UNIVERSITI PUTRA MALAYSIA

ONTOLOGY BASED RECOMMENDATION SYSTEM FOR RESEARCH COMMUNITIES

SITI HAJAR BINTI ABDUL RAZAK

FSKTM 2015 11
ONTOiogy BASED RECOMMENDATION SYSTEM FOR RESEARCH COMMUNITIES

By

SITI HAJAR BINTI ABDUL RAZAK

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirement for the Degree of Master of Science

May 2015
COPYRIGHT

All material contained within the thesis, including without limitation text, logos, icons, photographs and all other artwork, is copyright material of Universiti Putra Malaysia unless otherwise stated. Use may be made of any material contained within the thesis for non-commercial purposes from the copyright holder. Commercial use of material may only be made with the express, prior, written permission of Universiti Putra Malaysia.

Copyright © Universiti Putra Malaysia
I dedicated this thesis, especially to:

My awesome Husband,

Muhammad Ashraf bin Mohamad Jalani

My wonderful Parents,

Abdul Razak bin Abdul Rashid &
Siti Esah binti Md. Hussain

My beloved Daughter

Siti Safiya binti Muhammad Ashraf
Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

ONTIOLOGY BASED RECOMMENDATION SYSTEM FOR RESEARCH COMMUNITIES

By

SITI HAJAR BINTI ABDUL RAZAK

May, 2015

Chairman: Professor Rusli bin Hj. Abdullah, PhD
Faculty: Computer Science and Information Technology

The enhancement of Virtual Community of Practice (VCoP) among research universities (RU) in Malaysia has led to a proper system model for new researchers to ensure that they are joining the right research communities effectively. It is important for researchers to capture and express their expertise in a form that can be easily accessed and used by others. Besides, it has led to devise a proper system model to group researchers in a community with mutual research interest since there is a limitation of system model in finding the right people to work together. The formation of virtual research communities in RU is known as VCoP where it provides a flexible way for researchers to interact, reuse, and share knowledge virtually. In this context, researchers are lecturers, as well as postdoctoral and postgraduate students. Thus, this research had adopted the Quick Ontology Mapping (QOM) as an ontology mapping technique since this technique had been proven to be effective and the applications of ontology are to classify, as well as to model the VCoP. In addition, the aim of this research was to propose an ontology-based model in recommending research groups to new researchers, besides proving the effectiveness of the system model that implemented the ontology mapping technique. The proposed system model was constructed based on literature review. Then, a case study was conducted upon the research community at the Faculty of Computer Science and Information Technology (FCSIT) in Universiti Putra Malaysia (UPM). The aim of this case study was to validate the elements of the proposed system model. As a result, the research findings showed that: (i) most of the respondents agreed that there was a need to group the researchers in the same field, and (ii) most of the respondents agreed that the proposed system model could recommend suitable research groups based on their interests. Apart from that, in order to prove the effectiveness of the proposed system model, this study compared the ontology mapping with simple matching technique. The purpose of this comparison had been to differentiate the mapping technique with and without ontology for it to function in a more relevant manner based on user’s perspective. With that, a system prototype was developed to transform the proposed system model into a more workable state. Then, a post survey was conducted to prove the effectiveness of the system prototype. In addition, the results were analyzed by using Rasch Model since
this tool has been proven good in analyzing small sample size. The findings indicated that: 58% of respondents completely agreed (Strongly Agreed and Agreed) with the implementation of ontology mapping technique, and (ii) most of the respondents like the way ontology mapping technique recommended the research group. Hence, this research showed that this system model could be used as a guide to recommend research groups to new researchers. Finally, this proposed system model could be used by other communities to group their members with similar knowledge. Indirectly, knowledge can be shared and reused effortlessly.
Abstrak tesis ini dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

SISTEM CADANGAN BERASASKAN ONTOLOGI UNTUK KOMUNITI PENYELIDIKAN

Oleh
SITI HAJAR BINTI ABDUL RAZAK

Mei, 2015

Pengerusi:  Professor Rusli bin Hj. Abdullah, PhD
Fakulti:  Sains Komputer dan Teknologi Maklumat

Peningkatan komuniti amalan haya (VCoP) di antara Universiti Penyelidikan (RU) di Malaysia membawa kepada keperluan untuk mempunyai sebuah model sistem yang sesuai untuk penyelidik baharu bagi memastikan mereka menyertai kumpulan penyelidikan yang betul secara berkesan. Ini adalah penting untuk penyelidik mengambil dan menyatakan kekapanan mereka dalam bentuk yang mudah diakses dan boleh digunakan oleh penyelidik lain. Oleh hal yang demikian, sebuah model sistem yang sesuai telah dirangka untuk mengumpul penyelidik di dalam komuniti yang mempunyai minat penyelidikan yang sama kerana kekurangan model sistem dalam mencari orang yang tepat untuk bekerjasama. Pembentukan komuniti penyelidikan maya dalam RU dikenali sebagai VCoP di mana ia adalah cara yang fleksibel untuk penyelidik berinteraksi, menggunakan semula, dan berkongsi pengetahuan secara maya. Dalam konteks ini, penyelidik merupakan pensyarah, juga pasca kedoktoran, dan pelajar pasca sismazah. Seterusnya, kajian ini telah menggunakan Quick Ontology Mapping (QOM) sebagai teknik pemetaan ontology kerana teknik ini telah terbukti berkesan dan penggunaan ontology adalah untuk mengelaskan dan juga untuk memodelkan VCoP. Di samping itu, tujuan kajian ini adalah untuk mencadangkan sebuah model sistem yang berasaskan ontology untuk mencadangkan kumpulan penyelidikan kepada penyelidik baharu, dan membuktikan keberkesan model sistem yang melaksanakan teknik pemetaan ontologi. Model sistem yang dicadangkan diberasarkan kepada literature. Kemudian, satu kajian kes telah dijalankan di kalangan komuniti penyelidikan di Fakulti Sains Komputer dan Teknologi Maklumat (FSKTM), Universiti Putra Malaysia (UPM). Tujuan kajian ini adalah untuk mengesahkan model sistem yang dicadangkan. Keputusan menunjukkan: (i) kebanyakan responden bersetuju bahawa terdapat keperluan untuk mengumpulkan penyelidik dalam bidang yang sama dan; (ii) kebanyakan responden bersetuju bahawa model sistem yang dicadangkan boleh mengesyorkan kumpulan penyelidikan yang sesuai berdasarkan minat mereka. Selain daripada itu, untuk membuktikan keberkesanan model sistem yang dicadangkan, kajian ini mengambil keputusan untuk membandingkan teknik pemetaan ontologi dengan teknik padanan ringkas. Tujuan perbandingan ini adalah untuk membezakan teknik pemetaan dengan ontology dan tanpa ontology untuk
ACKNOWLEDGEMENT

Thank Allah the Almighty, for all the blessings. Alhamdulillahirabbil'alamin and Peace and blessing to beloved Prophet Muhammad S.A.W. Allahummasolia'la Muhammad.

I would like to give a big thank to my supervisor, Professor Dr. Rusli bin Hj. Abdullah, and my co-supervisor, Associated Professor Dr. MasrahAzrifahbintiAzmi Murad for their invaluable advice and assistance throughout the course of this research.

Special thanks goes to my parents, Abdul Razak bin Abdul Rashid and SitiEsahbinti Md. Hussain, my beloved husband, Muhammad Ashraf bin Mohamad Jalani which have been there through all the times and always told me to be patience and to never give up. Thanks to my family members and my friends who always helps me when I’m in need. You know who you are.

Last but not least, I would like to thank to Universiti Malaysia Pahang (UMP), Ministry of Education Malaysia (MOE), and Research University Grants Schema (RUGS) that was sponsored my studies and my research project as well.
I certify that a Thesis Examination Committee has met on 25 May 2015 to conduct the final examination of Siti Hajar binti Abdul Razak on her thesis entitled “Ontology-Based Recommendation System For Research Communities” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

Members of the Thesis Examination Committee were as follows:

**Rusli Abdullah, PhD**  
Professor  
Faculty Computer Science and Information Technology  
Universiti Putra Malaysia  
(Chairman)

**Hamidah Ibrahim, PhD**  
Professor  
Faculty Computer Science and Information Technology  
Universiti Putra Malaysia  
/Internal Examiner

**Marzanah A. Jabar, PhD**  
Associate Professor  
Faculty Computer Science and Information Technology  
Universiti Putra Malaysia  
/Internal Examiner

**Shahrul Azman Mohd Noah, PhD**  
Professor  
Faculty of Information Science and Technology  
Universiti Kebangsaan Malaysia  
Malaysia  
(External Examiner)

**ZULKARNAIN ZAINAL, PhD**  
Professor and Deputy Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date: 27 October 2015
This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

**Rusli bin Hj. Abdullah, PhD**  
Professor  
Faculty of Science Computer and Information Technology  
Universiti Putra Malaysia  
(Chairmain)

**Masrah Azrifah Azmi Murad, PhD**  
Associate Professor  
Faculty of Science Computer and Information Technology  
Universiti Putra Malaysia  
(Member)

---------------------------------------------  
**BUJANG KIM HUAT, PHD**  
Professor and Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date:
Declaration by graduate student

I hereby confirm that:

- this thesis is my original work;
- quotations, illustrations and citations have been duly referenced;
- this thesis has not been submitted previously or concurrently for any other degree at any other institutions;
- intellectual property from the thesis and copyright of thesis are fully-owned by Universiti Putra Malaysia, as according to the Universiti Putra Malaysia (Research) Rules 2012;
- written permission must be obtained from supervisor and the office of Deputy Vice-Chancellor (Research and Innovation) before thesis is published (in the form of written, printed or in electronic form) including books, journals, modules, proceedings, popular writings, seminar papers, manuscripts, posters, reports, lecture notes, learning modules or any other materials as stated in the Universiti Putra Malaysia (Research) Rules 2012;
- there is no plagiarism or data falsification/fabrication in the thesis, and scholarly integrity is upheld as according to the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) and the Universiti Putra Malaysia (Research) Rules 2012. The thesis has undergone plagiarism detection software.

Signature: ______________________ Date: __________________

Name and Matric No.: _________________________________________

Declaration by Members of Supervisory Committee

This is to confirm that:
- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

Signature: ______________________ Signature: ______________________
Name of Chairman of Supervisory Committee: ______________________
Name of Member of Supervisory Committee: ______________________

Signature: ______________________ Signature: ______________________
Name of Name of
Member of Member of
Supervisory Supervisory
Committee Committee
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>i</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>v</td>
</tr>
<tr>
<td>APPROVAL</td>
<td>vi</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xi</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xii</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>xiii</td>
</tr>
</tbody>
</table>

## CHAPTER

### 1 INTRODUCTION

1.1 Research Background 1  
1.2 Problem Statement 2  
1.3 Research Questions 3  
1.4 Research Objectives 3  
1.5 Research Contribution 3  
1.6 Scope of Research 3

### 2 LITERATURE REVIEW

2.1 Introduction 5  
2.2 Communities of Practice (CoP) and Virtual Communities of Practice (VCoP) 5  
2.3 Recommendation System Model 6  
2.3.1 Collaborative Filtering (CF) 6  
2.3.2 Content-based Filtering 6  
2.3.3 Knowledge-based Recommendation 7  
2.3.4 Summary of the Recommendation System Model 7  
2.4 Ontology 8  
2.4.1 Ontology Tools 8  
2.4.2 Uses of Ontology 8  
2.4.3 Web-Ontology Languages (OWL) 9  
2.4.4 Ontology Modeling 10  
2.4.5 Ontology Classifications 10  
2.4.6 Ontology Applications in CoP and VCoP 11  
2.4.7 Ontology Mapping 12  
2.4.8 Benefits of Ontology 14  
2.5 Related Works 14  
2.6 Summary 15

### 3 METHODOLOGY

3.1 Introduction 16  
3.2 Research Methodology 16  
3.2.1 Phase 1: Proposed System Model 17
3.2.2 Phase 2: The Translation of the Model into the Prototype System 20
3.3 The Ontology Mapping Process in the Development of the Prototype System Model 22
3.4 Ontology Hierarchy for Research Communities 22
3.6 Process Diagram 26
3.7 Summary 27

4 DEVELOPMENT OF THE PROPOSED SYSTEM MODEL AND ITS ARCHITECTURE - A CASE STUDY 28
4.1 Introduction 28
4.2 Administration of the Preliminary Survey 28
4.2.1 Preliminary Survey Results and Analysis 28
4.3 Architecture Layer and Functionality 35
4.4 Summary 36

5 DEVELOPMENT OF THE OVCOP SYSTEM MODEL 37
5.1 Introduction 37
5.2 Software Requirement Specification (SRS) Documentation 37
5.3 The Development of the System Model (OVCOP) Prototype 37
  5.3.1 Mapping Technique Implementation 38
5.4 Interface of the OVCOP System 42
5.5 System Validation and Testing 46
5.6 User Manual for Prototype System (OVCOP System) 46
5.7 Summary 46

6 ANALYSIS OF THE PROTOTYPE SYSTEM IMPLEMENTATION 47
6.1 Introduction 47
6.2 System Prototype Testing and Evaluation 47
6.3 Results and Analysis of the Post Survey 47
  6.3.1 Statistical Analysis 48
  6.3.2 Technical Analysis 52
6.4 Summary 53

7 CONCLUSION AND FUTURE RESEARCH 55
7.1 Introduction 55
7.2 Research Findings 55
  7.2.1 Proposed Model 55
  7.2.2 System Architecture 56
7.3 Contribution 56
7.4 Research Strengths and Limitations 56
7.5 Recommendation for Future Research 57
7.6 Conclusion 58
REFERENCES
APPENDICES
BIODATA OF STUDENT
LIST OF PUBLICATION

60
65
102
103
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1: The Proposed System Model</td>
<td>25</td>
</tr>
<tr>
<td>3.2: Translating the Model into the Prototype System</td>
<td>25</td>
</tr>
<tr>
<td>4.1: Descriptive Statistics of the Preliminary Survey in Investigating Researcher Perception in Handling Research Project in Research Group</td>
<td>28</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1: Content-Based Filtering</td>
<td>7</td>
</tr>
<tr>
<td>2.2: OWL DL Constructors</td>
<td>9</td>
</tr>
<tr>
<td>2.3: Guarino’s Ontology Classification (Guarino, 1998)</td>
<td>11</td>
</tr>
<tr>
<td>3.1: Research Methodology Flowchart</td>
<td>17</td>
</tr>
<tr>
<td>3.2: The Proposed System Model</td>
<td>18</td>
</tr>
<tr>
<td>3.3: Ontology Hierarchy for Research Communities</td>
<td>24</td>
</tr>
<tr>
<td>3.4: Process Diagram</td>
<td>26</td>
</tr>
<tr>
<td>4.1: Classification of Respondents Based on Position</td>
<td>28</td>
</tr>
<tr>
<td>4.2: Summary of Measured Person and Item</td>
<td>30</td>
</tr>
<tr>
<td>4.3: Item Measure</td>
<td>31</td>
</tr>
<tr>
<td>4.4: Person Measure</td>
<td>32</td>
</tr>
<tr>
<td>4.5: Principal Contrast Analysis</td>
<td>33</td>
</tr>
<tr>
<td>4.6: Wright Map for Preliminary Survey</td>
<td>34</td>
</tr>
<tr>
<td>4.7: System Architecture</td>
<td>35</td>
</tr>
<tr>
<td>5.1: Ontology Mapping Process for Researcher Groups and New Researchers using a Class ID (Hierarchical View)</td>
<td>40</td>
</tr>
<tr>
<td>5.2: Ontology Mapping Process for Research Groups and Researchers (New Researchers) using an ID (Ontological View)</td>
<td>40</td>
</tr>
<tr>
<td>5.3: Interface for OVC0P System Main Page (Home Screen)</td>
<td>43</td>
</tr>
<tr>
<td>5.4: Interface for User Information (User’s Profile)</td>
<td>43</td>
</tr>
<tr>
<td>5.5: Interface for User Information Page (select menu ‘Propose Research Group’)</td>
<td>44</td>
</tr>
<tr>
<td>5.6: Interface for Recommended Research Group</td>
<td>44</td>
</tr>
<tr>
<td>5.7: Interface for Recommended Research Group (Simple Matching Technique)</td>
<td>45</td>
</tr>
<tr>
<td>5.8: Interface for Recommended Research Group (Ontology Mapping)</td>
<td>45</td>
</tr>
<tr>
<td>6.1: Summary Statistics</td>
<td>48</td>
</tr>
<tr>
<td>6.2: Item Measurements</td>
<td>49</td>
</tr>
<tr>
<td>6.3: Person Measurements</td>
<td>50</td>
</tr>
<tr>
<td>6.4: Wright Map for Post Survey</td>
<td>51</td>
</tr>
<tr>
<td>6.5: Role of Respondents in Research Group</td>
<td>52</td>
</tr>
<tr>
<td>6.6: The Effectiveness of the Mapping Technique</td>
<td>53</td>
</tr>
<tr>
<td>7.1: OVC0P System Model Architecture</td>
<td>56</td>
</tr>
</tbody>
</table>
LIST OF ABBREVIATIONS

CoP  Community of Practice
CoPE  CoP of E-learning
FCSIT  Faculty of Computer Science and Information Technology
FOAF  Friend of a Friend
FSKT-M  FakultiSainsKomputerdanTeknologiMaklumat
ICT  Information and Communication Technology
IHL  Institute of Higher Learning (IHL)
IS  Information System (IS)
ISC  Information Systems and Computing
IT  Information Technology
KM  Knowledge Management
MNSQ  Mean-Square
NC  New Comer
NOM  Naïve Ontology Mapping
NR  New Researcher
O’COP  Ontology Dedication for Communities of Practices
ODBC  Open Database Connectivity
Onto’CoPE  Ontology for Communities of Practice
OntoGP-VCoP  Ontology Group Profiling- Virtual Communities of Practice
On-to-knowledge  Ontology-Based Tools for Knowledge Management
OntoShare  Ontology-Based Knowledge Sharing System
OVCoP  Ontology Virtual Community of Practice
OWL  Web Ontology Language
PCA  Principal Contrast Analysis
PMBOK  Project Management Body of Knowledge
QOM  Quick Ontology Mapping
RDF3  Resource Description Framework
RG  Research Group
RU  Research University
SD  System Development
SLP  Learner Profile Ontology
SQL  Structured Query Language
SRS  System Requirement Specification
UPM  Universiti Putra Malaysia
VC  Virtual Communities
VCoP  Virtual Communities of Practice
W3C  World Wide Web Consortium
WWW  World Wide Web
XOL  Ontology Exchange Language
Z-std  Z- Standard
CHAPTER 1

INTRODUCTION

1.1 Research Background

Communities of Practice (CoP) has been rapidly used in Knowledge Management (KM) practices (Eri et al., 2014; Food et al., 2003; Wenger, 1998). According to Etienne & Wegner-Trayner (2015), the importance of CoP is to improve the performance of an organization, where CoPs are groups of people who share similar interests and are able to make it consistently (Eri et al., 2014). In addition, the growth of the internet has given an impact to the organizations, including Institute of Higher Learning (IHL). Moreover, according to Eri et al., (2012), IHL is one of the knowledge organizations with several research-based communities that are known as research communities, which are formed based on mutual research interests or research areas.

On top of that, the evolution of the internet infrastructure has an impact on the CoP, whereby CoP can form Virtual Communities of Practice (VCoP). Furthermore, Andreatos (2009) asserts that VCoP is a virtual place for communicating and exchanging practices between the professional units that build around common interest, and the members may communicate virtually. Nonetheless, the limitation of channel in finding the right people to collaborate (Eri et al., 2014) has affected new researchers since Holm (2001) has claimed that finding the right experts is important for making better decisions. In line with the evolution of the internet, this research study has proposed an ontology-based system model to recommend research groups to new researchers. According to Kim et al., (2010), the recommended system mostly focuses on the recommended items to individuals rather than groups of people in participating in a group activity. Besides, Burke (2000) and Ruotsalo (2010) reveal that system recommendation guides users in selecting the item they wish to analyze, rather than searching for the information manually. Hence, this research study has proposed a recommendation system where new researchers can identify suitable research groups effectively, without wasting time searching for information manually.

Apart from that, this research study has focused on the technique used to map new researchers to suitable research groups. With that, the application of ontology in this research study models and classifies the proposed system model since ontology could be employed to model and classify the VCoP based on related work (Eri et al., 2012). In fact, recently, a research has discovered that ontology has become an important field in the Information System and Computing (ISC) discipline (Al-debei & Fitzgerald, 2009). Besides, according to Davies et al. (2003), ontology specifies the ontological classes where users can identify information. In addition, in order to identify a modular coupling among bodies of knowledge, ontologies are used as knowledge-level protocols for input, output, and communication (Gruber, 1991).
Therefore, in order to construct the proposed system model, a protégé has been chosen to model and to classify the ontology since it could design and query the ontology. Details pertaining to the protégé are discussed in Section 2.4.1 in Chapter 2.

1.2 Problem Statement

As noted earlier, according to Holm (2001) perspective on Knowledge Management (KM), working with the right people is important. Meanwhile, Jakovljevic et al. (2013) concluded that the evolution of Communities of Practice (CoP) has impacted the Institute of Higher Learning (IHL). However, they highlighted that there was no specific guidance to group the CoP for IHL. Jakovljevic et al. (2013) listed six phases of their study: (i) developing a theoretical framework for communities of practice, (ii) exploring preliminary learners’ attitudes toward communities of practice, (iii) forming pilot communities of practice, (iv) evaluating pilot communities of practice groups, (v) implementing action research to pilot communities of practice, and (vi) applying the communities of practice model to other groups. However, they failed to help the groups’ members to identify the CoP virtually. The formation of VCoP is important as the internet users continue to grow rapidly.

The VCoP formation is imperative, as members can obtain and share knowledge virtually, anywhere and anytime. Eri et al. (2014) stated that the information of the research community (i.e. research interests, grants, publications, and member’s profile) of the IHL were kept in a static form and displayed in the related portal. Searching for the information of the research groups manually was time consuming. At times the information was outdated or undefined. It caused managing groups and managing group knowledge to become a difficult task (Eri et al., (2012); Eri et al., (2014)).

Muhammad & Nordin (2013) determined that currently, there was no available ontology model that can be used for group formation. Therefore, their focused were to ascertain the semantic group formation model for CoP. They proposed group formation and implementation in order to share knowledge and to develop professional skills. To have a group formation is important, but to identify suitable groups for new members is even more important, to ensure that knowledge can be shared and developed easily.

A survey that was conducted by Eri et al. (2014), indicated that most of the respondents faced difficulty to identify members that interest them. Nowadays, applicants (new researchers) should identify and contact a possible researcher personally. There is no systematic tool available to guide new researchers to identify suitable research groups effectively. Hence, new researchers have to undertake this task manually. According to Eri et al. (2012), channels to find the right people to work with were non-existence, therefore their aims were: (i) to classify virtual communities in research communities of IHL and, (ii) to model virtual communities based on similar research interest using ontology.
As discussed previously, most of the scholars focused on how to manage the knowledge, formed groups for CoP, and classified the community in order to have better KM activities. However, they overlooked the fact that it is more crucial to help new members to identify suitable research groups virtually, as this will provide the opportunity for new members to gain knowledge from current members of the group; thus knowledge will be used and shared effortlessly.

1.3 Research Questions

In line with the problem statement, 3 research questions are depicted, as in the following:
- What kind of appropriate ontological model can be used to recommend the suitability of new researcher’s participation?
- Which appropriate mapping technique can be used to recommend suitable research groups?
- How does the model work to prove its effectiveness in recommending new researchers to suitable research groups based on their research interest?

1.4 Research Objectives

Based on the research questions, the aims of this thesis were:
- To propose an ontology based system model in recommending research communities to new researchers.
- To prove the system model using ontology mapping technique is effective.

1.5 Research Contribution

This research study has contributed an ontology-based recommendation system model for new researchers to guide them in recommending the suitable research groups that meet their research interests effectively. Besides, this research study has adopted the Quick Ontology Mapping (QOM) as a mapping technique, and some tools have also been used to implement the prototype system model, as discussed in Chapter 3. On top of that, the research focuses further on knowledge reuse and sharing between research communities virtually.

1.6 Scope of Research

This research study has focused on the research communities in the context of academician environment. In addition, this research has examined and proposed the best practices that could offer benefits to researchers in the research communities. Besides, the scope of research for this particular study is the mapping technique employed, as well as the research communities involved. As for the mapping
technique, this research has selected the Quick Ontology Mapping (QOM), which is explained in Chapters 2 and 5.

1.7 Structure of Thesis Organization

This thesis is generally divided into 7 chapters, where the first chapter is the introduction of this research study that explains the research background. Next, the statement of the problem, the research questions, the research objectives, the contributions of this research study, the scope of the research, and lastly, the organization of the thesis, are depicted.

Chapter 2 of the study looks into the related articles of the Communities of Practice (CoP) and Virtual Communities of Practice (VCoP), the recommended system model, as well as ontology, which includes ontology tools, uses of ontology, ontology languages, ontology modeling, ontology classification, ontology applications, ontology mapping, and advantages of ontology. Basically, this chapter reviews the important information concerning this research study in order to achieve the research objectives.

Chapter 3 describes the methodology employed in this research study that starts with research methodology flowchart. There are 2 main phases in this research study: (i) the proposed system model, and (ii) the translation of the model into the prototype system. Besides, the chapter also discusses the ontology mapping process in the development of the prototype system model, the ontology hierarchy for research communities, the system model construction, and the system model process diagram.

Chapter 4 discusses the results and the analysis of the preliminary survey in order to validate the elements of the proposed system model based on the literature review, as discussed in Chapter 2. Next is Chapter 5, which discusses the Software Requirement Specification (SRS) documentation, and the development of the system model prototype. In addition, this chapter discusses mapping technique implementation, interface of the OVCoP system, system validation and testing, as well as user manual for prototype system.

Chapter 6 presents the results and the analysis of the system model prototype in order to evaluate the effectiveness of the system model that uses ontology mapping technique. Finally, the conclusion of this research study is presented in Chapter 7, which includes findings of this research, research contributions, strengths and limitations of this research study, as well as recommendation for future works.
REFERENCES


