



AN EXPERT ADVISORY SYSTEM FOR TOURISM IN KOLKATA

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ABSTRACT

Knowledge-based systems and, particularly, expert systems are bringing new thinking to how we view knowledge. Increasingly, we see knowledge as a commodity or an object, something generated, discovered, restructured, repackaged and delivered. Powerful tools have been developed for expediting our work in manipulating knowledge. People need to travel for business and people nowadays consider holidays to be more of a necessity than a luxury, so the tourism industry proves time after time to be a very resilient one. This paper therefore presents the development of an expert advisory system for tourism in Kolkata, where, in spite of its size and immense potential as a tourist destination, there has seen relatively low levels of international tourist arrivals and receipts. The expert tour advisory system can act as a guide for the tourists providing them with detailed and up-to-date information, ask them for their purpose of visit, take their preferences as input and generate the detailed tour schedules according to their need using its expert knowledge based inference engine. These are the areas where the tourists are mostly cheated and their purpose of visit is not served. The developed tour advisory system has two major components, i.e. a) knowledge base to capture the relevant tour information, and b) an inference engine to design the tour schedule based on the user preferences. Broadly, three main purposes of the expert tour advisory system are identified, i.e. a) provision of tour information, b) tour schedule generation, and c) knowledge base update, so three different applications are developed, which work on a single database. The tourists will use the first two applications, whereas the third application will be used by the concerned knowledge engineers. Particular emphasis is given on the formulation of the heuristics in knowledge engineering and the design of a user-friendly interface. Problems associated with the implementation experience and future directions are also discussed.

Key Words: *Tour advisory system, Expert system, Database, Graphical user interface, Kolkata, Tourist spot.*

1. INTRODUCTION

Expert systems can help automate anything from complex regulations to aiding customers in selecting from among a group of products, or diagnosing equipment problems. At present, there are many areas in the service industry where expert systems (ES) have been successfully applied [1]. Expert system is a program that emulates the interaction a user may have with a human expert to solve a given problem. The end user provides input by selecting one or more answers from a list or by entering data. The program will ask questions until it has reached to a specific conclusion. The conclusion may be the selection of a single solution or list of possible solutions arranged in order of likelihood. These characteristics make expert systems most suitable for tourism industry, but still there has been very little application of expert systems in tourism industry [2]. It can act as an expert guide for the tourists providing them with detailed and up-to-date tour information, ask them about their purpose of visit and take their preferences as input to generate tour schedules according to their need. These are the areas where the tourists are mostly cheated and their purpose of visit is not fulfilled. This paper describes the development of an expert advisory system for tourism in Kolkata, a metropolitan city of India.

India always appealed to a class of international tourists for its oriental charm and mystery and this class visited India to explore and get to know it [3]. India was promoted as a destination having enough charm for every type of tourist. But, tourism in Kolkata has been facing the problem of not getting the expected number of foreign tourists despite extensive marketing efforts [4]. It has been observed that Kolkata is rated highly for its rich art forms and cultural heritage. However, irritants like cheating, begging, unhygienic conditions, lack of safety dampen the spirits of tourists. Kolkata can be positioned in the world map only after these hygiene factors are improved along with other motivators. Kolkata represents an interesting case in which, despite its immense potential as a tourist destination, has seen relatively low levels of international tourist arrivals and receipts [5]. In fact, growth in international arrivals and receipts in Kolkata during the past decades has not kept pace with the rates of increase within the country. The main factor that has been found to be largely responsible for this poor performance of tourism sector is the low prioritization of tourism in the hierarchy of development directions identified by the concerned Government. As a consequence, key areas such as tourism infrastructure development, marketing and promotion,

and manpower development have lagged behind the industry's requirements and expectations. The statements regarding the inflow of tourists in Kolkata during the last few years are provided in Table 1.

Table 1 Inflow of tourists in Kolkata

Calender Year	Domestic Tourist	Foreign Tourist	Total
1991	484,599	85,181	569,780
1992	530,683	96,127	626,810
1993	559,640	87,887	647,527
1994	641,448	123,638	765,086
1995	640,177	139,721	779,898
1996	645,783	140,392	786,175
1997	661,126	145,185	806,311
1998	668,621	143,566	812,187
1999	673,977	144,307	818,284
2000	684,679	142,704	827,383
2001	715,756	210,793	926,549
2002	1,443,002	336,418	1,779,420
2003	1,969,992	402,003	2,371,995
2004	3,183,323	449,956	3,633,279
2005	3,939,093	509,664	4,448,757

Inadequate tourism infrastructure is clearly one of the main reasons behind Kolkata's inability to attract tourists. By tourism infrastructure what is meant here will be all the physical facilities that contribute to the quality of the tourist experience. Facilities that are currently available in Kolkata have been considered by many potential visitors as falling short of their requirements of an interesting and pleasant travel experience. It has been estimated that less than 20% of the total foreign tourist traffic is channeled through travel agents and tour operators. The remaining tourists make their own arrangements for travel and stay. Even for the biggest potential markets, it has been observed that very few agencies offer attractive tour packages. A major factor behind this situation is inadequate international networking between the tour operators and their counterparts in foreign countries. This suggests that tourism marketing and promotion efforts need to be reoriented, focusing much more on these intermediary agencies.

An important requirement for effective tourism planning and policy is the availability of a comprehensive database on various tourism statistics.

There are also very limited data on outbound tourism and on the travel patterns of non-resident Indians (NRIs). It will be difficult, under these circumstances, to undertake good studies on important planning and policy issues, such as demand projections, market research and analysis of economic impact of tourism. There is a pressing need for greater rationalization of tasks relating to tourism data collection. This facility can be expanded to encompass a more comprehensive range of up-to-date tourism information. Once such a database system is in place, it will definitely be possible to carry out more reliable and timely analyses of tourism patterns and trends for the purpose of effective planning and policy deployment.

Over the past two decades, expert system has emerged as an important development in the field of information science. Once merely experimental in nature, expert system has since evolved to become a practical tool used in aiding the decision-making of a widening variety of business processes. An expert system not only takes advantage of an electronic handbook and computerized data, but also makes decisions or recommendations directed to the end users. Furthermore, it provides additional features such as explanations, guidance and advice to assist those users who are less experienced in finding the causes of problems, helping them with possible solutions. The tourism industry is now beginning to realize the advantages of computerizing the perishable knowledge of the experts in the industry. Expert system offers the potential of being the first practical method available to preserve the intellectual property of an organization/industry.

2. TOURISM IN KOLKATA

Kolkata, the capital city of the State of West Bengal under Republic of India, is a city of love and warmth, sorrow and despair, dreams and hopes, poverty and squalor, grandeur and glory [6]. The city of joy is also referred to as the intellectual capital of India. Kolkata is compelling, effervescent, teeming with life and traditions - a medley of moods, styles, cultures, politics, industry and commerce. More than 300 years ago, Job Charnock, an English tradesman set up a trading post on the banks of the Ganga along the three-village nucleus. Gradually Europeans started setting up businesses and trade establishments, while the moneyed class taking interest in banking and usury. The East India Company steadily encroached into the matters of state. The fate of the Nawabi rule was sealed in the Battle of Plassey and the English went ahead to seize power, a grip that loosened only 250 years later when power was transferred from the British

Empire to the Indians. Independent India has crossed more than 50 years and these five decades have seen many miracles. Kolkata has grown, remains a city of contrasts, a mix-up of light and shade, a strange medley of ancient and modern, skyscrapers and Victorian edifices, haven of the rich and the poor as seldom found anywhere in the world. There is so much to see in this incredible city.

Kolkata is a city that means many things to many people [7]. For some, Kolkata is the city of joy, while for others, it is dirty, crowded and noisy. Once the greatest colonial city in the orient, it was later reviled as a cauldron of poverty, dirt and disease. Today, it ranks among the four major metropolis of India along with Delhi, Mumbai and Chennai. A mere village in the 17th century, it is not an ancient city like Delhi. Like Mumbai and Chennai, it originated largely due to the expansionist ambitions of the European powers, specially the British Raj. Little wonder, it has some of the finest Raj edifices built in a variety of styles.

Some of the best-built buildings in India are the colonial buildings located in Kolkata. Thus, when one is holidaying in Kolkata, there are a number of landmarks worth visiting. The Victoria Memorial is the most important tourist spot in Kolkata. As the name suggests, it was built in the memory of Queen Victoria. It has a huge white-marble structure. The structure, which is now floodlit in the night, gives a fascinating site. It has been now converted into a museum that houses the most impressive collection of memorabilia's from the days of British Raj in India. Howrah Bridge is another milestone synonymous with Kolkata. A million people from every corner of India stream across the massive Howrah Bridge, swarm around the Hooghly River and flock along the busy avenues through its narrow lanes. Then one arrives at the great expanse of the Maidan, the heart of Kolkata, which is the home to the second largest planetarium in Asia, the Birla Planetarium. On the banks of the Hooghly River, there is Vidyasagar Setu too.

The oldest museum in India, Indian Museum is also located in Kolkata. For the sports lovers, Eden Gardens is a must check out. It is a well laid-out garden that has the renowned cricket ground also. For those spiritually inclined in, the Kali Mandirs at Kalighat and Dakhineswar must be visited. The temples are dedicated to Kali Ma, the goddess of destruction. Fort William, Raj Bhavan, Palladian Villas, Botanical Gardens, the busy streets of Shyambazar, College Street and Kalighat, bookshops, art galleries,

coffee houses are all part of Kolkata with so varied and vibrant shades. Jorasanko, the birthplace of Rabindranath Tagore and cradle of the Indian Renaissance's fascination defies analysis. It is an addiction and an affair of the mind and heart. Anyone who has lived here once can never be happy anywhere else in the world. The best time to visit Kolkata is during the winter months from October to March. Durga Puja is another occasion when the city is at its best.

With the growth of the city, Kolkata provides very good choices in accommodation. Every income group has wide spectrum of accommodations to choose from. The hotels are convenient and provide all the modern facilities. Kolkata offers the most luxurious accommodation in India with world-class services and best ambience. Kolkata has always remained a peaceful city and the same can also be found in the neighborhood of the hotels in Kolkata. In order to make the travel tour to Kolkata even more joyful, one needs to choose just the right kind of accommodation for him and his family or friends in Kolkata.

People are not wrong when they say Kolkata is a city of paradoxes. The most poignant among them is its un-splendid isolation in India's tourist map. While its denizens cannot stop gushing about its warmth and character, the sad fact is that the City of Joy remains low down the priority list in any tourist's travel itinerary. Its other metropolitan siblings like Mumbai, Delhi, Chennai, Hyderabad or Bangalore attract Indian and foreign tourists by the millions. But Kolkata languishes in what seems like a remote eastern fringe of India's overwhelming contour. Thanks to this, the state of tourism in West Bengal has also been suffered. Now the State Government has therefore taken many steps to encourage tourism.

Few general information [8] about Kolkata are provided below for the convenience of the tourists:

Global position	: Latitude 23° 35_ N Longitude 88° 28_ E
Nearest airport	: Netaji Subhash International Airport, Kolkata
Major rail heads	: Howrah, Sealdah and Kolkata (Chitpur)
Nearest port	: Kidderpore (Kolkata)
Area	: Kolkata city area 187.33 sq km. and Kolkata metropolitan district area 1380.12 sq km
Population	: 4.39 million as per 2001 census
Altitude	: 6.4 meters (20 ft.) above sea level

Climate	: Winter	Max 36.3° Celsius	Min 9.6° Celsius
	: Summer	Max 41.7° Celsius	Min 3 8.1° Celsius
Rainfall	: 1581 mm (Monsoon months - June to early September)		
Best season	: October to March		
Clothing	: Cotton in summer and light woolen in winter.		

3. DEVELOPMENT OF THE EXPERT TOUR ADVISORY SYSTEM

Usually, an expert tour advisory system is to be accessed by two groups of people, i.e. tourists and knowledge engineers. Tourists interact with the expert system through a user interface, while the knowledge engineers create, delete and update information in the expert system via a knowledge development shell. So in the heart of the developed expert tour advisory system lies two main components, i.e.

- a knowledge base to capture the relevant tour information, and
- an inference engine to design the tour schedule on user preferences.

The schematic diagram of the developed tour advisory system is shown in Fig. 1.

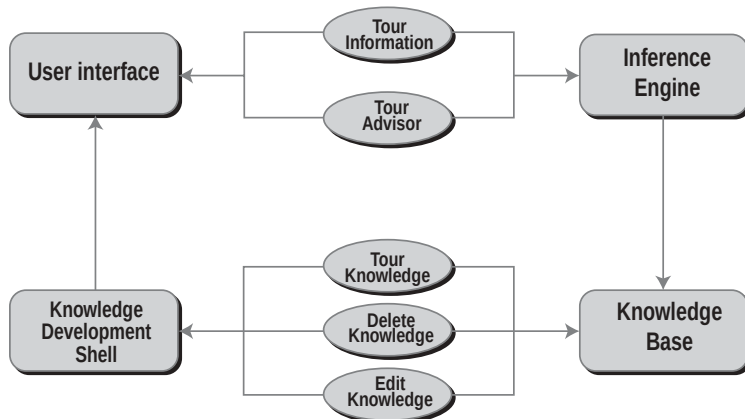


Fig. 1 Schematic representation of the expert tour advisory system

Broadly, three main functions of the expert tour advisory system are identified so three different applications are developed, which work on a single database. The three main applications of the developed tour advisory system are enlisted as below:

- a) Tour information: This provides detailed information about various tourist spots. Information regarding accommodations can also be obtained from here.

- b) Tour schedule generation: This captures user preferences and duration of tour in an interactive manner and generates detailed tour schedules based on this information.
- c) Knowledge base update: This application is primarily and periodically accessed by the knowledge engineers to keep up-to-date information in the database.

The first two applications are used by the tourists, whereas the third application is used by the knowledge engineers. Error trapping mechanisms are provided in every step to make this expert system more user- friendly so that no one can pass any wrong information leading to crashing of the system.

A single database maintains the detailed information about various tourist sites/spots. Although all the tourist spots have many attributes in common but still they refer to some special categories, which make themselves important. Accordingly, the tourist spots are classified as follows:

- a) Historical places
- b) Pilgrimage places
- c) Amusement parks
- d) Shopping malls
- e) Entertainment places
- f) Hotels.

Based on these, different tables for each of the tourist spot are developed and included in the database. The attributes for various tourist spots become the fields of these individual tables. Some of the common attributes are as follows:

- a) Unique ID
- b) Name
- c) Address
- d) Nearest Metro Station
- e) Telephone Number
- f) Description
- g) Visiting Hour Details.

Other attributes for a particular category of tourist spot are also included, such as:

- a) Room details for hotels
- b) Entry fees for amusement parks and historical places
- c) Show times for entertainment places
- d) Prayer timings for pilgrimage places, etc.

The backbone of the expert tour advisory system is the database that provides up-to-date information about various tourist spots in Kolkata. Special attention is paid while developing the database. The entire database is therefore built by collecting information about every tourist spot from various sources, such as

- a) Information from Internet,
- b) Conversation over telephone,
- c) Personal visit to the place concerned, and
- d) Articles from newspapers.

Sixty nine tourist spots which include twenty one historical places, eight pilgrimage places, six amusement parks, eighteen shopping malls, four entertainment places and twelve hotels are identified in Kolkata and included in the database.

Tour scheduling involves selecting different tourist spots, deciding the appropriate time and duration of the visits, arranging for meals, transportations etc. Since all these activities are to be scheduled precisely in a given time slot, complexity is immense. Hence, while developing the expert tour advisory system, the following few assumptions are made:

- a) Start and return points of the tour will be from the hotel only.
- b) Order of visit to a spot is solely dependent on the preference provided by the user/tourist.
- c) Transportation time from one spot to another is assumed to be constant taking 25 minutes
- d) Each tourist spot is assumed to be open on the day of visit.
- e) No specific place is restricted for taking the lunch. Only a break of 30 minutes is to be provided after visiting a tourist spot, whenever the expected lunchtime exceeds the current time of visit, lunch is to be taken at that spot only.
- f) Ties among different tourist spots with respect to preferences are to be broken arbitrarily.

g) The developed tour advisory system will have English Graphical User Interface (GUI) only.

The detailed scheme for providing the relevant tour information in the database of the system and the algorithm for generation of tour schedule depending on the user preferences are shown in Fig. 2 and Fig. 3 respectively.

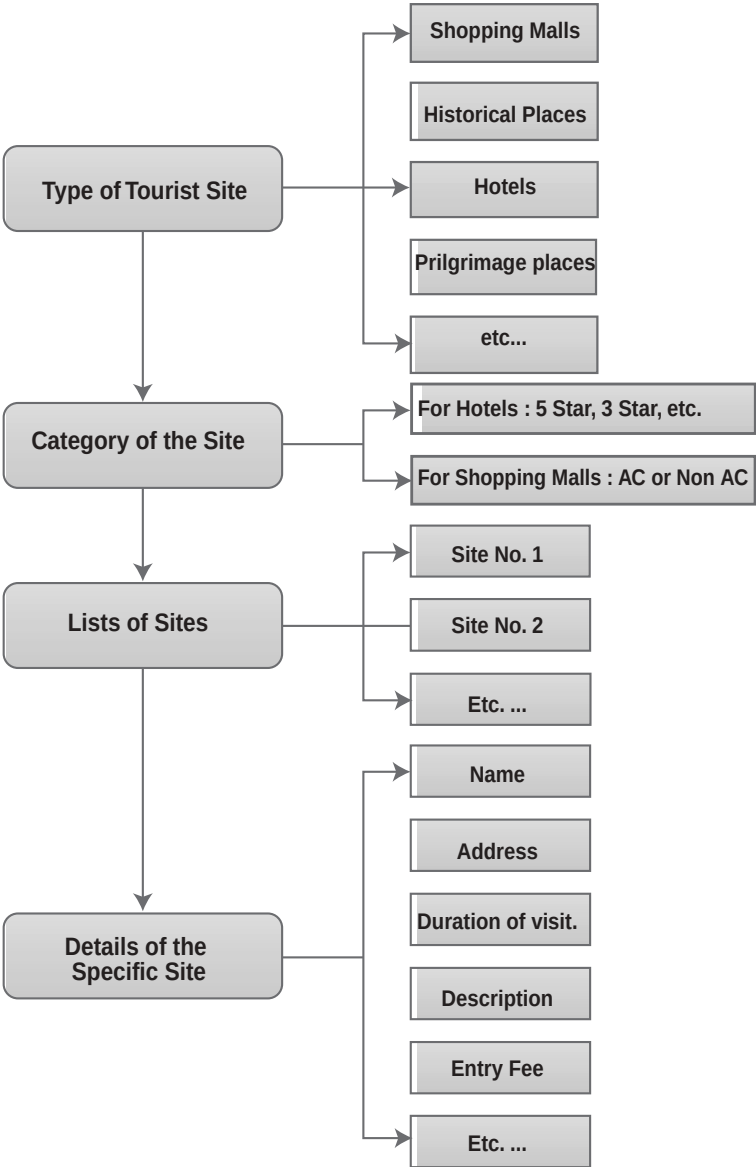


Fig. 2 Scheme for provision of tour information

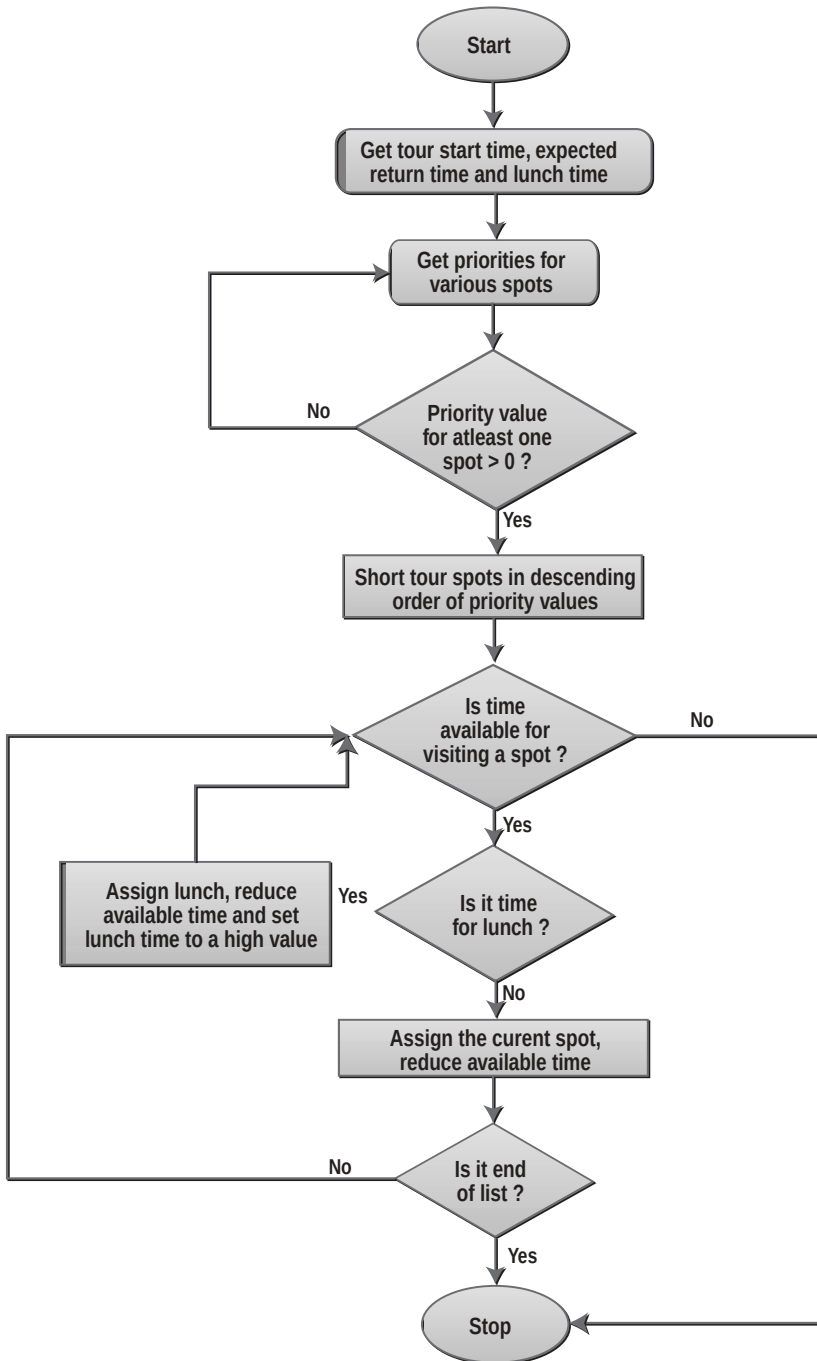


Fig. 3 Algorithm for generation of tour schedule

4. INPUTS AND OUTPUTS OF THE EXPERT TOUR ADVISORY SYSTEM

The graphical user interface (GUI) of the expert tour advisory system is developed using Visual Basic 6.0. The opening window of the tour advisory system is exhibited in Fig. 4, which contains buttons referring to various types of tourist places. After clicking one of the buttons, a new window appears which shows the categories available under that particular type of tourist place. A single click on any of these categories displays the detailed list of entries under that category. For some cases, where the categories are not present (say for historical places), the list containing different tourist spots is directly displayed. Double clicking on any of the list entries gives the entire information regarding the concerned tourist spot. The details of a 5-star hotel and a historical place in Kolkata are shown in Fig. 5 and Fig. 6 respectively. The 'Home' button in the tourist spot selection window takes the user to the startup screen from where he/she can select a different category or type of tourist place. Similar windows showing detailed information about other tourist spots can also be viewed through the developed system.

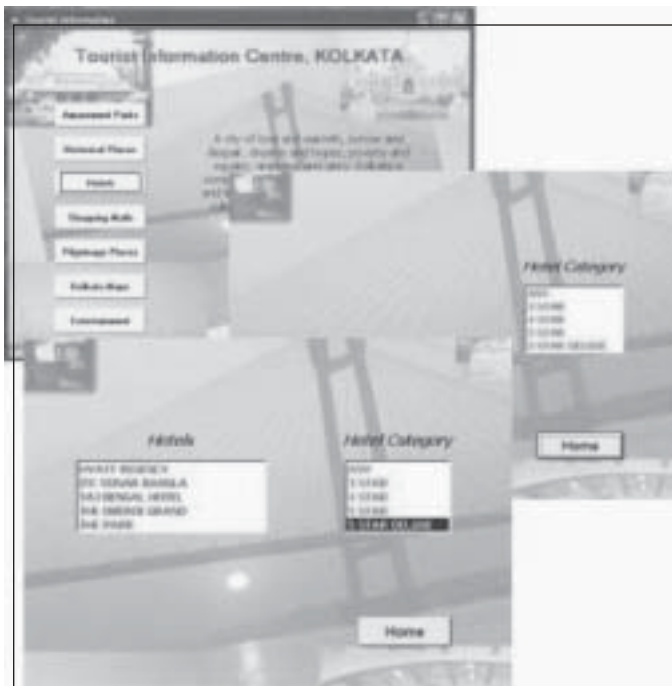


Fig. 4 Main screen

Another input window of the expert tour advisory system, shown in Fig. 7, is designed to generate the corresponding tour schedule according to the preferences of the tourists. It prompts the user (tourist) to select his/her place of stay from a dropdown list that contains the listing of the hotels present in the database. In the same window, the user has to specify three times (in HH:MM format), i.e. start time and expected return time for the tour, and preferred lunchtime during the tour. Initially, there are three default values set for these times. The user can change those timings or accept the default ones. Once these timings are entered and their validation is done, the 'Priority Option' button is to be activated. Validation means that the start time of the tour should always be smaller than the expected return time and the preferred lunchtime should always lie between the start time and the expected return time of the tour. If the user enters any wrong information, an error message is popped and the 'Priority Option' will not be activated.

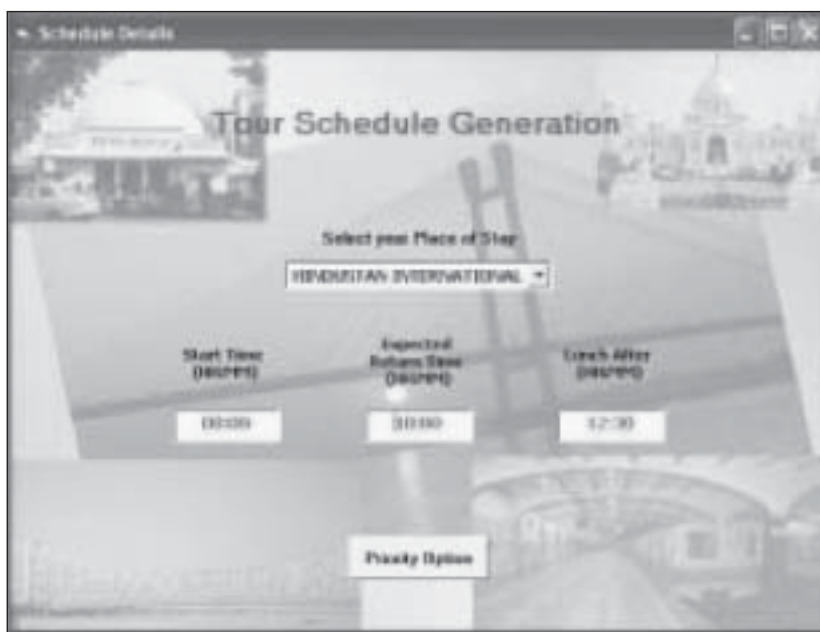


Fig. 7 Startup window for tour advisory system

Once the ‘Priority Option’ is clicked, a new window will appear, as shown in Fig. 8. At first, it will prompt the user to enter his/her preferences or priority values for various categories of tourist places. Four categories of tourist places are taken into consideration in this expert tour advisory system due to limited screen size. A general priority value for each category is to be selected from the dropdown list, which has values ranging from 0 to 9. Each category also lists the corresponding tourist spots under its head and has a column for entering the priority values in a 0 to 9 scale. These priority values are assigned to various tourist spots under different categories of tourist places that the tourist wants to visit. If other values except 0 - 9 are entered, an error message will be popped. The default values of these priorities are initially set to 0. Once the user finishes assigning the priority values to various tourist spots, the ‘Confirm’ button is to be clicked. It is essential to select the priority value for at least one entity to proceed; otherwise, an error message will be popped.

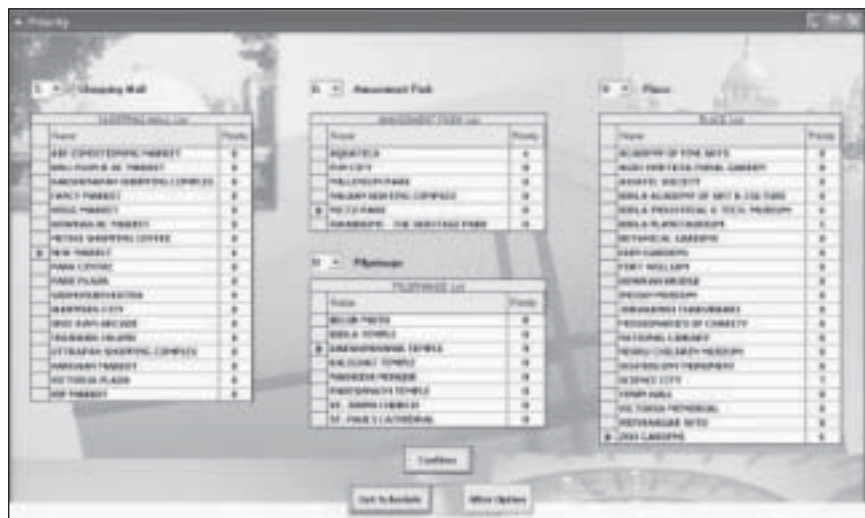


Fig. 8 Selection of priorities for different tourist spots

On clicking the ‘Confirm’ button, two new buttons ‘Get Schedule’ and ‘Alter Option’ will be activated. ‘Alter Option’ button allows the user to modify any priority value by taking back to the previous screen. On clicking the ‘Get Schedule’ button, the required tour schedule will be generated. It lists all the spots to be visited in one table along with the time schedule and also shows those spots that will be missed due to shortage of time in another table. It also specifies the tour start time, actual

return time to hotel, lunch time along with the place where the lunch is to be taken and the excess time, if any. If excess time is available, it also asks whether the user wants to include one of the missed tourist spots in the tour schedule by increasing the tour duration. The tour schedule is graphically presented with a time line bar diagram, as shown in Fig. 9. The 'Print' option helps the user to get a hard copy of the generated tour schedule. The 'Alter Option' enables the user to modify the priority values for different tourist spots and get a fresh tour schedule according to that.



Fig. 9 Generated tour schedule

This application thus acts interactively with the user with its pop up messages and helps the user to generate the tour schedule according to his/her preferences. To make this application more realistic, a special feature is added to it through which the user can have the detailed information of the tourist spot whenever he/she is assigning a priority value to that spot. By double clicking the name of the corresponding tourist spot in the priority selection window, as shown in Fig. 8, the user can have the relevant information about the concerned spot, which can otherwise be viewed through the tourist information provision module. Clicking on any particular category of tourist place will provide the list of entries available under that



Fig. 11 Add new information window

5. CONCLUSIONS

The main aim of this paper is to design and develop an expert advisory system for tourism in Kolkata based on a user-friendly application software to implement the same. Implementation of the expert tour advisory system shows that how effectively and successfully it can be used in tourism industry, where complex decisions are to be taken while generating the desired tour schedules. This developed system generally serves two basic purposes, i.e.

- a) provision of automatic tour information, and
- b) generation of tour schedules based on user preferences.

It is observed that the expert system will reduce the complexity associated with the generation of the user preference-based tour schedule and eliminate errors committed due to human calculations and interventions. The graphical user interface (GUI) of this expert system makes it more user-friendly as well as interactive providing warning at every step whenever any wrong information is entered by the user/tourist. The generated outcomes of this expert system are quite satisfactory to prove its acceptability for commercial purposes. An automatic tourist information center, tour schedule generation based on the user preferences and periodical update of the database are the three main areas that can help the tourism industry. The tourist information center developed for Kolkata is well equipped with the necessary information for most of the tourist spots.

In this paper, the main under-stressed area in tour schedule generation is related to transportation. The transportation time from one tourist spot to another is assumed to be fixed, whereas it actually varies. A 'From to Chart' can be incorporated in this application to overcome the problem. Network analysis techniques can also be implemented to reduce the transportation time as much as possible. With these few limitations, the developed expert tour advisory system for Kolkata is observed to perform satisfactorily as needed. The expert system is developed using Visual Basic 6.0 in the front end and Microsoft Access 2000 at the back end. It is tested under Windows 98/2000/XP/2003 sever environment and found to work satisfactorily. It takes a few seconds to load the initial database and then the results are displayed almost instantly. All the error-trapping functions are observed to work accurately with pop up messages. The interface with the printer and operating system is also tested.

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