Aiding Systems Design & Development through Features Analysis & Evaluating their System Importance

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Abstract. The paper presents a method in aiding the design and development of a system by using features analysis to derive the list of desired system components while utilizing a decision theory model to find out the level of importance of each of the derived system components. Systems features analysis and Applied Hierarchy Process are briefly described and their implementation and use on a system development case is presented which showed the effectiveness and usefulness of the proposed method.

Keywords: Systems Features Analysis, Applied Hierarchy Process, Software.

1 Introduction

Systems design and development takes a lot of effort, coordination and understanding between the project proponents, the contractors and users. One problem that was encountered in the course of systems design and development was the need of easily deriving the system components and at the same time a way to assess or evaluate the level of importance of the derived components not just to the whole system but to each other components when needed. Systems Features Analysis is proposed to be used to address the need of easily finding out the system components while Applied Hierarchy Process [1] will solve the problem of finding the order of importance of the derived features based on several factors such as the stakeholders involved, features derived, etc. The relative ease of use of both SFA and AHP giving good results is on the reason why the tandem of SFA and AHP is being proposed for this problem. A brief description of SFA is presented in Section 2 followed by the Applied Hierarchy Process in Section 3. An implementation of the proposed method on the design and development of a marine information system is then presented in Section 4 followed by the concluding remarks.

[1] Please note that the LNCS Editorial assumes that all authors have used the western naming convention, with given names preceding surnames. This determines the structure of the names in the running heads and the author index.

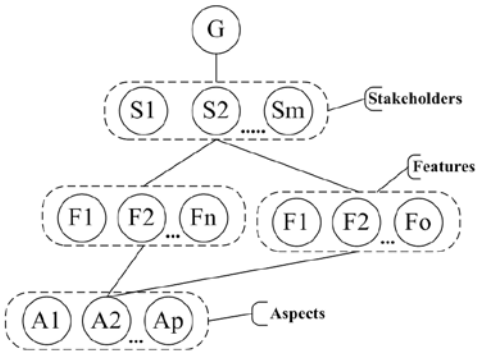

Fig. 1. The AHP used in this paper

2 Systems Features Analysis (SFA)

Systems Features Analysis is an offshoot of the Rapid- Non-Formal and By-Customer Approach[2]. It is an integral part of the proposed solution as it serves as a technical aspect in the design and development of a proposed system as well as its result being a basis as to deciding the order of developing the specific features. The system operations are broken down into components or features. The particular steps for acquiring, segregating and processing the data are studied to complete the identification and definition of a specific feature of the system. The systems features analysis is performed repeatedly until all the systems features have been identified and their corresponding sub-processes studied and defined.

3 Analytical Hierarchy Process (AHP)

AHP is a well-known decision theory model formulated by Saaty. It is a theory of measurement through pairwise comparisons that depends on the experts to make a judgment call in deriving the priority scales that measure the intangibles in relative terms. Boehm [3] wrote about describing and selecting the right requirements in requirements engineering and proposed the WinWin requirements negotiation tool which supports the interaction of various stakeholders in identifying, analyzing and reconciling requirements While Lozano-Tello [4] used AHP in the taking of multicriteria decisions for software components reuse Ahmad used it in selecting software project management tool. For this study (Fig. 1), we tap onto the work done by Ruhe [5] that proposed an improvement over the WinWin of Boehm with the use of Analytical Hierachy Process in the stepwise determination of the stakeholders preference in quantitative terms. They applied AHP to determine the importance of the various stakeholders from a business perspective. It was also used to prioritize the different classes of requirements from the perspective of each stakeholder. Specifically it is targeted to help in the decision making process of choosing which feature will be the priority for design and development.

4 Implementation of SFA and AHP

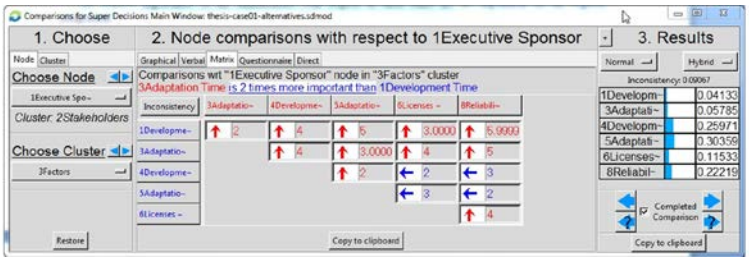

Fig. 2. Piecewise comparison of factors with respect to stakeholder Executive Sponsor

Use of SFA. Performing SFA on the given system requirements of a marine information system gave the following components as its core processes: (1) Pre-processing raw Eletronic Navigational Chart data, (2) Base map processing, (3) Map details processing, (4) Ship representation and plotting, (5) Global Positioning System (GPS) data processing, and (6) Digital compass data processing.

Use of AHP. The Stakeholders (Executive sponsor, End-users, and Developer) are the main characters involved in the system design, development and deployment. The following Factors (Development time, Training time, Adaptation time, Development Expenses, Adaptation Expenses, License costs, Effectiveness and Reliability) impact the "Alternatives" or systems features. The Executive Sponsor is concerned with Development Time, Adaptation Time, Development Expenses, Adaptation Expenses, License Costs and Reliability. The End-users are concerned with Training Time, Adaptation Time, Effectiveness and Reliability. The Developer is concerned with the Development Time, Training time, Adaptation Time, Effectiveness and Reliability. The relative importance of the stakeholders with respect to the goal is set via piecewise comparison (Fig. 2) in the AHP program "Super Decisions". This is also applied to factors with respect to each stakeholders, the alternatives with respect to the factors and even alternatives with respect to other alternatives.

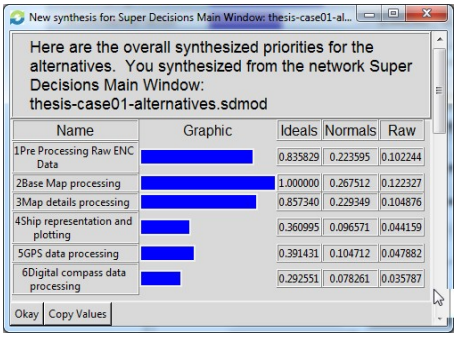

Fig. 3. Synthesized result of "SuperDecisions" showing relative importance of system features

The synthesized result showing the relative importance of the alternatives with respect to the piecewise comparisons is shown in Fig. 3. It tells us that “Base Map Processing” is of major importance over all the other alternatives while “GPS Data Processing” is approximately 39.14% relative importance with respect to “Base Map Processing”. It can also be understood that “Base Map Processing” is of 26.75% importance with respect to the overall system while “GPS Data Processing” is of 10.47% importance to the whole system.

5 Conclusion

The result of using Analytical Hierarchy Process to evaluate the importance of the features derived from Systems Features Analysis showed their capability in solving the problem of finding the features of a particular system and their order of importance to be able to make informed decisions about the system. It is envisioned that using SFA and AHP in tandem would help in the decision making process specially when trying to decide which features are of vital importance with respect to the stakeholders through several given factors. The availability and ease of use of the software “SuperDecisions” makes it even more promising to those developers who find it discouraging to study and use AHP.

Acknowledgments

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