Building an Agent –based Search Engine

Fathy E. Eassa[*] **Nasser Al Biqami**[**] **Abdulfatah Mashat**[*] **Sakher Ghanem**[*]
* King AbdulAziz University, Jeddah, Saudi Arabia
** UMM AL-Qura University, Makkah, Saudi Arabia
E-mail: Feissa@hotmail.com

Abstract

The use of the Internet has exploded in recent years with the appearance of the World-Wide Web. In this paper, we show how current technology deals with searching method, and what mobile agent gives to the users. The agent-based search engine has been developed and applied to retrieve information from different Islamic web sites.

This paper introduces an agent-based search engine. This search engine is used to retrieve information from different Islamic web sites. This search engine is a mobile agent which can roam a distributed system or the internet to collect information. This agent-based search engine can be sent to a single site or to multisites at the same time.

1. Introduction

Mobile agents are computational software processes capable of roaming wide area networks (WANs) such as the WWW, interacting with foreign hosts, gathering information on behalf of its owner and coming back home having performed the duties set by its user.[1,2]

Mobile Agents provide a number of benefits:

- Reduced communication costs: there may be a lot of raw information that need to be examined to determine their relevance. Transferring this raw information can be very time-consuming and clog of the networks. Imagine having to transfer many images just to pick out one. It is much more natural to get your agents to "go" to that location, do a local search/pruning and only transfer the chosen compressed image back across the network.

- Limited local resources: the processing power and storage on the local machine may be very limited (only perhaps for processing and storing the results of a search), thereby necessitating the use of mobile agents.

- Easier coordination: it may be simpler to coordinate a number of remote and independent requests and only collate all the results locally.

- Asynchronous computing: you can set off your mobile agents and do something else and the results will be back in your mailbox, say, at some later time. They may operate when you are not even connected.
- It provides a natural development environment for implementing free market trading services. New services can come and go dynamically and much more flexible services may co-exist with inferior ones, providing more choices for consumers.
- A flexible distributed computing architecture: mobile agents provide a unique distributed computing architecture which functions differently from the static set-ups. It provides for an innovative way of doing distributed computation.
- Lastly, mobile agents represent an opportunity for a radical and attractive rethinking of the design process in general. Following on from the latter, it turns the conventional design process on its head, and some truly innovative products should/would emerge out of mobile agent technology. [1, 2]

There are Some Challenges of mobile agents that researchers have to deal with them like:

- Transportation: how does an agent move from place to place? How does it pack up and move?
- Authentication: how do you ensure the agent is who it says it is, and that it is representing who it claims to be representing? How do you know it has navigated various networks without being infected by a virus?
- Secrecy: how do you ensure that your agents maintain your privacy? How do ensure someone else does not read your personal agent and execute it for his own gains? How do ensure your agent is not killed and its contents core-dumped?
- Security: how do you protect against viruses? How do you prevent an incoming agent from entering an endless loop and consuming all the CPU cycles?
- Cash: how will the agent pay for services? How do you ensure that it does not run amok and run up an outrageous bill on your behalf?
- Performance issues: what would be the effect of having hundreds, thousands or millions of such agents on a WAN? [2, 3]

When any body wants to search for anything on the Internet he will use search engines. These search engines at this time have doing the job but Agent System is the best solution for these problems. Table 1 is given some problems with search engine and its solution by Agent System.

	Search Engine	Agent System
1	Search based on keywords given by a user. This means that user must put keywords in correct spelling and order or it will cause too many or too little results.	More intelligently it can enable to search on related topic and also correct user keywords if necessary.
2	Some times search engine cannot reach because it's busy or down.	It's on user computer, So it's available to the user at any time.
3	Information On Internet is very dynamic. Sometimes search result referee to information that is moved to other place or not exists.	Its able to scan Internet for newly available information about topics that user interested in.

Table (1)

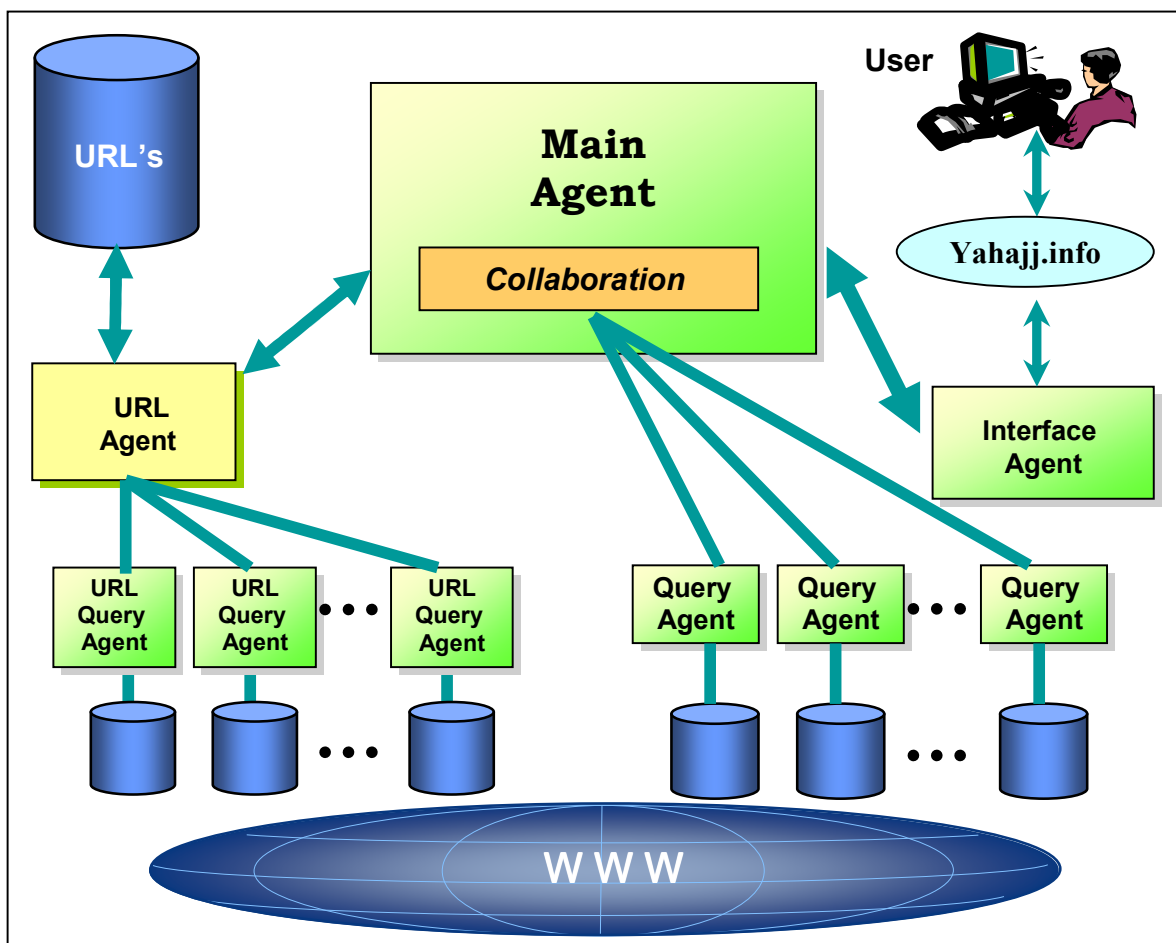## 2. The agent-based search engine

Figure (1): The design of Agent-based search engine

As shown in Figure (1), the search engine consists of many agents: interface Agent, Main Agent, URL Agent, Query Agent and URL Query Agent.

Interface Agent: This Agent receives a user Query (keyword and topic) and sends it to Main Agent.

Main Agent: This Agent receives the user Query from interface agent and sends it (keyword and topic) to URL Agent. URL Agent searches in the URL database to return the locations which contain information about the Query. After that, the Main Agent sends the URLs to the Collaboration.

> **Collaboration:** creates multi mobile agents and sends them to URL's that received from Main Agent. These agents (multi mobile agents) are intelligent to search at URL's sites and give a rate for each result, so when they come back to collaboration they can be easily ordered by their rates.

Query Agent: An intelligent Mobile Agent that can go to the destination and search for the Query and go back with results.

URL's Agent: This Agent is used to search the Internet about new URL's that contain information about Islam and Hajj, and stores them in URL's Data Base and return the result to Main Agent. This agent has intelligent so it can make more searches for new topics and URL's at what user always asked for.

URL's Data Base: This Database contains URL's data. The schema of the URL Table is described in Table (2).

id	URL	Keyword	Category	Sub Category	Date Added
1	http://www.kaau.edu.sa/	Science Collage	Learning	University	15-5-2003

Table (2)

3. The detailed design of Agents

We use the interaction diagram tool to design the agents in details. The interaction diagram consists of blocks (represented by vertical lines), functions (represented by rectangles), and messages (represented by horizontal arrows).
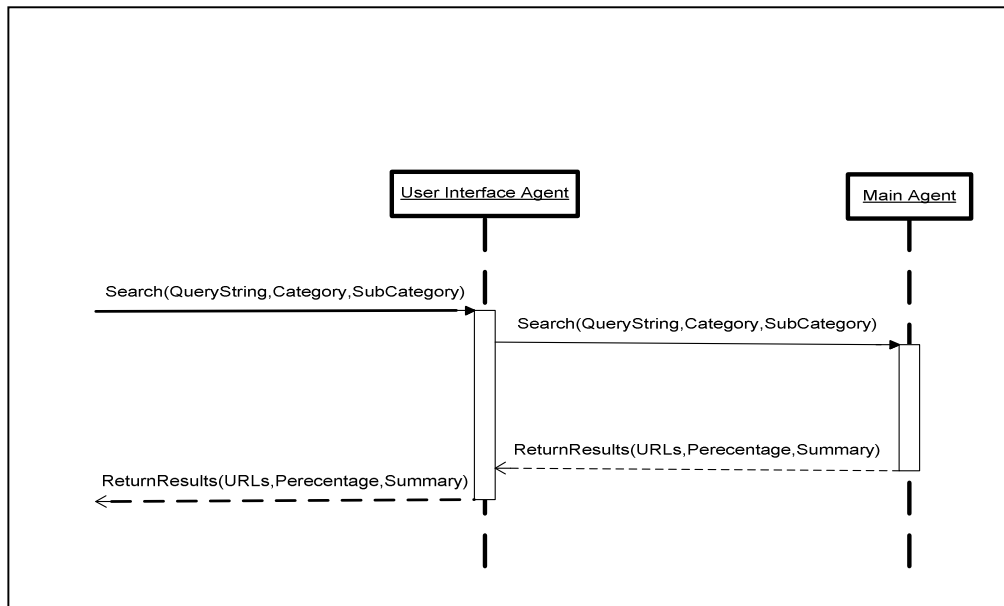
3.1 Interface Agent Interaction Diagram

Figure (2): The interaction diagram of Interface Agent

The Design for user Interface Agent is illustrated by an Interaction Diagram as shows in Figure (2). User Interface Agent receives a function call from a user this function *Search (QueryString, Category, and SubCategory)*. User Interface Agent will send a message to Main Agent, the message is *Search (QueryString, Category, SubCategory)*. After Main Agent finishes it's job it returns results to User Interface Agent which return result to the user *ReturnResults(URLs,Percentage,Summary)*.
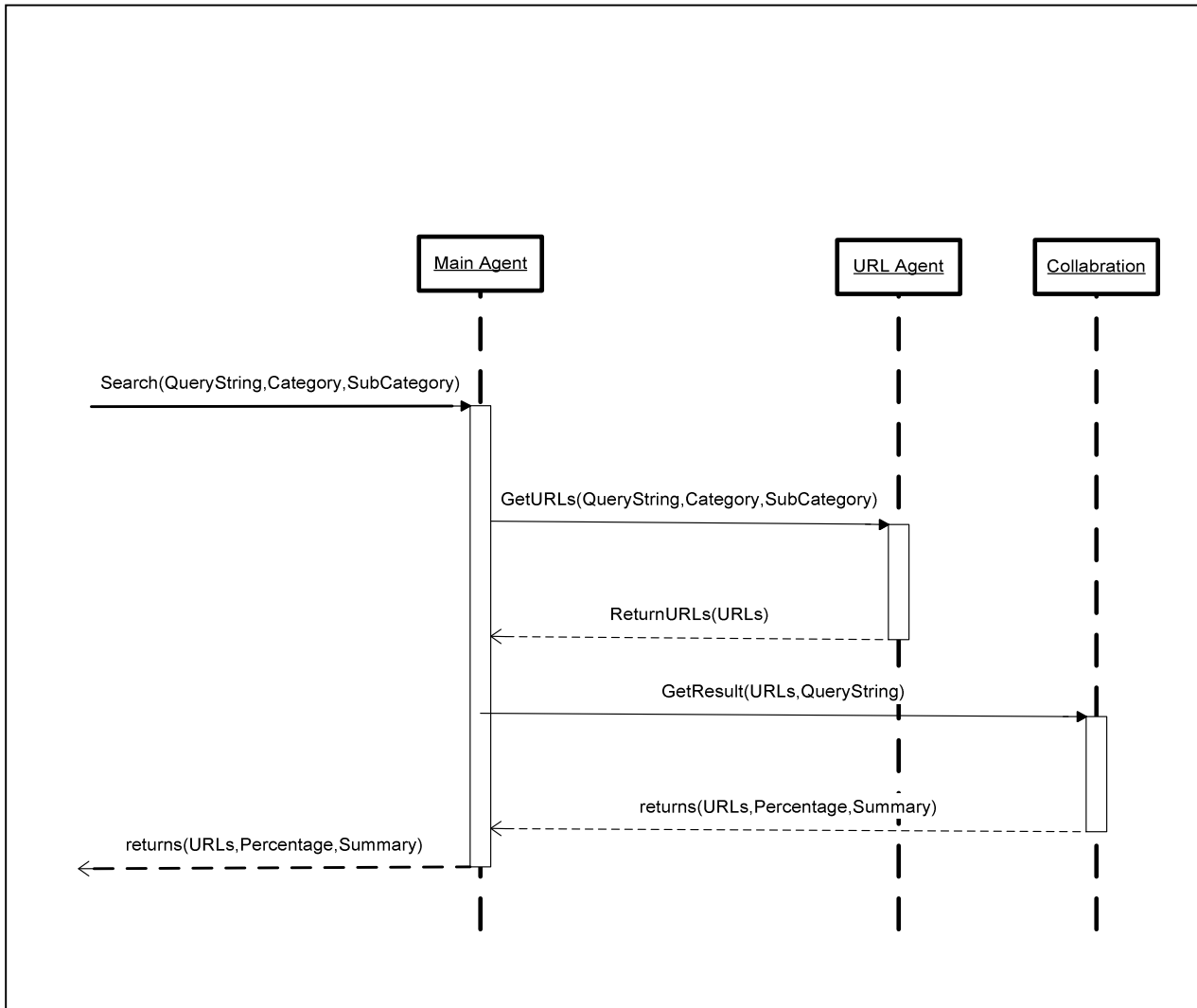
3.2 Main Agent interaction diagram

Figure (3): The interaction diagram of Main Agent

Main Agent receives a call from User Interface Agent: *Search(QueryString, Category,SubCategory),* Main Agent will call URL Agent by the function *GetURLs(QueryString,Category,SubCategory).* After that URL Agent returns the results to Main Agent. Also, Main Agent will call function *GetResult(URLs, QueryString)* in Collaboration which returns the *Returns(URLs,Percentage,Summary)* to Main Agent and Finally, Main Agent Sends them to User Interface Agent.

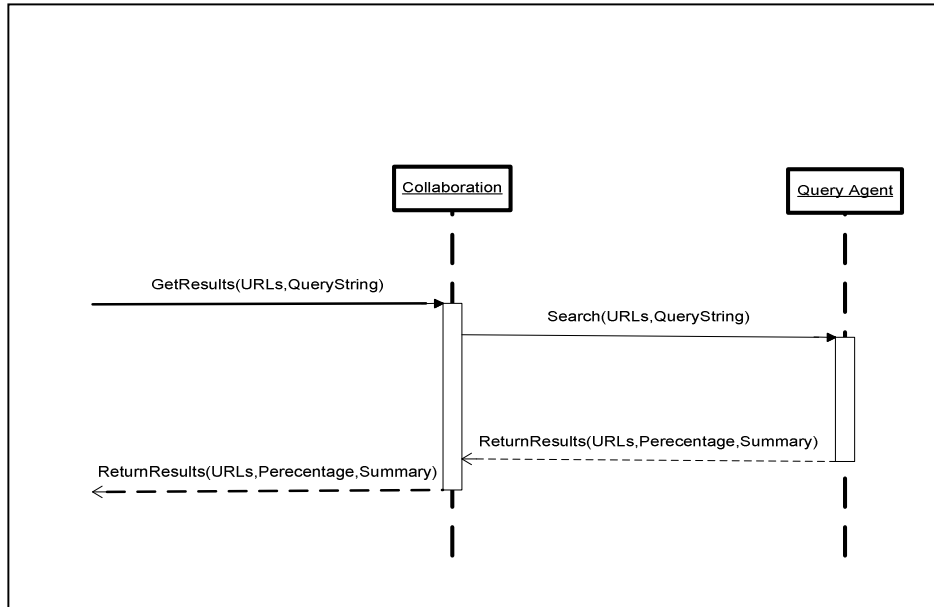## 3.3 The interaction diagram of Collaboration

Figure (4): The interaction diagram of Collaboration

Collaboration is a Part of Main Agent. It receives a function call *GetResults(URLs,QueryString)* from Main Agent and then Collaboration will send Multi Query Agent by *Search(URLs,QueryString)* function. Finally every Query Agent returns its result to Collaboration which it returns the final result to Main Agent.
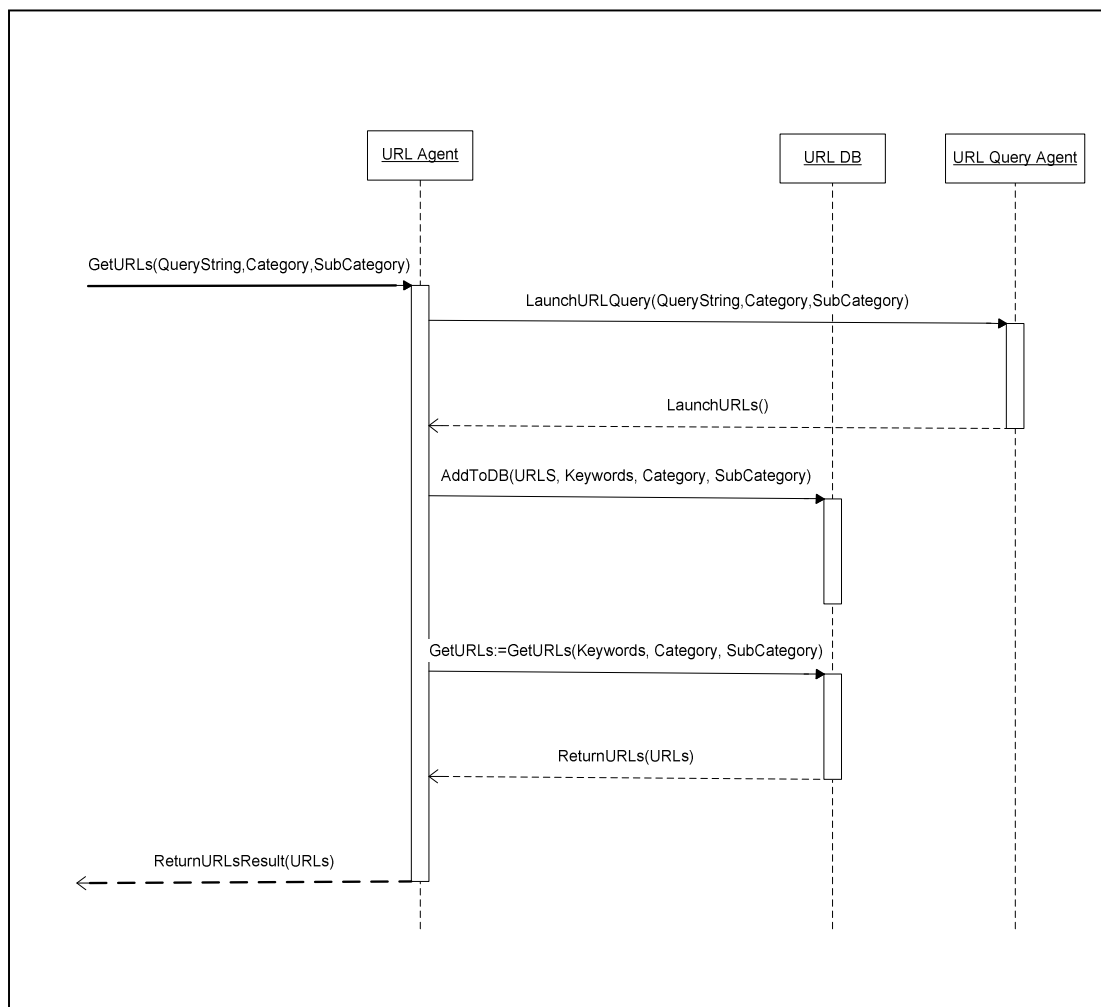
3.4 The URL Agent interaction diagram

Figure (5): the interaction diagram of URL Agent

URL Agent receives a function call *GetURLs(QueryString,Category, SubCategory)* from Main Agent then URL Agent will call the function *LaunchURLQuery(QueryString,Category, SubCategory)* which it sends Multi URL Query Agent to get URLs for QueryString. After that URL Agent will add URLs results to URL Database. Finally, URL Agent will *GetURLs (QueryString,Category, SubCategory)* from database and send them to Main Agent.

4. The Agents implementation

All agents has implemented in java programming under the control of CONCORDIA Server. The following is a simple of agents code.

```java
// Static Model


public class URL_Agent
{

    private string[] URLs;

    private string[] URLsFound;

    public string GetURLs(string QueryString,
                          string Category,
                          string SubCategory)
    {
        URL_Query_Agent URLQA=new URL_Query_Agent();
        URLsFound = URLQA.LaunchURLQuery();

        URL_DB URLDB=new URL_DB();
        URLDB.AddToDB(URLsFound,Keywords,Category,SubCategory);

        URLs = URLDB.GetURLs(Keywords,Category,SubCategory);

        return URLs;
    }

}// END CLASS DEFINITION URL_Agent

// Static Model


public class URL_DB
{

    public void AddToDB(string[] URLS,
                        string Keyword,
                        string Category,
                        string SubCategory)
    {

    }

    public string[] GetURLs(string Keywords,
                            string Category,
                            string SubCategory)
    {

    }

}// END CLASS DEFINITION URL_DB
```

```
// Static Model


public class URL_Query_Agent
{

     // This will launch the Agent to search in the internet for New
Locations about the Querystring with specific category and
subcategory
     public string[] LaunchURLQuery(string Keywords,
                                              string Category,
                                              string SubCategory)

     {

     }

}// END CLASS DEFINITION URL_Query_Agent
```

Conclusion

There is an increase of amount of information available on the WWW. This information increases the complexity of locating relevant information. Complexity shows the need for improved search engine. Intelligent mobile agents are the best way to improve search and, making them active personal assistants. Therefore, this paper introduced an agent-based search engine. This search engine has been developed based on software agent technology. This search engine consists of many agents, some of them are stationary and others are mobile.

The search engine is implemented in Java programming language under the control of CONCORDIA Agent Server.

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