



INTEGRATION OF QFD, AHP, AND TRIZ FOR MULTIPURPOSE BOOKSHELF INNOVATIVE DESIGN



**BACHELOR OF MANUFACTURING ENGINEERING
TECHNOLOGY WITH HONOURS**

2022



**Faculty of Mechanical and Manufacturing Engineering
Technology**



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BOOKSHELF INNOVATIVE DESIGN**

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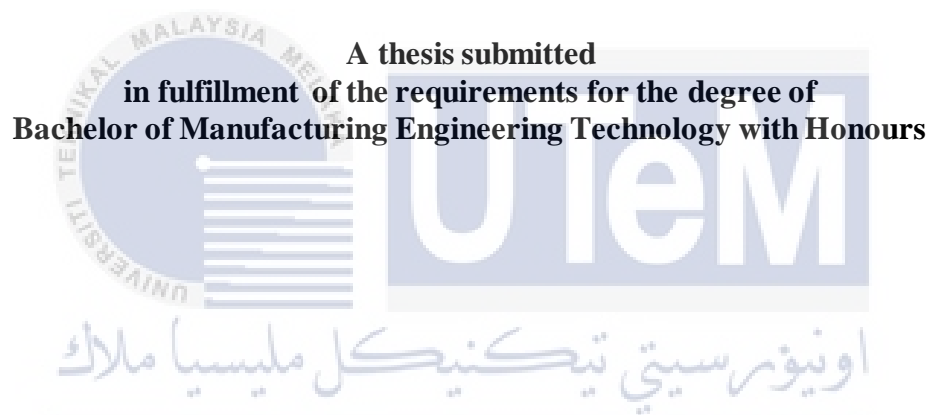
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Bachelor of Manufacturing Engineering Technology with Honours

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**INTEGRATION OF QFD, AHP, AND TRIZ FOR MULTIPURPOSE BOOKSHELF
INNOVATIVE DESIGN**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this thesis entitled “Integration of QFD, AHP, and TRIZ for Multipurpose Bookshelf Innovative Design” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Manufacturing Engineering Technology with Honours.

Signature :


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Pensyarah Kanan

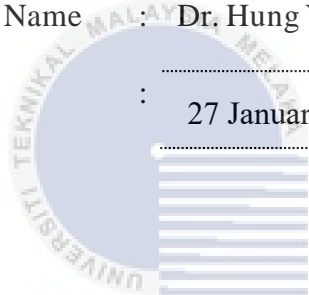
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27 January 2022



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DEDICATION

I dedicate this final year project to my parents because they are the reason why I strive to make this project successfully. I also dedicate this project to my supervisor, Dr. Hung Yu Ching @ Muhammad Hung for his countless hours of reflecting, reading, encouraging and most of all patience throughout the entire process of this Final Year Project.



ABSTRACT

The bookshelf is a common product in daily life. Most cities face problems as their populations continue to rise while human needs stay constant or expand where citizens are being pushed into less space as cities expand and marketing prices rise. These issues result in the appearance of small houses, flats and small building company which fail to provide spaces with quality and comfort. This project's primary purpose is to design and develop a multipurpose bookshelf that satisfies customers' requirements and solves problems such as limited space and limited function furniture. To design a multipurpose bookshelf that meets customer requirements, the Quality Function Deployment (QFD) method is applied. It is a method that helps to collect opinions from customers and translate the respondents' requirements into technical characteristics. So, the integrated QFD method, the Analytic Hierarchy Process (AHP) and the Theory of Inventive Problem Solving (TRIZ) method is distributed throughout the project. At the early stage of this project, a questionnaire survey is carried out as preliminary research to define the customers' requirements. These customers' needs are ranked according to their technical characteristics through AHP pairwise comparison matrix. This method's primary tools are the House of Quality (HOQ), where all of these data will be recorded and calculated inside it. Then, the TRIZ 39 Parameters and 40 Inventive Principle is then used to identify a suitable solution for the design concept. In conclusion, concept 3 (Lauve) is selected through complete HOQ since this concept obtained the highest relative importance. Based on the survey result, there are more than 70% of respondents think that this multipurpose bookshelf set helps to save space. Overall, these three methods are used to innovate the multipurpose bookshelf design that satisfies the user's demand while minimizing the space used.

Keywords: *Multipurpose bookshelf, Quality Function Deployment(QFD), Theory of Inventive Problem-solving(TRIZ), Analytic Hierarchy Process(AHP), Innovation design*

ABSTRAK

Rak buku adalah produk asas dalam kehidupan seharian. Sebilangan besar bandar menghadapi masalah kerana populasi mereka terus meningkat sementara keperluan manusia tetap berterusan atau berkembang di mana rakyat didorong ke ruang yang lebih kecil ketika bandar semakin berkembang dan harga pemasaran yang meningkat. Masalah-masalah ini mengakibatkan kemunculan rumah-rumah kecil, flat dan syarikat bangunan kecil yang gagal memberi ruang dengan kualiti dan keselesaan. Tujuan utama projek ini adalah untuk mereka bentuk dan menginovasi rak buku pelbagai guna yang dapat memenuhi keperluan pengguna dan menyelesaikan masalah seperti ruang terhad dan perabot fungsi yang terhad. Untuk mereka bentuk rak buku pelbagai guna yang memenuhi keperluan pelanggan, kaedah Quality Function Deployment (QFD) digunakan. Ia adalah kaedah yang membantu mengumpul pendapat daripada pengguna dan menterjemahkan keperluan mereka ke dalam ciri teknikal. Oleh itu, kaedah QFD, Analytic Hierarchy Process (AHP) dan Theory of Inventive Problem Solving (TRIZ) digunakan sepanjang pelaksanaan projek. Pada peringkat awal projek ini, tinjauan soal selidik dijalankan sebagai penyelidikan awal untuk menentukan keperluan pengguna. Keperluan pengguna ini disenaraikan mengikut ciri teknikal mereka melalui "AHP pairwise comparison matrix". Alat utama kaedah ini adalah House of Quality (HOQ), di mana semua data ini akan direkodkan dan dikira di dalamnya. Kemudian, TRIZ 39 Parameter dan 40 Inventive Principle kemudiannya digunakan untuk mengenal pasti penyelesaian yang sesuai untuk konsep reka bentuk. Sebagai konklusi, konsep 3 (Lauve) dipilih melalui HOQ yang lengkap kerana konsep ini mendapat kepentingan relatif tertinggi. Berdasarkan hasil tinjauan, terdapat lebih daripada 70% responden berpendapat bahawa set rak buku pelbagai guna ini membantu menjimatkan ruang. Secara keseluruhan, ketiga-tiga kaedah ini digunakan untuk menginovasi reka bentuk rak buku pelbagai guna yang memenuhi permintaan pengguna sambil meminimumkan ruang yang digunakan.

Kata Kunci : Rak buku pelbagai guna, Quality Function Deployment(QFD), Analytic Hierarchy Process(TRIZ), Analytic Hierarchy Process(AHP), Reka bentuk inovasi

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LIST OF SYMBOLS AND ABBREVIATIONS

QFD	-	Quality Function Deployment
HOQ	-	House of Quality
TRIZ	-	Theory Of Inventive Problem-Solving
AHP	-	Analytic Hierarchy Process
VOC	-	Voice of customer
DEMATEL	-	Decision-making trial and evaluation laboratory
A	-	AHP pairwise matrix
a	-	Unknown a
i	-	Number of rows
j	-	Number of columns
k	-	Order of the judgment matrix
n	-	Order of matrix
C	-	Criterion
λ_{max}	-	The average number of total consistency measure
CI	-	Consistency index
CR	-	Consistency ratio
IVIF	-	Interval-valued intuitionistic fuzzy
ARIZ	-	Algorithm of Inventive Problem Solving

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In this chapter, the background and brief about this project will be introduced. The problem statements, research objectives, scopes and limitations are also stated in this chapter.

1.2 Background

Most societies are struggling with population growth and urbanization as a result of increased demand for housing in cities, which has led to the emergence of small apartments. Middle-class communities are forced to live in apartments and flats due to a preference for a progressive lifestyle, economic size, and a lack of housing space. To sustain human wellbeing, basic human issues should be maintained in apartments. One of the reasons for person's dissatisfaction in cities is a lack of space in their homes. Most small apartments only have multipurpose rooms intended for several activities like studying, watching TV, having dinner or family gathering (Husein, 2020).

In India, the majority of India's middle-class population lives in small flats and houses, leading to their economic status as well as a lack of living space. But in the present scenario furniture occupies a majority of the space in the home. Furthermore, high population growth causes a high gap between the rich and poor people, as well as high electricity costs and home prices. There are typical issues these days. One solution to these issues is to use space-saving furniture. In this paper, we will discuss innovative designs,