Implementation of a web software application for decision support in participative environmental planning - The case of Municipality of Larisa (Central Greece)

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Abstract

This paper introduces a new way to conduct participative environmental planning in urban communities using modern technologies. The basic objective is the implementation of a web based software application that can give answers to participative environmental planning issues. Also, the paper discusses how a citizen could participate in the decision making process and express in public his opinion on main aspects of local authority policies.

The concepts of environmental planning, participative planning, Web Geographic Information Systems, Spatial Decision Support Systems and e-government are discussed. Furthermore, a web software application is developed that can be transformed to an integrated information system for participative planning. Up to this point, this application can manage and analyze: a) the participation and the opinion of citizens, public entities and others on various policy scenarios that planners and experts propose within the social, economic and legal framework of local urban communities, and b) the results of planning for every environmental issue that emerges and demands a solution.

This software application combines many web technologies such as Content Management Systems (using PHP programming language, MySql Database system and Apache server), Blogs, Social Forums, On line Survey Systems, and Web Geographic Information Systems (using UMN Mapserver).

The analysis and operation of this web software application is based on data from the city of Larissa (Central Greece) incorporating the specific characteristics of the regional institutional framework in Greece. By using modern technologies the planner and the citizen can get closer and collaborate for the most optimal solution on issues that concern the quality of life in urban space.

Key words: Participative Environmental Planning, Web Geographic Information Systems, UMN Mapserver, Online surveys, Blog, Forum, E-Government

1. INTRODUCTION

It is a known fact that in Greece and abroad many theories have been developed and analyzed over time related to the planning of urban space (Aravantinos, 1997). These theories are mainly concerned with the definition of the context of action, but all recognize that there are three basic stages in the planning process: a) objective setting, b) analysis and c) synthesis. The following steps summarize quite masterfully the implementation process:

Step 1: System description and problem formulation
Step 2: Configuration and analysis of alternative solutions
Step 3: Evaluation and selection of best solution
Step 4: Implementation and follow-up

Environmental planning in a urban region is also a form of planning that follows the above-presented procedure with an emphasis in achieving sustainability in the particular urban region and beyond it (Athanasouli-Rogakou *et al*., 1999). In addition, its priority is the choice of corrective interventions with the environmental dimension in mind and the growth and development of the urban web of a particular region.

The experience mainly in countries where environmental planning is an essential part of the institutional operations has proved that the final results of planning are better when the ultimate recipients of these results accept them and have participated in their concretization. That is, when planning has incorporated and balanced the opinions of all involved institutions and entities.

Thus, as participative environmental planning (Christofilopoulos, 1990) in an urban region could very simply be reported a process which follows the steps of planning with the environmental dimension always in mind and achieves the participation in the process of all who should and want to express an opinion (including simple citizens). The following mark its operational functioning:

1. the public institution is the agent of legality and the one that ratifies decisions (Local Authority or State)
2. the scientist coordinates, directs, expresses, specializes and implements all that is decided (city planner, designer)
3. the citizens and the remaining institutions and entities participate and determine components of planning through dialogue and exchange of opinions, viewpoints, studies, arguments etc

For the finalization of planning, and more specifically of planning that refers to the scale of the urban web, many tools exist which help in the clarification of all its stages. An important such tool are the Geographic Information Systems (GIS). A GIS could be defined as an integrated system for the collection, storage, management and analysis of information, which involves personnel, equipment, software, and data in digital form and helps in mapping and representation of the existing characteristics and occurring events in a geographic region (Paraschakis *et al*., 1991).

Unfortunately in Greece all efforts made for environmental planning have always faced serious problems and have never included in a direct way the opinion of those who would finally feel its results (Dimopoulos, 2006). The research reported in this paper was motivated by this fact. An effort is made to develop an initial approach that can reverse this situation and address the question: to what extent there could be essential participation of citizens, institutions and other entities in the decisions made during the practice of environmental urban planning?

This work proposes a tool (a software application) in order to overcome the difficulty of participation, to automate it, and to make it more flexible and applicable at each moment in time. The developed software application includes many of the new trends and internet technologies (Apache server, MySql, UMN Mapserver, PHP) and makes tangible the application of planning in the light of true participation in it of state, planners, institutions, citizens and others. The application is composed of the following functional units:

internet-based system of geographic information aiming at the diffusion via internet of the maps portraying the policies or the policy scenarios on some subject-problem,

system of diffusion of policy scenarios and material on them aiming at providing to anyone via internet of all informative material that concerns to some question,

system of collaboration, exchange of opinions and formation of task forces aiming at the implementation of participation and fermentation of opinions,

system of briefing-information aiming at the specialized and targeted briefing on the issues,

system of materialization of questionnaires, polls and voting aiming at the diagnosis and better imprinting of opinions in a context of democratic operation for the selection of final policy.

The pilot testing of the software tool and the data it manages are related to the municipality of Larisa in the Prefecture of Thessaly, Central Greece.

2. DESIGN - ARCHITECTURE

The application follows the general architecture of client - server. It exploits the capabilities of an Apache web server and it is offered to the final user as webpages viewed with a browser. It constitutes an internet site, which many users can visit (multi-session) and participate simultaneously using its services. It has been based entirely on open source software (http://www.opensource.org/) and was developed in the logic of implementing its services in source code. Thus it can be characterized as an open system that possesses a model way of communication and interoperability via the world wide web and can be parameterized and developed further with easy incorporation of additional services and re-use of code.

For its operation a PC (server) provides both internet services and geographic services for the support of the internet-based GIS of information. In addition, it

hosts all data of a relational data base. The final users of the application can have access from other PCs that are connected to the internet via any browser.

The application is characterized by a three-tier architecture (Figure 1). Initially it has an autonomous system for database management (MySql - descriptive data, digital cartographic layouts and files with spatial data) that constitutes the ***Data ManagementTier***. This gives the possibility to perform various tasks with the data (briefing, deletion, questions etc) and with those that are involved in participative environmental planning (users - administrators).

In the ***Middle Tier*** there is the implementation of the internet site and the electronic services that support the participative planning and have been reported upfront as its functional units. All functional units are implemented in PHP5 and have been set up in an Apache server. They interconnect the user with the digital material (incorporating html code), the data and the cartographic layouts that a UMN Mapserver composes during its operation.

Finally, the ***Presentation Tier*** lies on the side of the final user and is portrayed in the browser (Opera-http://www.opera.com/, Mozilla Firefox - http://www.mozilla.com/en-US/firefox/personal.html or other) when the final user selects the application which supports participative environmental planning.

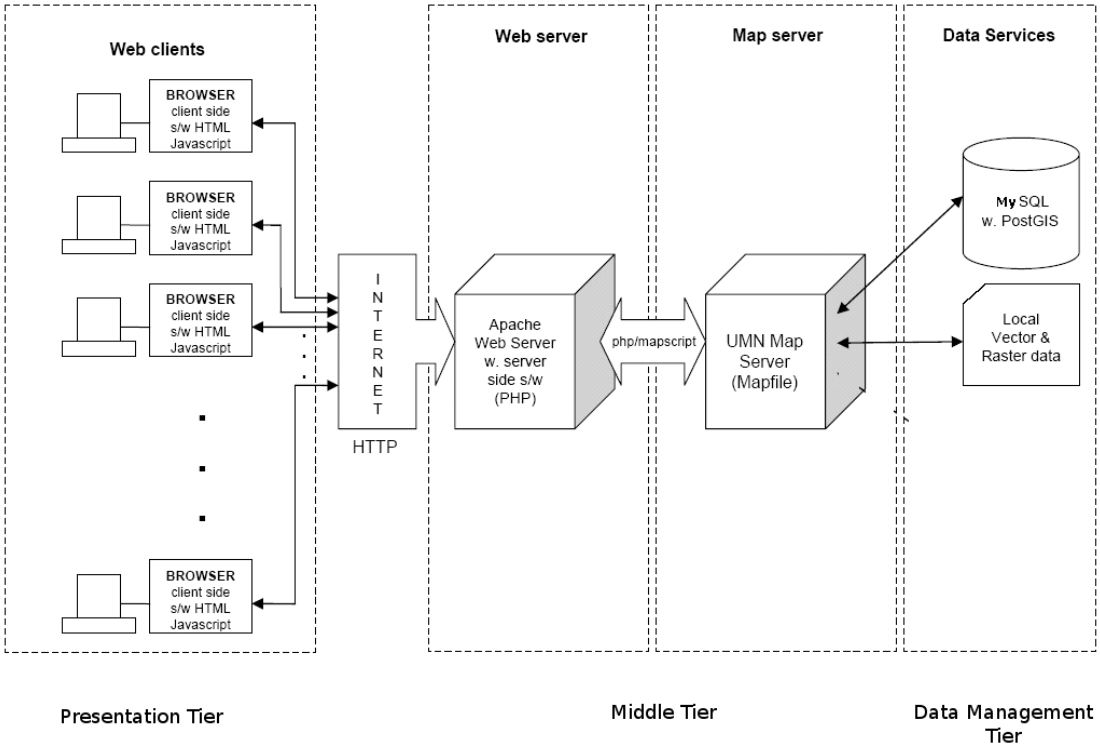

Figure 1: The three-tier architecture of the application.

3. OPERATION

The developed application offers the possibility of navigation on issues for which participative planning can be applied. The final user who wants to participate uses a browser to access the application url. Then the server shows the available functional units of the application (choices). That is, the user can request from the application server to see the cartographic depictions of proposed solutions to a certain environmental planning issue or to see what has been said and what has been studied by other parties or to vote on some question etc. The browser portrays what is sent by the server as a response to a certain demand.

The server very often is called to recover data via simple http calls made by the final user via his browser. The answers that it gives result from a combination of available technologies of the application. The Apache server uses the PHP to dynamically fulfill the demand. The PHP collaborates with MySQL when the demand is related to data retrieval and with the UMN Mapserver when the demand calls for the production of a map. Finally the Apache server takes the result of collaboration

and dispatches it to the browser in HTML form. Based on the CSS that serve the interconnection and the final appearance of each service used the user in order to send his demand to the application site, the result and the choices are presented in the user's browser.

For example, during the operation of portrayins information on a map object (in the internet-based GIS) which is executed with a click of the mouse in a map region on the side of the browser, an http demand is placed on the server to retrieve from the database the descriptive data that were asked. The http answer contains the results. For this process the Apache server collaborates with the UMN Mapserver so that the map picture is formed and afterwards it dispatches it to the user's browser. A similar logic exists in the all operations - services of the application, such as the finding of thematic units for discussion, the participation to a voting etc.

The application can be used simultaneously by many users each of whom enjoys different services through the materialization of a separate session for each one by the server and PHP.

4. AVAILABLE TECHNOLOGIES

The Apache server (http://www.apache.org) that is used in the application is the most often used web server that collaborates irreproachably with the programming language PHP.

The PHP (http://www.php.net) is a programming language for the development of internet applications. From 1994 when it was created, it is used in a wide range of internet applications (among which http://www.yahoo.com etc) and has gained the support of big companies as IBM which provides it free of charge for use with the systems of servers it produces. It is a mature and completely object-oriented programming language. The PHP can incorporate HTML code and collaborates with the CSS for the materialization and export to the side of browser of tasteful depictions. Also because the PHP has the capability of incorporating SQL code in it and collaborates with database management systems as MySql, it allows the server to retrieve all kinds of data (descriptive, spatial or other type) making it extremely competitive.

The MySQL (http://www.MySQL.com) is a system for relational database management. In Version 5.0 it constitutes a system immediately comparable to larger and perhaps better known systems (Oracle, SQL Server), which is used by big companies/organisms such as NASA, Apple, Motorola etc. It is been distributed free of charge. The whole database for the services of the application has been structured in MySQL. Beyond this, however, dynamic demands to the database and the transformation of results in HTML form can be materialized via MySQL.

The UMN Mapserver (http://mapserver.gis.umn.edu) is an open source software, that provides spatial services and is characterized as a geospatial web server (Tziachris, 2006) which materializes geospatial services aiming at the distribution of spatial data through the web based on the standards and the specifications issued by OGC (http://www.opengeospatial.org/). This particular server is capable through its collaboration with Apache to diffuse the cartographic layouts and the relative descriptive information. The UMN Mapserver is software supported by OSGeo (http://www.osgeo.org/), a non-profit organization that supports and promotes the synergistic development of open spatial technologies and data. The UMN MapServer manages the file Mapfile in which all the characteristics of information are declared. This information is finally presented after it is taken from digital cartographic layouts (e.g. in shapefile form). Thus on the basis of the data that the mapfile has at each moment and the descriptive information that has determined its structure, the cartographic layouts are drawn by the Mapserver and pictures are created that finally portray the map.

The Apache server takes the data processed by the UMN MapServer and dispatches a suitable html to the final user browser that portrays the environment of application and the cartographic layouts. In the present application the UMN MapServer manages shapefiles (http://en.wikipedia.org/wiki/ Shapefile). These contain the geometry and the features of geographic entities to which each cartographic layout is referred to, and they are constituted mainly by:

- the basic file **.shp**, that includes the geometry of forms that represent the geographic entities
- the index file**.shx**, that includes the index of geometry of entities
- the file of table of features **.dbf**, which includes the values of features for each form

5. THE FUNCTIONAL UNITS OF THE APPLICATION

The user through the application can see organized information on each subject for which it is required to practice participative environmental planning. A template has been materialized in the provided interface through which, depending on the selected hyperlink, the relative information and services are presented.

In order to enter the application each user must give the user name and password assigned to him by the institution administration. Initially he views all the available projects, studies, and problems

which the administration (Municipality of Larisa) opens up to participative planning. Also he can communicate with the institution by means of communication forms. After choosing a project of interest to the user, the five functional units of application appear (Figure 2).

5.1 System of diffusion of policy scenarios and other material

For each planning topic there exists a general description which is dynamically updated by the system administrator. Also content is offered concerning the official documents that have been produced by teams of experts employed by the institution. These give the general wider policy context that affects the proposed scenarios for the particular subject. The system administrator can incorporate dynamically digital files referring to each subject (studies, audio or video files etc) by the administration institution or by other entities which the final user can store in his PC.

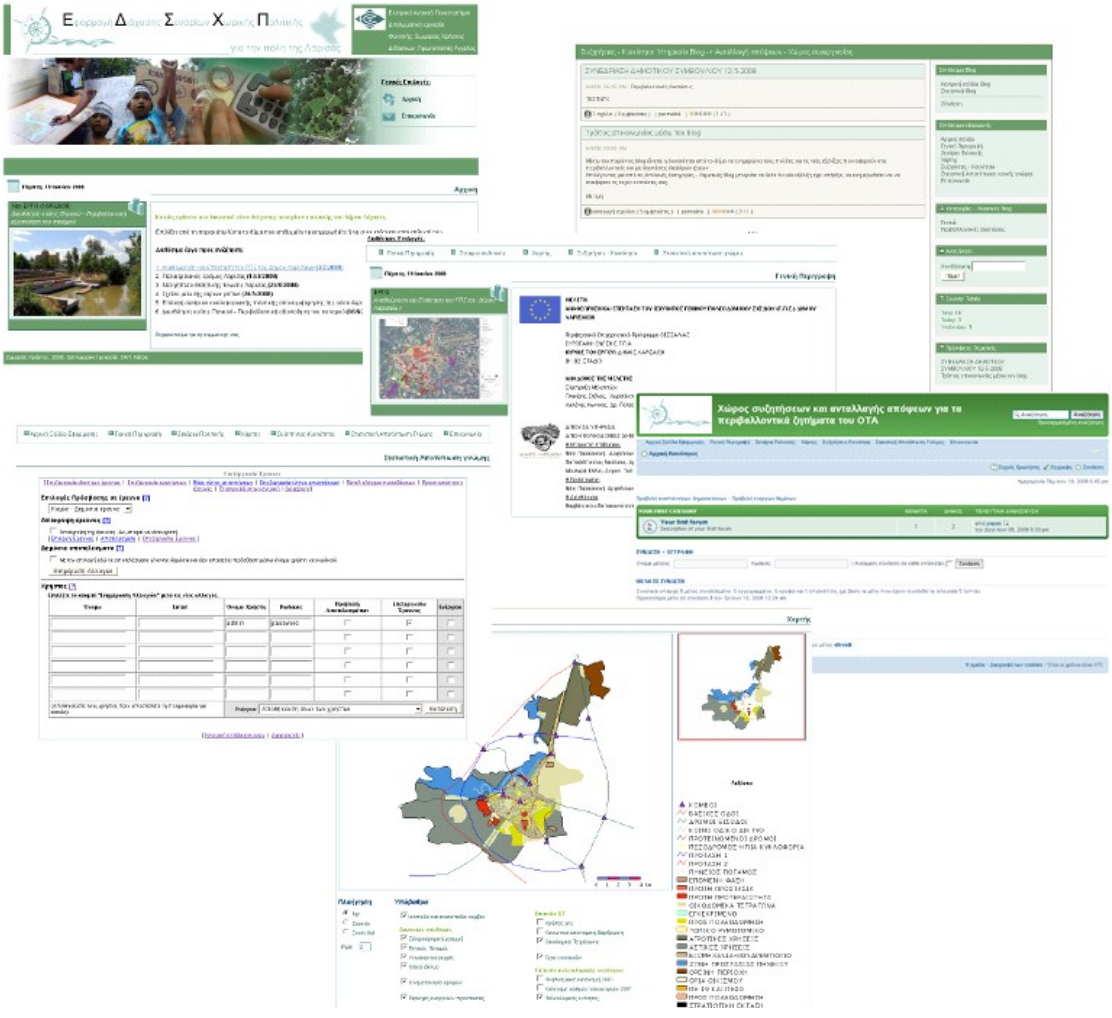

Figure 2: The five functional units of application depicted on the user's side.

5.2 Internet-based GIS

In this unit the user can see a dynamically evolving map that describes the data, proposed solutions and alternative scenarios of the official position of the institution on the subject. The user can focus and move in the spatial data and de/activate the layouts of spatial information in order to analyze the dimensions and characteristics of the problem under study. The administrator can update this information during the course of planning. In this system the views and positions of planning teams and institutions are also portrayed as they are shaped over time.

5.3 System of collaboration, exchange of opinions and formation of task forces

This unit follows the logic of forum discussions (http://www.phpbb.com). The administrator organizes the discussion in thematic units by grouping the general categories of issues that compose, relate to and

affect each planning subject. Thus, the final users can make publications, interventions, collaborations and communicate memoranda of certain common opinions. The result is to facilitate direct creation of teams of those who agree (discussion teams) and constitute teams that can jointly announce proposals. The planning experts can then decode and translate these proposals into terms of policy decisions on the particular subject.

5.4 System of briefing-information

The particular system follows the logic of Blog (http://www.simplephpblog.com/) from where the user can be informed for all current developments on the subjects of interest to him. The briefing is related to the opinions and the proceedings of the meetings of municipal councils that are related to the subject selected by the user and which the administrator can also post. The user can add his arguments for each publication, which the institution officials can analyze over time.

5.5 System of realization of questionnaires, polls and voting

From this unit the application users or the administrators can conduct questionnaire surveys, polls and electronic voting on various questions that emerged from the discussion in the Blog and Forum on questions that require ratification of political decisions of the institution on any issue that subjected to participative planning. All users can participate only once in each survey, poll or voting (http://www.bigredspark.com/survey.html).

4. CONCLUSION

The present paper analyzes a framework of achieving participative environmental planning and introduces an innovative approach to interactive planning process aiming at achieving better political decisions with the use of modern technologies. It also proposes a concrete solution on how the best interests of citizens can be served in the subjects of environmental urban planning. In addition, it combines the theoretical knowledge on two subjects (Urban planning – Software Technology) and creates a common field of application. The application is developed in the context of activation of electronic enterprising in state institutions (Kalogirou *et al*., 2006), for which there existed and still exist many actions via European funding (Tsigani, 2004). Finally, it creates a solid base for further analysis and realization of an integrated management application of spatial problems and support of the decision-making process for them with the parallel involvement of all stakeholders.

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