Implementation of Consumer-oriented Intelligent Decision Support System (CIDSS) for Tourism Packages

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Abstract

In many situations, the quality of decision is important, human judgment and decision making has been a major focus of science and technology. Decision Support Systems (DSS) are defined as interactive computer-based systems intended to help decision makers utilize to make decisions. This paper is developed as web-based decision support system for Myanmar people who are interested in traveling. The aim of this paper is to implement online Tour Services not only in local but also on abroad like India, Thailand, Singapore and Malaysia. In proposed system, DSS will be implemented by using Nonstructural Fuzzy Decision Support System (NSFDSS). In this system, NSFDSS can help to get the decisions for the appropriate and suitable Tour packages.

1. Introduction

This paper presents to develop a web-based decision support system for E-Tourism services. Decision Support System (DSS) is a specific class of computerized information system that supports business and organization decision making activities. Decision support systems are gaining an increased popularity in various domains, including business, engineering, the military, medicine and tourism. Multiple-Criteria Decision Making (MCDM) is the study of methods and procedures by which concerns about multiple conflicting criteria can be formally incorporated into the management planning process. The basic ingredients of Multi-Criteria Decision Making (MCDM) consist of the weighting of criteria importance, the trading off of one criterion to another, the notion of the balanced decision and even the interaction between human judgment and a formal model [2]. MCDM is one type of decision support model. MCDM problem has four elements: Goal, Objectives, Criteria and Alternatives. Some problem solving techniques are SAW (Simple Additive Weighting), TOPSIS (Technique For Order Preference by Similarity to the Ideal Solution), ELECTRE, BAYESIAN NETWORK BASED FRAMEWORK, AHP (Analytical Hierarchy Process), ANP (Analytic Network Process), NSFDSS (Nonstructural Fuzzy Decision Support System) and etc. In this paper, Tour trips or packages selection system may support various users who are wishing to travel not only in local but also in global (foreign). A web-based DSS for choosing the Tour trips or packages is to enhance the online Tour Services to Myanmar travelers (users), and the Tour Company managers or Tour Planners will be gained many benefits in their decision making process. To fit user needs or requirements, NSFDSS can help to get the decisions by applying efficient and accurate processing techniques.

Myanmar people are interested in travelling on their holidays or vacation periods. They want to go somewhere according to their available budget (money amount to spend), and travel time (days) and also their preferences (Eg. shopping in abroad as a hobby). Nowadays, Internet, the web technology is the center of activity in developing Decision Support System (DSS) and can be expected to result in organizational environments that will be increasingly more global, complex, and connected. The advent of the web has enabled inter-organizational decision support systems, and has given rise to numerous new applications to existing technology as well as many decision support technologies themselves. Nonstructural Fuzzy Decision Support System (NSFDSS) integrates both expert's judgment and computer decision modeling. Analytical Hierarchy Process (AHP) is a commonly used decision aiding tool for resolving multi-criteria decision problems. However, users sometimes find it difficult to ensure a consistent pair-wise comparison between voluminous decisions. So NSFDSS, an alternative approach, is used in this system for Tour trips or packages planning.

2. Related Work

Web based Decision Support System from the same business domain is the Tour planning. Tour planning or Tour packages reservation system requires users to provide trip type (local or foreign), budget, travel days, trip origin, trip

destination, other places, Tour company, Date and how many persons to travel. In this system, users can search available Tour packages or Tour trips according to their needs (input data) and reserve any Tour packages they wish. In this paper, the proposed system is designed to offer Myanmar people as local Tour service and also global (abroad) Tour services on Internet. One of the related works of Tourism domain is decision support system for Tourism by using Rule-Based decision support system [7]. In other work of DSS, to make decisions by applying one of the MCDM methods, NSFDSS is utilized to get efficient and better decisions as Tour packages. Site Layout Planning, a routine task for many site staff in both pre-contract and post-contract stages, is one of the typical multi-criteria and multi-objective construction problems. To facilitate the decision-making process for these problems, a Nonstructural Fuzzy Decision Support System (NSFDSS) is used to solve these problems [5].

3. Background Theory

3.1. Decision Support System

An interactive software-based computerized information system intended to help decision makers compile useful information from raw data, documents, personal knowledge, and business models to identify and solve problems and to make decisions [1]. DSSs provide data storage and retrieval functions. Database Management System is one of the fundamental components of DSSs [3].

Three fundamental components of DSS are:

- Database Management System: It serves as a data bank for the DSS. It stores large quantities of data that are relevant to the class of problems for which the DSS has been designed and provides logical data structures with which the user interact. A DBMS separates the users from the physical aspects of the database structure and processing.
- The Model-Base Management: The model management Component handles representations of events, facts, or situation.
- The Dialog Generation and Management System: The User Interface Management Component is of course the component that allows a user to interact with the system [4].

3.2. Consumer-Oriented Intelligent Decision Support System (CIDSS)

CIDSS can be defined as web-based intelligent DSS. It provides generic and specific application functions, information resources, model and knowledge computing mechanisms, as well as communication facilities efficiently. CIDSS assists consumers in making personalized and group decision. Web based consumer-oriented intelligent decision support systems are developed to facilitate all phases of consumer decision making process in business-to-customer (B2C) e-service applications.

3.3. Multi-Criteria Decision Making (MCDM)

Multi-Criteria Decision Making (MCDM) consists of construction a global preference relation for a set of alternatives evaluated using several criteria, MCDM is a selection of the best actions from a set of alternatives. MCDM is evaluated against multiple, and often conflicting criteria.

3.4. Nonstructural Fuzzy Decision Support System (NSFDSS)

Analytical Hierarchy Process (AHP) is a commonly used decision-aiding tool for resolving multi-criteria decision problems. However, users sometimes find it difficult to ensure a consistent pair-wise comparison between voluminous decisions. An alternative decision-making tool to AHP, alternative approach is Nonstructural Fuzzy Decision Support System (NSFDSS). NSFDSS is similar to the analytical hierarchy process (AHP), a widely used decision-making operational research technique. However, in pair-wise comparison, NSFDSS is obviously superior to AHP by adopting "Logical checking" which only consists of three options:

1. "D_1", is better than "D_2;"
2. "D_1", is equally important as "D_2"; and
3. "D_1", is worse than "D_2" [5].

There are three stages in NSFDSS:

3.4.1 Decomposition

Decomposition structures a problem into elements of different level.

It work downward from the goal on the top through criteria bearing to the goal on the second level and then to sub-criteria on the third level and soon working from the general (and sometime and certain) to the more specific at the lower levels.

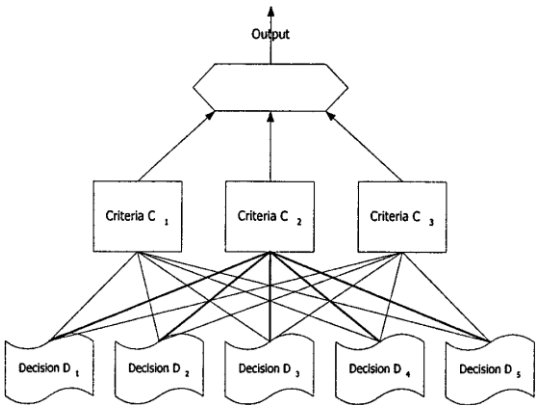


Figure.3.4.1 Decomposition of multi-criterion problem

3.4.2. Comparative judgment

Comparative judgment is applied to construct pair-wise comparisons of the relative important of element on some going level with respect to shared criterion or property on the level above.

It give rise to the corresponding matrix.

3.4.3. Synthesis of Priorities

In NSFDSS, priorities are synthesized from the second level down by multiplying local priorities with the priority of their corresponding criterion on the level above, and weighting each element on a level according to the criteria it affects.

This gives composite or global priority of that element.

4. The proposed system

The proposed system in this paper is "Implementation of Consumer-Oriented Intelligent Decision Support System (CIDSS) for Tourism Packages". This system utilizes Nonstructural Fuzzy Decision Support System (NSFDSS) Theory for Tourism domain. In this system, user can choose local or foreign trip type. And then, user can choose origin place, destination place, other places, expected budget, expected travel days, travel date, desirable Tour Company and number of persons want to go.

There are five stages in Nonstructural Fuzzy Decision Support System (NSFDSS). NSFDSS is applied to systematically evaluate each Temporary Facility (TF_n) and various Decision criteria (C_n).

(1) Stage-1 Pair-wise Comparisons

In this pair-wise comparison, there are three scales-better, the same, and worse.

0, 0.5 and 1 refer to comparison of x to y.

Decision Criteria (C_n), 0 = element X is worse than element Y, 0.5 = the two are the same, and 1= element X is better than element Y.

(2) Stage-2 Consistency Checking

With respect to decision criteria C_n, the matrix of pair-wise comparison of the corresponding element is

$$iE = \begin{bmatrix} ie_{11}, ie_{12}, \dots, ie_{1n} \\ ie_{21}, ie_{22}, \dots, ie_{2n} \\ . \\ . \\ . \\ ie_{n1}, ie_{n2}, \dots, ie_{nn} \end{bmatrix} \quad (1)$$

$= (ie_{kl});$

$k = 1, 2 \dots n;$

$l = 1, 2 \dots n;$

(3) Stage-3 Priority Ordering and Assignment of Priority Scores to Temporary Facilities

$$ir_j = \frac{1 - ia_{1j}}{ia_{1j}} \quad ; 0.5 \le ia_{1j} \le 1$$

Where ia_{1j} = semantic score; (2)

ir_j = priority score;

(4) Stage-4 Derivation of Weightings by Normalizing Semantic Scores

In NSFDSS, this process is carried out by the normalization of semantic scores.

Let $\omega = (w_1, w_2, \dots w_n)$ be weightings of decision criteria, $C_1, C_2, C_3, \dots C_n$.

The set of weighting (ω) is then developed from the normalization of the semantic scores.

(5) Stage-5 Determination of Results

$$u_j = \frac{1}{1+\left[\frac{\sum_{i=1}^{m}\left[W_i(r_{ij}-1)\right]^p}{\sum_{i=1}^{m}(w_i r_{ij})^p}\right]^{\frac{2}{p}}} \quad (3)$$

For Hamming distance p = 1 and Euclidean distance p = 2

p = 1, 2 and u = (u_1, u_2, u_3, ... , u_n), where u= priority of vector; u_j = average distance For p = 1 and 2; w_i = weight of C_n;

$r_{ij} = i_{rj}$ = semantic scores and p = distance parameter

In step-1, pair-wise comparisons are made between data in database and user's inputs with three scales, 0, 0.5, and 1 as Decision Criteria (C_n). Tour packages are evaluated as Temporary Facility (TF_n) in this proposed system.

In step-2, with respect to Decision criteria (C_n), consistency checking is made by summation of each Temporary Facility (TF_n).

In step-3, priority scores to Temporary Facility (TF_n) are calculated by sorting step-2 results. And then, scores are obtained by mathematical division of each sum result by maximum sum.

In step-4, weightings of decision criteria are evaluated using score values from step-3.

In step-5, the result of the system is finally calculated against Hamming distance p = 1 and Euclidean distance p = 2 to get decisions as Tour packages for users.

In this proposed system, NSFDSS Theory is used for decision making process. NSFDSS offers some benefits over traditional decision-making models. It uses a simple comparative rating scales (1, 0.5, and 0) in evaluating the relative importance of different factors, which provides a built-in consistency checking mechanism to maintain and correct discrepancies in the evaluation process. The model provides an alternatives technique in decision-making for complex multi-criteria problems, where multiple objectives exist.
When compared with the most commonly used multi-criteria aiding method AHP, NSFDSS has shown the following superiorities:

- Automatic consistency checking and correction: At the consistency check, NSFDSS assumes that the logical indicators at the upper rows of the matrix are reliable than those of the lower rows. On the other hand, AHP only provides a "consistency ratio" as a guideline for decision makers to monitor the consistency of a pair-wise comparison.

- Simplified scale of comparison: NSFDSS only uses 1, 0.5, and 0 for comparing the relative importance, where AHP relies on a more complicated nine-point scale for evaluation.
- Elimination of consistency deviation: The global acceptance of the consistency ratio in AHP has its own shortfalls. In contrast, NSFDSS gives absolute consistency during evaluation; so, the priority order of the decisions is generally close to the optimum solution.

5. Implementation of the proposed system

For example, if user's choices are local trip type, origin place is Yangon, destination place is Taunggyi, other place one is Inlay, other place two is Pindaya, expected budget are 160000 kyats, expected travel days are 5 days, travel date is 12/16/2009, desirable Tour company is New Motion and number of persons want to go is 1, the result Tour package of the system like this:

In stage-1,

Origin	0.5
Destination	0.5
P_1	0.5
P_2	0.5
P_3	0
P_4	0
Charges	0
Day	1
Company	0.5
Date	0

P_1, P_2, P_3, P_4 refers to other place 1, 2, 3&4

In stage-2,

Origin	0.5
Destination	0.5
P_1	0.5
P_2	0.5
P_3	0
P_4	0
Charges	0
Day	1
Company	0.5
Date	0
Sum	3.5

In stage -3,

Origin	0.5
Destination	0.5
P_1	0.5
P_2	0.5
P_3	0
P_4	0
Charges	0
Day	1
Company	0.5
Date	0
Sum	3.5
Score	1

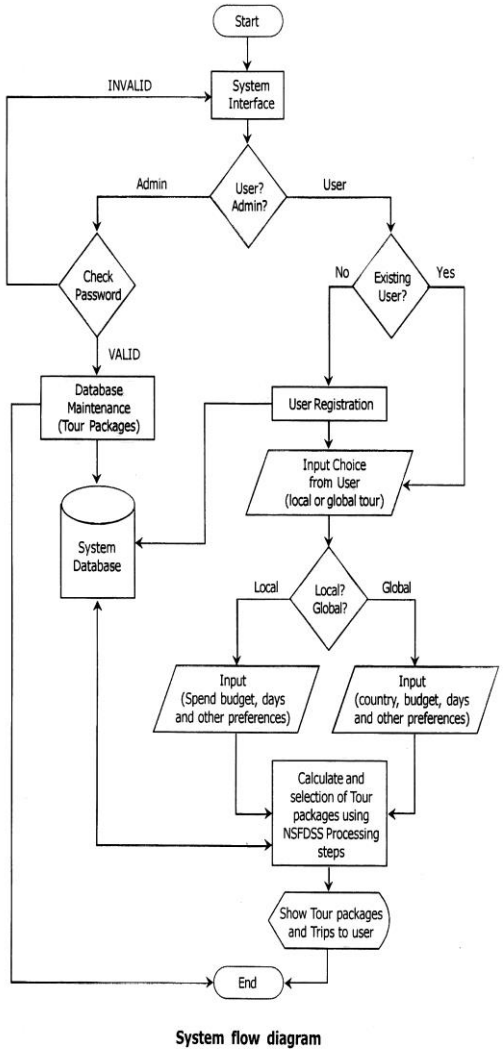
In Stage-4 and Stage-5, Result of Tour package is

Origin	Yangon
Destination	Taunggyi
P_1	Inlay
P_2	Pindaya
P_3	-
P_4	-
Charges	150000
Day	5
Company	New Motion
Date	12/17/2009

As a result, user can reserve the Tour package Yangon- Taunggyi - Inlay- Pindaya.

Another example, if user's choices are local trip type, origin place is Yangon, destination place is Mrauk-U, other place one is Inlay, other place two is Myitkyina, other place three is Shwesettaw, expected budget are 400000 kyats, expected travel days are 7 days, travel date is 1/1/2010 , desirable Tour company is Unique Star and number of persons want to go is 2.

There is no Tour package that match the user's desire choices, especially, travel day is 7 and other places are impossible to reach. In this situation, the result for the user could not be matched the criteria data of the system.



System flow diagram

Figure.5.1 System Flow Diagram

6. Conclusion

This system presents web-based Decision Support System for Tourism domain. The proposed methodology is based on MCDM method using Nonstructural Fuzzy Decision Support System (NSFDSS) and it helps in selection and reservation of suitable and appropriate Tour packages amongst a large number of alternative Tour packages for

user needs or preferences. The web based DSS can help user by providing services and information and time they wish on the Internet. In this paper, this system gain time-saving benefits because users have no need to plan or prepare Tour trips in local and abroad and also provide Myanmar people as Online Tour Agency services.

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