The Role of Artificial Intelligence Technologies in the Implementation of People-Finder Knowledge Management Systems

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Abstract

The development of Knowledge Management Systems (KMS) demands that knowledge be obtained, shared, and regulated by individuals and knowledge-sharing organizational systems such as Knowledge Repositories. One kind of Knowledge Repository, known as Knowledge Yellow Pages or People-Finder Systems, are repositories that attempt to manage knowledge by pointing to experts possessing specific knowledge within an organization. This paper presents the insights, challenges and future plans for the development of two People-Finder KMS: the Searchable Answer Generating Environment (SAGE), and the Expert Seeker. Here we also discuss the role that Artificial Intelligence technologies play in the development of People-Finder KMS and in automating the profile-maintenance.

Introduction to Knowledge Management Systems

Knowledge Management Systems (KMS) have been defined as "an emerging line of systems [which] target professional and managerial activities by focusing on creating, gathering, organizing, and disseminating an organization's 'knowledge' as opposed to 'information' or 'data'" (Alavi and Leidner 1999). It has been observed that KMS currently underway at most organizations fall into three categories (Becerra-Fernandez 1999a):

1. Educational KMS: To elicit and catalog tacit knowledge, and at the same time serve as an educational tool.
2. Problem-Solving KMS: Organizations with significant intellectual capital require eliciting and capturing knowledge for reuse in solving new problems as well as recurring old problems.
3. Knowledge Repositories: The majority of the KMS in place. One kind of Knowledge Repository is known as Knowledge Yellow Pages or People-Finder Systems, are repositories that attempt to manage knowledge by holding pointers to experts who possess specific knowledge within an organization.

The paper presents insights from the development of two examples of such People-Finder KMS: the Searchable Answer Generating Environment (SAGE), and the Expert Seeker. This paper discusses insights and lessons learned from the development of these two systems. Finally, it presents the role of technology in automating the process of profile-maintenance, as well as future plans for the integration of Artificial Intelligence technologies in the development of People-Finder KMS.

The Searchable Answer Generating Environment (SAGE) KMS

The NASA/Florida Minority Institution Entrepreneurial Partnership (FMIEP) grant is funding the development of the Searchable Answer Generated Environment (SAGE), which is in the category of People-Finder KMS (Becerra-Fernandez 1999b). The purpose of this KM System is to create a repository of experts in the State of Florida (FL) State University System (SUS). Previous studies have pointed out that there is a void in the ability to identify the capabilities in the FL SUS (Kotnour 1998). Currently, each State University in Florida keeps a database of funded research, but these databases are disparate and dissimilar. The SAGE KM System creates a single repository by incorporating a distributed database scheme, which can be searched by a variety of fields, including research topic, investigator name, funding agency or university. As NASA-Kennedy Space Center (KSC) looks to develop new technologies necessary for the continuation of their space exploration missions, their need to partner with Florida SUS experts becomes evident.

The main interfaces developed on the query engine use text fields to search the processed data for key words, fields of expertise, names, or other applicable search fields. The application processes the end user's query and returns the pertinent information. The purpose of the SAGE KMS is to unify myriad data collections into one database collection that could easily be mined for relevant data. The benefits of SAGE are:

1. SAGE is a repository of Intellectual Capital within the state of FL SUS.
2. SAGE helps locate FL SUS researchers for collaboration with industry and federal agencies, thus increasing the potential for research funding to the SUS.
3. SAGE enhances communication and allows more visibility for FL SUS experts, making universities more marketable.
4. SAGE combines and unifies existing data from multiple sources into one user web-accessible interface.

The SAGE system addresses an important KM problem:

giving a user access to distributed knowledge, through a web-based Graphical User Interface.

The Technologies to Implement SAGE

The development of SAGE was marked by two design requirements: the need to validate the data used to identify the experts, and at the same time minimize the impact of each of the universities' offices of sponsored research, who collect most of the required data. For this reason, we opted for taking the data structure in its native form and making necessary data cleansing at the SAGE server site. SAGE's strength rests in the fact that is built upon a criterion that is recognized as a valid indicator of expertise, actual funded-research grants received.

Although a number of database systems exist on the world-wide-web, which claim to help you find people with a defined profile, most of these tools rely on people to self-assess their skill against a predefined set of keywords. Self-assessment is inherently unreliable, and the results could be biased and hard to normalize. On the other hand, while a number of search engines are available on the web, the entity seeking for an expert has to use a combination of different tools in order to get find the appropriate information. With SAGE, all the information is easily accessible due to the versatility of its searching options, which allow you to refine the search until you get the degree of accuracy required.

SAGE is built upon the integration of the following technologies

1. Cold Fusion™ – An off-the-shelf Rapid and Integrated Development Environment.
2. Open Database Connectivity (ODBC) – allows middle-ware to interface with the database.
3. Verity's Search 97 – used to perform the Keyword search. It also allows the use of logic operators, which enhances the power of the search engine.

SAGE is online since August 16, 1999 at http://sage.fiu.edu.

One of the technical challenges faced during the design and implementation of this project was the fact that the source databases of funded research from the various universities were dissimilar in design and file format. Manipulating the data included the process of cleansing the data, followed by the data transformation into the relational model, and ultimately the databases migration to a consistent format (in this case SQL Server 7.0). One of the most important research contributions of SAGE is the merging of inter-organizational database systems through the use of correspondence tables, which function much like array pointers, and allow compliance to differing database formats. Future developments for SAGE include the development of algorithms that will facilitate the maintenance of SAGE.

The Expert Seeker KMS

The NASA Faculty Awards for Research (FAR) is funding the development of Expert Seeker, which is in the category of People-Finder KMS. Previous Knowledge Management studies at KSC affirm the need for a center wide repository, which will provide KSC with Intranet-based access to experts with specific backgrounds. Currently KSC is reorganizing from an operations center into a research and development center. Expert Seeker aims to help locate intellectual capital within NASA-KSC, and is this particular characteristic what differentiates Expert Seeker from SAGE (the latter a KMS to find experts within the Florida universities). Expert Seeker will be used to search for experts located at KSC, although its use is expected to expand to other NASA Centers. The Expert Seeker KMS will be accessed via KSC's Intranet, in contrast the SAGE KMS which is on the world-wide-web is accessible through the Internet. Another important difference between SAGE and Expert Seeker is that the latter will enable the user to search for much more detailed information regarding the experts' achievements, including information such as intellectual property, skills and competencies, as well as the proeficiency level for each of the skills and competencies. The Expert Seeker KMS will provide access to competencies available within the organization, including items that are not typically captured by the typical Human Resource applications, such as completed past projects, patents, hobbies, and other relevant knowledge. This People-Finder KMS will be especially useful when organizing cross-functional teams.

The main interfaces on the query engine in Expert Seeker will use text fields to search the proposed data for keywords, fields of expertise, names or other applicable search fields. Expert Seeker will allow KSC experts more visibility, and at the same time allow interested parties to identify available expertise within KSC.

The Technologies to Implement Expert Seeker

The development of Expert Seeker requires the utilization of existing data as much as possible. Expert Seeker will use the data in existing Human Resources databases for information such as employee's formal educational background, the X.500 Directory for the employee point-of-contact information, a Skills Database which profiles each employee's competency areas, and GPES, an employee performance evaluation system.

Information regarding skills and competencies, as well as proficiency levels for the skills and competencies needs to be collected, to a large extent, through self-assessment. Recognizing that there are significant shortcomings of self-assessment, we propose to use an increased reliance in technology to update employees' profiles, and thus place less reliance on self-assessed data. For example, we're proposing the use of Global Performance Evaluation System (GPES), an in-house performance evaluation tool,

to mine employees' accomplishments and automatically update their profiles. Typically, employees find it difficult to make time to keep their resumes updated. Performance evaluations, on the other hand, are without a doubt, part of everybody's job. We therefore seek to use this tool, augmented with appropriate queries, to inconspicuously keep the employees profiles up-to-date. Finally, a data mining effort of the document repository will also contribute to update employees' profiles. Based on the assumption that authors of documents in the repository are subject matter experts, therefore, mining the electronic document repository will contribute to keeping employees' profiles up-to-date in an unobtrusive way.

The Role of AI in People-Finder KMS

Future developments for People-Finder systems such as SAGE and Expert Seeker include the development and integration of artificial intelligence (AI) technologies to enhance the capabilities of these systems. For example, data mining could enhance the process of updating profiles by mining the authors of documents in an electronic repository and identifying a correspondence with the topic of the document. Authors of documents in an electronic repository are experts in those knowledge areas; therefore, the profile of the contributors to the repository could be automatically updated with keywords related to the subject matter contribution. This data mining effort would result in a diminished reliance on self-assessment.

Furthermore, a data mining effort could be instrumental in clustering similar data objects together. For example, the data in SAGE is organized by grant awards and indexed by the Principal Investigator (PI) field. Through the use of a clustering tool (Mehrotra, Alvarado, and Wainwright 1999), data can be grouped into clusters of expertise, to reveal expertise areas that may not be currently defined. The implementation of the clustering technology will create a domain dictionary that will serve to increase the semantic domain of the keyword. In this fashion, relationships that may not be necessarily obvious may be identified also – a sort of "fuzzy matching." The resulting "pseudo-keywords" may be saved for future re-use.

Another application of this clustering notion is the development of a "super" concept, which would allow to group experts together, developing a group-level of expertise. In the case of SAGE, grouping of researchers with completing areas of research from universities in the Florida State University System would result in virtual "centers of excellence". This effort could reveal areas of strength that could otherwise go unnoticed in the organization. Additional developments in this area will be instrumental in the development of organizational training programs, designed to address the gap between what "is known" and what "needs-to-be-known".

In conclusion, our vision of People-Finder KMS fits well with the work to develop systems that seek to create an IT-support environment for knowledge workers. This is done through the use of intelligent assistants in a business process environment; keeping in mind that "an IT tool may only act as a facilitator for sharing, creating or retrieving knowledge, but never as a key player in creating, evaluating or contributing knowledge" (Schurr, Sttab, and Studer 1999).

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