

SERIES 2

EMPOWERING INNOVATION POST-PANDEMIC

**Editor
Nur Fadhlina Zainal Abedin**



Empowering Innovation
Post-Pandemic
(Series 2)

BOOK COMPILATION

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FOREWORD

All praise and thanks are due to Allah the Most Merciful and the Most Gracious for His abundant blessings, under which the International Invention & Innovative Competition (InIIC) Series 2/2023 was successfully organized virtually. It is with immense gratitude that we announce the results of this momentous event, which took place on the 31st of October 2023. Our heartfelt congratulations go out to all the deserving winners who have showcased exceptional talent and ingenuity.

Within the pages of this book, 'Empowering Innovation Post-Pandemic (Series 2)', lies a treasure trove of knowledge and inspiration. This collection of essays comprises the invaluable contributions of the participants of InIIC Series 2/2023, encapsulating their visionary ideas and ground-breaking discoveries. With 11 enriching chapters dedicated to innovation, this compilation serves as a beacon of enlightenment for both practitioners and academics alike, offering an innovative source and a point of reference to nurture and enhance creativity. We extend our sincere appreciation to all the authors who have generously shared their time, thoughts, and ideas in shaping the content of this book.

It is our earnest hope that 'Empowering Innovation Post-Pandemic (Series 2)' will serve as a catalyst for transformative ideas within your own endeavours. May it kindle the flames of creativity and the spirit of innovation as you embark on the path of designing new products, systems, and solutions. Let this book be your guide, igniting the spark of inspiration and propelling you towards ground-breaking achievements.

Editor

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Chapter 1

The Perfect 10 Batik Bliss Carry-All: Effortless Travel, The Elegance Way

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ABSTRACT

The Perfect-10 Batik Bliss Carry-All is a multifunctional and inventive travel bag specifically created to enhance travellers' experience by providing both aesthetic appeal and practicality. It possesses several distinctive attributes that cater to the requirements of diverse consumers. The bag has versatile compartments of varying sizes, serving multiple purposes, including an external zip pocket with sufficient storage capacity. Furthermore, the bag is equipped with inner smart LED lights and a key holder, hence enhancing the convenience of accessing personal items during low lighting. In addition, the product features conveniently accessible charging slots that allow for the charging of mobile devices while in transit. Moreover, a convenience sampling method was employed to conduct a market survey through social media platforms to get input from prospective purchasers regarding The Perfect-10 Batik Bliss Carry-All. The study gathered 117 responses, wherein a significant majority of 79.5% of participants expressed their inclination towards acquiring the travel bag. The primary determinant for the tendency to purchase the bag was the convenience associated with consolidating all necessary travel items into a single bag, as 75.2% of the participants indicated. The result of this study suggests that potential consumers hold a favourable perception and demonstrate a strong inclination towards accepting the product. The bag was crafted by individuals with disabilities at PPDK Wakaf Tapai, Terengganu, with batik fabric to emphasise functionality and cultural legacy, specifically highlighting a lightweight structural composition. The partnership established with PPDK Wakaf Tapai advances sustainable cultural, social, and economic development principles within the local community, harmonising with the objectives outlined in the sustainable development goals (SDGs). This campaign exemplifies an effective framework for sustainable development rooted in community engagement.

Keywords: travel bag, batik, traveller, travel behaviour

1. INTRODUCTION

Wan Ariffin et al. (2023) reported that the ways traditional Malaysian crafts are used are changing. Traditional handicrafts, like Terengganu Batik, have been changed by new ideas. These new ideas have helped preserve the craft's cultural heritage (Wahed et al., 2023; Razali et al., 2021; Kaewareelap et al., 2021). The Perfect-10 Batik Bliss Carry-All is made to look good with today's fashions while still being useful and paying homage to its roots.

Since it is simple, flexible, and practical, the Perfect-10 Batik Bliss Carry-All is a must-have for running errands, commuting, travelling, and night outings. It has the potential to create a versatile travel bag that offers enhanced appearance and functionality and boasts various features to cater to diverse consumer needs. The bag includes multiple compartments of varying sizes and an external zip pocket for ample storage. Additionally, it comes with inner LED lights and a key holder, ensuring convenient access in low-light conditions. The bag also features convenient charging slots for mobile devices on the go. The bag's versatility suits it for travel, ordinary errands, and formal events. In addition, its lightweight design and cultural significance make it a valuable addition to any ensemble, both for men and women.

Individuals with disabilities from PPDK Wakaf Tapai, Terengganu, produced the Perfect-10 Batik Bliss Carry-All, making the innovation project unique. A social entrepreneurship project initiative stands out as a promising way for disabled people to achieve great things in the future (Asma Zulaikha & Rafiduriada, 2023) because it takes a lot of work to find meaningful work for people with disabilities. People think this kind of social entrepreneurship could help the disabled's economy and quality of life, giving them a way to make money and the drive to become entrepreneurs (Ngali et al., 2023; Abd Hamid & Anuar, 2023). This innovation project is important not only because it encourages people with disabilities to become social entrepreneurs but also because it gives people meaningful experiences, especially those who travel. The innovation project's findings will help government programmes and plans work better. These include the National Entrepreneurship Policy (NEP) 2030, the Malaysian Plan of Action for People with Disabilities (MPAPD) 2016–2022, the 12th Malaysian Plan (RMK12), and the Sustainable Development Goals (SDGs).

2. METHODOLOGY

This section will highlight the production process of The Perfect 10 Batik Bliss Carry-All, presenting the study approach and the outcome of the final development process for this innovative product.

2.1 Research Procedure

Figure 1 shows how this product innovation project used the Design Thinking Method to empathise with others and centre the approach around humanity by defining the issue as a problem statement. Ideas were generated by finding creative solutions to the problem statement. Then, multiple products or features within the product were prototyped to test the solutions from the previous stage. Testing the entire product using the best prototyping solutions was the final step.



Figure 1: Process conducted to develop The Perfect 10 Batik Bliss Carry-All

2.2 The Perfect 10 Batik Bliss Carry-All: Development Process

2.2.1 Empathise Stage

The newest iteration of the Perfect 10 Batik Bliss Carry-All product line, known as The Breezy Batik Perfect-10 Carry All, has been developed following the successful creation of six previous travel kits. Feedback and recommendations from the previous market survey were collected and considered during the development of this new product. Based on the survey findings, many respondents preferred specific features to be integrated into the new "carry all" product concept.

1. Each item features its own distinct and personalised design.
2. Convenience in carrying is improved by including a strap and a larger size.
3. Despite the conclusion of the pandemic phase, the upholding of fundamental practices of personal hygiene and safety precautions is ensured.
4. The inclusion of smart LED lights within the bag makes it easier to locate items.
5. The bag features a key holder and a charging port to allow users to charge their mobile devices, making it even more unique and attractive.

2.2.2 Define, Ideate, Prototype, and Test Stage

The steps to guarantee a seamless development of The Perfect 10 Batik Bliss Carry-All are outlined as follows (as depicted in Figure 2):

1. *Define* - A session involving collaboration with team members to define and generate ideas for product innovation.
2. *Ideate* - A collaborative discussion session with PPKD Wakaf TAPAI, the individual overseeing The Perfect 10 Batik Bliss Carry-All production, covering topics such as bag design, colour choices, budget evaluations, and production timelines.
3. *Prototype* - The selection of materials and products for the exclusive innovation product, including choices related to fabric, label application, and kit contents, was carried out through consensus among all innovators and collaborators. Following this, the OKU trainee from PPKD Wakaf TAPAI commenced the bag production process, signifying the ultimate phase.
4. *Test* - The final stage of product development includes testing, during which a market survey is conducted among potential buyers and users of the innovative product. In this survey, the innovators are particularly interested in gaining insights into the potential buyer's perceptions, willingness to accept, and intention to purchase The Perfect 10 Batik Bliss Carry-All.

3. RESULTS AND DISCUSSION

The Perfect-10 Batik Bliss Carry-All is a versatile and innovative travel bag designed to improve the travel experience through aesthetics and function. Four innovative features make the product versatile and essential for modern travellers. Its unique features satisfy a wide range of consumers. The bag has many different-sized compartments for different purposes. An external zip pocket provides ample storage. The bag also has interior smart LED lighting to help passengers find their belongings quickly. A key holder feature reduces key loss, a common user issue. Finally, the product has convenient charging holes for mobile devices while moving. The Perfect-10 Batik Bliss Carry-All also holds wallets and phones, making it a versatile accessory. For travellers, its ability to "carryall" all necessary travel items makes it a valuable asset. The Perfect-10 Batik Bliss Carry-All is a versatile and innovative product that meets modern traveller needs.

A market survey was conducted to gather information about The Perfect-10 Batik Bliss Carry-All. Social media platforms were used to collect data for the convenience sample study. The survey had 117 respondents who provided valuable feedback. The study sought to understand participants' opinions and willingness to use the product after watching the Google Form survey movie. Participants were invited to provide suggestions for enhancing The Perfect-10 Batik Bliss Carry-All. The insights gathered from the survey can aid in refining the product's features to align with the needs of potential customers.

3.1 Demographic Data: Frequency Result of Respondent's Profiles

The market study examined six travel-related topics to assess respondents' behaviours and patterns. The survey covered age, gender, location, marital status, education, profession, income, and annual travel frequency. This data was collected to understand respondents' travel preferences. The majority of participants were female, 90.6% (n=106), with 9.4% (n=11) being male. The largest age group of respondents was 21-40, 44.4% (n=52). Most respondents—72.6% (n=65)—were unmarried. 38.5% (n=45) of participants reported a monthly income below RM2500, mostly students. Many participants (47%, n=55) reported many trips annually. The above findings help explain the sample group's demographics.

3.2 Respondent's Purchase Intention towards The Perfect-10 Batik Bliss Carry-All

This section examines respondents' Perfect-10 Batik Bliss Carry-All purchase intentions. The results indicate that many participants want The Perfect-10 Batik Bliss Carry-All. 79.5% (n=93) of participants preferred the 4 to 5-point Likert scale, indicating intentionality. The convenience of packing all their travel essentials into one bag was the main reason respondents wanted The Perfect-10 Batik Bliss Carry-All, which was chosen by 75.2% of participants. Additionally, 48.7% of participants planned to buy the bag to support the disabled people who made it. The findings emphasise the importance of convenience and social responsibility in influencing respondents' purchase decisions.

4.0 CONCLUSION AND RECOMMENDATION

In conclusion, the Perfect-10 Batik Bliss Carry-All has a good reputation and is widely liked by potential buyers. Furthermore, the Carry-All successfully meets the basic needs of its users every day, with a focus on exceeding the expectations of women. Our long-term

goals include adding a wider range of bags, such as messenger bags, clutches, and backpacks, to our current collection. These additions aim to better meet the needs and wants of people of all ages and from multicultural backgrounds. The idea includes giving out different themed bags and taking other safety precautions. Suggestions have been made to expand the range of batik patterns, providing people with more options. Therefore, we aim to strengthen our partnership with Terengganu State Tourism and Kraftangan Malaysia, Terengganu, to help the batik craft business grow by encouraging Malaysian batik to become more prevalent in everyday life.

Furthermore, we intend to partner with the Pejabat Pembangunan Wanita Negeri Terengganu (PPWN) to foster tighter connections with women's organisations. The Perfect-10 Batik Bliss Carry-All exemplifies a product meticulously manufactured by individuals with disabilities at PPDK Wakaf TAPAI, Terengganu. This carry-all is made using locally sourced Terengganu batik fabric, which not only emphasises its practicality but also showcases the region's rich cultural legacy. The collaboration between individuals with disabilities from PPDK Wakaf TAPAI facilitates the advancement of cultural, social, and economic dimensions within the nearby community, aligning with the objectives outlined in Sustainable Development Goal 16 (SDGs). This effort is a prime example of a prosperous model for community-driven sustainable development and establishes a strategic stance. The Perfect-10 Batik Bliss Carry-All is a multifunctional and fashionable bag that conserves the traditional Malaysian Terengganu Batik.

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Chapter 2

Intelligent System to Estimate Food Calories to Aid in Balanced Diet Using Computer Vision

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ABSTRACT

This study aims to combat the rising global obesity rates, which have surged in the past decade, posing a critical public health challenge. Obesity, characterized by excessive body fat, is a major health risk linked to non-communicable diseases and straining healthcare systems. The primary driver of obesity is the imbalance between calorie intake and energy expenditure, exacerbated by modern sedentary lifestyles and the prevalence of calorie-rich processed foods. A crucial issue is the lack of awareness about daily caloric intake, often compounded by inadequate calorie labelling on food items. To combat this, this research introduces a novel system using computer vision and image processing to accurately estimate food item caloric values. The core objective is to empower users with knowledge, enabling informed dietary decisions and calorie intake control. This project's significance lies in using technology to fight obesity and implementing artificial intelligence practically to enable users to assess meal caloric content, plan weight management, and monitor daily calorie intake. Targeting individuals on a weight loss journey and health-conscious individuals, this system aims to address the obesity crisis via a user-friendly web application accessible on both desktop and mobile platforms. Overcoming challenges in domain understanding, tool selection, system development methodology, data collection, and comprehensive documentation is crucial for project success in achieving these goals.

Keywords: Computer Vision, Artificial Intelligence, Intelligent System, Web Application.

1. INTRODUCTION

There has been a prevalent rise in obesity rates globally over the past decade making it a critical public health issue. Obesity rates have been increasing at a sharp rate with an estimated 20% of the world's population or nearly 1 billion adults being overweight

globally (Zia et al., 2022). In Malaysia alone, it is estimated that 29.4% of the adult population are overweight making it the country with the highest obesity rate in Southeast Asia (Nor et al., 2018). Obesity presents a major health risk as people with obesity are more susceptible to non-communicable diseases (NCD) such as stroke, diabetes, and chronic heart diseases. This issue puts a major strain on the health infrastructure and governments are always looking at new initiatives and policies to curb the endemic rise of obesity.

Past studies have shown that the main factor causing obesity is the calorie intake of an individual that exceeds their energy expenditure, causing excess fat to accumulate. Calories are a measure of energy and can be defined as the estimated amount of energy required to raise the temperature of one gram of water by one degree Celsius (Osilla et al., 2022). Advancements made in food processing have also led to an abundance of cheap processed foods to be widely available. These processed foods are high in calories and fat which can lead to obesity if excessive consumption of such food is taken.

Most individuals are unaware of their daily caloric intake, let alone the caloric value of their meals. The lack of knowledge about their consumption of food may lead them to develop unhealthy eating habits and jeopardize their health (Zia et al., 2022). This issue is further exacerbated by the lack of proper labelling of the caloric values of food items. Even health-conscious individuals will have a hard time keeping track of their caloric intake. Therefore, this project proposes a system that can accurately estimate the caloric values of food items using computer vision and image processing. The research will focus on using computer vision to accurately estimate the caloric values of the meal depending on the portion size.

2. LITERATURE REVIEW

Obesity can be defined as the abnormal accumulation of body fat that has an adverse impact on health (Agha & Agha, 2017). One way to measure if the person is obese is by looking at their Body Mass Index (BMI) which is calculated by dividing the person's weight by their height. This will give the person's total body fat in relation to their height. A person is considered obese if their BMI exceeds 30. Obesity is associated with a host of health issues called non-communicable diseases (NCDs) such as diabetes, stroke, and chronic heart diseases (Omer, 2020). Obesity is deemed a national health hazard which can lead to a crisis if left unchecked. Countries with a large obese population face a workforce with reduced productivity due to various health issues. People suffering from obesity related issues will place a greater strain on the country's health infrastructure which will lead to an increase in national healthcare spending (Nor et al., 2018). People with obesity also tend to have a decreased quality of life and face discrimination in employment (Agha & Agha, 2017). Therefore, it is in the country's interest to reduce the obesity rate in their own respective countries by implementing various measures to curb the rising rate of obesity.

Calories are defined as the unit of energy needed to raise the temperature of 1 gram of water by 1° centigrade (Osilla et al., 2022). It is often used to describe the amount of energy that food items provide. Energy is needed by the human body to maintain its basic functionalities. A balanced diet is important in ensuring the health of an individual which includes weight gain and obesity. A balanced diet can be defined as the correct proportions of essential nutrients relative to the daily energy requirements. These essential nutrients include carbohydrates, proteins, vitamins, minerals, fats and water.

Computer Vision is a sub-branch of Artificial Intelligence that concerns itself with assisting computers in understanding the content of digital images and videos (Karn, 2021). The goal of computer vision is to allow systems to understand digital images and have them react accordingly. Computer vision is a multidisciplinary field covering both artificial intelligence and machine learning and uses various methods and algorithms from other computer science disciplines (Kotappa et al., 2022). The application of computer vision covers many industries including healthcare, industrial, automobile and astronomy. One of the uses of computer vision in the healthcare industry is for automatic food recognition to aid in dietary assessment. Research done by Subhi et al. (2019) states that advancements made in machine learning and computer vision enable applications that can keep track of dietary consumption automatically without much need for human intervention.

Subhi et al. (2019) also did a comprehensive survey on applications that utilises computer vision to classify and keep track of dietary intake. The study notes that traditional classification methods contain three main progressive steps which are segmentation, feature extraction and classification. Another approach in image classification is by utilising Deep Learning approaches. Deep learning is a subset of machine learning and deals with improving the effectiveness of neural networks. Deep learning algorithms are gaining popularity over traditional approaches because of their better performance and ability to handle larger datasets. Convolutional Neural Networks (CNN) is the most popular algorithm associated with deep learning. CNN functions by incorporating multiple layers such as convolutional, pooling and fully connected layers. CNN has two crucial processes that make it different from other neural networks which are convolution and sampling. In the convolutional layer, the units are structured into feature maps which are then connected to filters from the previous layer feature map. The visual features of the previous layer will then serve as the input for the next layer. The process continues until deep learning is achieved and a decision is made by the classifier. CNN is well suited to be used in food recognition because of its ability to learn visual data while training on large-scale image datasets.

A comparative analysis can be done to identify the features of the similar systems. Regarding the segmentation techniques, each system utilized different segmentation techniques with varying degrees of success. It was noted that the system by Haque et al. (2022), that segmented the food items using the food characteristics such as shape, texture and colour had difficulty in identifying certain fruits because of factors such as the light reflection on the fruit and the overlapping shapes of certain fruits. Park et al. (2019) used a SIFT-based Bag of Visual Words (BoW) technique that allowed it to segment the food items individually which is impressive considering that the Korean food dataset is mostly of compound food with various food types included together. It is noted however that the model was trained and tested on a custom dataset that allowed it to become specialized in detecting Korean food.

As for the classifying technique, all the contemporary systems studied utilized CNN or its derivative. Park et al. (2019) utilized a Deep CNN (DCNN) that allows for wider and deeper networks to be implemented which improved performance. Liang & Li (2017) used Region CNN (R-CNN) which differs from regular CNN by separating the image into smaller regions with each region being applied with its own CNN. While this may yield improved results due to each region having been processed separately, its biggest disadvantage is the time taken to train such models. There is a clear trend in food recognition systems to utilise CNN because of its superior performance and easy to train characteristics compared to other machine learning approaches such as SVM and KNN.

3. METHODOLOGY

This research uses the Research and Development (R&D) methodology by collecting research on similar systems that can detect the caloric value of food items. The data collected is then used for the system design and requirements which further enhances the capabilities of the system.

4. RESULTS & DISCUSSION

The model uses MobileNetV2 as a base model which uses pre-trained weights saved into the base model. MobileNetV2 is a lightweight image classifying algorithm that was developed by Google (Tsang, 2019). The model uses a Depthwise Separable Convolution approach which significantly reduces the complexity and size of the model. The model was designed to be used in mobile devices that possess low computational power. For the custom food detection model used for this project, three new layers were added to improve the overall result when dealing with the custom dataset. The first two additional layers that were added is a dense layer which means that every neuron or node in the current layer is connected to every neuron from the previous layer. The connection between these nodes will be used as weights and adjusted during training to learn the relationship between the input and the desired output. These layers also have 128 neurons that are set as part of the parameter to train the model. Generally, the more neurons, the better the model is able to understand complex patterns from the data. The activation function used for these two layers is the Rectified Linear Unit (ReLU) which is used to determine the mathematical function to determine the output of a neuron. The final layer is a dense layer with only 10 neurons to signify the 10 food classes that are to be predicted by the model.

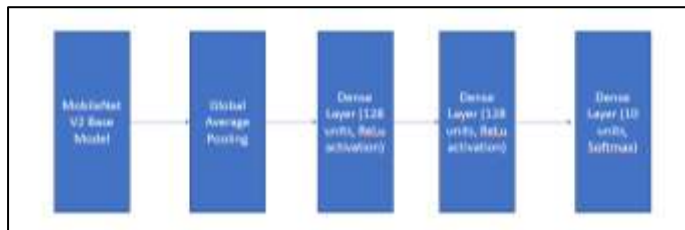


Figure 1: Model Architecture Diagram.

Table 1: Model Results.

	Precision	Recall	F1-score	support
Accuracy			0.88	720
Macro avg	0.88	0.88	0.88	720
Weighted avg	0.89	0.88	0.88	720

5. CONCLUSION & RECOMMENDATION

The proposed system aims to allow users to keep track of their caloric intake and to provide them with the necessary information for their weight loss journey. Overall, it is believed that the proposed system has managed to fulfil the objectives of the project though several improvements in the implementation phase can help alleviate some of the issues identified in the system. The main recommendation for further enhancements in the project is to include the ability for the model to segment the different food types to give more

information to the user. In addition to that, the ability of the system to detect the caloric value of the food according to the portion size should also be implemented as this provides a better understanding of their caloric intake and would prepare them with the information necessary to adjust their diet. Another suggestion would be to improve the functionalities of the application as the current implementation only contains a few basic functionalities due to time considerations. Therefore, further functionalities such as managing their meals, receiving notifications for exceeding the daily caloric limit and the ability to gamify the process to incentivize the users to follow the daily caloric threshold.

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Chapter 3

Dry Peppers Seed Separator

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ABSTRACT

The industrial sector is one of the important sectors in Malaysia in this decade. This can be seen through its contribution to generating national income. Hence, various approaches are used and have been made to achieve goals from developing countries to developed countries. One of the goals of a developed country is to ensure that Malaysia is one of the most innovative countries. Therefore, the basis of the study is done on an important element in the economic aspect and the ability of this study is also a descriptive study. This study focuses on the performance evaluation analysis of the pepper seed separation process through the developed product model. The product model called Dry Pepper Seed Separator was generated after getting an idea from the problems obtained and from a survey of several housewives and street food sellers. Data are collected and evaluated to determine the necessary parameters used in model development. The objective of this product was to solve the source of the problem. Three aspects of the main problems have been identified and the solution of the three main problems, which is to simplify the work of cutting pepper, separating pepper time and energy saving are selected for analysis. The quantity and quality of processing for the workstation, the number of resources and the time taken for the user to complete one process cycle were taken. Dry Pepper Seed separator successfully increases the quantity and quality of work separation compared to existing manual work procedures. A dry pepper seed separator also successfully reduces the time of 40% of the existing work for processing 100 grams of dry peppers. In general, this product can help simplify kitchen work in separating peppercorns and help produce the maximum quantity for those who running the business. At the same time, saving working time can be achieved and reduce energy.

Keywords: Dry Pepper Seed Separator, Peppercorns

1. INTRODUCTION

Nowadays, in this modern era of technology, the manufacturing environment has become highly competitive. Many companies have made a resolution to become a world-class manufacturer. Continual improvement in quality, lower scrap, shorter lead time, reducing bottleneck, lower machine cycle time and others will be done to maximize productivity (Glenny and Mac kulak, 1985).

The manufacture of domestic products that are more efficient in design, more work problems can be solved and increased workforce, cost reduction and guarantee quality and quantity results. It fulfills the Malaysian government's goal to achieve the status of a developed country by 2030.

Rapid development in the fields of science and technology, socioeconomics and politics is one of the factors that caused the increase in the number of factories in the country as a result of which it has led to the use of more sophisticated equipment and technology in daily life and work. This has changed the system and methods of working and the workplace environment. Therefore, identifying the target group that uses machine technology can be achieved one hundred percent. The interaction between humans and machines and the environment has forced us to focus and pay attention to ergonomic aspects. The focus on Work Station Safety is a major topic in safety and health management at the moment.

According to O borne (1987), ergonomics is one of the important principles in performing a work activity. Companies in America, Canada and Japan concluded ergonomics is known as a human engineering factor because it involves a scientific analysis of human aspects in design. The concept of ergonomics is broad and covers various aspects such as humans, machines, work fields and work environments.

Therefore, the development of *DRY PEPPER SEED SEPARATOR* was designed to contribute as follows:

1. Increase the level of student knowledge
2. Increase the ability level of students
3. Identify the time that can be produced in grinding peppers.
4. Reduce time to do tasks

2. LITERATURE REVIEW

DRY PEPPER SEED SEPARATOR is one of the household appliances that every family must have. *DRY PEPPER SEED SEPARATOR* is a device to re-grind and separate seeds from pepper. The main advantage of this blender *DRY PEPPER SEED SEPARATOR* is that it is very compact and easy to use. Usually, these devices are designed for longevity. They should last a long time, be efficient, and most importantly, bring convenience to the cooking process.

2.1 Statement of Problem

The idea of developing this product arose when we saw the difficulty of preparing sauteed chilli sauce for cooking our traditional food nasi lemak. After conducting a question-and-answer survey of several housewives and hawkers, significant findings were found.

2.2 Significance of the Study / Importance of the Study

1. Pepper-size pieces are smaller
2. Separate seeds from pepper
3. Blender works more smoothly
4. Save time and energy

2.3 Objectives

DRY PEPPER SEED SEPARATOR designed to meet several objectives such as:

- a) Facilitation of pepper seed separation work
- b) Labor cost reduction
- c) Saving working time.
- d) Protect skin from blistering and burning heat

3. METHODOLOGY, RESULT & DISCUSSION

The implementation method discussed in this chapter aims to obtain the information and data needed to achieve the design objective. It covers the collection of information about design and data.

3.1 Product Design and Details



Figure 1: Terminology of Dry Pepper Seed Separator

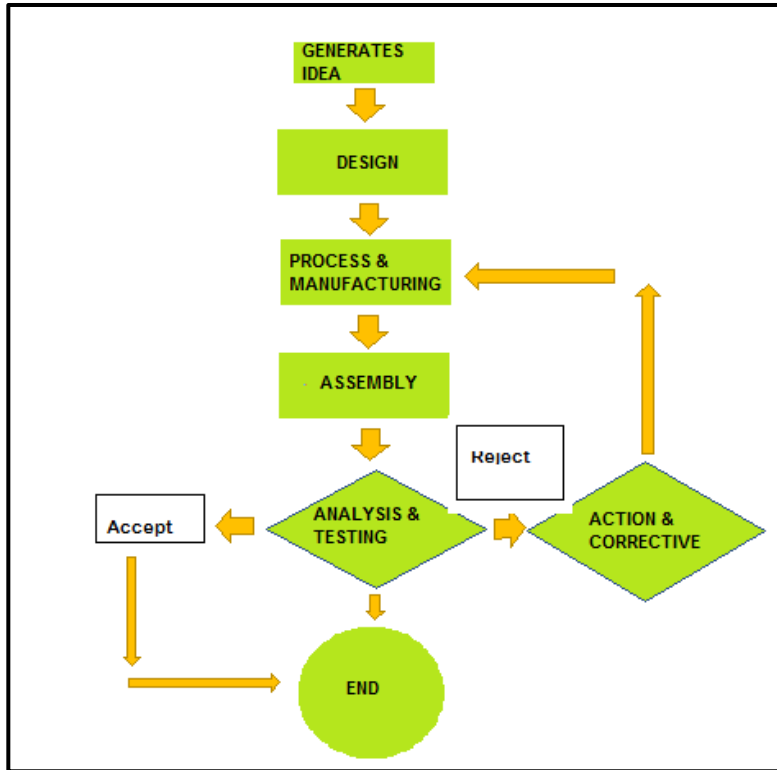


Figure 2: Flow chart of Dry Pepper Seed Separator process

3.2 Material, Tool and Equipment

Table 1: Bill Of Material (BOM)

TYPES OF MATERIAL & TOOLS	SIZE OF MATERIAL & TOOLS	QUANTITY
Aluminium plate	50 x 80 x 25mm	1
Aluminium bar	Ø 30 x 40mm	1
Aluminium sheet	200 x 600 x 3mm	1
End mill (Tool for conventional milling)	Ø 6	1
	Ø 10	2
	Ø 12	2
Motor DC	12V	1
Knife Blade	0.4 x 9 x 80mm	1

Table 2: Equipment uses

TYPES OF EQUIPMENT	QUANTITY
Conventional Milling Machine	2
Conventional Turning machine	1
Measuring Equipment :	
a) Vernier Caliper	1
b) Micrometer	1

3.3 Work Process

The machining process is a process that removes parts of the material that are not needed so that the shape or size of the product that is to be produced can be applied in a clearer form. However, it depends on the appropriateness of the process carried out. Examples of machining processes include cutting using various types of machines like Milling and Turning. After each machining process is completed, testing of the work results must be done to ensure the quality of the work conducted according to the particular specifications.





Figure 3: Type of Machine Uses



Figure 4: Assemble operation of Dry Pepper Seed Separator

4. RESULTS

Table 3: Comparison Job for 100gram peppers

BIL	SCALE	MANUAL JOB USE SCISSOR	DRY PEPPER SEED SEPARATOR
1	WORK RESULT FINDINGS		
2	TIME TAKEN	10 min without separation peppercorns	10 min with separation peppercorns
3	PARAMETER MEASURE	Gross cut	Fine cut
4	BLENDER JOB	Take time to blend & quite rough	Faster & smooth
5	SAFETY	Blister and burn	Protected

5. CONCLUSION & RECOMMENDATION

As a result of the final project that has been carried out, skills can be improved from time to time in several aspects including machining skills and making paperwork and work reports about this final project.

In addition to practical skills, management skills are also improved. As a result, through this final project, the design of the *DRY PEPPER SEED SEPARATOR* is attractive, simple and able to meet the specifications that have been set to make it easier for users.

5.1 Novelty

This product was originally generated, designed by myself and developed by my own students at the Machining Manufacturing Technology workshop, Institut Latihan Perindustrian Pasir Gudang.

5.2 Advantages and Commercial Features

This product has a great impact in general on all women especially on housewives and hawkers. This product will separate seed pepper faster than compared to cutting the pepper using scissors. The advantages to society this product can speed up work more efficiently and save more time, especially for working women.

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Chapter 4

Exploring the Impact of Qualitative Performance Evaluations on Team Effectiveness: A Qualitative Study

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ABSTRACT

Transformational leadership is a leadership style that has a profound impact on team performance and organizational success. This approach involves leaders inspiring and motivating their team members to achieve their full potential, fostering a sense of shared vision, and promoting individual growth. Research has shown that transformational leadership has several benefits for businesses, including improved employee morale, increased loyalty, reduced turnover, and enhanced team effectiveness. Transformational leadership can significantly influence team performance through mechanisms such as intrinsic motivation, trust, and collaboration. It fosters a positive work environment where team members feel valued and motivated to excel. In various settings, from virtual teams to sports teams, the positive relationship between transformational leadership and team performance has been demonstrated. Assessing team performance is a critical aspect of organizational success. Behavioral observer ratings and self-assessment ratings are commonly used approaches to measure team performance. These assessments help organizations identify strengths and areas for improvement in teamwork, collaboration, and goal attainment. In conclusion, transformational leadership plays a pivotal role in enhancing team performance, fostering a positive work culture, and achieving organizational goals. Effective assessment of team performance is essential for ongoing improvement and success in today's dynamic business environment. Understanding the principles of transformational leadership and the tools for team performance assessment is crucial for leaders and organizations aiming to thrive in the modern workplace.

Key Words: Transformational leadership, team performance, assessment

1. INTRODUCTION

In today's fast-paced and competitive landscape, the success of any organization hinges upon the effectiveness of its teams. Teams are the building blocks of innovation, productivity, and success. To ensure that the team is operating at its full potential, leaders

need to understand its strengths and weaknesses. This is where a Team Performance Assessment (TPA) comes into play. Transformational leadership is a powerful leadership style that can significantly impact team performance. Through this assessment, leaders can gain valuable insights into their team's performance. By answering items across various key performance areas, leaders have access to tailored feedback, tips, and advice designed to enhance their team's overall effectiveness.

Transformational leaders inspire and empower their teams, encouraging creativity and innovation. The correlation between transformational leadership and improved team performance is well documented. This assessment aligns with the principles of transformational leadership, enabling leaders to foster a more motivated and high-achieving team. As leaders explore this assessment, keep in mind the positive outcomes associated with transformational leadership, such as increased trust, collective efficacy, and a focus on shared goals, all of which can contribute to the team's success. Instructions are important because they provide clear guidance on how to complete a task or achieve a goal. In this case, the instructions emphasize the importance of transformational leadership and its positive impact on team performance. By following the instructions and incorporating the principles of transformational leadership, leaders can create a more motivated and high-achieving team. It is crucial to keep in mind the positive outcomes associated with transformational leadership, such as increased trust, collective efficacy, and a focus on shared goals, as these factors contribute to the overall success of the team.

2. LITERATURE REVIEW

2.1 Transformational Leadership

Transformational leadership is a leadership theory that focuses on motivating and inspiring employees. Leaders who adopt this style aim to create a shared vision, encourage innovation, and elevate their team's performance. This theory emphasizes the importance of leaders serving as role models, displaying a genuine passion for their work, and fostering an environment that encourages creativity and positive change within an organization (Khan, et al., 2020). Transformational leadership is crucial in modern organizations because it encourages employees to showcase their creativity and innovation. Leaders who embrace this approach become role models for their teams, fostering an environment where employees are motivated to excel. This leadership style is instrumental in inspiring employees to drive positive changes, innovate, and shape the future of the organization. The emphasis on individual requirements and strong relationships between leaders and employees enhances employee performance and engagement, ultimately contributing to an organization's success (Kouzes & Posner, 2017).

In today's dynamic landscape, transformational leadership remains highly relevant (Ayaz, 2022). It focuses on altering processes and values within groups and individuals, enabling organizations to adapt and thrive in rapidly changing environments. This leadership style is particularly effective in promoting innovation, motivating employees, and enhancing overall team performance. Its relevance lies in its ability to drive positive organizational change, encourage creativity, and create a culture of continuous improvement, making it a cornerstone of effective leadership in the contemporary world (Huang, et al., 2022). In conclusion, transformational leadership is of significant importance and relevance in today's world, as it empowers leaders to motivate and inspire their teams for high performance, foster innovation, and drive positive organizational change. This leadership style remains a valuable asset for organizations aiming to adapt, innovate, and

achieve success in a constantly evolving environment. Next, we will discuss the team's performance.

2.2 Team Performance Assessment

In today's competitive landscape, team performance is a critical factor in achieving success. Team performance refers to the collective effectiveness of a group of individuals working together to achieve common goals and objectives. It is a critical aspect of organizational success, as high-performing teams are more likely to meet or exceed their targets, demonstrate innovation, and contribute positively to the overall mission of the organization (van den Hout & Davis, 2022). However, many teams struggle with identifying and addressing key performance areas that hinder their effectiveness (Morrison-Smith & Ruiz, 2020). The problem at hand is the lack of a structured approach to evaluate and enhance team performance. Without a means to gain insights into team dynamics, communication, collaboration, productivity, and leadership, teams often find themselves facing challenges that limit their potential. There is a need for a systematic tool that can assess these critical performance areas through a set of twenty questions and provide customized feedback, practical tips, and expert advice. Such a tool is essential to empower teams and their leaders to proactively improve their performance, thereby driving positive change and ensuring they remain competitive in their respective industries. In summary, team performance is the outcome of a combination of factors, including clear goals, effective communication, collaboration, and strong leadership. Organizations that prioritize and foster high-performance teams are more likely to achieve their strategic objectives and remain competitive. In the next section, we will discuss how transformational leadership enhances team performance.

2.3 Transformational Leadership in Enhancing Team Performance

Transformational leadership is a powerful leadership style known for its profound impact on enhancing team performance. This approach centers on a leader's ability to inspire, motivate, and empower team members to reach their full potential. Transformational leaders create a compelling vision, set high expectations, and encourage innovation and creativity. They build trust and commitment within the team, fostering positive psychological states like job satisfaction and a sense of purpose (Baquero, 2023). This leadership style is associated with increased intrinsic motivation, unity among team members, and a culture of continuous improvement. Through transformational leadership, teams are more likely to achieve their goals, surpass expectations, and consistently produce outstanding results. Studies (Dionne, et al., 2004; Merce, et al., 2021) confirm the positive correlation between transformational leadership and improved team performance, making it a vital tool for organizations seeking to achieve their objectives and excel in today's competitive landscape.

3. METHODOLOGY

This study employed by qualitative research design using thematic analysis as a method (Braun & Clark, 2006). Thematic analysis based on Braun and Clarke (2006), explained that this method is used to identify, analyze, and report the pattern or theme from the data. This study was designed to investigate leaders' perceptions of using Team Performance Assessment to enhance their team performance. The participants in this

study were three leaders from different schools, who were selected through purposive sampling. The researcher conducted structured interviews to gather data on the leaders' experiences and perspectives regarding the use of Team Performance Assessment (TPA). Additionally, the thematic analysis allowed for a comprehensive understanding of the emerging themes and patterns in the data, providing valuable insights into how leaders perceive and utilize this assessment tool to improve their team's performance.

4. RESULTS & DISCUSSION

The themes and topics emerging from the interview data were described in terms that stayed close to the language used in the data set. The index created a conceptual framework, which was drawn up by reviewing each interview transcript and listing, then sorting the themes into clusters of higher-order categories. This process allowed for a comprehensive understanding of the underlying concepts and ideas present in the data. Additionally, by organizing the themes into higher-order categories, it became easier to identify patterns and connections between different aspects of the participants' experiences.

There are two emerging themes: a) motivation to attend training, and b) expectations as in Table 1. These emerging themes provide valuable insights into the participants' motivations and goals related to their training experiences. The theme of motivation to attend training sheds light on the factors that drive individuals to seek knowledge and improve their skills. On the other hand, the theme of expectations helps us understand the specific outcomes and benefits that participants anticipate from their training endeavors. By exploring these themes, we can gain a deeper understanding of the participants' perspectives and tailor future training programs to better meet their needs.

Table 1 Emerging themes and its sub-themes

Motivation to attend training	Expectations
Self-Motivation	Knowledge
Personal Experience	Understanding Team Performance

The objective of the qualitative study was to investigate the experiential aspects of leaders' participation in team performance assessment. After the evaluation results were obtained, how did the individuals perceive their needs? What information can be shared regarding the present and prospective requirements for training? The findings of this investigation are depicted in Figure 1, where they are situated inside a conceptual framework that was constructed in this study. This framework illustrates the interrelated nature of the themes and their connections to different theoretical perspectives on adult learning, as proposed by Knowles (1998). The displayed Figure 1 illustrates the whole journey of personal encounters as derived from the collected interview data.

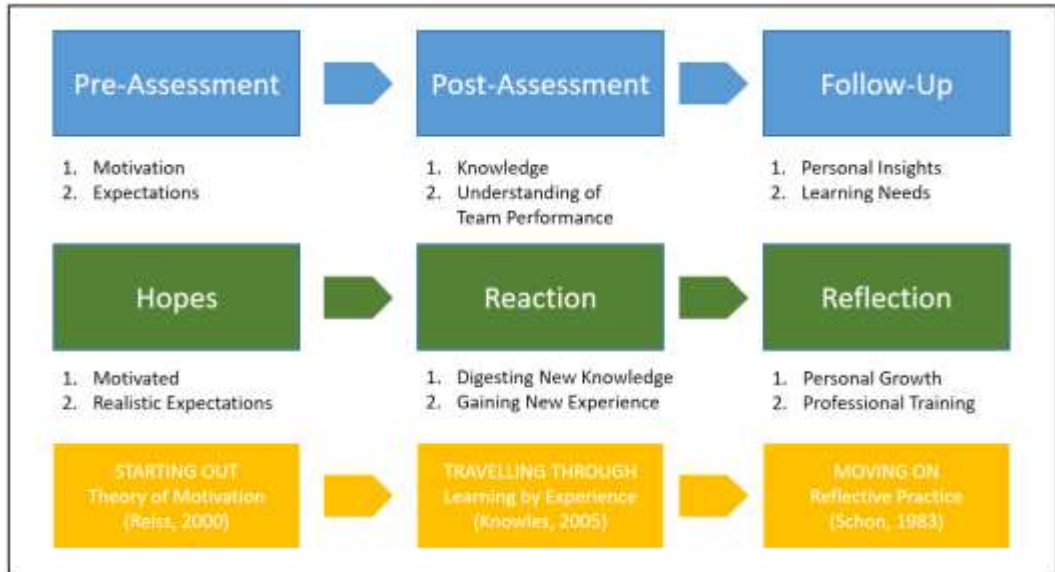


Figure 1. Interconnectedness of themes

5. CONCLUSION

In conclusion, the evaluation of team performance is an essential procedure that assesses the efficiency of team members' collaboration, attainment of objectives, and ability to adjust to organizational changes. Highly efficient teams not only attain high levels of productivity, but also establish robust team processes to guarantee the accomplishment of their objectives. Assessments encompass a range of criteria, including but not limited to progress made towards development objectives, levels of training attendance, and rates of engagement in mentoring activities. It is vital to comprehend that team performance encompasses not just individual contributions but also the collaborative efforts of team members in pursuit of shared goals.

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Chapter 5

KneeWell: Empowering Knee Joint Health

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ABSTRACT

The project aims to develop a simple mobile app that addresses the early diagnosis of knee osteoarthritis (KOA) and is a virtual educational portal that focuses on precautions, prevention, and risk factors associated with KOA in Malaysia. The proposed name of this mobile app is “KneeWell” and this mobile app will be available for download from the Google Play Store, Apple App Store, and Huawei App Gallery. This app will provide multiple solutions linked with KOA to the Malaysian community, which is the second-highest inactive population among ASEAN countries, including early KOA diagnosis, virtual KOA education on risk factors, personalized exercise recommendations, vigorous signs (diabetes, blood pressure, and cholesterol) monitoring to promote proactive health management, and so on. This mobile app will be the first of its kind to raise public awareness and find solutions related to KOA among the Malaysian population. After commercializing, the development of the “KneeWell” website along with the mobile app will enable a wide group of the Malaysian community to access healthcare and promote joint health and overall well-being of the population regardless of age, education level, and socioeconomic status.

Keywords: Knee osteoarthritis, KneeWell, mobile app, Malaysian people.

1. INTRODUCTION

KOA is a prevalent degenerative joint disorder characterized by the gradual deterioration of cartilage within the knee joint (Fan et al., 2020). The function of articular cartilage is to provide cushioning and frictionless movement of the joint by covering the ends of bones (Monteagudo & Lories, 2017). When cartilage wears away in knees due to OA, bones rub against each other, causing inflammation, pain, and stiffness (Lockwood, 2021). It is the most common type of OA that impairs a person's QOL by causing pain, stiffness, and decreased joint function (Atukorala & Hunter, 2023). KOA can affect people of all ages, although it is more common in the older population aged 50 and over (Loeser, 2017). Several factors can contribute to KOA including aging, female gender, genetics, joint usage, prior joint injuries, and also obesity (Chen et al., 2017). Common signs and symptoms of KOA are swelling, a restricted range of motion, and pain while walking,

climbing stairs, or bending the knee (Belluzzi et al., 2017). Despite the fact, KOA is an irreversible condition, it cannot be completely cured (Wang et al., 2020). Although there are several therapeutic options available to help patients to manage their symptoms as well as improve their overall health and well-being including pain-relieving drugs, physical therapy, intraarticular injections, and both dietary and lifestyle modifications. In extreme situations, surgical procedures such as arthroscopy, osteotomy, and knee replacement surgery can be used as an intervention (Fotouhi et al., 2018). Overall, KOA is a medical condition that can affect a person's capacity to carry out everyday tasks and keep up an active lifestyle. Due to its impact on mobility and daily function, KOA is a significant health concern nowadays (Bennell, Hunter & Paterson, 2017). Understanding the underlying causes of KOA and creating efficient preventive and management plans are still the main goals of research and medical development (Mahmoudian et al., 2021). Introducing a groundbreaking mobile app, dedicated to improving the health and well-being of the Malaysian community will be a good initiative. The mission is to raise awareness about KOA, a prevalent yet often overlooked condition that affects countless lives. With this app, the Malaysian community will gain vital insights into KOA, and understand its causes, symptoms, and risk factors. It will authorise the knowledge needed to prevent and manage this condition, helping Malaysian people to take proactive steps towards a healthier future. Nevertheless, this app will provide a wealth of resources, including exercise routines, nutritional guidance, as well as lifestyle tips, all custom-made to the Malaysian context.

2. LITERATURE REVIEW

As KOA accounts for nearly four-fifths of the global OA burden, it is the most prevalent type of arthritis and its prevalence will continue to increase as life expectancy and obesity rates rise (Yeap et al., 2021). In line with the global KOA prevalence trend, Malaysia is also experiencing a sharp increase in KOA prevalence due to the combination of many risk factors, with ageing, obesity, and physical inactivity being the most important risk factors observed in the country (Zamri et al., 2021). The recent Malaysian Ministry of Health's Clinical Practise Guidelines on the Management of Osteoarthritis states that 10-20% of Malaysia's adult population suffer from KOA and it is going to increase in the upcoming days. The Arthritis Foundation of Malaysia (AFM) estimates that one in ten older Malaysians over the age of 60 suffer from OA, with OA of the knee being the most common form. Among those over 55 living in Kuala Lumpur, the weighted prevalence of KOA symptoms was 17.9% among Chinese, 37.7% among Malays, and 25.7% among Indians (Mat et al., 2018). A mobile application is essential in the Malaysian context to raise awareness on the prevalence of KOA and its risk factors along with prevention for several compelling reasons and below are some significant issues or aspects (see Table 1) that explain the need for this kind of mobile app (Safiri et al., 2020; Cui et al., 2020).

Table 1: Significant issues related to “KneeWell”

Key Factor	Description
Pervasive Accessibility	With smartphones becoming an integral part of daily life, users across Malaysia will have access to key health management insights besides tools with unprecedented ease through this kind of app.
User Centric Design	User-friendly design and navigation will ensure that all users can easily access and utilize by providing accessible, evidence-based information related to KOA, the app counters misinformation and supports informed decisions.
Language Options	This mobile app can offer content in multiple languages to cater to Malaysia's diverse population.
Real-Time Updates	It will allow for real-time updates on the latest research, treatment options, and lifestyle recommendations.
Visual Content	Incorporating videos, infographics, as well as interactive tools can simplify complex medical concepts. This mobile app can provide an interactive platform, making it engaging and also educational for users.
Geo-Targeting	Location-based features can provide localized information and resources, such as nearby clinics also fitness centres.
Cost-Effective	It's a cost-effective way to broadcast information compared to traditional awareness campaigns.
Personalization	Users can set goals and receive personalized recommendations to inspire healthier lifestyles.
Diversity and Inclusivity	This app can be designed with accessibility features for users with disabilities.
Patient Tracking	Users can track their symptoms and progress, aiding in early diagnosis and management, and healthcare providers can remotely monitor and support KOA patients through this mobile app.
Progress Tracking	Users can monitor their progress, such as pain levels, mobility improvements, and exercise compliance.
Data Collection	Collective user data to identify trends and areas requiring more focus.

In short, a mobile app for KOA awareness is indispensable in Malaysia due to its ability to reach a wide audience, provide real-time information, support, and personalized guidance, and foster a sense of community focused on prevention and healthier lifestyles. It addresses the unique needs of the Malaysian population while offering a cost-effective and scalable solution for KOA awareness and prevention.

3. OBJECTIVE OF THIS PROJECT

1. To provide comprehensive and easily accessible information about KOA, its risk factors, symptoms, and preventive measures to educate users about the condition.
2. Educating users is the first step in KOA prevention and management to dispel myths and misinformation while promoting a deeper understanding of the condition.
3. To encourage and facilitate physical activity among users through personalized exercise routines, challenges, and tracking tools.
4. To facilitate early detection of KOA through self-assessment tools, symptom tracking, and risk assessment.
5. Early detection and intervention can significantly improve the prognosis for KOA to empower users to recognize warning signs and seek timely medical attention.

4. DISCUSSION

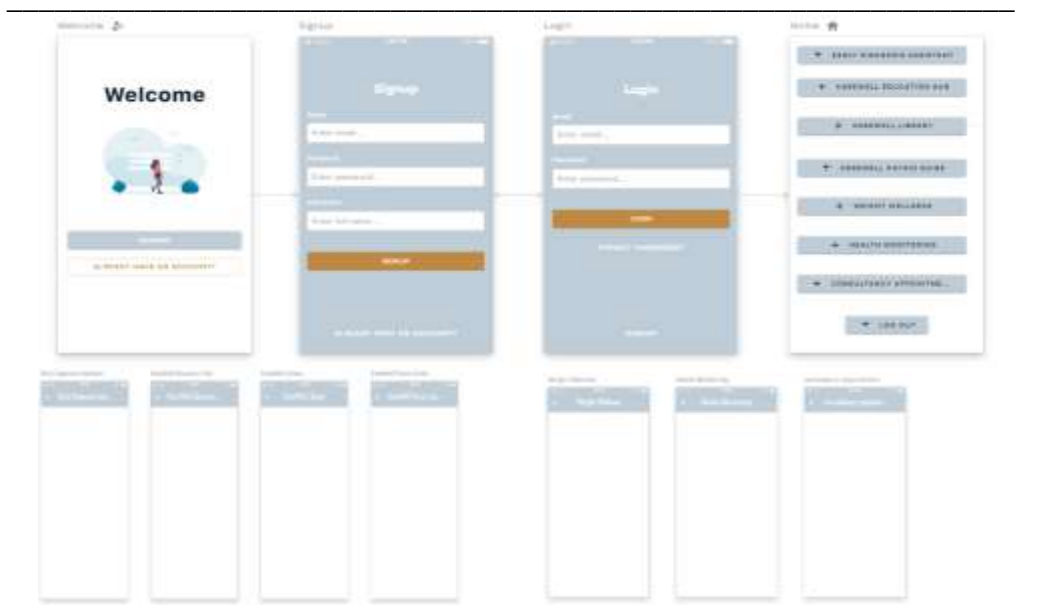
This mobile app is now in the prototype stage. It has features including an early diagnosis assistant, patient education hub, library, rehab gamification, virtual trainer, health

Monitoring, and consultancy appointments to serve the Malaysian community (see Table for the descriptions of the features)

Table 2: Features of “KneeWell”

Features	Description	
Early Diagnosis Assistant	Provision of an early KOA diagnosis based on objective symptoms based on American College of Rheumatology guidelines. This criterion is mainly based on the medical history of the KOA patients and their clinical symptoms. According to this criterion if someone has knee pain and any of the following three conditions then the diagnosis of KOA has been understood:	
	(a) Over 50 years of age	(b) Crepitus on active motion
	(c) Bony tenderness	(d) Less than 30 minutes of morning stiffness
	(e) Bony enlargement	(f) No palpable warmth of synovium
KneeWell Education Hub	Tailored content to discover KOA risk factors, prevention, care, and comprehensive KOA management.	
KneeWell Library	An extensive library of research articles, videos, and case studies.	
KneeWell Physio Guide	Personalized KOA exercise and rehabilitation guide to treat KOA with clear instructions and video demonstrations. Rehab gamification can also be a good option to make the program more interesting.	
Weight Wellness	The system provides BMI calculation, weight control tips, and personalized workouts to help users lose weight in a healthy manner.	
Health Monitoring	The app incorporates vital signs monitoring, including blood glucose, heart rate, and blood pressure.	
Consultancy Appointment	A one-stop solution for reliable and direct links to healthcare professionals, physiotherapists, and nutritionists to schedule appointments, send messages, or join live consultations.	

5. OUTLINE OF THE APP



6. CONCLUSION

This innovative app is poised to make a significant impact on public health in Malaysia. By providing early diagnosis, and comprehensive education, as well as promoting physical activity while offering gamified rehabilitation, the app is set to improve the overall quality of life for Malaysian KOA patients. This comprehensive approach underlines the importance of multifaceted solutions in addressing musculoskeletal health challenges. The diverse health challenges facing Malaysia necessitate innovative solutions that empower individuals to take charge of their well-being by doing so, it provides a comprehensive approach to health management. It is going to be a one-stop solution for individuals looking to lead healthier lives while managing existing health conditions.

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Chapter 6

Structural Equation Modelling of Energy Consumption in Residential Building

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ABSTRACT

Building energy consumption has become a serious issue due to increased energy demand, which contributes heavily to global warming. Malaysia Green House Gas (GHG) emission is expected to increase by about 74% from 2005 to 2020 if proper mitigation is not put in place. Among the major contributors is the building sector, which is generating a massive 40% of total greenhouse gas emitted. The aim of this innovation is to establish a structural relationship of socioeconomic, dwelling and climate factors on residential building energy consumption. The first objective was to identify the independent and dependent factors affecting energy consumption in residential buildings. The second objective was to analyze and establish the critical independent factors of energy consumption in residential buildings. The third objective was to formulate a structural relationship based on the established critical independent and dependent factors as a strategy for improving energy consumption in residential buildings. Three benchmarked independent and six dependent factors were established. The descriptive research design employed lead to the structural model development as the central focus of the innovation. A structured questionnaire consisting of 80 items was used for data collection. The research population was Johor residents and the survey employed 425 returned questionnaires. The collected information was analyzed using descriptive and Confirmatory Factor Analysis. Based on the results, a Building Energy Consumption structural relation was established using Structural Equation Modeling (SEM). The structured model provides useful information to the Malaysian Construction Industry through improved design and solutions on issues related to residential building energy consumption. The model will help and

assist the stakeholders in reducing the skyrocketing increase of carbon emissions in the country due to building energy consumption. It will equally help the occupants of residential buildings to better understand the role they are expected to perform in building energy saving. This model revealed that for effective Building Energy Consumption (BEC), there is a need for an integration of relevant BEC policies in order to improve the sustainability of the construction industry. The model can help construction stakeholders especially the developers to decide on the most effective residential design to save energy consumption.

Keywords: Energy consumption, sustainable, residential buildings.

1. INTRODUCTION

The trend of building energy consumption is on the increase in many countries around the world. In Malaysia, buildings consume up to 48% of the energy in the country (Chua & Oh, 2011; Jibrin et al., 2014). The aim of this study is to establish a structural relationship of socioeconomic, dwelling and climate factors on residential building energy consumption. Three objectives were identified to achieve the aforementioned aim. The first objective was to identify the independent and dependent factors affecting energy consumption in residential buildings. The second objective was to analyze and establish the critical independent factors of energy consumption in residential buildings. The third objective was to formulate a structural relationship based on the established critical independent and dependent factors as a strategy for improving energy consumption in residential buildings. The focus of this research is on residential building energy consumption. This study focuses on residential buildings because the literature proves that there is increasing energy consumption in Malaysia (Kubota et al., 2011). The major component that contributes to climate change is urban development (construction activities) which generates a massive 50% of total greenhouse gas discharges (Griggs et al., 2013). The construction industry is responsible for an environmental threat in terms of natural resource consumption and is emitting millions of tons of carbon annually (Klufallah et al., 2014). The Malaysian building sector is responsible for the emission of 5,301 ktons of GHG with an annual growth rate of 6.4% in 2010, this is equivalent to 20% of the total GHGs emitted in the country (UNDP, 2009; Zaid & Graham, 2012). The forecast is expected to reach 8,088 ktons of GHG emissions in the year 2014 (Zaid et al., 2015). Another weak point of the industry is its failure to blend the construction production process and the design process (Ibrahim et al., 2010). This study found this problem as a matter that needs proper investigation and possible solution. In an attempt to provide a better solution to the above problem, this study focuses on building energy consumption in relation to socio-economic, dwelling and climate factors. From the previous studies, socio-economic, dwelling and climate are the major attributes to residential energy consumption. It is described that residential energy consumption is not only influenced by building characteristics, but also influenced by household characteristics, occupant behavior, and efficiency of the service system (Reinhard et al., 1998). Energy used in the household sector, which includes space and water heating, cooling, lighting and the use of appliances (IEA, 2008) was reported to be the major determinant of building energy consumption as studied by the following authors (González & Zamarreño, 2005 and Luis et al., 2008). Residential energy use plays a vibrant role in contributing to GHG emissions.

2. RESEARCH METHODOLOGY

This research employed the use of descriptive design. Descriptive research design is a scientific method that involves observing and describing the behavior of a subject without influencing it in any way (Stangor, 2011). A convenience method for data collection was employed in this research (Creswell, 2012). This method was used because the study targeted residential household heads. The method of “drop and pick” was employed in the collection of the study data. Drop and pick simply means dropping or leaving the questionnaire with the respondent to be collected after some days. The quantitative parametric data obtained was analyzed using a tool of Confirmatory Factor Analysis (CFA), Exploratory Factor Analysis (EFA) technique, descriptive statistics as well as regression analysis process. This was achieved using an appropriate statistical package of SPSS software version 22 and AMOS statistical software version 22.

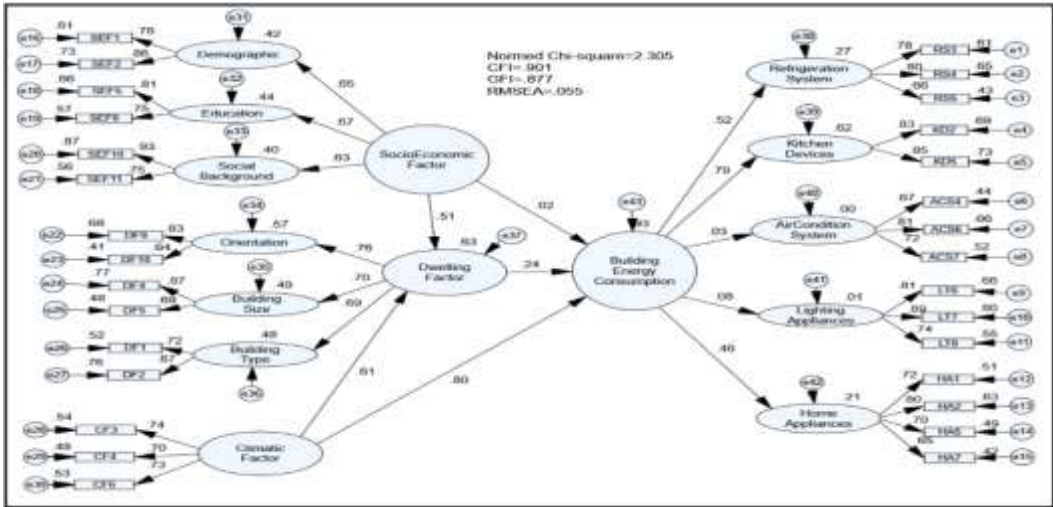
3. RESULTS & DISCUSSION

The first objective serves as the prime objective that identifies the factors of building energy consumption considered in this research. The establishment of the factors was achieved through a literature review and pilot questionnaire survey. The findings from this objective identify the research's independent and dependent factors. In general, the literature reveals that the trend of building energy consumption in Malaysia is on the increase. The findings from this literature study identify 31 independent related factors and 49 dependent related factors of building energy consumption in relation to residential buildings arguments and findings should be described in detail.

The literature reviewed established fourteen (14) factors of socio-economic, eleven (11) of dwelling and six (6) of climate-related factors were analyzed using CFA and EFA through SPSS and AMOS statistical software packages. The 31 identified items of independent factors (Socio-economic, Dwelling, and Climate) are critically studied and only 17 items are considered fit for the study after CFA and EFA. The items considered fit for the study are seven (7) items on Socioeconomic, six (6) items on Dwelling and four (4) items on Climate-related factors.

The final structural model was developed after developing 3 different structural models of socio-economic, dwelling and climate-related energy consumption. The model in Figure 1 portrayed that the Socio-Economic Factor has no significance and no direct effect on residential building energy consumption. However, literature and research conducted show that there is a significant and direct effect of socio-economic features on building energy consumption. This implies that demographic factors, educational background and social background which defined Socio-economic in this research are either playing a negative role or not applicable to the residential occupants of this research.

Figure 1 shows that Dwelling Factor, which is defined by the orientation of the building (building positioning), building size and building type, has no significant neither direct effect on building energy consumption. The findings of the study show that energy consumption in Malaysia can be reduced if residential occupants adjust their ways of using air conditioning. Finally, the research finds out that the use of electricity in lighting plays a major role in electricity energy consumption as it was not supported by this research findings.



4. CONCLUSION & RECOMMENDATION

After the completion of this research, a gap still exists in the literature on building energy consumption. The structural relation model developed shows areas considered important in the various aspects of the building energy consumption (BEC) model in relation to occupants’ awareness. The research on the conceptual model of BEC implementation strategies needs to be conducted. Like any other research, this research also has its own limitations. The structural model developed in this research is in the general residential buildings. For a better understanding of building energy consumption, different buildings like terraced, condominiums, etc. should be considered separately.

In conclusion, it is quite clear that for a country to have significant and continuous development, it must transform its construction industry. The findings of this research have resulted in the development of a structural relationship model that comprised socio-economic, dwelling and climate-related factors. This research further revealed that for effective Building Energy Consumption, there is a need for an integration of relevant BEC policies in order to improve the sustainability of the construction industry. The model was developed out of the findings obtained from the quantitative data. Based on the analyzed result, the structural model shows the relationship between components of the model areas based on their level of importance.

After the completion of this research, a gap still exists in the literature on building energy consumption. The structural relation model developed shows areas considered important on the various aspects of the BEC model in relation to occupants’ awareness. Research on the role of Uniform Building By-Laws (UBBL) in relation to the Malaysian construction industry should be conducted in the future and new research should be employed in commercial buildings using the same approach.

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Chapter 7

Formulation To Improved Mechanical Properties of Composite Using Granite Waste

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ABSTRACT

The rise in the granite industry has led to an increasingly significant environmental concern in the form of granite waste. This research project explores the impact of incorporating micro granite particles into a new composite material using industrial polyester resin. The composite materials, incorporating basalt and glass fibres, were created through hand lay-up and vacuum silicon mould techniques. Different weight percentages (1%, 3%, and 5%) of micro granite were added to the polyester resin, and the resulting composites were subjected to experimental testing to assess their visual impact properties. These results were compared to a conventional Carbon Tech Global (CTG) industrial sample. The findings of this study revealed significant improvements in the mechanical properties of the composites when micro granite was added, with the most favourable results observed at the 3% weight percentage. The composite material exhibited superior performance compared to the CTG industrial sample, suggesting its potential for commercial applications, especially in manufacturing truck body panels. In conclusion, this research demonstrates that incorporating 3% micro granite into polyester-based composites reinforced with basalt and glass fibres can substantially enhance their impact properties, making them a viable choice for use in various industries and highlighting their potential for commercialisation.

Keywords: Micro Granite; Basalt Fibre; Glass Fibre; Polyester; Vacuum Silicon Mould.

1. INTRODUCTION

The granite industry has been a cornerstone of construction and design for centuries, providing stunning natural stone materials for buildings, monuments, and countertops. However, the exponential growth of this industry has brought forth an alarming environmental issue: the generation of granite waste. This waste, when not appropriately managed, poses a significant environmental threat. It can result in air and water pollution, soil contamination, and habitat disruption. The granite industry can significantly reduce its environmental footprint by adopting innovative solutions, strict regulations, and a commitment to sustainability (Huang et al., 2022).

Micro granite particles can be incorporated into composite materials to improve their mechanical properties. These particles act as fillers, enhancing the composite's strength, durability, and other characteristics. Crushed micro granite particles can be used in landscaping to create decorative pathways, driveways, and ground cover. The small size of the particles allows for a smooth and aesthetically pleasing surface (Sharma et al., 2020). Micro granite is sometimes used in epoxy resin coatings for floors and countertops to provide a textured, non-slip surface. It also adds an attractive, speckled appearance to the finished product. It's essential to note that the specific application of micro granite can vary depending on the size of the particles and the industry's requirements (Doddi et al., 2021). Using these fine granite particles helps minimise waste and provides a sustainable way to utilise leftover materials from the granite industry.

Incorporating micro granite as a filler in polyester resin is a versatile and practical approach to improving the mechanical properties of composite materials. This technique has the potential to find applications across various industries. Composite materials using micro granite filler can create durable and visually appealing countertops and surfaces for kitchens and bathrooms. The enhanced mechanical properties make these composites suitable for manufacturing lightweight yet strong body panels for automobiles, improving fuel efficiency (Cionita et al., 2022). Incorporating micro granite into polyester resin to enhance mechanical properties opens up various industry applications. These composites offer a compelling combination of strength, weight reduction, and durability, making them valuable for various products and components.

2. MATERIALS AND METHOD

The manufacturing process involved creating composite materials from basalt and glass by adding varying percentages (1%, 3%, and 5% by weight) of micro granite as a filler. The materials used included woven glass and basalt fibres and CRYSTIC® 272E Isophthalic Polyester Resin supplied by Carbon Tech Global Sdn Bhd. The resin and hardener were mixed in a 100:2 ratio. The polyester resin and micro granite filler were thoroughly mixed using weight percentages for even distribution. A mechanical stirrer was employed for about 120 minutes at a rotational speed of 400 RPM. A silicon mould was used to encase the specimen, removing trapped air within the composite material through vacuum assistance. After sealing, the fibre-reinforced polymer (FRP) specimen underwent an approximately 8-hour curing process under ambient conditions. Post-curing, the composite specimens were subjected to precise measurements according to American Society for Testing and Materials (ASTM) standards. The process was completed using a circular saw apparatus while strictly adhering to established testing protocols and utilising the provided specimens.

2.1. Drop weight Low-Velocity Impact

The study followed the ASTM D7136 standard, and the Instron Dynatup 8250 Drop Weight Impact Tester was used for experimentation [14]. The dimensions of the specimens utilised in this experiment were 50 mm x 50 mm x 5 mm. The drop tower had a hemispherical tip impactor measuring 13 mm in diameter and weighing 13.24 kg. By subjecting the weight to a vertical displacement of 0.78 m, we observed kinetic energy amounting to 101.3 J while maintaining a consistent gravitational acceleration of approximately 9.81 m/s. To ensure precision, the researchers tested five identical

specimens of each system [15]. This experiment enables the assessment of the composite laminates' energy absorption and impact strength to be examined.







3. RESULTS AND DISCUSSION

The present study investigated the characteristics of different composite laminates, including important factors such as energy absorption, impact resistance, and visual aesthetics. The study examined laminates composed of basalt fibre-reinforced polymer composite (BFRPC), glass fibre-reinforced polymer composite (GFRPC), and an industrial sample known as Carbon Tech Global (CTG).

3.1 Effect of nano-silica on visual impact properties of Basalt Fibre Reinforced Polymer Composites (BFRPC) and Glass Fibre Reinforced Polymer Composites (GFRPC)

Based on Figure 1, we can see the visual impact on each system of the sample. At the front, we can see a circle mark and cross mark on all the samples and a circle mark on the back side of the sample. We can see clearly from the side that the indenter penetrates the sample. Sample 0wt%MG-BFRPC can see the delamination from the side. For sample 1wt%NS BFRPC, we can see a cross mark and hole penetrating the sample from the front but not from the bottom. We can also see a penetration depth at the side of the sample of about 2cm.

Meanwhile, for sample 3wt%MG-BFRPC, we can see a light cross mark, jig mark, and delamination at the back of the sample. We can also see a penetration depth at the side of the sample of about 1.8cm. Then, for sample 5wt%NS BFRPC, we can see a light cross mark from the front and a light jig mark at the bottom (Jaafar et al., 2022). We can also see a penetration depth at the side of the sample of about 1.7cm.

System	Front/Top	Back/Bottom	Side
0wt%MG-BFRPC			
1wt%MG-BFRPC			

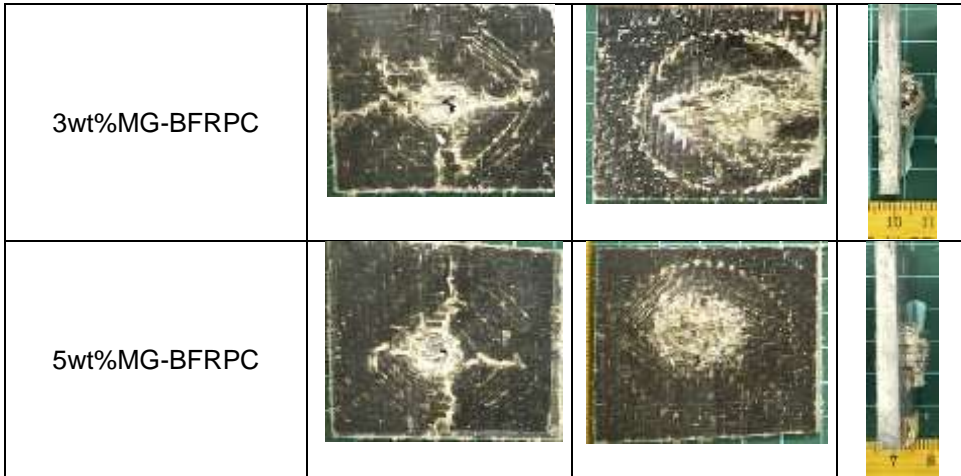








Figure 2: Visual impact properties of basalt fibre-reinforced polymer composite

Based on Figure 2, we can see the visual impact on each system of the sample. At the front, we can see a line across the indenter mark and a jig circle mark on the back side of the sample. We can see clearly from the side that the indenter penetrates the sample. Sample 0wt%MG-GFRPC can see the line across the indenter, a slight hole at the front of the sample, and delamination at the back. Penetration depth is about 1.1cm from the side. For sample 1wt%MG GFRPC, we can see a hole penetrating the sample from the front but not from the bottom, delamination and light jig mark (Karimi et al., 2020; Muslim et al., 2022). We can also see a penetration depth at the side of the sample of about 1.5cm.

Meanwhile, for sample 3wt%MG-GFRPC, we can see a hole by indenter at the front, scatter mark, and delamination at the back of the sample. We can also see a penetration depth at the side of the sample of about 0.7cm. Then, for sample 5wt%MG GFRPC, we can see a hole from the front and a jig mark at the bottom. We can also see a penetration depth at the side of the sample of about 0.5cm.

System	Front/Top	Back/Bottom	Side
0wt%MG-GFRPC			
1wt%MG-GFRPC			

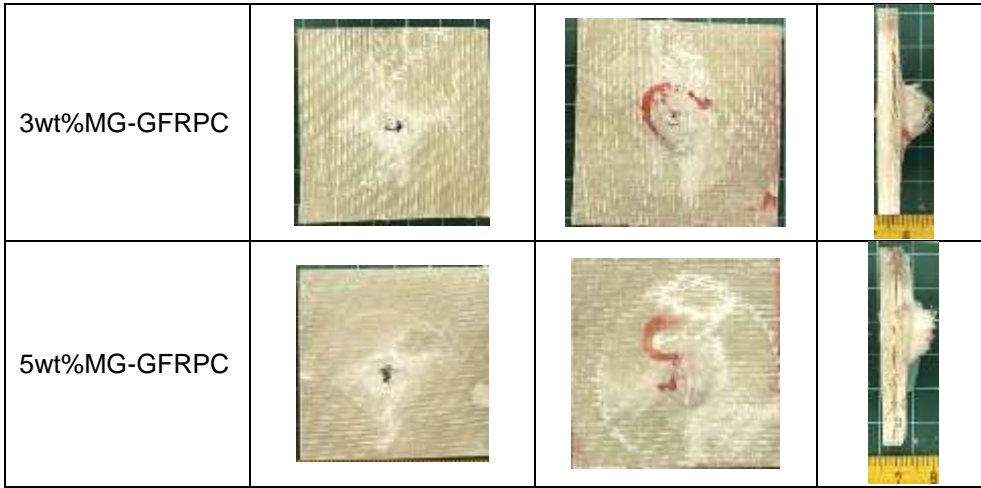


Figure 3: Visual impact properties of basalt fibre reinforced polymer composite, GFRPC

For the CTG sample, as in Figure 3, we can see a round mark of indenter at the front and delamination at the back. We can see a penetration depth of 0.9cm from the side view.

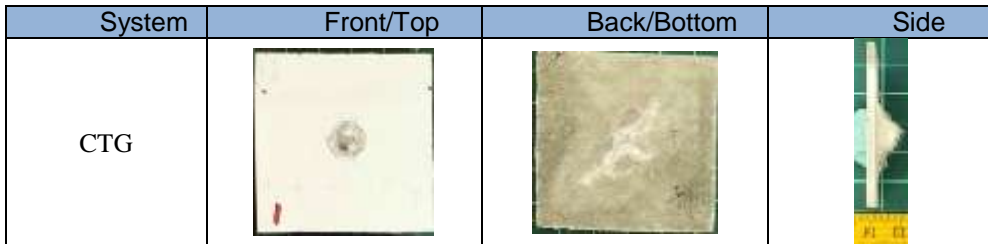


Figure 4: Visual impact properties of the industrial sample, CTG

4. CONCLUSION & RECOMMENDATION

From the result of impact testing, we can conclude that the incorporation of micro granite will enhance the impact properties of the composite. The highest impact strength and energy absorption value happened at 3wt%MG at both composites. The impact strength and energy absorbed value are higher than the CTG value. Therefore, incorporating micro granite will improve the properties, and the value of basalt is higher than glass. So, it is relevant to change fibre glass to basalt fibre and using micro granite will enhance the impact strength and energy absorbed.

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Chapter 8

Improving Group Formation Through Linked Open Data-Enabled Cross Domain Recommender System

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ABSTRACT

Users' perspectives on information searching are transitioning from searching for information to receiving information as a new search paradigm evolves. One of the new ways to obtain information is via recommender systems (RS). RS has demonstrated success in numerous traditional domains, such as tourism and e-commerce. The group recommender system (GRS) and individual RS challenges are triggered by an insufficient number of user-item ratings. Due to this incompleteness, the problem of data sparsity arises. The lack of data within a group has a negative effect on the quality of recommendations made to the group. It occurs because of inefficient group formation, which frequently involves individuals with sparse user profiles. The majority of current research focuses on this issue after group formation. However, this study focused on data sparsity at the individual level prior to the group formation process, with the assumption that addressing data sparsity at the individual level would be more efficient. The primary objective is to develop a cross-domain approach utilizing Linked Open Data (LOD) technology to guarantee that data sparsity issues can be resolved prior to the group formation procedure. Thus, by minimizing data sparsity in user profiles, this research will improve the quality of recommendations.

Keywords: Group recommender system, cross-domain, linked open data.

1. INTRODUCTION

As a group and social activities such as listening to music, watching movies, traveling, and attending sporting events generate numerous information requirements, RSs for groups of users are gaining prominence. In addition, according to Felfernig et al. (2018), compared to conventional RS, GRS is a relatively new field with few reported commercially effective applications. Even though research concentrating on the recommendation to a group of users is still limited, Xu et al. (2019) report that the demand for such recommendation applications has increased recently.

When data is scarce, GRS still struggle to provide reliable recommendations (Nawi et al., 2021). This predicament arose due to the association between insufficient data and the GRS groups. If the user preferences data in the user profile is missing, groups cannot be effectively formed. Thus, emphasizing insufficient data in the group profile is an important practice in providing quality and relevant recommendations for groups (Nawi et al., 2021; Trattner et al., 2018).

Most recent studies use cross-domain (Anwar & Uma, 2022; Ma et al., 2022; Richa & Bedi, 2021) and LOD technologies for RS for individuals, including minimizing data sparsity (Behera & Nain, 2022; Mahdi & Hadi, 2021; Roko et al., 2020). According to the survey of the literature, no study that focuses on the prior of group formation in GRS utilizing a cross-domain method using LOD technology has been undertaken. Furthermore, the GRS study that used LOD technology and cross-domain separately did not focus on the group formation of GRS. Thus, the purpose of this study was to determine whether the employment of LOD technology with a cross-domain approach can increase the quality of recommendations to the group.

2. LITERATURE REVIEW

Adopting the technique through cross-domain integration with LOD technology is offered to ensure that data sparsity issues can be overcome before the group formation process is conducted.

Current GRS research works have addressed data sparsity issues after group formation, indicating that the data sparsity issue is addressed between groups, as in Pujahari & Singh (2020). However, the study's hypothesis is that it would be more efficient if the issue of sparsity was resolved prior to group formation. While numerous approaches for addressing data sparsity have been presented, such as recursive filtering approaches (Ihm et al., 2021), artificial neural network approaches (Althbiti et al., 2021) and data imputation approaches (Inan et al., 2018), GRSs have received little attention.

Table 1 Related works regarding cross-domain in group recommender system

Author	Method	Domain and dataset
(Liang et al., 2020)	"Hierarchical attention neural-network-based cross-domain group recommendation method (HAN-CDGR)"	1. Mafengwo (tourism website) 2. Yelp (restaurant dataset) 3. CAMRa2011 (movie rating records of group members) 4. MovieLens1M 5. MovieLens25M 6. MovieLens-Simi
(Richa & Bedi, 2021)		Tourism and its sub-domain including restaurants, hotels, and others.

Table 1 demonstrates related works that employ cross-domain recommendations for groups in improving the data sparsity. We also provide a brief review related to the scope of this study.

2.1. Group Recommender System

GRS was established in response to the necessity to deliver a set of recommendations to a group. GRS approaches generally follow a three-step process: (a) group formation - identifying users with similar preferences as group members, (b) group

modeling - aggregate of group members' preferences, and (c) prediction - prediction of unrated items. In the context of GRS, groups can be categorised in a variety of ways depending on various characteristics relating to their members, such as the types of preferences or the cause for the group's establishment (Valera et al., 2021).

2.2 Cross-domain Recommender System

Cross-domain techniques have largely been studied to improve recommendations in a target domain with limited user preferences. A common strategy for dealing with these problems is to supplement or enrich the available knowledge in the target domain with knowledge from the source domain. Cross-domain recommendation has emerged as a viable solution to RS's cold-start and data-sparse problems (Ma et al., 2022). It attempts to address the data shortage by exploiting user preferences and item attributes in domains that are distinct yet linked to the target domain.

2.3 Linked Open Data

The successful manifestation of data links on the Web is LOD. It combines disparate data from multiple sources across businesses to create new knowledge and allow sophisticated services and applications. Linked data assets in the so-called "LOD Cloud" (Abele et. Al, 2017, as cited in Haller et al., 2020) were set up to publish graph-shaped data assets in an openly accessible manner using standard Web protocols (Haller et al., 2020). Over the last ten years, data publishers from various areas have published many datasets based on LOD principles.

3. METHODOLOGY

Figure 1 describes the research framework that will be utilized in this study. It consists of the development of cross-linked domain model and its implementation in collaborative GRS.

The task of creating the model will include extracting domain item information from the linked dataset, which links to items and concepts in the source and target domains. This operation also necessitates data mapping to retrieve the data from the LOD dataset. We use the DBpedia as LOD dataset in this study. Algorithms for computing semantic similarities to rank and filter objects in the target domain will also be developed. Thus, it must recognize bridges as a strategy for transferring information across domains. The aim will be to enrich the sparse target domain by examining a prospective collaborator represented by a collection of users/items from a source domain.

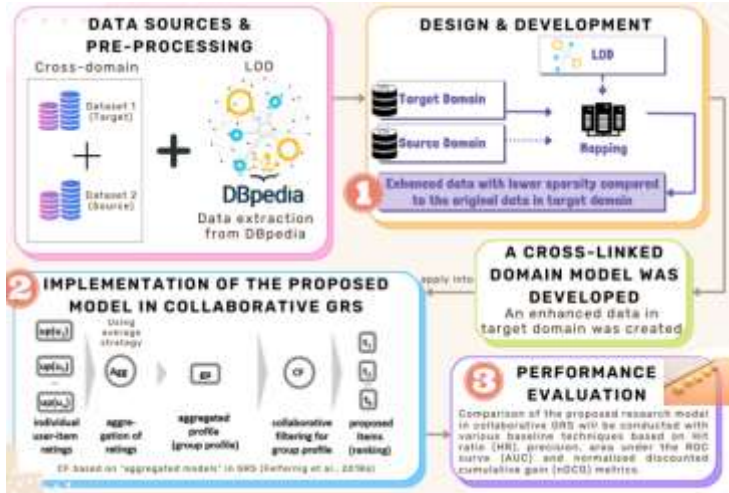


Figure 1: Research framework

The model, which relates to a cross-linked domain, will subsequently be implemented in the collaborative GRS with the selected aggregation strategy.

4. RESULT AND DISCUSSION

We utilize the mapping dataset by Noia et al. (2016) to map the 'title' feature in the MovieLens 1M dataset to the DBpedia for the purpose of data extraction of 'starring' and 'director'. The data is then represented via a graph visualization. Figure 2 shows how the cypher queries were used to split actor names and add 'starring' nodes to link to the movie nodes.

```
FOREACH (starringName IN split(row.Starring, ',')) |
  MERGE (s:Starring {name: trim(starringName)})
  MERGE (s)-[:STARRED_IN]->(m)
)
```

Figure 2: Cypher queries in linking the movie nodes.

The graph visualization in Figure 3 showed the data linkage between the dataset of MovieLens 1M and DBpedia. We can see the nodes and the relationship between the two features set in this study ('starring' and 'director'). Using the cypher query, we can find similar movies by leveraging the graphs.



Figure 3: Linkage of nodes in graph visualization

5. CONCLUSION AND RECOMMENDATION

The data sparsity has a considerable impact on grouping and clustering. While numerous efforts have been made to resolve data sparsity issues in RS for individual, the impact on GRS continues to be a major concern. GRS continues to struggle to deliver reliable recommendation when user profile data is sparse. This method aims to eliminate data sparsity in user profiles in order to deliver more effective recommendations to groups. In the future, the work represented in this study will be extended by inheriting social metadata in cross-domain recommendations.

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Chapter 9

A Near-Field Communication Smart Attendance System (NFCAW)

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ABSTRACT

The conventional methods practiced in most of the institutions are by calling names or signing papers, which is highly time-consuming and insecure. This project was produced based on a comprehensive study of the most convenient method for taking worker attendance. This article presents the automatic attendance management system for convenience or data reliability. The system is developed through the integration of components to make a portable device for managing the student's attendance using Near-Field Communication (NFC) technology. Near-field communication is a set of communication protocols that enables communication between two electronic devices over 4 cm or less. NFC offers a low-speed connection through a simple setup that can be used to bootstrap more capable wireless connections. Our research purpose is to record workers' attendance more quickly and easily and to produce innovative and more efficient products for companies and workers. The main outcome is that NFC communication can save labour and property, such as paper, while also having a good impact on the environment. The purpose of the study is to investigate the effectiveness of mobile applications (NFCAW) in improving attendance system outcomes that we have as well as minimizing absenteeism among workers on construction sites. Android Studio software and the Flutter coding language are used to produce NFCAW apps.

Keywords: Near-Field Communication, Workers, Attendance, Absenteeism, Construction Sites.

1. INTRODUCTION

Near-field communication (NFC) smart attendance systems are innovative solutions that leverage NFC technology to streamline and enhance attendance tracking processes in various settings, such as schools, universities, offices, and events. NFC is a short-range wireless communication technology that allows devices to establish communication by simply being in proximity to each other, typically within a range of a few centimeters.

The introduction of NFC-based smart attendance systems aims to replace traditional manual methods, such as paper-based sign-in sheets or bar code scanning, with a more efficient and convenient approach. By utilizing NFC-enabled devices, such as smartphones or smart cards, individuals can quickly and easily record their attendance by tapping or bringing their device close to an NFC reader or terminal.

The key components of an NFC smart attendance system include NFC-enabled devices, NFC readers and terminals, and attendance management software. The benefits of NFC smart attendance systems include time efficiency, accuracy and reliability, improved security, and streamlined administration.

NFC smart attendance systems offer a modern and efficient approach to attendance management, enhancing convenience, accuracy, and security while streamlining administrative processes in various environments.

2. LITERATURE REVIEW

2.1 Attendance System

An attendance system is a technology used to track and record the presence or absence of individuals, typically in a specific location, such as a school, workplace, or event. The primary purpose of an attendance system is to keep a reliable record of when people arrive at or depart from a particular place, which is often used for various administrative and management purposes.

2.2 Types of Attendance System

2.2.1 Manual Attendance Register

In this system, employees will sign in and out using a paper-based attendance register or logbook. They will manually record their arrival and departure times, and HR staff will manually compile and calculate attendance data.

2.2.2 Punch Clock

A Punch Clock is a mechanical device that requires workers to insert a paper timecard into the clock and physically punch or stamp the card to mark their arrival and departure times, and HR staff will manually compile and calculate attendance data.

2.2.3 Biometric Attendance System

Biometric systems use technologies such as fingerprint or handprint scanning, facial recognition or iris scanning to identify and record employee attendance. Employees will physically interact with biometric scanners to enter and exit.

2.2.4 Bar Code/QR Code System

The system involves employees carrying identification cards or badges with unique bar codes or QR code patterns. They will scan their card using a designated bar code or QR code scanner to record their presence.

2.3 Research Finding

2.3.1 Security and Privacy

Although NFC is a secure communication technology, there is a need for further research to explore potential vulnerabilities and develop robust security measures to prevent unauthorized access, data breaches and identity theft. NFC systems require continuous research.

2.3.2 Interoperability

NFC technology is compatible with various devices and systems. However, there is a need for research to further improve interoperability between different NFC-enabled devices and platforms. This includes addressing compatibility issues, standardizing protocols and establishing seamless communication between NFC systems and other technologies.

2.3.3 Range and Performance Optimization

NFC technology has a limited communication range, usually within a few centimeters. It focuses on exploring techniques to extend the range without compromising safety or power consumption. Additionally, optimizing NFC system performance, such as by reducing communication latency and increasing data transfer rates, will improve user experience and enable new applications.

2.3.4 Energy Efficiency

NFC technology relies on radio frequency signals and can use significant power, especially when active for longer periods. Research can explore energy-efficient approaches to reduce power consumption in NFC-enabled devices, increase battery life and enable extended use.

2.3.5 User Experience and Use

Understanding consumer behaviour, preferences, and barriers to using NFC technology is important. Further research can investigate user-centered design principles, usability studies and user acceptance factors to optimize the user experience and drive widespread adoption of NFC enabled systems and applications.

3. METHODOLOGY

3.1 Research Flow Chart

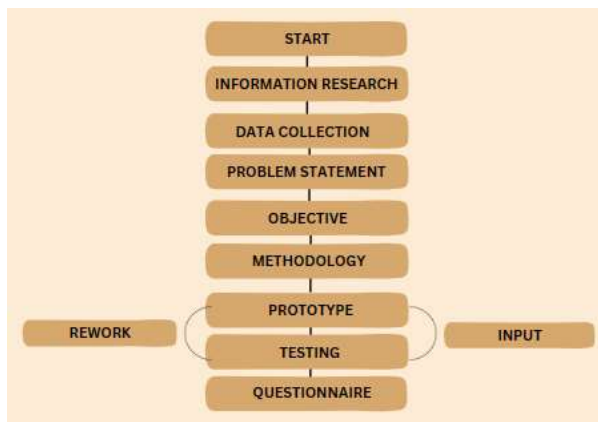


Figure 3.1.1: NFCAW research flow chart.

3.2 System

A system refers to a set of interconnected or interdependent elements, components, or parts that work together to achieve a common purpose or goal.

3.3 Types of System

3.3.1 Android Studio

It is the primary tool used by developers to build, test, and deploy Android apps for smartphones, tablets, wearable technology, and other platforms powered by Android. Android Studio provides a comprehensive set of features and tools to make the app development process more efficient and streamlined.

3.3.2 Coding System (Flutter)

These instructions are typically written in a specific programming language and are used to create software applications, websites, and various other computational solutions. Coding systems are essential for turning human-readable instructions into machine-executable code.

3.3.3 Mobile Application (Android)

Implement NFC functionality to detect and read NFC signals from employee card and /tags and design screens and user flows to display attendance information and capture NFC signals. Integrate the mobile app with the back end server's API endpoints for authentication and data transmission.

4. RESULTS AND DISCUSSION

4.1 Discussion of Nfc Smart Attendance System

The application of an NFC smart attendance system presents a transformative solution for attendance tracking in various settings, from educational institutions to corporate environments. Leveraging the power of Near Field Communication (NFC) technology, this system streamlines attendance processes with remarkable efficiency and accuracy. Users, be they students or employees, simply need to tap their NFC-enabled cards or devices against a reader to register their attendance, significantly reducing the likelihood of manual errors and ensuring swift, real-time data updates. Not only is this method eliminating the need for physical attendance sheets and manual data entry, but it also minimizes the risk of fraudulent attendance. The system's customization and integration capabilities further empower organizations, enabling tailored solutions that seamlessly integrate with existing databases. Ensuring data privacy and compliance with relevant regulations is paramount when implementing such systems. In essence, this technology represents a significant leap forward in attendance tracking, enhancing efficiency, accuracy, and overall management of attendance-related data.

4.2 Demonstration of Nfcaw Apps



Figure 4.2.1: Pre-test of NfCAW apps to students and lecturers.



Figure 4.2.2: Log-in of NfCAW apps in student's smartphone.

5. CONCLUSION

In conclusion, Near-Field Communication Attendance for Workers (NfCAW) is an important asset in recording attendance for workers at Polytechnic Sultan Salahuddin Abdul Aziz Shah. During the development of this application, there were obstacles, such as several times failing to download coding languages such as Flutter and Java SE on our laptop. In addition, relatively weak internet access is also one of the obstacles, but we manage to figure it out. Our hope is that this app will develop further and continue to help students in the future, ultimately having a good effect on the discipline of civil engineering.

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Chapter 10

Identification of Prospective COVID-19 Vaccine Candidates Among Indonesian SARS-CoV-2 Variants

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ABSTRACT

Despite the declaration of Coronavirus disease 2019 (COVID-19) as an endemic, it remained a threat to public health. The existing vaccines targeting SARS-CoV-2 circulating in Indonesia were designed based on the wild-type strain, which protection level would decrease in the presence of other variants. To address the challenge, this study aimed to predict epitopes that could be used to manufacture vaccines specifically for SARS-CoV-2 strains circulating in Indonesia. A total of 3,700 Indonesian samples collected between January 1st and June 30th, 2023, along with 19 references, were retrieved from the Global Initiative on Sharing All Influenza Data (GISAID) and aligned using Clustal Omega. Additionally, extraction of S-gene was performed using Biopython and the subsequent phylogenetic analysis was done by MEGA11. Selection of representatives enabled the prediction of continuous and discontinuous B cell epitopes using Bepipred and Discotope respectively. Whereas MHC-II binding peptides were predicted with NetMHCII 2.3. These epitopes were then subjected to rigorous assessment with Vaxijen v2.0, Allergen FP v.1.0, ToxinPred, and ProtParam for their antigenicity, allergenicity, toxicity, and stability respectively. The analysis revealed that omicron was the most prevalent strain in Indonesia. Furthermore, four potential epitopes for continuous B and three for MHCII were identified along with a set of discontinuous epitopes for B cell. This study lays the groundwork for effective vaccine development strategies, underscoring its importance in addressing the evolving challenges presented by SARS-CoV-2 in a timely and effective manner. Additionally, this procedure can be adapted for rapid responses to emerging viral threats.

Keywords: COVID-19, SARS-CoV-2, Vaccine

1. INTRODUCTION

World Health Organization (WHO) has officially declared that the pandemic is over on May 5th, 2023 (WHO, 2023). However, following the statement, Dr. Tedros Adhanom Ghebreyesus, the Director-General of the WHO claimed that COVID-19 still remained a threat to public health as it continued to claim a life every three minutes (WHO, 2023). Currently, the number of cases and hospitalization rates are increasing and according to experts, this will get worse during the winter season, especially in the northern and southern hemispheres (Chapman, n.d.). This phenomenon has been linked to the globally prevalent variant which is the omicron EG.5 variant.

Researchers have also mentioned that the vaccine efficacy and protection level will drop by several folds upon infection with variants other than wild-type strain (Shrestha et al., 2022). Hoping to address challenges presented by SARS-CoV-2, this research aims to predict potential epitopes that could be utilized for vaccine development specifically tailored against prevalent strains in Indonesia. This is done to maximize vaccine performance for Indonesian population.

2. LITERATURE REVIEW

Coronavirus disease 2019 (COVID-19) is a highly transmissible respiratory disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) which emerged in Wuhan, China, in late 2019 (Harapan et al., 2020). This disease was initially concluded as a viral pneumonia of unknown cause due to the similarity of symptoms and transmission method. However, due to the lack of effective therapies or treatments available, this virus quickly spread across the world, leading to the pandemic declaration on March 11th, 2020.

SARS-CoV-2 possesses four structural proteins which include spike (S), envelope (E), membrane (M), and nucleocapsid (N) (Khailany et al., 2020). This virus is capable of infecting the respiratory cells of humans by binding itself to a cell receptor called Angiotensin Converting Enzyme-2 (ACE2). The interaction allows the virus to infiltrate cells and proliferate. Failure of the immune system to resolve the infection results in full-blown COVID-19, which may result in mortality.

World Health Organization has recommended vaccination in an attempt to reduce the risk of infection by SARS-CoV-2. There are several types of COVID-19 vaccines circulating in Indonesia, such as messenger RNA vaccines (Pfizer and Moderna), protein subunit vaccines (AstraZeneca) and inactivated viral vaccines (Sinovac). The mechanism of these three vaccines is different, however they all share a common purpose, to induce immune responses towards SARS-CoV-2 (Justiz Vaillant et al., n.d.).

According to a study conducted by Shrestha LB, *et al.*, there have been mutations in the spike protein associated with the ability of the Omicron variant to escape detection by the immune system (Shrestha et al., 2022). These mutations reduce the efficacy and protection level of the vaccine by 8 to 127 folds upon infections by other variants.

3. METHODOLOGY

This study employed a dataset consisting of 19 references, which included the wild-type strain along with all known variants, and 3,700 Indonesian isolates collected between January 1st, 2023 and June 30th, 2023, sourced from Global Initiative Sharing All Influenza Data (GISAID) (Elbe & Buckland-Merrett, 2017; Khare et al., 2021; Shu & McCauley, 2017). Sequences of

these isolates were aligned using Clustal Omega (Sievers et al., 2011) prior to extraction of S-gene and its subsequent conversion to S-protein with BioEdit (Hall, 1999). Consolidation of sequences with 100% similarity was performed using Biopython (Cock et al., 2009).

These sequences were subjected to phylogenetic analysis using Molecular Evolutionary Genetics Analysis Version 11 (MEGA11) (Tamura et al., 2021). The phylogenetic tree was generated by employing the Maximum Likelihood statistical method while keeping all parameters at default and the bootstrap value set to 100.

Several representatives were selected at random from the major cluster and their parameters were compared to the wild-type variant. This comparison was completed using Chou & Fasman Beta-Turn Prediction (Chou & Fasman, 2006), Emini Surface Accessibility Prediction (Emini et al., 1985), Karplus & Schulz Flexibility Prediction (Karplus & Schulz, 1985), Kolaskar & Tongaonkar Antigenicity (Kolaskar & Tongaonkar, 1990), and Parker Hydrophilicity Prediction tools (Parker et al., 1986) available on Immune-Epitope-Database and Analysis-Resource (IEDB) (Vita et al., 2019). Following the comparison of parameters, the prediction of continuous B cell epitopes was carried out using Bepipred (Larsen et al., 2006) available from IEDB for all representatives and wild-type. Following parameter and epitopes comparison, one representative was chosen for further analysis.

Epitopes of chosen representative that consisted of more than nine amino acid residues were chosen for protective antigen prediction performed using Vaxijen v2.0 (Doytchinova & Flower, 2007), allergenicity using AllergenFP v.1.0 (Dimitrov et al., 2014), toxicity using ToxinPred (Gupta et al., 2013), stability using ProtParam (Gasteiger et al., 2005), and enzyme digestibility using Protein Digest (SystemBiology, n.d.).

Additionally, MHCII epitopes were predicted against 25 HLA-DR alleles, 20 HLA-DQ alleles, and 9 HLA-DP alleles, with a threshold set at 2% for strong binder using NetMHCII (Jensen et al., 2018). Subsequent protective antigen detection for these MHCII epitopes was performed using the same method as a continuous B cell.

Prior to conformational or discontinuous B cell epitopes prediction, homology 3D modelling was conducted using the Swiss Model ExPasy webserver (Waterhouse et al., 2018) to predict an approximate model of the target protein. Models with the highest degree of similarity were then selected for further analysis with DiscoTope 2.0 available in IEDB (Kringelum et al., 2012). Chain A of the model was chosen for this analysis and all amino acid residues greater than -1.0 were selected as epitopes. Visualization of residues constituting the discontinuous epitope was performed with PyMOL (Schrödinger LLC, 2015).

4. RESULTS AND DISCUSSION

This study aimed at predicting epitopes that could be used to manufacture SARS-CoV-2 vaccines with improved performance to counter viral strains circulating in Indonesia. Vaccines distributed to Indonesian citizens thus far were based on the wild-type variant. This goal was in line with a study conducted by Flores-Vega V, *et al.*, which highlighted the need to develop a surveillance strategy along with the development of a better vaccine to prevent or decrease the emergence of new viral strains, reducing mortality and morbidity rate due to SARS-CoV-2 infection (Flores-Vega et al., 2022).

Out of 3,700 Indonesian isolates collected, only 361 were selected for further analysis. This was due to the fact that the majority of isolates were riddled with multiple ambiguous nucleotides (Ns). These Indonesian isolates, along with one S-gene reference

and 18 representatives from different variants of non-Indonesian origin were translated into amino acid sequences to be used for subsequent phylogenetic analysis using MEGA 11.

The phylogenetic tree shown in Figure 1A revealed that most of non-Indonesian origin isolates representing variants other than omicron were mainly clustered with the wild-type (EPI_ISL_402124). In contrast, this analysis also revealed that the Indonesian isolates formed a distinct cluster along with all omicron subvariants references. This finding indicated that there was a high degree of similarity of S-protein sequence of Indonesian origin with those of the omicron variant, suggesting that omicron was the prevalent strain in Indonesia. For further analysis, EPI_ISL_17997245, EPI_ISL_17736544, and EPI_ISL_16534757 were selected from this cluster.

A comparison of parameters between wild-type and three representatives was done for the antigenicity, flexibility, turns, surface accessibility, and hydrophilicity. Figure 1B shows the amino acid residues predicted to be part of the epitope based on these parameters. Residues located above the threshold level were likely to be part of the epitope. There were differences found between wild-type variants and all representatives, which was indicative of the possibility of different epitope formation among these four sequences. The most striking difference could be found between wild-type and EPI_ISL_17997245, especially in the Chou Fasman Beta Turn prediction outcome.

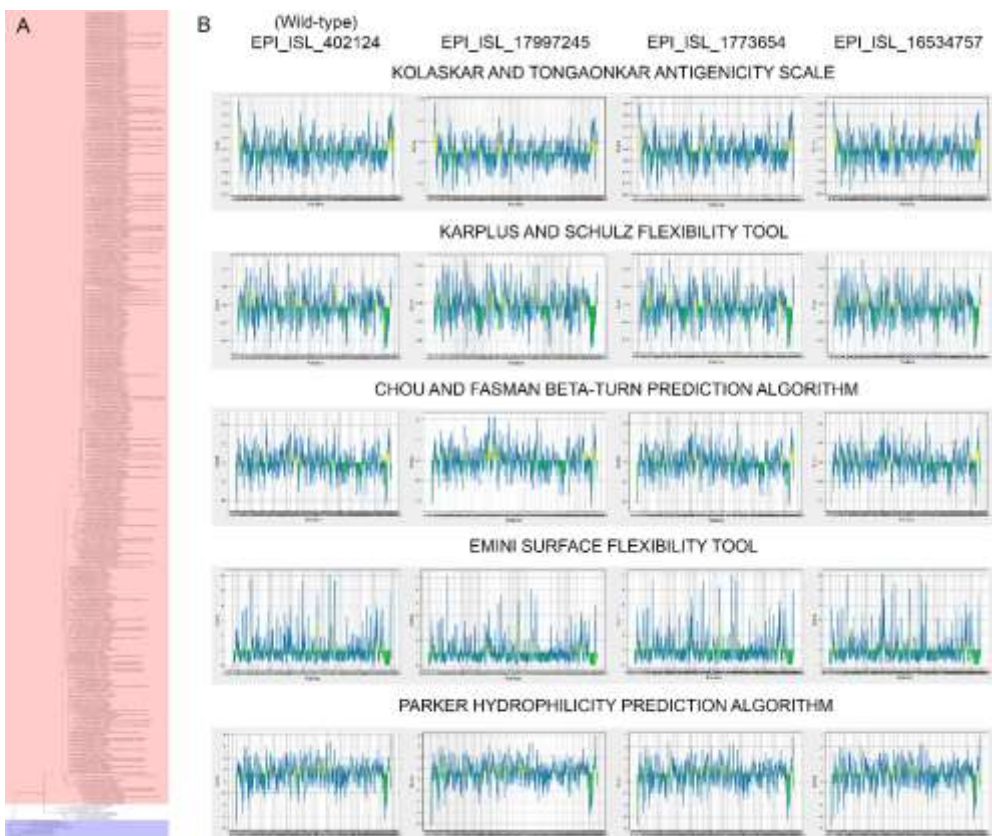


Figure 5. (A) Phylogenetic tree constructed using variants from Indonesia and SARS-CoV-2 references from other countries. Wild-type along with non-omicron references cluster was highlighted in purple, while all Indonesian isolates clustered with omicron references were highlighted in pink. (B) Parameter comparison of wild-type variant (EPI_ISL_402124) and three

representatives (EPI_ISL_17997245, EPI_ISL_17736544, EPI_ISL_16534757). Prediction of these parameter was completed using IEDB server. Yellow region located above the threshold was indicative of amino acid residues that were likely to be part of linear B cell epitope, whereas the green region underneath the threshold was not.

These four sequences were further examined for their differences in epitope formation using Bepipred. Epitope prediction revealed that there was a difference in the number and position of epitopes as summarized in Table 1. There was a total of 18 epitopes on wild-type reference, 16 on EPI_ISL_17997245 and EPI_ISL_17736544, while 17 epitopes could be found on EPI_ISL_16534757. The most notable difference was the absence of the wild-type epitope RTQLPPAYTNS and IYKTPPIKDF in all three representatives. There was also a case where peptide FDEDDSEPVL on wild-type was marked as non-antigenic, while on EPI_ISL_17736544 and EPI_ISL_17997245, this epitope was marked as antigenic.

Table 2. Epitopes predicted by Bepipred available on IEDB. Epitopes highlighted in yellow were designated as probable antigen

	Start	End	Peptide		Start	End	Peptide
EPI_ISL_402124	21	31	RTQLPPAYTNS	EPI_ISL_17997245	68	83	SGTNGTKRFDNPALPF
	71	81	SGTNGTKRFDN		246	257	TPVDSSSSGWTAG
	249	261	LTPGDSSSSGWTAG		403	416	VSQIAPGQGTGNIAD
	407	420	VRQIAPGQGTGKIAD		435	444	NKLDSPKPSGN
	439	447	NNLDSEKVG		469	488	YQAGNKPCNGVAGPNCYSPL
	473	483	YQAGSTPCNGV		490	502	SYGFRPTYGVGHQ
	495	506	YGFQPTNGVGYQ		519	528	TVCGPKKSTN
	523	532	TVCGPKKSTN		563	576	RDIADTTDAVRDPQ
	567	580	RDIADTTDAVRDPQ		593	602	VITPGTNTSN
	597	606	VITPGTNTSN		671	679	QTQTKSHRR
	675	687	QTQTNPRRARSV		768	776	VEQDKNTQE
	772	780	VEQDKNTQE		801	812	ILPDPSKPSKRS
	788	797	IYKTPPIKDF		1065	1073	PAQEKNTFT
	805	816	ILPDPSKPSKRS		1133	1144	VYDPLQPELDSF
1069	1077	PAQEKNTFT	1153	1163	KNHTSPDVDLG		
1137	1148	VYDPLQPELDSF	1252	1261	FDEDDSEPVL		
1157	1167	KNHTSPDVDLG	68	78	SGTNGTKRFDN		
1256	1265	FDEDDSEPVL	205	216	TPVNLGRDLPQG		
EPI_ISL_1773654	68	78	SGTNGTKRFDN	EPI_ISL_16534757	246	258	LTPGDSSSSWTAG
	246	258	LTPGDSSSSWTAG		404	417	VSQIAPGQGTGNIAD
	404	417	VSQIAPGQGTGNIAD		436	445	NKLDSEKPSGN
	436	446	NKLDSEKPSGN		470	479	YQAGNKPCNG
	470	479	YQAGNTPCNG		493	503	GFRPTYGVGHQ
	493	503	GFRPTYGVGHQ		520	529	TVCGPKKSTN
	520	529	TVCGPKKSTN		564	577	RDIADTTDAVRDPQ
	564	577	RDIADTTDAVRDPQ		594	603	VITPGTNTSN
	594	603	VITPGTNTSN		672	680	QTQTKSHRR
	672	680	QTQTKSHRR		769	777	VEQDKNTQE
	769	777	VEQDKNTQE		802	813	ILPDPSKPSKRS
	802	813	ILPDPSKPSKRS		1066	1074	PAQEKNTFT
	1066	1074	PAQEKNTFT		1134	1145	VYDPLQPELDSF
	1134	1145	VYDPLQPELDSF		1154	1164	KNHTSPDVDLG
1154	1164	KNHTSPDVDLG	1253	1262	FDEDDSEPVL		
1253	1262	FDEDDSEPVL					

Comparative analysis of parameters and epitopes among the wild-type, EPI_ISL_17997245, EPI_ISL_17736544, and EPI_ISL_16534757 revealed differences in

the S-protein of wild-type and Omicron variant, which was prevalent in Indonesia during the first half of 2023. It is noteworthy that vaccines circulating in Indonesia were originally designed based on the wild-type strain. Therefore, it could be inferred that the level of protection offered by these vaccines would decrease, as previously discussed by Shrestha LB, *et al.* (Shrestha et al., 2022) Furthermore, this concern is corroborated by another study conducted by Cao Y, *et al.*, which highlighted that infection with Omicron variant would result in reduction of humoral immune protection (Cao et al., 2022). As a result, these results underscored the importance of developing vaccines to match the currently prevalent strain (Flores-Vega et al., 2022).

Further analysis was conducted using sequence EPI_ISL_17997245, wherein previously predicted linear B cell epitopes underwent thorough assessment. Epitopes comprised of 9 to 14 amino acid residues were selected for the prediction of protective antigens to maximize the specificity. This prediction was based on several criteria including antigenicity (above 0,4), toxicity, allergenicity, stability (instability score below 40), and digestibility. These aspects were evaluated utilizing a combination of tools, namely Vaxijen v2.0, ToxinPred, AllergenFP v.1.0, ProtParam, and ProteinDigest. Based on this analysis, four B cell epitopes were identified, each of which was detailed in Table 2, along with their respective parameter.

Table 3. Recommended B and T cell epitopes along with their parameter

Parameter	B Cell Epitope				MHCII Epitope		
Start	490	563	593	1153	233	251	882
End	502	576	602	1163	247	265	896
Epitope	SYGFRP TYGVGH Q	RDIADTT DAVRDP Q	VITPGTN TSN	KNHTSP DVDLG	RFQTLL ALHRYS LTP	SSGWTA GAAAYY VGY	WTFGA GAALQI PFAM
Allele Count	n/a	n/a	n/a	n/a	9	9	9
Vax. Score	0,8480	0,4400	0,4217	14,039	0,5470	0,4136	0,6670
Length	13	14	10	11	15	15	15
Molecular Weight	1468,59	1572,65	1003,08	1182,26	1816,14	1523,62	1580,86
Theoretical pI	8,33	4,14	5,49	5,21	10,84	5,24	5,52
Extinction Coefficient	2980	n/a	n/a	n/a	1490	9970	5500
Half-life (mammalian reticulocytes, <i>in vitro</i>)	1.9 hrs	1 hr	100 hrs	1.3 hrs	1 hr	1.9 hrs	2.8 hrs
Half-life (yeast, <i>in vivo</i>)	>20 hrs	2 mins	>20 hrs	3 mins	2 mins	>20 hrs	3 mins
Half-life (<i>E. coli</i>, <i>in vivo</i>)	>10 hrs	2 mins	>10 hrs	3 mins	2 mins	>10 hrs	2 mins
Instability Index	4,45	6,24	-23,01	21,66	38,63	11,63	28,87
Aliphatic index	22,31	62,86	68	61,82	110,67	46	78,67
GRAVY	-0,845	-1,229	-0,32	-1,191	-0,067	0,207	1,033
Digesting Enzyme	5	7	2	5	5	3	4

Epitope prediction for MHCII was conducted against 25 HLA-DR alleles, 20 HLA-DQ alleles, and 9 HLA-DP alleles. Strong binders for these alleles were identified at a 2% threshold. Epitopes that consistently exhibited strong binding across at least nine alleles were selected for further assessment to predict the protective antigen. The criteria for this prediction were consistent with those used for linear B cell epitopes. Following the analysis,

the analysis, three MHCII epitopes were identified. These epitopes, along with their parameters are presented in Table 2.

Homology modelling for isolate EPI_ISL_17997245 was conducted using Swiss-Model Expasy, where model 8d56.1.8 for Spike Glycoprotein BA2 variant was chosen due to the high similarity. This model served as the bases for predicting an approximate structure of the target protein through the use of DiscoTope 2.0. Chain A was chosen for the analysis and all residues with propensity score and DiscoTope score greater than -1.0 were chosen to strike a balance between specificity (85%) and sensitivity (30%). All amino acid residues constituting the discontinuous B cell were visualized using PyMol. Notably, the position of all these residues in the 3D model was on the surface of the S-protein.

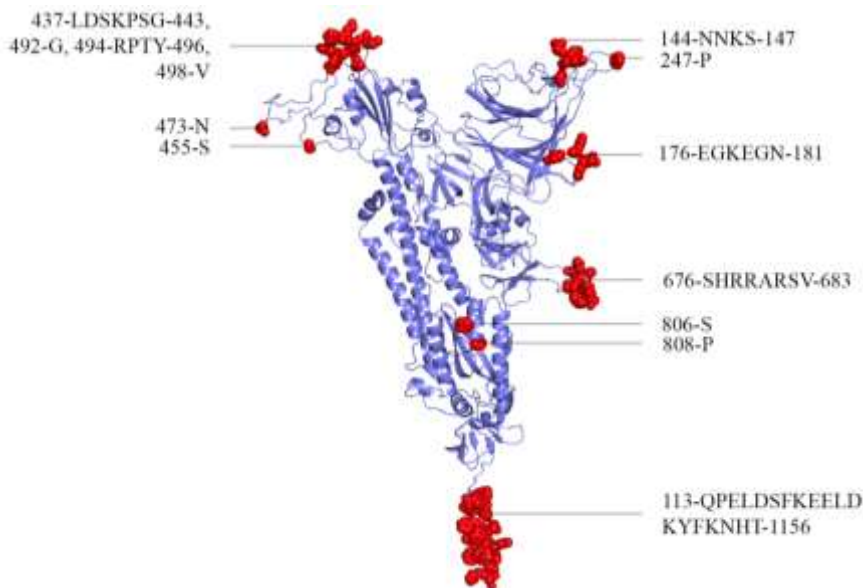


Figure 6. The location of conformational (discontinuous) B cell epitope. The red-colored spheres represented the amino acid residues predicted to be part of the epitope.

5. CONCLUSION

Analysis of SARS-CoV-2 variants using computational method has revealed four potential epitopes for continuous B cells (SYGFRPTYGVGHQ, RDIADTTDAVRDPQ, VITPGTNTSN, and KNHTSPDVDLG), three for MHC-II (RFQTLALHRSYLTP, SSGWTAGAAAYVGY, and WTFGAGAALQIPFAM), and discontinuous B cell as shown in Figure 2. Exclusion of epitopes that could potentially induce allergic reactions or toxicity would help to reduce unwanted side effects of the vaccine being manufactured. Physicochemical properties and digestibility of the epitopes were assessed to ensure their stability as well.

The utilization of robust bioinformatic tools could help in addressing evolving challenges posed by SARS-CoV-2 while improving the resource allocation and cost to develop vaccines. Through the optimization of vaccine performance, this approach has the potential to alleviate the burden on healthcare systems. Furthermore, the inherent flexibility of this approach allowed researchers to adapt the procedure to address a spectrum of viral

threats. Lastly, this could help to improve the efficiency of resource and cost-related measures allocated for vaccine development.

6. RECOMMENDATION

This study was predominantly based on computational methods rather than conducting actual laboratory experiments. While computational methods offer valuable insights and have been widely employed for their predictive capability, they lack laboratory confirmation provided by experimental studies, warranting validation through experimental studies.

The second limitation was related to the quality of the available data. It was observed that the majority of Indonesian SARS-CoV-2 isolates in the dataset were riddled with long stretches of ambiguous nucleotides (Ns). This ambiguity introduced uncertainties in data processing, which in turn, impacted the accuracy of the analysis and prediction. Despite the limitation, the study provided valuable insight into potential candidates for the COVID-19 vaccine based on SARS-CoV-2 strains in circulation, offering a foundation for further research.

For further research, determining the cross-reactivity of predicted epitope using the Basic Local Alignment Search Tool (BLAST) webserver to avoid cross-reactivity with other pathogens is of utmost importance to prevent unintended immune responses. Aside from that, predicting the interaction between MHC-II molecule and predicted epitope to determine their binding affinity using the molecular docking method should be performed to further narrow down vaccine candidates.

Before applying for ethical clearance for clinical trials, initiating an *in vitro* study to supplement predictions produced in this research to provide an overview of the actual performance of the vaccine is imperative. Lastly, to maintain vaccine performance and keep them up to date against emerging strains, collaborating with universities, governmental and non-governmental organizations, as well as manufacturers to establish a framework to continuously monitor the SARS-CoV-2 variant in circulation could be done as well.

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Chapter 11

AutiBot System: Chatbot for Prediction of Autism using Machine Learning and NLP (ABS)

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ABSTRACT

Virtual assistants driven by Neural Networks (NN) and Natural Language Processing (NLP) are redefining interactions with users thanks to the rapid advancement of technology. This project set out a lofty goal to create a chatbot able to recognize the user's feelings for autism and comprehend human moods. The chatbot aims to give instantaneously, customized answers by leveraging Python's abilities and connecting it with the EJS template via Flask servers. In addition, the application of sentiment analysis enabled personalised suggestions, which contributed to user engagement. Backend activities are powered by Express in Node.js to provide reliable website functionality, while MySQL was used for data storage. The project, nevertheless, was not devoid of its difficulties, which ranged from integration issues to worries regarding sustainability and data protection. This article looks into the project's complexities, commenting on its successes, obstacles, and the possibility for future improvements in the field of AI-powered systems of communication.

1. INTRODUCTION

The World Health Organization knows that mental health is one of the most important reasons that make an individual successful in life and makes the individual's production significantly advanced. (Abd-alrazaq et al., 2019) found that mental disorders affect 29% of people throughout their lives. The number of mentally disturbed people has increased from 182 million to 258 million, which will, in turn, cause many losses that will reach \$16 trillion. The reason is employment that was unavailable because of fear, mental illness, mental disorder or autism.

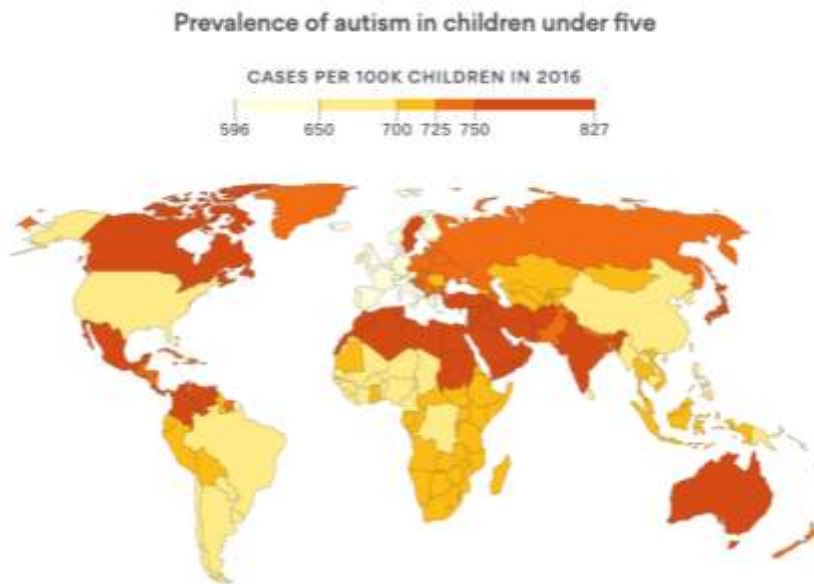


Figure 7: Autism prevalence in children under the age of five years World Map (Axios article)

(Hotez, 2018) said that, globally, an Axios article found that 4.5 million children have autism and have not yet reached the age of five, meaning that one out of every 138 children have autism. As shown in Figure 1, children with autism live in low- and middle-income countries and are concentrated in Asia, Africa and North America.

Introducing AntiCareHub's cutting-edge chatbot, a revolutionary tool designed to predict autism cases and empathize with users' emotions. Our chatbot employs sentiment analysis to understand user feelings, providing tailored responses to uplift their mood. Whether users express negativity, positivity, or neutrality, our chatbot monitors their writing style, tracking every sentence for emotions. Moreover, if needed, it seamlessly connects users with doctors through the AntiCareHub Website, ensuring timely professional intervention. Embrace this innovative solution, promoting emotional well-being and facilitating autism diagnosis like never before.

2. LITERATURE REVIEW

Autism spectrum disorder (ASD) is a cognitive illness that impairs interpersonal interaction and verbal exchange and is frequently characterized by repeated and limited behaviors. ASD is expected to affect One in every 54 kids across the United States, causing it to be among the most strongly common childhood disorders. Adults with ASD frequently have interpersonal problems such as difficulty with linguistic understanding, practicality, and interpersonal interaction. These difficulties can have a substantial influence on their capacity to connect with people and participate in charitable endeavours (*Key Findings from the ADDM Network, 2023*).

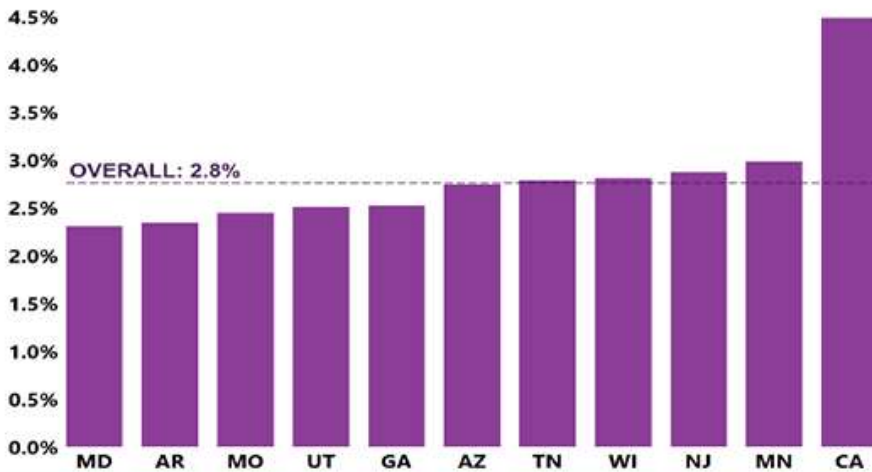


Figure 2: ADDM Connection Links discovered the percentage of eight-year-old kids who had Autism

The latest developments in the use of AI, NLP, and algorithms for (ML) have resulted in the creation of virtual assistants that can help people with ASD communicate and connect socially. Conversational agents are computer programmes that replicate human interaction by offering clients automated replies to linguistic data. To give help and advice to people with ASD, bots for conversation can be implemented into smartphone apps, web pages and other platforms on the internet.

The goal of this investigation is to look at the present level of literature on virtual assistants for autism, with an emphasis on those that use natural language processing and machine learning approaches. The evaluation will look at the prospective advantages and problems of virtual assistants for people with ASD and their relatives, as well as the methodology utilized in virtual assistants' creation and the investigation's limits and planned developments (Safi et al., 2020).

NLP and ML approaches have grown in popularity in virtual assistant creation in the past few decades. machine learning and natural language processing approaches have a chance to increase virtual assistants' effectiveness by allowing them to better grasp and react to input that is based on.

The integration of machine learning and natural language processing approaches in the framework of virtual assistants' creation for autism may prove very effective. Adults with autism may exhibit distinct behavioural traits and issues, making it challenging for conversational assistants to read and react to their feedback. Virtual assistants could be built to recognize and adjust to the behaviours and demands of members with autism by utilizing machine learning and natural language processing approaches more effectively (Abd-alrazaq et al., 2019).

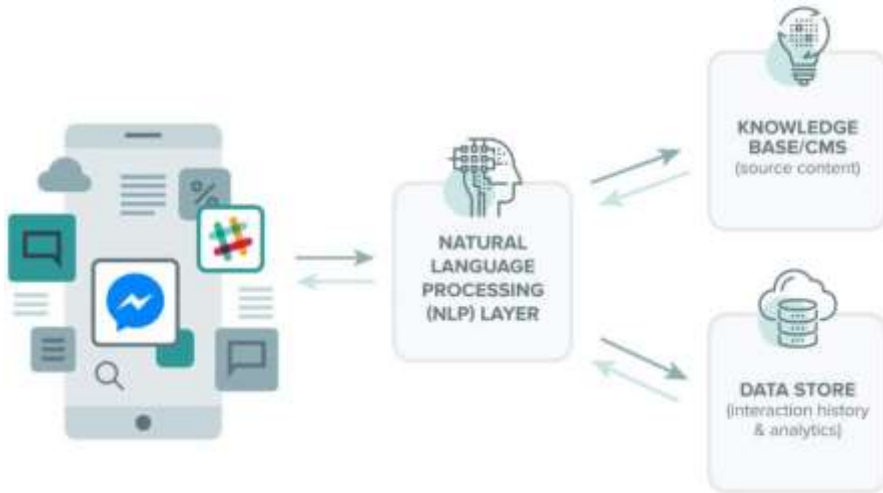


Figure 3: Links between NLP, chatbot and Data (Ranford, 2020)

Similar System/s

Bunji chatbot

Bunji, a chatbot created for psychological assistance, was tested in an initial study including 318 participants from around the globe. For three exploratory experiments, 34 suitable subjects were chosen according to specific eligibility requirements. The first study used a sort of quasi-experimental methodology to assess the efficacy of Bunji's psychological assistance capabilities. A state of mind enhancement metric was developed, and information was analysed using an unilateral the Mann-Whit testing. The results revealed significant progress in attitude rating from pre-to-post-usage.

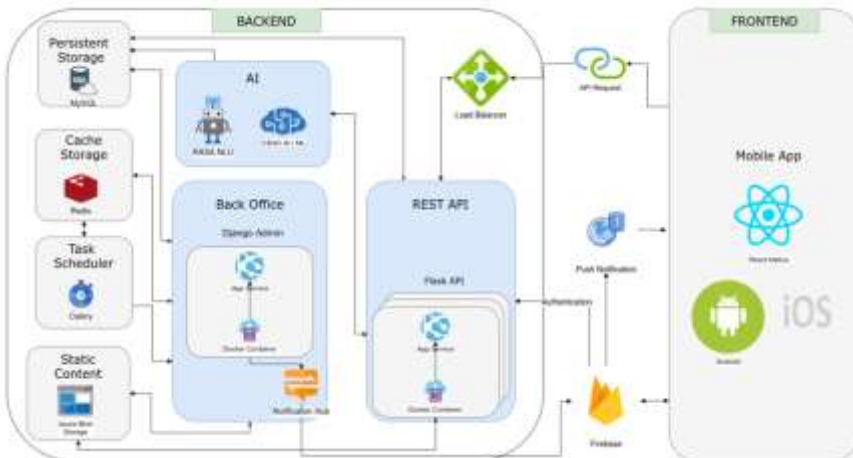


Figure 8: Bunji chatbot diagram

Woe chatbot

WOE (wellbeing Optimising Interaction) is a virtual assistant that promotes psychological health by offering individuals with personalised advice and support. To comprehend and react to user inputs in a conversational style, the virtual assistant employs the use of natural language processing (NLP) and machine learning algorithms. WOE's goal is to give users with a safe and private forum to share their psychological challenges, as well as guidance and resources to assist with their general health.

The results of the poll were subjected to a chi-square test to assess the significance of variations in specialist replies in various groupings of concerns connected with technological encouragement of psychologists' work. The concerns addressed were the individual's relationship, substantial parts of an evaluation, and diagnostic processes. The findings revealed no statistically distinct differences in expert answers within the context of a patient's relationship and substantial parts of a diagnosis, but an important distinction in answers between methods of diagnosis connected to the context of a patient's relationship and substantial components of a diagnosis. The p-values were 0.744, 0.0479, and 0.0086, with a confidence level of 0.05 (Rojewska et al., 2022).

Table 1: Comparison between Woe and bunji chatbot at accuracy(Liao, n.d.)(De Silva & Alahakoon, 2022)

NLP (Woe chatbot)	Accuracy
Deep Learning	85%
Rule-based	75%
Statistical	80%

Table 1: NLP Accuracy at Woe chatbot

NLP	Woe chatbot	Bunji chatbot
Analysis of Sentiment	77.5%	85.7%
Emotion Detection	80%	89%
Classification of intent	80%	92.31%
Recognize Entity	86.67%	89.3%

Replika chatbot:

The Replika app is powered by artificial intelligence virtual assistants that offers consumers psychological assistance and connection. It understands data provided by users and generates replies that are supposed to resemble human conversations using machine learning and natural language processing methods.

Replika's capacity to acquire knowledge and modify users' identities and habits of interaction over the years constitutes one of its distinguishing advantages. Replika's systems analyze customer input and produce replies that are customized to their specific requirements and values as they engage with a virtual assistant.

A number of investigations on the application of machine learning in psychological assistance have been undertaken as well as of investigations on the precision and outcomes of virtual assistants like Replika (Pentina et al., 2023).

3. SYSTEM DEVELOPMENT METHADODOLOGY

CRISP Methodology

CRISP (Cross-Industry Standard Process) approach is a popular strategy for data analysis and AI applications. It serves as an organized and systematic structure for guiding

the full prediction predictive modelling procedure, from analysing the business challenge through implementing the simulation in a manufacturing environment.

The CRISP technique consists of multiple critical processes, which include information comprehension, gathering data, modelling, assessment, and implementation. Each of these processes is crucial to the successful completion of the endeavour, since they usually are cyclical in the environment, with observations and knowledge acquired throughout the method influencing the initial phases.

Researchers and AI programmers may guarantee that their predictions are produced in a thorough and controlled manner, with an obvious emphasis on the business challenge and the ultimate user, by adopting the CRISP process. This may assist enhance the predictive capacity and efficacy while also streamlining the creation procedure and ensuring that the framework is appropriate for function.

4. RESULT AND DISCUSSION

```
with torch.no_grad():
    n_correct = 0
    n_samples = 0
    test_data = torch.from_numpy(X_test).float().to(device)
    test_labels = torch.from_numpy(y_test).to(device)
    outputs = model(test_data)
    _, predicted = torch.max(outputs.data, 1)
    n_samples += test_labels.size(0)
    n_correct += (predicted == test_labels).sum().item()

test_acc = 100.0 * n_correct / n_samples
print(f'Accuracy of the network on the {n_samples} test samples: {test_acc} %')
```

Figure 9: Evaluating Model

The training chatbot algorithm is evaluated for correctness on a different test dataset during the evaluation phase. This evaluation begins by disabling gradients monitoring using `torch.no_grad()`, which ensures that no weight updates are carried out throughout this process. The total number of test samples (`n_samples`) and the number of successfully predicted samples (`n_correct`) are both set to zero. Preprocessing the test data involves turning it to PyTorch tensors and sending it to the suitable computing device, either CPU or GPU.

The framework is then used with the test data, with predictions generated for each sample. These predictions are contrasted with the test dataset's actual labels. By obtaining the largest value along the axis of anticipated class probabilities (axis 1), For each sample, the developer obtain the projected class. By matching these anticipated classes to the real labels, the number of correctly categorized samples is determined, and the count of properly categorized samples is updated.

Finally, the test accuracy is calculated as a % by dividing the total number of test samples (`n_samples`) by the number of successfully classified samples (`n_correct`) and multiplying the result by 100. This accuracy score indicates the ease with which the trained chatbot model works on unseen data, which aids in determining its generalization potential.

According to the outcomes, the chatbot model obtained high levels of reliability on both its training and evaluation datasets. Specifically, the model achieved an accuracy of roughly 97.31% on the training dataset of 1,414 samples. This means that the model

accurately classified 97.31% of the training instances during training. The model achieved an even greater accuracy of roughly 98.23% on the test dataset of 283 samples, suggesting that it could adapt well to previously unseen data. The loss values provided throughout training epochs indicate that the model underwent oscillations in its training process, with some epochs exhibiting a small loss (epochs 500 and 600) and others exhibiting slightly greater loss values (epochs 400 and 1000). Overall, the findings indicate that the chatbots model performs remarkably well when it comes to accuracy and generalization, albeit with some fluctuation in loss throughout training.

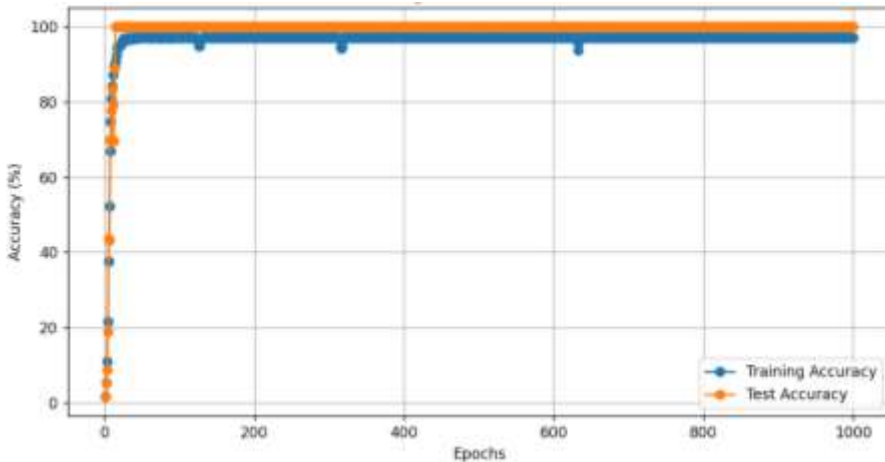


Figure 10: Training and test accuracies plot

```
Accuracy of the network on the 1414 training samples: 97.31258840169731 %
Accuracy of the network on the 283 test samples: 98.23321554770318 %
```

Figure 11 Training and test accuracies result

```
Epoch [500/1000], Loss: 0.0006
Epoch [600/1000], Loss: 0.0004
Epoch [700/1000], Loss: 0.1465
Epoch [800/1000], Loss: 0.0028
Epoch [900/1000], Loss: 0.0001
Epoch [1000/1000], Loss: 0.2268
```

Figure 12: Training loss

5. CONCLUSION & RECOMMENDATION:

Finally, the establishment of an autistic conversationalist (ABS) incorporated into an online platform utilizing Python and the programming language Node.js using Mongo DB through windows OS in addition to the incorporation of NLP and machine learning techniques, has the possibility of helping offer a readily affordable and efficient form of assistance for those with autism. The investigative study emphasized the benefits of utilizing Python and the Node.js for these endeavors, such as its adaptability, simplicity of utilize, and library and tool accessibility. The use of natural language processing (NLP) and machine learning techniques can also improve the chatbot's precision and efficacy in comprehending and reacting to individuals.

Moreover, surveying undergraduates to acquire data and input on the chatbot's efficiency, simplicity of utilize, and overall efficacy is critical to guarantee that the chat assistants correspond to the requirements of its intended consumers. The CRISP approach was determined to be the most appropriate one for these endeavors since it provides an organized and all-encompassing strategy for creating and using the virtual assistant (ABS).

The incorporation of Neural Networks (NN) and Logistic Regression into Natural Language Processing (NLP) has recently opened the path for advanced chatbots. These virtual assistants can now diagnose illnesses like autism and evaluate user feelings with surprising accuracy by employing technologies like the vectorization and analysis of sentiment. Python, a powerful programming language, is crucial in coordinating various functions. It guarantees smooth interactions between users through connection to the EJS template via Flask servers. In addition, the chatbot's capacity to offer response suggestions according to analysis of sentiment gives user encounters an intimate feel. with addition, using Express with Node.js for backend processes improves website performance, delivering an overall user experience. The use of MySQL as a storage system guarantees that data is reliably stored and retrieved.

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