Web Interfaces for georeferenced information searches

PEDRO MARTINS  
pedrofmartini@gmail.com  
Instituto Superior Tecnico, INESC-ID  
Av. Professor Cavaco Silva, 2744-016 Porto Salvo, Portugal

The use of geographic web services, such as Google Maps, has led to the appearance of several papers focused on the development of systems of search information in documents supporting the geographical context, also existing works that are focused on developing user interfaces for those specific systems. However, most of the current systems are still focused on presenting search results in the form of ordered list of results. This work aims to solve the problem of finding information in documents (in this case the documents correspond to news) with support for geographic context. We established some objectives like the use of a map, the development of mechanisms for specifying queries and lists of results, among others, to be pursued in order to be able to solve the problem. A solution was developed that achieved the objectives pursued and in that solution a map was added that allows geographic queries, it is possible to filter the news by categories and was given some sort options of the results list, in addition to the search box that was added too. Finally an evaluation of the solution was made in which, according to the results obtained, showed that the inclusion of a map for searching the information with geographical context, helps users to finding what they want.

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1. INTRODUCTION

The technology of web search content and the forms of presentation and display the results of the searches, have evolved greatly in recent years. Although most commonly used systems (eg, Google) are still mainly based on keyword queries and on the paradigm of presentation based on ranked lists of results, there are also academic prototypes or other commercial systems that provide users with richer viewing experience and exploitation of research results. However, most of these prototypes do not support the search for documents based on geographical constraints, a problem that has been addressed in the area of Geographic Information Retrieval [Jones and Purves 2008; Martins and Calado 2010]. The geographic information retrieval offers the possibility to go beyond search through keywords, supporting users in response to complex questions involving geospatial constraints. Although the literature in the area describe several promising approaches for the treatment of geographic references in documents [Martins et al. 2010], as well as approaches to measure the similarity between geospatial queries and documents [Martins and Calado 2010], there are surprisingly few papers in the area specifically focused on the development of user interfaces for specific recovery information based on geographic context [Frontiera 2008].

1.1 Problem

This article shows a solution to solve, or at least to help in solving the problem of exploration of search results on document collections based on geographical constraints using a map and the problem of maintaining a consistent presentation of the results on a map and an ordered list of results.

1.2 Objectives, Hypothesis and Methodology

To help solve the problem presented, we established some objectives to be achieved with this work:

- Development of mechanisms for information needs, using maps and traditional forms.
- Developing mechanisms for reporting, using maps, sorted lists of results and the results of the queries.
- Development of a Web interface combining the mechanisms for specific queries and for presenting of search results.
- Evaluation of the developed interface in terms of its usability.

In addition to the initial objectives presented a hypothesis was formulated, whose validation is the main objective:

In the context of a search engine with support for geographic context, user interfaces to support the presentation of results on dynamic maps enhance the user experience of these systems, allowing easier access to information sought by users.

The prototype took into account a specific scenario for achieving the objectives and the validation of the hypothesis. First it was created the database of the prototype that used in collection of news from Reuters [Rose et al. 2002], then geographical given by the Yahoo! Placemaker1 web service, was added to the database. With the database created, we proceeded to the construction of the prototype web interface using the JavaScript language. The evaluation methodology, that will be presented in more detail later in this article, consisted of tests performed by users, consisting of four tasks and after that, an inquiry was answered. The test results allowed to draw some conclusions: (i) the use of the map reduces the time it takes to find you the information you want, (ii) the interface is simple and easy to use, and (iii) the fact can see the results of research in both the map and list of results, synchronized, it is very useful.

1.3 Organization of the Article

This article is organized as follows:

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1 http://developer.yahoo.com/geo/placemaker/
Section 1 present the work and the problem it seeks to solve. Are also present the objectives that must be achieved, the evaluation methodology and some of its results.

Section 2 present some related work.

Section 3 present the initial study undertaken to determine the habits of users when it comes to search engines.

Section 4 describe the architecture of the prototype and each of the parties involved.

Section 5 describe the evaluation methodology and all results obtained.

Section 6 present the final conclusions to be drawn, as well as future work.

2. RELATED WORK

Currently there are several works that are being developed in the context of web interfaces for search engines. This section describes the most important works in each of the areas that form the basis for the developed work that this article presents.

2.1 Support to the Formulation of Queries

There are several techniques that help users to formulate queries more representative of their information needs, efficiently and effectively. One that techniques corresponds to automatically complete the queries, by allowing the user to specify only a few letters or words to formulate a query. Speaking specifically of the use of this technique on an interface, its main purpose is to show the user a small set of cues that may contain terms that he intends to use [Hildebrandt et al. 2007].

Another technique that helps in the formulation of queries is the disambiguation of queries, that happen after a search is taken, specifically at the time of viewing the results. Many of the words that we use have different meanings given the context in which they appear that complicates the search is, and the search engine used is not prepared to separate the results according to various semantic meanings of the query [Sanderson 2008]. There are several ways to perform disambiguation of queries, so I will describe only one example based on query expansion. The expansion of queries aims to improve a user’s search query by adding more terms. The expansion can be achieved in two ways, including an interactive when the user enters the new terms, or in an automated way when an information retrieval system decides which terms to add, based on the documents returned to the top original query. In automatic query expansion, there are three commonly used techniques, namely (i) expansion of the independent collection of data, which corresponds to the addition of a fixed number of terms to each query, (ii) expansion of query-dependent data collection in which is a collection of data used to calculate the best value we have noted above, and (iii) the expansion depends on the query, where the optimal number of terms is calculated taking into account each particular query [Ruthven 2003].

2.2 Visualization and Exploration of Search Results

The way one can make the visualization and exploration of the results of a research, can greatly help users find what they want. The grouping of results is a form of exploration taking into account terms that are related to a survey. The Carrot2 [Carpineto et al. 2009; Olsinski and Weiss 2005; Stefanowski and Weiss 2003], a framework that aims at automatic clustering results, and Flamenco [Yee et al. 2003] that uses facets to the same purpose. In the project Carrot2, the grouping is done taking into account various components (input, filter, output and communication). These components perform the entire process ranging from finding documents relevant to the research, through the filtering of these documents using clustering algorithms such as K-means [Kanungo et al. 2002] and ending in the handling of documents returned by the filtering in order to be viewed correctly. Part of the communication serves to promote efficiency and flexibility of the framework.

The project Flamenco uses facets instead of clustering techniques to group the results and explore them. Using the facets technique, Flamenco bet on ranking the results and then in the user interaction to help in the searches. The interaction is essentially composed of three phases:

The opening, in which the user is presented with a summary of the entire collection of documents, organized by subject, to get a sense of the possibilities of browsing the results.

The intermediate interaction, with the visualization of the results obtained in the research, are organized as a list of various categories where they are inserted, and another list where they are presented individually.

The final interaction, after the desired result is selected all the information are showed and the list of categories where the result is inserted, for the case that the user want to see other results for each of those categories.

There is another work that uses the collection of the results using the facets technique, the "elastic list" [Stefaner and Muller 2007]. However, the mode of operating results using facets used by the "elastic list", needs to follow certain rules like the fact that the amount of information related to the attributes of each set of facets must be visibly noticeable. Being respected the previous characteristic, it is easier to emphasize the characteristic values of a given profile, i.e., can thus understand the relationship between a specific data set and the entire collection. The animation during the exploration of the data, for example through a gradual transition when you select multiple facets to get the results, enables a more fluid.

Also in the grouping of results, we need to talk about another technique, the Self-Organizing Map [Lagus et al. 1996]. The SOM is an algorithm for mapping documents in a two-dimensional surface, distributed according to some encoding finding documents that may be related to a query, which is little explicit, i.e., a query that contains a few words. In a general way, the SOM consists of two steps, namely a training phase where the map is created, providing an initial input is then used in the mapping step to classify the next input. The previously mentioned studies focus on techniques for grouping results. However, the development of an interface involves not only show the results of applying techniques such as clustering of results, but also involves a concern with usability aspects such as learning, efficiency, memory, the ability of the interface gives user to recover from errors that appear (e.g., able to recover the initial state of who has done research), and satisfaction that the use of the interface will provide [Hearst 2009].

The Koru system [Milne et al. 2007] offers an interface to the exploration of results that allows a rapid use learning. The interface provides a preview of each result and has three different display panels:

The query topic panel, where the results are broken down by threads created with the help of a thesaurus, being automatic selected those that are directly associated with the search terms. But other topics are available through synonyms that are similar to the search terms that can be added.

The query results panel, which navigates through the documents containing the selected topics.
• The document tray panel, which displays the document content.

2.3 Visualization and Exploration of Geographic Information

This section describes various related topics in information visualization interfaces for geographical exploration, such as the SPIRIT and VisGets, where the authors addressed the construction of interfaces for the exploration of geographic information. The EXHIBIT is a data mining tool that is intended to allow the development of interfaces to search or browse information on multi-faceted. This tool aims at facilitating the publication of information on the web, so that users may have a more dynamic and attractive way to interact with information. Among other options that this framework gives to refine the results of a search we have the facets technique, used to filter the results, and the use of different views such as tables or Timeline. Even creating views that support the geo-temporal visualization of the results using a timeline, it is still not possible to make geo-temporal queries. This tool also allows the definition of lenses, ie, a way to format the information content, an overview, of a result that is presented to the user. For the tool to work, beyond the simple inclusion of the JavaScript file, the type of data source must be converted that will be presented for the type of data that EXHIBIT uses. This becomes crucial when trying to handle a large amount of data, taking a lot of time when performing the conversion. The tool itself does not support the handling of a large amount of data, ie, it is not scalable [Huynh et al. 2007].

The SPIRIT project, is an interface was developed specifically to support basic maps, together with a textual interface for formulating queries. Support for maps is carried out using free map service, given to the user total freedom on what service to use. The queries are formulated by selecting a geographic area on a map, based on a polygonal selection. The user can use this function when he want to view the results like its location or when it knows exactly where to search. A negative aspect lies in the fact that the queries can not be re-submitted, allowing only the user to re-specify the area of the map to highlight the search result, the relevant documents [Purves and Yang 2001].

The VisGets is another recent project, which also lets user to perform queries on a map, which aims to explore using widgets RSS feeds to display the search results. To explore the search results, the widgets are arranged to be used in three dimensions, in which most of the information on the Web is organized:

• Time, corresponding to the timestamp associated with the resources.
• Maps, corresponding to the origin of resources.
• labels, where the words most frequently used documents.

After done the search, it can be further refined using the technique of weighted brushing by passing the mouse pointer over a word in the tags section on the map or even a section of the timeline, the results will be highlighted in other sections, which are related to the selected item. It can also be altered the time slider to show only certain documents relating to certain times in time. All the changes mentioned above also take effect on the map allowing the user to see the number of documents and articles in each geographic area of countries that are represented [Drk et al. 2009; Drk et al. 2008; Dörk 2008].

2.4 Discussion of related work

The works and systems studied were chosen taking into account the specific characteristics of each, some of which characteristics were chosen to integrate the solution developed in the work that i am presenting. Below are listed the various positive and negative aspects of the work and studies the characteristics that were chosen.

About the techniques that help support the formulation of queries in search engines, were described two techniques that help, in a early stage, to construct more precise queries. Although the use of the techniques is not the best to find what a user want, is a good way early in the search to eliminate a considerable amount of results that are not of interesting.

The study of the work on the project Carrot2 showed that this framework is appropriate for grouping of results and gives the possibility to make useful changes to the definitions of a search in order to try to improve the construction of clusters. This might influence the choice of framework for integrating development solution for clustering of results, since its interface is not an optimal solution for visualization.

The project Flamenco studied was another framework that allows the grouping of results, unlike the project Carrot2, its interface allows an exploration of th results with the most appealing way. As the facets act as filters, and allow a grouping results in a hierarchical manner, it is possible to quickly navigate through the various hierarchical levels of results. This rapid exploration, taking into account the chosen filters, allows the user to find what he want easily.

The previous projects, although allowing the visualization of results in interfaces themselves, were not built with a focus on exploration of results. Works related to web interfaces like VisGets and Koru systems, the tool Exhibit and the SPIRIT project, are examples that can give good experiences with the use of interfaces. Although the Koru system does not have many aspects that VisGets and Exhibit have, it possess the ability to view different states of exploration of search results and that is a strong point of this system. It also provides the possibility to add new topics to refine the initial query results.

The Exhibit, the SPIRIT project and VisGets were studied because they permit the exploration of geographic information. The easy implementation of the Exhibit, refinement of the results using facets, view and timelines on a map, correspond to the positive aspects of the tool, which has the negative aspect of the need to convert data types and which makes their manipulation complicated when there are in large quantities. In the case of VisGets, the fact of using widgets to display information on the Web like temporal (using timelines), use maps for the location information and labels corresponding to words used in research, is one of its strengths.

How the information displayed on different widgets is connected, any widget undergoes changes in its content if another widget is changed. The SPIRIT project, unlike other projects, focuses specifically on supporting maps to search, so their only positive aspect is to enable the formulation of research on maps.

The characteristics chosen to integrate the solution comes from two studies, VisGets and Koru systems. The way the results are presented and then screened in the prototype system, are based on the Koru, in which the same panel shows the results of a search and have an indication of their quantity. The mode of viewing the contents of the results is done by tabulation, such as in the Koru. VisGet systemhas give the idea of keeping the results of a search synchronized with the information shown on the map. However to the developed prototype solution, a modification was made that made possible to disable this feature to allowing search without changing the map.
3. INITIAL STUDY ON THE USE OF SEARCH INTERFACES FOR NEWS

To be able to develop an interface that is simple and easy to used by users, we elaborate an inquiry to gather information.

3.1 Description of the Study

This study was aimed at trying to understand the usage habits of users with regard to search sites for more general information or more specific (eg, sites for searching), and about the features that those sites offer (eg, options filtering, use of the map, etc.) that people use more.

The inquiry was divided in three parts:

* In the first part, it tries to draw a profile of users in terms of their age, sex, search engines or search sites that they use and their frequency of use.
* In the second part, it attempts to obtain information on how users search for information (information specifically related with news) on those sites, and which features they use most.
* In the third part, based on a usage scenario, we try to ascertain from users how they want to or would like to search and explore the results of their searches.

3.2 Results from the Study

The release of the inquiry was done by e-mail sent to all students of the Instituto Superior Tecnico, friends and family, trying to make the universe of respondents as comprehensive as possible, covering both people in the area of information technology and ordinary users. The inquiry remained active for a month, and at the end we obtained 42 responses.

3.2.1 Profile of Users. Of the 42 respondents, 67% were male and 33% female, aged mostly between 18 and 25 years. When asked about the search sites that most use and frequency of use, 100% of respondents chose Google as the preferred site to search for information, and 81% admit to using several times a day. A similar situation in the preference of search sites for information related to places, where 98% of respondents use Google Maps, owned a range services offered by Google, but the frequency of use boils down to a few days a week.

3.2.2 Usage Profile Research. In general, the users use site news search specific information about news and news related with locals. However, the generic search sites are preferably chosen to search for news related with locals. About they that the users conduct their searches, they respond that they use the filtering by category as a way to search for information, eg, in sites of newspapers. The normal search by keywords, both to search simple information, as well as search information on places by entering the name of the place, it is also widely used. When it comes to the forms of exploration of the results on the chosen news sites, the query using the list of results sorted by relevance was the most voted. If the exploration results of an search for information associated with a local, the users to use a map to explore the results.

3.2.3 Scenario of Use. Finally, the last questions were used for determining which search features users would like to be able to use, given usage scenario described by the phrase:

Imagine there is a site that allows you to search information associated with local news, and that it has several search features.

Analyzing the inquiry results, the users liked to be able to explore the results using a map or sorting the results, were the features they would most like to have in the site. About the sorting results feature, they liked very much the sort by relevance of the results, not release the other sort options.

The option to see the results of a search for news using markers, was welcomed by 33 of respondents over the option of coloring the regions of the map as the news. Regarding the possibility to view a kind of information on the markers, the users would like to see the results using markers associated with the categories of news.

3.3 Conclusions Drawn from the Study

The preparation of this inquiry provided information regarding the habits of use of search tools for information from users which had implications later in the design of the interface prototype. In terms of aspects of search support, the interface must have a textbox for entering the keywords of a search, the option to choose the themes information to refine the results to be obtained, which are key aspects to be included in the solution prototype. At the level of support to the exploration of results, the interface should provide several options for filtering the results (apart from the normal list of results sorted in alphabetical order), eg, filtering by relevance, by date of publication (defining a time interval to display current information), by geographic proximity. The filtering of the results is one of the features of the operating results that should be mandatory in the solution of the prototype.

Given the opportunity to check results on a map, the users were receptive to the option of using markers associated with certain types of information, with an option to include filtering the solution and its design interface.

4. DEVELOPMENT OF THE PROTOTYPE

This section describes the architecture of the prototype, the evolution of Low-Fidelity Prototype (LFP) over the three versions, and the construction phase of the prototype.

4.1 Architecture

Figures 1 and 2 show the architecture on which the prototype is based. The user uses the web interface of the prototype to perform research news, the interface becomes an XQuery expression using the terms of research and coordinates services provided by Google maps. Created XQuery expression, this is then loaded into the tool Qizx, which comes to getting the database (which already contains the geographic information associated with the collection of data) the news that comply with the requirements of the XQuery expression. Then the tool Qizx returns the result of the submission of search to the web interface in order to create the list of results that is presented to the user.

The prototype of the solution is divided into two parts, as shown in Figures 1 and 2. The Figure 1 is related to the part being formed by the collection of data from Reuters [Rose et al. 2002], which is added to the geographic information using the web service Yahoo! Placemaker 4 using an XQuery expression that adds information to the database will be stored in the final tool Qizx 3. In Figure 2 we can see part of the architecture that involves interface web that was built using the JavaScript language and other library’s, leaving search part to the use of XQuery expressions submitted to the

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4 http://developer.yahoo.com/geo/placemaker/
3 http://www.xm-lmind.com/qizx/
database and using a mapping service such as Google Maps to show the location of the results.

4.2 Evolution of Low-Fidelity Prototypes (LFP)

After collecting and analyzing the data obtained from the Inquiry, we passed to a development phase concerning with low-fidelity prototypes, in order to study various ways to integrate the various aspects of the future interface. We created three versions of LFPs which are described as below.

According to data obtained in the initial study, the interface of the prototype should have the normal results list with some sort options, the map to research and explore results, a timeline to filter the results in time and category filtering news through the inclusion of your listing.

In the first version of the LFP, the top of the interface would contain the search box and the appropriate button beneath a droplist appear with the categories apear and a button next for adding more categories, appearing after the categories selected below the text box. When a user want to remove a category simply select the button "Remove" category. At the bottom of the interface the user could see the sights of the Timeline, Map, List results and how to view the content of a news story. Navigation through the various views would be done by selecting the left or the right button to bring up their views. On the left side the Timeline and map emerge, on the right side a results list and the various news that would be open, can be seen. The view of the timeline would still have filters such as the "ltimas 24h" (last 24 hours). Moving to the view of the map, the map would contain the markers appear where the news would have options for filtering by category and country. The view of the map also contains a search box locations and a droplist with various countries and the button to search, it simple have a text box of typing the name of a location. About the view of open display of content news, the buttons "ver o mapa" (see the map) and "ver noticias recentes" (see recent news) were removed, because of the way the different views are arranged, for example, the map and the view of the content news would side by side. In the results list, was added to each result, the icon of the category that is associated with the result, plus a button "find map" to animate the appropriate marker on the map.

In Figure 3 we can get an idea of the final version of the LFP. On the left side while the map view, the center we have the categories of news that can be filtered, along with the filtering options and navigate through multiple result sets. The various results of a search would be presented as follows: indicating the title, date of publication and abstract. Finally, the open view of the news content would contain news, plus a button to see the news on the map and another to see recent news. When they were open various news, these are arranged in tabs.

In the second version of the LFP, there were some changes starting with the arrangement of elements in the interface and navigation of the various views that came to be delimited. The categories would then be in the central part of the interface and selection of categories would be done differently in that category would be a selectable button. Each one of these buttons, in addition contain the name of the class would contain the icon of the category plus the number of reports of research that had associated with that category.

In this version the view of the timeline was set aside by a decision taken at meetings. In view of the map, the filtering options have been eliminated and added an option to keep your bookmarks synchronized on the map and in the results list (ie, whenever the list changes the map too, and vice versa) and one more button to synchronize with the map list when the option is disabled. The views of the results list and viewing news content remained the same patients and did not undergo major changes.

In the third version of the LFP, the arrangement of elements has not changed. In view of the map wont have the droplist containing the various countries and the button to search, it simple have a text box of typing the name of a location. About the view of open display of content news, the buttons "ver o mapa" (see the map) and "ver noticias recentes" (see recent news) were removed, because of the way the different views are arranged, for example, the map and the view of the content news would side by side. In the results list, was added to each result, the icon of the category that is associated with the result, plus a button "find map" to animate the appropriate marker on the map.

4.3 Functional Prototype Development

This section describes the framework used to support the prototype search engine and web interface development.

4.3.1 Framework Support for Search Engine Prototype. The building of the database of news was based on an information retrieval system built using an XQuery engine, namely Qizx\(^4\). This system supports indexing textual content and search for keywords based on the standard XQuery Full-text\(^5\). To populate the database, we used a collection of Reuters news, namely RCV1 [Rose et al. 2002] which contains metadata relating to the publication date and the geographical context of the news\(^6\) items. However, this collection does not contain the metadata for the geographic information in the form of geospatial coordinates. For geographic information we use the Yahoo! Placemaker\(^7\) web service, more precisely a function provided by the service called location-xml. This function takes the name of the location associated with a news and returns an xml file that contains the corresponding geographic coordinates that are then added to the collection of data, and ultimately a update the database with georeferenced information. With the georeferenced database built, we used a Tomcat server to allow the connection between the database and the web interface.

4.3.2 Web Interface Prototype. Having created the database, creating the web interface was the next step, using Javascript language. The construction of the prototype interface was based on the JavaScript files used in a work already studied, namely the Koru [Milne et al. 2007] system.

The general appearance of the interface when it was decided that studied the LFP’s, is divided into four sections:

- At the top of the text box will search for the keywords and their search submit button.
- In the bottom left will be the map view.
- In the central part will be the list of categories.
- At the bottom right, will the results list and view the textual content of the results.

The mode of operation of the Web Interface is similar to that which is used in the interfaces of common search engines like Google and Bing, and an related work as such a Koru [Milne et al. 2007] or Visgets [Drk et al. 2008] when performing a normal search keywords or regions on the map. There is however certain aspects of the Web interface of the prototype in the way it works is different from normal search engines and other related work. The first differentiating aspect has to do with the perception that you can have in terms of geographical distribution of news on the map, they are immediately displayed when the user first accesses the Web interface, as seen in the area bounded by a rectangle red in Figure 4 (letter A). The user also has the ability to see the listing of the first 250 news found in the database (the area bounded by a yellow rectangle in Figure 4 with letter B) as well as information on the number of existing news categories (area bounded by a blue rectangle in Figure 4 with letter C), not forgetting the normal search box (area bounded by a black rectangle in Figure 4 with letter D).

Another aspect, if not the main one, is related to the fact that it is possible to search for keywords getting the normal list of results and simultaneously see the geographical distribution in the map, or do a search for regions seeing the results in the map and at the same time get a list of results. Regarding the visualization of a content result, it is open a new tab that displays the title, the name of the location, date of publication and content. What was said before is for users who want to simultaneously view the results of a search in a list and a map. The user, after performing an initial search by keywords or by region, can perform each
Fig. 4. The user interface of the prototype system.

individual type of search, i.e., the user can search by keywords and see only the results in the list or see the results only the map, just by disabling the option "Synchronized". With this option disabled, the user can perform further searches without losing the context both geographically and results list. However, if a marker has more than 5 is associated with results given the option to "List all news" that allows the user to list all the results in the results list to see all results. At any time, if user wish so, he can re-activate the "Synchronized" to return to see changes to the results in the map and in the list of results at same time.

Finally we have the list of categories that is at the center of the interface. The categories are represented by buttons, allowing the user to check every time the categories that are included in the searches. Initially all categories are green indicating that will be included in searches. The user can select a category when he wants, implying that will change color to gray to indicate that it is excluded from the results. Each button in addition to the category name, the button have the number of results associated with that category and the image associated with it. It is possible to view information from the corresponding marker on the map of a result. By clicking on the maker an information bubble appears containing all the images associated with the categories and the title of the news, so that user can maintain a logical connection with the category.

5. EVALUATION

This section describes the validation procedure used to determine if the use of the map along with text search allows users to find the desired information faster than without the map.

5.1 Validation Procedure

For the validation of the work was necessary to create tasks to be performed by users, and a final inquiry to gather their opinions. With the tasks and the questionnaire ready, was necessary to carry out pilot tests to see if there were no problems in solving the tasks and responding the inquiry, before performing the tests with more users.

Finally, tests were conducted with users and the test sessions corresponded to three parts:

- In the first part we gave a short explanation about our prototype and then we allowed users to freely experiment during 5 minutes.
- In the second part users performed tasks to test the interface.
- In the third part the users answered a satisfaction questionnaire.

The tasks correspond to four questions (written in English) in which users need to use the system to find the answers. The questions were as follows:

- How old were the two male players who died during the games of the 1996 rugby league?
- According to the collection of news stories, where did we have more crime occurrences?
- Find two sports events that occurred in the city of London, early in 1996.
- Tell the names of six Iberian soccer teams from the first league (three from each country) that played in the 1997 championship.

To perform the tasks, we invited 14 users who were divided into two groups, one group of 7 users accomplish tasks (equal in both cases) without recourse to the map and the other 7 using a map (both groups were constituted for 2 girls and 5 boys). The numbers of users were "divided" in this way to try to see whether the inclusion of a map in a search system helps or not to decrease the time it takes a user to find the information that they want. The environment were the tests took place was the Instituto Superior Tecnico, in TagusPark, was consistently used the same computer with local database and interface web, and all users performed the tasks in the same order (T1 to T4). During the execution of a task, if an user can not find the correct answer within the time limit of seven minutes, the task is given as not completed, and recorded the time when the user found the right answer in time. Finally, the user answered to a satisfaction questionnaire.
and the not inclusion of maps in the searches, affect very much the response times.

Through the analysis of users responses to the questionnaire of satisfaction, it is possible to verifying that the original objectives have been achieved. According to the results of the questionnaire, users liked the features that the system provided (the case of map, text search box, sorting options, filtering news categories) to conduct search, which indicates that the objective Development of mechanisms for specifying research questions, using maps and traditional forms, has been reached. In the same way, when users were asked about if the features available are sufficient to present the results, the majority said yes, leading to the conclusion that the second objective proposed Development of mechanisms for reporting, using maps and ordered list of results, were also reached. Regarding the web interface and how the various elements was prepared, the majority of users liked, which was concluding that the objective Development of a Web interface combining the mechanisms of specification of queries and presentation of research results, was reached. Finally, taking into account the opinions that users gave in the questionnaire, they liked the way the system worked, its simplicity and ease of use, shows that the last objective initially proposed was also reached, Evaluation of user interface developed in terms of its usability.

Given that all objectives were achieved, it can be concluded that the development of the prototype was successful.

6. CONCLUSIONS

This section presents a description of the main conclusions and possible ways to future work.

6.1 Final Conclusions

The main contributions that this work had, came from work on Vis-Gets [Drk et al. 2009; Drk et al. 2008; Dörk 2008] and Koru [Milne et al. 2007] systems. The way Kore system allows the exploration of results, according to several panels for the results list and viewing the contents of the tab-results, influenced the way the news system developed within this work that we presented, allows the exploration and visualization and the way the various interface elements were arranged. In relation to the VisGets system, the fact that this allows a synchronized presentation from the map results and the list of results, influenced the decision to allow viewing of the results of the system developed in this work, in a synchronized way but also give the possibility of disable the synchronization. The main conclusion to be drawn has to do with the fact that the objectives proposed in the early development of the system were achieved. It was possible to confirm that the inclusion of the map in full-text search, in general helps users to quickly obtain the information they want. The inclusion of the map also allows you to have a better sense of the geographical distribution of the results and together with the filtering categories of news (and other features of the system), allows to perform more restrict searches which implies significantly reduce the number of results. Finally one can conclude that the final look of the interface is simple and easy to use, it also helps the user when he carries out his research.
6.2 Future Work

A first way into the future work relates to the fact that the possibility of introducing the functionality of the Timeline in the developed system. The introduction of Timeline would be an asset as it would explore the temporal component of a search of news, giving the user great flexibility in defining the appropriate timing of the news. A Timeline would display the amount of news per day, month, year and decade, giving the user a perception of the temporal distribution of news. The definition of appropriate timing of the news could be done by choosing several days a month, they could not all be followed, applying the same concept in the choice of months, years and decades.

Another possible route has to do with the use of the updated databases. With the necessary adjustments would be possible to use the system developed to search for news of the actuality, giving users a good tool when it comes to conducting searches related news with location specifically (in terms of cities, towns, etc.) or more general (the level of countries or continents).

The fact that the system enable synchronized operation of the results list and the map gives an indication of the another way for future work, the possibility to choose the database in the system. It would be possible to exploit research results on the map and the list of results separately, using a different database on the search on the map without affecting the results of the list that belong to another database.

REFERENCES


