

# ENVIRONMENT WEB-BASED DECISION SUPPORT SYSTEM

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Abstract

Web Based Decision Support Systems are referring to computerized systems that deliver decision support tools using a Web browser and large Data Bases. Developing the user interface and data managing for Web-based DSS remain the major tasks in building such complex systems. An experimental model of Web Based Decision Support System is presented in this paper. The model is dedicated to the environmental monitoring stations.

## 1. Introduction

A decision-making process refers to the sequence steps (or analyses) that lead to a decision and it is often described in terms of inputs, transformations, and outputs. Decision processes are sometimes part of larger business or organization processes and hence it can be hard to identify and define a distinct one. Basic individual decision processes related to a specific decision can be often not noticeable. In 1980, Alter S. identified three major characteristics of DSS: a) DSS are designed specifically to facilitate decision processes; b) DSS should support automate decision making; c) DSS should be able to respond quickly to the changing needs of the decision makers; d) DSS have friendly user interfaces that make easier their exploitation [1]. In conclusion, Decision Support Systems are interactive, computer-based systems that help the decision makers to solve complex, unstructured or semi-structured decision problems with the help of data base or data models [2]. This paper aims to present a Web Based Decision Support System which meets most of those characteristics.

## 2. General architecture

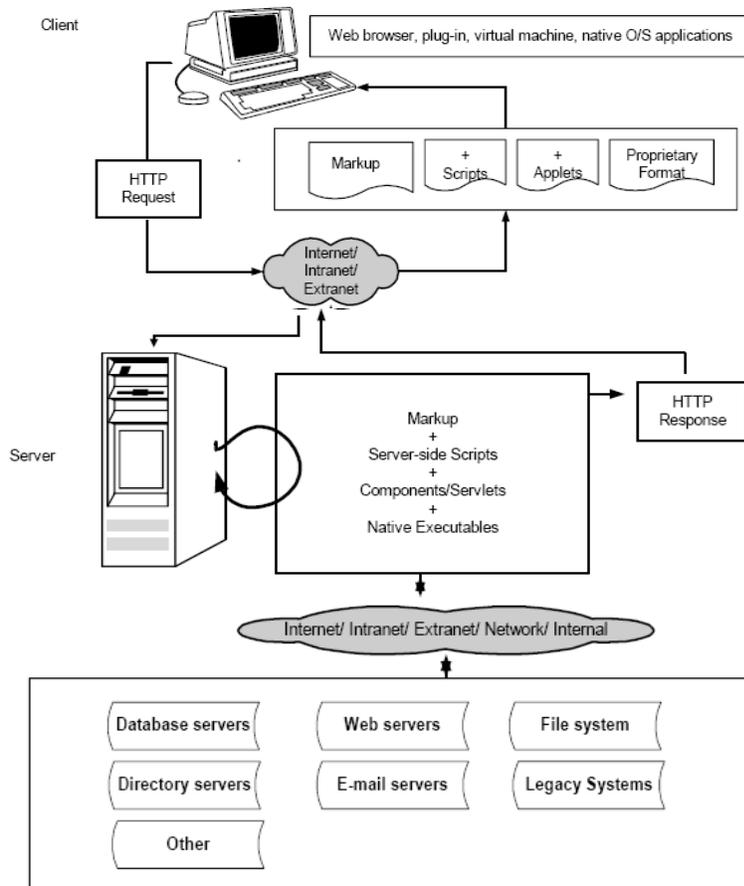


Fig. 1. Web based DSS architecture (after [3])

The general architecture of a WBDSS consists in a Web server, a Data Base and an Internet connection [3]. The decision maker uses a Web browser to send a request to the Web server with the help of a transfer protocol (usually HTTP). The Web server processes the request using a program or a script. The script may implement a model, a data base request or a document.

The results are redirected to the user's Web browser for display. There are Web applications especially designed to allow an authorized user to interact with the results. The application code resides on a remote server and the user interface is presented at the client's Web browser [3].

An experimental WBDSS for the environment was developed to monitor and control different environmental parameters. The architecture of this particular WBDSS is given in the figure 2.

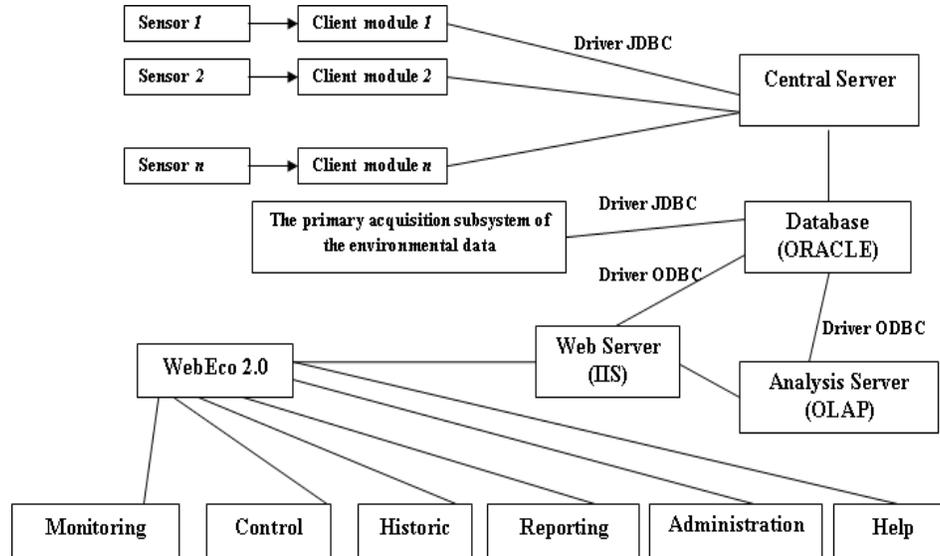


Fig. 2. The General Architecture of the Experimental Web Based Decision Support System in Ecology [4]

The description of the architecture subsystems is given in [5] as it follows:

1. **ORACLE Database** gathers the measured values provided by the sensors. It contains the maxim and the minim values for every monitored parameter.
2. **OLAP** subsystem connects to ORACLE Database using an Oracle ODBC (*Open Database Connectivity*) driver. The data of the OLAP subsystem is used by the environmental application to show different reports to the decision maker.
3. **The primary acquisition subsystem of the environmental data** receives the measured values provided by the sensors which are placed in the territory, using a Java application. This application sends the measured values to a Central Server (developed in Java) according to the data from the Oracle database.
4. **Central Server** determines the sensors best priority using an internal priority algorithm. This subsystem sends mails to persons who are monitoring the measured values.
5. **The subsystem of the environment data show** monitors the evolution of the parameters, showing data in many formats. A desktop Java application using a JDBC (*Java Database Connectivity*) driver makes the connection to the Oracle Database.
6. **WebEco 2.0 – Ecology and environment Monitoring subsystem** is developed for monitoring of the environmental and warning parameters. This subsystem uses advanced models to show the evolution of the values measured by the sensors and to predict the estimated values of these parameters. **WebEco 2.0** is a Web application developed in C# using .Net components [6].

In the next paragraphs we will present the principal components of the **WebEco 2.0** subsystem and their functions.

### 3. Application menu

**WebEco 2.0** is an application developed using *Microsoft Visual Studio.NET* platform and is installed on an *IIS (Internet Information Server)* Server. The following browsers can be used to open the application: Internet Explorer, Netscape, and Mozilla FireFox.

After the authentication in the first page of the **WebEco 2.0** application, the decision maker sees a horizontal menu that easy navigates between the application pages (fig. 3)

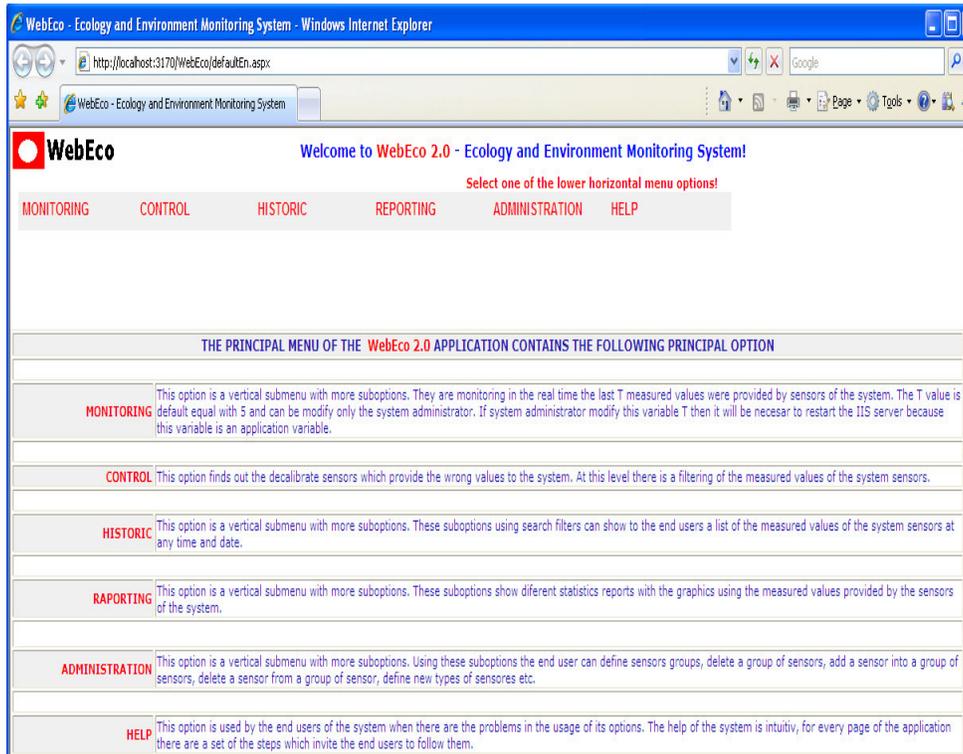


Fig. 3. The initial window of the WebEco 2.0 application

The web application contains a horizontal menu with its options: **Monitoring**, **Control**, **Historic**, **Reporting**, **Administration** and **Help**. Every of these options is a vertical menu with one ore more submenus. The result of each action of choosing a vertical menu option is uploaded in the same page, under the horizontal menu.

The operational mode for each submenu is described below.

**Monitoring option** is a vertical submenu with more sections. The last T measured values provided by system sensors are monitored in the real time. The T value is 5 by default. This value can be changed but only the system administrator. Then the IIS server is necessary to be restarted because this variable is an application one. The most important options of this submenu are: The Last Values, All Values and The Sensors Prediction (fig. 3). In the figure, **Place** column means the place where the sensor was located; **Sensor** is the name of the sensor; **Data** column is the date when the measured value was sent to the **Central Server**; **Measured Value** gives the measured value by the sensor, value stored in the Oracle database; **Alarm** is warning with tree states; **Prediction** column contains a set of buttons which start the prediction module.

**Control** option finds out the non calibrated sensors which provide the wrong values to the system. At this level there is a filter for the measured values

**Historic** option is a vertical submenu with more sections. These sections provide a list of the measured values in time.

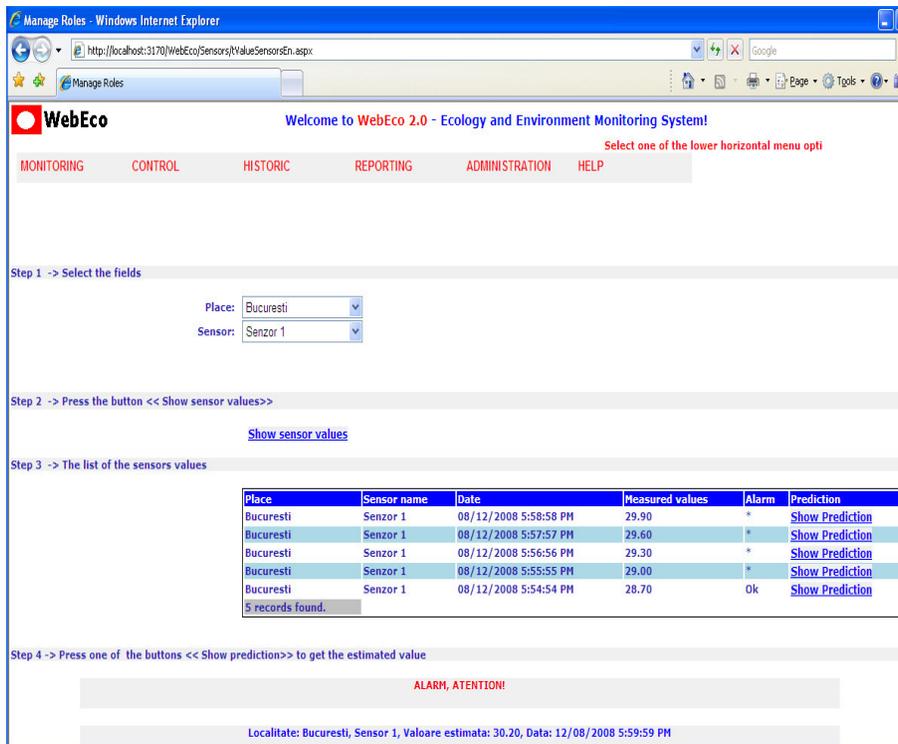


Fig. 4. The Last Values option

**Reporting option** sections show different statistics reports using graphical representation of the measured values. The values are actualized in the background at every hour (the period can increase or decrease) using a SQL job. This job runs an SQL DTS (Data Transformation Service) that contains OLAP cubes.

For example in the figure 5 the **Sensor 2** placed in **Bucharest** in the date 10.08.2008 between the hours **02:10 p.m.** and **02:19 p.m.** recorded a linear growth of the alarm values.

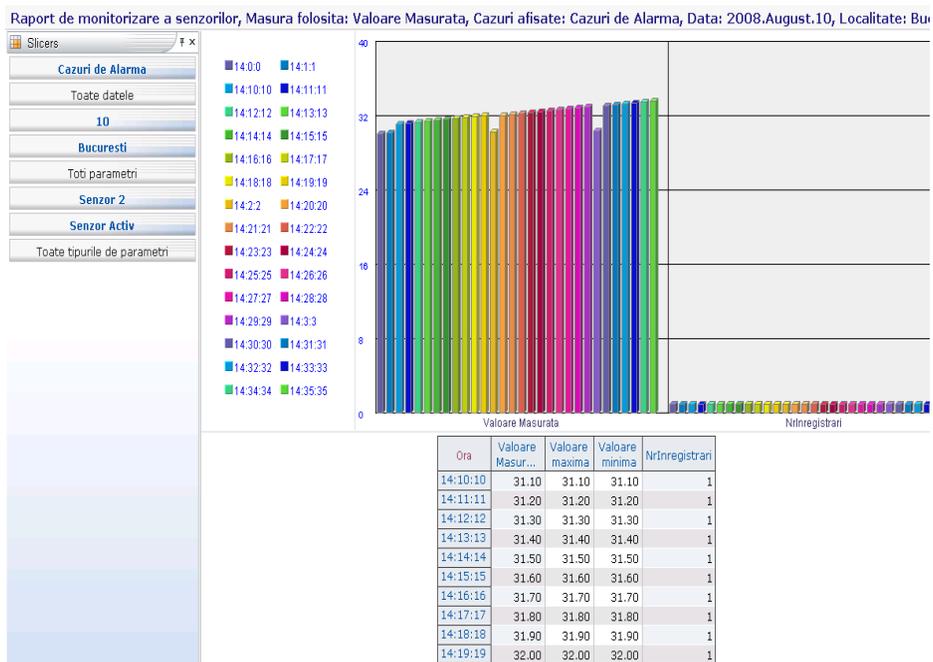


Fig. 5. Alarm values report

**Administration** option allows the user to define sensors groups, to delete a group of sensors, to add a sensor into a group of sensors and to define new types of sensors. The principal sections of this submenu are: **Group Administration, Administration of sensors group, Places Administration** (fig. 6).

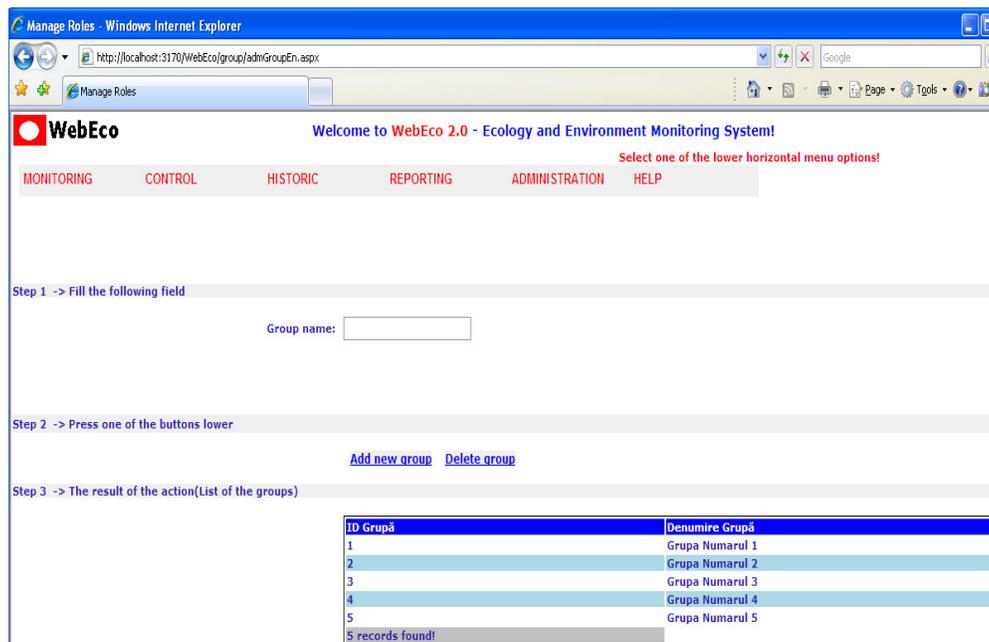


Fig. 6. **Group Administration** section

The **Group Administration** section can be used to define a new sensor group or to delete certain sensors groups which are unrelated in a certain period of time. This part of the system was implemented for the necessity of monitoring the environment factors grouped on certain areas. **Help** option is used by the user when he meets problems in the usage of its options. For every page of the application there are steps for guiding the user to manage the problem.

## 4. Conclusion

The model of Web Based Decision Support System presented in this paper is intended to assist the ecology decisions makers to choose the best solution in the decision process to minimize the risk. Through the Web interface the proposed system can present graphical information of different environmental parameters evolution and can be easily integrated with an expert system or an intelligent system. Future work will be concentrated on designing environmental WBDSS for Group decisions as in [7].

## References

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