Design and development of an expert system for rating the ecotourism destinations

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Introduction

The development of an expert system is discussed that would help the visitors, tour operators and administrators in rating various eco-destinations in one's area of interest. An Expert system is a computer program that represents and reasons with knowledge of some specialist subject, with a view to solving problems for giving advice (Jackson, 1999). The process of collecting the required knowledge for developing the rule base of an expert system is known as Knowledge Engineering as shown in Figure 1. Expert systems are designed to cope up with problems or decisions that conventional computer tools are not capable of handling (Mountinho et. al., 1996). The knowledge base is usually represented by a set of IF..THEN rules and the inference engine of the expert system matches appropriate combinations of rules in order to generate conclusions (Mountinho et. al., 2003).

Literature has enumerated the characteristics which make the problem domain an ideal candidate for expert system application (Crouch, 1991). Within the tourism sector also expert systems can play a significant role. The representation of tourism knowledge in expert systems might consolidate expertise, making it available where it is likely to have an impact namely, at the point of need (Mountinho et. al., 1996). The systems help to alleviate the problems of tourism by incorporating rules into a knowledge medium which can be distributed easily and inexpensively. It not only provides solutions but also suggestions to the user for the query posed to them. Many expert systems in tourism industry had been developed a decade back. Since then it has found applications in various areas of tourism like accommodation, transportation, tourism development, wholesaling, retailing, finance and government as shown in Table 1.

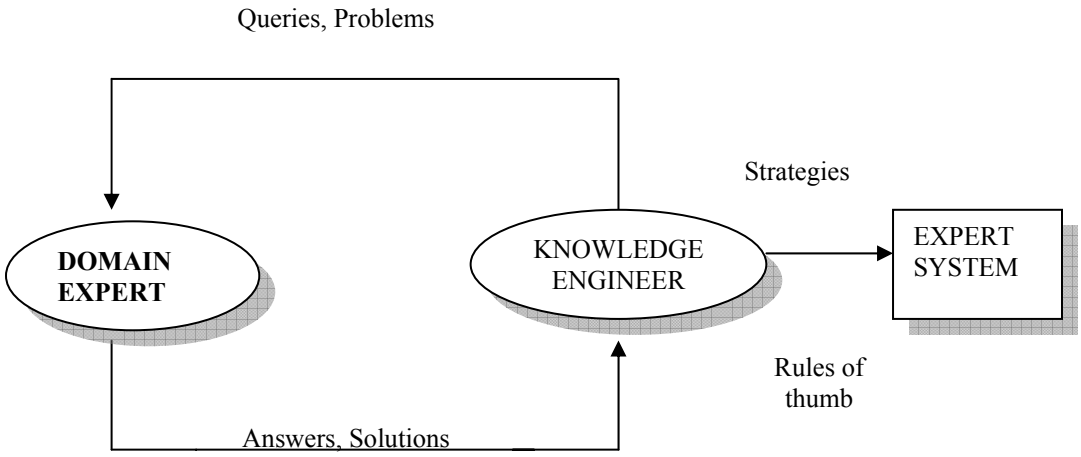

Fig. 1. Knowledge Engineering process (Waterman,1986)

From Table 1, it can be said that most of the expert systems in tourism have been developed in transportation and accommodation sector. Very less expert systems were developed in the government sector which is around 5% as shown in the Table 1. But not many Expert systems have been developed in Ecotourism sector. Literature also shows the presence of development of expert system for rating ecotourism sites in Malaysia (Nair et. al., 2003). The expert system developed here is exclusively for the state of Kerala which has abundance of ecotourism destinations in the "gods own country".

Table 1. Distribution of tourism expert system over subfields of tourism (Mountinho et. al., 1996)

Types of Tourism decision	Number of systems	Percentage of system
Wholesaling	6	26%
Transportation	9	39%
Accommodation	7	30%
Government	1	5%
Total	23	100%

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Development of the Expert System

The expert system developed is user friendly and does not require programming knowledge for a query session. The constraints of the problem at hand can be input to the system, as and when the system prompts for it through window menus, while running the program. The expert system was developed in Visual Basic (VB) (Balena, 1999). It runs on IBM PC/AT or compatible with a set of rules which define various parameters for the rating of ecotourism sites. The required knowledge for the development of the expert system was adapted from the literature (Rita et. al., 1994; Mountinho et. al., 1996; Mountinho et. al., 2003; Nair , et. al., 2003).The expert system gives the user a chance to rate the ecotourism destinations of his or her choice. The system provides a menu with various options like Beaches, Islands, Waterfalls, Forests/Reserves/National Parks, Mangroves, Backwaters, Hill stations and Rivers as shown in Figure 2. The user is prompted to provide inputs for various parameters/sub-parameters and finally, he or she gets a result as to whether the site is best, average or worst ecotourism site. For example, if a user wants to rate the beach in his/her area, then he or she has to go through nine parameters. The nine parameters include physical factors, quality of water, quality of sand, threats, population, amenities, pollution, natural features and ecotourism definition. The different parameters given above have several sub-parameters which can bind with one of the choices as input for that sub-parameter input by the user during query session as shown in Figure 3. Once the user completes the session, the Expert system rates the ecotourism site as best average or worst as shown in Figure 4. It also provides the user with an option to rate again other eco-destinations or to quit the system. The sample rule for assigning value to a sub-parameter value is as follows:

IF option = "No" THEN a=3
IF option = "Neutral" THEN a=15
IF option = "Yes" THEN a=25

In order to rate a beach, the user has to go through nine parameters with several sub-parameters each. Approximately, there are around 320 rules to help the expert system rate the beach alone. Thus for each sub-parameter within a parameter, a variable for example "a" is assigned. Also for each option, ie, No, Unlikely and so on, a numerical value is assigned. That is, if a rater selects "No" from the Option Box, which prompts the user with options like "No", "Unlikely", "Neutral", "Perhaps" and "Yes", then "a" is assigned with a value of 3 as shown above. Alternatively, if the user selects "Neutral", "a" is assigned with the value of 15 and so on.

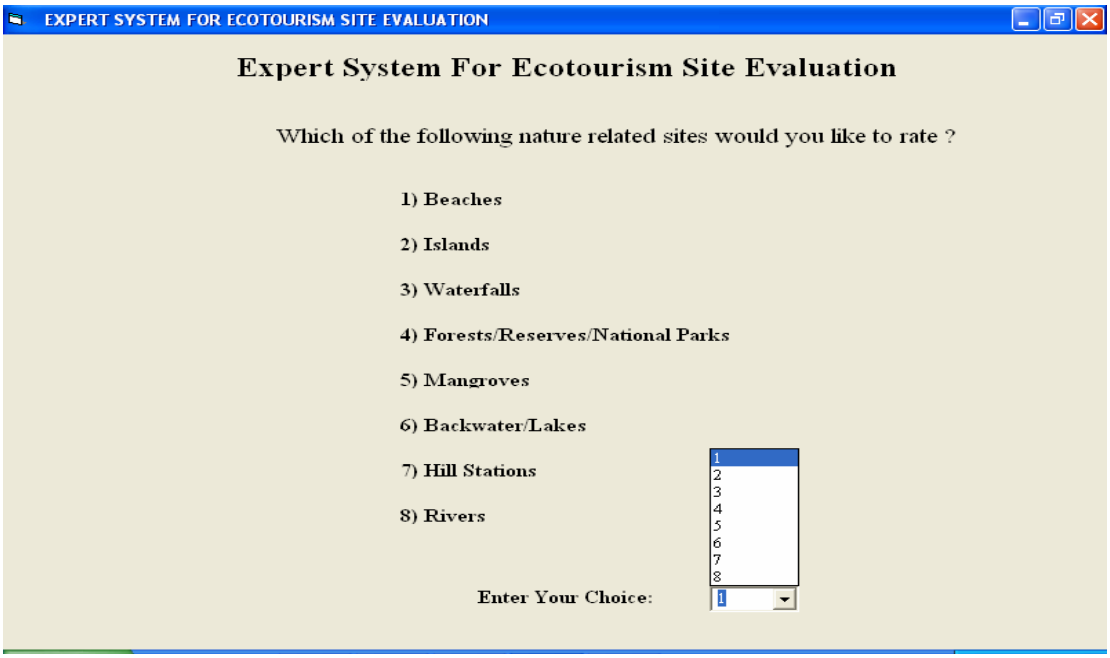

Fig. 2. Expert system menu for the rating of various ecotourism sites

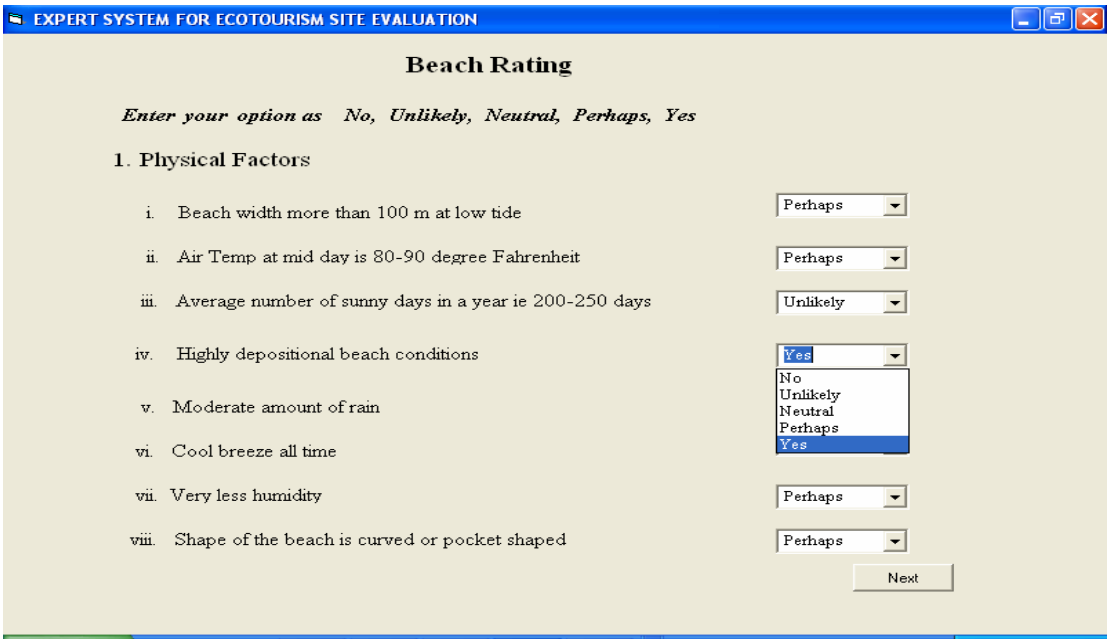

Fig. 3. The input sub-parameters for physical factors of the site.

Physical factors is only one of the parameters and there are eight more parameters with their corresponding sub-parameters for which the user inputs are to be got before rating the beach example. Once all the sub-parameters get their values through user input, the expert system adds the numerical values to find the composite score and a percentage value is calculated by the expert system, which in turn rates the beach as best or worst. Total allowable composite score is 980 for all the sub-parameters for rating the beach.

Fig. 4. The expert system provides the solution to the user

Description of all parameters and sub-parameters for beach rating

Table 2. Sub-parameters options entered during sample session and their corresponding values for parameters 1 t o 4

1.0 Sub-parameters for Physical factors	No	Unlikely	Neutral	Perhaps	Yes	Score	Total
1.1 Beach width is more than 100m at low tide				√		22	25
1.2. Air temperature at mid day is 76-80 deg. F				√		22	25
1.3.Average sunny days/year is 200-250		√				7	25
1.4. Highly depositional beach conditions					√	20	20
1.5. Moderate amount of rain			√			12	20
1.6. Cool Breeze all time	√					1	15
1.7. Very less humidity				√		8	10
1.8. Shape of the beach is curve/pocket shaped				√		8	10
2.0 Sub-parameters for Quality of water							
2.1. Water Temperature is 76- 85 deg F			√			15	25
2.2. Breaking waves low and very safe				√		22	25
2.3. Rip Currents very safe for kids	√					1	20
2.4. Tidal range is less than 1 m					√	20	20
2.5. Water is clear and transparent				√		13	15
2.6. Colour of water is Blue/Turquoise		√				1	15
2.7. There are no red tides			√			10	15
3.0 Sub-parameters for Quality of sand							
3.1. Beach material is soft and powdery					√	25	25
3.2. Colour of sand is white or pink			√			12	20
3.3. Beach is very clean with no debris		√				6	15
4.0 Sub-parameters for Threats							
4.1. Tides with no currents				√		7	25
4.2. Absence of stinging jelly fish/coral urchins			√			15	25
4.3. Sunburns					√	20	20
4.4. History of storms like Tsunamis/cyclones.		√				17	20
Subtotal						284	435

Tables 2 shows the sub-parameter options as entered by the user during an interactive session and their corresponding values as evaluated by the system based on rules in the knowledge base. Similarly, sub-parameter values has to be input for parameters 5 to 9 which is not shown here due to paucity of space. Score for a sub-parameter and the allowed maximum for a sub-parameter are as shown in the Table 2. Percentage can be computed by dividing composite score got for the site and the total allowed maximum composite score which is 980. The interactive session has a composite score of 655. Therefore, the composite score percentage is 66.84% for the sample session. As the computed percentage is between 60% and 85%, the corresponding rule for rating the beach gets fired and evaluates the beach as "Good" as shown in Figure 4.

Conclusion

The expert system developed is user friendly and the user need not have any programming knowledge. The user can smoothly navigate through nine different input screens before the system outputs its conclusion. It is possible alleviate the burden on tour operators by making use of such expert systems. Such systems are less costly to use and saves time. Moreover, it can execute on the Internet explorer which is a feature of Visual Basic and is ideal for execution from a web portal.

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