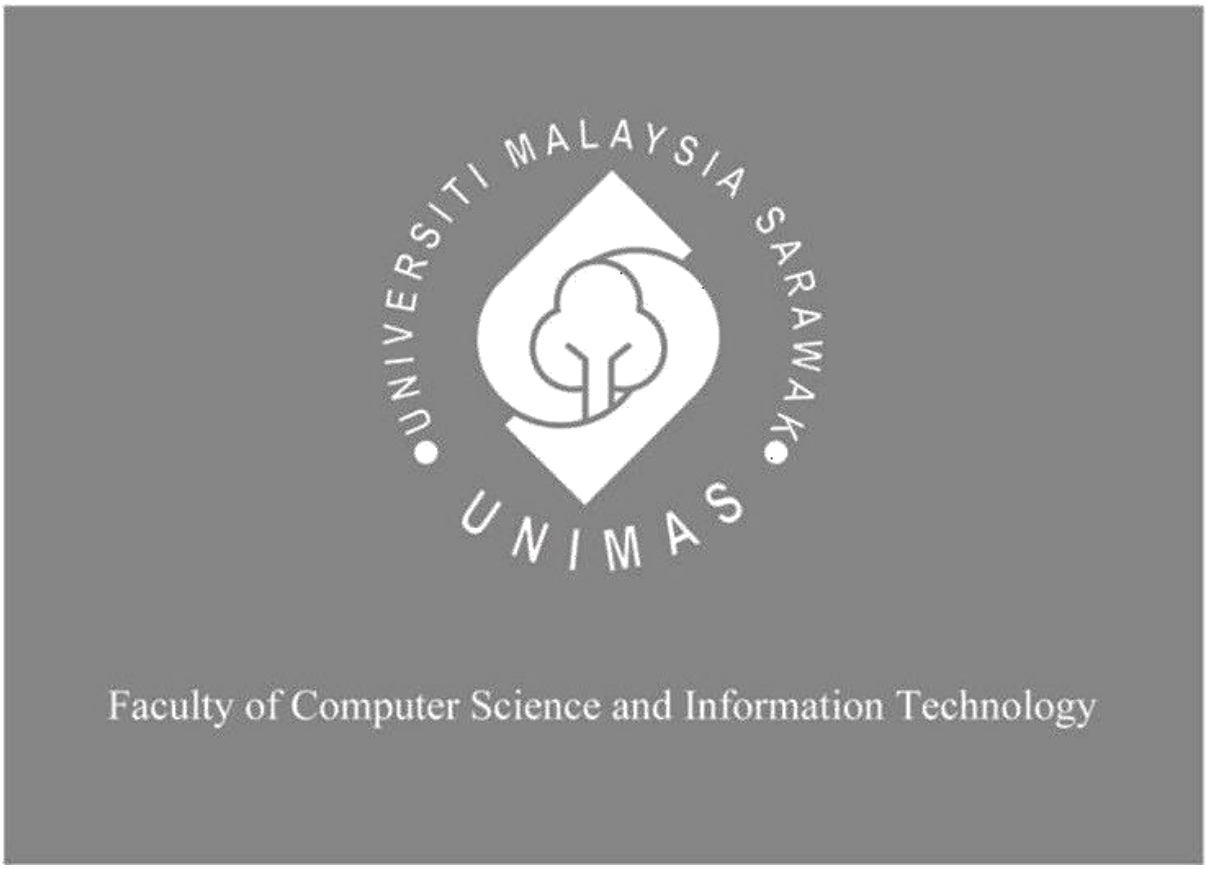

TRIZ Approach to FYP Title and Supervisor Matching System

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Bachelor of Computer Science with Honours

(Multimedia Computing)

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ABSTRACT

TRIZ Approach to FYP Title and Supervisor Matching System is proposed as a system to match a title and supervisor for a student. The proposed system is ideal to simplify the finding title and supervisor in pre-registration process. In the Faculty of Computer Science and Information Technology (FCSIT) at Universiti Malaysia Sarawak (UNIMAS), student needs to personally contact the supervisors in order to know whether there is an available quota for supervision. The proposed title will be rejected when the supervisor is not interested to it. This manual method is time consuming and may result in the search of unsuitable supervisor for guidance. In this paper, the proposed system follows a stepwise Waterfall methodology and utilizes TRIZ principles during the analysis phase to provide a satisfactory solution. The system incorporates an algorithm that considers students' CGPA, preferences, and titles for matching. A System Usability Scale (SUS) and User Acceptance Testing (UAT) was adopted in the testing phase to examine the system acceptance and adherence to customer requirements in using the proposed system. The average SUS score from all 30 users is 86.5. The results of the UAT reveal a mixed outcome, highlighting both positive aspects and areas for improvement. With the proposed solution, the students can save time and match to get their interest title with respective supervisor for final year project. Therefore, FYP Title and Supervisor Matching System will become more efficiency and effective to students for their final year project, where it will match the student to the most suitable lecture.

Keywords: *Final Year Project, Final Year Project Matching Systems, Matching Techniques, TRIZ Approach*

ABSTRACT

Pendekatan TRIZ kepada Sistem Pemadanan Tajuk dan Penyelia FYP dicadangkan sebagai satu sistem untuk memadankan tajuk dan penyelia kepada seseorang pelajar. Sistem yang dicadangkan adalah ideal untuk memudahkan pemilihan tajuk dan penyelia dalam proses prapendaftaran. Pelajar dari Fakulti Sains Komputer dan Teknologi Maklumat (FCSIT) di Universiti Malaysia Sarawak (UNIMAS), perlu menghubungi sendiri pensyarah untuk mengetahui sama ada terdapat kuota untuk penyeliaan. Tajuk yang dicadangkan akan ditolak apabila pensyarah tidak berminat dengannya. Kaedah manual ini memakan masa dan mungkin menmadankan penyelia tidak sesuai untuk bimbingan. Dalam kertas kerja ini, sistem yang dicadangkan mengikut metodologi Waterfall secara berperingkat dan menggunakan prinsip TRIZ semasa fasa analisis untuk memberikan penyelesaian yang memuaskan. Sistem ini menggabungkan algoritma yang mempertimbangkan CGPA, keutamaan dan tajuk pelajar untuk dipadankan. System Usability Scale (SUS) and User Acceptance Testing (UAT) telah diterima pakai dalam fasa ujian untuk mengkaji penerimaan sistem dan pematuhan kepada keperluan pelanggan dalam menggunakan sistem yang dicadangkan. Purata skor SUS daripada kesemua 30 pengguna ialah 86.5. Keputusan UAT mendedahkan hasil campuran, menyoroti aspek positif dan bidang-bidang yang perlu diperbaiki. Dengan penyelesaian yang dicadangkan, pelajar boleh menjimatkan masa dan mudah mendapatkan gelaran minat mereka dengan penyelia masing-masing untuk projek tahun akhir. Oleh itu, Sistem Pemadanan Tajuk dan Penyelia FYP akan menjadi lebih cekap dan berkesan untuk memadankan pelajar dengan penyelia yang paling sesuai untuk projek tahun akhir mereka.

Kata kunci: *Projek Tahun Akhir, Sistem Pemadanan Tajuk Projek Tahun Akhir, Teknik Pemadanan, Pendekatan TRIZ*

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CHAPTER 1

INTRODUCTION

1.1 Introduction

A Final Year Project (FYP) can play a substantial role in helping students graduate from an engineering degree (Tien et al., 2019). All students at the Universiti Malaysia Sarawak in Faculty of Computer Science and Information Technology (FCSIT) are required to take the FYP. The process of FYP involves several parties include students, supervisors, examiners and FYP coordinators. Among the objectives of this course is to student hands-on experience in the process of conducting a good research project or developing a system or prototype. Students are given the chance to apply and demonstrate the skills and knowledge that they have learned from more than one course and subject. It requires students to write and submit proposal of the approved title, defend the proposed title and complete their project with a supervisor's guidance. When students work on a project with the guidance of supervisor, they can better define their project work and solve the problems systematically. FYP is implemented into two courses consisting of FYP 1 and FYP 2. Each of FYPs 1 and 2 has to be finished within one normal semester and also each bearing 3 credit hours. FYP 1 will be the prerequisite to FYP 2. The FYP structure is shown as Figure 1.1.

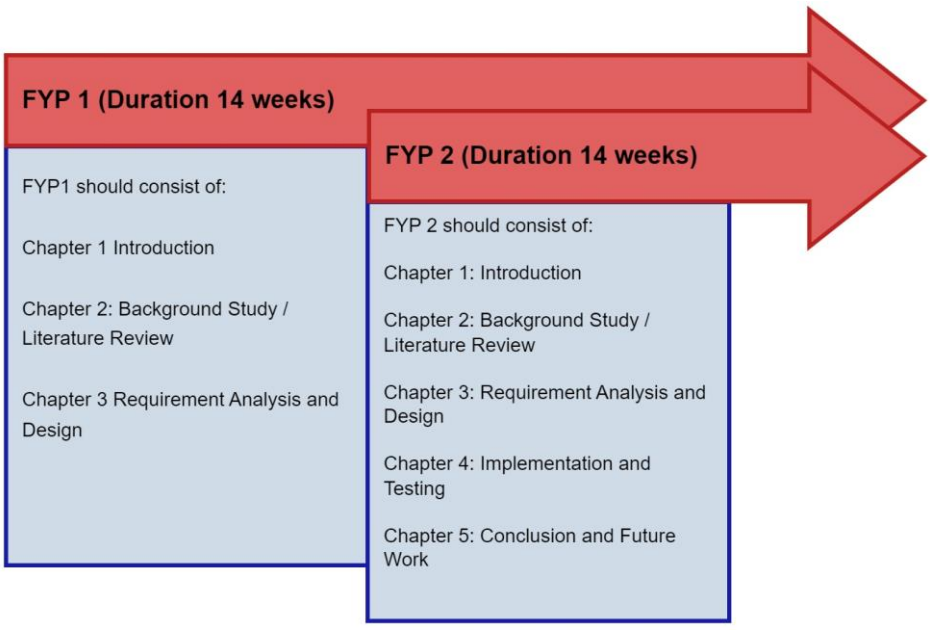

Figure 1.1 FYP Structure

FYP offers 6 credits course for a student's degree in order to graduate. It is very important because students can complete their FYPs that adhere to the standards with supervision from the FYP Coordinator and respective supervisor. The FYP Coordinator will brief the students on the project requirements based on the guidelines. Students are encouraged to meet with their supervisor at least once a week to discuss project progress. Supervisors will examine if student's project ideas are

appropriate and can assist in improving them as needed. They are knowledgeable and can make sure that students complete their FYP following the project requirement. The importance of the FYP as an overall indicator of student ability to acquire and apply knowledge throughout their study.

However, Final Year Project work is frequently a difficult nut to crack for final year students in higher education. For example, in research from MatTaib et al. (2020), students in Universiti Teknologi MARA (UiTM) find it difficult to select a title. Generally, they are still using old structure where hard copies of previous FYP theses are kept in supervisors' room or thesis room. The fact is that they can't access previous FYP theses hinders their ability to come up with new ideas. However, the issue of managing FYP theses in UiTM is solved by implementing a web-based system for students to search the related FYP thesis as their reference (MatTaib et al., 2020). It is advised to use a paperless documentation strategy so that FYP theses can be accessed from anywhere, at any time. Unfortunately, management and allocation of final year project for students in some institutions are still done manually. For example, Universiti Sultan Zainal Abidin (UniSZA) uses manual forms and booklets for FYP documentation (Mohamed et al., 2017). The manual process is considering difficult as students need to bring some related forms altogether when meeting with supervisor. It will result in being unable to evaluate student's progress if the student fails to appear for the appointment. Therefore, the student might not be able to provide a complete report on time. In order to solve that problem for monitoring and supervising student's project progress is through a web-based.

Hence, the proposed TRIZ approach to FYP Title and Supervisor Matching System will become more efficiency and effective to students for their final year project. Students can use this system to assist them to post their own title and match with supervisor based on their research field. Student needs to personally email the supervisors in order to know whether there is an available quota for supervision. The proposed title can be rejected when the supervisor is not interest to do. This manual method is time consuming and may result in the search for an unsuitable supervisor for guidance. With this proposed solution, the students can save time and be easier to get their interest title and supervisor for final year project.

1.2 Process in finding FYP title and suitable supervisor

In reality, students at UNIMAS find their title and supervisor manually. First, students will think what they can do and what area of focus. This is very important for them to know their ability and understand what they want to achieve throughout the FYP process. There are two types of FYP, development and research. Next, selecting their FYP title. There are different ways to find and choose their FYP title such come up with own idea, ask for a project from supervisor, and joining a competition. Then, start by contacting the supervisor by email and WhatsApp or other apps to get supervision. Students could simply follow by asking available quota to a supervisor and waiting for response. If the answer is no, students need to contact others supervisor until meet the available quota. In contrast, if the answer is yes, students will match their chosen field respect with the respective supervisor expertise. But, if the answer is no, students will need to contact again others supervisor until meet the suitable supervisor. After matching with a relevant supervisor in the research field, students can confirm an FYP title. Lastly, students can get a supervisor for their FYP. The Process in finding FYP title and suitable supervisor is shown as below.

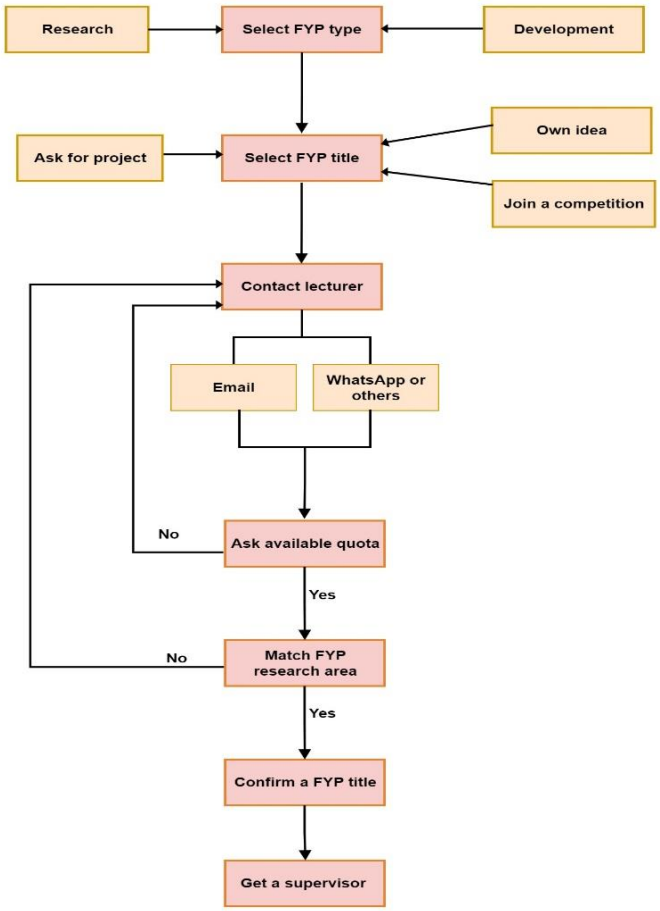

Figure 1.2 Process in finding FYP title and suitable supervisor

1.3 Theory of Inventive Problem Solving (TRIZ)

In this project explored the implementation of the theory of inventive problem-solving (TRIZ). There are problems with generally known solutions and those with unknown solutions that can be presented to people. Most problems with known solutions may be resolved using knowledge by reading varied books, journal article and so on. In contrast, the other type of problem requiring innovation and containing contradiction is one with no known solution and thus called an inventive problem. TRIZ is s a powerful creativity technique. TRIZ is mostly used at the conceptual design stage to generate design concepts and solve problems. In the TRIZ general problem-solving model, there are four steps to problem solution. TRIZ first identifies the specific problem at hand and generalize it to one of the TRIZ general problems. Identifying the general TRIZ solution from the TRIZ general problem and then applying it to the particular problem. The Figure below describes this process graphically.

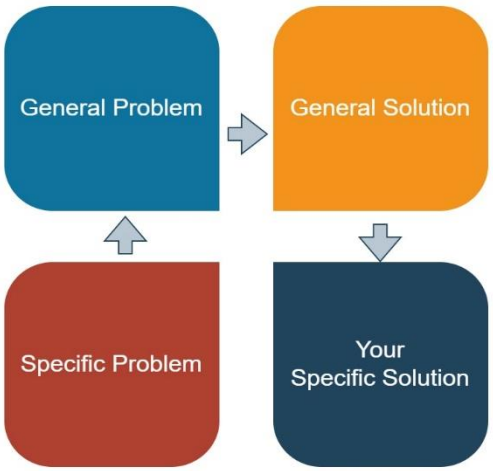

Figure 1.3 General Problem-Solving Model of TRIZ

1.4 Problem Statement

There are a few issues initially that led to the idea of designing a prototype for final year student allocation title. Here comes the first issue where problem on finding suitable title and supervisor to match the interest, level of complexity and students' background. This is because there are no formal and specific system to allocate Final Year Project' title to the students. It depends on students to do more research and find ideas that interest them. Student may find a supervisor but get an unsuitable project title or not interested. On the contrary, student may get their interest project title but get an unsuitable supervisor with respect to research field and supervision. This FYP manual presents a poor or unsatisfactory result without considering student's academic performance or without considering project supervisors' research interests.

Besides, time consuming approach on using email or messaging system to contact potential supervisor. Currently, at the Universiti Malaysia Sarawak, the process of selecting the supervisor for the final year student is time consuming as student have to propose one's own title, email to each supervisor to know whether quota is still available or not. If student did not have any idea on title, they have to email the supervisor for requesting project title and choose one from a pool of supervisor proposed titles.

Moreover, repeating similar or identical projects from previous projects is another problem. Every year have duplication of previous projects from different students take the same project topic. Students get supervision from different supervisors, they are unable to check if the proposed title belongs to a current project or a past one. This is because the FYP thesis is not manage properly and kept in thesis room. They need to manually search the previous projects from thesis room.

This process of allocating has been a major challenge for students to allocate the title which satisfied supervisors' project field. Due to this, students will take longer time in finding title and suitable supervisor. Cause Effect Chain Analysis (CECA) is one of the TRIZ tools used to identify the potential root cause for this problem. CECA is used for identifying the root cause of students unable to find FYP title and match to a supervisor. Hence, this proposed TRIZ approach to FYP Title and Supervisor Matching System will help a minimum of time is needed until the title and supervisor have been identified. It is therefore useful to help the students who struggle with choose one's project area are based on their strength, as well as helping students and supervisors on project selection. TRIZ provide problem solving technique where innovation is needed and provide systematic and efficient way to solve the problem. Therefore, TRIZ approach will be applied in the analysis phase of this project in order to provide a solution which satisfied student in finding title and supervisor for final year project.

1.5 Aims and Objectives:

The aim of this study is to provide a solution to help students to suggest their own FYP titles and request an interest title from respective supervisor.

The specific objectives are:

- To design and develop a FYP Project Matching System using TRIZ approach
- To evaluate the quality of the propose system using System Usability Scale (SUS) and User Acceptance Testing (UAT)

1.6 Scope

The scope of study for this project is inclined towards easily allocating students to supervisors. Only final year student in Faculty of Computer Science and Information Technology at Universiti Malaysia Sarawak available to use this system. It allows lectures and students to propose their interest title and match the title to students by considering student's skill, supervisor's expertise area and CGPA.

1.7 Significance of Project

The proposed TRIZ approach provide a systematic solution for students to find the title and suitable supervisor for final year project as there is no particular way that all students need to contact the lecture by email or WhatsApp to get supervision throughout the Final Year Project.

1.8 Expected Outcome

This project outcome is a prototype of FYP Title and Supervisor Matching System providing solution to the problem of finding suitable title and matching supervisor before starting FYP 1.

1.9 Milestone

Activities	**Week**													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Identify Project Title and Supervisor	■													
2. Project Title Registration		■												
3. Prepare Brief Proposal			■											
4. Submission of the Approved Brief Proposal				■										
5. Feedback and Comment from Examiner					■									
6. Prepare Full Research Proposal						■								

7. Submission of Full Proposal														
8.Discussion and writing for Chapter 1														
9. Proposal writing Chapter 2														
10. Proposed solution Chapter 3														
11. Submission of FYP 1 Final Report														

Table 1.1 Milestone

1.10 Summary

Overall, to summarize this chapter introduces students' final year projects process in order to find a project title and match to a supervisor. The main problems that can be finding from this case is there is no system to allocate Final Year Project' title to the students with matching supervisor at Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak (UNIMAS). Generally, students find their own title and email the supervisors to request for supervision. Students might take more time to search a supervisor by not knowing whether the supervisor quota are still available or not. The manual process is considerably inefficient and ineffective as the students may be matched with a title that is not their interest and unsuitable supervisor for guidance. Towards the end, there is an idea of designing a prototype of FYP Title and Supervisor Matching System which can ease the student in finding title and matching supervisor.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The Internet has emerged as one of the primary informational resources for college students. Mostly students spend time on the web searching on finding information for study relevant materials, quizzes, assignments, and projects. The ease of finding information on the internet allows them to gain more clarity on problems they don't understand by reading all of the questions and answers posted by others. With the availability of the Internet, students can get the information related to the problem at their fingertips.

A research paper usually includes a literature review as one of its components. Sources covered in the review may include books, newspapers, magazines, journal article, technical reports and so on. The literature review where several references from reputed journals and Databases are used like: IEEE Explore, ACM Digital Library or other online database in PeTARY UNIMAS, are generally considered to be among the most reliable sources of information.

This chapter will explain literature studies related to the proposed prototype. A research and analysis were conducted to collect relevant information from existing research and relate existing research to the chosen topic. Literature review presents a summary of papers related to the research area. There are several project allocation methods employed by others around the globe to improve the quality of the final year project allocation and management as well as solving the problems existed. This includes studies on the research paper regarding FYP allocation system using an algorithm and FYP management system. Techniques, data, and findings on those studies are discussed in this paper.

2.2 Theory of Inventive Problem Solving (TRIZ)

2.2.1 Research Background

TRIZ was invented by Genrich Altshuller, was a patent investigator in Russian Navy in 1946 (Lin & Chen, 2021). Altschuller analysed more than 200,000 patents in order to find out what way the innovation had taken place. He synthesized down to 40,000 patents that constituted inventive solutions, the rest were essentially improvements that made use of previously existing ideas (Cerit et al., 2014). He worked as a patent agent while serving in the Soviet Navy, assisting inventors with patent applications and resolving difficulties. He began to doubt the conventional wisdom that invention was a random act and that certain people just had an easier time coming up with ideas (Fitzgerald et al, 2006). Altshuller believed that invention could be converted into a systematic process that could be documented and taught to innovators. Altshuller developed a methodology for identifying problems

and offering direct solution to inventers rather than haphazardly searching the design space for a problem-solving solution. More than 1.5million patents have been analyzed by Altshuller and his team and discovered that 95% of problems faced by engineers in a specific industry had already been solved. Following Altshuller's insight, TRIZ is based on analysed patterns of issues and solutions. TRIZ has a significant edge over other approaches to creativity and problem solving. For example, approach like lateral thinking, mind mapping, brainstorming, and so on can discover or reveal underlying causes, but they cannot truly figure out solutions to the problem. In contrast, TRIZ aids in problem identification and provides direct solutions as well as in developing new ideas and solutions for our invention problems.

TRIZ philosophy is founded primarily on the concepts of ideality and contradiction introduced by Altshuller. Contradictions in the physical and technical are recognised by the TRIZ. A TRIZ method for overcoming contradictions is to use TRIZ tools to identify solutions in order to achieve ideality. The contradiction matrix is the core component of TRIZ tools which gathers 39 engineering parameters and 40 Principles able to overcome these contradictions.

Design problems must first be converted into TRIZ problems using the 39 common technical characteristics in order to use the contraction matrix. Then the 40 inventive principles need to be reviewed to determine which Inventive Principle provide ideas to solve on particular problem. The TRIZ solutions can then be utilised to tackle the similar design. The central tenet of the TRIZ technique is that we must adjust the general answer to fit our particular situation because all problems have previously been solved. The conceptual schema of the theory of inventive problem-solving is shown as below.

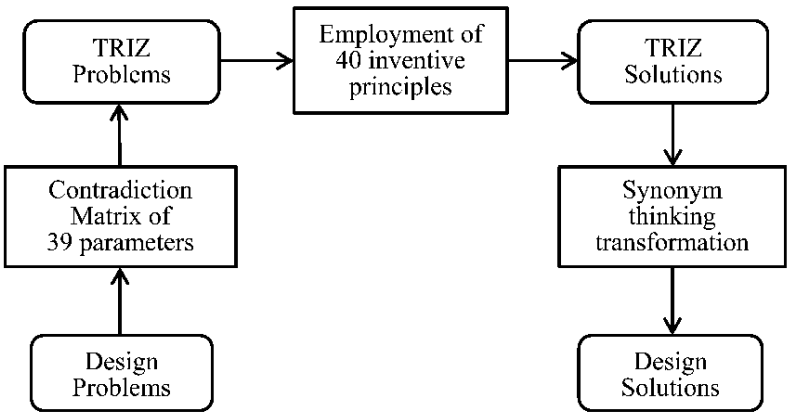

Figure 2.1 Conceptual schema of the theory of inventive problem-solving (Lin & Chen, 2021)

2.2.2 Use of TRIZ in similar problems

Based on the review, they described a problem with the electrolyzed water cleaning rig's limited allocation and chemical storage space (Jalil et al., 2021). The TRIZ contradiction matrix was used to explain the concept of generation for the design of a portable electrolyzed water purification device. The technical issue with a portable electrolyzed water cleaning equipment was subsequently resolved by applying the 40 innovative principles. As a result, the inventive design of a new portable electrolyzed water cleaning rig can provide cleaning solutions that are ecologically safe in addition to performing the same tasks as other cleaning apparatus already in use. By integrating TRIZ problem-solving tools and its knowledge base, Jiang et al (2021) proposed An Innovation Design Approach for Product Service Systems Based on TRIZ and Function Incentive. The PSS function blueprint and system function diagram were used to create the PSS function model in accordance with the function components and users. This research tries to achieve an interaction equilibrium between the functions of the product and the service during the conceptual design phase. Hence, by incorporating consumer needs from the start, PSS creative design breaks through the constraints of focusing just on product, structure, and technological carrier. Besides, company Hyflux is facing that can be studied using the TRIZ Contradiction Matrix in four different dimensions, making it simple to identify the successful element (Hsu et al, 2013). They implemented 39 TRIZ management parameters and obtained an enhanced 40 invention principle. Finally, they recommended a cloud-based approach that lowers prices for clients and grows the company's market.

2.3 Related works

Summary of studies on a similar or related topic that include keywords like final year project system, allocation system and project management system. There are only two sets of review papers that are summarized due to the systems being assessed based on the various functions. The two sets which are FYP allocation system using algorithm and FYP management system are explained below. To help in the development of the proposed system, a comparison is made of currently available systems, and this is shown in Table 2.1.

2.3.1 FYP allocation system using an algorithm

This section shows that some systems use algorithm to allocate title and supervisor to enchase the pre-registration process for the new becoming student final year. According to Chikwendu & Amaechi (2021), they are using an automation way helps to alleviate the drawbacks of manual processing, which is done with pen and paper. They discovered that manual way resulted in resulted in poor quality projects and duplication of existing projects. Anthony Ndubuisi and Emmanuel Chimezie's research also has employed an algorithm to automatically allocate a project to a student in order to

address the issue of using a manual system for project management and allocation (2021). The students can propose their topics and evaluated by their individual supervisors while the system allocates the topic with the highest point to the student.

Besides, some algorithms were designed to be matched with students and supervisors while taking their' preferences into consideration (Jailani et al., 2022). For example, the system consists of allocation module which is responsible for automatic allocation of project topics to each student based on preferences academic records of the student (Adamu, 2020). According to Hasan et al. (2009), they implemented preference based which uses a computer algorithm to allocate titles to students based on students' submissions of their 10 most preferred titles in order of preference. This is due to the fact that existing system which employs a first come first served in allocation supervisor proposed titles to students. In research from Modi et al (2018), they deployed basic Gale Sharply stable marriage algorithm in the process of allocating student project. It is allowing students to enter their preferences to the projects of their interest while the supervisor create their rank preferences from the student in the system. The algorithm takes as input the two preferences list and allocates each student to his/her most appropriate project from the perspective of both ranking. This result in both students and supervisors making a happier match than the manual matching will be possible. Salami & Maman reported their allocation for project by using genetic algorithm (GA) to assign a supervisor that matches the preferences of the students (2016). GA successfully assigned the most preferred project supervisors to students subject to the workload constraints of the supervisors.

Moreover, some systems match students and supervisors with parameters CGPA of student. Since the process of allocating Final Year Project for students at University of Sultan Zainal Abidin is form group randomly by faculty management and fill in their topic in Microsoft Excel online, which resulted in no students in the group having a balanced CGPA. The problem of FYP process discussed in research from Leung et al (2015), which is students have to form group and choose their favourite project topics by filling in forms on paper. To overcome this, the assignment of projects requires sorting out the priorities of groups based on their average GPA. The system will automatically recognize the members as a group and allow the group to select their preferred project themes. The Final Year Project Student-Supervisor Distribution using the Local search algorithms help the system to distribute student to supervisors follow by course and CGPA (BIN, 2018). The system will first analyse the number of students and supervisors in order to generate a list of students and supervisors followed by course. SAAD's research also employed the priority technique in which the system equally distributes supervisors and students based on CGPA (2018). By calculating final priority score to get a student of the same course that consists of CGPA excellent, average and weak.

Furthermore, there is a system with comparison research field and skills of supervisor and student for the system. In Latip et al 's research (2017), they deployed a Final Year Project (FYP)

matching system using Fuzzy Logic (FL). Additionally, they implemented a Mamdani-type FIS to classify research areas that the students are most suited to base on the skills entered. Then mapped out the student skill to the research areas. The FIS fuzzification process converts the inputs (on a scale of 0 to 1) to fuzzy inputs LOW and HIGH. The result is achieved when different output mappings for the FIS with different student's skills levels.

2.3.2 FYP Management system

In this section, several types of FYP systems have been developed and implemented. The FYP system is mostly related to the management and the process of FYP. Various literatures exist in final year student project and management system. For example, Adewale et al. (2013) developed university portal for management of final year project. This portal manages student project but does not allocate project topics to student. Since there is a FYP Management System in UNIMAS, I propose a FYP Title and Supervisor Matching System in the pre-registration FYP. Management system is concerned with managing student work, while our work focuses on matching FYP title and supervisor in pre-registration of FYP.

2.4 Comparison

Paper	Levels of automation	Algorithm	Filter (Course, CGPA)	Input preference	Data collection	Testing Result
(Chikwendu & Amaechi, 2021)	Fully Auto	X	X	X	13 students 10 questions	70% agreed
(Anthony Ndubuisi & Emmanuel Chimezie, 2021)	Semi Auto (submit 3, system allocate to the highest)	X	X	X	X	X
(Adamu, 2020)	Semi Auto (preference, supervisor allocate)	X	X	X	80 questionnaires	89% agreed
(Modi et al., 2018)	Fully Auto	Gale–Shapley algorithm	X	✓	X	X
(BIN,2018)	Fully Auto	Local Search Optimisation	Course, CGPA	X	X	X
(SAAD, 2018)	Fully Auto	Priority	X	X	X	X
(Latip et al., 2017)	Fully Auto	Fuzzy Logic	Skill, Research area	✓	426 students and 163 supervisors	X
(Salami & Mamman, 2016)	Semi Auto (match supervisor only)	Genetic Algorithm	X	✓	X	X
(Leung et al., 2015)	Fully Auto	X	Group GPA	✓	13 students 10 questions	70% agreed
(Hasan et al., 2009)	Semi Auto (match title only)	Network Flow Optimization algorithm	X	✓	125 students 10 preferred titles	78.5% got titles

Table 2.1 Comparison Existing System for FYP Title and Supervisor Matching System