

# OPEMS: Online Peer-to-Peer Expertise Matching System

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**Abstract** -Internet is a vital source to disseminate and share information to the masses. This has made information available in abundance on the Web. However, finding relevant information is difficult if not impossible. This difficulty is bilateral between information providers and seekers in terms of information presentation and accessibility respectively. This paper proposed an online Peer-to-Peer Expertise Matching system. The approach provides a highly scalable and self-organizing system and helps individuals in presenting and accessing the information in a consistent format on the Web. This makes the sharing of information among the autonomous organizations successful.

**Keywords:** Expertise matching; Information retrieval; Semantic heterogeneity; Ontology.

## I. INTRODUCTION

Internet is a vital source to disseminate and share information to the masses. This has made information available in abundance on the Web. Obtaining relevant information is difficult because the individuals who are publishing and/or acquiring the information are not adopting a systematic way through which explicit and to the point information can be published and/or acquired.

Moreover, access to information only is not sufficient, as individuals often need to communicate with each other in order to find more important information for solving problems that cannot be obtained from an explicit documentation [1]. Hence, we need to find the right person whose assistance can really help us in solving our problems. Expertise matching is the process of finding an individual with the required knowledge and skills. Expertise is having, involving or displaying special skills or knowledge derived from training or experience [1]. The expertise matching results in the list of experts.

This system will help the experts to publish their information and technical qualities to share information with the seekers. The goal of information sharing is to provide common access to existing information sources rather than having to re-create new information sources

and systems to handle them [3]. The major scope of this system is within academia but this is not the end of the world, the system can be expanded to other organizations based on their own domain requirements. One example can be of employees' recruitment in an organization i.e. matching employees profile with the requirements of the job.

The rest of the paper is organized as follows. The problems are described in Section 2. Section 3 describes related work and identifies their limitations. The proposed architecture for the Online Peer-to-Peer Expertise matching system is presented in Section 4. Section 5 presents the implementation details and Section 6 concludes the paper.

## II. PROBLEM DESCRIPTION

The objective of expertise matching system is to disseminate and share information with other individuals who are in need to access the information. The first issue is presenting and publishing information in an appropriate way in the web-pages and to maintain them up-to-date. This requires that individuals should acquire the technical skills for creating and maintaining web-pages. Hence, it is not possible for every expert to acquire such skills in the real world.

Secondly, experts may express their expertise in various keywords because each expert is autonomous and this will give rise to *semantic heterogeneity*. Semantic Heterogeneity refers to differences or similarities in the meaning of data [4]. Experts might use different keywords for the same skill or knowledge area. For example, two schema elements or attributes in two local data sources can have different names but refer to same concept or same intended meaning i.e. synonyms. For example, author of a book and writer of a book, both correspond to same concept. Alternatively, considering the same scenario as mentioned above with some alteration that attributes having same names but refer to different concepts i.e. homonyms. For example, 'cost' can correspond to manufacturing cost in one domain and

selling price in another domain. If domains are unknown the meaning remains ambiguous. Semantics is the interpretations of people attribute to data (i.e. relating data to what they represent) according to their understanding of the world. Though the data is present in the data sources but the different interpretation makes the information retrieval unsuccessful.

Syntactic heterogeneity can also occur in expertise matching system. This refers to incompatibility in data models, data manipulation languages, hardware and software platforms, communication protocols and so on [2]. However, syntactic heterogeneity is not difficult to resolve since most of the syntactic issues are based on well defined agreed upon infrastructures.

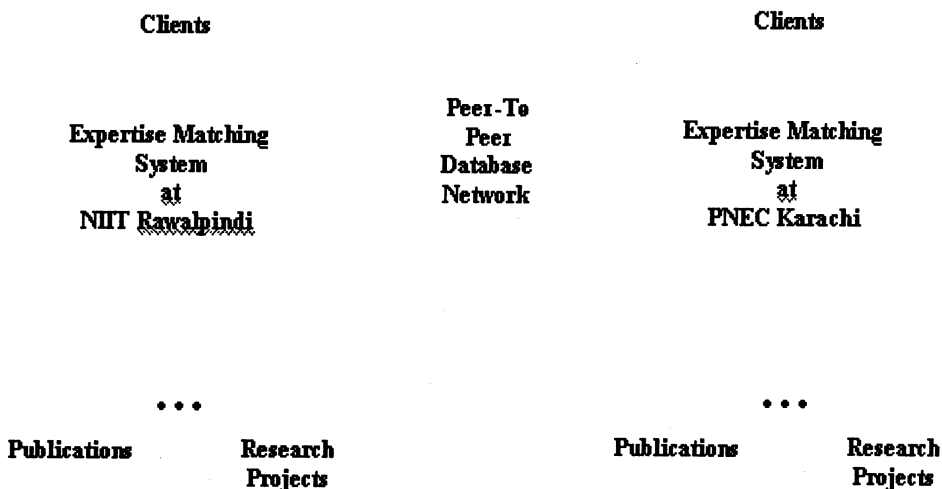
### III. RELATED WORK

Some of the existing expertise matching systems [5, 6] are performing keyword-based search, while others [7, 8] are searching experts on ontology-based. [1] is using a hybrid approach i.e. the combination of both keyword-based and ontology-based in the expertise matching system. The existing systems are neither decentralized nor

web-based. The existing approaches restrict the scalability and the accessibility of an expertise matching system to only one organization. In this paper, we extend [1] approach to a decentralized and web-based approach in order to enhance the scalability and accessibility of the system from one organization to various autonomous organizations.

### IV. THE PROPOSED EXPERTISE MATCHING SYSTEM

In this section, we have proposed OPEMS: an online peer-to-peer (P2P) architecture (Figure 1) for expertise matching system, designed to address the issues associated with current approaches. The primary objective of the online P2P expertise matching system is to build a decentralized Internet-scale distributed system for matching experts on the Web. The system is aimed to be highly scalable, self-organizing and robust way of matching experts. Finally, the system will make sharing of information successfully among the autonomous organizations.



**Figure 1:** Online Peer-to-Peer Expertise Matching System

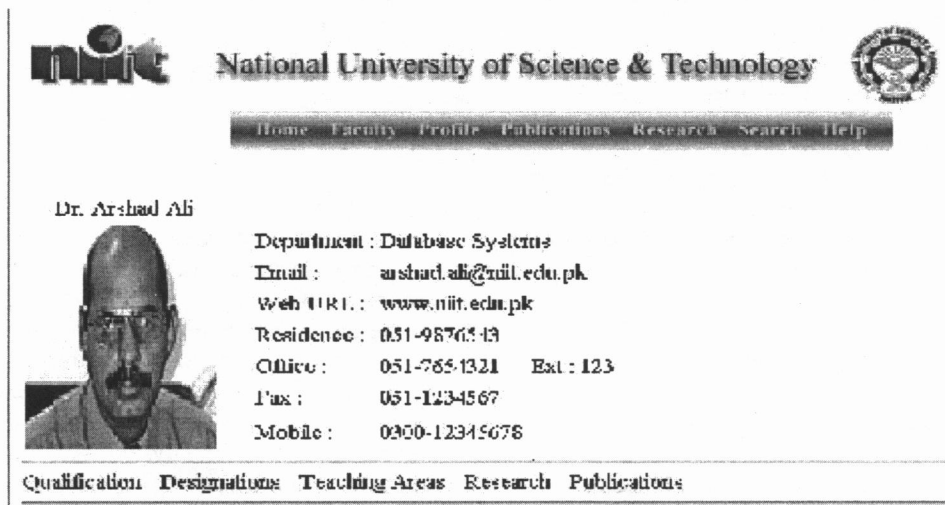
In addition, the system will enable the experts to publish their information and expertise without having technical skills. They will simply fill a web-based form and the information will be displayed on the dynamically generated web page in the system. Further flexibility of the system is to update their information in the web pages from anywhere at anytime. Likewise, the

users can also access the system from anywhere at anytime. Consequently their time will be saved.

## V. OPEMS PROTOTYPE

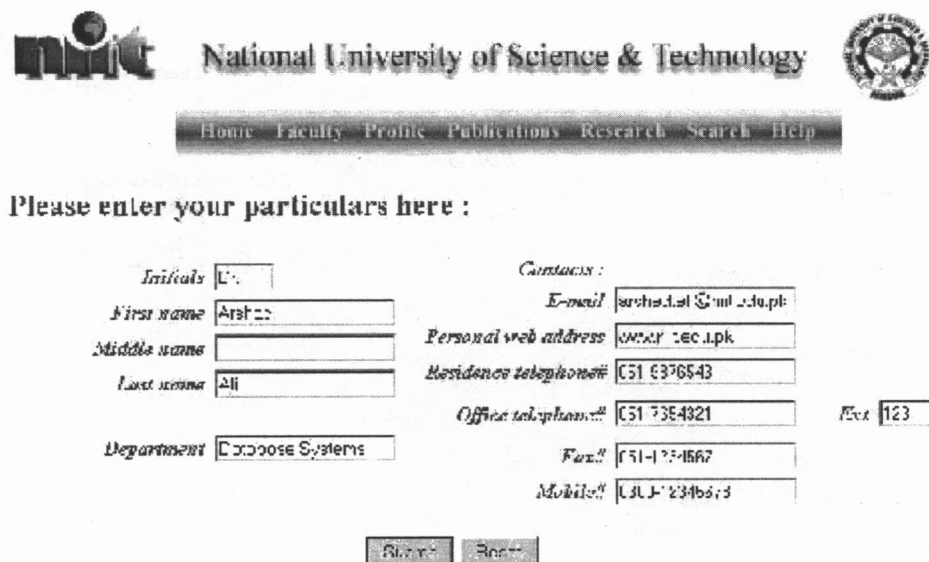
Incremental strategy has been adopted for the development of the Online Peer-to-Peer Expertise matching system. An OPEMS peer is

designed as a three tier model: clients, a web server and data sources.



The image shows a web page for Dr. Arshad Ali at the National University of Science & Technology (NUST). The page includes a header with the NUST logo and navigation links: Home, Faculty, Profile, Publications, Research, Search, Help. A profile picture of Dr. Arshad Ali is displayed on the left. To the right of the photo, his contact information is listed: Department: Database Systems, Email: arshad.ali@nust.edu.pk, Web URL: www.nust.edu.pk, Residence: 051-9876543, Office: 051-7354321 Ext: 123, Fax: 051-1234567, Mobile: 0300-1234567. Below this information, there are tabs for Qualification, Designations, Teaching Areas, Research, and Publications.

Figure 2: Expert Profile Web-page



The image shows an online information entry form for the NUST Institute of Information Technology. The form has a header with the NUST logo and navigation links: Home, Faculty, Profile, Publications, Research, Search, Help. Below the header, there is a section titled "Please enter your particulars here :". The form contains several input fields for personal and contact information: Initials (C), First name (Arshad), Middle name, Last name (Ali), Department (Database Systems), Contact (Arshad Ali), E-mail (arshad.ali@nust.edu.pk), Personal web address (www.nust.edu.pk), Residence telephone (051 9876543), Office telephone (051 7354321), Fax (051 1234567), and Mobile (0300-1234567). There are also buttons for "Save" and "Reset".

Figure 3: Online Information Entry Form

The OPEMS has been implemented at NUST Institute of Information Technology (NIIT), Rawalpindi, Pakistan. Currently, the server in a peer comprises of two major modules i.e. *Servlet Engine* and *JDBC Mediator*. JAVA Servlet Engine is used to execute the client's request and respond back to the client through HTML, as shown in Figure 2 & 3. While JDBC

Mediator performs data transactions with the database i.e. collect expert data from the database and pass it to the JAVA Servlet Engine for further processing or store data passed by the JAVA Servlet Engine into the database.

*Ontologies* is a promising approach to semantic heterogeneity [3]. It makes the information semantics explicit. The modules in

the peer for the development of *ontologies* with Resource Description Framework (RDF) and connectivity among the peers are in progress.

## VI. CONCLUSION AND FUTURE WORK

Today Internet reduces the gap of communication. Students search experts in universities for their higher studies. The current OPEMS helps experts to publish their expertise through web-pages and students to easily obtain the relevant information. We are enhancing the OPEMS to communicate among various autonomous organizations in order to share their information.

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