The Design of AHPEC in Web-based Decision Support System for Making Decision

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Abstract: - This paper presents the architecture of the WDSS using AHPEC for making decision. The WDSS-AHPEC involves client, user interface, server, web server, database, and DSS model. The DSS model in this study is using AHPEC method. In applying AHPEC, it involves 5 phases in helping decision maker in making decision. The process design shows the overall process and entities involved in the system. The module design also is explained and it involved two type of user which is decision maker (user) and administrator. The implementation of the WDSS-AHPEC is using PHP: Hypertext Preprocessor (PHP) and MySQL as a database management system.

Key-Words: - Decision making, Web-based Decision Support System (WDSS), Decision Support System (DSS), and AHPEC.

1 Introduction

Decision Making is a process of choosing among alternative courses of action for the purpose of attaining a goal or goals [1]. According to Turban and Aronson [2], Decision Support System (DSS) is an interactive, flexible, and adaptable computer-based information system, especially developed for supporting the solution of a non-structured management problem for improved decision making. It utilizes data, provides an easy-to-use interface, and allows for the decision maker's own insights.

Since the explosion of World-wide Web and global Internet has been growing day to day, the DSS can be built in web-based environment. WDSS is giving more support of technology platform for further extending the capabilities and deployment of computerized decision support.

Web-based Decision Support System (WDSS) is referring to a computerized system that delivers decision support information or decision support tools to a manager or decision maker using a "thin-client" web browser like Netscape Navigator, Mozilla Firefox or Internet Explorer. The computer server is hosting the DSS application is linked to the user's computer by a network with TCP/IP protocol. WDSS has reduced technological barriers and made it easier and less costly to make decision relevant information available to manager and decision maker in geographically distributed locations. The web has increased access to DSS and it should increase the use of a well-designed DSS in a company [3].

In this paper, the design of WDSS using AHPEC is explained. The AHPEC is the method that proposed by Nur Farha et al. [4] and it is use for deriving priorities in AHP. In order to apply AHPEC in WDSS, it involves five procedures which are explained in the next section.

2 System Architecture of AHPEC in WDSS environment

WDSS is to provide a way for storing, presenting, gathering, sharing, processing, and using information [5]. The WDSS also provide information processing, interaction, and tool with user-friendly interface. By using WDSS, it allows users to access system at anytime and anywhere.

Since WDSS is an online application, there must be a client, a server and a web browser. In order to make a decision, WDSS needs at least a model. A model is an important component in WDSS as it can make a simplified representation or abstraction of reality. The basic idea of model is to perform the WDSS analysis on the model of reality rather than on the real system itself.

For this study, AHPEC which was proposed by Nur Farha et al. [4] has been chosen to represent a model in WDSS prototype for making decision. Figure 1 shows the architecture component of WDSS prototype with the selected method, AHPEC.

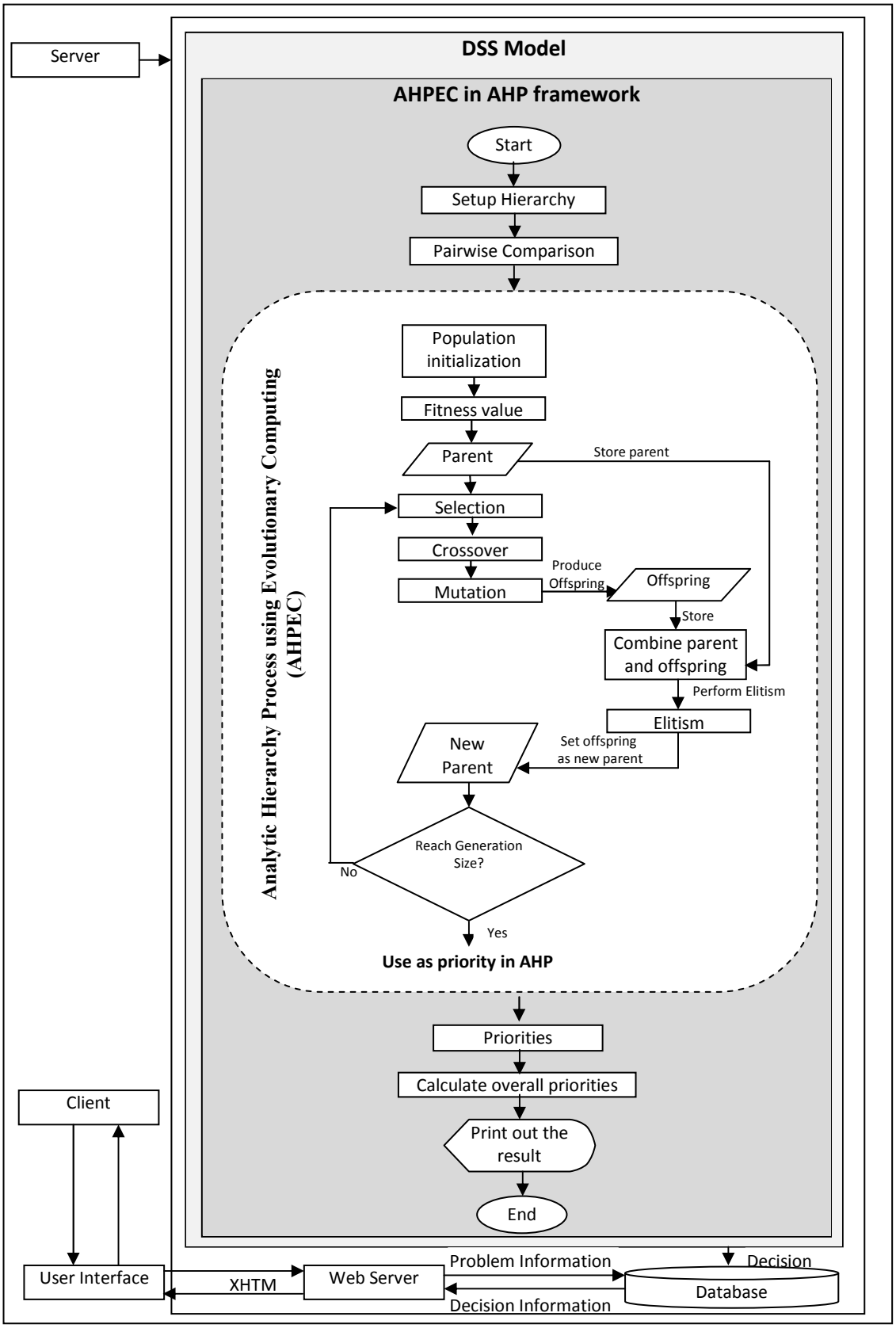

Figure 1: The architecture component of WDSS-AHPEC

2.1 The Procedure of AHPEC in AHP

The prototype, WDSS-AHPEC consists of five main phases. Figure 2 shows the flowchart representing the sequence of operations to be performed in the prototype of applying AHPEC in making decisions.

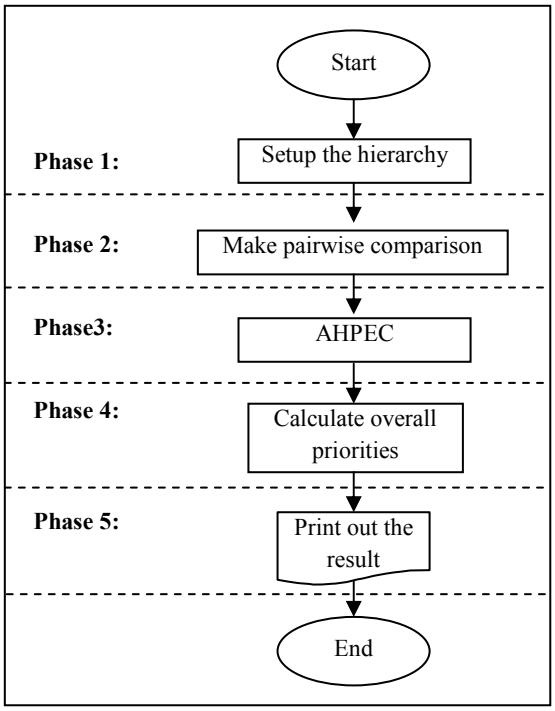

Figure 2: The flowchart of the WDSS-AHPEC

i. Phase 1: Setup the hierarchy

In this phase, a new project was created by setting up the hierarchy. It is a graphical representation of the problem in terms of the overall goal, the criteria to be used, and the decision alternatives. The hierarchy for this prototype involved 3 levels. The first level is the overall goal to select, second level is the criteria to be used, and the last level is the decision alternative. Figure 3 shows the example of hierarchy for a car selection problem.

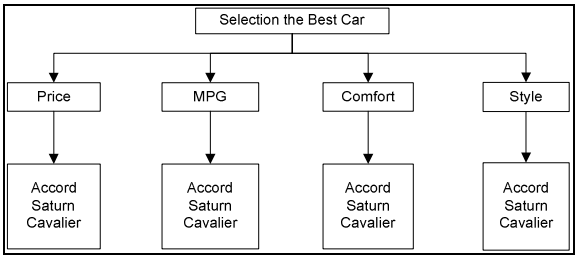

Figure 3: Hierarchy for the car selection problem

ii. Phase 2: Make pairwise comparison

The second phase required a pairwise comparison to be made for criteria respective to the goal and alternatives respective to the criteria; it was carried out following the hierarchy setup. In each comparison, users must select the more important criterion and the express a judgment of how much more important the selected criterion is, by using a Saaty scale with values from 1 to 9.

iii. Phase 3: AHPEC for deriving priorties

The third phase involved implementing the AHPEC in AHP. Details on deriving priorities using AHP have been discussed in Nur Farha et al. [4]. Figure 4 shows the example priorities for both criteria and alternative in hierarchy view based on the car selection problem.

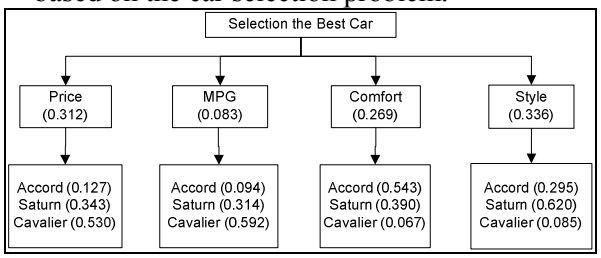

Figure 4: The priorities for each criteria and alternative

iv. Phase 4: Calculate overall priorities

This phase involved calculating the overall priorities in Figure 5. The calculation is as follows:

Overall priority of the Accord: 0.312(0.127) + 0.083(0.094) + 0.269(0.543) + 0.336(0.295) = 0.292
Overall priority of the Saturn: 0.312(0.343) + 0.083(0.314) + 0.269(0.390) + 0.336(0.620) = 0.446
Overall priority of the Cavalier: 0.312(0.530) + 0.083(0.592) + 0.269(0.067) + 0.336(0.085) = 0.261
AHP ranking of the decision alternatives: 1. Saturn = 0.446 2. Accord = 0.292 3. Cavalier = 0.261

Figure 5: The calculation overall priority ranking

v. Phase 5: Print out the result

Based on Figure 5, the AHP ranking of the decision alternatives determined that the Saturn is the best car. The Saturn would then be printed out in the result as being the best choice in car selection problem.

2.2 Process Design of WDSS-AHPEC

The process design shows the overall process and entities involved in the system. It is viewed in an angle where the entire core functions, and how they would work in the system, are shown. This type of design includes indentifying inputs, process and also the output. This design is represented in a data flow diagram (DFD) and system flow chat. The DFD illustrates how the system data moves along the entities, and results in an output or a decision. This diagram is usually illustrated according to levels, which are the Context Diagram, DFD Level 0 and DFD Level 1, with each process shown in detail. Figure 6 shows the context diagram of the system, and Figure 7 shows the DFD in Level 0.

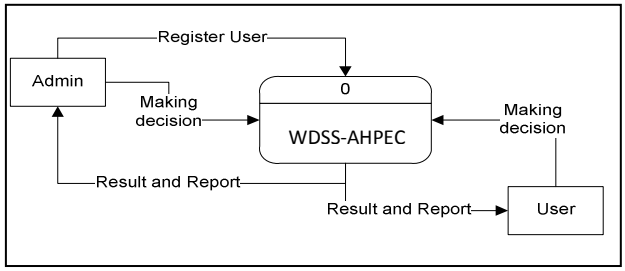

Figure 6: Context Diagram for WDSS-AHPEC

Figure 6 shows the context diagram in designing the WDSS-AHPEC system. This system involves two users, which are the administrator as a moderator and decision maker as the user. The administrator and user are allowed to make a decision by using the AHPEC method. Both users must login into the system first before using AHPEC method in making decisions.

The DFD Level 0 is shown in Figure 7, which explains the WDSS-AHPEC system in more detail. The main processes involved in the system are:-

i. Process 1.0: Login

This process is used for login to validate the user before a user can use the system, by requiring the User/Decision Maker and Administrator to key in their ID and password.

ii. Process 2.0: Admin Verification

This process is the first process for the administrator after a successful login. The administrator account is displayed by the system, and the administrator is allowed to change his or her password

iii. Process 3.0: User Registration

This process is to register the user or decision maker. It is divided into two small processes, which are the user registration process and change the password process in which the administrator can register a new user and users can change their password to login into the system respectively.

iv. Process 4.0: User Verification

This process is the first process for the users after a successful login. The user account is displayed by the system, and the user is allowed to change his or her password.

v. Process 5.0: Parameter Setting

This process is used by the user if they have their own EC parameter settings and intend to change the default parameter setting set by the administrator.

vi. Process 6.0: Making Decision

This process involves five sub-processes. Process 6.1 is to setup the hierarchy and includes identifying the goal of the problem, number of criteria, number of alternative, and also their names respectively. All the information is stored in the Case detail file. Process 6.2 is to make a pairwise comparison for criteria with respect to the goal and each alternative with respect to the criteria. The judgments are based on Saaty's scale and all the judgments are stored in the Judgment file. The parameters setting can also be set by the administrator and the inputs of parameters are stored in Parameter file. Process 6.3 is the implementation on AHPEC. The judgment and parameters are retrieved from the database in order to activate AHPEC. The AHPEC would then produce the results, which are the weight or priorities for criteria with respect to the goal and each alternative with respect to the criteria. The results in Process 6.3 are then used in Process 6.4 that would calculate overall priorities to retrieve the final results. The final results are stored in the Result file, after which the results are retrieved and the decision displayed in Process 6.5.

vii. Process 7.0: Report

In order to view the report by using WDSS-AHPEC system, the report process is required. This module will produce the report of the system.

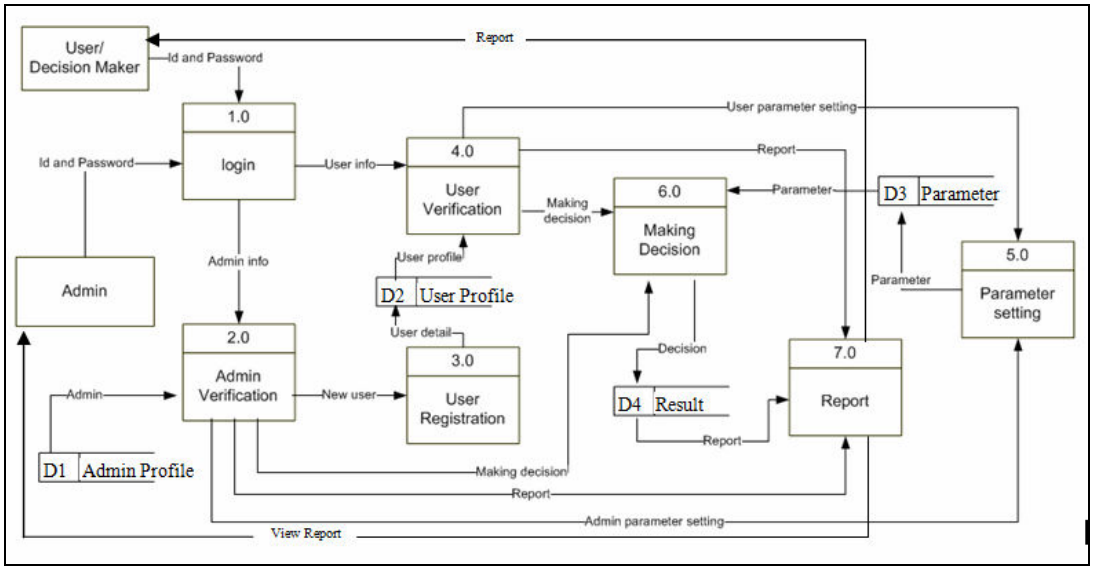

Figure 7: DFD Level 0 for WDSS-AHPEC

2.3 Module Design of WDSS-AHPEC

The WDSS-AHPEC system has seven main modules which are login module, admin verification module, user registration module, user verification module, parameter setting module, decision making module and report module. Every module has its own sub-module. The user registration module has only one sub-module which is add new user sub-module. The parameter setting module has two sub-modules which are add or view parameter setting sub-module and update parameter setting sub-module. The decision making module has five sub-modules which are setup the hierarchy sub-module, make pairwise comparison sub-module, AHPEC sub-module, calculate overall priorities sub-module, and print out the result sub-module. The report module has three sub-modules which are report menu sub-module, generate report sub-module, and print out report sub-module. An illustration of the structure chart between the module and the sub-module is presented in Figure 8.

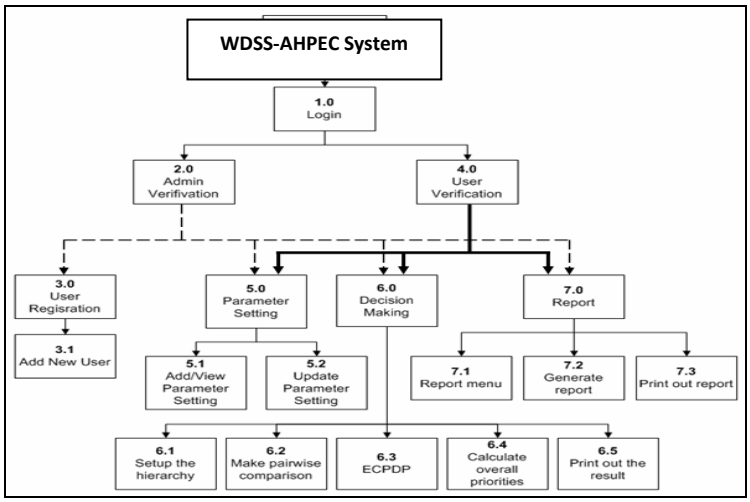

Figure 8: The mapping between the users and the modules

The WDSS-AHPEC system involves two types of users which are the administrator and user or decision maker. Based on Figure 8 above, there are two types of line. The dash line shows the module that the administrator can access. The bold straight line is for user or decision maker to access the module.

The administrator can access some modules such as user registration module, setting default EC parameter module, making decision module using AHPEC and report module. The user registration module is used to register a new user in the WDSS-AHPEC system. The user ID and password is set by the administrator, after which the WDSS-

AHPEC can be accessed by the user by using the user ID and the password that was set by the administrator. This process is necessary to make sure that only authorized user can access.

The decision making module is the main function in this system. The administrator can use this module in making decision. The default EC parameter setting in this system is set by the administrator and based on an experiment that was done by Nur Farha et al. [4] study. The report module then is used to generate reports. This system can generate the user's report on the decision making process.

The decision maker is involved with three modules, that are making decision module, user setting own EC parameter module, and report module. The decision maker module is used in making decision. Furthermore, the decision maker is also allowed to use this module in making decisions by applying the AHPEC method.

The parameter setting module allows the user to alter their EC parameter settings. Users have the choice of using either the default parameter setting set by the administrator or their own parameter setting. The system calculation is then based on the selected parameter setting. This is followed by the last module, the report module where users can view the report based on their decision making that has been done.

3 Conclusion

This study design the WDSS-AHPEC system with applies the AHPEC method that has been proposed. It is built in WDSS environment to provide a way for storing, presenting, gathering, sharing, processing, and using information.

For the further research, the development and implementation of the design will be done to demonstrate the prototype of WDSS-AHPEC.

In order to develop the WDSS-AHPEC, PHP: Hypertext Preprocessor (PHP) was selected. The PHP was selected because:

i. PHP is a server-side scripting language for creating dynamic Web pages.
ii. PHP is open source and it is free.
iii. PHP uses programming C language that is easy; therefore it reduces development time but still result in good product.

In WDSS-AHPEC, MySQL was used as a database management system.

References:

1. Turban, E. and J.E. Aronson, *Decision Support Systems and Intelligent Systems*, ed. 5th. 1990, New Jersey: Prentice Hall.
2. Turban, E. and J.E. Aronson, *Decision Support Systems and Intelligent Systems*. 5th edition ed. 1998: Prentice Hall PTR Upper Saddle River, NJ, USA.
3. Power, D.J., *Decision support systems: concepts and resources for managers*. 2002: Greenwood Publishing Group.
4. Nur Farha, Z., M.D. Halina, and C.H. Ab Razak, *Deriving Priority in AHP using Evolutionary Computing Approach.* WSEAS Transactions on Information Science and Applications, 2010. **7**(5): p. 714-724.
5. Hai, P.V. and V. Esichaikul, *A web-based decision support system for the evaluation and strategic planning using ISO 9000 factors in higher education.* VNU Journal of Science, Mathematics - Physics, 2008. **24**: p. 197-208.