An Active Server Pages (ASP) Approach in Ecotourism Rating Expert System

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ABSTRAK

Alam semula jadi merupakan asas pengeluaran sektor pelancongan. Keuntungan industri pelancongan bergantung kepada daya tarikan destinasi pelancongan. Malaysia adalah sebuah negara yang dikurniakan dengan keajaiban tropikal yang kaya dengan pelbagai tarikan ekologikal dan tentunya berpotensi untuk pelancongan. Justeru itu, status alam semula jadi memainkan peranan yang kritikal untuk mengekalkan industri ini. Konsep eko-pelancongan mengutamakan kepentingan ekologi pada tahap maksimum. Aspek ini walaupun mempunyai potensi yang khas untuk pembangunan dan eksploitasi, ianya masih belum menerima perhatian yang sepenuhnya di Malaysia. Semua eko-pelancongan harus dirancang, dipimpin dan diterokai dengan penuh pengawasan dan pengawalan untuk memastikan pengurusan yang berkesan dan cekap. Satu sistem pakar telah dihasilkan untuk menilai dan mengenal pasti tahap-tahap tertentu berlaraskan kepada beberapa kategori untuk megenal pasti kekalan destinasi eko-pelancongan di Semenajung Malaysia. Sistem pakar yang dibina berasaskan "*web-based information sharing platform*", berpandukan undang-undang keselamatan, kesihatan dan alam semula jadi yang sedia ada. Sistem ini direka dan dibina menggunakan "*back-end on-line database*" yang akan merekodkan semua urusan yang berjaya. Kertas kerja ini membentangkan sebuah model yang menggunakan cara skriptasi "*Active Server Pages*" untuk menguruskan dan mengeluarkan sistem penilaian pakar eko-pelancongan.

ABSTRACT

The environment is the backbone of tourism products. Profitability in tourism depends on maintaining the attractiveness of the tourist destinations. Malaysia is a tropical wonderland that is substantially rich in a variety of ecological pursuits and certainly of much tourist potential. Hence, the status of the environment plays a critical role if the industry is to sustain itself. The ecotourism concept emphasises the maximisation of the ecological interest areas. This aspect, while having vast potential for further development and exploitation, has not received adequate attention in Malaysia. All ecotourism sites must be planned, guided and exploited in a monitored and controlled manner for effective and efficient management. A systematic expert rating system is developed to maintain a certain level of standards based on different levels of categorisation to ensure the sustainability of ecotourism sites in Peninsular Malaysia. The expert system developed uses a web-based information-

sharing platform in line with the existing legislation on safety, health and environment. The system is designed and developed on a back-end on-line database, which will keep record of all successful transactions. This paper presents an efficient model using Active Server Pages scripting method to manage and deliver the ecotourism rating expert system.

Keywords: Expert system, web-based, knowledge-based, active server pages, ecotourism, sustainable management, rating

INTRODUCTION

As the tourism industry evolved, a new type of tourism, "ecotourism", has emerged and is making its mark in Malaysia. According to Cater and Lowman (1994), ecotourism evolved from nature tourism, which can be defined as ecologically sustainable tourism with the primary focus on experiencing natural areas. Using the same definition, ecotourism can be defined as ecologically sustainable tourism with the primary focus on experiencing natural areas that fosters environmental and cultural understanding application and conservation. Ceballos-Lascurain (1993) defined ecotourism as environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to enjoy and appreciate nature (and any accompanying cultural features - both past and present) that promotes conservation, has low negative visitor impact, and provides for beneficially active socio-economic involvement of local populations.

The ecotourism concept emphasises the maximisation of the ecological interest areas, which include marine parks and islands, national parks, recreational forest reserves, and other forests, mangrove sites, limestone hills and cave sites, rivers, waterfalls and lakes, beach sites and montane areas (Ceballos-Lascurain 1993). This aspect, while having vast potential for further development and exploitation, has not received adequate attention in Malaysia. All ecotourism sites must be planned, guided and exploited in a monitored and controlled manner. Effective and efficient management is necessary to ensure that the project is feasible on a sustainable basis.

The main problems in the current practice in ensuring sustainable development of the ecotourism industry are: (a) lack of effective and efficient sustainable management practice of the ecotourism sites, (b) lack of enforcement in ensuring the ecosystem is sustained, (c) insufficient environmental cum ecological expertise that incorporates the fundamentals of safety and health, and (d) lack of consistent approaches in implementing a mitigation abatement measure and in satisfying the requirement of national environmental regulatory authorities.

Hence, a reliable and consistent rating system is required to ensure the sustainability of these ecotourism sites. The rating system can be used to assist in intelligent decision-making in terms of identifying potential ecotourism sites, which are not adhering to the standards of safety, health and environment. The systematic rating system can maintain a certain level of standards based on different levels of categorisation.

In order to make ecotourism development sustainable and to keep its impact at a desired level for future development, it is important that the present trend of the use of visiting areas is evaluated and rated. At the same time, resource assessment in terms of importance and attractiveness has also to be implemented. This study is the first in Malaysia in attempting to rate the ecotourism industry based on safety, health and environment towards resources and tourism development using a Web-based expert system developed by the researchers.

Therefore, the objectives of this research are: (a) to design, develop, test and implement an expert system to rate the ecotourism components consistently and reliably based on safety, health and environment, and (b) to extract the opinions of the domain experts, existing statistics and literature and field survey of people's perception in order to produce a set of rules to enable the expert system to be used to make intelligent decisions.

This paper presents an efficient model using Microsoft Access 2000 database software and an Active Server Pages (ASP) scripting method to manage and deliver the ecotourism rating system. Providing dynamic data on the Web, especially from a relational database, can be a daunting task because HTML is a mark-up language that has little processing power. Using ASP technology, it is now possible to provide dynamic Web access to local databases.

RATING SYSTEMS IN THE TOURISM INDUSTRY

Evaluation of the destination is essential in determining the best rating system. According to Pearce (1997), the multi-faceted nature of tourism and the complex nature of tourist demand make evaluation of the sector a complex task. Many different factors may influence where tourist development occurs. As tourist resources do not occur evenly or randomly in space, developers and planners will be faced with such practical questions as assessing the feasibility of developing a particular site. The result from the evaluation of the resources can be further developed to design effective and realistic rating system for the hospitality industry, in particular the tourism sector (Ritchie and Goeldner 1994).

Pearce further added that factors influencing the location of tourist projects or the tourist potential of an area could be grouped into the following categories, namely climate, physical conditions, attractions, access, existing facilities, land tenure and use. These factors are all interrelated.

In the tourism sector, a number of rating systems are used for accreditation of the site in terms of compliance of the local legislations. In 1995, the Alaskan Wilderness Recreation and Tourism Association, USA, emphasized the following 8 guidelines for the rating of the tourism sites:
1. Environmentally sustainable economic growth by minimising visitor impact on the wildlife, wild-land, native cultures and local communities.
2. Travel modes and facilities maintain low impact on the environment.
3. Businesses benefit the local economy and local inhabitants directly.

4. Business operations' effect on the environment is minimised.
5. All employees are educated on environmental impact.
6. Educational emphasis for tourists to learn.
7. Formula for the business and the guests to contribute to local non-profit effort for environmental protection.
8. Travel in the spirit of appreciation, participation and sensitivity.

In 1999, the Chinese National Tourism Administration (CNTA) classified and graded the tourist attractions according to hygiene, communications, safety and environment (Huang and Xiao 2000). The internationally recognised Blue-Flag criteria is another rating system widely used for beaches. The Blue-Flag criteria cover 4 major aspects of beach management, namely water quality, environmental education and information, environmental management and also safety and services (Font and Buckley 2001).

Another rating system was proposed by Shores (1999) for ecotourism scaling. He established a 0-5 scale to classify the stages of ecotourism. The proposed non-cumulative scaling measured different attributes and different levels.

One of the pioneer and most successful nations in managing ecotourism is Costa Rica. According to Font and Buckley (2001), the Costa Rican Tourism Institute, which is regulated by the Costa Rican National Accreditation Commission, introduced the Certification in Sustainable Tourism (CST) in 1999. The 5-level scaling is done for tourism-based companies and hotels. For the tourism companies, the 4 criteria evaluated are physical-biological parameters, infrastructure and services, external clients and the socio-economic environment. For the hotels, evaluation is done for physical-biological parameters, hotel facilities, customers and the socio-economic environment.

In 1994, the Tourism Authority of Thailand developed a rating and ranking system for the 109-tourism destinations using 5 criteria (SIRG 1997). The criteria used are:
1. resource attraction
2. susceptibility of impacts
3. opportunity for developing interpretation and educational programmes
4. diversity of ecotourist activity
5. compatibility of ecotourism with other tourism activities

The Malaysian National Ecotourism Plan, prepared by the World Wildlife Fund compiled a diagnostic list of ecotourism sites (WWF 1999). Table 1 outlines the diagnostic list.

WEB-BASED EXPERT SYSTEM TECHNOLOGY FOR RATING

It is easy to create Web pages to display static data from a database table. Most systems, such as Microsoft Access, include a "Save As HTML or Save As Web" feature to do just that. However, pages created in this way are a "snapshot in

time"; they do not change as the database is changed. We must re-create the pages each time changes are made to the data. Publishing and maintaining a large number of static Web pages is a maintenance nightmare (Lam 1997). In addition, users cannot search the database or choose particular items of data. Users can only see what was previously saved in HTML format.

Dynamic Web pages allow the user to connect to up-to-the-minute data, search the Web and display the data in different ways (Hatfield 1999). According to Yerkey (2000), four common ways of managing dynamic Web pages are, namely, Client-side Processing, Server-side Processing, Common Gateway Interface (CGI) and Active Server Pages (ASP).

TABLE 1
Diagnostic factors for ecotourism sites in the
Malaysian Ecotourism Plan (WWF 1999)

	Diagnostic Factors
1.	Current tourism status
2.	Accessibility
3.	Existing facilities
4.	Flagship potential
5.	Development led by
6.	Type of attractions
7.	Type of activities
8.	Staff manning the site
9.	Rehabilitation and recovery needs
10.	Gross carrying capacity
11.	Current management agency

A simpler method of server-side processing is to use Active Server Pages (ASP). ASP is Microsoft's method of providing server-side processing for use by Web browsers. ASP embeds scripting statements directly onto the Web page, rather than by using a separate program. Being able to place ASP and HTML side by side can make coding much more manageable. As a result, ASP server-side scripting is browser-independent; a developer does not have to worry about browser dependencies, because only standard HTML will be delivered to the browser (Yerkey 2000).

The complexity of rating the components of the hospitality sector is evident with many factors to consider. With the aid of a Web accessed expert system, the rating procedure can be simplified. The World Wide Web has become the interface of choice for this information access in the 21st century.

The expert system developed uses a web-based information-sharing platform in line with the existing legislation on safety, health and environment. This diagnostic list from the Malaysian National Ecotourism Plan (WWF 1999) is used in enhancing the rating system.

EXPERT SYSTEM DEVELOPMENT METHODOLOGY

The initial study for this research project included a literature review on the existing rating system used in the hospitality and tourism sector. The findings of the research are combined with the opinions among domestic and foreign tourists and domain experts (including officers and ecotourism operators) to make the decision, and are to be converted into rules to be used as the basis for the construction of an expert system. Where no guidelines are available, recommendations based on the domain experts, literature and field survey statistics are incorporated. The expert system would use 3 levels of cumulative rating: the filtration module, basic compliance module and the advance compliance module. The domain experts would then be selected to determine the safety, health and environmental factors, which are critical in managing the ecotourism sites in Peninsular Malaysia. The knowledge derived from the expert opinions will be put into a series of analysis using the Delphi method (Birdir and Pearson 2000; Sahakian 1997) before deciding on the rules to be used by the expert system.

Data collection is carried out by the researcher and research assistants (RAs) from Universiti Putra Malaysia (UPM) and Taylor's College, School of Hospitality and Tourism (TCHT). The primary data required for the study is generated through the questionnaire survey of the domestic and foreign tourists to the study area. To strengthen the findings, the questionnaire survey is supplemented by reconnaissance survey and informal interviewing of the key informants.

In developing the questionnaire, previous studies on residents' perception and various other disciplines, namely, tourism and outdoor recreation, social and behavioural sciences, economics and management are obtained and used as guides. To measure the attitudes and perception, a five point Likert Scale (Murry and Hammons 1995) is used throughout the study. The decision to use the Likert Scale was based on the effectiveness of such a scale in previous studies of tourists' and residents' attitudes and perception (Wan Sabri 1987, Sengdeuane 1996).

All expert systems developed must fulfill 6 major development phases (Deborah *et al.* 1987; Durkin 1994). These iterative processes are incorporated in the rating system. They are Assessment (Phase 1), Knowledge Acquisition (Phase 2), Design (Phase 3), Testing (Phase 4), Documentation (Phase 5) and Maintenance (Phase 6). Similar development phase was also used by Giarrantano and Riley (1994) and Jackson (1992).

Phase 1: Assessment

A comprehensive literature review is done to determine the resource assessment in terms of the impact of the identified factors and the level of importance or weightage of these factors to ecotourism sites.

Phase 2: Knowledge Acquisition

The knowledge acquisition for the system is derived based on the domain expert consultation; secondary data of existing legislation and guidelines and

primary data based on field survey. Using the Delphi method (Birdir and Pearson 2000; Sahakian 1997), domain experts are consulted from:
a. Ministry of Culture, Arts and Tourism Malaysia
b. World Wildlife Fund for Nature (WWF) Malaysia
c. Forest Reserve Institute of Malaysia (FRIM) and Wildlife Department (PERHILITAN)
d. Taylor's College, School of Hospitality and Tourism and Sunway College, School of Hotel and Tourism
e. University of Toulouse, France

As for the secondary data, legislation and guidelines used to develop the rules for the inference engine of the expert system are based on:
a. Environmental Quality Act 1974 (Act 127) (DOE, 2000; DOE, 2001)
b. Occupational Safety Health Act 1994 (Act 514) (MDC, 1996)
c. National Ecotourism Plan Guideline for Malaysia (WWF, 1999)

The primary data collected through questionnaires in the field survey uses the perception of the domestic and foreign tourists and also officers' (persons manning the ecotourism sites) perception in terms of the level of agreement for safety, health and environmental factors on an online Likert Scale as used by Birdir and Pearson (2000) in the Delphi method. Table 2 shows the Alpha Reliability Coefficients result of various independent variables for the pre-testing of the questionnaire.

TABLE 2
Summary of reliability analysis for pre-test

	Independent Variable	Alpha Reliability Coefficients
1	Safety	0.8685
2	Health	0.7709
3	Environment	0.8175
4	Management	0.3108
5	Socio-economic	0.2700
6	Aesthetics	0.0717
7	Management/Socio-economic/ Aesthetics	0.2633

Results show a consistency in the survey questionnaire with a high reliability for safety, health and environmental factors.

Phase 3: Design

The system is designed on a web graphical user interface (GUI) for simplicity and broader networking on an information-sharing platform. The system is designed and developed on a back-end on-line database, which will keep record

of all successful transactions and rate accordingly. *Fig. 1* shows the simplicity of the system design.
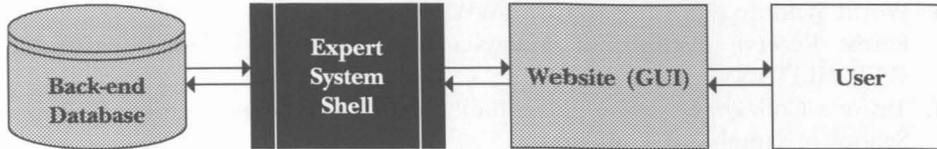

Fig. 1. User Interfacing with database

The system architecture of the rating system is detailed in *Fig. 2*. The home page (main URL) of the site is http://www.ecotoures-upm.net/. The site acts as the GUI for the users (ecotourism operators). The user interface is the vehicle through which the user views and interacts with the system. Microsoft Front Page 2000 is used as the developer interface for the knowledge engineer (the researcher).

The explanation facility subsystem is responsible for providing explanation on the reasoning and acts as a "help" function in the URL: http://~/rating.htm and http://~/help.htm. The algorithm for the working memory, knowledge base and inference engine is written in ASP. In the working memory, users enter information in an ASP generated form (http://~/*.asp). The system matches this information with the knowledge contained in the knowledge base to infer new facts. The facts in the working memory and the knowledge contained in the knowledge base are inferred by the inference engine in an ASP generated handler algorithm (http://~/*handler.asp) to derive new information. It searches the rules for a match between their premises and information contained in the working memory. When the inference engine finds a match, it adds the rule's conclusion to the working memory and continues to scan the rules looking for new matches.

All successful transactions would be updated in the knowledge-based database using external programs such as Microsoft Access 2000. In the rating Website, the database file is stored in he URL: http://~/*.mdb.

All questions are made up of standard HTML and Microsoft Front Page form components integrated with ASP. Generally, each question has a corresponding handler. The functions of a handler are to:
1. extract scores from previous questions
2. convert scores into integers
3. perform calculations on the score, to check if the question was answered adequately and move on to the next question, or to go straight to the summary page and end the session.

The summary page uses scores obtained for each question to tabulate a percentage based on safety, health and environment using different weightage.
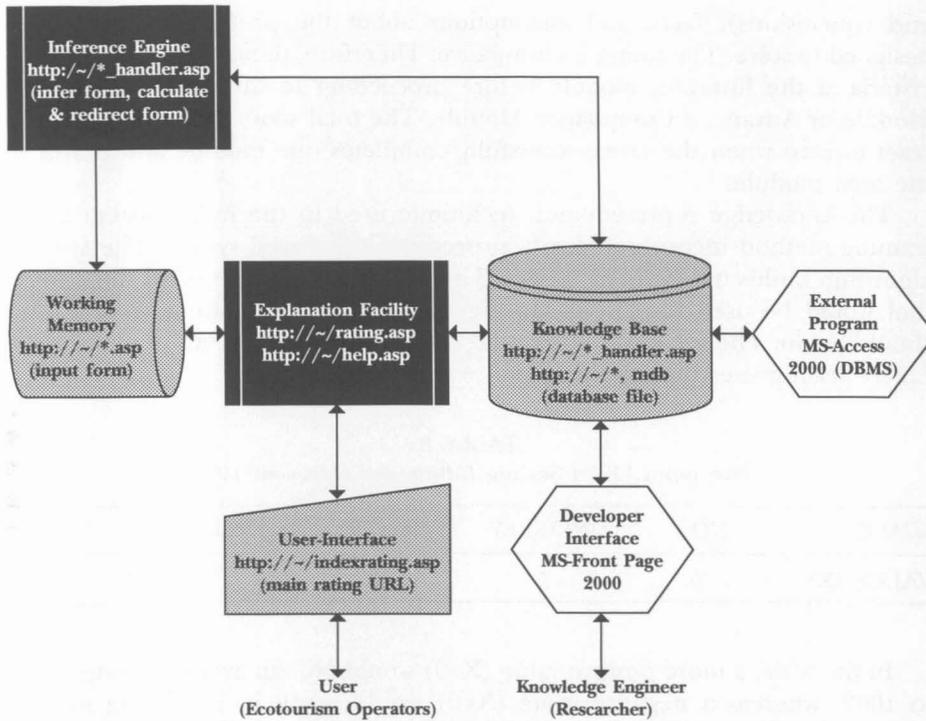
Fig. 2. Rule-based system architecture

The successful Costa Rican hospitality and tourism accreditation model (Font and Buckley 2001) and the Tourism Authority of Thailand rating and ranking system for nature tourism (Services Industries Research Group 1997), are used as the basis for the ecotourES algorithm and model. The general scoring mechanism uses the following equation:

$$\text{Total Score} = \sum_{i=1}^{n} \frac{W_i R_i}{W_i}$$

W_i = weighted score for given question
R_i = rated score for given question
n = total number of questions

The rating system can be divided into 3 modules, namely the Filtration, Basic Compliance and the Advance Compliance Module. The expert system would ask subsequent questions based on the user input. Therefore, no two users may be asked the same set or the same number of questions. The knowledge is typically represented in the form of *IF...THEN* type rules (premises

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and conclusions), facts, and assumptions about the problem the system is designed to solve. The rating is cumulative. Therefore, the user has to fulfill the criteria at the filtration module before proceeding to the Basic Compliance Module or Advanced Compliance Module. The total score for each module is reset to zero when the user successfully completes one module and moves to the next module.

The knowledge representation technique used in the rating system is the framing method incorporated in a procedural rule-based system. The systems algorithm builds two types of frames. The first frame consists of all the criteria that would be used for the rating together with the minimum score a user should attain. The second frame would capture the actual score of a user. The Likert Scaling uses the following values shown in Table 3.

TABLE 3
Five point Likert Scaling *(Murry and Hammons 1995)*

SCALE	NO	UNLIKELY	NEUTRAL	PERHAPS	YES
VALUE (X)	- 10	- 5	0	5	10

In the scale, a more positive value (X>0) would give an average rating closer to 100% whereas a negative value (X<0) would result in the rating moving closer towards 0%. The negative value would be able to reduce the average score computed in each module. Hence, equilibrium can be achieved in the rating.

Each question is weighted by its relevance on a scale of 1 to 3 (normal: low weightage = 1, medium: average weightage = 2 and high: high weightage = 3). Nevertheless, the procedural rule-based algorithm would reduce the total number of questions and options used to answer. This is in contrast to the Costa Rican CST programme where users have to answer all the 153 questions.

In the Filtration Module, users will have to pass the first level of filtration in order to be eligible to use the rating system. The filtration module would encompass the sites' safety, health and environmental compliance according to the ecotourism definition. The acceptable ecotourism definition used for compliance is developed through consultation with the domain expert and secondary data. The filtration level too would filter the eligibility of the user to proceed further in the rating based on the legislative and ecotourism guideline requirements. In the filtration level, a higher weightage is assigned for the ecotourism definition compliance.

The Basic Compliance Module takes into account the macro factors that influence the rating of the site, namely the ecotourism value factors, operator qualification to run the place and permitted/not permitted activities. Here the level of compliance in safety, health, environment and other factors is considered for rating. A higher weightage is assigned for the safety compliance. In this module, users are required to answer all the 5 questions.

The Advance Compliance Module takes into account the micro factors that influence the rating of the site, namely the impacts of tourism and also the site planning and management. The following flowchart (*Fig. 3*) shows the data flow of the rating system.

In the advance module, the inference engine in the expert system would use a rule-based *IF...THEN...ELSE* syntax to fix the rules according to the different ecosystem guidelines. The ecosystem guideline would be based on the National Ecotourism Plan Guideline for Malaysia (WWF 1999).
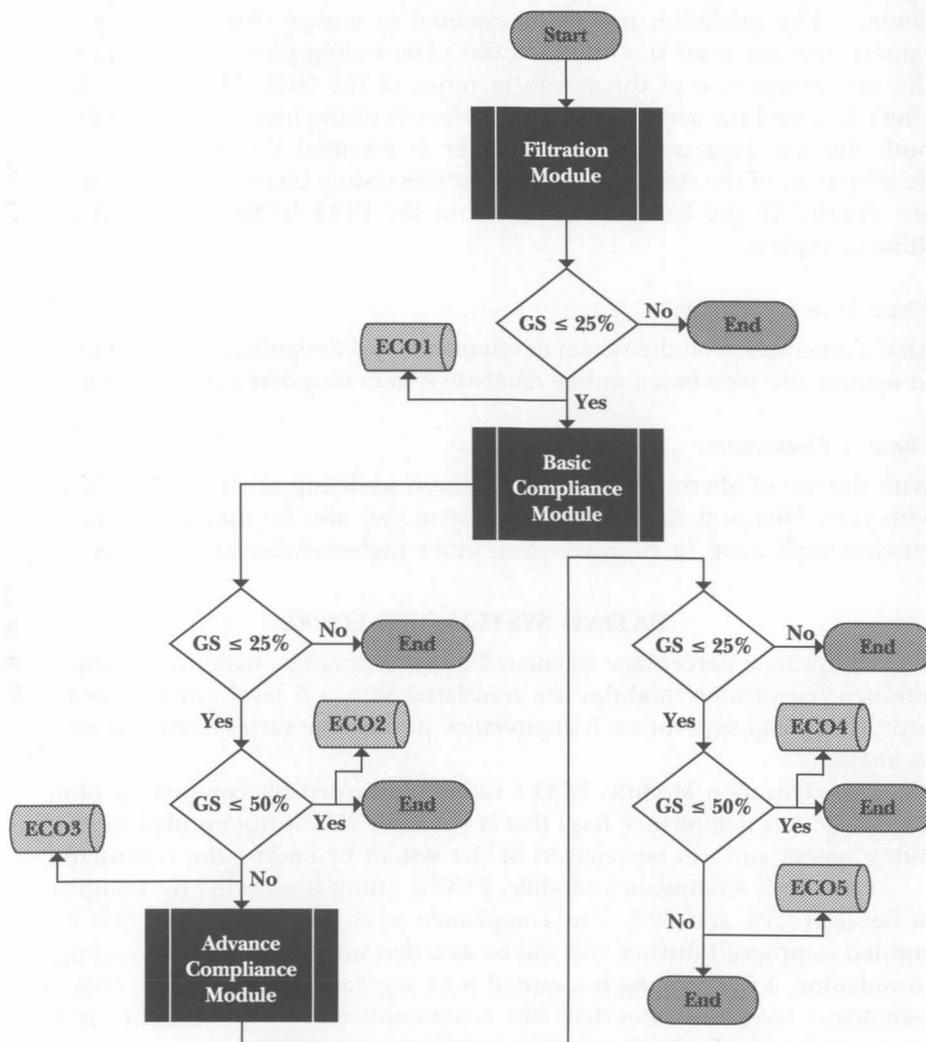

Fig. 3. Data flow of the rating system

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Similar to the Basic Module, the level of compliance in safety, health, environment and other factors is considered for rating. In addition, a higher weightage for rating is given in the Advance Module compliance of the National Ecotourism Guidelines.

Phase 4: Testing

The testing phase is an iterative process. New knowledge from the domain expert is added to the system throughout this phase. The major objective of testing is to verify and validate the overall structure of the system and its content. The validation process is essential to ensure that the rating system satisfactorily performs the intended task. The testing phase would also ensure the user acceptance of the system in terms of the GUI. This is important to check how well the system addresses the needs of the user. The acceptability of both domain experts and the end-user is essential for testing the overall development of the system's interface. At this testing phase, hypothetical values are inserted in the ES and the output of the ECO rating is analysed by the domain experts.

Phase 5: Documentation

All documentation on the system development and designing, including manuals to operate the Web based online database system is updated from time to time.

Phase 6: Maintenance

With the use of Microsoft Front Page Editor, updating of all data can be done with ease. Microsoft Access database system can also be updated without too much complication in comparison to other high-end database systems.

RATING SYSTEM DEVELOPED

The compliance percentage calculated in the filtrations, basic compliance and advance compliance modules are translated into a 5 level cumulative rating scale. The weightage for each compliance percentage varies from one module to another.

At the Filtration Module, ECO 1 rating is awarded for compliance of more than 75%. Any compliance level that is less than 75% is not entitled to use this rating system and will be rejected by the system by ending the consultation.

At the Basic Compliance Module, ECO 2 rating is awarded for compliance of between 25% and 50%. Any compliance level that is less than 25% is not entitled to proceed further and will be awarded with ECO 1 before ending the consultation. ECO 3 rating is awarded for compliance of more than 50%. Any compliance level that is less than 50% is not entitled to proceed further and will be awarded with the ECO 2 before ending the consultation.

At the final Advance Compliance Module, ECO 4 rating is awarded for compliance of between 25% and 50%. Any compliance level that is less than 25% is not entitled to proceed further and will be awarded with ECO 3 before

ending the consultation. ECO 5 is the highest rating awarded for compliance of more than 50%. Any compliance level that is less than 50% is not entitled to proceed further and will be awarded with the ECO 4 before ending the consultation.

The rating can be summarised as shown in *Fig. 4*. A successful rating can be accomplished in one of the 3 levels. The user can be awarded the rating from ECO1 gradually to ECO2 (Level 1) before terminating the rating. The user too can be rated from ECO1 to move directly to ECO3 and then gradually to ECO4 (Level 2). In the last type, the user can move directly from ECO1 to ECO3 to ECO4 (Level 3).
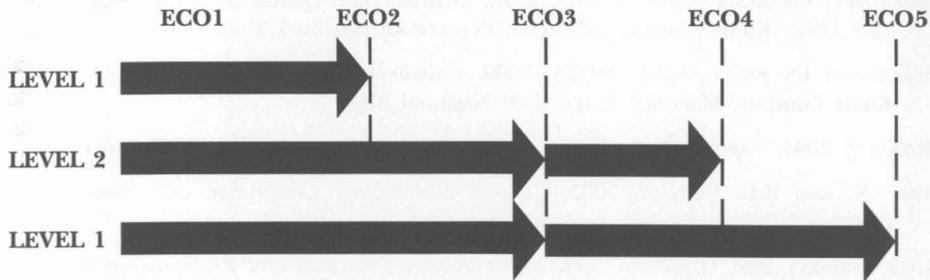

Fig. 4. Cumulative score for ECO rating

CONCLUSION

Microsoft's ASP technology is a simple way to retrieve and process database data for display on the Web. Well-constructed pages consisting of ASP and HTML exploit the power of a relational database. ASP allows one to develop pages to search, filter, sort, combine, select, add to, delete, and change database data. The data retrieved is as up-to-date as the database itself. The processing burden, and necessary software, resides on the server, allowing anyone using almost any browser to have access to the data. This was confirmed by Yerkey (2000) in his research using ASP for dynamic database for libraries.

In a market-driven environment, what the ecotourism industry needs and what the public must demand is a ruler for measuring the impact of tourism on natural resources. Ensuring that nature-based tourism establishes and maintains high standards will be a challenge for all parties.

With ASP, a standardised intelligent rating system like ecotourES can check the ecologically sensitive and economically viable methods and practices that will ensure the survival of the attraction of nature, without having the resources depleted. The management of a sensitive ecosystem in the ecotourism context can in one way protect a country's heritage and make it available for local education and tourism. The environment is the resource base for tourism; without protection, the natural attraction that brought the tourist in the first place will be lost. With the full enforcement and acceptance of a standardised rating system, the possibility of truly sustainable tourism can be a reality.

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