DYNAMIC SENSITIVITY ANALYSIS TOOL FOR
MULTI-CRITERIA DECISION MAKING

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DYNAMIC SENSITIVITY ANALYSIS TOOL FOR MULTI-CRITERIA DECISION MAKING

By

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DECLARATION

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

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### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declaration</td>
<td>ii</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>iii</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>iv-vii</td>
</tr>
<tr>
<td>List of Figures</td>
<td>viii-ix</td>
</tr>
<tr>
<td>List of Tables</td>
<td>x</td>
</tr>
<tr>
<td>Abstract</td>
<td>xi</td>
</tr>
<tr>
<td>Abstrak</td>
<td>xii</td>
</tr>
</tbody>
</table>

1. **AN OVERVIEW**
   - 1.1 Introduction
   - 1.2 Problem Statement
   - 1.3 Objectives
   - 1.4 Scope of Project
   - 1.5 Research Significance
   - 1.6 Methodology
   - 1.7 Project Plan/Schedule
   - 1.8 Project Distribution
   - 1.9 Conclusion

2. **LITERATURE REVIEW**
   - 2.1 Introduction
   - 2.2 Reviewing of Existing Software
     - 2.2.1 Expert Choice Professional Inc. (ECPro)
   - 2.3 Comparison of Different Other Decision Making Methodology
     - 2.3.1 Using Multi-Attribute Utility Theory (MAUT)
     - 2.3.2 Using Holistic Approach
     - 2.3.3 Using List of Pros and Con
     - 2.3.4 Using Delphi
   - 2.4 Comparison of Implementation Tools
     - 2.4.1 Why Object Oriented System Development (OOSD) Is Used
     - 2.4.2 Why Visual Basic 6.0 is used
   - 2.5 Proposed System
     - 2.5.1 Improvement of the current system
   - 2.6 Conclusion

3. **METHODOLOGY**
   - 3.1 Introduction
   - 3.2 Object Oriented System Development (OOSD)
     - 3.2.1 Object Oriented Analysis
     - 3.2.2 Object Oriented Design
     - 3.2.3 Prototyping
     - 3.2.4 Implementation
     - 3.2.5 Incremental Testing
       - 3.2.5.1 Black Box Testing
4. SYSTEM ANALYSIS

4.1 Introduction

4.2 Proposed System Analysis

4.3 Software Requirement Specifications (SRS)

4.3.1 Introduction

4.3.1.1 System Reference

4.3.1.2 Overall Description

4.3.1.3 Software Project Constraint

4.3.2 Requirement Description

4.3.2.1 User Requirement

4.3.2.1.1 Overview of Functional Requirement

4.3.2.1.2 Overview of Non Functional Requirement

4.3.2.1.2.1 Usability Requirement

4.3.2.1.2.2 Efficiency Requirement

4.3.2.1.2.2.1 Speed Requirement

4.3.2.1.2.2.2 Robustness

4.3.2.1.2.3 External Requirement

4.3.2.1.2.3.1 Software Developed Requirement

4.3.2.1.2.3.2 Ethical Requirement

4.3.2.1.2.3.3 Legislative Requirement

4.3.2.2 Specific Requirement

4.3.2.2.1 External Interface Requirement

4.3.2.2.2 Performance Requirement

4.3.2.2.3 Software Requirement

4.3.2.2.4 Hardware Requirement

4.3.2.2.5 Programming Languages Support

4.4 Conclusion
5.3.2.1 Description of Use Case Diagram
5.3.2.1.1 Actor 1 : User
5.3.2.1.2 Actor 2 : Analysis Tool
5.3.2.1.3 Use Case 1 : Define Goal
5.3.2.1.4 Use Case 2 : Insert Criteria
5.3.2.1.5 Use Case 3 : Making Choice
5.3.2.1.6 Use Case 4 : Insert Alternative
5.3.2.1.7 Use Case 5 : Compare Priority
5.3.2.1.8 Use Case 6 : Select Comparison Method
5.3.2.1.9 Use Case 7 : Print
5.3.2.1.10 Use Case 8 : Relative Priority
5.3.2.1.11 Use Case 9 : Create Dynamic Graph
5.3.2.1.12 Use Case 10 : Generate Report
5.3.2.1.13 Use Case 11 : Composite Priority

5.3.3 The Activity Diagram
5.3.3.1 Making Decision
5.3.3.1.1 Activity 1 : Set Goal
5.3.3.1.2 Activity 2 : Set Alternative
5.3.3.1.3 Activity 3 : Set Criteria
5.3.3.1.4 Activity 4 : Create Relative Priority
5.3.3.1.5 Activity 5 : Create Composite Priority
5.3.3.1.6 Activity 6 : Select View Result Method
5.3.3.1.7 Activity 7 : View Result
5.3.3.1.8 Activity 8 : Save Data

5.3.3.2 Compare Priority

5.3.4 The Interaction (Sequence and Collaboration)
5.3.4.1 Use Case 1 : Define Goal
5.3.4.1.1 Sequence Diagram
5.3.4.1.2 Collaboration Diagram
5.3.4.2 Use Case 2 : Insert Criteria
5.3.4.2.1 Sequence Diagram
5.3.4.2.2 Collaboration Diagram
5.3.4.3 Use Case 3 : Making Choice
5.3.4.3.1 Sequence Diagram
5.3.4.3.2 Collaboration Diagram
5.3.4.4 Use Case 4 : Insert Alternative
5.3.4.4.1 Sequence Diagram
5.3.4.4.2 Collaboration Diagram
5.3.4.5 Use Case 5 : Compare Priority
5.3.4.5.1 Sequence Diagram
5.3.4.5.2 Collaboration Diagram
5.3.4.6 Use Case 6 : Select Comparison Method
5.3.4.6.1 Sequence Diagram
5.3.4.6.2 Collaboration Diagram
5.3.4.7 Use Case 7 : Print
5.3.4.7.1 Sequence Diagram
5.3.4.7.2 Collaboration Diagram
5.3.4.8 Use Case 8 : Relative Priority
5.3.4.8.1 Sequence Diagram
5.3.4.8.2 Collaboration Diagram
5.3.4.9 Use Case 9: Create Dynamic Graph

5.3.4.9.1 Sequence Diagram
5.3.4.9.2 Collaboration Diagram

5.3.4.10 Use Case 10: Generate Report
5.3.4.10.1 Sequence Diagram
5.3.4.10.2 Collaboration Diagram

5.3.5 Object Model (Class Diagram)

5.4 Object Oriented Data Dictionary

5.5 Conclusions

6. SYSTEM IMPLEMENTATION

6.1 Introduction

6.2 Implementation of System Framework
6.2.1 Decision Making

6.3 Implementation of System Modules Interfaces
6.3.1 The Software Main Interface
6.3.2 System Modules Interfaces
6.3.2.1 Decision Objectives Module
6.3.2.2 Criteria Establishment
6.3.2.3 Alternatives Development
6.3.2.4 Alternatives Evaluation
6.3.2.5 Criteria Evaluation
6.3.2.6 Resolving Problem

6.4 Illustrated User’s Guide
6.4.1 Concrete Task Example
6.4.1.1 Relative Importance of Criteria
6.4.1.2 Relative Importance of Alternatives
6.4.1.3 Summary
6.4.2 Evaluation of Software

6.5 Conclusion

7. SYSTEM IMPLEMENTATION

7.1 Introduction

7.2 System Testing
7.2.1 Black Box Testing

7.3 System Evaluation: Case Study
7.3.1 3 Levels of Decision Making

7.4 Conclusion

8. CONCLUSION AND FUTURE WORKS

8.1 Introduction

8.2 Achievement
8.3 Future Work
8.4 Conclusion

Reference / Bibliography
Appendix
- A – Gantt Chart
- B – Source Code
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Figure No</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.1</td>
<td>Three Level of Decision Making Hierarchy</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>1.2</td>
<td>Four Level of Decision Making Hierarchy</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>5.1</td>
<td>Conceptual Model for Dynamic Sensitivity Analysis Tool</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>5.2</td>
<td>Use Case Diagram for Dynamic Sensitivity Analysis Tool</td>
<td>23</td>
</tr>
<tr>
<td>5</td>
<td>5.3</td>
<td>Activity Diagram for Decision Making</td>
<td>26</td>
</tr>
<tr>
<td>5</td>
<td>5.4</td>
<td>Activity Diagram for Comparing Priority</td>
<td>28</td>
</tr>
<tr>
<td>5</td>
<td>5.5</td>
<td>Sequence Diagram for Define Goal</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>5.6</td>
<td>Collaboration Diagram for Define Goal</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>5.7</td>
<td>Sequence Diagram for Insert Criteria</td>
<td>31</td>
</tr>
<tr>
<td>5</td>
<td>5.8</td>
<td>Collaboration Diagram for Insert Criteria</td>
<td>31</td>
</tr>
<tr>
<td>5</td>
<td>5.9</td>
<td>Sequence Diagram for Making Choice</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td>5.10</td>
<td>Collaboration Diagram for Making Choice</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td>5.11</td>
<td>Sequence Diagram for Insert Alternative</td>
<td>33</td>
</tr>
<tr>
<td>5</td>
<td>5.12</td>
<td>Collaboration Diagram for Insert Alternative</td>
<td>33</td>
</tr>
<tr>
<td>5</td>
<td>5.13</td>
<td>Sequence Diagram for Comparing Priority</td>
<td>34</td>
</tr>
<tr>
<td>5</td>
<td>5.14</td>
<td>Collaboration Diagram for Comparing Priority</td>
<td>35</td>
</tr>
<tr>
<td>5</td>
<td>5.15</td>
<td>Sequence Diagram for Select Comparison Method</td>
<td>35</td>
</tr>
<tr>
<td>5</td>
<td>5.16</td>
<td>Collaboration Diagram for Select Comparison Method</td>
<td>36</td>
</tr>
<tr>
<td>5</td>
<td>5.17</td>
<td>Sequence Diagram for Print</td>
<td>36</td>
</tr>
<tr>
<td>5</td>
<td>5.18</td>
<td>Collaboration Diagram for Print</td>
<td>37</td>
</tr>
<tr>
<td>5</td>
<td>5.19</td>
<td>Sequence Diagram for Relative Priority</td>
<td>37</td>
</tr>
<tr>
<td>5</td>
<td>5.20</td>
<td>Collaboration Diagram for Relative Priority</td>
<td>38</td>
</tr>
<tr>
<td>5</td>
<td>5.21</td>
<td>Sequence Diagram for Create Dynamic Graph</td>
<td>39</td>
</tr>
<tr>
<td>5</td>
<td>5.22</td>
<td>Collaboration Diagram for Create Dynamic Graph</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>5.23</td>
<td>Sequence Diagram for Generate Report</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>5.24</td>
<td>Collaboration Diagram for Generate Report</td>
<td>41</td>
</tr>
<tr>
<td>5</td>
<td>5.25</td>
<td>Class Diagram for Dynamic Sensitivity Analysis Tool</td>
<td>42</td>
</tr>
<tr>
<td>6</td>
<td>6.1</td>
<td>Dynamic Sensitivity Analysis Tool for Multicriteria Decision Making Framework</td>
<td>45</td>
</tr>
<tr>
<td>6</td>
<td>6.2</td>
<td>Splash Screen for Dynamic Sensitivity Analysis Tool</td>
<td>46</td>
</tr>
<tr>
<td>6</td>
<td>6.3</td>
<td>Main Menu for Dynamic Sensitivity Analysis Tool</td>
<td>47</td>
</tr>
<tr>
<td>6</td>
<td>6.4</td>
<td>Goal Description</td>
<td>47</td>
</tr>
<tr>
<td>6</td>
<td>6.5</td>
<td>Criteria Establishment</td>
<td>48</td>
</tr>
<tr>
<td>6</td>
<td>6.6</td>
<td>Alternatives Development</td>
<td>49</td>
</tr>
<tr>
<td>6</td>
<td>6.7</td>
<td>Alternatives Evaluation for Style Criteria</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>6.8</td>
<td>Alternatives Evaluation for Fuel and Reliable Criteria</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>6.9</td>
<td>Evaluation of Criteria</td>
<td>51</td>
</tr>
<tr>
<td>6</td>
<td>6.10</td>
<td>Sensitivity Graph</td>
<td>51</td>
</tr>
<tr>
<td>6</td>
<td>6.11</td>
<td>Centralization of Decision Problem</td>
<td>52</td>
</tr>
<tr>
<td>6</td>
<td>6.12</td>
<td>Introduction to Analytical Hierarchical Process (AHP)</td>
<td>53</td>
</tr>
<tr>
<td>6</td>
<td>6.13</td>
<td>State of Goal</td>
<td>53</td>
</tr>
<tr>
<td>6</td>
<td>6.14</td>
<td>Level of Decision Making</td>
<td>54</td>
</tr>
<tr>
<td>Chapter</td>
<td>Section</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>6</td>
<td>6.15</td>
<td>Determination of Relative Importance of Criteria</td>
<td>54</td>
</tr>
<tr>
<td>6</td>
<td>6.16</td>
<td>AHP Pattern</td>
<td>55</td>
</tr>
<tr>
<td>6</td>
<td>6.17</td>
<td>Eigenvector Calculation 1</td>
<td>55</td>
</tr>
<tr>
<td>6</td>
<td>6.18</td>
<td>Eigenvector Calculation 2</td>
<td>56</td>
</tr>
<tr>
<td>6</td>
<td>6.19</td>
<td>Eigenvector Calculation 3</td>
<td>57</td>
</tr>
<tr>
<td>6</td>
<td>6.20</td>
<td>Eigenvector Calculation 4</td>
<td>58</td>
</tr>
<tr>
<td>6</td>
<td>6.21</td>
<td>Summary of Decision Evaluation</td>
<td>59</td>
</tr>
<tr>
<td>6</td>
<td>6.22</td>
<td>Dynamic Sensitivity Analysis Tool with AHP Inside</td>
<td>60</td>
</tr>
<tr>
<td>7</td>
<td>7.1</td>
<td>Dynamic Sensitivity Analysis Tool Model for Selecting House</td>
<td>63</td>
</tr>
<tr>
<td>7</td>
<td>7.2</td>
<td>Dynamic Sensitivity Analysis Tool Model to Evaluate House</td>
<td>67</td>
</tr>
<tr>
<td>7</td>
<td>7.3</td>
<td>Sensitivity Graph indicates Bungalow is a Winner</td>
<td>68</td>
</tr>
</tbody>
</table>

Chapter Tab
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Tab</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Chapter</td>
<td>Table No</td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>5</td>
<td>5.1</td>
</tr>
<tr>
<td>5</td>
<td>5.2</td>
</tr>
<tr>
<td>7</td>
<td>7.1</td>
</tr>
<tr>
<td>7</td>
<td>7.2</td>
</tr>
<tr>
<td>7</td>
<td>7.3</td>
</tr>
<tr>
<td>7</td>
<td>7.4</td>
</tr>
<tr>
<td>7</td>
<td>7.5</td>
</tr>
<tr>
<td>8</td>
<td>8.1</td>
</tr>
<tr>
<td>8</td>
<td>8.2</td>
</tr>
</tbody>
</table>
ABSTRACT

Software systems are now ubiquitous. Virtually, all electrical equipment now includes some kind of software; software is used to help run manufacturing industry, schools and universities, health care, finance and government; many people use software of different kinds for entertainment and education. The specification, development, management and evolution of these software systems make up the discipline of software engineering.

Decision making is one of the important component in an organization. Every decision should consider every aspects as the result will effect the whole organization. We should have some tools that can help us make decision effectively, faster and less error. Based on this idea, 'Dynamic Sensitivity Analysis Tool for Multi-Criteria Decision Making' will be developed to support decision makers in their fields.

This software will improve the ability of decision makers in an organization. Furthermore, it will reduce the workload and the cost of decision making.
ABSTRAK

Sistem perisian kini boleh didapati di mana-mana sahaja. Secara virtual, boleh dikatakan kesemua peralatan elektronik mengandungi perisian; perisian ini digunakan dalam pelbagai bidang seperti bidang perindustrian, sekolah dan universiti, pusat kesihatan, kewangan dan kerajaan; kebanyakan orang menggunakan pelbagai variasi perisian untuk tujuan hiburan dan pendidikan. Spesifikasi, pembangunan, pengurusan dan evolusi perisian ini terangkum dalam bidang kejuruteraan perisian.


Diharapkan kewujudan perisian ini dapat meningkatkan kebolehan membuat keputusan di dalam organisasi atau orang perorang. Selebihnya, ini akan mengurangkan beban kerja serta kos untuk membuat keputusan.
1.0 AN OVERVIEW

1.1 INTRODUCTION

Decision making is one of the most fundamental areas of our lives and is critical for any successful business. No matter how good you are at making decisions, you know that making an important decision is difficult. However we believe that most people are much poorer at decision making than they think.

We need to convince others, although we may know what we are doing. We decide based on prior experience, intuition, or advice from others, but sometimes our decisions are rarely appropriate. This is because of bias during our decision process, since our judgement depends on the totality of our impression (Saaty, 1999).

Multi-Criteria Decision Making (MCDM) methods are procedures and mathematical algorithms for aiding decision making when multiple objectives are considered. This process involves a choice of one or more alternatives from among a set of possibilities, and the choice being based on how each alternative measures up to set of predefined criteria.

Sensitivity Analysis is a procedure, in which weights and criterion scores are varied in order to test the stability of assessment measure of each decision. The solution (ranking of decision alternatives) is said to be sensitive if small changes in weights or criterion scores produce significant changes in the order of ranked decision alternatives.

Based on such problems, we are going to build a decision support software called Dynamic Sensitivity Analysis Tool for Multi-Criteria Decision Making.

1.2 PROBLEM STATEMENT

Making a decision implies that there are alternative choices to be considered, and in such a case we want not only to identify as many of these alternatives as possible but also to choose the one that best fits with our goals. Some people have a very hard time making even the most mundane decisions and, in major decisions, we all have trouble. Hence, it is difficult to evaluate between criteria and options if we do not use effective techniques.

Human are not often logical creatures. Most of the time we base our judgments on hazy impressions of reality and then use logic to defend our conclusions (Saaty, 1999).

Let us consider the decision process involved in buying a new car. When people buy a car, they usually have several criteria or objectives to satisfy before they will be happy with their selection. Some objectives may be safety, reliability, comfort, performance, style, costs (purchase, maintenance) and status. When we know what our objectives are, we have already completed much of the difficult work towards making a good decision, regardless of its complexity. Much of the rest of the work involves determining how important the objectives are to the decision and how the alternatives perform relative to each objective.
1.3 OBJECTIVES

The MCDM approach involves describing a decision problem with six elements; value, goal, objectives, decision maker, decision alternative, criteria and outcome. Our system will enable user to define the goal and enter the set of criteria and alternatives systematically. Then make a pairwise comparison to compute weights representing the relative importance of criteria. Weights are not assigned directly, but represent a "best fit" set of weights derived from the eigenvector of the square reciprocal matrix used to compare all possible pairs of criteria.

A weight is a numeric value assigned to an evaluation criterion that indicates its importance relative to other criteria in the decision situation. The larger the weight the more important a given criterion is. The system then provide dynamic sensitivity graph for analysis.

1.4 SCOPE OF PROJECT

MCDM offers a structured approach, in which decision making is a process-oriented activity. The process used functional hierarchy that decompose complex systems into their constituent parts according to their essential relationships (Saaty, 1999).

We focused in creating three level of the hierarchy. The top level, called the goal is the overall objective consists of only one element. The second and third levels are called criteria and alternative respectively. The criteria level may each have several elements. The elements in one level are to be compared with one another against a criterion in the next higher level. Figure 1.1 shows the three level of decision making hierarchy.

![Figure 1.1 Three Level of Decision Making Hierarchy](image)

In addition, we may have another level to make overall level of hierarchy four, called sub-criteria. See Figure 1.2.

1.5 RESEARCH

Dynamic Sensitivity Analysis - Dynamic Sensitivity Analysis in decision management problem.

Firstly, the calculation can lead to errors in case if we need to modify if we need to models.

With the proposed model be kept in a file. This process is fast by calculating dynamic sensitivity of alternatives adjustments.

1.6 METHOD

We are using MCDM: We are using Illustrator 10.0, Photoshop 3.0 for our interactions. We choose to implement object-oriented analysis and design model and system evaluation, we implants

During system design and analysis. We compare and select hardware and software. We choose to implement object-oriented analysis and 

We are using MS
1.5 RESEARCH SIGNIFICANCE

Dynamic Sensitivity Tool for Multi Criteria Decision Making can be applied in most management problem. This tool will benefit the decision makers.

Firstly, the calculation in Multi-Criteria Decision Making (MCDM) is done manually; it may lead to errors in calculation. It is time consuming. If we not satisfied with the outcome values or if we need to modify the data, we need to make calculation from the beginning.

With the proposed system, all calculation will be done by computer and the processed value kept in a file. This will present the data redundancy and misplacement. With this system, that process is fast by editing the data that need to changed. By implement this system, provide dynamic sensitivity analysis graph, we easily can adjust the weight of criterion and the weight of alternatives adjusted dynamically.

1.6 METHODOLOGY

We are using Microsoft Visual Basic 6.0 as the main language in programming, Adobe Illustrator 10.0, Photoshop 7.0 and JavaScript Software Paint Shop Pro 7.0 and Animation Shop 3.0 for our interactive graphics, Rational Rose 2000e for our system design and text editor. We choose to implement Object-Oriented Approach integrating with Software Development Life Cycle.

During system analysis, we review current system analysis and release proposed system analysis. We come out with requirements engineering and acquire requirements from users, hardware and software. During system design, we come out with system architecture, and object-oriented approach by using UML. During system implementation, we release hierarchy model and system configuration. We will also develop a user manual. In system testing and evaluation, we implement system testing and user acceptance test.

We are using Microsoft Project Gantt Chart to keep our schedule running and meet the date.
### 1.7 PROJECT PLAN AND SCHEDULE

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perform Planning and Scheduling</strong></td>
<td>Start Date: June, 25, 02  The task will be done from June until end of July</td>
</tr>
<tr>
<td>✓ Revise overall project plan</td>
<td></td>
</tr>
<tr>
<td>✓ Complete detailed plan for detailed design</td>
<td></td>
</tr>
<tr>
<td>✓ Revise skeleton and generic plan for test</td>
<td></td>
</tr>
<tr>
<td>✓ Brief new team members</td>
<td></td>
</tr>
<tr>
<td>✓ Complete phase estimate</td>
<td></td>
</tr>
<tr>
<td>✓ Review plan</td>
<td></td>
</tr>
<tr>
<td>✓ Revise plan</td>
<td></td>
</tr>
<tr>
<td>✓ Complete project schedule</td>
<td></td>
</tr>
<tr>
<td><strong>Prepare Feasibility Studies</strong></td>
<td>The task will be done from early June until first week of August</td>
</tr>
<tr>
<td>✓ Release Technical Study</td>
<td></td>
</tr>
<tr>
<td>✓ Release Organisational Study</td>
<td></td>
</tr>
<tr>
<td>✓ Release Financial Study</td>
<td></td>
</tr>
<tr>
<td>✓ Document Feasibility Report</td>
<td></td>
</tr>
<tr>
<td><strong>Perform Requirement Elicitation &amp; Analysis</strong></td>
<td>The task will be done from early June until first week of August</td>
</tr>
<tr>
<td>✓ Understand the domain</td>
<td></td>
</tr>
<tr>
<td>✓ Acquire requirements</td>
<td></td>
</tr>
<tr>
<td>✓ Release a specification</td>
<td></td>
</tr>
<tr>
<td>✓ Solve a conflict resolution</td>
<td></td>
</tr>
<tr>
<td>✓ Finalize prioritization</td>
<td></td>
</tr>
<tr>
<td>✓ Check requirements validation</td>
<td></td>
</tr>
<tr>
<td>✓ List out requirements specifications (SRS)</td>
<td></td>
</tr>
<tr>
<td><strong>Release Software Prototyping</strong></td>
<td>The task will be done from early of August until third week of August</td>
</tr>
<tr>
<td>✓ Use prototype system</td>
<td></td>
</tr>
<tr>
<td>✓ Check system adequate</td>
<td></td>
</tr>
<tr>
<td>✓ Deliver prototype</td>
<td></td>
</tr>
<tr>
<td><strong>Prepare Physical Design &amp; System Model</strong></td>
<td>The task will be done from third week of August until early of October</td>
</tr>
<tr>
<td>✓ Determine security specifications</td>
<td></td>
</tr>
<tr>
<td>✓ Prepare system architecture</td>
<td></td>
</tr>
<tr>
<td>✓ Prepare behavioural model and physical system flow</td>
<td></td>
</tr>
<tr>
<td>✓ Generate data model</td>
<td></td>
</tr>
<tr>
<td>✓ Release design models with UML</td>
<td></td>
</tr>
<tr>
<td><strong>Design User Interface &amp; System Design</strong></td>
<td>The task will be done from third week of August until first week of November</td>
</tr>
<tr>
<td>✓ Evaluate design with end-users</td>
<td></td>
</tr>
<tr>
<td>✓ Produce dynamic design prototype</td>
<td></td>
</tr>
<tr>
<td>✓ Implement final user interface</td>
<td></td>
</tr>
<tr>
<td>✓ Specify system</td>
<td></td>
</tr>
<tr>
<td>✓ Develop software &amp; validate</td>
<td></td>
</tr>
<tr>
<td>✓ Deliver software</td>
<td></td>
</tr>
<tr>
<td><strong>Software Reliability Specification</strong></td>
<td>The task will be done from second week of November until end of December</td>
</tr>
<tr>
<td>✓ Check hardware reliability</td>
<td></td>
</tr>
<tr>
<td>✓ Check software reliability</td>
<td></td>
</tr>
<tr>
<td>✓ Check operator reliability</td>
<td></td>
</tr>
<tr>
<td>✓ Produce fault tolerance</td>
<td></td>
</tr>
<tr>
<td>✓ Installation and commissioning</td>
<td></td>
</tr>
<tr>
<td><strong>Perform System Testing</strong></td>
<td>Finish Date: Jan, 31, 02  The task will be done from early Jan until end of Jan</td>
</tr>
<tr>
<td>✓ Produce unit &amp; module code testing</td>
<td></td>
</tr>
<tr>
<td>✓ Implement subsystem integration testing</td>
<td></td>
</tr>
<tr>
<td>✓ Implement system integration testing</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.1 Project Schedule for Dynamic Sensitivity Analysis Tool

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1.8 PROJECT

This project covers on literature review, followed by the conceptualization and implementation of the tool. It touches on system architecture, implementation, and testing.

1.9 CONCLUSION

As a conclusion, the software 'Decision Making' - a decision support tool - is a crucial step to assist in the technical background of projects. It assists in several courses of action.
1.8 PROJECT DISTRIBUTION

This project covers five chapters. The first chapter gives an overview of the project, chapter two covers on literature review, and chapter three explains the methodology that will be used followed by the chapter four that covers on system analysis. The last chapter, chapter five touches on system design. These chapters describe all phases in the system development of implementing the software/system.

1.9 CONCLUSION

As a conclusion, with the development of 'Dynamic Sensitivity Analysis Tool for Multicriteria Decision Making', a decision maker can manage their work efficiently by the support from our decision support software. This software should be a standalone software. We are going to upload it through our final year project, Delta server. The path for our project is E:\delta\2002\fazharul.

This software is very simple to learn and use program. It does not require the user with any technical background. This tool presents a significant contribution to the decision making process. It assists a decision maker in solving complex problems involving many criteria and several courses of action.
2.0 LITERATURE REVIEW

2.1 INTRODUCTION

Dr. Thomas L. Saaty developed the Analytical Hierarchy Process (AHP) in 1970's and the process has been used to assist numerous corporate and government decision makers. Input from user is decomposed into a hierarchy of criteria and alternatives. The input is then synthesized to determine relative rankings of alternatives. Both qualitative and quantitative can be compared using informed judgments to derive weights and priorities. He demonstrated mathematically that the eigenvector solution was the best approach. (Saaty, 1990).

AHP provides a logical framework to determine the benefits of each alternative. It is widely used in strategic planning, resource allocation, source selection, business/public policy, program selection and others. AHP is a logical way for people to make decisions. AHP builds consensus, provides an audit trail, can be iterated and it's fun.

Currently, there is only one software that implements the AHP that is, the Expert Choice Professional Inc. (ECPro).

2.2 REVIEWING OF EXISTING SOFTWARE

2.2.1 EXPERT CHOICE PROFESSIONAL INC. (ECPRO)

Expert Choice Professional (ECPRO) automates the AHP, does all the math for us. We can save and iterate the results and perform sensitivity analysis. The number of criteria considered in a particular decision is often large. The AHP gives us a format in which to organize complex problems that have a large number of elements to be considered.

Expert Choice software is a multicriteria decision support tool based on the AHP, a mathematically based theory first developed at the Wharton School of the University of Pennsylvania by Thomas L. Saaty. Franklin (1999) strengthened the principal of AHP that it is a powerful and comprehensive methodology for making decisions using both measured data and judgments from the decision makers. It provides users with the tools to construct decision frameworks from both routine and non-routine problems and ways to include value judgments in these decision frameworks. This framework is a hierarchy, used to organize all the relevant factors to solve a problem in a logical and systematic way, from the goal to the criteria to the subcriteria and so on to the alternatives of a decision. The user must define the problem and enter all the relevant issues into the hierarchy and it is rarely perfect on the first attempt. (Franklin, 1999)

According to Franklin (1999), the decision maker then provides judgments on the elements in the hierarchy in pairs as to their relative importance. After the decision maker sorts the elements into hierarchy levels clustered into similar or homogeneous entities, Expert Choice asks the user how much more important, or preferred, X is compared to Y with respect to some property. A judgment is made using the AHP verbal or graphical scale or the equivalent 1 to 9 numerical state.
2.3 COMPARISON OF DIFFERENT OTHER DECISION MAKING METHODOLOGY

2.3.1 USING MULTI-ATTRIBUTE UTILITY THEORY (MAUT)

Basically, MAUT requires the decision maker to answer questions dealing with probabilities (Keeney & Raiffa, 1976). In some contexts, the probabilistic questions are very natural, but in others they are very unnatural. MAUT also implicitly assumes that the decision maker will never be inconsistent. (Boyce, Edward & Harker, 1989).

2.3.2 USING HOLISTIC

Holistic approach is concerning on the simplest and most efficient decision making methodology. If decision makers know what they want, they will choose it. (Boyce, Edward & Harker, 1989).

2.3.3 USING LIST OF PROS AND CONS

Most decision makers have used this method at some point: take a piece of paper, list the positive aspects of an alternative on one side, the negative on the other, and choose the alternative with the most “pros”. This technique is implicitly assumes that all the “pros” and all of the “cons” are equally important (Boyce, Edward & Harker, 1989).

2.3.4 USING DEPLHI

A group of decision makers are asked either through a questionnaire or through a one-on-one interviews to state their preferences on a set of alternatives and these results are then statistically analyzed to yield the final outcome (Boyce, Edward & Harker, 1989).

<table>
<thead>
<tr>
<th>Features</th>
<th>Maut</th>
<th>Holistic</th>
<th>Listing Pros and Cons</th>
<th>Delphi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis Technique</td>
<td>Answer questions dealing with probabilities</td>
<td>Decision makers know what they want, they will choose it</td>
<td>Take a piece of paper, list the positive aspects of an alternative on one side, the negative on the other, and choose the alternative with the most “pros”.</td>
<td>A group of decision makers are asked either through a questionnaire or through a one-on-one interviews</td>
</tr>
</tbody>
</table>

Table 2.1 Comparison Of Different Other Decision Making Methodology

2.4 COMPARISON

2.4.1 WHY OBJECTS

There are several reasons why system and business processes need to be modeled and analyzed via inventing static and dynamic systems. Furthermore, this kind of modeling is especially useful when we are dealing with complex systems. One reason is that the tools are already available.

Sommerville (2001) states that objects can be modeled as world entities so their components.

2.4.2 WHY VISUALIZATION

The great thing about those tools is the visual representation of code. In other words, code is no longer scattered buttons, and lines of code but a “program” looks like a user interface where elements would take less time to learn and program languages have been written.

2.5 PROPOSAL

2.5.1 IMPROVEMENTS

The proposed system is a user-friendly software. The user-friendly system (Tool: For Multicriteria) is portable and can be connected by standard Computer (PC). The user-friendly system will automatically provide help functions to the user.

The term ‘standalone’ refers to the system itself or the standalone system. No details of the syntax will be provided. However, the preference to use the system will be automatic.

Franklin (1999) reports that the preference of the system is the user of the system.
2.4 COMPARISON OF IMPLEMENTATION TOOLS

2.4.1 WHY OBJECT ORIENTED SYSTEM DEVELOPMENT IS USED

There are several advantages in using object-oriented concepts and techniques to model a system and business. Eriksson and Penker, (2000) list out that a system can be described in terms of processes that achieve goals by collaborating with different types of resource objects, via inventing static and dynamic object oriented models, similar concepts can be defined. Furthermore, this kind of approach is a well proven established technique used by large and complex systems. Object-oriented modelling finally has a standard notation: UML. That means the tools are already there, and that the same tools are used to describe the models.

Sommerville (2001) noticed that because objects are loosely coupled, the implementation of objects can be modified without affecting other objects. Objects are often representations of real world entities so the structure of the system is readily understandable. Because these real world entities are used in different systems, objects can be reused. Object-oriented programming languages have been developed which provide direct implementations of architectural components.

2.4.2 WHY VISUAL BASIC IS USED

The great thing about Visual Basic is that the program looks almost exactly like the output screen. In other words, to design and write the simple programmes, we would place text, buttons, and lines onto the screen, using the visual tools supplied with Visual Basic, until our "program" looks like what we desire our finished product to look like. Such placement of visual elements would take pages and pages of typed instructions using a traditional procedural programming language. (Perry, 1999)

2.5 PROPOSED SYSTEM

2.5.1 IMPROVEMENT OF THE CURRENT SYSTEM

The proposed system is developed as a decision support software which is a type of a standalone software. The user of the decision support software that we called 'Dynamic Sensitivity Analysis Tool: For Multicriteria Decision Making' should be the decision maker. The primary function on the proposed system is focusing on the criteria and alternatives inputted in the text box that will automatically generate sensitivity analysis graphs. Besides that, the proposed software can provide help functions as a guidelines for users of the software.

The term 'standalone software' refers to an access of using the software by a single user. Instead of that, user can repeat using the software by installing the software into their own Personal Computer (PC). The PC should satisfy minimum hardware requirements. Moreover the PC can be connected by server via Local Area Networking (LAN).

Franklin (1999) notes that to demonstrate why the chosen alternative is best, we present the details of the synthesis. It shows what criteria were used, the relative importance of the criteria, and the preferences for the alternatives with respect to each criterion.
We are going to make our software available at 4 levels. Furthermore, we are making our software to display more dynamic graphs by allocating more navigational windows. We are planning to develop 4 windows represent the four levels. We are keen on making our tool with more navigation windows and support backup files that will create *.dat, *.txt, *.mdb backup files in floppy disk. This software should be standalone. However, we are interested in making it a web based application with JavaScript tools.

2.6 CONCLUSION

'Dynamic Sensitivity Analysis Tool for Multi-Criteria Decision Making' is an amazing effort since existing software, Expert Choice Professional Inc. (ECPro) released already a comprehensive tool. A closer examination revealed new stuff and upgrades in our software useful especially for decision making up to 4 level and more clear dynamic graphs appear at the same time in difference resized windows. Simple, interesting and user friendly interfaces are to be designed to help and facilitate users especially decision makers in problem solving.

3.1 INTRO

We are using Rational Rose 20 for our interactive integrating with System Development process to do this.

Later, we come on the methodology and software. For the later phase, we are using UML. We review current system. We are implementing system.

3.2 OBJECT

Object Oriented applications.

It emphasizes the way.

3.2.1 OBJECT

An Object Oriented approach (analyze requirements, relationships), a posteriori propose that an application should be designed.

- Facilitate
- Facilitate
- Facilitate

Bahrami (1999)
3.0 METHODOLOGY

3.1 INTRODUCTION

We are using Microsoft Visual Basic 6.0 for our main computer language in programming, Rational Rose 2000 Enterprise Edition for our system design and JavaScript Paint Shop Pro 7.0 for our interactive graphics, and text editor. We choose to implement Object-Oriented Approach integrating with Software Development Life Cycle. In other term, we call it Object Oriented System Development (OOSD). Bahrami (1999) says that OOSD requires a more rigorous process to do things right.

We review current system analysis and release proposed system analysis during analysis phase. Later, we come out with requiremets its capturing and acquire requirements from users, hardware and software. Furthermore, we easily identify actor, use case, attributes and classes in this phase. In analysis phase, we come out with system architecture, and object-oriented approach by using UML. We release hierarchy model and system configuration during implementation of the system. We are interested in producing our own user manual. In system testing and evaluation, we implement system testing and user acceptance test.

3.2 OBJECT-ORIENTED SYSTEM DEVELOPMENT (OOSD)

Object Oriented System Development (OOSD) is a way to develop software by building self-contained modules or objects that can be easily replaced, modified and reused (Bahrami, 1999). It emphasizes cooperative philosophy by allocation of tasks among the objects of the applications.

3.2.1 OBJECT ORIENTED ANALYSIS

An Object Oriented Analysis (OOA) technique is generally composed of an OOA process to analyze requirements and identify specification components (e.g., classes and class relationships), and an OOA model to represent specifications [1]. According to observations, we propose that an OOA process should:

- Facilitate capturing real requirements from the functional aspect,
- Facilitate identifying specification components, especially classes and their attributes and operations, and
- Facilitate differentiating data that should be transformed into classes from those that should be regarded as attributes.

Bahrami (1999) states that during this phase, use case model and interactions diagrams should be designed. This is the first step towards identifying users’ needs and the system’s classes and their responsibility, then validating and testing the model, documenting each step along the way.
3.2.2 OBJECT ORIENTED DESIGN

Bahrami (1999) said that the goal of Object Oriented Design is to design the classes identified during the analysis phase and the user interface. During this phase, we identify and define additional objects and classes that support implementation of the requirements (Coud & Yourdon, 1991). OOD centers on establishing design classes and their protocol; building class diagrams, user interfaces, and prototypes; testing user satisfaction and usability based on usage and use cases.

3.2.3 PROTOTYPING

Bahrami (1999) notes that prototype is a version of a software product developed in the early stages of the product's life cycle for specific, experimental purposes. It should provide us a means to test and refine the user interface and increase the usability of the system. Sommerville (2000) states that prototype is an initial version of a software system which is used to demonstrate concepts, try out design options and, generally, to find out more about the problem and its possible solution.

3.2.4 IMPLEMENTATION

During the implementation phase, users learn and test the system to ensure it is the real requirements. By using the CASE tools or Object Oriented programming languages, we analyze the compatibilities of the software requirements with the system. The CASE tools for instances Rational Rose 2000e could help developers modeling the software. Rapid Application Development (RAD) is a set of tools and techniques that can be used to build an application faster than typically possible with traditional methods. It does focus more on process description and can be combined perfectly with object oriented approach. Instance of such tool is Visual Basic 6.0, which helps to develop the application rapidly and could satisfy all required requirements.

3.2.5 INCREMENTAL TESTING

This type of testing is likely to be the same as iteration testing. The application will be tested for bugs, and looks at the performance of the system to measure user satisfaction usability.

3.2.5.1 BLACK BOX TESTING

Black box test validates whether or not a given system conforms to all Software Requirements Specification (SRS). In implementation, black box tests introduce a series of inputs to a system and compare the outputs to a predefined test specification. It is concerning with the expected output and does not worry how the test is going on.

In black box testing, the user interface is exercised over a full range of inputs and the corresponding outputs are observed for correctness.

3.3 TOOLS

3.3.1 VISUAL BASIC

In its six versions, Microsoft Windows, delivering virtually all controls, is a popular tool for coding. Visual Basic lets us move controls on a form, or unload them when a user clicks on a control or a button.

Balena (1999) gave a good example of Visual Basic's graphical, multimedia, and application programming capabilities. It is such a tool. Moreover, we can work inside the Visual Basic environment and develop the application rapidly. Today we need much more than just work inside the Visual Basic environment. Visual Basic 6.0 is such a tool. More importantly, it is a matter of cost. It helps us to build an application faster than typically possible with traditional methods.

The primary difference of Visual Basic is that it is a visual programming language instead of programming tool. The primary difference of Visual Basic is that it is a complete Windows development environment.

The advantages of Visual Basic are:

- Visual Basic 6.0 is easy to learn.
- Visual Basic 6.0 is easy to use.
- Visual Basic 6.0 is easy to concentrate.
- Visual Basic 6.0 is easy to use.