VOLUNTEER REPUTATION EVALUATION FOR EMERGENCY RESPONSE OPERATIONS

By

Anum Kaleem
Enrollment No: 01-244132-001

A thesis submitted to Department of Software Engineering, Bahria University, Islamabad in the partial fulfillment for the requirements of a Masters degree in Software Engineering

October 2015

ABSTRACT

After the occurrence of a disaster, there is a dire need to handle the situation effectively. Disaster management helps people to cope with the situation with ease. It also reduces vulnerability to hazards. It is the collaboration of resources, relief organizations; NGO's and volunteers, in order to mitigate the effects of the disaster. Volunteers play a vital role in each disaster management phase. The information provided by them is critical as they are the first line of response in any disaster situation.

Natural and man-made disasters are constantly occurring leading to human casualties, infrastructure destruction, and financial losses. Volunteers and volunteer organizations participate actively in disaster management phases. Therefore, selecting and retaining skilled, motivated and competent volunteers is imperative. Existing Information & Communication Technology (ICT) based solutions only focus on resource allocation, team work and other disaster management activities. Conversely, none of these systems have addressed the issue of volunteers and their reputation. Reputation of a volunteer based on his personal traits and experience can be used for their selection for an emergency operation. It can also be used as a performance measurement tool during a particular operation.

The current work proposes a volunteer reputation management system. In order to do so reputation indicators have been identified based on existing disaster management agencies literature. These reputation indicators form the basis of the reputation evaluation framework. For the purpose of evaluation and validation of the framework a survey has been conducted to get feedback from the disaster management agencies. The results of the survey helped in identifying certain aspects which are essential for a good reputation evaluation framework. A computational algorithm has also been proposed to measure the reputation score of a volunteer. This computational algorithm has been used later in the reputation management system. A systems dynamics model is also proposed consisting of causal loop diagrams (CLDs) & stock and flow diagram to help understand the underlying dynamics of building reputation over a period of time.

Copyright Statement

1. The author of this thesis (including any appendices and/or schedules to this thesis) owns any copyright in it (the "Copyright") and he has given Bahria University, Islamabad the right to use such Copyright for any administrative, promotional, educational and/or teaching purposes.
2. Copies of this thesis, either in full or in extracts, may be made only in accordance with the regulations of the Bahria University Library. Details of these regulations may be obtained from the Librarian. This page must form part of any such copies made.
3. The ownership of any patents, designs, trade marks and any and all other intellectual property rights except for the Copyright (the "Intellectual Property Rights") and any reproductions of copyright works, for example graphs and tables ("Reproductions"), which may be described in this thesis, may not be owned by the author and may be owned by third parties. Such Intellectual Property Rights and Reproductions cannot and must not be made available for use without the prior written permission of the owner(s) of the relevant Intellectual Property Rights and/or Reproductions.
4. Further information on the conditions under which disclosure, publication and exploitation of this thesis, the Copyright and any Intellectual Property Rights and/or Reproductions described in it may take place is available from the Head of Department of Software Engineering, Bahria University, Islamabad.

CERTIFICATE OF ORIGINALITY

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institution of learning.

DEDICATION

I would like to dedicate this project to my family who has been a constant support. They have given me encouragement to deal with each and every problem with enthusiasm and determination. Without their support I would not be able carry out this research. Their love, affection and belief in me made me achieve my goals successfully.

ACKNOWLEDGMENT

All praise belongs to **Allah** Almighty who gave me the strength; courage and knowledge in completing this research .I owe my deepest gratitude to my supervisor **Dr. Awais Majeed** who has the attitude of a genius and a great research tactician. I am very fortunate to have his outstanding guidance, generous support and constant encouragement that has enlightened me at every step of my research work . I am also grateful to **Dr. Tamim Ahmed Khan** who has motivated me to continue this research despite various problems. Lastly I would like to thank my family and friends who had helped me along the way.

Table of Contents

DEDICATION i
ACKNOWLEDGMENT ii
KEYWORDS /ABBREVIATIONS ix
Chapter # 1: Introduction 1
1.1 Introduction: 1
1.2 Motivation: 2
1.3 Problem Statement: 2
1.4 Research Objective: 2
1.5 Organization of Thesis: 3
Chapter 2: Literature Review 4
2.1 Overview: 4
2.2 Trust 4
2.2.1 Trust definitions 4
2.2.2 Perspectives and characteristics of Trust 5
2.3 Reputation and reputation management systems: 5
2.3.1Classification of reputation systems: 6
2.3.2 Feedback aggregation models for reputation systems 9
2.3.3 Examples of commercial and live reputation systems 10
2.3.4 Limitations of reputation management systems: 11
2.4 Volunteerism and types of volunteers 12
2.4.1 Motives of volunteerism 13
2.4.2 Role of volunteer agencies in different stages of disaster management 13
2.4.3 Challenges and benefits of volunteer participation 14
2.4.4 Disaster management and collaboration through ICT based solutions. 15
2.5 Limitations of existing work 16
2.6 Conclusion 17
Chapter # 3: Volunteer Reputation Management Framework for Effective Disaster Management 18
3.1 Overview 18
3.2 Research Methodology 18
3.2.1 Literature Review and Publication Analysis 19
3.2.2 Framework Validation through Industrial Survey 19
3.2.3 Proof of Concept 21

3.3 Proposed Framework 21
3.3.1 Reputation Meta Model: 22
3.3.2 Causal Loop Diagram: 28
3.3.3 Computational Algorithm: 34
3.3.2Application Scenario 34
3.4 Conclusion: 37
Chapter # 4: Proof of Concept 38
4.1 Overview: 38
4.2 System Dynamic Modeling Technique: 38
4.2.1 Problem Statement/Problem articulation: 38
4.2.2 Dynamic Hypothesis Development: 38
4.2.3 Formulating a simulation Model 40
4.2.4 Tool for creating simulation model 40
4.3 Construction of Simulation Model of Volunteer Reputation 41
4.3.1 Conversion of Causal Loop Diagram into stock and flows maps 41
4.3.2 Stock and Flow Diagram of Volunteer Reputation Management System 41
4.3.3 Initial assumptions and equations on Stock and Flow Diagram 43
4.3.4 Volunteer Reputation Calculation Process and Constructs 45
4.3.5 Volunteer Experience Building Process 46
4.3.6 Interface of Reputation Management system Simulation 47
4.4 Scenario Development and Prototype Implementation 49
4.4.1 Scenario Overview 50
4.4.2 Usage of Reputation Management System for Disaster Management 50
4.5 Volunteer Selection based on simulation results 65
4.6 Conclusion: 65
Chapter # 5: Results and Analysis 66
5.1 Overview 66
5.2 Industrial Survey 66
5.2.1 Data Collection 66
5.2.2 NGO's Response 66
5.3 Rank of the Factors in Priority Groups: 90
Chapter 6: Conclusion 92
6.1 Overview of thesis 92

6.2 Future Work: 93
Appendix A: Questionnaire 98

Tables of Tables

Table 3.1 Framework Factors Extraction from Literature……20

Table 3.2: Score Ranges for Degree of Satisfaction…….35

Table 3.3 Score Ranges for Competence and Volunteer Experience……...35

Table 3.4: Reputations score of a particular partner…….36

Table 4.1 Conversion of Factors into stock and Convertors…….41

Table 4.2 Initial assumptions of the Simulation Model……43

Table 4.3 Weight Assignment according to priority groups…….44

Table 4.4 Reputation Process Description……45

Table 4.5 Volunteer Reputation Building Process……46

Table 4.6: Reputation Score Calculation using Reputation Management system……51

Table 4.7 Reputation analysis of volunteer 1……54

Table 4.8 Reputation analysis of volunteer 2……56

Table 4.9 Reputation analysis of volunteer 3……58

Table 4.10 Reputation analysis of volunteer 4……..60

Table 4.11 Reputation Analysis of volunteer 5…….62

Table 4.12 Reputation analysis of volunteer 6……..64

Table 4.13: Ranking of volunteers with respect to availability and reputation score……65

Table 5.1: Feedback about Factors related to Motivation Category…….....69

Table 5.2: Feedback about Factors related to Volunteer Experience……73

Table 5.3: Feedback about Factors related to Feedback Category……74

Table 5.4: Feedback about Factors related to Competence Category……....77

Table 5.5: Feedback about Factors related to Skills Category……...81

Table 5.6: Feedback Results about Main Factors……..85

Table 5.7: Rank of Factors in priority group…….90

Table of Figures

Figure 1.1 Organization of thesis…….....3
Figure 2.1: General Framework of Centralized Reputation system ……...7
Figure 2.2: General Framework of Distributed Reputation system ……7
Figure 2.3 Trust and Reputation system classification ……..8
Figure 3.1 Research Methodology……18
Figure 3.2: Meta Model for Volunteer Reputation Management……..22
Figure 3.3 Feedback……...24
Figure 3.4 Skills……25
Figure 3.5 Volunteer Experience……...26
Figure 3.6 Motivation……27
Figure 3.7 Competence……..28
Figure 3.8: Causal Loop Diagram of reputation and Feedback……29
Figure 3.9: Causal Loop Diagram of reputation and volunteer Competence……....30
Figure 3.10: Causal Loop Diagram of reputation and Volunteer Skills……....31
Figure 3.11: Causal Loop Diagram of reputation and motivation……32
Figure 3.12: Combined Causal Loop Diagram……..33
Figure 4.1: Causal Loop Diagram of Population growth……...39
Figure 4.2: Stock and Flow Diagram of Population growth……..40
Figure 4.3 Stock and Flow diagram of Volunteer Reputation Evaluation System……42
Figure 4.4 Reputation Calculation Process……....45
Figure 4.5 Volunteer Experience Building Process……...46
Figure 4.6: Main Interface Design of Volunteer Reputation Evaluation System……..47
Figure 4.7: Factor Weights Assignment……....48
Figure 4.8: Degree of Satisfaction Interface……..49
Figure 4.9 Relationship of current reputation and Reputation score of Volunteer 1…….....53
Figure 4.10 Relationship of current reputation and Reputation score of Volunteer 2……...55
Figure 4.11 Relationship of current reputation and Reputation score of Volunteer 3……...57
Figure 4.12 Relationship of current reputation and Reputation score of Volunteer 4……...59
Figure 4.13 Relationship of current reputation and Reputation score of Volunteer 5……...61
Figure 4.14 Relationship of current reputation and Reputation score of Volunteer 6……...63

Figure 5.1: Significance of the volunteer……...67
Figure 5.2: Occurrence of the volunteer's Reputation Assessment…….....68
Figure 5.3 Number of Agencies with well established Mechanism for volunteer reputation Assessment……69
Figure 5.4: Significance of Volunteer Attitude……..70
Figure 5.5: Significance of Volunteer Values…….....70
Figure 5.6 Significance of Volunteer Determination…….71
Figure 5.7 Significance of Volunteer's Respect for Diversity…….....72
Figure 5.8 Significance of Volunteer's Professionalism……...72
Figure 5.9: Significance of Number of Operations……...73
Figure 5.10: Significance of Volunteer's Age……...74
Figure 5.11: Significance of Volunteer's Feedback……..75
Figure 5.12: Significance of Donor Feedback…….....76
Figure 5.13: Significance of Peer Review…….....76
Figure 5.14: Significance of Disaster Management Agency Report……....77
Figure 5.15: Significance of Volunteer's Education…….....78
Figure 5.16: Significance of Volunteer's Training……79
Figure 5.17: Significance of Volunteer's Participation in Courses……...79
Figure 5.18: Significance of Volunteer's Participation in Drills……...80
Figure 5.19 Significance of Volunteer's Participation in Workshops…….....81
Figure 5.20: Significance of Volunteer's Communication Skills…….....82
Figure 5.21: Significance of Volunteer's Teamwork Skills……..83
Figure 5.22: Significance of Volunteer's Problem Solving Skills…….83
Figure 5.23: Significance of Volunteer's Leadership Skills…….....84
Figure 5.24: Significance of Volunteer's Time Management Skills…….....85
Figure 5.25: Significance of Volunteer's Motivation……86
Figure 5.26: Significance of Volunteer's Experience……87
Figure 5.27: Significance of Volunteer's Feedback……..87
Figure 5.28: Significance of Volunteer's Competence…….....88
Figure 5.29: Significance of Volunteer's Skills…….....89

KEYWORDS /ABBREVIATIONS

UNISDR	United Nations International Strategy for Disaster Reduction
FEMA	Federal Emergency Management Agency
UNDP	United Nations Development Program
NEMA	National Emergency Management Agency
UNV	United Nations Volunteers
CARD	Collaborative Agencies Responding to Disasters
IFRC	International Federation of Red Cross
NDMA	National Disaster Management Agency
ERRA	Earthquake Rehabilitation and Reconstruction Authority
ADRC	Asia Disaster Reduction Center
ADPC	Asian Disaster Preparedness Center's
PEER	Program for Enhancement of Emergency Response
SDMC	SAARC Disaster Management Center
FLVOAD	Florida Association for Volunteers Florida Voluntary organization Active in Disaster
NVOAD	National Volunteer Organizations Active in Disaster
CLD	Causal Loop Diagrams
AGAHE	Association for Gender Awareness and Human Empowerment
PY	Peace for Youth
SDP	Support To Deprived People
EHSAR	EHSAR, Badin Development Organization
STNAH	Save the Nature and Humanity Development Organization
IOM	International Organization for Migration
PRC	Pakistan Red Crescent Society
FURD	Foundation for Urban and Rural Development
ABM	Agent Based Model