UNIVERSITI PUTRA MALAYSIA

MORPHOLOGICAL APPROACH IN CREATIVE REQUIREMENTS ELICITATION FROM CROWDSOURCING

TENGKU AZHARUDDIN BIN TUAN MOHD AMIN

FSKTM 2017 8

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By

TENGKU AZHARUDDIN BIN TUAN MOHD AMIN

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

July, 2017

DEDICATION

Alhamdulillah, my grateful and praises to the Almighty of Allah who has inspired, strengthened, guided and ease the implementation of this project. I dedicate this dissertation to my family for their countless supports through this journey to finish up the thesis as part of requirement fulfillment for Master of Computer Science. I also would like to express appreciation from my deepest heart to all my family members and friends who have assisted and supported me during this postgraduate study.

ABSTRACT

Creativity is a subject that gained increasing interest in requirements engineering field. Creative-based requirements elicitation helps in generating requirements in original and innovative ways. Lately, crowdsourcing has been emerged in requirements elicitation after realizing the benefits of crowd. Crowdsourcing allows a wide diversity of stakeholders able to express their perceptions about product. However, to analyze the large amount of ideas from crowd would be a great challenge. This work focuses on how creative ideas gathered and analyzed from the crowd using morphological approach in deriving requirements for the software product. In addition, the approach encourages collaboration between crowd and requirements engineers in order to elicit creative ideas for producing an innovative software product. In this study, a prototype is developed to evaluate the proposed approach. The prototype assists requirements engineer to produce creative and innovative solutions from the ideas elicited from the crowd. Based on the results, it shows that the use of text mining to build morphological matrix can provide a large number of potential creative requirements that cannot be easily captured by requirements engineer.

ABSTRAK

Kreativiti merupakan salah satu subjek yang telah semakin mendapat tempat di dalam bidang kejuruteraan keperluan. Perolehan keperluan berasaskan kreatif membantu dalam menghasilkan keperluan-keperluan di dalam bentuk yang asli dan inovatif. Terkini, *crowdsourcing* telah muncul sebagai alternatif di dalam proses perolehan keperluan setelah menyedari manfaat penggunaan orang ramai. *Crowdsourcing* membolehkan pelbagai pihak yang berkepentingan menyatakan persepsi dan menyuarakan pandangan mereka tentang sesuatu produk. Walau bagaimanapun, menganalisa sejumlah besar idea daripada orang ramai telah menjadi satu cabaran yang besar. Kajian ini telah memberi tumpuan kepada bagaimana idea yang kreatif dapat diperolehi, dikumpul dan dianalisa daripada orang ramai menggunakan pendekatan morfologi di dalam mendapatkan keperluan untuk produk perisian. Di samping itu, pendekatan ini menggalakkan kerjasama antara orang ramai dan jurutera keperluan untuk mendapatkan idea kreatif bagi menghasilkan produk perisian yang berinovatif. Dalam kajian ini juga, prototaip telah dibangunkan untuk menilai pendekatan yang dicadangkan. Prototaip ini membantu jurutera keperluan untuk menghasilkan penyelesaian yang kreatif dan inovatif daripada idea-idea yang ditimbulkan dari orang ramai. Berdasarkan hasilnya, ia menunjukkan bahawa penggunaan *text mining* untuk membina matriks morfologi dapat menghasilkan sejumlah besar potensi keperluan kreatif yang tidak dapat diperolehi dengan mudah oleh jurutera keperluan perisian.

ACKNOWLEDGEMENT

I would like to express my immense gratitude to Almighty of Allah for the wellness and mercies for allowing me to complete this project within the timeline. I also would like to thank my supervisor **Dr. Sa'adah Binti Hassan** for her guidance, motivation and patience during my research. Your good deeds will always be in my thoughts and prayers. My appreciation goes to UPM lecturers, facilitators and staffs who have been involved directly or indirectly in this project. Besides that I would like to thank my colleagues and my family for endless support in completing this project. Last but not least, I am indebted to Public Service Department (JPA) and Government of Malaysia for awarding me scholarship to further postgraduate study (master level) in Faculty Science Computer and Information Technology, University of Putra Malaysia.

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LIST OF ABBREVIATIONS

Abbreviations	Meaning
RE	Requirements Engineering
NLTK	Natural Language Toolkit
POS	Parts of speech
LDA	Latent Dirichlet Allocation
NMF	Non-negative Matrix Factorization
UPM	University Putra Malaysia
NLP	Natural Language Processing

CHAPTER 1

INTRODUCTION

1.1 Background

For the most part, the successful of a software system depends on upon how well it fits the requirements of its users and its environment (Nuseibeh and Easterbrook, 2000). Requirements incorporate more than desired functionality but software system must have the capacity to adapt and improve rapidly because of changing both user's needs and environmental conditions. In that capacity, enhancing the viability and effectiveness of requirements-related activities requires multi-disciplinary research, involving aspects of computer science, engineering, human-computer interaction, data science, cognitive sciences, mathematics and so forth.

In Requirement Engineering, elicitation phase viewed as the most crucial step and it comprises the set of activities that empower discovering, understanding and documenting of the goals and motives in building a proposed software system. The term elicitation is used to raise the fact that good requirement cannot be just collected from the stakeholders and users but has to be interpreted, analyzed, modeled and validated before the requirements engineer can feel sure that an entire arrangement of requirements of the system have been gained (Ben and Rolland, 2001).

Requirements also must be no less than complete but no more than necessary; detailed enough to be verifiable and realizable, but free from premature design decisions. The optimum is found somewhere in between the “breadth” and “depth” of requirements to handle this trade-off efficiently. Known requirement elicitation techniques, like brainstorming, workshops, and scenarios, have been generally utilized as a part of these approached with a large set of new techniques have emerged recently, e.g., viewpoints combination, analogical reasoning, and walkthroughs among others are strongly based on the co-presence of the stakeholders involved. These techniques are able to explore the depth very successfully, but they become too costly or time-consuming when employed among larger numbers of stakeholders. However, automation now enables us to acquire and interpret data from very large and heterogeneous groups of stakeholders, so-called “crowds”.

1.2 Problem Statement

A recent understanding describes the requirements engineering process as intrinsically creative, involving cycles of incremental building took after by insight-driven re-conceptualization of the problem space. Several researchers have focused on the noteworthy of requirements engineering as a creative problem solving process. Maiden et al (2010) suggested requirements should be imagined and invented by stakeholders, rather than being simply “gathered” from them. Generating idea is a part that promises a high potential for integrating established creativity techniques into requirements elicitation activity. The importance of these

works, in a context where innovative solutions represent a competitive advantage for companies, is notable. Furthermore, crowdsourcing is beneficial to software development, particularly at the requirements engineering phase, since the crowd could be the potential users of software system which is designed to meet their requirements. However, the challenge is to discover creative requirements from the crowd.

1.3 Objectives and Scope

The goal of this study is to enhance requirement elicitation in the software development by extracting creative requirements for the system development from the crowd using morphological approach. This study focused on how data gathered and analyze from the crowd using morphological matrix. Then, it can be use by requirements engineer team to facilitate them elicit creative requirements towards producing innovative software product. The objective of this study can be fold into two parts;

- to propose morphological approach for the crowd based requirement elicitation.
- to evaluate the approach as proof of concept

1.4 Contributions

The new proposed approach is expected to accelerate and enhance requirements elicitation process extracting creative requirements from crowd. This study also emphasis on facilitate requirements engineer team to elicit creative requirements towards producing innovative software product

1.5 Thesis Organization

This thesis is organized into six (6) chapters that including this chapter which covers the backgrounds of the study, problem statement, objectives, research's questions, scope of the research, contribution and thesis structure. Chapter 2 present a literature review by covering existing study on creative requirements, crowdsourced requirements elicitation concept, method/approach and models. Morphological analysis are also discuss in this chapter especially on their implementation as proven creativity tools and text mining usage to perform knowledge discovery from collections of unstructured textual data. Chapter 3 presents the methodology and propose a approach to achieve the objective. Proper planning to carry out this study is important to reduce unforeseen problem in the future. Meanwhile in Chapter 4, the implementation of the model and prototype development will be covered. It is followed by result and discussion which will be elaborated in Chapter 5. Finally, the last chapter, Chapter 6 summarizes the thesis finding and work that can be done in future.

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