

## Virtual Tour Agent

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### Abstract

*Tourists normally have to rely on common tour packages that are designed and prepared by travel agents or they have to prepare their own tour itinerary which may or may not fulfill their expectations. The authors propose that Software Agents technology and other Artificial Intelligence Techniques like Expert System could be utilized to prepare a custom based solution to cater to personalized requirements. The Software Agent Technology is used to filter data from the net; Expert System is used to generate the travel itinerary; and Nearest Neighbor Algorithm is used to find the optimal pathway among locations. It also provides facilities to regenerate a travel itinerary in different circumstances. Apart from that, the travelers are also provided with travel related information plus travel support functions to provide a compressive solution.*

### 1. Introduction

Sri Lanka as a small tropical island relies heavily on tourism as one of the major drivers of its economy. In this context, it is extremely important that the tourists who visit Sri Lanka carry with them a life long experience, which in turn would increase the influx of tourists to the country. Therefore providing a travel plan to fulfill the likes and dislikes of each individual is a key issue that needs to be addressed. Today the potential traveler has access to an unprecedented wealth of travel related information available on the internet. Planning actual trips using only internet-based resources requires a lot of work and sometimes turns to be a

rather difficult task. Therefore, a traveler must devote a lot of effort sifting through many sites of varying quality and data simply to form a coherent picture of his/her intended destinations, choices of hotels restaurants, possible means of transportation, etc. The total amount of data is so

large that it is impossible to find all pertinent and important information in a reasonable time. This is vital since the traveler should be aware where he/she is going and what he/she would be doing and such matters would totally depend on the unbiased and true information that he/she has collected.

Travel planning is in itself a complex decision making process that requires undivided attention to detail. Travelers often encounter problems, as they tend to overlook vital matters. Hence, it results in wastage of resources such as money and time. The complexity of travel planning lies with the fact that it must satisfy as many factors as possible. The success of a travel plan greatly relies on its ability to achieve a satisfactory balance among these factors.

The travelers find it difficult to plan the travel itinerary even when the destination is finalized. Most travelers take a long time even to decide on the easiest way of traveling which are the tour packages (also known as all-inclusive packages) because they hardly find a package, which matches most of their requirements. Generating a travel itinerary is one of the most cumbersome and complicated process in the travel and tour domain because of the travelers individual preferences. Common travel packages do not fulfill all the preferences of the traveler, which depend on factors like background characteristic such as age, income, living/social status, location etc. In short, common travel packages cater a general context rather than the individual needs and preferences of the traveler. Apart from this, the burden of searching for information on items listed on the travel plan falls on the traveler.

The main factors which have a direct impact on the unsuitability of common travel packages are; the cost, the need to search for information, unchangeable destinations in travel packages (mainly Pre-Made tour packages), likes and dislikes of both the traveler and travel agent, knowledge level of the person who designs the

travel packages and changes to the current travel plan (Tailor Made tour packages) takes a long time to process. However, the biggest issue with the Tailor-Made travel packaging is that it requires the traveler to have a good knowledge about the arrangement and facilities available for him/her to initially make the selections. In addition, the traveler himself/herself is responsible for becoming aware of changes to his/her travel itinerary on the basis of the current situation pertaining to the tour. This is rather impractical for a busy person.

The aim of the project is to develop and evaluate a system, which will generate and design a travel itinerary using Software Agents Technology and Artificial Intelligence Techniques, for a traveler who is planning to visit Sri Lanka for a holiday.

Travelers have various types of ways to purchase a travel package or a travel itinerary. In the current context, several methods have been identified as ways to generate a travel itinerary. Among these, Manual Planning, Pre-Made Tour Packages and Tailor Made Tour Packages are popular as the common way of traveling. Manual Travel Planning is the most traditional and oldest way of travel planning. In Manual Planning the travelers have to go to the travel agent and select the destination, hotels, etc manually. This is a very long process since both travel agent and the traveler have to come to a conclusion on what the traveler is getting as a travel plan and how the travel agent is going to provide and arrange them.

In contrast, Pre-Made tour packages are set out before hand and travelers can buy those off-the-shelves from travel agents. They are mainly popular among the "Last-Minute Travelers" who have a busy scheduled life and less time for planning any leisure traveling activities. They are mainly sold and brought through the means of the internet. This is comparatively costly than Manual Travel Planning and always targets the upper middle class.

The Tailor Made tour packages are prepared by the travel agents in consultation with the traveler in terms of his preference and requirements. Here the traveler would be providing all the necessary and vital information for travel planning like destination, hotel and all the requirements & facilities that they need etc. The overall role of the travel agent would be to arrange the necessary ground facilities, and make sure what the traveler asked for is provided without any delay or mistakes. This is a product which mainly targets only the high end travelers.

Both Pre-Made and Tailor Made tour packages are more comprehensive and cover a range of requirements including flight reservation, traveling within the destination, hotel reservation, etc. However, the biggest issues with the tour packages are that it requires the traveler to have a good knowledge about the arrangement and facilities available for him/her to initially make the selections.

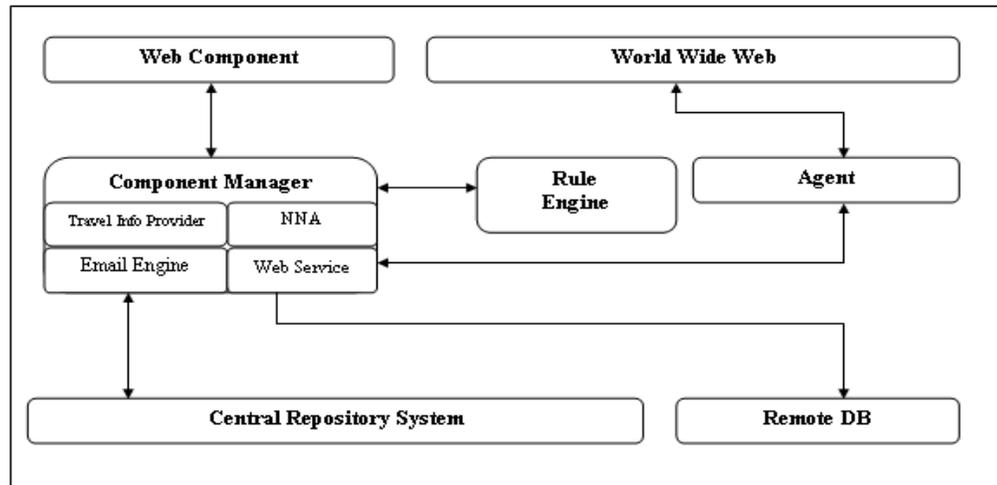
There are several IT and IS solutions made available targeting both the travel and tour industry. In this sense, the software systems such as eBusinessoft [3], Tour Plan [4] and XYKA [5] etc, have been commonly used in the travel and tour industry. Apart from the above, mentioned there are also Global Distribution Systems (GDS) like SABRE, Galileo, and World Span etc available. The main end users of these systems are hotels, travel agents, tour operators, airlines etc. The main facilities that the software solution provides for travelers are, Online Payments Gateways and to publish a travel itinerary (which is done manually) through the web pages if a web site is available through a dedicated server etc. In the case of GDS it's better to a certain extent as there are general public versions like websites (i.e. easySABRE, Travelocity.com) which are available. But the GDS still operates through agreements, dedicated chain of networks and dedicated means of communication channels which are only open to them, in which overall makes the cost factor increasingly very high.

The above mentioned software solutions and GDS still do not provide a compressive solution for travel planning. But overall the support or features given by both kinds of systems are really low or sometimes non existent. However, it is evident that there are so many powerful software technologies available for supporting the activities in the field of travel planning. Among others the Software Agent Technology is a good candidate for implementing an effective IT solution for travel planning. In fact, the idea of the Agent technology has been inspired by how an experienced travel agent assists a traveler with a little information provided by the traveler to the Agent.

This paper presents our Agent based approach (called Virtual Tour Agent – VTA) to travel planning. The VTA has been designed as a static Agent that runs on a travel planning web sever. VTA is also powered by an Expert Systems (ES) and Nearest Neighbor Algorithms (NNA). VTA is more comprehensive and covers a range of requirements including flight reservation, transportation in the destination, hotel reservation and provides travel support information etc.

## 2. Design

The design of VTA consists of few major components as shown in Figure 1. The Web Component is the main component that the users directly interact with VTA. The core component of the VTA is the Agent Component. The Agent Component is used in filtering the necessary information from the eXtensible Markup Language (XML) which is hosted in the WWW, and the filtered information would be sent to the database of VTA.



**Figure1:** The Architecture of the Virtual Tour

The other major component in the VTA is the Component Manager. The Component Manager consists of other minor components like Travel Info Provider, NNA, Email Engine and Web Service. The reason behind Component Manager Module in VTA is to achieve divide and conquer approach. This approach enables the advantages to the VTA service providers where they can come up with their own modules and function which could be pluggable to the current design. The Component Manager gets the information posted by the user such as hotel criteria and user preference. Component manager passes the list of hotels, districts present in the back end with the user preference. Considering the user preferences and the back end information Rule Engine executes the rules and generate the possible cities that can be included in his/her proposed travel itineraries and pass the itineraries to the component manager. The NNA is used to get the best and optimal pathway with the results generated by the Rule Engine. The Web Service Component is used to make reservation to the remote database which is the hotel database. The Email Engine is used to get confirmation to the users personnel email account when a hotel reservation has been made. The email is

generated from the particular hotel when a reservation is made using their database which is the remote database.

The other main component of VTA is the Expert System or the Rule Engine. The Rule Engine is used to generate the travel itinerary for the travelers according to their categories, preferences, amenities required, and the price.

It should be noted that all these above mentioned criteria plus sub categories make the total rules of

the Expert System. The ES was mainly used to achieve the status of the expert knowledge in travel and tour industry to prepare the travel itinerary. The other main reasons as to why the ES was used: because the problem is well structured, not very much common sense is required, is not based on traditional approaches, and finally the problem domain is well scoped and sized. The Rule Engine works in the Feed Forward Chaining mechanism and the ES is made out of a Rule Engine called Java Expert System Shell (JESS).

The Repository Module is another module which could be divided into major areas such as Central Repository and Remote Database. The Central Repository consists of data of user/travelers personal information, preference information which he/she provides to generate the travel itinerary. The remote database is considered as the hotel database and it is being used for making reservation to the hotels.

## 3. Implementation of VTA

The Virtual Travel Agent (VTA) has been designed to operate from a web server, which is

accessible by the travelers from anywhere in the world. The VTA is fundamentally designed as an Expert System [1] that uses Nearest Neighbor Algorithm [2] for creating of optimal schedules to meet with dynamically changing requirements. The VTA also provides local news events since most of the travelers do not come across local news media. It also provides travel related information (i.e. weather, transportation, currency rates etc) and travel support functions (reservation and confirmation mail) to travelers as an overall travel planning solution.

The VTA filters the information from the web pages XMLs and stores the data in the database. This would reduce the workload of maintaining the database as the updating is done automatically and periodically. The ES in the VTA will generate the travel itinerary according to the user's preferences and the NNA will generate the optimal pathway between the destinations chosen by the ES earlier. The agent can also filter useful travel information like weather, transportation, exchange rates for travelers whenever required.

The VTA is developed in Java to take advantage of its platform independence, multi threading, robustness, simplicity and other features. The VTA would be filtering travel related information using XML format from the remote web sites and will store data accordingly. The whole project is built in the J2EE - three tier architecture. The JSPs are used to construct the client tier, the EJBs the middle tier and MySQL, the database. The client tier (presentation layer) is done in Model View Controller (MVC) architecture using Struts Framework. The Java Architecture for XML Binding (JAXB), which is a new technology, is used to serialize the XML into an Object with the aid of the JAXB Compiler. Java Expert System Shell (JESS) has been used to develop the Expert System to prepare the travel itinerary and Java has been used to develop NNA to generate the optimal pathway.

#### **4. VTA - How it operates**

The user is presented with a web page, where he/she enters how many days he/she will be staying. Then he/she would be selecting his/her preferences, hotel type (star class), amenities, and price range of the hotel. The VTA agent will process the selections and will filter the necessary information from the WWW and store them in the database. The VTA Agent is capable of keeping track of the modifications to remote web pages and will update the database accordingly. The ES in VTA will work on the filtered data and generate the travel itinerary according to the traveler's requirement. The generated itinerary

would be worked through NNA to find the optimal pathway between the destinations. The itinerary would then be displayed in the web page of the VTA.

The VTA is capable of catering to a situation where the traveler requires modifications to the itinerary. The user can regenerate the travel itinerary, taking into consideration all the preferences that he/she entered, and taking into account the remaining number of days and the current location. The updated travel itinerary approved by the user would be stored in the database.

If a user logs on the VTA with different start and end dates, and give instructions to generate a new travel itinerary for his second visit, the agent would consider the previous itinerary whilst preparing the new one in order to provide a more personalized itinerary. The agent will learn the particular user's traveling style and adopt accordingly. In any required situation, the agent itself can suggest a new travel itinerary to the traveler by keeping track of destinations and events that he/she missed on his/her previous visit. VTA agent will obtain travel related information (i.e. currency updates etc) as and when required. When a travel itinerary is finalized the traveler can make a reservation in a hotel site using the travel support functions. The personnel details provided by the user can be used to make reservations in the remote database (hotel) through web services and the confirmation details can be emailed to the traveler's personal email account. The travelers are also provided with facilities to alter booking information before it is sent for reservation. VTA system comes along with a state-of-the-art security system which is done using Java Authorization and Authentication Services (JASS). The VTA also provides other travel support function which would enable better travel planning according to situations. VTA has several types of logins which provides different levels of permission rights. This is useful when it comes to maintenance purposes when the system is running live and allows the system do be maintained in the distributed architecture.

#### **5. Evaluation**

The main objective of the evaluation was to make sure the prototype is evaluated from the point of effectiveness, efficiency and the proportion by which it meets the requirements of the user. The main evaluation strategies were to

distribute questionnaires, to do live demonstrations and to have interactive interviews. The major areas to be evaluated were problem domain, approach to solving the problem and the prototype itself.

The problem domain was reviewed in order to evaluate the solution provided. The evaluation process was performed under the following criteria: the problem worth solving, current practices and methods in travel planning, accuracy of the travel itinerary generated and amount of support provided for the other travel related activities.

The proposed approach was evaluated independently in order to determine the appropriateness of the methodology proposed for the problem addressed. The technologies used in the system for travel planning and its other related functions were also considered in the evaluation process. The approaches to the problems were evaluated according to the following criteria: applicability of Intelligent Agent to collect information, the use of Expert System technology to generate the travel itinerary and Nearest Neighbor Algorithm to find the optimal pathway.

The evaluation of the prototype is crucial in order to determine the success rate of the core project idea which was designed and implemented with other support functionalities. The prototype was evaluated on the basis of the following categories: accuracy of the travel itinerary created, the support functions provided for travel planning, the editable functionalities for travel planning, user interfaces, user friendliness, hotel reservation and email component, and general opinions and further comments.

## 6. Conclusion

This paper presented the design and implementation of Virtual Travel Agent as a solution for effective travel planning. We conclude that the Agent-based approach has so many advantages in the travel planning domain due to the following reasons. Firstly, due to its autonomous [6] feature, VTA can operate with very little information from the traveler. Second, the Agent can work proactively, to provide various services related to the destination. Third, the Agent can be reactive on the request of the traveler. Fourth, VTA can maintain a traveler profile and keep contact with the traveler to

suggest to the traveler when possible offers are available. Fifth, since VTA is designed to operate on the travel agent web server, this approach does not give a burden on individual travelers to run and install VTA on their machines. From an implementation viewpoint, since the VTA is a static Agent, the security of the Agent is not a serious issue.

This paper is presented for a fully conceptualized VTA system with its design, evaluation and completion. During the evaluation the VTA showed more than 80% success rate which was done with people who are attached to the travel and tour industry, software engineers, normal users and the real travelers. We have presented the use of agent technology for the travel planning domain. We explained the design, implementation and evaluation of the system. We have achieved the efficiency and advantage of the agent system for the approach over the standard learning of travel planning. We conclude that this approach will have many advantages for the planning of a travel itinerary.

## 7. References

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