EXPERT PROFILE DATABASE

for Computer and Information Sciences Department,

UTP

by

Ahmad Abeed Mohd Lotfy

(6852)

BUSINESS INFORMATION SYSTEM

Dissertation submitted in partial fulfillment of

the requirements for the

Bachelor of Technology (Hons)

(Business Information System)

JULY 2008

Universiti Teknologi PETRONAS

Bandar Seri Iskandar

31750 Tronoh

Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

EXPERT PROFILE DATABASE for Computer and Information Sciences Department, UTP

By

Ahmad Abeed Mohd Lotfy

A project dissertation submitted to the
Computer and Information Sciences Programme
Universiti Teknologi PETRONAS
in partial fulfillment of the requirement for the
BACHELOR OF TECHNOLOGY (Hons)
(BUSINESS INFORMATION SYSTEM)

Approved by,

_____
Mazeyanti Mohd Ariffin

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
July 2008

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

_____

AHMAD ABEED MOHD LOTFY

ABSTRACT

This report basically discusses the research and progress that has been done regarding the development of an **Expert Profile Database** (EPD) system. This mainly consists of details of the construction of the front end as well as the backend of the system. The targeted research area is within Universiti Teknologi PETRONAS (UTP). After sufficient data and information collection during the part 1 (FYP 1), part 2 (FYP 2) will focus on the construction of the system; front end as well as back end.

As mentioned in part 1 of the project, an open-source website will serve as the front end of the system and a database for the backend. The layout (front end) being fully modified, has been successfully completed during a period of one (1) to two (2) months. Concurrently, the functionalities of the backend of the system are ongoing and will proceed for the next month.

The results obtained through questionnaires and interviews during FYP 1 were the main references for the construction of the EPD's content. Besides obtaining data and information on the user requirements, the questionnaire also returned information on currently available systems used within UTP or CIS. The selection of the front end and back end of the EPD system and why it has been selected will also be discussed in this report. Mock data will be used replacing the information from the lecturer's profile from the LAN documents due to its inaccessibility.

ACKNOWLEDGEMENT

Alhamdulillah, praise to Allah S.W.T, with His blessing, I have successfully been able to complete my Final Year Project, thus completing my studies at Universiti Teknologi PETRONAS after four and a half years.

I would like to express my gratitude towards my FYP supervisor, Mrs. Mazeyanti Mohd Ariffin, who has played a crucial role in assisting me with any issues that arise during my project completion. She has helped me a lot for both semesters and supported me in completing my project smooth.

I would also like to thank the staffs of the Computer and Information Sciences department, who have assisted me in many ways, directly and indirectly.

Much thanks as well to my family and friends who have continuously encouraged me and supported me in completing my final year project.

LIST OF FIGURES

TABLE OF CONTENT

ABBREVIATION AND NOMENCLATURES

KM	Knowledge Management
UTP	Universiti Teknologi PETRONAS
CIS	Computer and Information Sciences
KMS	Knowledge Management System
EPD	Expert Profile Database
LAN	Lembaga Akriditasi Negara
COS	Community of Sciences
REO	Research Enterprise Office

CHAPTER 4 RESULTS AND DISCUSSION

CHAPTER 5 CONCLUSION

CHAPTER 1
INTRODUCTION

1. 1 Knowledge Management and Malaysia

Knowledge Management (KM) is actually the culture of a certain community, while most mistaken it about technology or reengineering. This includes identifying important information or knowledge, creating new information from that information or knowledge, sharing it with others in the organization and preserving it. A good example is Lesson Learned Review (LLR). Identifying the good and bad consequences of a certain project and learning from those consequences. It is then shared among a certain group of similar interest or area. After solutions or steps to improve those consequences are discussed, the discussion perhaps will then be stored in video or audio form. This would be used for references in the future.

For Malaysia, during the country's administration under the fourth Prime Minister (PM), Tun Dr. Mahathir Mohamad, KM and the importance of it, was introduced. Woods mentioned the PM highlighted the need to transform the economy towards a knowledge-based economy (Peter Woods, 2005). This was part of the PM's initiative in moving Malaysia from an Industry-based nation; production and in export and import business, to a Knowledge-based nation; the application of knowledge management within the development of organization's corporate strategy, according to Dr. Raja Suzana of UiTM.

Slowly, Malaysian companies began to adopt several approaches in promoting KM in their organizations. Some 'imported' KM applications through the Multinational Companies (MNC) (such as HP, Microsoft, etc.) said Woods. In Malaysia's public organizations, Knowledge was available in the Ministry's procedures and policies, job manual procedures, ISO 9002, desk file, workflow and databases (Rowland F. *et* al, 2004). In Malaysia's Public Higher Institutions, we found that the existence of Knowledge Sharing Culture is still very low. (Suhaimee S. *et al*, 2006) .

As quoted from Tun Dr. Mahathir Mohamad, it is essential for Malaysia to be a Knowledge-based country in order to achieve Vision 2020. Ignoring the importance of it will cause the nation to be left behind development-wise.

In order to assist us Knowledge Workers in shifting towards a Knowledge-based country, KM Systems (KMS) must be utilized, guided by a variety of KM mechanisms and technologies. KMS is the integration of technologies and mechanisms to support KM processes (Becerra-Fernandez I. *et al,* 2004). KMS are categorized into four kinds; Knowledge Discovery Systems, Knowledge Capture Systems, Knowledge Sharing Systems and Knowledge Application Systems (Beccerra-Fernandez I. *et al,* 2004). However, for this particular project, the EPD system is a Knowledge Sharing System only and we will be discussing more on this.

1. 2 Expert Profile Systems

Since the introduction of knowledge management, many methods have been thought of in order to preserve the needed information and knowledge, especially relating to experts as they obtain valuable knowledge. Kai Romhardt from the University of Geneva mentioned that the organizational memory is the crucial point of reference for new experiences: without memory, learning is impossible (Kai Romhardt, 1997). This justifies the need of such KMS in order for following generations to continue learning.

The Expert Profile Database is meant for the storage details of experts identified within the university while at the same time function as a repository for their research work in documentation form. These are mostly kept in non-editable form such as in pdf form. The documents uploaded will first be screened by administrators and experts (editor of document) for permission before releasing the document onto the system. Documents such as research papers are those which have been approved and presented earlier in any conference or seminars.

1.3 Problem Statement

The geographical area of study will be conducted within Computer and Information Sciences, UTP. For this particular project, some challenges have been identified:

- The incompleteness of data and information of experts available in current KMS (UTP website only).
- Information and knowledge of experts not structured.
- Advertising of experts available in UTP is lacking; not enough details relating to area of profession released to public and even occupants of UTP itself.
    - o Students having difficulty in identifying relevant lecturers to approach for certain area of study. An example would be during Final Year Project.
- Lack of sharing expertise among staff.

3

Figure 1: Sample of expert details from UTP website

In this project, the details linking to each expert will be properly identified and be constructed in a more structured manner, thus improving the staff/ expert directory. This will bring to the ease of other researcher on who to refer to in certain subject matter.

1.4 Project objectives

The main objective of this project is to:

- Categorization of every detail and information obtained on experts available.
- Construction of a virtual database for storing the structured information of all SMEs with a proper user interface (front end) for easy viewing and retrieval by targeted users; researcher, lecturers and students.
- Promote information sharing among staff and students within campus.

In order for completing these tasks, an existing profile database will be taken as references. This expert profile database contains information of its staff structured in individual profiles. Among attributes of this information are name, position, organization, department/ division, primary areas, expertise, contact details, publications and many others.

1.5 Scope of Study

The study conducted and that will proceed for the next few months will cover:

1. The existence of currently available applications or repository storing information of experts and measuring the extent of usage and its effectiveness towards users.
2. The construction of the actual EPD system.
   i. Identification of open-source tools to be utilized for development of front-end of EPD system; Joomla© Open Source.
   ii. Identification and selection of appropriate components and modules for utilization in system, meeting user requirements as much as possible.
   iii. Modification of front-end layout using available templates complete with graphical advertising.
   iv. Constructing expert profiles using mock data; solution to past issue of obtaining real data from CIS department's LAN documents due to confidentiality.
3. Testing and modifications of EPD system.

For this particular project, several tools have been identified appropriate in the construction of both the front-end and the back-end of the EPD system. Primarily, being a database, the main tool selected was of a repository software; phpMyAdmin and mySQL. This software would cater as the back-end of the EPD system, acting as a repository storing all necessary information and content of the whole database. The language used would be Sequel Statements or SQL. For the front-end, an open-source software has been adopted; Joomla© open source.

CHAPTER 2

LITERATURE REVIEW

2.1 Knowledge Management

KM is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving and sharing all of an enterprise's information assets. The locations of knowledge are usually in various places. These assets may include databases, documents, policies and previously uncaptured expertise and experience in individual workers (Gartner, 1998). These are divided into tacit and explicit knowledge.

Knowledge can be held in people's heads (tacit knowledge) such as experience and skills of a person or it can be written down (explicit knowledge) such as articles and books. It is not possible to capture the full richness of what's in people's heads. On the other hand explicit knowledge can be stored and searched, and can be a good catalyst for connecting people together. Then, questioning can bring out the tacit knowledge (Collison and Parcell, 2001).

Various companies have already begun adopting KM in their "practices". For a consulting firm in Europe called Arthur D Little (ADL), a pilot project with Lotus Notes in 1995/96 "led to the realization that the computer system was but one element in a broad initiative to maximize the potential of our knowledge resources. In addition to the hardware/software, we had to concern ourselves with issues of content, culture, and process." Their core concept of knowledge management comprised of two essential domains: (1) The definition of the individual steps necessary to develop and maintain the knowledge base. (2) The description of the roles required to be filled by the participants of knowledge management" (Mertins *et. al,* 2001) or the subject matter experts (SMEs).

The targeted experts for this particular project are the lecturers. The reason for this is that in an academic institution such as UTP, the lecturers are the academicians and the people with most important information and knowledge. They bring an important role towards the credibility of the institute represented and the quality of students produced by that particular institute.

In trying to most effectively implement KM it is tempting to begin by simply introducing system-wide technological solution (Peter Smith, 2003). The application of KM is crucial and is usually implemented through the assistance of KMS. Bear in mind that KM is not technology but it is only assisted by technology. An example would be Expert Networks which uses videoconferencing or could even be supported via e-mail and slightly more complex discussion lists on company intranets; BPX (British Petroleum's exploration unit) is able to tie together networks of experts. (Fred Nickols, 2000).

2.2 Expert Management Applications

As far as this project is concerned, the outcome would produce a KM application; Knowledge Sharing System, storing information of experts such as those of taken from http://expertguide.com.au or http://www.findanexpert.unimelb.edu.au/; a database containing a profile of its expert's / staff's profession background only.

After some research, several sites have been identified in using the similar concept of centrally storing the information of their staff or experts in a single repository. For example, University of Melbourne has a section in its website called 'Find an Expert' which contains information of all of its staff and lecturers. This information is organized according to department or school. Each profile contains the general contact details of the individual while other information such as their biography, expertise and linkages, awards and qualifications, publications and research classifications are separated according to tabs (refer Figure 2).

Figure 2: Sample of expert database from Melbourne University

Another site; http://expertise.cos.com/ is the quite similar KMS such as EPD system. The research site called Community of Sciences (COS) implements this expertise database as an initiative for KM. It is a premier leading global resource for 'hard-to-find' information critical to scientific research and other projects across all disciplines.
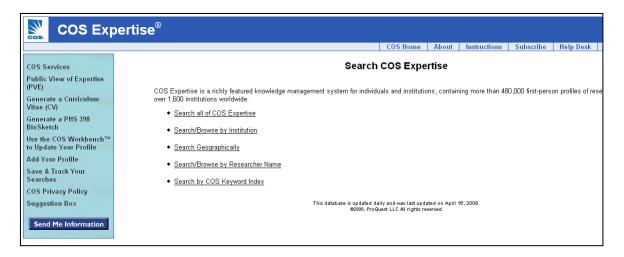

Figure 3: Community of Sciences (COS) expertise

COS Expertise contains more than 480,000 first-person profiles of researchers from over 1,600 institutions, government agencies and other R & D organizations worldwide. It allows its users to browse through all of the experts, by institution, by geographical area, by researcher name, and by keyword index. Each profile submitted to be added or updated is carefully reviewed by a skilled team of editors to insure the relevance, consistency and accuracy of the data, and to optimize the record for searching. Among the attributes of an expert displayed by the system are contact information and position, qualifications and expertise, publications, patents, and awards, standard COS keywords and many more.

2.3 Experts in UTP

Currently, in UTP, the technique used in capturing the expertise of its experts and finding them is through the application developed by UTP's Research, Development and Consultancy (REO) department, the Expertise Database; http://www.utp.edu.my/reoex/expertise.html. This database contains all experts from all academic departments in UTP. It generally describes each expert; majority lecturers, such as their name, department and their area of expertise. This information is filled out by the expert themselves. Refer Figure 4.
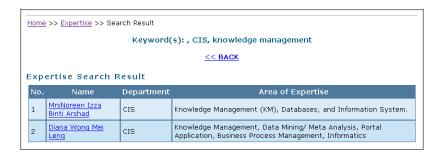

Figure 4: Expertise Database, REO.

All of this information could be considered simple but would assist in the sharing if it with others and that it will hypothetically be of importance in decision making for example. It would also benefit researchers or collaborators who seek external expertise in certain matters.
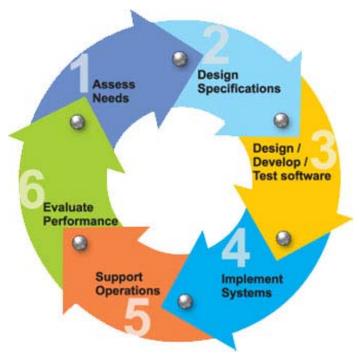
Furthermore, there are existences of such Knowledge Management Systems (KMS), which allocate expert resources, method of allocating expert resources and program product therefore. Ravin, Sharpe, and Stern (2006) noted that "the data on experts may be stored in an expert database and data on requesters stored in a requestor's database. A pairing unit identifies an appropriate expert matched to each request and requestor. The pairing unit includes a request/requestor characterization unit collecting request/requestor attributes, a matching unit matching request/requestor attributes with an expert, and a routing unit routing each incoming request to a selected matching expert."

CHAPTER 3
METHODOLOGY

3.1 Research Methodology

For the development of the EPD system, the classical **System Development Lifecycle (SDLC)** methodology will be adopted.

All **insourcing** efforts towards the development of it will be based on the SDLC methodology.

The main content of the EPD system is captured through obtaining the user requirements from the users; in this case, the 40 lecturers of the CIS department in UTP. For this, a simple questionnaire containing 7 questions has been prepared and distributed to the lecturers in the CIS department. In this particular questionnaire, suggested content by the lecturers to be included in the EPD system was queried and captured.

Insourcing of the SDLC for this project specifically is as follow:

3.1.1 <u>Planning</u>

Identifying the need of a KMS within the organization align with the development of KM and defining the KMS to be developed; Expert Profile Database, to centralize expert profile throughout the targeted area of study (CIS department) while promoting K-Sharing among its users with easy viewing and retrieval of the information needed.

3.1.2 <u>Analysis</u>

This stage involves mostly collecting user requirements from users. This is done through questionnaire development and interview. Results as follow:

<u>Questionnaire Results</u>

Out of 41 lecturers, 15 (36.6%) have responded accordingly; requires at least. The following are the results compiled according to question.

1. *Do you use any sort of applications / systems when searching for an Expert or a Subject Matter Expert (SME) of a certain subject?*

Figure 5.1: Q1 Results

Out of the 15 respondents, 9 have given a positive response with answering YES, which they do use applications when searching for an Expert or an SME, while 6 responded NO (Figure 5.1).

The applications used can be categorized **internal**; systems available within UTP, and **external**; systems available outside UTP. Among the applications used is the Phonebook Finder and AXIS, while among the applications used externally is mostly the Internet; specifically the Google search engine is among the popular ones used. Other than that are Publication Websites (eg IEEE, ACM), Yahoo search engine, and university portals.

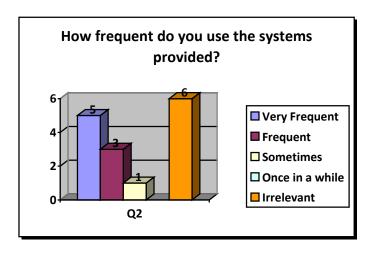2. *If you answered YES in Q1, how frequent do you use these systems provided?*

Figure 5.2: Q2 Results

Out of the 15 respondents, 5 responded *very frequent*, 3 *frequent*, 1 *sometimes*, while 6 were irrelevant. From analyzing Figure 5.2, we are able to determine that the usage of enablers such as these applications and tools, internally and externally are considerably high among the lecturers in the CIS department. The existence of the EPD system is hypothetically to gain support from the lecturers, depending on its ease-of-use capabilities.

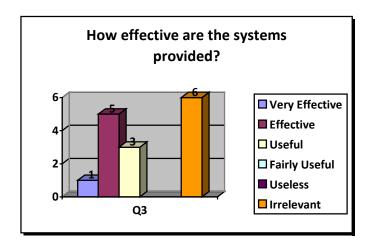*3. If you answered YES in Q1, how effective is the system in fulfilling your requests?*

Figure 5.3: Q3 Results

Out of the 15 respondents, 1 responded the effectiveness of the systems to be *very effective*, 5 *effective*, 3 *useful*, while 6 were irrelevant. Figure 5.3 shows that most of the systems or applications used by the lecturers tend to be effective towards fulfilling the information requested. This is a positive response as the need of enablers such as the systems and applications used is high.

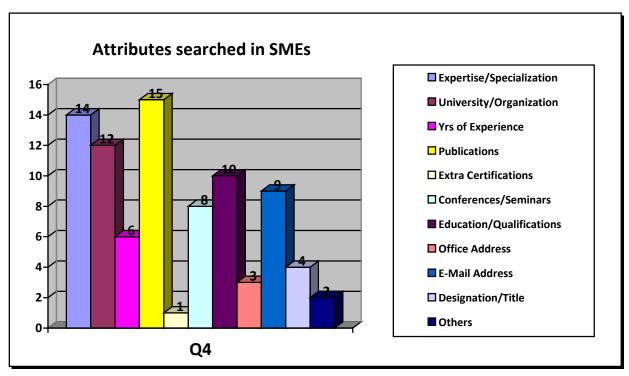*4. When searching for an Expert or SME, what are the typical attributes you would search for?*

Figure 5.4: Q4 Results

Through Q4, several queries were requested from the lecturers on what attributes that they consider when searching for an Expert or an SME. Among all listed attributes, the highest rate is the publications in which the Expert or SME has produced. This includes research papers; journals, books and other printed materials produced by the expert themselves. Among other highly attributes considered when searching for an expert are the expertise or specialization of the expert, from which university or organization the expert is from, their education background and other qualifications, the E-Mail address of the expert and the conferences and seminars attended and presented by the expert.

5. *If there were a system specifically developed for storing and searching Experts or SMEs based in attributes such as mentioned in previous question, would you use it?*
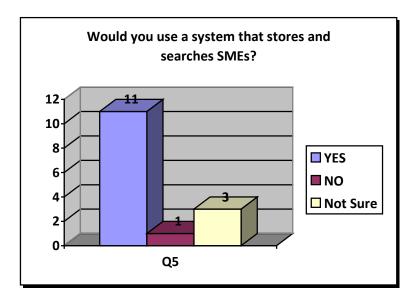
Would you use a system that stores and searches SMEs?

Figure 5.5: Q5 Results

When asked whether they would utilize a system such as EPD; stores and searches experts within the department, it is found that 11 out the 15 respondents replied that they will utilize the system created while 1 will not and 3 respondents not sure.

6. *Taking account that the system already exists, where would you prefer it to be?*
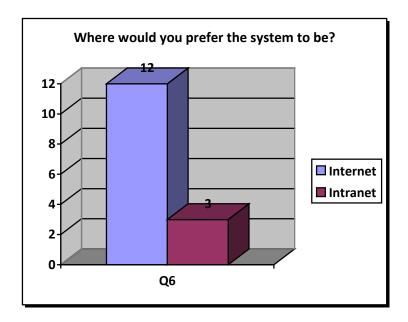

Figure 5.6: Q6 Results

Out of the 15 respondents, 12 have preferences of the system to be Internet accessible while 3 prefer it to be on intranet. Having the system on the Web will able the lecturers to be able to utilize it not only in the office but they will also be able to access it from anywhere with Internet connection.

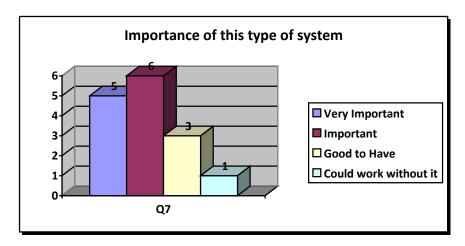7. *How important is it having this sort of system / database to you?*

Figure 5.7: Q7 Results

From the 15 respondents, 5 have determined the importance of the existence of this type of system to be *very important*, 6 determining it as *important*, 3 saying it *good to have*, and 1 who *could work without it*. This justifies even more that the EPD system would hypothetically gain support from the CIS department, but also considering the interface and fulfillment of the user-requirements.

<u>Interview Results</u>

(Interview questions in appendices). Details of the interview conducted as follow:

    Date: **April 1st, 2008 (Tuesday)**

    Time: **5.00 pm (sent)**

            5.40 pm (received)

From the response obtained, having to preserve knowledge and information of an expert; in this case, the lecturers of CIS, is important for several reasons. Among them are:

- To be able to have the knowledge and information to 'stay' once the expert is no longer with the organization.
- To be able to share the expert knowledge and information with others; especially junior staff.
- To enable Lesson Learned on a wider context.

4   <u>Design</u>

In this stage, the system architecture developed will serve as the main references in developing the system. The tools needed for user interface and back end are identified as well. The *blueprints* of the project is prepared.

3.1.3 System Development

This stage is fully concerned with the physical development and construction of the EPD system by using the selected tools in the design stage until the system is complete. Functionalities identified from the user requirements collected are included into the system.

It primarily begins with the creation of the stand alone server for the main purpose of the development; WAMP5. Once the installation of the open source tools was completed, the customization begins. Components which suit the system's user requirements are identified such as developing a login form for the use of registered users. Users who wish to view the complete database of profiles must register and if they are an expert, a profile is to be submitted to the administrator.

Figure 6.1: EPD main page

For the profiles, each expert is entitled to a few pages of their own which would contain their basic contact details, a list of their expertise, and another page containing their professional publications and journals.
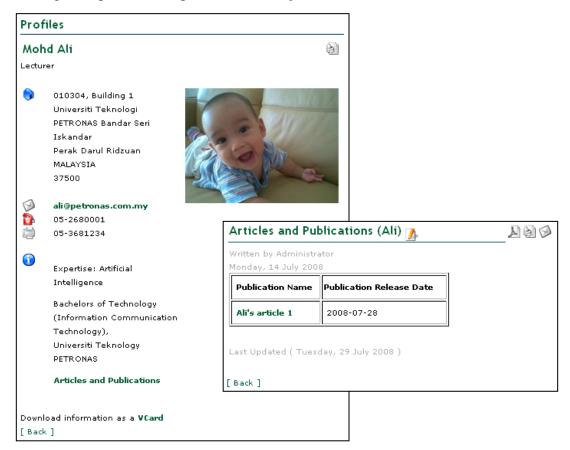

Figure 6.2: Sample Profile

Publications are submitted by the expert themselves to the administrator. It will then be confirmed of its authority of release before it is actually published on the site. This means the article or journal must be presented publicly and accepted at any conference or seminars beforehand.

Other functions enabled so far are a **search engine**, able to search the whole site for any queries, **poll taking, news or content submission** and **profile submission**.

A forum section is also introduced in the EPD system as it will provide members and public to share views and discuss further more on any KM related topics. Topics discussed within the KM Forum however are displayed to its users according to access levels which are predetermined by the administrator. Some topics considered confidential and should be protected from public view will be limited only to those with authorization.
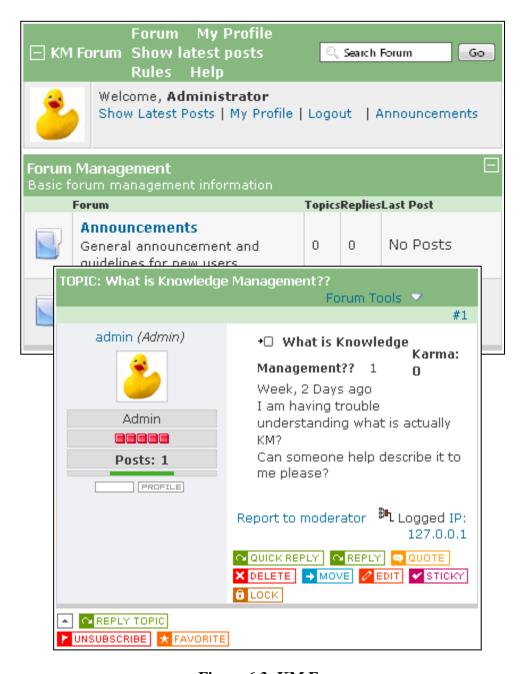

Figure 6.3: KM Forum

3.1.4 Testing

After the system is fully developed together with the interface and functionalities identified through the user requirement gathering, testing of the developed system will be conducted. This is to identify real outcomes with pre-determined outcomes hypothesized earlier. Any difference will be debugged accordingly.

3.1.5 Deployment

Once all flaws of the system interface and function wise are debugged, the EPD system will be deployed or released for actual usage by the users. With a friendly user interface, no training is hoped to be required.

3.1.6 Maintenance

The EPD system will need to be periodically updated with new updates such as new profiles or updated profiles of the experts to be aligned with current situations. The system must also be up to date with current situations and technologies.

3.2 Project Activities

Phase 1

For this particular project, the challenges within the current KMS in storing expert profiles are examined and areas of improvement are to be identified. During this stage, a comparison with other existing expert profiles on the Internet is done simultaneously. From here, the numerous attributes (mentioned in objectives) will be identified. Be reminded these attributes relate to expert profession wise only; personal details preferred avoided. Data and other related information will be gathered through interviews and questionnaires/ surveys that has been prepared and distributed.

Phase 2

After collection of information and data is complete, the second phase of the project will begin with the development of a detailed workflow of all related gathered information and data linked to each other in an organized manner with the aid of diagrams.

This phase would be focused on the physical construction of the system; backend (database) and frontend (web-based interface). The construction would take up most of the timeline during the second part of the project (FYP2). Inclusion of needed functionalities is also constructed to cater user needs and requirements.
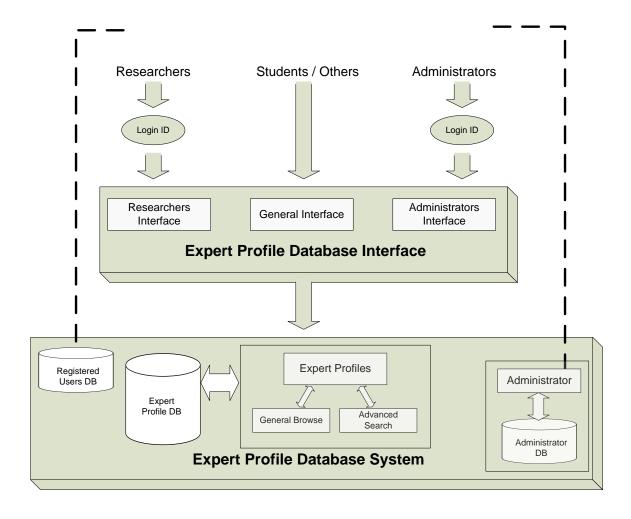
Expert Profile Database (EPD) system architecture

Figure 7: EPD system architecture

3.2.1 Database and Interface

Back-end of the EPD system is through the usage of integrated software; WAMP5, a Windows web development environment which combines Apache, PHP and MySQL database. Also comes with PHPMyAdmin and SQLiteManager for database management.
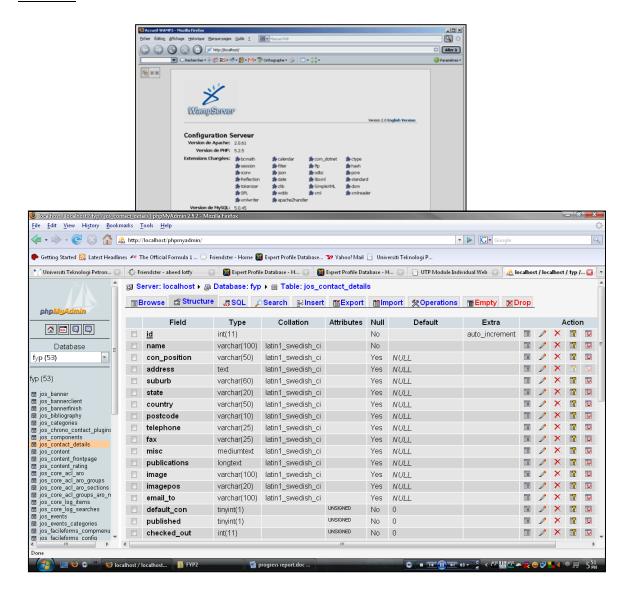
WAMP5

Figure 8: Database screenshots

Phase 4

After the construction of database is completed, testing will be done on its functionalities and effectiveness. Testing phase will continue throughout FYP 2 and the final product will be presented during FYP 2.

(Refer Gantt chart and Milestone in Appendix)

3.3 Tools

Phase 1:

- ✓ Mindjet Mind Manager Pro 6
    - o Development of needed knowledge/ mind maps.

Phase 2:

- ✓ Microsoft Office Visio
    - o Development of workflow.
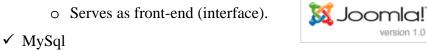   - o Development of ERD, EERD and other diagrams.

Phase 3:

- ✓ Apache Server
    - o Serve as stand alone server for database testing.
- ✓ Joomla©
    - o Serves as front-end (interface).
- ✓ MySql
    - o Serves as back-end; central repository and DBMS.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Questionnaire and Interview (FYP 1)

User requirements were gathered during Part 1 of the project (FYP 1) by using a questionnaire distributed to 41 lecturers of the CIS department. It also includes the available systems currently used within the university and how effective it works. Input from the Programme Head, Dr Ahmad Kamil B. Mahmud was also captured from the interview made.

4.2 Expert Profile Database (EPD) Development

As mentioned in Scope of Study of Chapter 1, some development has been done for the past couple of months. This mainly concerns the construction of the front-end layout of the system, or the interface which will be used by the users to navigate through it according to access levels.

The actual construction of the system began from the front-end where the interface and layout was properly modified from a template made available in Joomla©. The site's accessibility is divided into three (3) access groups; general viewing (requires no login), member / expert viewing (requires registration and login) and administrative viewing for the administrator to monitor and administer the site.

The content of the site is divided into five (5) major sections; Home page, Contact Us, News, Links and most important Profiles.

4.2.1 Submitting a Profile

To submit a profile, only a registered user, authorized by the administrator is allowed. Registered user (comprised of lecturers / experts majority), would have a 'Submit Profile' link in the Main Menu section. When clicked, user is required to complete a form querying details on expert which is to be created a profile (or expert including/editing their own profile). Details included such as name, contact information, expertise, education/qualification and any published publications of the expert.

Once completed, it will be submitted to the administrator for verification and approval before posted on the EPD system.
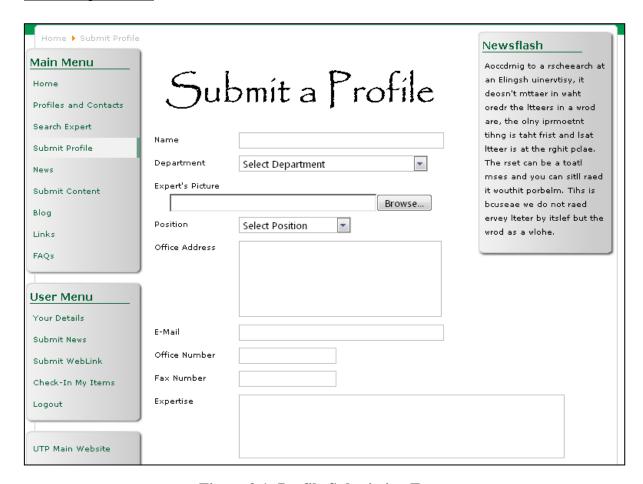
Submitting a Profile

Figure 9.1: Profile Submission Form

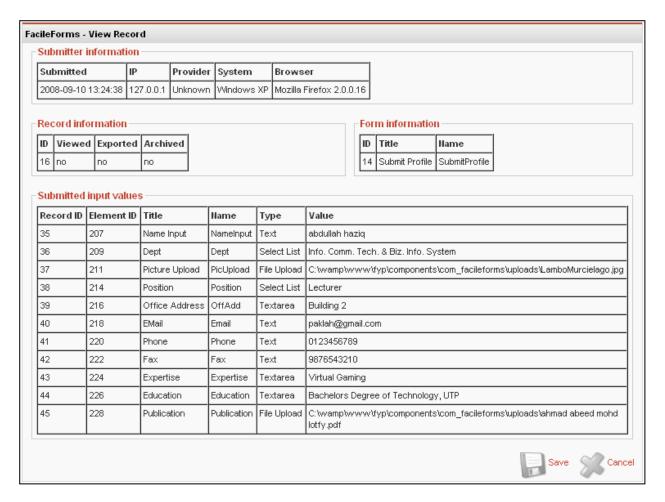Expert Profile Database Output sent to Administrator

Figure 9.2: Submitted Profile Administrative View

CHAPTER 5
CONCLUSION

5.1 Conclusion and Recommendation

After collecting the sufficient amount of information gathered from lecturers especially for user requirements, the development made on the Expert Profile Database (EPD) System should be able to meet the requirements. This includes all functions and types of information requested by the users.

Once the development of the system is completed, meeting the user requirements 100% or closest possible, testing is to be made. Methods to be used for testing would be by bringing the system to the users themselves and for them to test. To what degree it would meet their expectations will be taken account and suggestions made by users will be taken account for further modifications to the system.

To conclude, once the EPD system is ready for utilization, it is hoped that it will contribute to the CIS department for a trial period especially in the field of Knowledge Management specifically sharing. And this would hope to increase the productivity of the staff in their research.

REFERENCES

Professor Petter Woods (2005) *Knowledge Management in Malaysia – The FACTS!*
<http://www.kmtalk.net/article.php?story=20050401235019162>

Rowland F., Sharifuddin S. O. (2004) *Benchmarking knowledge management in a public organization in Malaysia*
<http://www.intanbk.intan.my/cda/m_online/JUSA_FILES/kmbij.pdf>

Sirajuddin Suhaimeea, Ahmad Zaki Abu Bakarb, Rose Alinda Alias (2006) *Knowledge Sharing Culture in Malaysian Public Institution of Higher Education: An Overview*
<http://eprints.utm.my/3367/1/Knowledge_Sharing_Culture_in_Malaysian_Public_Institution_of_Higher.pdf>

Micheal Braun Hamilton (2003) *Online Survey Response Rates and Times Background and Guidance for Industry*
<http://www.supersurvey.com/papers/supersurvey_white_paper_response_rates.pdf >

Fred Nickols (2000) *KM Overview Applications*
<http://home.att.net/~discon/KM/KM_Overview_Applications.htm>

Dr. Raja Suzana Raja Kasim (2007) *The Contributions of Public-listed Organizations to Knowledge-based Development in Malaysia*
<http://m08.cgpublisher.com/proposals/195/index_html>

Irma Becerra-Fernandez, Avelino Gonzalez, Rajiv Sabherwal (2004). *Knowledge Management: Challenges, Solutions, and Technologies*, pp. 37 – 40.
<http://www.expertguide.com.au/!ProfessorKeithDavids!_7834.aspx>

Michael E. D. Koenig (2005) *KM moves beyond the organization: the opportunity for librarians.*

Peter A.C. Smith (2003) *Successful Knowledge Management: The Importance of Relationships.*

Kai Mertins, Peter Heisig, Jens Vorbeck (2001) *Knowledge Management: Best Practices in Europe*

Chris Collison, Geoff Parcell (2001) *Learning to Fly: Practical Lessons from one of the World's Leading Knowledge Companies*

Kai Romhardt (1997) *Processes of Knowledge Preservation: Away from a Technology Dominated Approach.*
<http://www.dfki.uni-kl.de/~aabecker/Freiburg/Final/Romhardt/romhardt.html>

Ruzaif Adli Bin Md. Daud (2007) *Knowledge Management Systems (KMS) in Organization:A Collaborative Model for Decision Makers*
<http://www.kmtalk.net/article.php?story=2007071609353970&query=KMS>

Coley Consulting (2001-2007) *What is a Requirement?*
<http://www.coleyconsulting.co.uk/require.htm >

The University of Melbourne, Australia (2007) *Find an Expert*
<http://www.findanexpert.unimelb.edu.au/ >

Universiti Teknologi PETRONAS (2008) *Expertise Database*
<http://www.utp.edu.my/reoex/expertise.php>

COS Expertise Website
<http://expertise.cos.com/ >

Wikipedia, The Free Encyclopedia
<http://en.wikipedia.org/wiki/Systems_Development_Life_Cycle >