employing state of the art, user friendly and end user accepted technologies is progressing more and more. In addition, modularity and object-oriented techniques, widely used in software development, suggest that when a portal is developed, it is easy to “transfer” it to multiple application domains, by scaling its modular dimensions and by parameterising its components. This can be considered as a “paradigm sift” in action (Kuhn 1996), and has many advantages.

Modular information portals that make use of state-of-the-art Internet and telecommunications tools should be scalable and flexible. A generalised information portal is presented, as developed in the frame of the APNEE project. The system supports user-friendly information management and dissemination via multiple information channels, and can be applied in multiple information domains or be part of relevant applications or service backbones.

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