CERTIFICATE

Delhi Technological University
(Government of Delhi NCR)
Bawana Road, New Delhi-42

This is to certify that the thesis entitled **"Feasibility of ANN in Agile Methodologies for Effort Estimation"** done by **ARPIT SANGHAVI** (Roll Number: **2K11/SWE/02**) for the partial fulfillment of the requirements for the award of degree of **Master of Technology** Degree in **Software Engineering** in the **Department of Computer Engineering**, Delhi Technological University, New Delhi is an authentic work carried out by him under my guidance.

Project Guide:
Prof. Daya Gupta
Professor and Head of Department
Department of Computer Engineering
Delhi Technological University, Delhi

ACKNOWLEDGEMENT

I take this opportunity to express my deep sense of gratitude and respect towards my guide **Prof. Daya Gupta (Head of Department) Department of Computer Engineering.**

I am very much indebted to her for her generosity, expertise and guidance i have received from her while working on this project. Without her support and timely guidance the completion of the project would have seemed a far –fetched dream. In this respect I find myself lucky to have my guide. She have guided not only with the subject matter, but also taught the proper style and techniques of documentation and presentation. I would also like to take this opportunity to present my sincere regards to **Dr. Vijay Rao,** Scientist ISSA,DRDO and **Ms. Shruti Jaiswal**, Research Scholar, DTU for extending their support and valuable Guidance.

Besides my guides, I would like to thank entire teaching and non-teaching staff in the Department of Computer Engineering, DTU for all their help during my tenure at DTU. Kudos to all my friends at DTU for thought provoking discussion and making stay very pleasant.

ARPIT SANGHAVI
M.Tech Software Engineering
2K11/SWE/02

ABSTRACT

Software development effort estimation is the process of predicting the most realistic use of effort required to develop or maintain software based on incomplete, uncertain and/or noisy input. Poor estimation may be the cause of significant challenges in project management and in the software quality. Therefore, it is important to make the use of estimation models and appropriate techniques to avoid losses caused by poor estimation.

Software effort estimation has been an important and difficult task since the evolution of the software. Many formal and informal methods have been proposed for software estimation. It is important for estimation methods to generate realistic software estimates to build the trust of customers as well as team members. Unrealistic estimates are major factors for either software project failure or decreasing the quality of the software.

Agile software processes try to minimize the impact of insufficient estimation accuracy by ensuring that the most important functionality is developed first. This is achieved through a flexible development process with short iterations. However, there is still a need for accurate estimates, as these are the basis for staffing, planning, prioritization and contract negotiations.

To address the effort estimation related issues in case of agile software development, I will be proposing a new way to estimate effort required to develop software which is going to be built by agile methodologies. This new way incorporates categorization of various important project characteristics into 10 metrics (Team, Complexity, performance etc) which can be helpful to increase the accuracy of effort estimation by the use of artificial neural network.

TABLE OF CONTENTS

CERTIFICATE ..... [i]

ACKNOWLEDGEMENT ..... [ii]

ABSTRACT ..... [iii]

TABLE OF CONTENTS ..... [iv]

LIST OF FIGURES ..... [vi]

LIST OF TABLES ..... [vii]

CHAPTER 1

INTRODUCTION 1

- **1.1. GRENRAL CONCEPTS** 1
- **1.2. MOTIVATION** 3
- **1.3. RELATED WORK** 5
- **1.4. PROBLEM STATEMENT** 7
- **1.5. SCOPE OF THE THESIS** 7
- **1.6. THESIS ORGANIZATION** 9

CHAPTER 2

AGILE METHODOLOGIES AND EFFORT ESTIMATION 10

- **2.1. INTRODUCTION OF AGILE METHODOLOGIES** 10
- **2.2. TYPES OF AGILE METHODOLOGIES** 11
- **2.3. CHARACTERISTICS OF AGILE METHODOLOGIES** 16
- **2.4. EFFORT ESTIMATION** 16
- **2.5. CLASSIFICATION OF EFFORT ESTIMATION** 17
- **2.6. BENIFITS OF ACCURATE ESTIMATION** 18

CHAPTER 3

SOFTWARE ESTIMATION TECHNIQUES 20

3.1. LINE OF CODE 20
3.2. FUNCTION POINT 20
3.3. COCOMO 21
3.4. COCOMO 2 22
3.5. PLANNING POKER 23
3.6. ESTIMATION USING ANN 25

CHAPTER 4
PROPOSED METHODOLOGY 27
4.1. PROJECT CHARACTERISTICS METRICS 27
4.2. PROPOSED METHODOLOGY USING ANN 36

CHAPTER 5
IMPLEMENTATION 42
5.1. TOOLS USED 42
5.2. INTERFACE OF DIFFERENT MODULE 44

CHAPTER 6
RESULT AND ANALYSIS 56
6.1. OVER ESTIMATION AND UNDER ESTIMATION 56
6.1. ANALYSIS USING A DATA SET 57
6.3. RESULTS 58

CHAPTER 7
CONCLUSION 65
REFERENCES 66
APPENDIX 1 69
APPENDIX 2 75

LIST OF FIGURES

Figure 1: Agile Model 2

Figure 2: Comparision of Modelling techniques 3

Figure 3: General Way of Developing Software through XP 12

Figure 4: Key roles and interaction artifacts in SCRUM 15

Figure 5: Planning Poker 24

Figure 6: Project characteristics metrics 28

Figure 7: Proposed methodology 36

Figure 8: ANN Model 41

Figure 9: Starting of metrics Weight Calculations 44

Figure 10: Selecting different intensity level of different metrics 45

Figure 11: Selecting different intensity level of different metrics 46

Figure 12: Selecting different intensity level of different metrics 47

Figure 13: Final weights of different metrics and Cumulative weight 48

Figure 14: Starting nftool 49

Figure 15: Input and output of ANN 50

Figure 16: Sample Classification 51

Figure 17: Selecting Number of Neurons 52

Figure 18: Training the Network 53

Figure 19: Results of ANN 54

Figure 20: Saving results 55

Figure 21: Penalties for underestimation vs. Penalties for overestimation 57

Figure 22: Regression Curve of Training 60

Figure 23: Regression Curve of Validation 60

Figure 24: Regression Curve of Testing 61

Figure 25: Regression Curve of Training 62

Figure 26: Regression Curve of Validation 62

Figure 27: Regression Curve of Testing 63

LIST OF TABLES

Table 1: Percentage usage of Different Development technique 4

Table 2: Estimates using Planning Poker 25

Table 3: Collective Values of Regression Curve for 15 Hidden neurons 61

Table 4: Collective Values of Regression Curve for 10 Hidden neurons 63

Table 5: Criteria for selecting intensity level of Complexity metric 69

Table 6: Criteria for selecting intensity level of Team metric 70

Table 7: Criteria for selecting intensity level of Performance metric 70

Table 8: Criteria for selecting intensity level of Organization metric 71

Table 9: Criteria for selecting intensity level of Configuration metric 71

Table 10: Criteria for selecting intensity level of Programmer's Capability metric 72

Table 11: Criteria for selecting intensity level of Expandability metric 72

Table 12: Criteria for selecting intensity level of Reuse components metric 73

Table 13: Criteria for selecting intensity level of Constraints metric 73

Table 14: Criteria for selecting intensity level of Project management metric 74

Table 15: Data Set 75