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Developing Recommender System for Tourist Attraction Area Selection in Ethiopia: The Case Based Reasoning Approach

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Abstract

Using recommender systems with the help of computer systems technology to support the tourist advising process offers many advantages over the traditional system. A knowledge based recommender reasons about the fit between a user's need and the features of available products. Providing an effective service in the Ethiopian Tourism sector is critical to attract more foreign and local tourists. However, there are major problems that need immediate solution. First, the difficulty of getting fast, reliable, and consistent expert advice in the sector that is suitable to each visitor's characteristics and capabilities. Second, inadequacy of the number of experienced experts and consulting individuals who can give advice on tourism issues in the country. Therefore, this paper aimed to design a recommender system for tourist attraction area and visiting time selection that can assist experts and tourists to make timely decisions that helps them to get fast and consistent advisory service. So that, visitors can identify tourist attraction areas that have the highest potential of success/satisfaction and that match their personal characteristics. The system provides recommendation to visitors based on previously solved cases and new query given by the tourist. For this study, about 615 cases which were collected from National Tour operation and 10 attributes which were collected from experts were used as case base. These attributes and cases were used as knowledge base to construct case base recommender. The system calculates similarity between existing case and new queries that were provided by the visitors and provides solution or recommendation by taking best cases to the new query. In this study, JCOLIBRI case base development tool was used to develop the prototype of case based recommender system. JCOLIBRI contains both user interface which enables visitors to enter their query and programming codes with the help of Java script language. To decide the applicability of the prototype system in the domain area, the system has been evaluated by involving domain experts and visitors through visual interaction using the criteria of easiness to use, time efficiency, applicability in the domain area and providing correct recommendation. Based on prototype user acceptance testing, the average performance of the system was 80% and 82%

by domain experts and visitors respectively. The performance of the system was also measured using the standard measure of relevance (IR system) recall, precision and accuracy measures, where the system registered 83% recall, 61% precision and 85.4% accuracy.

Index Terms — recommender system, case based reasoning (CBR), tourism, Ethiopia

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1. Introduction

Nowadays, it is very important for people to be supported in their decisions due to the exponential increase of the available information. This exponential growth of information creates information overload. However, there cannot be many people who have not experienced the feeling of having too much information which uses up too much of their time, causing them to feel stressed which, in turn, affects their decision-making i.e. people may tend to be reluctant in making decision or they may led to wrong decision [1].

Recommender systems have proven to be an important response to such a problem by providing users with more proactive and personalized information services. It usually tracks user's behaviour. [19]. Recommender systems attempt to reduce information overload and retain customers by selecting a subset of items from a universal set based on user preferences. Case based recommender system is a part of knowledge based recommender system that exploits case based reasoning to generate personalized recommendations for exploiting the knowledge contained in past recommendation cases [2].

Tourism is one of the largest and rapidly growing industries in the world, and is even considered by the UN World tourism Organization as the biggest industry in the world when related and complementary industries are taken into consideration. Ethiopia has immense tourism potential owing to its natural, historical and cultural endowments and the flow of tourists in the country becomes increasing from time to time [6]. But, in Ethiopia, there are a number of problems the tourism sector face. For example, experts lack appropriate, relevant, and understandable information to give advice and guidance to their client's /tourists/,

As stated by [3] above, getting advice is one of the most important problems of the tourism sector because the sector also uses traditional advisory system. As a result, tourists may lose their money and time by visiting the wrong area during the wrong seasons. The main problem in Ethiopian tourism sector is the speed of advice giving time. It is very slow because of this the message takes long time to reach the tourists in time. Difficulty of getting appropriate advice appropriately is a critical issue for tourists since knowing the right tourist attraction area is a key factor. knowing the right time to visit a place is another factor to be considered for a new tourist [7]. Therefore, this study aimed to design a recommender system that helps visitors to get fast and consistent advice so that visitors can identify tourist attraction areas that have the highest potential of success/satisfaction and that match their personal characteristics.

2. The Comparison of Case Based and Rule Based Reasoning

A. Case Based Reasoning

A case typically represents the description of a problem situation together with the experiences gathered during the solution of the problem situation. It may also contain other items such as the effects of the solution applied or a justification for the solution and explanation or the enrichment by an administrative part (including e.g., a case number) [13]. A case-based reasoning (CBR) system is a problem solver that uses the recall of examples as the fundamental problem-solving process. It also contains a number of different knowledge containers like the case base, the vocabulary in which cases are described, the similarity measure used to compare cases, and, if necessary, the knowledge needed to transform recalled solutions. Case-based reasoning relates to a reasoning process based on recalling a related previous experience (a memory of stored cases recording specific prior episodes) rather than reasoning based on generalized rules. It also means using old experiences to understand and solve new problems. In case-based reasoning, a reasoner remembers a previous situation similar to the current one and uses that to solve the new problem [4].

Conceptually, case based reasoning (CBR) is commonly described by the CBR-cycle. This cycle comprises four activities [8].

Retrieve the most similar case or cases.

Reuse the information and knowledge in that case to solve the problem.

Revise *the proposed solution.*

Retain the parts of this experience likely to be useful for future problem solving.

In CBR, nearest-neighbour retrieval technique is used to measure similarity between the source case and the case which we are searching. The similarity of the problem (target) case to a case in the case-library for each case attribute is determined. This measure may be multiplied by a weighting factor. Then the sum of the similarity of all attributes is calculated to provide a measure of the similarity of the case in the case-base to that of the target case [9].

Similarity (T, S) =∑ f (Ti, Si) X Wi,

Where:

T- Target case

S- Source case

i - An individual attribute from 1 to n

f- Similarity function for attribute i

W- Weight of attribute i

The similarity of the problem (target) case to a case in the case-library for each case attribute is determined. It is possible to use the unification mechanism directly as matching operation to retrieve similar cases [10].

B. Rule Based Reasoning

Rule based reasoning: Symbolic rules are one of the most popular knowledge representation and reasoning methods. Their popularity stems mainly from their naturalness, which facilitates comprehension of the represented knowledge.

The basic form of a rule is the following:

If <conditions>

Then <conclusion>

Where <conditions> represents the conditions of a rule, whereas <conclusion> represents its conclusion. The conditions of a rule are connected between each other with logical connectives such as AND, OR, NOT etc., thus forming a logical function. When sufficient conditions of a rule are satisfied, the conclusion is derived and the rule is said to fire (or trigger). Rules represent general knowledge regarding a domain [11].

Rules are suitable to represent general knowledge, whereas cases are suitable for representing specific situations. Rules in a rule based system have the abilities to represent experiential knowledge acquired from experts in a direct fashion. Cases are capable of representing specific historical knowledge. The problem here is that it is difficult to acquire complete and perfect knowledge in a complex domain. Cases are natural and easy to obtain. They can be collected from the historical record, repair logs or other sources [11]. CBR uses partial matching to draw a conclusion. If some of the given problem descriptions match with a given case, then the case is applicable to the proposed solution. It also tries to handle novel problems by referring previously solved cases. Rule based reasoning uses perfect matching to apply a rule for a given problem.

3. Problem Description

As stated above [3], lack of advice is one of the most important problems of the tourism sector because the sector uses traditional advisory system. Therefore. this traditional nature of the existing advisory system attracted us to undertake this study. We were not able to access to the appropriate and complete information from the Ministry of Culture and Tourism because of its inadequate information system. Its collection, organization, and dissemination system is not well developed. sector.

In addition, there was no integration or collaboration from different experts of tourism sectors in developing and giving an organized guidance to new tourists. Appropriate collection of ideas from different tourist sectors is important to develop well defined and organized guidelines to the tourists. For instance, one expert may have the awareness about natural tourist attraction areas but have no idea about historical tourist attraction areas, etc. These shows experts' advice is limited only to the most familiar ones to them [12].

In the context of visiting, the wise words of the oracle emphasizes that success depends on ensuring that your visiting strategy fits your personal characteristics [7]. Even though all visitors are trying to get satisfaction, each one comes from a diverse background and has different needs and capabilities. It follows that specific visiting vehicles and methods are suitable for certain types of visitors.

According to the interview made with Ministry of Culture and Tourism development promotion expert, tourists have a few factors to consider when looking for the right place to visit such as age, nationality, gender, travel frequency, attraction preference and current income level. The expert further comments that due to lack of knowledgeable domain experts, from the Ministry of Culture and Tourist it was impossible to give sufficient information to visitors where and when to visit an area. As a result, visitors were frequently confused about where and when to visit the area. They were unable to get sufficient information about the best tourist attraction area to satisfy themselves during their recreational program. In developing countries, like Ethiopia, the availability of specialists/experts who can provide an effective service to tourism sector is a problem particularly in many small towns and villages. In such case, building case based recommender systems is indispensable.

4. Methodology of the Study

The following methodologies were used in this study to achieve the above stated research objective.

4.1 Data Source

The main data source used for this study were domain experts working at MoCT (Ministry of Culture and Tourism) and NTO (National Tour Operation) as well as previously solved cases which were available in the aforementioned organizations. The Researcher's selected these organizations for they were using traditional advisory system of tourists and the traditional nature of the Existing advisory system makes it interesting to undertake the study.

4.2 Data Collection Methods

To collect the required domain knowledge, both primary and secondary data collection methods were employed. As primary sources, Tourism experts from MoCT& NTO and tourists from different tourism sectors were interviewed. In addition, relevant literature from all possible sources including journal articles, tourism related websites, manuals especially on Ethiopian tourism, and guidelines were reviewed. To acquire the required tacit knowledge from the selected domain experts, the researcher employed semi-structured interview technique which focused on the concept, procedures, and guidelines as well experience which domain experts used while advising tourists. The researcher's selected semi-structured interview technique because it allowed the interviewer to change the order of the questions and add new question based on the participant response.

4.3 Sampling Techniques

The researchers used Purposive sampling technique to select domain experts for knowledge acquisition and to collect previous tourist cases archived in Ethiopian ministry of culture and tourism. The selection criteria of domain experts for the study were based on the expertise, educational qualification level, year of experience and their immediate position. A total of six experts were selected from the sectors and they were interviewed accordingly. These experts were consulted throughout the research work to evaluate the correctness of the acquired knowledge and to verify the cases acquired from the previous visitors cases.

4.4 Knowledge (Case) Representation

After the knowledge is acquired, the next task is knowledge (case) representation. Although there are various knowledge representation methods, like relational database knowledge representation, feature-value case representation, predicate based representation and soft computing knowledge representation methods, they have their own advantages and disadvantages. But for this research, the researcher used feature-value case representation. The reason for representing the cases using feature-value representation is that this approach supports nearest neighbour retrieval algorithm and it represents cases in an easy way [17].This approach also uses old experiences to understand and solve new problems. It also reuses its solutions and lessons learned for future use. In addition, it represents cases

in an easy way by using attribute and value pair representation [18]. The algorithms used to calculate the similarity of cases in a case base representation for this research were nearest neighbour retrieval algorithm. The similarity function of nearest neighbour retrieval algorithm involves in computing the similarity between the stored cases in the case base and the new query. After that, it selects the most similar stored cases to the query.

In the process of case based recommender system development, Knowledge representation is one of the basic steps. It refers to the formalism, both syntax and semantics, used to store knowledge in the architecture. It is also the process of interpreting domain knowledge into computer understandable form using various knowledge representation techniques. The object of a knowledge representation is to express knowledge in a computer tractable form, so that it can be used to enable our AI agents to perform well [18]. The common Knowledge representation techniques include semantic network, logics, rules, case base and frames. Among these, the researchers used case based representation method for this research.

4.5 Development Tools

To develop a recommender system there are various programming tools which are available both freely and commercially. Among this SWI-prolong, myCBR, and jCOLIBRI are the most widely used and known frameworks for teaching and academic research purpose. All of the aforementioned tools have their own capabilities and limitations.

According to [20] above, jCOLIBRI framework has the following features. Therefore, for this research the researcher used jCOLIBRI framework due to the following unique capabilities of the tool.

JCOLIBRI supports the full CBR cycles (Retrieval, Reuse, Revise and Retain).

JCOLIBRI is extensible, reusable, different types of users and different purposes (development, research and/or teaching); compatible with commercial applications and, supporting different types of CBR systems, since it is just a .jar file suitable for web applications.

It is suitable for developing large scale applications.

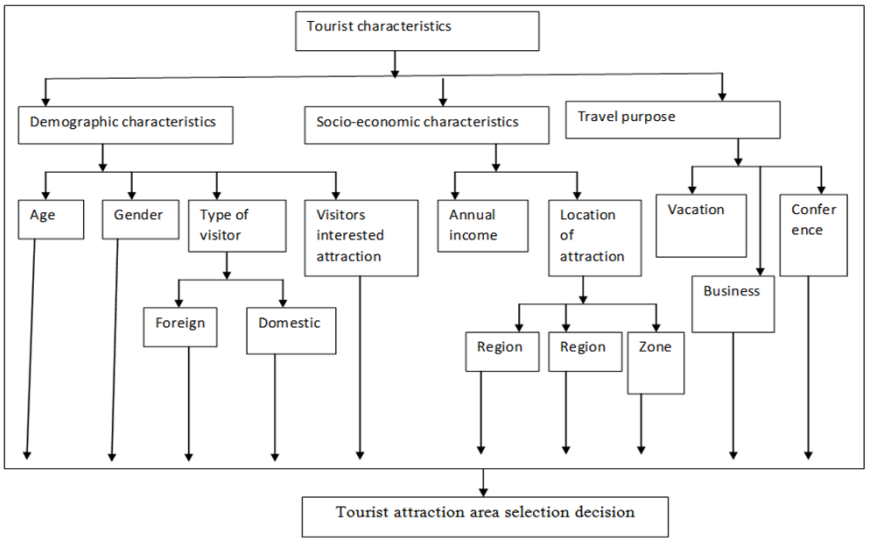
JCOLIBRI works well in external database.

Testing/ Evaluation

Once the prototype is developed, the functionality and user acceptance of the system should be tested. The evaluation processes focus on system's user acceptance of the prototype and the performance of the system. User acceptance measurements are concerned with issues how well the system addresses the needs of the user, whereas performance measurement determine if the system perform the required task successfully. In addition to this, the standard measures of relevance (performance of the system) in the information retrieval (precision, and recall) have been used to evaluate the performance of the prototype.

The researcher tested user acceptance of the system by involving evaluators using visual interaction methods together with questionnaire.

System evaluators were interacting with it by using appropriate cases. That is, sample cases were selected purposely and then evaluators from the domain area were interacting with the system by taking a sample of test cases then, an experiment was conducted to know how new cases were matched with the cases from the case base using case similarity measurement. Each case was selected purposively and used to test the performance of the prototype. Based on that, they evaluated the performance of the system by using close ended questions. Recall and precision value of the system were calculated based on its retrieval results.



5. Prototype Development

According to [21] above, Knowledge modelling is very significant for knowing the operational means in the development process of a knowledge-based system. It is also a vital stage of the knowledge engineering process. It can provide a means to easily understand the source of knowledge, the inputs and outputs of knowledge, and the designation of other parameters.

Although there were various conceptual modelling techniques, for this study hierarchical tree structure was used to model how tourist attraction area selection was performed because it is a simple model concept and clearly explains the concepts in the problem area. It models the knowledge in the hierarchical manner. This model starts from the main concept at the highest level of the hierarchy and other sub concepts that can affect or affected by the highest level concept put next to down ward in the hierarchy.

6. Architectural Design of CBR System for Tourist Attraction Area Selection

As the new query (problem) is entered, the prototype of the system matches the new case with the solved case in the case base of the system by using similarity measurement. If relevant cases are found within the case base, then the prototype system ranks the relevant retrieved cases based on their local similarity. After that, the prototype by itself proposes a solution.

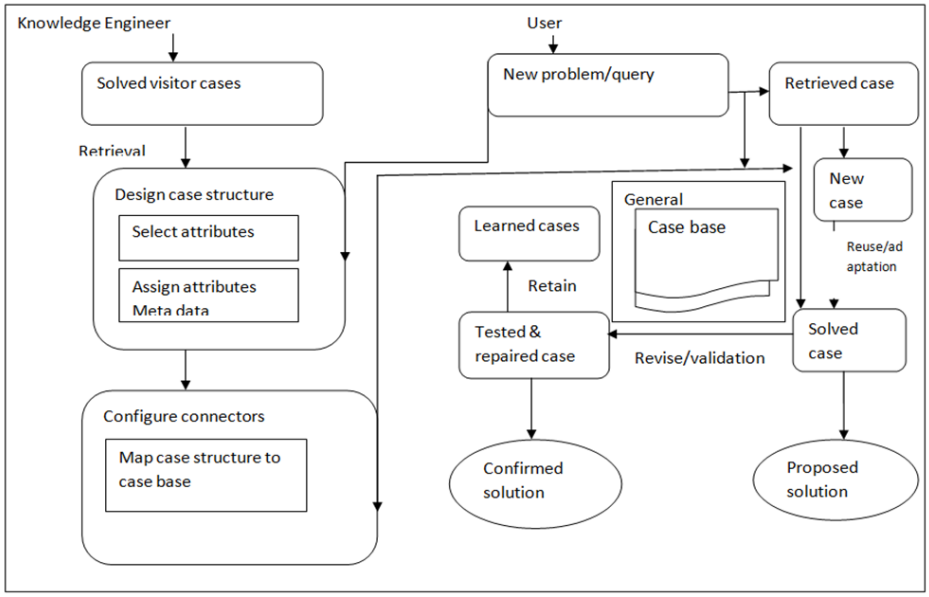
The proposed solution can be derived directly from a retrieved case that matches exactly or partially to the problem of the new case. Partially match of retrieved cases means some attribute values of the existing case and new cases (query) are the same and some attribute values are different. Using the proposed solutions directly may have a risk because some attribute values may need editing (changing) based on different conditions. As a result, the user of the system should have made an adaptation on the proposed solution having differences between the proposed case and the new case. In addition to adaptation, case contradictions are revised if there are situations where previous visitor's cases attribute values are not similar with the new case (query) attribute values. There is no similarity between the existing case and new case means there are no previous stored cases having similarity with the new case (query) in all attribute values. Therefore, if there is no similarity between the existing and new case, the proposed solution cannot give recommendation to new cases. So during this time, this new case or problem of visitor can be revised and stored in the case base. Finally, the revised

solution or stored cases is retained in the case base for problem solving in the next time.

Building of case based recommender system was started by collecting previously solved cases (i.e. previous visitor's cases) from NTO & MoCT consisting of recorded data of visitors who are successful or satisfied in their recreational program. Since previously solved cases contains missing values and unnecessary information for this research, it needs further processing in order to avoid such a problem and remove unnecessary attributes for tourist attraction area selection process. After processing of cases and selecting the most significant attributes, assigning weight and important parameters for each attribute was the next task which was performed.

For the selection of important attributes that influence the recommendation of best tourist attraction area and visiting time, the researcher used data mining attribute selection algorithm called attribute selection algorithm. The reason for using attribute selection mechanism is since all attributes are not equally important to recommend tourist attraction areas and suitable visiting time to new visitors.

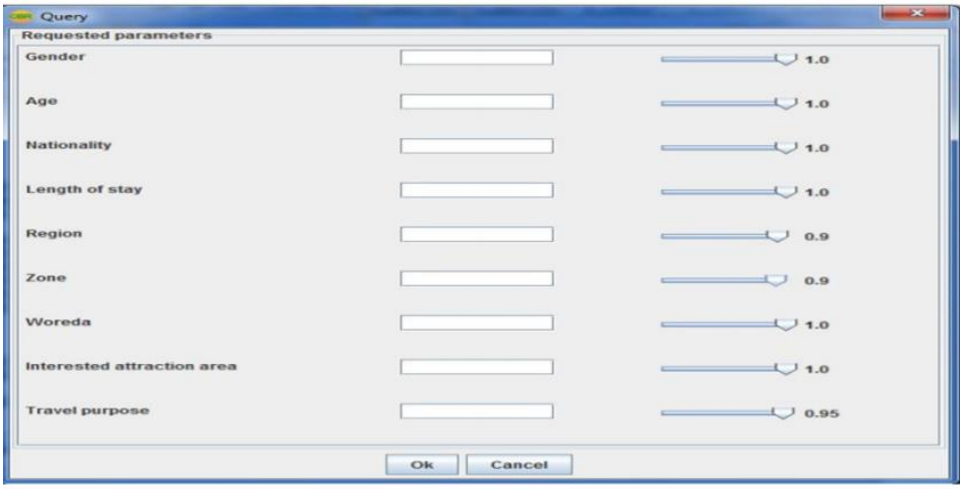
Once the case based recommender system is developed, users/tourists can use the system easily to choose their attraction areas based on the recommendation given by the system in order to retrieve the best cases that can match with their query. When users/visitors enter their query/case description through the user interface window, the system searches the best matching cases from the case base and retains the possible solution. If there is exact matching between the query and previous cases in the case base, the system recommends the most matched attraction area and visiting time for visitors. If the similarity between query and existing case is approximate, the proposed solution needs modification (adoption of solution) to fit the new case (query). At the end, the best modified solution should be stored into the case base for future use. The case base updates incrementally when the system learns from new case used by visitors.



7. Implementing the Case Based Recommender System

After defining and configuring all the necessary steps required in designing case based recommender system using the program7ming tool JCOLIBRI, new case (query) entry application for new tourists is the next step as shown below.

Fig 4. Windows for Case Entry into the Case Base



As it is shown in the above query window (Fig. 4), visitors are expected to enter the query to each requested parameters or attributes in the space

provided. After entering the query, at the bottom of the screen they will see the results of similar previous visitor cases and the recommended attraction areas, recommended visiting time, and explanation facility about the attraction areas on the execution log. For example in "Nationality" box visitors are required the query of their ethnic group as Ethiopian, Germany, Italy, Spain etc.

8. Explanation Facility

One of the more interesting features of knowledge based systems is their ability to explain themselves. The explanation facility in this study was used to give explanation about the recommended attraction area after decision or recommendation was made by the system. Once the system reaches its final decision on the recommendation of attraction area and appropriate visiting time, the user may not have brief information about the recommended attraction area. In this case, the system provided explanation facility about the recommended attraction area. Then, the system gives more descriptions about the attraction areas such as the definitions, location, type of accommodations while visiting etc

9. Testing & Evaluation

Evaluation is an important issue for every system. The purpose of the evaluation process is to get the end user's views on the significance or usefulness of the system. The evaluation and testing issue of the system answers the question "To what extent the recommender system gives acceptable and accurate recommendation and explanation facility service to tourists/visitors?" To answer this question, system performance testing and user acceptance testing methods are used.

A. Validating the Performance of CBR System

The CBR engine has a built-in set of test cases in their case library. Effective use of this feature can facilitate the validation process by minimizing the involvement of domain experts in the process. Retrieval of previously stored cases to solve new problems is the first step in any CBR application. Retrieval of similar cases to the new case from previously solved cases was followed by the reuse of similar solutions. The CBR retrieval test was designed to evaluate the correctness of the retrieval function. To conduct the retrieval testing, for each test case the relevant visitors' cases from the case base should be identified. For identification of relevant cases, test cases were

given to the domain expert in order to assign possible relevant cases from the case base to each of the test cases. The domain expert used the recommendation value and solution attributes of the tourist cases as the main concept to assign the relevant case to the test cases. After the identification of the relevant cases to the test cases by the domain expert, precision and recall were calculated.

Table 1. Relevant Cases Assigned by the Domain Expert for Sample Test case

Test case	Relevant case from the case base
Case 364	Case 521, case 19, case 273, case 95, case 476, case 559, case 314, case 603, case 66, case 44
Case 277	Case 29, case 550, case 423, case 615, case 92, case 478, case 73, case
Case 472	Case 381, case 473, case 88, case 576, case 400, case 562, case 226, case 12
Case 44	Case 92, case 559, case 400, case 73, case 562, case 51, case 231, case 606, case 17
Case 556	Case 562, case 73, case 559, case 400, case 92, case 44, case 605, case 500
Case 600	Case 17, case, 43, case 604, case 605, case 606, case 20, case 99,
Case 12	Case 226, case 78, case 231, case 233, case 51, case 499, case 46, case 519
Case 311	Case 51, case 314, case 312, case 78, case 66, case 497, case 19, , case 364, case 13, case 607, case 2

Once the relevant cases were identified and assigned to the test cases the next step was calculating the recall and precision value of the retrieval performance of the CBR system with a threshold interval. As indicated in the research of [22], there was no standard threshold for the degree of similarity that was used for retrieving relevant cases in CBR. Different CBR researchers use different case similarity threshold. For this study, the threshold level of [1.0, 0.8) was adopted. This means cases with global similarity score greater than 80% were retrieved.

Table 2. Performance Measurement of the System Using Precision and Recall

Test case	Recall	Precision
Case 364	0.7	0.71
Case 277	1.0	0.5
Case 472	0.87	0.57
Case 44	0.77	0.64
Case 556	0.87	0.57
Case 600	1.0	0.5
Case12	0.87	0.57
Case 311	0.63	0.78
Average	0.82	0.61

As shown in the above table, the average recall and precision results were registered as 82% and 61% respectively which was a promising result and indicated that retrieval was done properly. For every test case more than average was registered for both recall and precision. But, precision was lower compared to the average recall. This was because of the trade-off between precision and recall and small number of cases.

B. User Acceptance Testing

User acceptance testing is the process of ensuring that whether the system satisfies the requirements of its end-users or not. This performed in real circumstances at National Tour Operation specifically with Tourism Experts and visitors. During testing the user acceptance, the applicability of the prototype was evaluated by potential users of the system. Potential users of the system were tourism experts and visitors. Case based reasoning system user acceptance evaluation method allowed users (domain expert and visitors) to directly interact with the system and evaluate the performance of the case based system from the users' point of view. User acceptance testing helped to ensure the performance of the prototype by assessing the feedback acquired from the domain expert and visitors towards the developed prototype system. In order to evaluate the user acceptance of the developed prototype system, the researcher used questionnaire adapted from Ethiopia, (2002). To achieve the ambition of user acceptance evaluation of the prototype system, fourteen visitors and eight domain experts from NTO who were participating in different tourism sectors in the country were purposely selected for the ease of analysing the performance of the system based on user's feedback, the researcher assigned numeric values to the five options as

follows: Excellent=5, V. good=4, Good=3, fair=2 and poor=1 for each of the criteria's..

Table 3 Evaluation Questions for User Acceptance Testing

Question No	Evaluation Criteria
Question1	Easy to use of the recommender system
Question2	Is the system efficient in time system
Question3	Is the user interface interactive
Question4	Adequacy and clarity of the system
Question5	Relevancy of the retrieved case in the decision Making
Question6	Fitness of the final solution to the new case understand for new users
Question7	Does the explanation facility give brief description about the recommended attraction area
Question8	Rate the significance of the system in the domain area domain area ate and useful
Question 9	Relevancy of attributes in representing visitors case

Table 4. Performance Evaluation by Visitor

Query	Excellent	Good	Good	Fair	Poor	Average	%
1	2	9	3	-	-	3.9	78
2	6	8	-	-	-	4.4	84
3	2	12	-	-	-	4.1	82
4	3	7	4	-	-	3.9	78
5	3	9	2	-	-	4.0	80
6	4	7	3	-	-	4.0	80
7	1	8	5	-	-	3.7	74
8	1	13	-	-	-	4.9	98
	3	11	-	-	-	4.2	84
		4.1	82				

The average value of each questionnaire is calculated using the sum of values of Excellent, V.Good, Good, Fair and Poor.

As it is shown in the above table, 21.4% of the respondents rated the easiness of the recommender system as good. 64.2% of them rated as very good and the remaining 14.2% rated as excellent. In case of efficiency of the system in terms of time, 57.14% of the respondents were rated as very good, and the remaining 42.85% of them rated as excellent. Regarding to the interactivity of the prototype, 85.71% of the respondents rated as very good and the remaining

14.28% of them rated as excellent. In the case of adequacy and clarity of the system, 28.57% of the respondents rated as good, 50% of them rated as very good and the remaining 21.42% of the respondents rated as excellent. In the same way, 92.85% of the respondents rated the applicability of the prototype in their domain area as excellent and the remaining 7.14% of the respondent's rated as very good .Generally, it was found that most evaluators have positive feedback about recommender system. The average performance of the system according to the evaluation results filled by the domain experts was 4.2 out of 5 or 82% which showed a promising result and users were satisfied with the recommender system.

10. Results and Discussions

In this study, both system performance testing and user acceptance testing was done for the prototype recommender system. In measuring the performance (accuracy) of the system, the CBR modules were validated. The accuracy of CBR module was calculated as 85.4%. In addition to accuracy, user acceptance evaluation of the prototype system was calculated as 82%. The researchers faced some challenges during the study which limited the recommender system to register a better performance for recommending tourist attraction area. These were discussed as follows: The tacit knowledge elicited from the domain experts, the explicit knowledge acquired from documented sources and cases collected from the different tourist cases were in the form of paper printed format. During the system development process, it was difficult for the researcher to convert all the needed knowledge into the electronically recorded format because it needed a lot of data pre-processing and this task was also tough. The performance of the prototype system depended directly on the quality of the knowledge acquired from domain experts. However, knowledge elicitation from domain experts was the most difficult task due to the fact that, tacit knowledge was difficult to transfer to another person.

11. Conclusions and Future Work

Recommender systems have proven to be an important response to the problem of information overload by providing users with more proactive and personalized information services. CBR enables people to make decision from the past solved cases i.e. a new problem is solved by finding a similar past case and reusing it in the new problem circumstances. CBR can work with new cases that matches partially to the case from the case base as compared to rule based reasoning. Though, rule based reasoning cannot solve a problem that doesn't

exactly match with the rule of the system. This shows that rule based reasoning works in a closed assumption where every fact are known and represented.

As studies showed that, the advising services given on the area of tourism in Ethiopia is in its infant stage. There are various factors that affect the tourism sector to be in its infant stage. Among these, shortage of skilled man power in the area, lack of guide line or criteria to assign visitors in different attraction area, absence of experts that can provides consistency advising service, and lack awareness on the side of visitors about the purpose of advising systems for the selection of tourist attraction area and visiting time can be mentioned .

In this paper a recommender system that can provide possible recommendation system for visitors has been developed. The system was evaluated using different evaluation methods and achieved 85.4% of an average performance.

The relevant attributes used for this research were collected from the previous tourist cases from NTO and MoCT. These attributes are not sufficient for the selection of attraction area and visiting time decision. So further research can be conducted by adding other important attributes such as housing preference, level of education, marital status, and purchasing habits by making a direct survey of successful visitor

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