Faculty of Computer Science and Information Technology

EC FORMULATION SYSTEM – A USER-GUIDED ENVIRONMENT FOR FORMULATING ENGINEERING CONTRADICTION

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EC FORMULATION SYSTEM – A USER-GUIDED ENVIRONMENT FOR FORMULATING ENGINEERING CONTRADICTION

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SHEREENA ANAK OBENG

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ABSTRACT

There are many methods of problem solving that we can apply to our daily life. One of the most effective method is TRIZ. TRIZ is a theory, a process and consisting series of tools based on the concept of settling contradictions. Based on TRIZ methodology, Engineering Contradictions are the root of many problems where trade-off and compromise is needed to stable the improving and worsening parameter. Most people know TRIZ but somehow they do not know how to apply this method into problem solving. For beginners, to learn and to formulate the right Engineering Contradiction can take time to understand. They need a lot of exercises and references to understand the use of Engineering Contradiction. EC Formulation System which EC is stand for Engineering Contradiction, is a web system that provides a user-guided environment for user to formulate Engineering Contradiction. This project demonstrates on how to reduce difficulties for new learners to formulate Engineering Contradiction. This website will assist users especially beginners to learn and understand on how to formulate Engineering Contradiction correctly. EC Formulation System provides platform for users which enable users to learn on how to formulate Engineering Contradiction step-by-step. Besides that, users are also able to study the 39 parameters together with explanations as well as formulating session is also provided so that users can practice and understand well.

ABSTRAK

Terdapat banyak kaedah penyelesaian masalah yang boleh kita gunakan untuk kehidupan seharian kita. Salah satu kaedah yang paling berkesan ialah TRIZ. TRIZ adalah teori, proses dan terdiri daripada siri alat berdasarkan konsep penyelesaian percanggahan. Berdasarkan metodologi TRIZ, Kontradiksi Kejuruteraan adalah punca banyak masalah di mana perdagangan dan kompromi diperlukan untuk memastikan parameter peningkatan dan memburuk. Kebanyakan orang tahu TRIZ tetapi entah bagaimana mereka tidak tahu cara menerapkan kaedah ini untuk menyelesaikan masalah. Bagi pemula, untuk belajar dan merumuskan Kejuruteraan Teknik yang betul boleh mengambil masa untuk difahami. Mereka memerlukan banyak latihan dan rujukan untuk memahami penggunaan Kontradiksi Kejuruteraan. Sistem Formulasi EC yang EC adalah penentangan Kejuruteraan, merupakan sistem web yang menyediakan persekitaran pengguna yang dipandu pengguna untuk merumuskan Kontradiksi Kejuruteraan. Projek ini menunjukkan bagaimana mengurangkan kesulitan untuk pelajar baru untuk merumuskan Kontradiksi Kejuruteraan. Sistem ini akan membantu pengguna terutamanya pemula untuk belajar dan memahami bagaimana untuk merumuskan Kontradiksi Kejuruteraan dengan betul. Sistem Formulasi EC menyediakan platform untuk pengguna yang membolehkan pengguna mempelajari tentang bagaimana untuk merumuskan Kontradiksi Kejuruteraan secara berturut-turut. Selain itu, pengguna juga boleh mengkaji 39 parameter beserta dengan penjelasan serta sesi formulasi juga disediakan supaya pengguna dapat berlatih dan memahami dengan baik.

CHAPTER 1: INTRODUCTION

1.1 Background

TRIZ is pronounced in a Russian acronym for “Teoriya Resheniya Izobreatatelskikh Zadatch” which means “Theory of Inventive Problem Solving”. In 1940’s, TRIZ was developed by a Russian patent engineer namely Genrich Altshuller. Genrich revealed that problems, solutions as well as patterns of technical development were repeated based on the study of approximately 200,000 patents which then was reduced into 40,000 innovative patents. These indicates that problems repeated across sciences and industries and it was discovered that the resolutions to these problems are repeated correspondingly where these solutions are then was formed into 40 Inventive Principles.

TRIZ is a philosophy, a process and a series of tools based primarily on the concept of resolving contradictions (San, Jin, & Li, 2009). It is also can be described as a structured problem-solving process with the integration of a set of problem definition as well as resolution without compromise (Chai, Zhang, & Tan, 2005). In TRIZ theory, most problems have inherent contradictions not just in work but also in our daily lives. Rather than compromising, improving versus worsening characteristic are identified as well as resolving Engineering Contradiction that evolves.

An Engineering Contradiction arises when an improvement of one characteristic resulting in degradation of another characteristic (San, Jin, & Li, 2009). Model of Problem can be simplified using Engineering Contradiction to two parameters which is the improving

and worsening. Engineering Contradiction is formulated from the generalization of an actual problem. With these contradictions, TRIZ has the ability to eliminate contradictions and suggest break-through solutions.

1.2 Problem Statement

TRIZ is one of the most recommended method when it comes to solving a problem as it is based on data, logic and research rather than on intuition. By portraying a problem as "contradiction" and resolve it, TRIZ can come up with valuable and effective solutions. Most people know TRIZ but do they know how to apply this method into problem solving?

TRIZ have shown its abilities to overcome the weaknesses of all problem solving methods such as brainstorming. For beginners, TRIZ is a good thing to learn and explore, however, the learning curve is high because it takes time to learn as well as to understand TRIZ's theory and its tools. In addition, even a beginner learn to understand and use Engineering Contradiction, they need a lot of exercises. Sometimes, beginner have difficulties to formulate the right Engineering Contradiction as they cannot see the connection between user terms to parameters and do not understand the concept.. Furthermore, even if they want to continue to use Engineering Contradiction, there is no reference to it.

Therefore, this project is proposed to a web system namely EC Formulation System, which provides a user-guided environment for formulating Engineering Contradiction.

1.3 Scope

The scope of this project is as below:

i. This system focuses on developing Engineering Contradiction tools in TRIZ
ii. This system concentrates on beginners of using TRIZ
iii. This system emphases on providing a guided platform for formulating Engineering Contradiction

1.4 Aim and Objectives

The aim for constructing this project is to reduce difficulties for new learners to formulate Engineering Contradiction. The objectives are:

i. To develop a system that enables user to view step-by-step of formulating Engineering Contradiction
ii. To implement an interface that allow user to upload TRIZ problem for formulating Engineering Contradiction
iii. To create an interface which enables user to learn the complexity of Engineering Contradiction

1.5 Project Methodology

Rapid Application Development (RAD) methodology is chosen as the suitable methodology to be applied in the development of EC Formulation System. Basically, RAD is a summarized development process which fabricates high performance system with low investment costs (Editorial, 2017). It is a method that highlights on iterative delivery as well as rapid prototyping which stresses the user to achieve the existing prerequisite of a proposed system. This methodology is chosen as the procedures enable us to modify in a fast paced to shift requirements thus this helps to reduce cost.

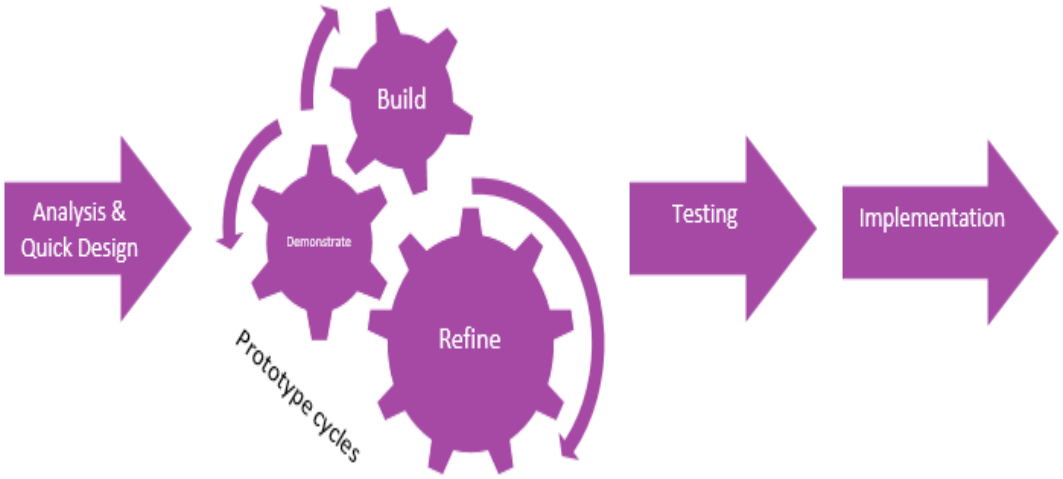

Figure 1.1 Rapid Application Development Methodology

The Rapid Application Development methodology contains 4 phases which are Analysis and Quick design, Prototype cycles (including build, demonstrate, refine), Testing and Implementation.

1.5.1 Analysis and Quick Design

It is the initial phase in RAD methodology where the project scope, requirements and constraints of the project need to be defined. Interaction between supervisor and targeted user is needed so that system processes, inputs and outputs of EC Formulation System are determined.

1.5.2 Prototype cycles

In this phase, build, demonstrate as well as refine repeated until user validate that the product fulfill all the requirements. At the build stage, which also can be described as development stage will be carry out when analysis is done. In the process of EC Formulation System development, build stage is mainly about coding. After done with prototyping, then it will be demonstrated to the supervisor to obtain feedback. If the prototype does not fulfill the requirements, the prototype will then move to the next stage which is refine. At refining stage, if enhancement or changes are needed, the prototype will be refined based on the feedback from supervisor. In this phase, the cycle will keep iterate until the requirements are fulfilled.

1.5.3 Testing

This phase will be carry out after cycles of prototype. Overall, the time for testing is reduced as the prototype are independently tested during the iterations in the previous phase. Nevertheless, it is crucial to thoroughly test the data flow and features with complete test coverage. The testing feedback need to be documented for future enhancement.

1.5.4 Implementation

It is the final phase in Rapid Application Development methodology where the system will be implement to user surroundings.

1.6 Project Significance

This project is developed to help beginners to understand TRIZ and how to formulate Engineering Contradiction.

1.7 Project Schedule

The project schedule is constructed as a reference to ensure that the project completes on time. The schedule starts at 4th September 2019 until 15th August 2020 as shown in Appendix A.

1.8 Expected Outcome

At the end of this project, an effective system is developed as:

i. A user platform to train beginners which enable user to view step-by-step of formulating Engineering Contradiction
ii. A user platform that enable user to upload general problem statement and formulate Engineering Contradiction
iii. A platform which are able to display and update

1.9 Project Report Outline

This project consists of six chapters which are Introduction, Literature Review, Requirement Analysis and Design, Implementation, Testing as well as Conclusion and Future Work.

1.9.1 Chapter 1: Introduction

In this chapter, it depicts the description and background of the EC Formulation System which provide the user wider context as well as overview based on the proposed system. This chapter covers the problem statement, project scope, aim and objectives, project methodology, significance of the project, expected outcome of the proposed system and summary of Chapter 1.

1.9.2 Chapter 2: Literature Review

This chapter discusses the knowledge of the EC Formulation System which includes the comparison with the existing system. The existing systems are analyzed based on the tools used, its advantages and disadvantages.

1.9.3 Chapter 3: Requirement Analysis and Design

Chapter 3 portrays the listing of the requirement for web system design and development which include user's software and hardware requirements, user requirements as well as functional and non-functional requirements. Data Flow Diagram is encompassed in this chapter to present the database design of the system.

1.9.4 Chapter 4: Implementation

This chapter describes the implementation of EC Formulation System with specified descriptions which includes system modules, functionalities and features of the system as well as discussion on system constraint and limitations.

1.9.5 Chapter 5: Testing

Chapter 5 elaborates on the functional and non-functional testing on EC Formulation System. The testing is evaluated with test cases on every system functionalities based on usability, functionality and reliability.

1.9.6 Chapter 6: Conclusion and Future Work

In this chapter, it presents conclusion and outline further work of the proposed system. Lessons learnt from developing the proposed system is also included with appropriate examples.

1.10 Summary

In a nutshell, chapter 1 is basically introduces EC Formulation System. This website is exposed to provide a platform that train beginners to formulate Engineering Contradiction. This proposed project will help beginners to reduce their difficulties on understanding the concept of TRIZ to formulate Engineering Contradiction. It is hope that the proposed project can ideally encourage others to learn TRIZ and apply this method to their daily lives.