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Relation Based Search Engine In Semantic Web

By

S.Dineash

Register Number: 71206621013

Of

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COIMBATORE - 641006

BONAFIDE CERTIFICATE

Certified that this project report titled **"Relation Based Search Engine In Semantic Web"** is the bonafide work of **"S.Dineash"** (Register Number: **71206621013**) who carried out the research under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

Supervisor **Head of the Department**

Submitted to Project and Viva Examination held on 06.07.2009

Internal Examiner **External Examiner**

MEZOBLANCA
SOLUTIONS

Date : 04-06-2009

TO WHOMSOEVER IT MAY CONCERN

This is to certify that the titled **"A RELATION BASED SEARCH ENGINE IN SEMANTIC WEB"** done by **Mr.S.DINEASH (Reg.No:71206621013),** of final year **MCA, KUMARAGURU COLLEGE OF TECHNOLOGY, Coimbatore** has undergone project work in our organization from 18.12.2008 to 03.06.2009. During his training period his conduct was good. The source code and Exe Files of the project cannot be issued under any circumstances.

For Mezoblanca Solutions (India) Pvt. Ltd

(M. Arunkumar)
Managing Director

Mezoblanca Solutions (India) Pvt. Ltd. CBE - 4.

Mezoblanca Solutions (India) Pvt. Ltd.,
204, PSG Step Software Park II,Peelamedu, Coimbatore - 641 004. India.
Tele : (91) (422) 4363316, 4363318

ABSTRACT

With the development of the Web, information "Big Bang" has taken place on the Internet. Search engines have become one of the most helpful tools for obtaining useful information from the Internet.

However, instead of caring about the semantics of information, the machine on the current Web cares about the location and display of information only.

Because of this shortcoming of the current Web, the search results by even the most popular search engines cannot produce satisfactory results. The development of the next generation Web, Semantic Web, will turn the situation around completely.

This paper proposes a prototype relation-based search engine, "OntoLook," which has been implemented in a virtual Semantic Web environment in our lab. We also present its system architecture and analyze the key algorithm.

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ACKNOWLEDGEMENT

The satisfaction that accompanies the successful completion of any task would be incomplete without mentioning the names of people who made it possible, whose constant guidance and encouragement crowns all efforts with success.

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CHAPTER 1

INTRODUCTION

1.1. COMPANY PROFILE

Mezoblanca Solutions has been in forefront of developing and delivering enterprise asset management, parts & catalog management, inventory & materials management, work order scheduling and work force management, fleets management, facilities and various business solutions. Mezoblanca Solutions strengths are based upon industry centric management expertise, consulting services, software & technology products development, and process automations by listening to their clients, identifying their challenges from day to day operational issues to strategic management goals, and implementation of business solutions to solve their challenges

Mezoblanca Solutions has been providing information technology and database management consulting services for more than a decade. They have successful database management consulting and execution experience with fortune 2000 clients all over the world. Mezoblanca Solutions has also been developing industry solutions based on Oracle and Microsoft database platforms with customers all over the world. Their expertise includes database architecture, data modeling, security & privacy, migration, database administration and maintenance services.

Mezoblanca Solutions, based at Coimbatore, is a part of a group involved in IT development, IT services, Plant Maintenance Consulting & Software, Materials consulting & Software, Payroll and HR Solution , Biometric based IT solutions, Data preparation etc., They have good experience in successfully executing very large projects for Private Organizations for both National and International customers. It is a

technology oriented company promoted by professionals with rich experience and expertise in the industry.

The company is focusing on providing technical consultancy and solutions in the automation industry for various applications. Mezoblanca Solutions also looks at providing the necessary business computing systems for optimizing the total systems integration, with the help of its vast product range. Mezoblanca Solutions offers total solutions on Automatic Identification Systems for Transaction Automation through Barcode/Radio Frequency and Biometrics Technology.

They increase their clients' competitiveness by rolling out industry solutions leveraging our proven software products, information technology solutions and business Process optimization services.

1.2. OUTLINE OF PROJECT

With the development of the Web, information "Big Bang" has taken place on the Internet. Search engines have become the most helpful tool for obtaining useful information from the Internet. However, the search results returned by even the most popular search engines are not satisfactory.

It is not uncommon that search engines return a lot of Web page links that have nothing to do with the user's need. It surprises users because they do input the right keywords and search engines do return pages involving these keywords, and, yet, the majority of the results are useless.

The problem is the moment we submitted our keywords to the search engine, the relations between them were erased because there is no way to record the relations between entities under the system architecture of the current Web. Thus, the search engine cannot return the pages we want.

Relations lost—this is the key of the whole problem!

Everything is related to other things in various manners. When we try to comprehend an entity, we comprehend this entity from the way it relates to other entities. For example, with regard to "Shanghai" and "hotel," one of the relations between them is "Located In." "Hotel" also relates to "Five Star;" the relation between them is "hasRating." Together, the relations form the semantics of "Hotel" in this context: The hotel is located in Shanghai and it has been ranked as a "five star" hotel. In fact, the semantics of an entity exist in the relationship between the entity and others. For communications between machines, the relationships between entities have to be defined before the machines can understand the semantics of each other.

There are three core principles ,

The first principle is that the query language should provide convenient and efficient access to any kind of data expected to be found on Semantic Web. That is to say, the query language on Semantic Web cannot only query Web pages formed by X(HTML), but must also query the semantic description of the Web data formed by RDF. Certainly,

if the querying language addresses the semantic description formed by RDF, it can address the ontology formed by OWL because OWL is a subset of RDF.

The second principle is that the query language should be based upon the principles of referential transparency and answer-closedness.

The third principle requires query languages that allow queries and answers to be incomplete. In the second approach, we translate ontology to some mature data store manner and the design of translation system becomes the key. Corcho and Gomez-Perez propose a Layered Model of the translation system. It divides the translation system to four layers: lexical, syntax, semantic, and pragmatic. The major advantage is easy construction of the translation system and convenient maintenance and reuse.

The main objectives are

- To make use of the relations between the concepts to retrieve a more precise and smaller result set.
- The relations are stored in ontology as the form of triple. Utilizing ontology to retrieve information in the Semantic Web
- It can search SWD (Semantic Web Documents) in the Web, and it defines the relations between SWDs.
- The search engine makes use of the successive relation defined in RDF documents between concepts to associated searches.

- When querying information using semantics offered by ontology is how to extract information from ontology more efficiently.
- The way to directly query semantic information from ontology using some ontology query language and to translate ontology to a mature data store manner like RDBMS first, and then to query semantic information from RDBMS.

CHAPTER 2

SYSTEM ANALYSIS

System analysis involves the process of diagnosing, interpreting and helps us to propose a new system. This chapter describes existing and proposed system.

2.1. EXISTING SYSTEM

In the existing system the problem is, the moment we submitted our keywords to the search engine, the relations between them were erased. There is no way to record the relations between entities under the system architecture of the current Web. The search engines cannot return the pages we want and also returns a lot of Web page links that have nothing to do with the user's need.

2.2. PROPOSED SYSTEM

In the proposed system, the search engines use the relations between the concepts to retrieve a more precise and smaller result set. The relations are stored in ontology as the form of triple. Utilizing ontology to retrieve information in the Semantic Web and it search SWD (Semantic Web Documents) in the Web, and it defines the relations between SWDs.

CHAPTER 3

DEVELOPMENT ENVIRONMENT

This chapter describes the hardware and software requirements of the application.

3.1. HARDWARE REQUIREMENTS

The hardware support required for deploying the application is:

Processor	:	Inter Pentium IV 2.4 GHz
RAM	:	256 MB
Hard Disk	:	40 GB hard disk

3.2. SOFTWARE REQUIREMENTS

The software support required for deployment is:

Operating System	:	Windows XP
Front End	:	VB .Net
Back End	:	SQL Server 2000

3.3. PROGRAMMING ENVIRONMENT

3.3.1. Microsoft .NET Framework

The .NET Framework is an integral Windows component that supports building and running the next generation of applications and XML Web services. The .NET Framework is a large set of class libraries that can be used for many programming languages, like Microsoft's C#, Visual Basic, Managed C++ and more. So the first thing we notice here is that the .NET Framework class libraries can be used for more than one programming language.

Besides the Class Libraries, the Framework provides a Common Language Runtime (CLR) that manages the execution of any .NET application written in it using a .NET programming language. Simply put, the .NET Framework consists of Class Library that provides the common system services and functions that you will use and extend in your applications, and an Execution Environment that manages .NET Applications. The functionality provided by the Class Library will help you to develop Windows applications, Web applications, distributed applications and even let you integrate XML and XML Web services into your applications.

VB .NET

VB.Net is a new programming language from Microsoft designed specifically to target the .NET Framework. Microsoft's .NET Framework is a runtime environment and class library that dramatically simplifies the development and deployment of modern, component-based applications.

VB.Net supports concepts such as inheritance, encapsulation, polymorphism, and interface-based programming. VB.Net supports common C, C++, and Java language constructs such as classes, structures, interfaces, and enums, as well as more novel constructs such as delegates, which provide a type-safe equivalent to C/C++ function pointers, and custom attributes, which allow annotation of code elements with additional information.

In addition, it incorporates features from C++ such as operator overloading, user-defined conversions, true rectangular arrays, and pass-by-reference semantics that are currently missing from Java.

Unlike most programming languages, VB.NET has no runtime library of its own. Instead, it relies on the vast class library in the .NET Framework for all its needs, including console I/O, network and file handling, collection data structures, and many other facilities.

Assemblies

Every time you compile VB.NET code the file produced (.dll file or .exe file) is called an Assembly. The Assembly is a self-describing component; when you compile the source code files the compiler emits information about the types contained in the application, along with other information that is needed by the runtime (such as what files are needed to run the application).

3.3.2. SQL Server 2000

Database

A database is a structured collection of data. Data refers to the characteristics of people, things and events. SQL Server stores each data item in its own fields. In SQL Server, the fields relating to a particular person, thing or event are bundled together to form a single complete unit of data, called a record (it can also be referred to as raw or an occurrence). Each record is made up of a number of fields. No two fields in a record can have the same field name.

During an SQL Server Database design project, the analysis of your business needs identifies all the fields or attributes of interest. If your business needs change over time, you define any additional fields or change the definition of existing fields.

SQL Server Tables

SQL Server stores records relating to each other in a table. Different tables are created for the various groups of information. Related tables are grouped together to form a database.

Primary Key

Every table in SQL Server has a field or a combination of fields that uniquely identifies each record in the table. The Unique identifier is called the Primary Key, or

simply the Key. The primary key provides the means to distinguish one record from all other in a table. It allows the user and the database system to identify, locate and refer to one particular record in the database.

Relational Database

Sometimes all the information of interest to a business operation can be stored in one table. SQL Server makes it very easy to link the data in multiple tables. Matching an employee to the department in which they work is one example. This is what makes SQL Server a relational database management system, or RDBMS. It stores data in two or more tables and enables you to define relationships between the tables and enables you to define relationships between the tables.

Foreign Key

When a field is one table matches the primary key of another field is referred to as a foreign key. A foreign key is a field or a group of fields in one table whose values match those of the primary key of another table.

Referential Integrity

Not only does SQL Server allow you to link multiple tables, it also maintains consistency between them. Ensuring that the data among related tables is correctly matched is referred to as maintaining referential integrity.

Data Abstraction

A major purpose of a database system is to provide users with an abstract view of the data. This system hides certain details of how the data is stored and maintained. Data abstraction is divided into three levels.

Physical level: This is the lowest level of abstraction at which one describes how the data are actually stored.

Conceptual Level: At this level of database abstraction all the attributed and what data are actually stored is described and entries and relationship among them.

View level: This is the highest level of abstraction at which one describes only part of the database.

Features of SQL Server

- Enterprise wide Data Sharing
- Portability
- Open Systems
- Distributed Data Sharing
- Unmatched Performance
- Sophisticated Concurrency Control

CHAPTER 4

SYSTEM DESIGN

This chapter describes the data model and process model of the application.

4.1. DATA MODEL

This section describes various data model used in the application.

4.1.1. Table Structure

The table structures are shown from table 4.1.1.1 to 4.1.1.5

Table Name: Tbl_DomainTree

Description: This table stores the domains.

	Column Name	Data Type	Length	Allow Nulls
🔑	Domain_Index	int	4	☐
	Relation_Name	varchar	100	
	Domain_Index_Ref	int	4	

Table 4.1.1.1 Tbl_DomainTree

Table Name: SearchedResultURL

Description: This table stores the resulted URL and their match count.

	Column Name	Data Type	Length	Allow Nulls
🔑	ResURL	varchar	500	☐
	MatchCount	int	4	

Table 4.1.1.2 SearchedResultURL

Table Name: KeyRelation

Description: This table stores the submitted keywords with their relations.

	Column Name	Data Type	Length	Allow Nulls
▶	Keyword	varchar	100	☐
	Relation	varchar	100	

Table 4.1.1.3 KeyRelation

Table Name: RelationCount

Description : This table stores the relations and their count.

	Column Name	Data Type	Length	Allow Nulls
▶	Relation	varchar	100	☐
	TotPres	int	4	

Table 4.1.1.4 RelationCount

Table Name: CutSearched

Description: This table stores the resulted URL.

	Column Name	Data Type	Length	Allow Nulls
🔑	ResURL	varchar	500	☐

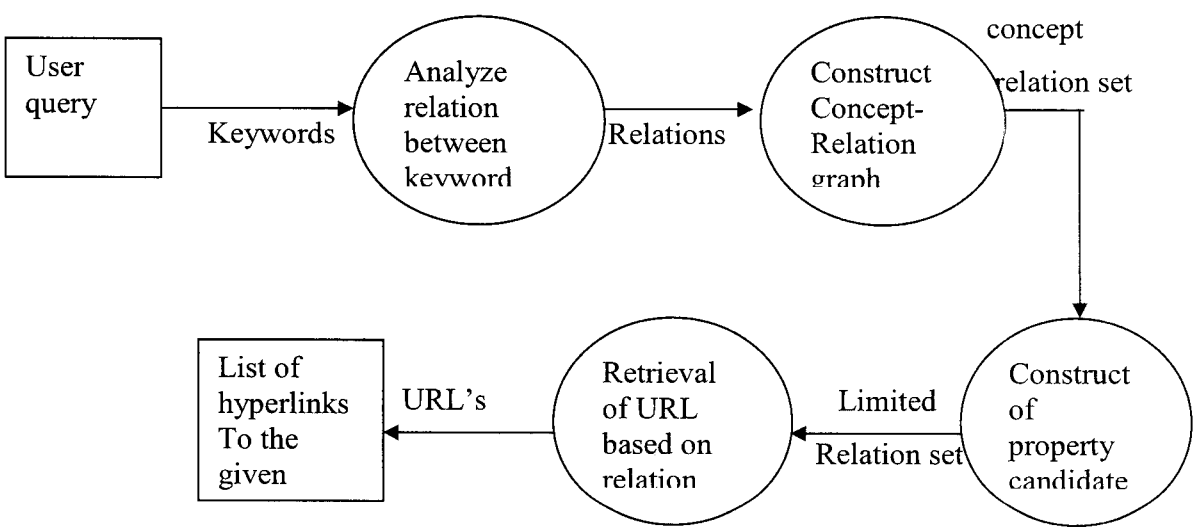
Table 4.1.1.5 CutSearched

4.2. PROCESS MODEL

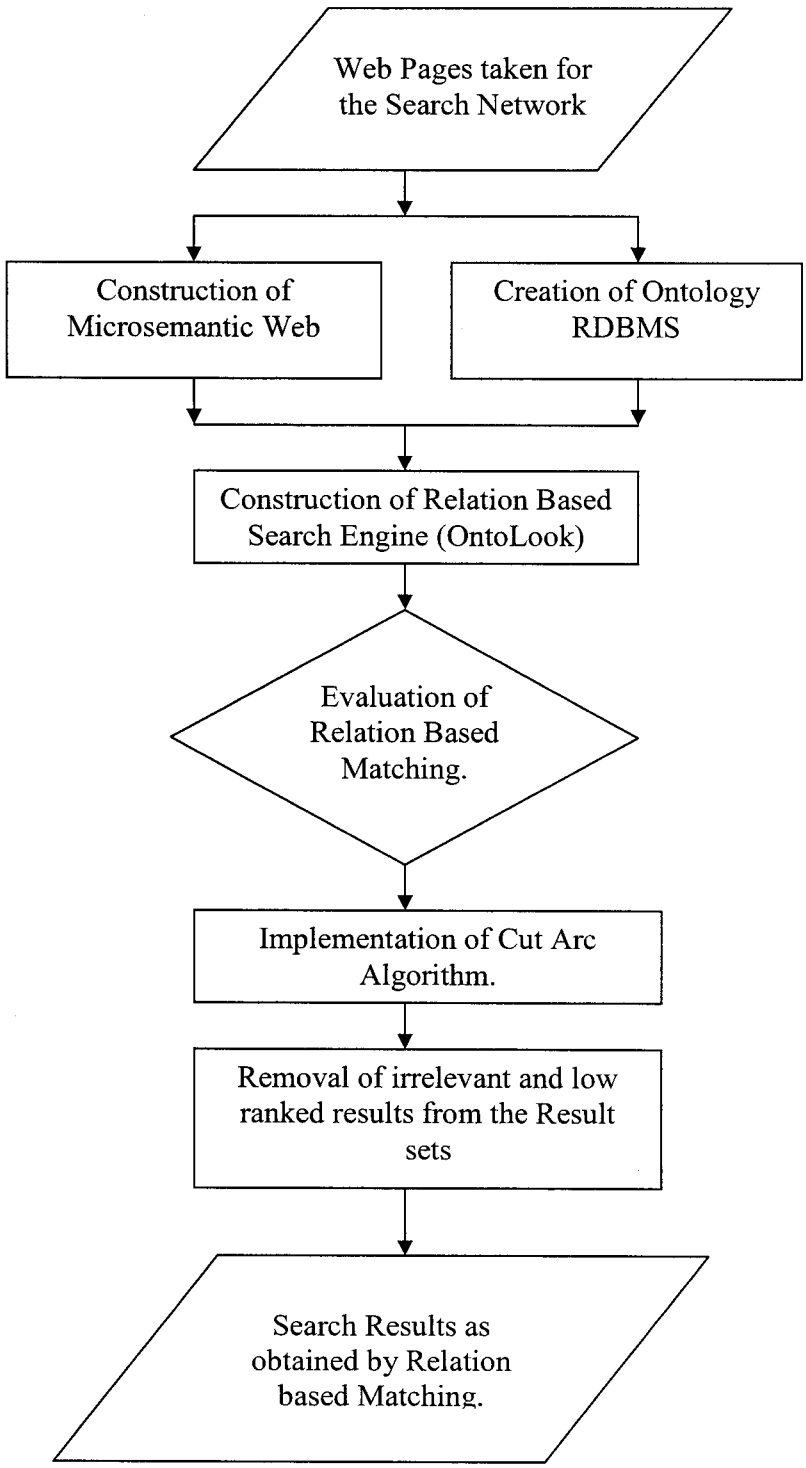
This section describes data flow diagram and system flow diagram of the application.

4.2.1. DFD Diagram

Data Flow Diagram



4.2.2. SFD Diagram



CHAPTER 5

SYSTEM DEVELOPMENT

System development is a series of operations performed to manipulate data to produce output from computer system. This aim at translating the design of the system produced during the design phase into code in user programming language. A modular approach is used for the development of the software.

The development phase for the project was created from the specifications created during the design phase. A principal activity of the development phase is coding and testing the computer program that make up the computer program component of the overall system. Other important activities include implementation, planning, equipment acquisition and system testing. The development phase concludes with the report and review.

5.1. MODULE DESCRIPTION

- Construction of Microsemantic Web.
- Creation of Ontology RDBMS.
- Architecture of relation-based search engine "OntoLook."
- Implementation of Cut arc algorithm.
- Performance Evaluation.

5.1.1. Construction of Microsemantic Web :

Construct a Microsemantic Web environment. First, many Web pages are downloaded, and then embedded semantic annotation into them. The first segment,

that is, the content between label <ontopath> and </ontopath>, indicates the location that the ontology of the current Web page belongs to.

The ontology will interpret the metadata in semantic annotation. We use the "travel" edited by prote´ge´ as our ontology in our Microsemantic Web. The second segment, that is, content between label <rdf_description> and </rdf_description>, annotates the main content of the current Web semantically.

The three level data model namely Web page, semantic annotation, and ontology, has been constructed and resulting in construction of the Microsemantic Web.

5.1.2. Creation of Ontology RDBMS

We translate ontology to some mature data store manner i.e., in form tables to form RDBMS and the design of translation system becomes the key. It divides the translation system to four layers: lexical, syntax, semantic, and pragmatic.

The major advantage is easy construction of the translation system and convenient maintenance and reuse. Since there is no mature querying language and RDBMS is used extensively.

We use the second approach to obtain the semantic information: mapping ontology to RDBMS first, and then querying the database.

5.1.3. Architecture of Relation-based Search Engine "OntoLook."

"OntoLook," constructed in Semantic Web, can exclude the keywords-isolated pages from the result set. Different from the traditional keyword-based search engines, "Onto-Look" is a relation-based search engine.

When "OntoLook" processes the keywords, not only are the keywords processed, but so is the relationship between the entities offered by the architecture of Semantic Web.

A page will be returned to users only when it includes the relationship between keywords; and those pages with the keywords only and without the relationship are discarded.

5.1.4. Implementation of Cut Arc Algorithm

We implement the Cut arc algorithm to retrieve the exact webpages with matched keyword's relations from the Concept-Relation Graph formed. To cut arcs from graph G is to find and label the arc to be cut in the arc set R.

From the definition of power set, we can determine that the time complexity of the cut arc algorithm is O(2n).It seems to be ill-fitted in practice, but, fortunately, few people will submit large numbers of keywords to search engines. Form the Property-Keyword Pair Candidate Set. In subgraph Gp, we can take out, in turn, an item from the property-keyword pair of each arc Rij to form property-keyword pair candidate set CRKSetp.

Sending an item in CRKSetp in turn, and intersecting these result sets, we can obtain the Web page set users need, because it covers all of the relations among the keywords user input.

5.1.5. Performance Evaluation

We evaluate the performance of the proposed Graph-Relation Based Cut arc algorithm based on the RDBMS ontology with that of the Non Semantic Web pages search. The quality and the quantity of the search result set is studied and evaluated.

The relations based system and non relation based system are studied by giving many user search queries as the input to the system and the respective result sets are compared in detailed.

CHAPTER 6

SYSTEM IMPLEMENTATION

Implementation is the state in the System where the theoretical design is turned into a working system. The system can be implemented only after through testing is done and if found to work according to the specification. The most crucial stage in achieving a new successful system relies in giving confidence for the users on the new system that will work efficiently and effectively.

It involves careful planning, investigation of the current system and to constraints on implementation, design of methods to achieve the changeover, an evaluation of changeover methods apart from planning. System Analysis and design efforts will be more complex system being used for writing program code.

Program Code Preparation

One of the important development activities is the code of programming. The system DFD's and other channels are converted to modular programs; they have to be complied, tested and debugged.

CHAPTER 7

SYSTEM TESTING

Software testing is a critical element of software quality assurance and represents the ultimate reviews of specification, design and coding testing represents interesting anomaly for the software. During earlier definition and development phases, it was attempted to build software from an abstract concept to tangible implementation.

The testing phase involves the testing of developed system using various test data. Preparation of the test data plays vital role in the system testing. After preparing the test data the system under study was tested using those data. While testing the system, errors were found and corrected by using the following testing steps and corrections are also noted for future use. Thus, a series of testing is performed for the proposed system was ready for the implementation.

7.1. Unit Testing

A program represents the logical elements of a system. For a program to run satisfactorily, it must compile and test data correctly and tie in properly with other programs. Achieving an error free program is the responsibility of the programmer. Program testing checks for two types of errors: syntax and logical. Syntax error is a program statement that violates one or more rules of the language in which it is written. An improperly defined field dimension or omitted keywords are common syntax errors. These errors are shown through error message generated by the computer. For Logic errors the programmer must examine the output carefully.

7.2. Functional Testing

Functional testing of an application is used to prove the application delivers correct results, using enough inputs to give an adequate level of confidence that will work correctly for all sets of inputs. The functional testing will need to prove that the application works for each client type and that personalization function work correctly.

When a program is tested, the actual output is compared with the expected output. When there is a discrepancy the sequence of instructions must be traced to determine the problem. The process is facilitated by breaking the program into self-contained portions, each of which can be checked at certain key points .The idea is to compare program values against desk-calculated values to isolate the problems.

7.3. Non-Functional Testing

This testing used to check that an application will work in the operational environment. Non-functional testing includes:

- Load testing
- Performance testing
- Usability testing
- Reliability testing
- Security testing

7.4. Load Testing

Test case no	Description	Expected result
1	It is necessary to ascertain that the application behaves correctly under loads when 'Server busy' response is received.	Should designate another active node as a Server.

7.5. Performance Testing

Test case no	Description	Expected result
1	This is required to assure that an application perforce adequately, having the capability to handle many peers, delivering its results in expected time and using an acceptable level of resource and it is an aspect of operational management.	Should handle large input values, and produce accurate result in a expected time

7.6. Reliability Testing

Test case no	Description	Expected result
1	This is to check that the server is rugged	In case of failure of the

	and reliable and can handle the failure of any of the components involved in provide the application.	server an alternate server should take over the job

7.7. Security Testing

It is necessary to check that the application's data is secured.

Test case no	Description	Expected result
1	Checking that the user identification is authenticated	In case failure it should not be connected in the framework
2	Check whether group keys in a tree are shared by all peers	The peers The peers should know group key in the same group

7.8. White Box Testing

White box testing, sometimes called glass-box testing is a test case design method that uses the control structure of the procedural design to derive test cases. Using white box testing method, the software engineer can derive test cases.

Test case no	Description	Expected result
1	Exercise all logical decisions on their true and false sides	All the logical decisions must be valid
2	Execute all loops at their boundaries and within their operational bounds.	All the loops must be finite

3	Exercise internal data structures to ensure their validity.	All the data structures must be valid

7.9. Black Box Testing

Black box testing, also called behavioral testing, focuses on the functional requirements of the software. That is, black testing enables the software engineer to derive sets of input conditions that will fully exercise all functional requirements for a program. Black box testing is not alternative to white box techniques. Rather it is a complementary approach that is likely to uncover a different class of errors than white box methods. Black box testing attempts to find errors in the following categories.

Test case no	Description	Expected result
1	To check for incorrect or missing functions	All the functions must be valid
2	To check for interface errors	All the interface must function normally
3	To check for errors in a data structures or external data base access.	The database updation and retrieval must be done
4	To check for initialization and termination errors.	All the functions and data structures must be initialized properly and terminated normally

CHAPTER 8

CONCLUSION AND FUTURE ENHANCEMENT

CONCLUSION

The situation of having no way to process the information semantics due to the current Web system architecture will be improved considerably after the popularization of the next generation Web, the Semantic Web. In Semantic Web, the semantic information of the Web is recorded by RDF triple and is embedded in Web pages. In RDF triple, the concepts and their relationships are defined. We call the data defining the resource and its relations (concept and property) metadata.

However, if it does not define metadata (concept and property) farther, then there is not enough information present about the semantics of the resource in the context of Web page retrieve the result set. Because the Web pages returned from the database not only include the keywords the user inputs, but also include the relations, some semantics of keywords are recorded by the form of RDF triples. So, the Web pages returned by "OntoLook" will be closer to the users' intention.

FUTURE ENHANCEMENT

Further work involves improving the environment of Microsemantic Web and the choice of cutting some arcs in concept-relation graph. The weight of relations in forming the property-keyword candidate set also needs to be considered. The priority ranking between concepts is an important study field.

Because the number of relationships between concepts may be large, the priority ranking of relationships will affect the returned pages lot. If one could combine the priority ranking technology and the page ranking technology to make a "relation-based page rank," it would be interesting.

APPENDICES

LOGIN

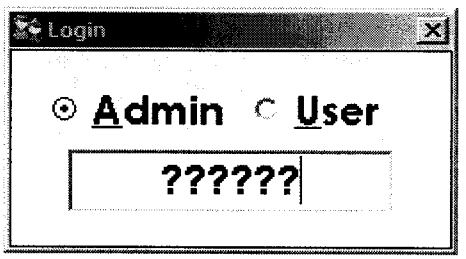


Figure A.1 Login Screen

RELATION BASED SEARCH ENGINE

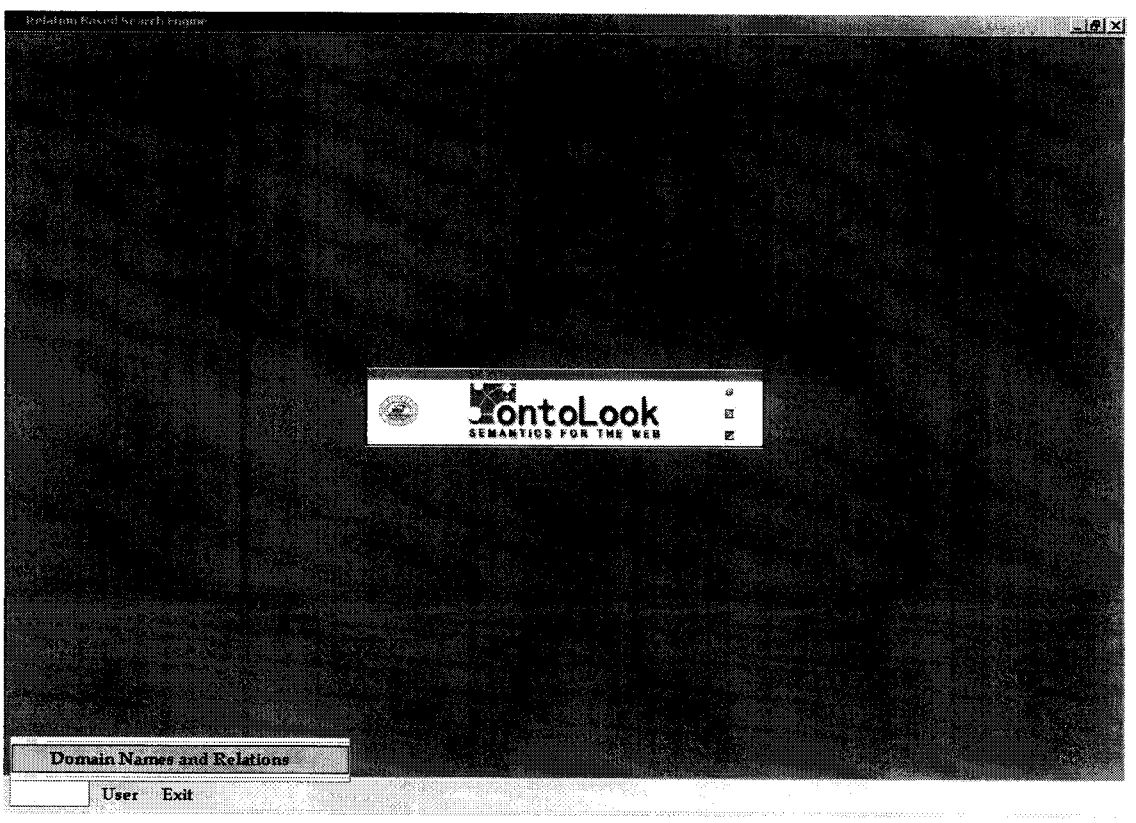


Figure A.2 Relation Based Search Engine Home Screen For Admin

DOMAIN RELATIONS TREE

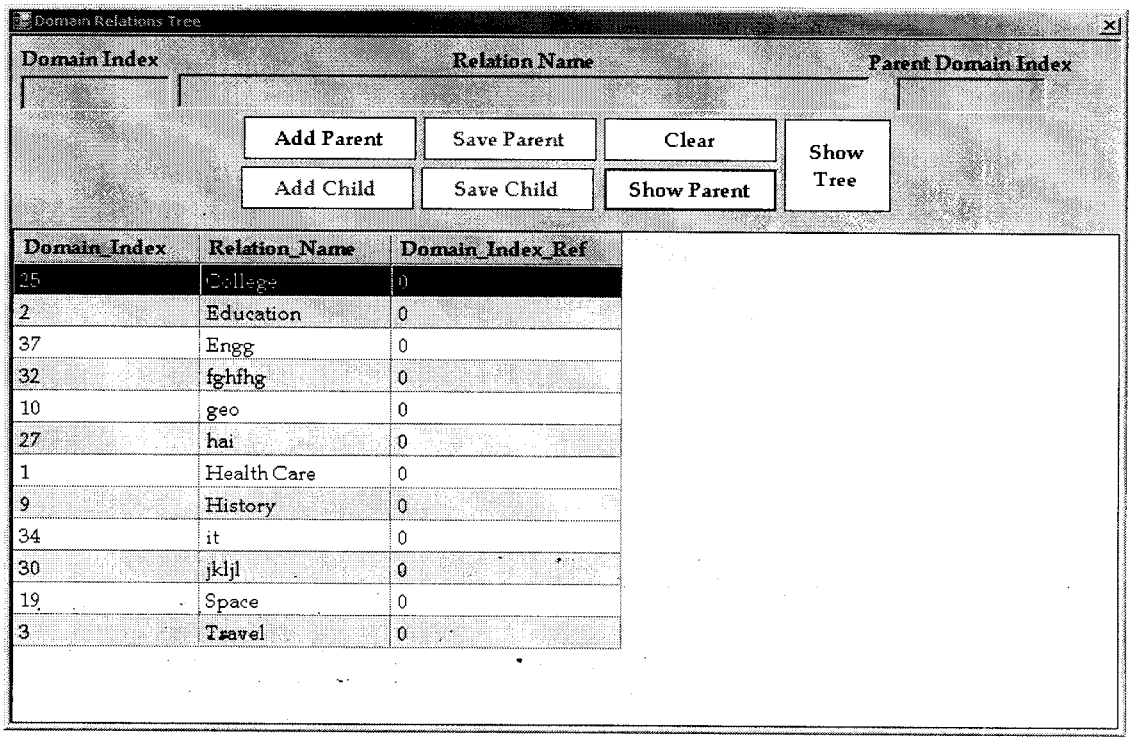


Figure A.3 Domain Relations Tree Screen

DOMAIN RELATIONS TREEVIEW

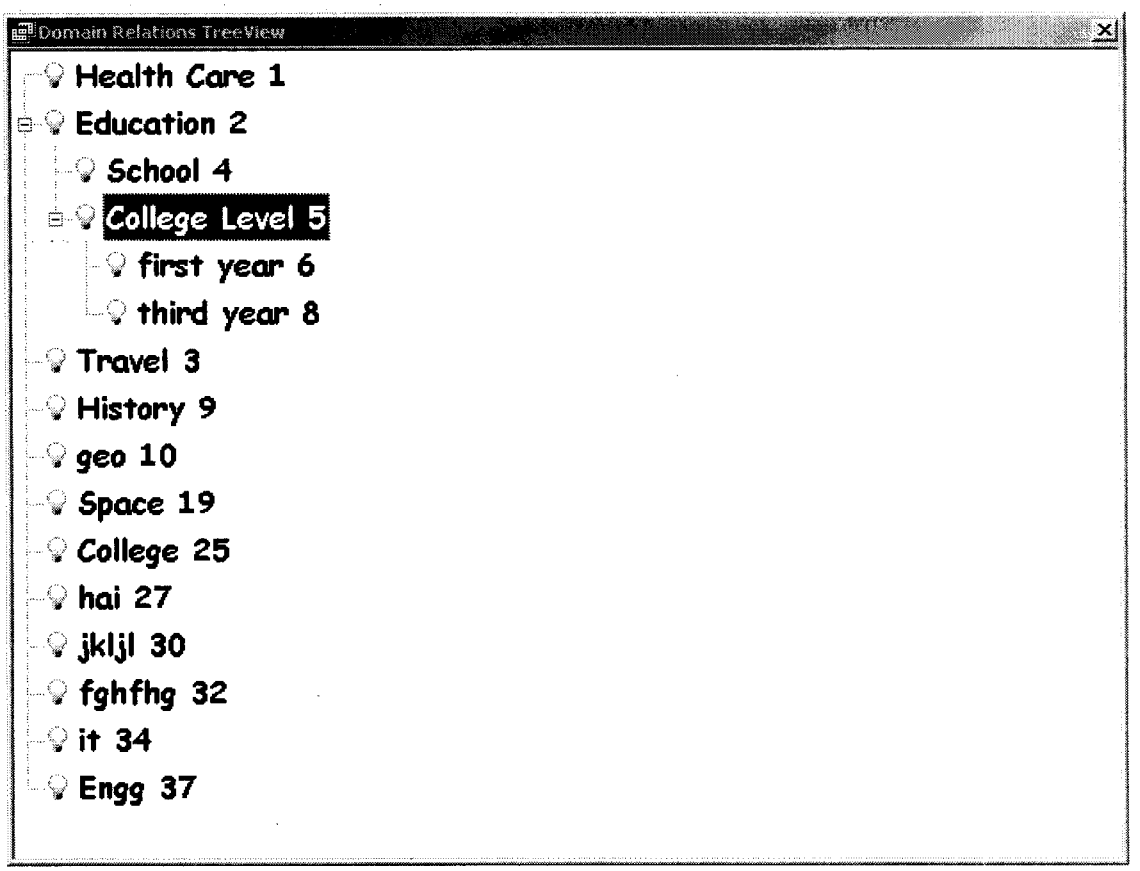


Figure A.4 Domain Relation TreeView Screen

RELATION BASED SEARCH ENGINE

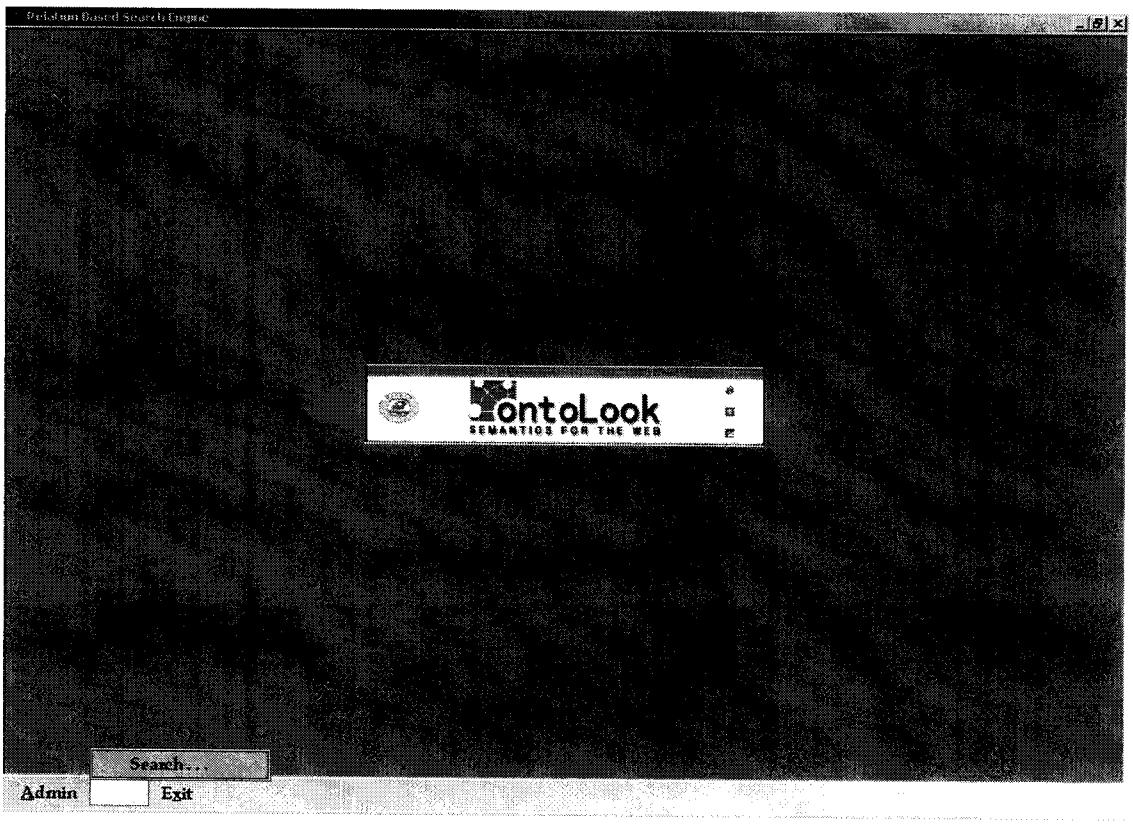


Figure A.5 Relation Based Search Engine Home Screen for User

SEARCH ENGINE

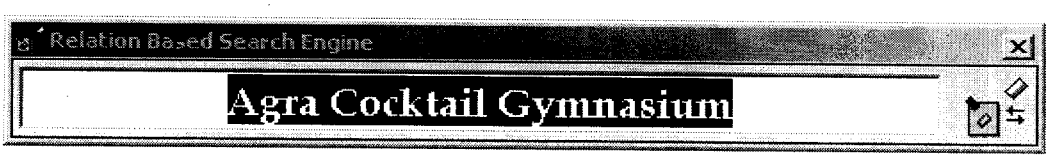


Figure A.6 Search Engine Screen

MAPPING RELATIONSHIP

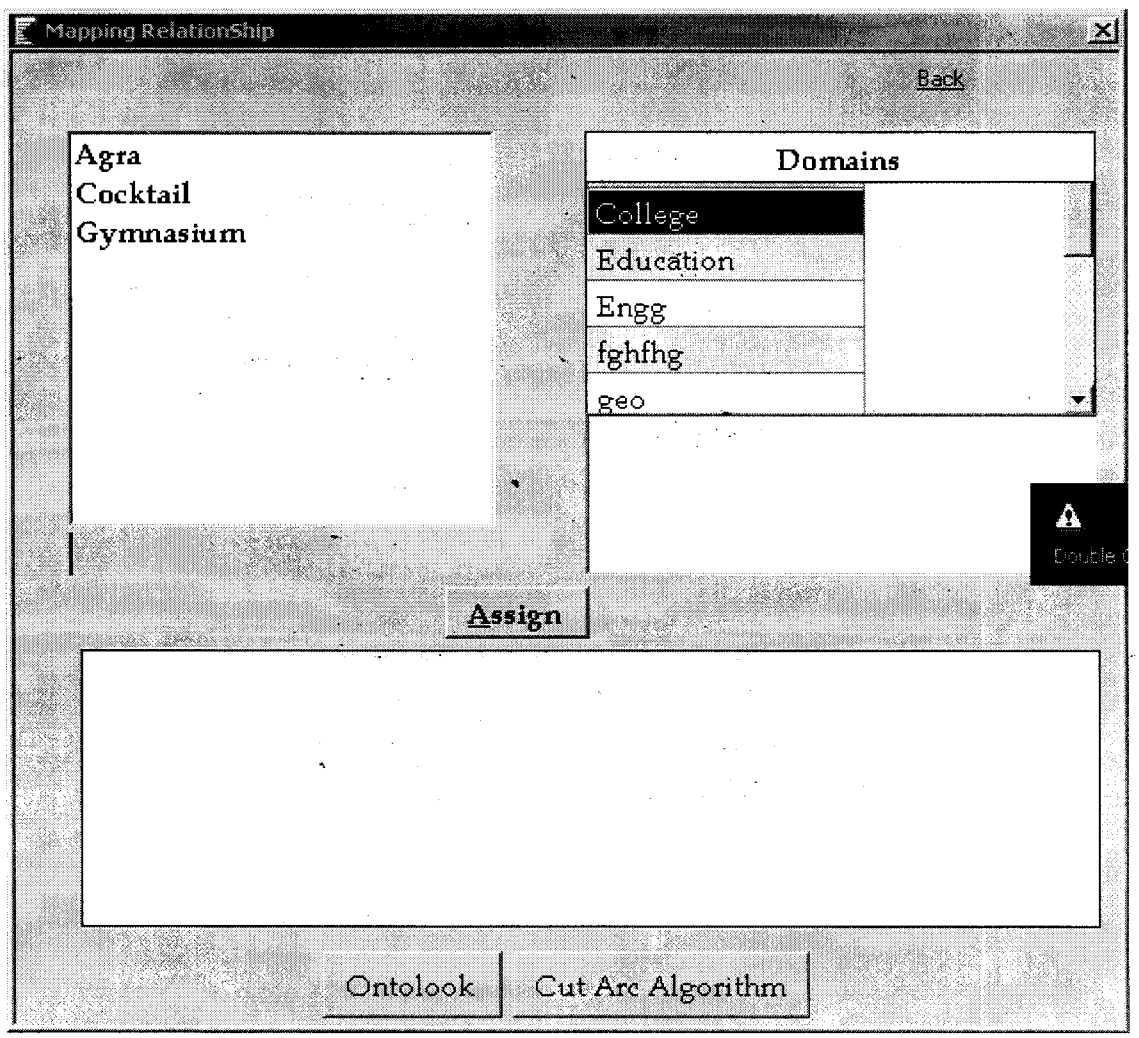


Figure A.7 Mapping Relationship Screen

MAPPING RELATIONSHIP

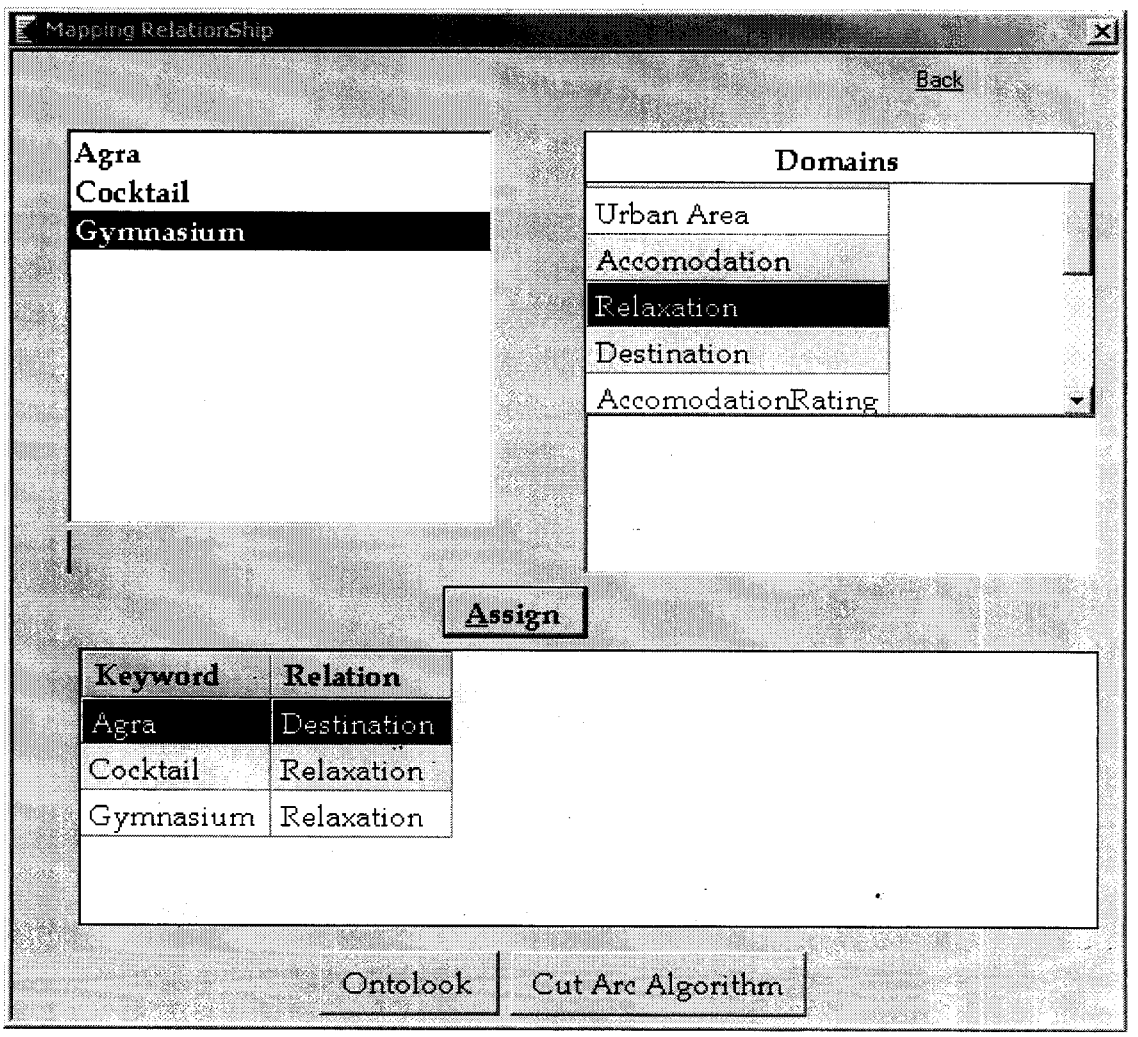


Figure A.8 Mapping Relationship Screen with keywords and their relations

DISPLAYED URL

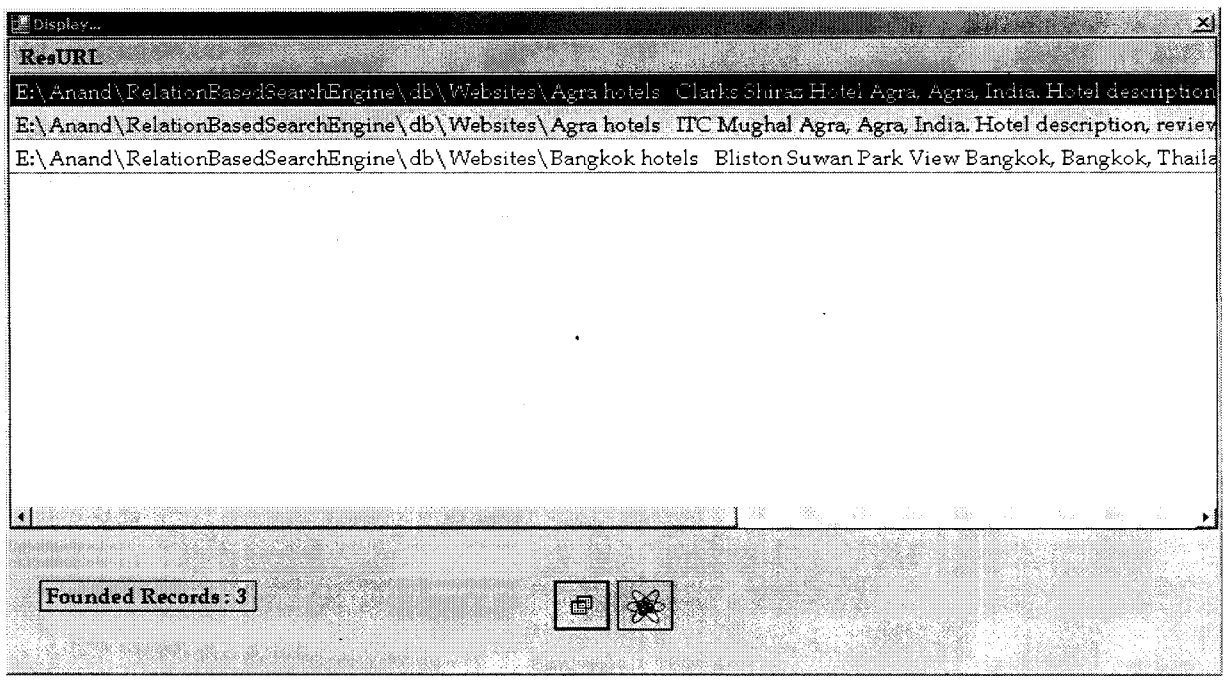


Figure A.9 Displayed URL Screen

WEB PAGE

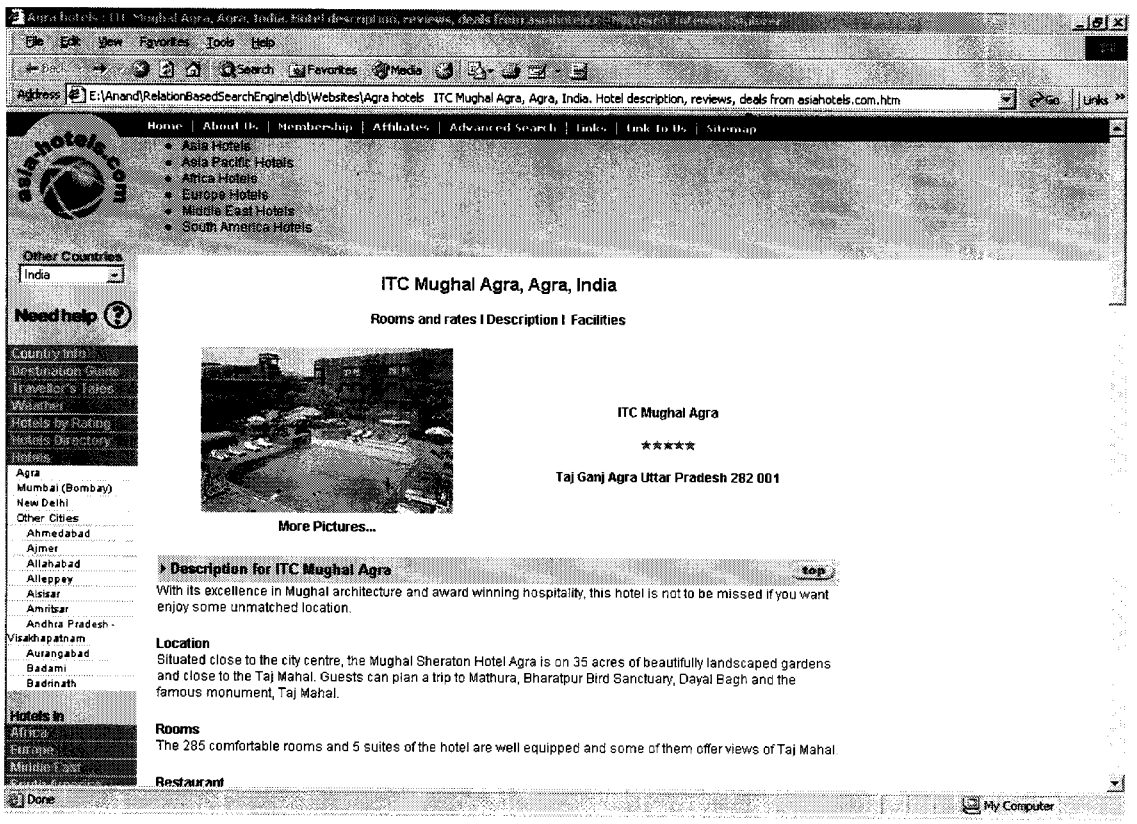


Figure A.10 Web Page Screen

MAPPING RELATIONSHIP

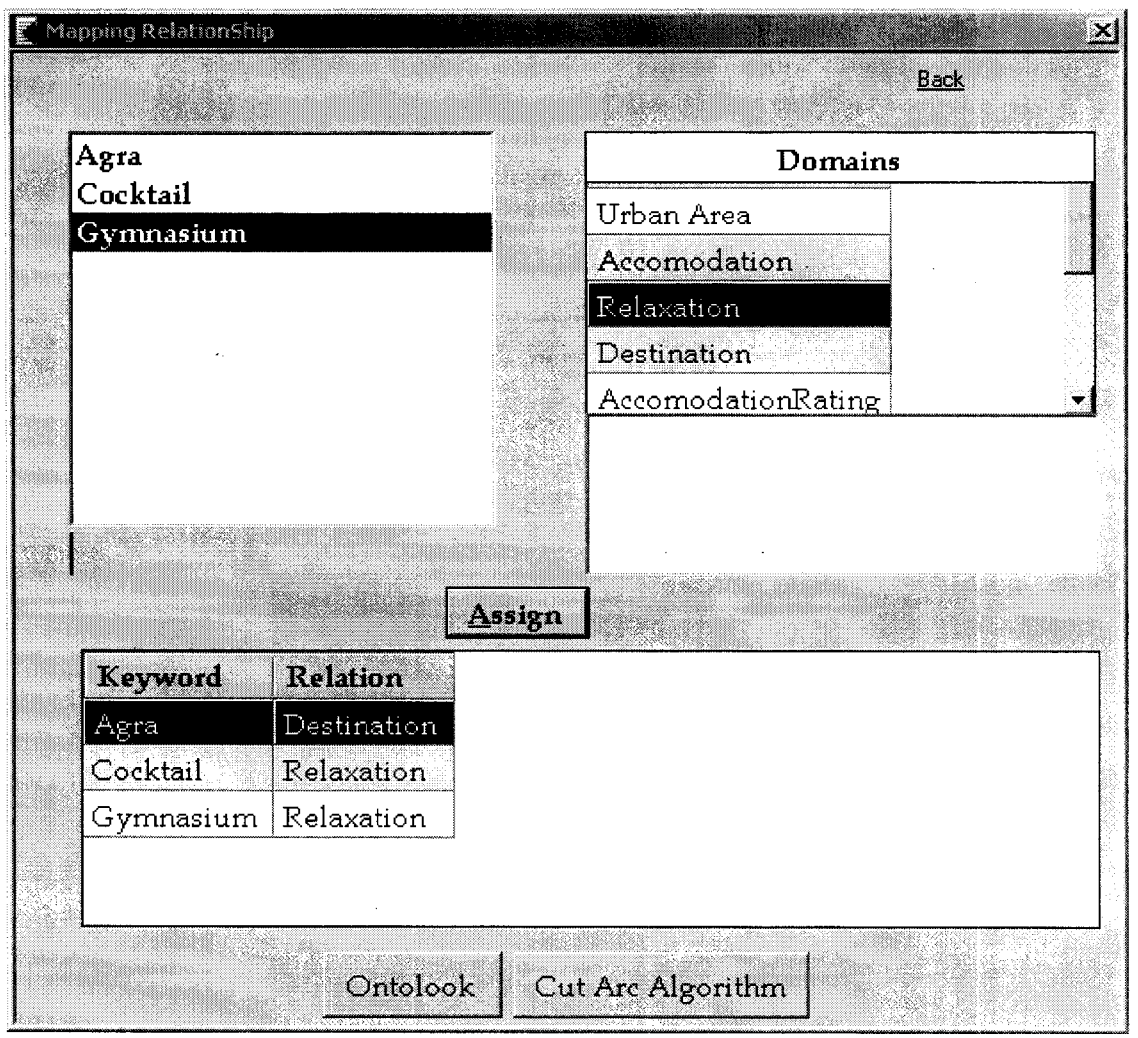


Figure A.11 Mapping Relationship Screen with keywords and their relations

DISPLAY RELATION

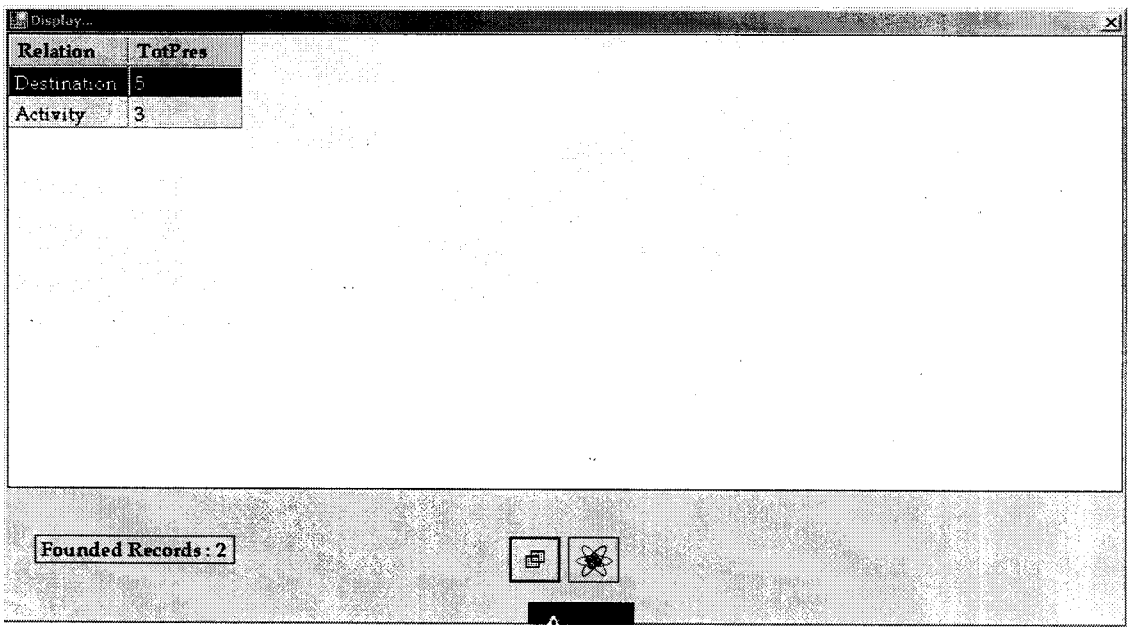


Figure A.12 Display Relation Screen

RESULTED URL

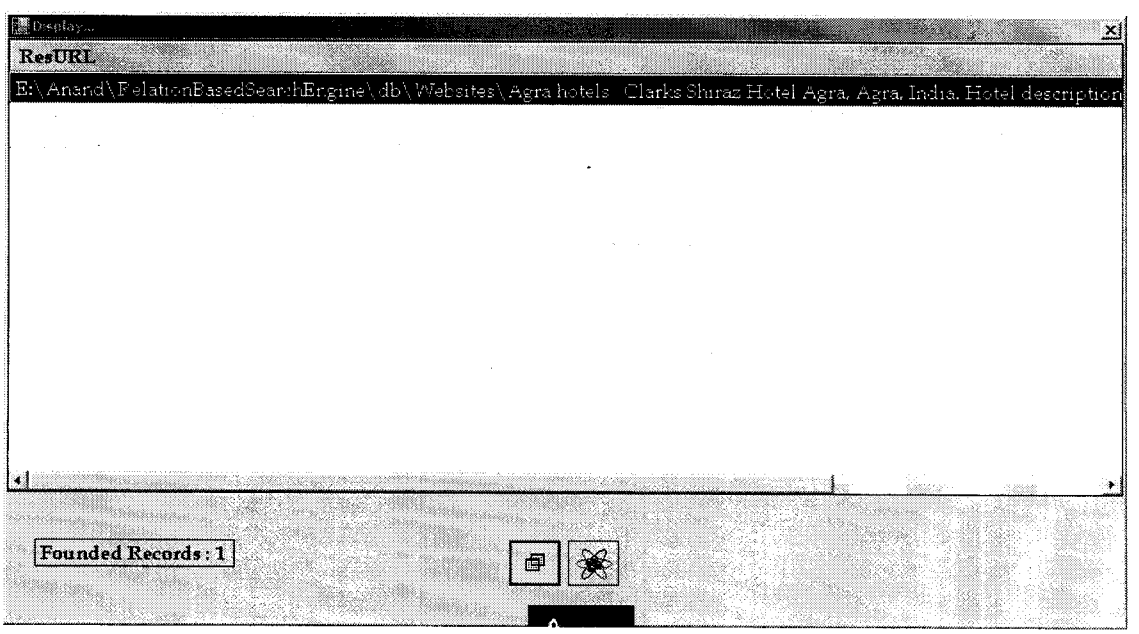


Figure A.13 Resulted URL Screen

WEB PAGE

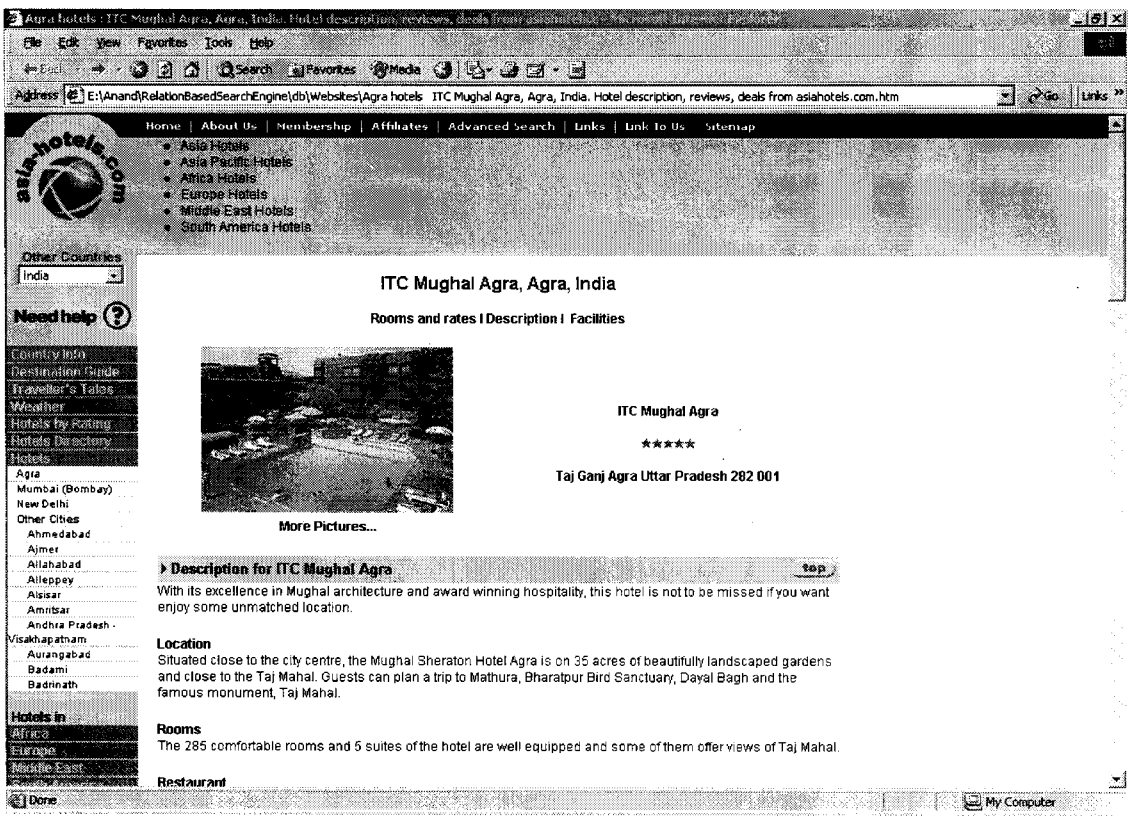


Figure A.14 Web Page Screen

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