USER BEHAVIOR FRAMEWORK FOR PERSONALIZED LIBRARY ONTOLOGY

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Abstract -The Web in current years has become an essential platform of shared information. We see an enormous number of Web sites contribute different categories of tools for users to interact with each other and to establish their social networks online. We propose an ontology-based user modeling framework for Personalized Library Management System using protégé tool and Analyze user behavior with respective to their web browsing activities. We use web logs to store information about the visitor's action on a web site and tracking URLs. The decision making system survey the web logs data and finds important links to make navigation more effective. The proposed framework reduces the user's search phase from massive web Information.

Keyword: User behavior profiling, behavioral tracking, framework, Semantic usage Log, Ontology generation

I. Introduction

The prompt evolution of data on the Web, with several billion pages and more than 400 million of users globally access the huge repository information from web. Indeed, it is considered as one of the most important means for sharing, gathering, and distributing information and services. At the same time this information volume causes several harms that relate to the progressively trouble of searching, establishing, retrieving, and maintaining the necessary information by user [1]. This paper challenges to provide required information to the user. To retrieve relevant information we use personalization ontology framework [2].

In proposed system we use recommender system to provide relevant information by using semantic web logs. We need to challenge the technical issues on transforming web access activities into ontology, and deduce personalized usage knowledge from the ontology. Semantic web logs, which aim to determine interesting and frequent user access behavior from web usage data, can be used to model previous web access behavior of users[3],[4],[5].

The developed model can then be used for analyzing and forecasting the future user access behavior. In Semantic Web background, user access behavior models can be shared as ontology [6], [7], [8], [9]. To provide semantic usage personalization, we need to challenge the technical issues on how to define user access activities, discover hierarchical relationships from user access activities, transform them into ontology automatically, and deduce personalized usage knowledge from the ontology[10],[11],[12],[13].

This paper is organized as follows. Section II develops User Modeling Personalized Ontology for Library System. Section III discusses about the Semantic Web Logs. Section IV proposes User Model Framework. Section V Discuss Conclusion and Future enhancement and finally Section VI presents References.

II. Building User Modeling in Personalized Library Ontology

To build Ontology we define Classes, Subclasses and taxonomy (Classes-Subclasses) of hierarchy. Then we identify the properties, individuals, constraints and logical relationships between objects. In this paper we develop new personalized library ontology for user model. The Figure 1 shows Personalized Library Ontology developed by Protégé Ontology editor using top-down approach [14],[15].

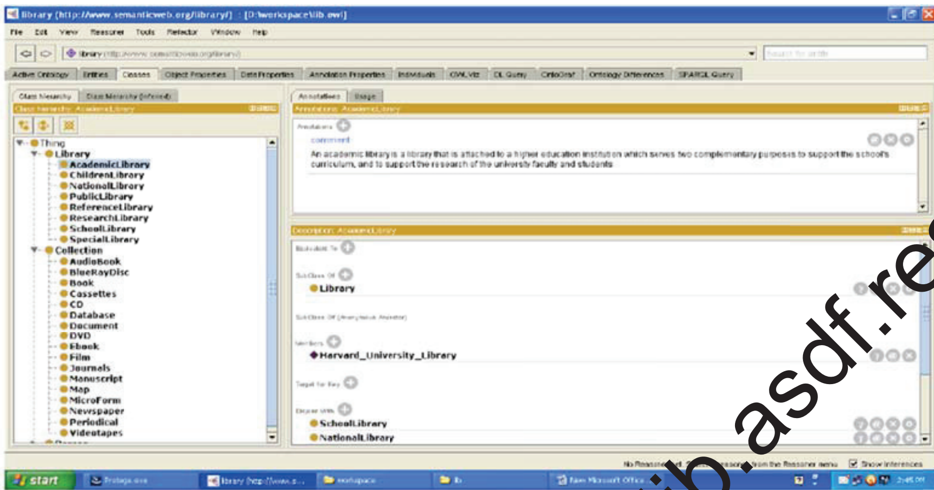

Figure 1 Personalized Library usage Ontology

Information about various topics is collected and required knowledge is extracted for library system. Analyze the gathered information to classes and their hierarchies. Then gather intrinsic and extrinsic properties of each term. Then identify individuals and determine their properties. Figure 2 shows the object properties and their relationships for personalized library ontology.

```
<ObjectProperty rdf:about="http://www.semanticweb.org/library/administratorOf">
  <rdfs:domain rdf:resource="http://www.semanticweb.org/library/Administrator"/>
</ObjectProperty><!-- http://www.semanticweb.org/library/adminstratorIn -->
<ObjectProperty rdf:about="http://www.semanticweb.org/library/adminstratorIn">
        <rdfs:range rdf:resource="http://www.semanticweb.org/library/Library"/>
        <rdfs:domain rdf:resource="http://www.semanticweb.org/library/Person"/>
        <inverseOf rdf:resource=
        "http://www.semanticweb.org/library/administratorOf"/>
</ObjectProperty><!-- http://www.semanticweb.org/library/hasBlueRayDisc -->
<ObjectProperty rdf:about="http://www.semanticweb.org/library/hasBlueRayDisc">
        <rdfs:range rdf:resource=
                "http://www.semanticweb.org/library/BlueRayDisc"/>
        <rdfs:domain rdf:resource="http://www.semanticweb.org/library/Library"/>
</ObjectProperty><!-- http://www.semanticweb.org/library/hasBook -->
        <ObjectProperty rdf:about="http://www.semanticweb.org/library/hasBook">
        <rdfs:range rdf:resource="http://www.semanticweb.org/library/Book"/>
        <rdfs:domain rdf:resource="http://www.semanticweb.org/library/Library"/>
</ObjectProperty>
```

Figure 2 The object property and their relationships

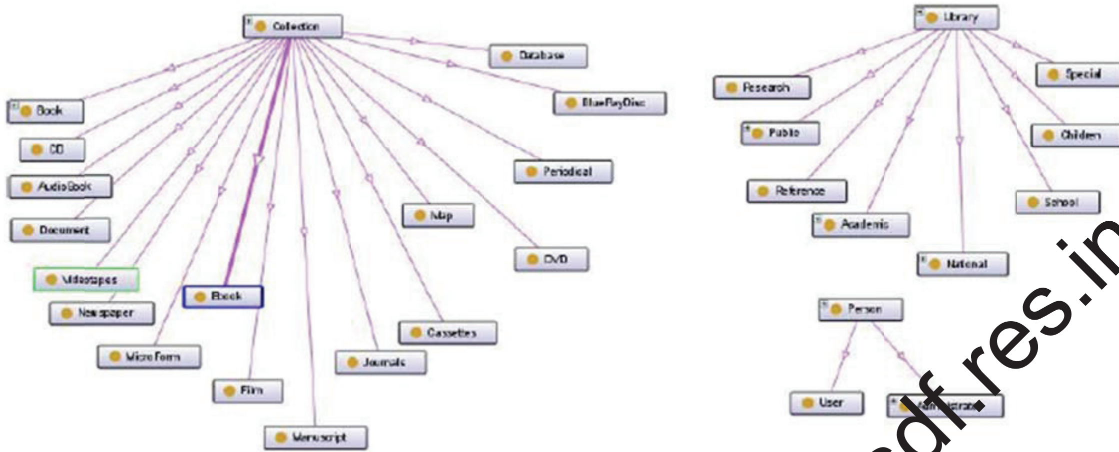

Figure 3 The graphical representation of classes.

In library ontology the main classes are created as Collection, Library, Person and etc., each class has its subclasses. Figure 3 shows the graphical representation of classes and their relationships. The individuals are included in personalized Library Ontology. Figure 4 shows the individuals in the library classes.

```
<NamedIndividual rdf:about="http://www.semanticweb.org/library/Harvard_University_Library">
        <rdf:type rdf:resource="http://www.semanticweb.org/library/Academic"/>
        <library:country>USA</library:country>
        <library:administratorOf rdf:resource=
            "http://www.semanticweb.org/library/Artificial_Intelligence"/>
        <library:hasBook rdf:resource=
            "http://www.semanticweb.org/library/Artificial_Intelligence"/>
        <library:hasMember rdf:resource="http://www.semanticweb.org/library/Kevin"/>
</NamedIndividual>
<NamedIndividual rdf:about=
        "http://www.semanticweb.org/library/National_Library_of_Wales">
        <rdf:type rdf:resource="http://www.semanticweb.org/library/National"/>
        <library:hasMember rdf:resource="http://www.semanticweb.org/libra http://www.semanticwe
</NamedIndividual><!-- http://www.semanticweb.org/library/Sankari -->
<NamedIndividual rdf:about="http://www.semanticweb.org/library/Sankari">
        <rdf:type rdf:resource="http://www.semanticweb.org/library/User"/>
</NamedIndividual><!-- http://www.semanticweb.org/library/Supriya -->
<NamedIndividual rdf:about="http://www.semanticweb.org/library/Supriya">
        <rdf:type rdf:resource="http://www.semanticweb.org/library/User"/>
</NamedIndividual>
```

Figure 4 The individuals in the member classes

III. Semantic Web Logs

The semantic web logs enhanced to store users' log entry such as UserID, Timestamp, requested URL and annotated with relevant semantic information (topics, concepts, etc.) manually or semi-automatically. We marked each web log entry with predefined topics such as academic, engineering, food libraries, etc., and an emotional rating. The user rate web content at the end of each web page according to their emotional influences, which help to reduce the new user's search phase from massive web information. The semantic web logs automatically displayed for each new user's request.

Table 1 Semantically Enhanced Weblog.

UserID	Timestamp	URL	Rating	Topics
User3	14/March/2014 08:20:01	URL1	3	#Topic1, #Topic2,...
User1	14/March/2014 08:20:04	URL2	5	#Topic2, #Topic3,...
User3	14/March/2014 08:20:06	URL3	4	#Topic3, #Topic4,...
User3	14/March/2014 08:20:08	URL1	3	#Topic5, #Topic6,...
User1	14/March/2014 08:20:09	URL1	4	#Topic2, #Topic3,...
User2	14/March/2014 08:20:10	URL2	5	#Topic2, #Topic3,...
User2	14/March/2014 08:20:20	URL3	3	#Topic1, #Topic5,...

In Table 1 each user entry can be inferred as "User N accessed specific resources at a specific time and was emotionally influenced by a specific amount". The following decision making algorithm is used to identify periodic web access pattern. Here we use fuzzy association rule to identify frequently access web page. Fuzzy logic and Formal concept analysis are the important tools to extract and handle information from databases. We join fuzzy logic into Formal concept analysis directly from semantic web logs [16],[17],[18],[19].

Decision making Algorithm

1: Identify set of Fc itemsets
2: Prompt both P and N for fuzzy association
3: Insert B label to itemset A for each frequent access
4: Check the following condition for P and N association
4.1: **If** $A \cup \{B\}$ ==Frequent
4.2: **If** ($A \rightarrow B$)
4.3: P=Positive association rule
4.4: **Endif**
4.5: **Elseif** $A \cup \{B\}$! = Frequent
4.6: **If** ($\neg A \rightarrow B$)
4.7: N=Negative association rule
4.8: **Endif**
4.9: **Endif**
5: Check any itemset falls between A and B, then
6: Verify Support and Condition threshold with the following
6.1: Association $\neg A \cup B \rightarrow y$ and Association $A \cup \neg B \rightarrow y$.

First we identify frequent condition (Fc) items (i.e., predefined topics) and we prompt positive (P) and negative (N) fuzzy association rules. We describe positive (P) association rule as frequently access web content and negative (N) association rule as infrequently access web content[20],[21],[22],[23]. This positive (P) and negative (N) fuzzy association rules help the user to make a decision quickly to retrieve the information from the enormous web.

IV. User Model Framework

We propose user behavior framework for personalized library ontology. The library ontology is developed by protégé editor using top-down approach. This ontology is created by the following association concept primarily defining Classes, Properties and Class Hierarchy relationship [24], [25].

Classes: - Each user access activity is mapped into an activity class
Properties:- Each temporal and event attribute of a user access activity is transformed into a property of the corresponding class. The membership value of each attribute is stored in the corresponding property. Further, the fuzzy support and confidence of each web access activity are also represented as properties named "Support" and "Confidence" respectively and
Class Hierarchy Relations:- Each hierarchical relation between user access activities forms a grouping relation between activity classes.

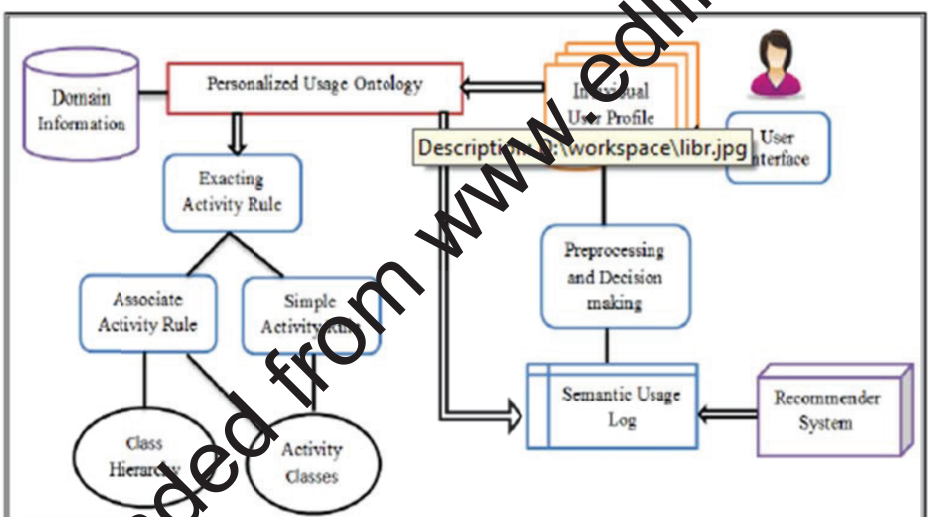

Figure 5 Generic User Model Framework

Methodology to access personalized library ontology

Step 1: To view the library information the user need to login to the home page and need to register. This helps to identify user behavior.
Step 2: After registration the individual user profile will get generated.
Step 3: According to their specification given by user in the registration the recommender system displays semantic web logs for user.
Step 4: Now the user make a decision to choose relevant web information.
Step 5: The user who view the library information should rate them separately. Rating to web page decides the emotion of the user whether the user is interested in the web content or not. The user's rating is stored in the semantic web logs to analyze the users' emotion.

Figure 5 shows the Generic User Model Framework for Personalized ontology. The personalized usage ontology stores user information. The knowledge from personalized usage ontology can be extracted as Simple Activity Rules and Associate activity rule. In simple activity rules, each activity class are in the form of, “If x is A then y is B is S”, where A and B are fuzzy sets of the corresponding temporal properties and event properties of the activity class respectively. We can calculate the fuzzy truth qualifier S using the confidence property (Conf) of the activity class and the minimum confidence (MinConf) that is used for pruning the Web Usage Lattice.

In Association activity rules, “If x is A then y is B is S”, where A and B are fuzzy sets of the temporal properties and event properties of the activity classes n and m. Here m to be the immediate subclass of activity class n, Conf > MinConf. Then the association activity rule of fuzzy confidence(Conf) is equal to the support property of the activity class m divided by that of activity class n[26],[27].

V. Conclusion and Future Enhancement

The generic user model for a specific user is established on an explicit description provided by the user through the user profile editor (UPE) and by an implicit portion maintained by intelligent services. We have proposed a user behavior model framework for personalized library ontology. Here we used user’s decision making approach in semantic web logs that reduces user’s search time from the huge web. To make navigation more effectively, the personalized library user model uses recommender system which provides relevant web information. In future the proposed user behavior framework for personalized library ontology further is enhanced to develop A Generic Web Library Ontology Framework.

VI. References

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