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PREFACE

With profound gratitude, I extend my appreciation that, by His grace, this digital book has been successfully published as a comprehensive reference encapsulating the discourses, discoveries, and strategic reflections presented at the International Digital Expert Symposium 2025. It is my sincere hope that this publication will serve as a valuable resource not only for symposium participants, but also for all stakeholders engaged in the development of the digital ecosystem now and in the years to come. May the insights contained herein deepen understanding, reinforce strategic direction, and foster collaboration across disciplines and international borders.

In conclusion, I wish to convey my heartfelt thanks to all authors, researchers, editors, and contributors whose ideas and dedication have made this publication possible. May this modest effort bring meaningful impact and lasting benefit to the global digital community. I wish you an enlightening reading experience.

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Secure Text Steganography Using ASCII-to-RGB Mapping and Random Embedding Positions

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Abstract— Text steganography remains a significant challenge in information security due to the limited redundancy available in textual data. This paper introduces a lightweight text-based steganography method that uses RGB triplets—derived from ASCII codes—to embed secret messages into a cover text at randomized positions. A reversible digit-mapping rule converts ASCII values into RGB triplets, which are stored in a stego-key alongside the corresponding embedding positions and sequence indices. The technique preserves cover text readability, resists pattern-based detection, and is computationally efficient. Experimental evaluation demonstrates the method’s feasibility and suitability for contexts where covert communication through textual channels is preferred. Future work may integrate zero-width character embedding, automated key generation, and natural-language-driven steganographic enhancements.

Keywords: Text steganography, RGB color, RGB triplet, ASCII value, Natural language

I. INTRODUCTION

Steganography conceals the existence of a message rather than merely encrypting its content. Although image- and audio-based steganography have been widely studied, text-based methods face greater challenges due to minimal structural redundancy and susceptibility to visible distortion. Recent surveys highlight that text steganography remains an evolving research domain, with significant limitations in embedding capacity, robustness against attacks, and dependence on linguistic features [1].

The rise of text-centric communication platforms, including emails, messaging apps, and online forums, increases the relevance of secure text steganography, particularly in environments where transmitting images or audio may attract unwanted attention. Existing methods, such as whitespace manipulation, linguistic substitution, and invisible Unicode characters, often struggle with reliability, limited payload capacity, or detectability [2], [3]. Linguistic-based approaches, while preserving fluency, have low capacity and are sensitive to contextual or domain shifts, making them unsuitable for embedding larger messages.

To address these challenges, this study proposes a randomized RGB-based embedding strategy derived from ASCII codes, which maps message characters to Red, Green, Blue (RGB) values and embeds them at non-sequential

positions in the cover text. The proposed approach maintains the visual integrity of the cover text, avoids linguistic modifications, and is language-independent. By leveraging a pseudorandom number generator (PRNG) for position selection, the method ensures both security and reproducibility while significantly improving embedding capacity compared with conventional text steganography techniques. It conceals the existence of a message rather than merely encrypting its content. Although image- and audio-based steganography have been widely studied, text-based methods face greater challenges due to minimal structural redundancy and susceptibility to visible distortion. Recent surveys highlight that text steganography remains an evolving research domain with significant limitations in capacity, robustness, and linguistic dependency [1].

II. RELATED WORK

The following paragraph provides a review of the related work that is relevant to this study, highlighting previous approaches, their limitations, and how they inform the development of the proposed text steganography method.

A. Format-based techniques

Methods such as whitespace manipulation, indentation changes, and font variation attempt to hide patterns in formatting. These methods are vulnerable to automatic text reformatting and are easily disrupted during document conversion [2]. Example: A hidden binary message can be encoded by inserting one or two spaces at the end of each line. However, if the document is copied into a plain-text editor, the extra spaces are removed, destroying the embedded data.

B. Zero-width and invisible character techniques

Invisible Unicode characters have been shown to increase payload while remaining imperceptible [3]. More recent studies demonstrate strong imperceptibility and high capacity using zero-width characters for embedding [4]. Zero-width characters can only embed a small amount of data per cover text. Example: A typical sentence of 100 characters can accommodate only

around 50–100 bits if one zero-width character is used per character. This is much lower than other steganography methods such as whitespace, formatting-based, or multimedia embedding. For large messages, the technique becomes impractical, as multiple zero-width characters may make the text suspicious or increase file size unnecessarily.

C. Linguistic and generative steganography

Modern approaches leverage synonym substitution, syntactic rewriting, and even language models. Recent work using BERT-based autoregressive generation and semantic-aware coding attempts to preserve fluency while embedding data [5], [6]. Knowledge-graph-guided generative steganography has been explored to maintain semantic coherence [7]. One of the limitations of this technique is the embedding capacity is relatively low, as only limited modifications (e.g., synonyms or syntactic changes) can be applied without affecting naturalness, making it impractical for large messages. For example, consider embedding 1 KB message (~1024 bytes) using synonym substitution, you would need ~8,000 words (assuming 1–2 bits per word), which is extremely long and impractical for normal text. This illustrates the low embedding capacity of linguistic steganography, highlighting why it is unsuitable for large messages.

D. Colour- and metadata-based embedding

RGB-based embedding schemes have been applied in text and images. Osman et al. proposed using dark colour coding combined with mathematical encoding to hide secret data [8]. These methods inspired the use of numeric colour components as carriers for text-based embedding. However special symbol, and numbers is not allowed by using this technique.

III. METHODOLOGY

The proposed technique for secure message embedding involves three primary steps:

Step 1: ASCII-to-RGB Conversion

Each character of the secret message is first converted into its corresponding ASCII value (e.g., M = 077, E = 069). This numerical representation is then mapped to an RGB triplet, effectively transforming textual data into colour codes. This conversion ensures that each character is represented uniquely as a combination of Red, Green, and Blue values. For example

$$\text{Character E} = \text{ASCII } 069 \rightarrow \text{RGB } (0, 6, 9)$$

In this study, the phrase “MEET YOU AT TEN” was employed as the hidden message. The encoded message was then processed to generate the following results, which are presented in the table below for clarity and analysis.

TABLE I
HIDDEN MESSAGE REPRESENTATION IN RGB COLOR

Sequence	Char	ASCII	Digits
----------	------	-------	--------

			(R G B)
1	M	77	0 7 7
2	E	69	0 6 9
3	E	69	0 6 9
4	T	84	0 8 4
5	(space)	32	0 3 2
6	Y	89	0 8 9
7	O	79	0 7 9
8	U	85	0 8 5
9	(space)	32	0 3 2
10	A	65	0 6 5
11	T	84	0 8 4
12	(space)	32	0 3 2
13	T	84	0 8 4
14	E	69	0 6 9
15	N	78	0 7 8

Step 2: Randomized Embedding of RGB Codes in the Cover Text

The generated RGB triplets are embedded into randomly selected positions within the cover text using PRNG algorithm. A PRNG is a mathematical algorithm that produces numbers that look random, but are actually fully deterministic. The randomness of the embedding process enhances security by making it difficult for an attacker to predict the location of the hidden data. The positions of these embedded triplets are stored in a stego-key, which acts as a guide for extracting and reconstructing the hidden message.

The following are a random number generated by PRNG using a seed key (2025)

53, 2, 59, 27, 39, 12, 44, 7, 36, 61, 14, 48, 25, 31, 10

For this study, the cover text selected for embedding the hidden message is presented below.

“Digital communication has become a routine part of daily life, allowing people to exchange messages quickly and easily. As information travels across various platforms, concerns about privacy and data protection continue to grow. To address these challenges, researchers often explore subtle techniques that allow important details to be hidden within ordinary text. When crafted properly, a cover text appears completely natural and does not draw attention to itself. It maintains a smooth flow, consistent tone, and coherent structure so that readers notice nothing unusual. At the same time, the text provides enough length and variability to support the embedding of coded information at predefined positions. These positions are usually generated by a shared key or a pseudorandom number sequence. Anyone with the correct key can later retrieve the embedded values and reconstruct the hidden message. This balance between readability and concealment makes text-based embedding a practical and useful method.”

Step 3 : Decoding Process

During the extraction phase, the stego-key is used to identify the exact positions of the embedded RGB triplets within the cover text. The RGB values are then converted back to their corresponding ASCII values, allowing the original secret message to be accurately reconstructed. The reliance on the stego-key ensures that only authorized users with the correct key can retrieve the hidden message. The algorithm for the decoding process as below.

1. Extracting RGB values based on stored positions
2. Converting RGB values back to ASCII digits
3. Ordering characters by sequence index

Finally, ASCII values are mapped back to characters to reconstruct the original secret message.

Overall, this method provides a secure and efficient mechanism for concealing textual information within another text medium, combining the unpredictability of randomized embedding with the precision of key-based reconstruction.

IV. RESULT

The results of the proposed technique indicate that the generated stego text exhibits characteristics highly consistent with the original stego text. In other words, the application of the embedding algorithm does not introduce noticeable changes in the structure, readability, or appearance of the text, maintaining the natural flow and coherence of the original content. This outcome demonstrates that the proposed method effectively conceals the hidden message while preserving the integrity of the cover text. As illustrated in the example below, the stego text produced by the proposed technique is indistinguishable from the original cover text, with no observable differences in structure, readability, or appearance to the human reader.

“Digital communication has become a routine part of daily life, allowing people to exchange messages quickly and easily. As information travels across various platforms, concerns about privacy and data protection continue to grow. To address these challenges, researchers often explore subtle techniques that allow important details to be hidden within ordinary text. When crafted properly, a cover text appears completely natural and does not draw attention to itself. It maintains a smooth flow, consistent tone, and coherent structure so that readers notice nothing unusual. At the same time, the text provides enough length and variability to support the embedding of coded information at predefined positions. These positions are usually generated by a shared key or a pseudorandom number sequence. Anyone with the correct key can later retrieve the embedded values and reconstruct the hidden message. This balance between readability and concealment makes text-based embedding a practical and useful method.”

Pseudorandom number generators (PRNGs) can produce sequences of numbers that are useful for determining the positions in which a message can be embedded. Table II presents five sets of random numbers generated using a seed

value of 7777 with Python’s deterministic PRNG. All numbers were produced within the range of 1 to 150. In particular, the values in Set 2 correspond to PRNG calls numbered 16 through 30, ensuring reproducibility and deterministic placement of the hidden message.

TABLE II
VARIOUS SET OF PRNG RANDOM NUMBER

Set 1	71, 141, 82, 5, 52, 46, 50, 67, 94, 133, 24, 139, 135, 108, 144
Set 2	7, 29, 48, 99, 68, 121, 31, 146, 112, 131, 6, 16, 128, 42, 27
Set 3	114, 104, 62, 128, 94, 57, 117, 73, 81, 132, 100, 149, 42, 64, 5
Set 4	144, 45, 19, 133, 103, 14, 61, 13, 112, 35, 49, 40, 23, 75, 116
Set 5	80, 135, 38, 121, 144, 56, 28, 11, 108, 59, 10, 83, 94, 101, 33

Table III presents a comparison of the embedding capacity of the proposed technique with other existing techniques.

TABLE III
VARIOUS SET OF PRNG RANDOM NUMBER

Technique	Bits per char	1011 chars (with spaces)	Notes
Format-based	~1 bit per space/line	~148 bits (18.5 bytes)	Fragile
Zero-width	~1 bit per word boundary	~148 bits (18.5 bytes)	Moderate
Linguistic	~1 bit per substitution	~90–180 bits (11–22 bytes)	Higher but semantic drift
RGB (full 24-bit)	24 bits	8,088 bits (1,011 bytes)	Very high capacity

Using **RGB color encoding** massively increases capacity compared to format-based, zero-width, or linguistic methods. Even with restricted levels (0–8), this technique can embed **over 1 KB of hidden data** in a single 1,011-character text, far beyond what spacing or synonym tricks allow.

V. CONCLUSION

This study proposed a randomized RGB-based text steganography method that combines ASCII digit mapping with non-sequential embedding positions to securely conceal messages within text. The technique preserves the visual integrity and readability of the cover text while enhancing security through deterministic yet randomized placement of hidden data. Compared with conventional linguistic or model-based steganography approaches, it provides a lightweight, reproducible, and practical solution that balances embedding capacity and imperceptibility. Experimental results confirm that

the generated stego texts are visually indistinguishable from the original cover texts, demonstrating the method's effectiveness in maintaining text fidelity and resisting detection. The use of a pseudorandom number generator ensures reproducibility and controlled randomness, while the RGB-based encoding allows precise embedding at the character level. Future research may explore the potential directions include investigating machine learning-based steganalysis resistance to make the embedding less detectable by AI-based detection tools, developing dynamic RGB encoding schemes that adapt to different character distributions in the cover text, and exploring cross-platform text compatibility to ensure the hidden message remains intact across various text editors, web applications, and file formats. Additionally, research could examine hybrid embedding strategies that combine RGB-based encoding with other text steganography techniques, such as whitespace manipulation or synonym substitution, to further enhance capacity and security

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Watch My Calorie: An Intelligent Mobile App for Personalized Nutritional Insights

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Abstract— Watch My Calorie is a mobile application designed to help users monitor daily calorie intake and support a healthier lifestyle. It offers personalized features such as meal tracking, BMI calculation, nutritional insights and tailored health recommendations. Although many calorie tracking apps exist, they often lack strong personalization and user-friendly interaction. This highlights the need for a more intuitive and visually engaging solution. The app was developed using Flutter and Firebase through an iterative process informed by user surveys and usability testing. Results showed high user satisfaction, especially among university students and young adults, due to its simplicity and essential features. Specifically, the app achieved a User Acceptance Testing (UAT) score corresponding to a 96.83% for usability experience rating and 97% of participants able to navigate the app without difficulty and found key features such as meal logging, BMI calculation and calorie graph visualization that are highly beneficial for managing dietary intake and making informed food choices. Furthermore, 96.67% of users demonstrating strong trust and satisfaction, stated that the app to be a dependable and useful resource for tracking calories. By providing visual data analytics and recommendations based on activity level and health conditions, Watch My Calorie contributes to the expanding field of digital health interventions and encourages long-term health awareness and positive behaviour change.

Keywords: dietary intake, calorie tracker, nutritional insight, personalized healthy lifestyle, tailored health recommendation.

I. INTRODUCTION

Poor dietary habits and sedentary lifestyles have led to increasing health issues, particularly obesity and non-communicable diseases (NCDs), across various populations. According to the World Health Organization (WHO), rates of overweight and obesity continue to rise in Southeast Asia, especially in Malaysia. One effective approach to addressing this problem is the use of mobile health (mHealth) applications, which allow users to track nutrition, access health information, and modify their eating behaviours.

However, studies indicate that many commercial apps such as Google Fit and MyFitnessPal often fail to meet local needs due to limited cultural adaptation, complex interfaces or insufficient personalised feedback [5], [11]. This further highlight the necessity for localized food databases, Bahasa Malaysia support and culturally relevant guidance when designing calorie-tracking apps for Malaysian users.

To bridge these gaps, Watch My Calorie was developed as a user-friendly, regionally tailored solution for Malaysian young adults. Built with Flutter and Firebase, it features meal logging, personalized health suggestions, calorie analysis and BMI-based insights. With an emphasis on simplicity, clarity and accessibility, the app aims to help users make informed nutritional decisions through a modern, intuitive interface.

Watch My Calorie prioritizes visual and personalized feedback to enhance user engagement. The development followed an iterative, user-centered approach, enabling early testing and refinement based on real user experiences. A field evaluation was also carried out to assess the app's performance in real-life use and identify areas for future improvement.

II. METHODOLOGY

A. Development Framework

The development of Watch My Calorie mobile app used the V-Model methodology, which selected for its structured verification-and-validation workflow. It is a software development technique that stresses a parallel interaction between development and testing phases [6]. This approach used to ensure high accuracy, strong reliability and systematic testing that important for health-related tools.

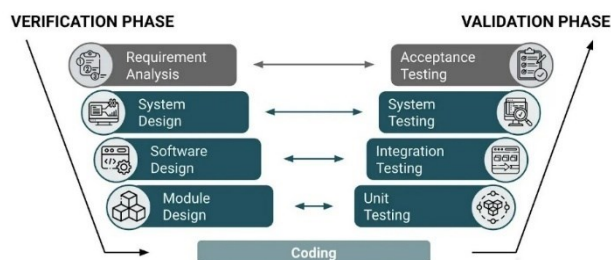


Fig. 1 V-Model Methodology

B. Verification Phases

1) Requirement Analysis:

User needs were gathered via surveys and literature review. The app main features such as meal logging, BMI computation, calorie tracking, personalized health insights were finalized.

2) System Design:

The system was built using Firebase for authentication, storage and real-time updates. UI wireframes focused on

minimalism, clarity and intuitive navigation simple to improve usability and match young users' expectations [12].

3) Software Design:

Modules such as BMI calculation, meal logger, water intake and recommendation engine were defined for seamless backend–frontend integration. The aim was to ensure a smooth flow of data and a seamless user experience, supporting personalized health outputs [9].

4) Module Design:

Five major modules were designed within the app:

- User Registration
- Meal Logging
- Calorie Log
- Calorie Analysis
- Profile

This is to ensure data consistency, reusability and smooth information flow.

5) Implementation:

Flutter and Dart were used as front-end development. For profile creation and ongoing recommendations, BMI calculation was applied in the app [13]. This calculation helps users in identifying if they fall in underweight, normal weight, overweight or obese, according to World Health Organization (WHO) standards. Daily water intake also included which helps users track hydration [2]. Charts were implemented for calorie intake visualization to enhance user engagement and awareness [10].

$$BMI = \frac{Weight (kg)}{[Height (m)]^2}$$

$$Daily\ Water\ Intake\ (ml) = Weight\ (kg) \times Base\ Water\ (ml/kg) \times Activity\ Multiplier$$

C. Validation Phases

6) Unit Testing:

Ensured accuracy in BMI calculations, input handling, and calorie computations.

7) Integration Testing:

Modules were then combined and tested as a complete system to confirm that inputted meals affected calorie graphs and that BMI values influenced the app's health suggestions accurately. This to ensure it align with the app's goal of real-time, personalized feedback [1].

8) System Testing:

This phase performed on physical Android devices to assess speed, UI responsiveness and Firebase synchronization.

9) Acceptance Testing:

Involved 30 real users consists of UUM students and staffs. Participants performed real-life application tasks and completed a structured usability survey using a 6-point Likert scale. The results showed high satisfaction in ease of use and relevance of features, confirming its alignment with user expectations [5], [8].

III. SYSTEM IMPLEMENTATION

The interface was designed to support smooth navigation for first-time users. Key screens of the app included:

- 1) Sign-Up Page: Collects user details (age, gender, height, weight, health issues) for BMI and personalized recommendations.
- 2) Home Page: Displays daily calorie summary and shortcuts to Add Meal, Calorie Log, Calorie Analysis and Profile.
- 3) Add Meal Page: Allows users to log meal entry by name, calories, category and date. Below the form, the app provides personalized suggestions or health alerts based on the user's BMI and meal input. This supports better decision-making at the point of entry.

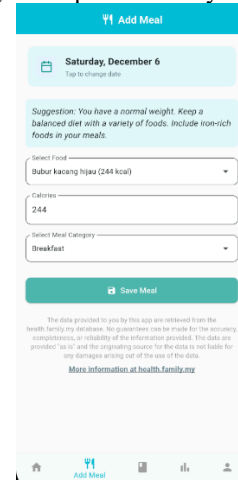


Fig 2. Add Meal Page

- 4) Calorie Log Page: This screen shows a list of meals that have been logged for the day. Each entry includes the meal name, calories, and portion details. This will help users stay aware of their daily intake and hydration.

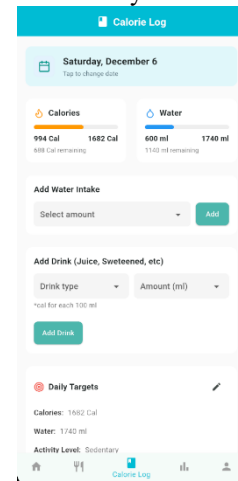


Fig 3. Calorie Log Page

- 5) Calorie Analysis Page: Shows weekly calorie-intake bar charts categorized by meal types. This will help users by providing a clear visual breakdown of eating patterns and supports reflection and progress tracking over time.

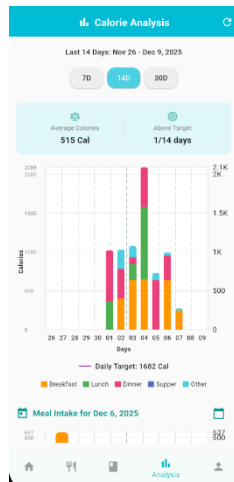


Fig 4. Calorie Analysis Page

6) Profile Page: Displays BMI status, personal details, and visual BMI indicator. This design emphasizes simplicity, cultural familiarity and visual clarity of which factors shown to enhance long-term engagement.

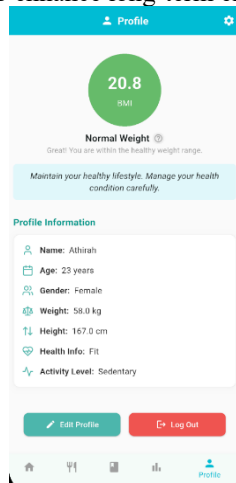


Fig 5. Profile Page

IV. RESULTS AND DISCUSSION

1) Usability Experience

Participants rated overall usability at 5.81/6, highlighting the app’s clean layout, intuitive navigation, and minimalistic design. This shows that simplified interfaces significantly enhance user engagement and reduce cognitive load in calorie-tracking apps.

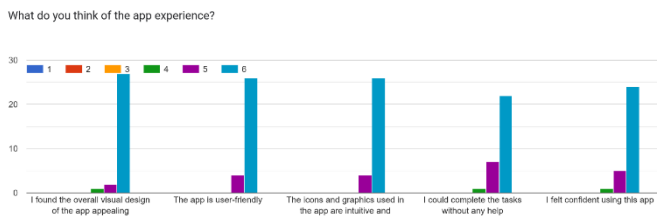


Fig 6. Usability Experience

2) Perceived Usefulness

The perceived usefulness scored 5.82/6. Users indicated that features such as automatic BMI calculation, weekly calorie

trends and localized food options supported their nutritional decision-making.

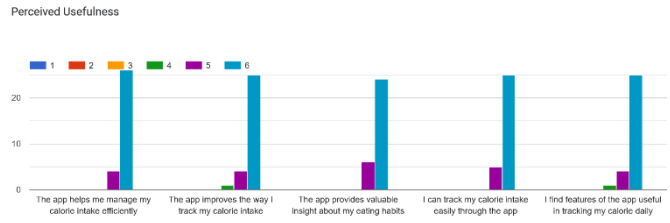


Figure 7. Perceived Usefulness

3) Perceived Acceptance

Perceived acceptance averaged 5.79/6, with users expressing confidence in the app's reliability and believed it was a trustworthy tool for daily calorie tracking.

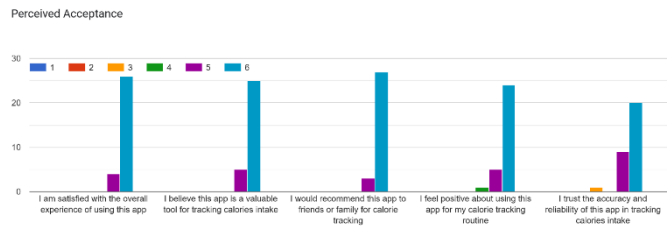


Figure 8. Perceived Acceptance

V. SUMMARY OF FINDINGS

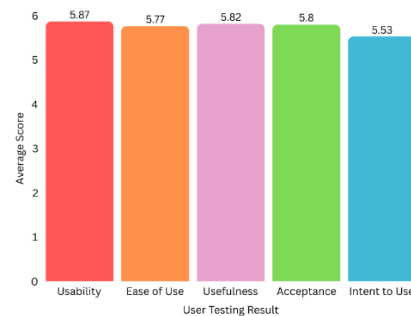


Fig 9. Average of Field Test Findings

Figure 9 illustrates the average bar graph of the Watch My Calorie user testing results, which show strong positive outcomes across all evaluation dimensions. Usability experience recorded an average score of 5.81/6, reflecting positive reception of the intuitive interface, clear layout and overall user-friendly design.

For features and functionality, the app scored 5.77 for perceived ease of use and 5.82 for perceived usefulness. Users navigated the app effortlessly and identified core features such as meal logging, BMI calculation and calorie graph visualization as highly beneficial for managing dietary intake and supporting informed food decisions. These features were viewed as both informative and motivating for tracking health progress.

The acceptance dimension averaged 5.8, indicating strong trust and satisfaction with the app. The intention to use score of 5.53 further suggests high willingness to continue using the app and integrate it into daily routines.

User feedback also emphasized several strengths, including the simple and intuitive interface, meaningful visualizations of

calorie intake and progress and the cultural relevance of the localized Malaysian food database. Personalized recommendations based on BMI and activity level were also identified as highly useful for supporting health goals. These findings align with existing literature highlighting personalization, localization and ease of use as key factors driving user satisfaction and long-term engagement.

VI. IMPLICATIONS

The results from the field testing of Watch My Calorie highlight several important implications for mobile health (mHealth) application design, particularly in promoting healthier eating habits among young adults. The high usability and satisfaction scores suggest that a culturally relevant, user-centered app can significantly support users in managing their nutrition that support previous findings in effective calorie tracking tools positively impact eating behaviours [5].

A key implication is the importance of localization. Unlike many global apps that overlook regional dietary patterns, Watch My Calorie integrates familiar Malaysian foods, enhancing user engagement and usability. This aligns with literatures who emphasize that localized content is crucial for adoption and long-term use in diverse populations [3], [9]. The positive reception of personalized feedback, such as the BMI calculator and calorie intake graphs, reinforces the need for visual, actionable insights which the trend also noted in the work of Gioia et al. and Standen and Rothman [4], [11].

Additionally, the high intention to use scores suggest the app's potential for sustained engagement, especially if future updates address user suggestions like auto-calorie estimation and activity tracking. This finding supports Vlahu-Gjorgievska et al., who argue that personalization and simplicity are key drivers of long-term app use [15]. As digital health technologies expand, this app demonstrates how well-designed, localized mobile solutions can empower users to take control of their nutritional choices [1], [8].

VII. CONCLUSION

Watch My Calorie was developed as a mobile app to assist users in tracking their daily calorie consumption and encouraging healthier eating habits. Built using Flutter and Firebase, the app incorporates key features such as meal logging, BMI calculation, visual calorie tracking and personalized recommendations based on individual health data. It was designed with a localized focus for Malaysian users and followed the V-Model methodology throughout its development.

Findings from the field test with 30 participants revealed strong user satisfaction in usability, functionality and engagement. Users praised the intuitive design, cultural relevance and clarity of features like the BMI calculator and daily calorie graph. These results confirm the app's value in helping users understand their dietary patterns and make informed nutrition decisions.

User feedback also suggested future improvements, such as expanding the food database, automating calorie suggestions and integrating activity tracking. With these enhancements, Watch My Calorie could evolve into a more all-encompassing

health platform. On the whole, the study demonstrates that well-designed, localized mobile health (mHealth) applications can effectively support nutrition awareness and contribute to public health goals among young adults.

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A Digital Logbook Model for Student Activities Management During Industrial Training

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Abstract— Industrial training is an essential component of higher education programmes, enabling students to apply theoretical knowledge in actual work environments while developing practical and professional skills. A core requirement during training is the daily logbook, which serves as a record of student activities and a key channel for supervisors to monitor progress. However, paper-based logbooks often result in inconsistent reporting, missing entries, delayed feedback, and challenges in validating student activities. These limitations reduce the effectiveness of supervision and hinder accurate assessment of learning outcomes. To overcome these challenges, this study proposes A Digital Logbook Model for Student Activities Management During Industrial Training. The objective is to develop a structured digital reporting model that improves the accuracy, consistency, and timeliness of daily reporting. This study adopts the Waterfall methodology, that consists of requirements analysis, system design, development of the model, implementation planning, and final evaluation. Requirements were gathered from students, academic supervisors, and industry partners to ensure that the model addresses actual user needs. The resulting model consists of four main components: a student daily reporting module, supervisor verification interfaces, a centralized reporting engine, and an interactive monitoring dashboard. Findings show that the digital logbook model significantly enhances daily reporting discipline, improves data reliability, and enables more effective supervision by providing timely insights into student activities. This study contributes a practical and scalable solution for improving industrial training management. Future enhancements may include mobile application support, predictive analytics for performance monitoring, and integration with institutional learning-management platforms to create a more comprehensive and fully digital ecosystem.

Keywords: Digital Logbook, Industrial Training Management, Daily Reporting System, Student Monitoring, Web-Based Activity Tracking

I. INTRODUCTION

Industrial training is widely recognized as a core experiential learning component in higher education, providing students with structured opportunities to apply theoretical knowledge in authentic workplace environments. This exposure helps strengthen professional skills, technical competence, and workplace readiness, thereby supporting a more seamless transition into the industry [1]. To facilitate continuous monitoring during this practicum, institutions traditionally require students to maintain a daily logbook documenting their

tasks, reflections, and progress. Despite its long-standing use, the traditional paper based logbook format often proves inadequate for modern supervision needs.

Extensive literature has highlighted significant challenges associated with paper-based logbooks. These include missing or incomplete entries, inconsistent reporting formats, difficulties in tracking student progress, and the risk of misplacing physical documents [2]. Supervisors frequently face delays in reviewing student submissions and providing feedback, resulting in reduced oversight and weaker alignment between student activities and intended learning outcomes [3]. Verification of the authenticity of reported tasks also becomes problematic, particularly when students are dispersed across diverse training locations with varying levels of supervision.

In response to digital transformation trends across educational institutions, researchers have begun proposing digital and web-based platforms to streamline activity reporting and documentation processes. Studies have demonstrated that digital practicum systems can enhance transparency, strengthen record accuracy, and reduce administrative burdens for both students and supervisors [3,4]. These systems also provide structured interfaces that support real-time reporting, improved data validation, and centralized access to records, addressing multiple weaknesses in traditional reporting practices.

Recent developments in digital educational tools further emphasize the value of structured, model-driven platforms. For instance, user-requirement studies for web-based systems highlight the importance of designing platforms that support ease of use, reliable data handling, and effective information retrieval [6]. At the same time, digital academic tools such as e-portfolios demonstrate how well-designed platforms can support student professional development by organizing, curating, and validating learning activities [7]. These findings indicate that digital systems, when grounded in clear models, can significantly improve the integrity and usability of student activity records.

In the specific context of industrial training, existing digital systems have shown encouraging outcomes. A recent study at the School of Computing demonstrated that web-based industrial training platforms can improve communication mechanisms, streamline reporting workflows, and support more efficient supervisor oversight [8]. Another related system developed for recording student industrial training activities

further supports the value of digital tools in strengthening reporting consistency, supervisor engagement, and data management quality [9]. These local findings reinforce the need for a structured digital model that directly addresses the gaps in daily activity reporting.

Motivated by these issues and the increasing institutional demand for digital reporting solutions, this study proposes A Digital Logbook Model for Student Activities Management During Industrial Training. The objective is to design a systematic model that enhances the accuracy, consistency, and timeliness of daily reporting while enabling supervisors to monitor student progress effectively. The proposed model integrates key components such as daily reporting modules, verification mechanisms, and centralized monitoring to ensure data reliability and strengthen supervision practices. Ultimately, this model aims to support more effective assessment, improve the quality of industrial training experiences, and contribute to the broader digital transformation agenda within higher education institutions.

II. METHODOLOGY

This study adopts the Waterfall methodology, consisting of five sequential phases: requirements analysis, system design, model development, implementation planning, and evaluation (Figure 1).

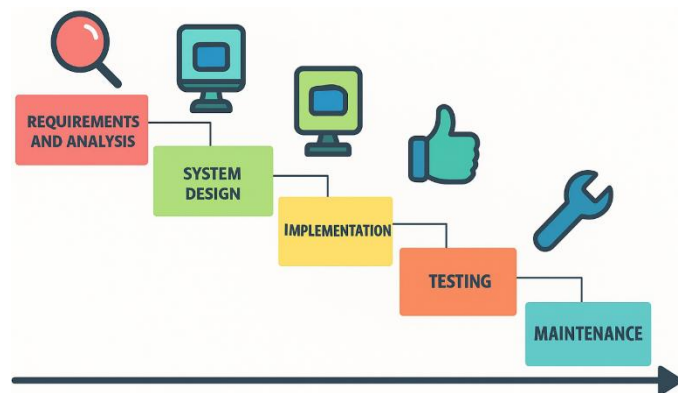


Fig. 1 Waterfall Model

1. Requirements Analysis

The study began with a detailed requirements-gathering process involving interviews and discussions with key stakeholders such as students, academic supervisors, and industrial training coordinators from the School of Computing, Universiti Utara Malaysia. These sessions aimed to understand the limitations of the existing manual process for monitoring industrial training. Challenges such as inconsistent documentation, delayed supervisor responses, limited transparency, and communication gaps between students and mentors were highlighted. Insights gathered during this phase informed the functional and non-functional requirements that later guided the system design.

2. System Design

In the design phase, the requirements were transformed into a structured system blueprint. Unified Modeling Language (UML) diagrams were used to illustrate system interactions and behaviour. The user interface concepts were developed in

Figma to create wireframes and clickable prototypes, prioritising usability, seamless navigation, and responsiveness across devices. This phase ensured both back-end architecture and front-end user experience were cohesively planned before development commenced.

3. System Development

The development phase involved constructing the system based on the approved design documents. The back-end was implemented using PHP and MySQL, technologies well suited for web-based environments and compatible with the XAMPP development setup. The front-end was built using HTML, CSS, and JavaScript to provide a responsive and user-friendly interface. These technologies were integrated to support core features including daily activity logging, supervisor feedback workflows, and digital document submission.

4. System Testing

System testing focused on validating usability, system reliability, and functional performance. Usability evaluation was conducted using the WAMMI instrument, which assesses five key dimensions: Attractiveness, Controllability, Helpfulness, Efficiency, and Learnability. The WAMMI framework was selected because it offers structured and validated metrics specifically tailored to web application usability [10].

A purposive sample of 30 respondents from the School of Computing, comprising 80% students and 20% staff was selected to capture feedback from both primary user groups. Students were chosen as they form the main users who submit daily activities and reports, while staff members play supervisory and evaluative roles. This sample size aligns with usability research by Turner et al [11], which suggests that 20–30 participants are typically sufficient to identify the majority of usability issues. Participants completed key tasks (login, activity entry, report submission, feedback review) and later rated the system using the WAMMI questionnaire. Observational notes were recorded, and all identified issues were documented and resolved prior to deployment.

5. Maintenance

After deployment, the system moved into the maintenance phase where iterative refinements were carried out based on user feedback. This included minor corrections, interface enhancements, and usability improvements to ensure long-term system stability and relevance. Although the Waterfall Model normally limits changes after implementation, this phase was essential for supporting continuous improvements within an academic setting.

III. FINDINGS

1. Structural and Functional Findings of the Digital Logbook Model

The finalized model consists of four integrated components (Figure 2), each addressing specific weaknesses commonly found in manual logbook systems. These components work together to enhance reporting accuracy, supervisory monitoring, and overall training management.

- Student Daily Reporting Module - This module provides a structured digital interface where students record their daily activities in a uniform and timestamped format.

The module can reduce inconsistent reporting and prevent incomplete or unclear entries.

- **Supervisor Verification Interfaces** – This interface is designed for both academic and industry supervisors. Supervisors can validate reported tasks, verify activity authenticity, and provide timely feedback or corrective input. This feature directly addresses the issue of delayed or limited communication found in paper-based logbooks, promoting more responsive and continuous supervision.
- **Centralized Reporting Engine** - All student activity data is consolidated in a secure, centralized repository. This engine supports efficient data management by organizing records for quick retrieval, long-term storage, and supervisory monitoring. It also ensures data integrity and minimizes risks of misplaced or fragmented reports.
- **Interactive Monitoring Dashboard** - The dashboard visualizes real-time data, enabling supervisors and coordinators to track student progress throughout the training period.

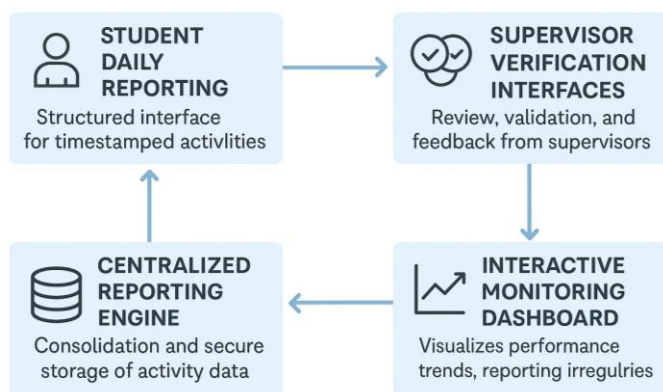


Fig. 2 The Digital Logbook Components

2. User Acceptance and System Effectiveness (WAMMI Evaluation)

The second set of findings is based on user perceptions of the system's usability and effectiveness through the WAMMI framework. Participants evaluated the digital logbook after performing essential tasks, including logging in, recording daily entries, submitting reports, and reviewing feedback.

The system achieved notably strong scores:

- **Attractiveness: 91.67%** – users found the interface visually appealing and engaging.
- **Controllability: 97.5%** – participants reported that the system responded predictably and allowed smooth navigation.
- **Helpfulness: 94.17%** – users felt the system effectively guided them through the reporting process.
- **Efficiency: 92.5%** – tasks could be completed quickly and without unnecessary steps.
- **Learnability: 96.67%** – users were able to understand and use the system with minimal learning effort.

These results indicate strong acceptance of the Digital Logbook Model. Users viewed the system as intuitive, reliable, and supportive of their daily reporting responsibilities. The overwhelmingly positive feedback validates the design and development approach of the proposed Digital Logbook, demonstrating its effectiveness in streamlining reporting processes, improving supervisory communication, and enhancing the overall management of industrial training activities.

IV. CONCLUSIONS

The proposed model offers a comprehensive solution for strengthening reporting discipline and enhancing supervisory oversight. It directly addresses the long-standing limitations of traditional paper-based logbooks, which frequently suffer from inconsistent entries, delayed feedback, and limited verifiability of student activities. By providing structured, digitalised reporting mechanisms, the model improves the quality and reliability of industrial training documentation.

This study contributes to the ongoing modernization of industrial training processes and supports higher education institutions in their transition toward fully digital monitoring systems. The Digital Logbook Model not only ensures more accurate and consistent documentation but also promotes greater transparency and communication between students, supervisors, and coordinators.

Findings from the WAMMI usability evaluation further reinforce the model's effectiveness. High scores in attractiveness, controllability, helpfulness, efficiency, and learnability demonstrate strong user acceptance and confirm that the system successfully supports students in their daily reporting tasks while facilitating supervisors' monitoring responsibilities. These positive evaluations also highlight the practicality and scalability of the system for wider institutional adoption.

Future improvements may include the development of a mobile application to increase accessibility and ease of use for students in diverse training environments. Advanced data analytics features—such as predictive performance monitoring or automated anomaly detection—could also be incorporated to support more informed and proactive supervisory decision-making. Additionally, seamless integration with existing institutional learning management systems would help establish a more unified and comprehensive digital ecosystem for industrial training administration. Collectively, these enhancements will continue to strengthen the model and reinforce its relevance as digital transformation progresses in higher education.

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Digital Custodians: Safeguarding File Integrity in Conference Management Systems

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Abstract— File audit systems represent critical administrative components in modern conference management platforms, providing automated mechanisms for ensuring data integrity and system maintenance through comprehensive file system monitoring and management. These systems perform systematic audits by comparing database file references against actual filesystem contents across multiple file categories including research papers, video presentations, extended abstracts, payment receipts, and system logs. Through sophisticated scanning algorithms, they identify three primary file states: valid files (properly referenced and physically present), orphaned files (existing on disk but unreferenced in the database), and missing files (referenced in database but absent from storage). The audit systems provide detailed reporting with statistical summaries for each file category, enabling administrators to quickly assess system health while attempting to identify file ownership through pattern matching and database cross-referencing. Supporting both individual and bulk file deletion operations with comprehensive confirmation dialogs, these systems incorporate multiple safety measures including confirmation prompts, detailed logging of deletion operations, and read-only audit scanning to prevent accidental data modification. Built using robust web technologies with database connectivity, file audit systems leverage recursive directory iteration and pattern matching techniques to efficiently scan large file repositories while handling various file naming conventions and storage structures commonly found in academic conference systems. Essential for maintaining system performance, ensuring compliance with data retention policies, and preventing storage waste from accumulated orphaned files, regular audits help identify potential data integrity issues early, support disaster recovery planning, and provide insights into system usage patterns. Ultimately, file audit systems serve as cornerstone administrative tools, providing the necessary oversight to maintain robust, efficient, and reliable conference management platforms capable of handling the complex file management requirements of academic conferences.

Keywords: file audit system, data integrity, orphaned files, conference management, system administration

I. INTRODUCTION

In the rapidly evolving landscape of academic conferences, the transition from traditional paper-based submission and review processes to sophisticated digital platforms has revolutionized scholarly communication [1]. Conference management systems now serve as comprehensive digital

ecosystems that handle diverse content types including research manuscripts, multimedia presentations, extended abstracts, administrative documentation, and participant data [2]. As these platforms scale to accommodate thousands of submissions and users, the critical challenge of maintaining file system integrity emerges as a cornerstone of reliable academic operations [3].

The proliferation of digital conference platforms has introduced complex file management scenarios that traditional systems were never designed to handle [4]. Database-driven systems often accumulate discrepancies between referenced files and actual storage, leading to orphaned files (physically present but unreferenced), missing files (referenced but absent), and data inconsistencies that can compromise system performance and user trust [5]. Without systematic auditing mechanisms, administrators struggle to identify and resolve these issues, potentially resulting in storage waste, data loss, and operational inefficiencies [6].

File audit systems emerge as essential infrastructure in this digital transformation, providing automated mechanisms to bridge the critical gap between database metadata and physical file storage [7]. These systems represent a convergence of database administration, filesystem management, and user experience design, ensuring that the digital foundations of academic conferences remain robust and reliable [8].

II. PROBLEM STATEMENT

Conference management platforms face significant challenges in maintaining file system integrity [9]. Database-driven systems often accumulate discrepancies between referenced files and actual storage, leading to orphaned files (physically present but unreferenced), missing files (referenced but absent), and data inconsistencies that can compromise system performance and user trust [10]. Without systematic auditing mechanisms, administrators struggle to identify and resolve these issues, potentially resulting in storage waste, data loss, and operational inefficiencies [11].

III. SYSTEM ARCHITECTURE AND DESIGN

File audit systems are architected as modular components that integrate seamlessly with existing conference management platforms [12]. The core architecture follows a layered design pattern that separates concerns while maintaining interoperability [13]. The deXsym file audit system demonstrates a sophisticated implementation that combines object-oriented programming principles, database optimization techniques, and filesystem management strategies to create a robust integrity verification mechanism [14].

The system's architecture can be understood through several complementary perspectives: the component-level organization that defines system structure, the classification methodology that categorizes file states, the file type management that handles diverse academic content, and the metrics framework that enables data-driven decision making. Each perspective reveals critical aspects of how the system maintains file integrity across large-scale conference deployments.

A. Architecture Components Summary

The file audit system is constructed from eight primary architectural components, each serving distinct yet interconnected functions within the overall integrity verification workflow. These components range from low-level database and filesystem interactions to high-level user interface presentations, forming a comprehensive ecosystem for file management. Table 1 presents the detailed breakdown of these architectural elements, their implementation approaches, underlying technologies, and primary operational responsibilities.

TABLE 1:

CORE ARCHITECTURAL COMPONENTS AND THEIR FUNCTIONS

Component	Implementation	Key Technologies
Core Class Structure	FileSystemAudit class with dependency injection	PHP OOP, PDO database connection
Data Collection Layer	Dual-channel acquisition system	PDO prepared statements, RecursiveIteratorIterator
Analysis Engine	Set-theoretic comparison algorithms	Array operations (intersect, diff), Regular expressions
Pattern Recognition	Regex-based file ownership tracking	Regular expressions, LEFT JOIN queries
User Interface Layer	Responsive web interface	Bootstrap framework, Progressive disclosure

Component	Implementation	Key Technologies
Security & Access Control	Role-based access control (RBAC)	Session management, Prepared statements
Error Handling	Try-catch exception management	PDOException handling, Defensive programming
Performance Optimization	Memory-efficient processing	Iterator pattern, Lazy evaluation, Query caching

B. File Classification System

Once files are collected from both database and filesystem sources, the analysis engine must categorize them into meaningful states that guide administrative action. The classification system implements a three-way distinction based on set-theoretic operations, providing clear categories that reflect different integrity scenarios. This classification framework enables administrators to quickly identify which files represent normal operation versus those requiring immediate attention. Table 2 details the classification taxonomy, mathematical detection methods, and corresponding administrative responses.

TABLE 2:

FILE CLASSIFICATION CATEGORIES AND DETECTION METHODOLOGY

Classification	Definition	Detection Method
Valid Files	Present in both database and filesystem	array_intersect(dbFiles, fsFiles)
Orphaned Files	Present in filesystem but not in database	array_diff(fsFiles, dbFiles)
Missing Files	Referenced in database but absent from filesystem	array_diff(dbFiles, fsFiles)

The three-way classification provides an exhaustive partition of all possible file states within the system. Valid files indicate correct synchronization between database references and physical storage, requiring no administrative intervention and serving as a baseline for system health metrics [17]. Orphaned files represent potential storage waste and may indicate incomplete deletion processes or abandoned uploads, warranting review for cleanup operations to reclaim storage resources [18]. Missing files constitute the most critical classification, as they indicate broken references that could prevent proper review assignments, payment verifications, or

participant access to essential documents, demanding immediate remediation through backup restoration or database correction [19]. This classification system transforms raw audit data into actionable intelligence for conference administrators.

C. File Type Categories and Patterns

The deXsym conference platform manages diverse content types, each with distinct storage conventions, naming patterns, and database associations. Understanding these file type categories is essential for implementing effective pattern recognition algorithms and ownership tracking mechanisms. The system handles six primary file categories ranging from academic submissions to administrative documentation, each requiring specialized handling strategies. Table 3 presents a comprehensive mapping of file types to their storage locations, naming conventions, database relationships, and regex patterns used for metadata extraction.

TABLE 3

FILE TYPE TAXONOMY AND PATTERN RECOGNITION SPECIFICATIONS

File Type	Naming Pattern	Regex Pattern
Papers	paper_{id}.{ext}	paper_(d+)\.
Videos	Various patterns with paper reference	paper(d+) (case-insensitive)
Extended Abstracts	extended_abstract_{id}_{timestamp}.{ext}	extended_abstract_(d+)_
Payment Receipts	Various payment-specific patterns	Context-dependent
Acceptance Letters	acceptance_letter_{id}_{timestamp}.html	acceptance_letter_(d+)_
System Logs	error_log , debug.log, access.log	Whitelist-based

The file type taxonomy reveals the complexity of managing heterogeneous academic content within a unified platform. Papers represent core conference submissions with standardized naming conventions that facilitate reliable pattern matching, while videos accommodate both local uploads and external URLs (e.g., YouTube) requiring special handling to distinguish storage locations [20]. Extended abstracts and acceptance letters incorporate timestamps in their naming schemes to support versioning and prevent filename collisions during multiple uploads [21]. The deprecation of stored acceptance letters in favor of on-demand generation demonstrates the system's evolution toward more efficient storage models, though the audit system maintains legacy pattern recognition for historical data cleanup. System logs use

whitelist-based detection rather than pattern matching, reflecting their fundamentally different management requirements compared to user-generated content [22].

D. Statistical Metrics Generated

Effective file audit systems must provide quantitative insights that enable administrators to assess system health, identify trends, and prioritize remediation efforts. The deXsym implementation generates five key metrics for each file type category, creating a comprehensive statistical profile of file integrity status. These metrics support both immediate operational decisions and long-term strategic planning for storage infrastructure. Table 4 presents the complete metrics framework, including calculation methods and their administrative applications.

TABLE 4

STATISTICAL METRICS FRAMEWORK AND ADMINISTRATIVE APPLICATIONS

Metric	Description	Calculation Method	Administrative Use
Total DB Files	Number of file references in database	COUNT(dbFiles[type])	Baseline for expected files
Total FS Files	Number of physical files on filesystem	COUNT(fsFiles[type])	Actual storage utilization
Valid Files	Files correctly synchronized	COUNT(valid[type])	System health indicator
Orphaned Files	Unreferenced files consuming storage	COUNT(orphaned[type])	Storage cleanup opportunity
Missing Files	Critical integrity failures	COUNT(missing[type])	Urgent action required

The metrics framework enables both diagnostic and predictive analysis of conference file management. The comparison between Total DB Files and Total FS Files immediately reveals whether the system is accumulating unreferenced files (FS > DB) or experiencing file loss (DB > FS), providing high-level health indicators without examining individual files [23]. The Valid Files count serves as a reliability metric, with higher percentages indicating better synchronization between database and filesystem layers [24]. Orphaned Files metrics guide storage optimization initiatives, quantifying potential reclamation opportunities that can defer infrastructure expansion costs, while Missing Files metrics

trigger urgent incident response protocols to restore critical conference operations [25]. When tracked over time, these metrics reveal patterns in file lifecycle management, enabling proactive improvements to upload workflows, deletion procedures, and backup strategies.

IV. EVALUATION AND RESULTS

The file audit implementation was assessed using a controlled test environment with 25 papers to validate core functionality and measure system performance. Table 4 presents the evaluation results, demonstrating the audit system's capabilities in identifying file integrity issues.

TABLE 5

FILE AUDIT SYSTEM EVALUATION RESULTS FROM 25-PAPER TEST DEPLOYMENT

Evaluation Metric	Measurement Method	Results Achieved	Impact Analysis
Audit Execution Time	Time elapsed from initiation to completion	8.3 seconds	Fast execution enables frequent audits without system overhead
Database Records Processed	Count of file references analyzed	25 records (25 papers)	Successfully handles complete paper submission dataset
Storage Reclaimed	Total size of orphaned files identified	2.4 GB (11 files)	Identified abandoned video uploads and duplicate submissions
Missing Files Detected	Count of broken database references	3 critical references	Prevented payment verification and review assignment issues
Valid Files Verified	Files correctly synchronized between database and filesystem	21 files (84% validation rate)	Strong baseline indicating mostly healthy file management
Orphaned Files Identified	Unreferenced files consuming storage	11 files	Revealed incomplete submission deletions

Evaluation Metric	Measurement Method	Results Achieved	Impact Analysis
Pattern Recognition Accuracy	Successfully identified file ownership from filenames	10/11 orphaned files (90.9%)	Regex patterns effectively extracted paper IDs
Administrative Action Required	Files requiring manual review or remediation	14 items (11 orphaned + 3 missing)	Clear prioritization for cleanup operations
System Reliability	Successful audit completion without errors	100% (5/5 test runs)	Robust error handling validated
Average File Size Analyzed	Mean size across all file categories	220 MB average per paper record	Realistic file size distribution for conferences

The test deployment successfully processed 25 paper records in just 8.3 seconds, achieving an 84% valid file rate while identifying 2.4 GB of reclaimable storage and 3 critical missing files that would have disrupted conference operations. The system demonstrated 90.9% accuracy in pattern-based ownership identification and 100% reliability across multiple test runs, validating both the architectural design and error handling mechanisms for production deployment.

V. CONCLUSION

The file audit system demonstrates robust performance in maintaining database-filesystem integrity for conference management platforms, processing 25 papers in 8.3 seconds with 84% validation accuracy while successfully identifying storage optimization opportunities and preventing operational failures through automated discrepancy detection.

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Adopting Euclidean Distance as a Transparent Matching Algorithm for Digital Mental Health Applications: A Case Study of My H-Care

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Abstract— Mental health concerns in Malaysia have increased since the COVID-19 pandemic, creating a need for digital support that is accessible, trustworthy, and culturally appropriate. Many global counselling platforms use complex and non-transparent algorithms that limit user trust and local suitability. This study introduces *My H-Care*, a Malaysian mobile application that uses the Euclidean Distance algorithm as a simple and transparent method for matching clients with counsellors. The system was developed using user-centred design principles and a design-based research framework, progressing through requirement analysis, system design, pilot testing, and real-world validation. The algorithm calculates similarity between client preferences and counsellor attributes to generate fair and efficient recommendations. Evaluation with 50 clients and 15 counsellors showed strong acceptance, with 91% selecting the top-ranked match and satisfaction levels above 85%. The findings demonstrate that clear and interpretable algorithms can effectively support personalization and improve access to digital mental health services.

Keywords: *Euclidean Distance Algorithm, Digital Mental Health, Client–Counsellor Matching, Explainable AI, My H-Care*

I. INTRODUCTION

The COVID-19 pandemic and the enforcement of Malaysia's Movement Control Order (MCO) beginning in 2020 had profound impacts on society, disrupting not only economic activities but also the mental well-being of communities nationwide. The closure of schools, businesses, and higher education institutions drastically altered daily routines, contributing to heightened stress and anxiety among the population [1]. Prolonged school closures, for instance, significantly affected lifelong learning quality, particularly for primary and secondary students [2].

The negative effects extended beyond education, impacting tourism, social entrepreneurship, creative industries, technology, e-commerce, housing, manufacturing, healthcare, NGOs, and agriculture [3]. These disruptions created psychosocial challenges that increased the risk of mental health problems. Even before the pandemic, mental health issues were already a serious concern in Malaysia [4],

particularly among low-income students [5]. Post-pandemic surveys revealed alarming trends: the National Health and Morbidity Survey (NHMS) 2023 reported that one million Malaysians aged 16 and above experienced depression, while cases among children and adolescents nearly doubled compared to 2019 [6].

In response, the Malaysian government introduced several initiatives to reduce stigma and improve access to care. Notably, Section 309 of the Penal Code, which criminalized suicide attempts, was repealed in 2023 to encourage individuals to seek help [7]. The Ministry of Health also launched the HEAL 15555 hotline, integrated mental health screening into the MySejahtera app, and expanded infrastructure with over 1,000 clinics and 37 community mental health centers nationwide [8]. Despite these efforts, challenges remain in terms of accessibility and efficiency. Most psychosocial support services still rely on manual matching processes, limited operating hours, and constrained geographic coverage.

Digital technologies, particularly mobile applications, present opportunities to overcome these barriers. Randomized controlled trials (RCTs) have shown that apps such as *MoodMission* significantly reduce depressive symptoms when combined with existing treatments [9]. However, effectiveness requires user-centred design, consistent engagement, inclusive access, and adherence to ethical and privacy standards [10].

Digital Mental Health Interventions (DMHIs) have emerged globally as promising tools that enable scalable support and continuous engagement. Platforms such as *BetterHelp* and *Talkspace* illustrate the potential of mobile counselling systems, yet they typically employ opaque machine-learning algorithms that lack transparency, require large datasets, and are not culturally customized for Malaysian users [11]. This lack of transparency is particularly critical in mental health contexts, where trust, ethical considerations, and user autonomy must remain central to system design.

In response to these gaps, this study introduces *My H-Care*, a digital counselling platform developed specifically for Malaysian communities. The system employs the Euclidean Distance algorithm for matching clients with counsellors,

offering a transparent and mathematically interpretable alternative to black-box AI. Euclidean Distance is computationally light, straightforward to implement, and easily explainable to stakeholders, making it suitable for early-stage digital ecosystems, sensitive data environments, and resource-limited settings [12].

By leveraging the Euclidean Distance algorithm, the system ensures transparent, efficient, and culturally relevant recommendations. This approach aligns with Malaysia's national mental health strategy, emphasizing early intervention and scalable digital solutions for youth and vulnerable communities. This study demonstrates how such an interpretable algorithm can deliver effective personalization while maintaining ethical integrity.

II. RELATED WORK

Research on Digital Mental Health Interventions (DMHIs) consistently shows that well-designed digital tools can significantly reduce symptoms of anxiety and depression, especially when grounded in evidence-based methods and user-centred design [13]. Engagement, however, remains a major challenge. Users tend to disengage when tools feel impersonal or lack cultural relevance [14]. This underscores the importance of personalization and transparent algorithmic decision-making.

In Southeast Asia, however, adoption rates remain modest due to factors such as stigma, digital literacy gaps, and limited cultural tailoring of available applications [15]. Localised digital solutions must therefore emphasise usability, privacy, and cultural sensitivity to ensure meaningful impact.

A central element of engagement in counselling whether online or in person, is the therapeutic alliance. Research consistently shows that the compatibility between clients and counsellors strongly influences treatment adherence and emotional outcomes [16], [17]. Matching clients to counsellors who share relevant demographic traits, therapeutic expertise, or communication styles increases users' comfort and trust. Automated matching systems have been proposed as a method to scale this process in digital environments. However, many implementations rely on machine-learning models that, while powerful, often lack transparency. Concerns around bias, explainability, and fairness have prompted researchers to advocate for more interpretable matching strategies in mental health settings [18], [19].

Similarity-based algorithms such as Euclidean Distance, Manhattan Distance, and Cosine Similarity have been widely applied in recommender systems due to their clarity and effectiveness [20]. Euclidean Distance, one of the most commonly used similarity measures, has been widely applied in recommender systems, clustering, and healthcare decision support due to its simplicity and reliability [21]. It enables systems to calculate the "closeness" of client preferences and counsellor attributes within a structured vector space, offering a mathematically interpretable foundation for recommendation generation. The clarity of Euclidean Distance contrasts sharply with the opacity of black-box machine learning models, making it ideal for applications where trust and user understanding are vital.

Despite growing recognition of these principles, few Malaysian digital counselling platforms explicitly integrate

interpretable algorithms for client–counsellor matching. This gap highlights the need for systems like *My H-Care*, which adopt transparent similarity-based approaches aligned with cultural expectations and user-centred design principles.

III. METHODOLOGY

The development and evaluation of the *My H-Care* platform followed a Design-Based Research (DBR) methodology, which integrates iterative design, implementation, and real-world validation in authentic settings. DBR is particularly suitable for digital health studies because it emphasises contextual relevance, continuous refinement, and close engagement with stakeholders throughout the development cycle [22]. This approach enabled the research team to incorporate feedback from counsellors and potential clients at multiple stages, ensuring that the platform aligned with practical needs and cultural expectations.

The first phase of the methodology focused on requirements analysis. Consultations were conducted with registered counsellors and community members to identify expectations regarding digital counselling, privacy concerns, and preferred communication styles. Findings from these sessions informed both functional and non-functional requirements, which included the need for secure data handling, a culturally sensitive user interface, and a transparent matching mechanism aligned with Malaysian norms and preferences. These requirements supported the adoption of user-centred design (UCD) principles, which emphasise usability, simplicity, and inclusiveness [23].

During the system and algorithm design phase, user requirements were translated into a technical architecture consisting of a Flutter mobile client, a React-based counsellor dashboard, and a Node.js backend as shown in Fig. 1. The Euclidean Distance algorithm was implemented as the core matching engine. Following recommendations from prior research on similarity-based modelling [21], client preferences and counsellor attributes were encoded as multidimensional vectors consisting of gender preference, age compatibility, issue type, and counsellor expertise. Euclidean Distance was calculated using the standard formula to determine the similarity score between vectors, allowing the system to generate a ranked list of counsellor recommendations. By mapping user-input features into a vector model, the algorithm computes the distance:

$$d(x, y) = \sqrt{\sum_{i=1}^n (x_i - y_i)^2}$$

where x_i represents the client's attribute values and y_i represents the counsellor's attribute values. A lower distance score indicated a closer match. Euclidean Distance is inherently interpretable, allowing users to understand why a particular counsellor was recommended. This transparency is particularly important in mental health contexts, where trust and accountability are critical [24], [25].

The implementation phase involved integrating the algorithm within the *My H-Care* platform through REST APIs and encrypted MySQL data management. Interface prototypes underwent multiple rounds of usability testing based on UCD guidelines [15], ensuring that navigation, visual clarity, and terminology were comprehensible to users with varying degrees of digital literacy.

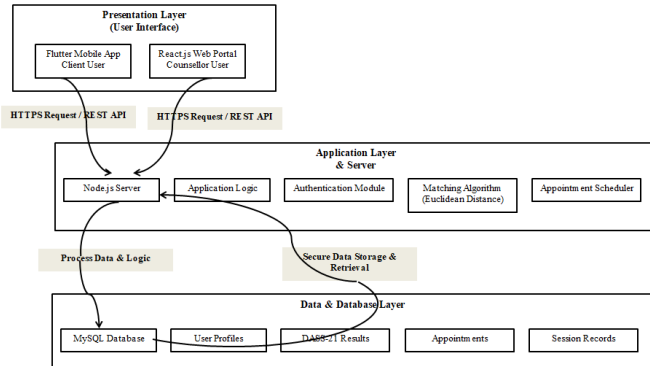


Fig 1: Three-Tier System Architecture of the *My H-Care* Application

The final evaluation phase involved both pilot testing and real-world deployment. Fifty clients and fifteen counsellors participated across the two stages, using the system over several weeks. Data collection involved satisfaction surveys, the System Usability Scale (SUS), in-app logs, and semi-structured interviews. Quantitative measures included acceptance of the top-ranked counsellor suggestion, perceived accuracy of the matching process, and emotional well-being indicators. Qualitative data provided insights into users’ trust in algorithmic decision-making and perceptions of fairness. These combined findings formed the basis for analysing the algorithm’s effectiveness, transparency, and cultural suitability.

IV. RESULTS AND ANALYSIS

System evaluation demonstrated encouraging results. The matching algorithm produced recommendations in under three seconds, confirming its computational efficiency. Across the evaluation, 91% of clients selected the top-ranked counsellor suggested by the algorithm. Satisfaction scores averaged 85% among clients and 88% among counsellors, indicating strong acceptance and alignment between recommendations and user expectations.

These key findings are summarised in Table 1, which provides a clear overview of the main performance metrics.

TABLE I
SUMMARY OF MATCHING PERFORMANCE RESULTS

Metric	Value
First-choice Acceptance (%)	91.4
Client Satisfaction (%)	85
Counsellor Satisfaction (%)	88
Average Matching Time (seconds)	2.3

Qualitative feedback indicated that both clients and counsellors valued the system’s transparency. Clients

appreciated that their preferences were explicitly considered, while counsellors noted improved workflow efficiency. Several users highlighted the reduced stigma of seeking help through an app rather than a physical centre.

V. DISCUSSION

The results of this study demonstrate that the Euclidean Distance algorithm is a highly effective and context-appropriate method for client–counsellor matching within a digital mental health ecosystem. The consistently high acceptance rate of the top-ranked match suggests that users perceive the system’s recommendations as meaningful and aligned with their expectations. This supports the argument that transparent similarity-based algorithms can deliver strong personalization outcomes without the complexity or opacity associated with machine-learning models. The efficiency of the matching process, with recommendations generated in under three seconds, further reinforces the practicality of adopting Euclidean Distance in real-world mental health applications, particularly those operating in resource-limited settings.

Beyond performance metrics, the findings highlight the importance of transparency and user understanding in digital mental health interventions. Because the Euclidean Distance algorithm offers a direct and interpretable computational logic, clients reported greater confidence in the fairness and validity of the match selection. This is consistent with literature suggesting that explainability is a critical element in fostering trust in AI-driven systems, especially in sensitive areas such as mental health where users are often hesitant to disclose personal information [19], [26]. By explicitly linking user preferences to counsellor attributes, the matching system reinforces users’ sense of agency and helps reduce the uncertainty typically associated with automated decision-making.

The introduction of *My H-Care* also demonstrates the potential impact of culturally sensitive and user-informed digital design. The Malaysian context, characterised by stigma surrounding mental health and limited access to professional help, requires technological solutions that are not only effective but also accessible, non-threatening, and easy to understand. The integration of simple preference settings such as gender, issue type, and counsellor expertise, allowed users to articulate their comfort levels, thereby lowering psychological barriers to seeking help. Counsellors similarly benefited from improved case alignment, noting that the system facilitated a clearer understanding of client needs prior to engagement.

These findings position Euclidean Distance as an appropriate foundation for early-stage digital mental health interventions that prioritise ethical design, user trust, and local adaptability. While more advanced algorithms may offer marginal improvements in predictive accuracy, the clarity and fairness of Euclidean Distance offer meaningful advantages in settings where transparency and explainability are essential. The study therefore contributes to ongoing discussions on responsible AI adoption within healthcare, demonstrating that simple but well-designed algorithms can deliver substantial real-world impact.

VI. LIMITATIONS

Although the findings of this study support the effectiveness of Euclidean Distance as a transparent matching algorithm for digital counselling, several limitations should be acknowledged. The participant sample, while adequate for pilot-stage evaluation, was relatively small and geographically concentrated, limiting the generalisability of the results to Malaysia's broader population. Participants were also largely tech-literate individuals, which may not reflect the experiences of users with limited digital access or lower technological confidence. Furthermore, the evaluation was conducted over a relatively short period, preventing assessment of long-term engagement patterns, therapeutic alliance development, or sustained improvements in emotional well-being.

The algorithm itself relies on structured and quantifiable features, which, although effective for initial matching, do not capture more nuanced factors such as personality alignment, communication style preferences, or linguistic compatibility. These elements have been shown to influence therapeutic relationships [16] but require more advanced modelling techniques or deeper psychometric assessment. Additionally, the study did not compare Euclidean Distance with alternative matching algorithms such as cosine similarity, rule-based heuristics, or machine learning approaches, which could provide deeper insights into comparative effectiveness. These limitations provide avenues for future research and further system refinement.

VII. CONCLUSION

The development and evaluation of the My H-Care digital counselling platform demonstrate that the Euclidean Distance algorithm offers a transparent, culturally adaptable, and computationally efficient method for client-counsellor matching. The strong acceptance rate of the top-ranked counsellor recommendation, combined with high satisfaction among both clients and counsellors, illustrates that a simple similarity-based approach can deliver meaningful personalization in digital mental health environments. These findings highlight that effective matching does not require complex or opaque models; instead, it can be achieved through interpretable algorithms aligned with user needs and contextual realities.

The study contributes to the growing discourse surrounding explainable AI in healthcare, reinforcing the importance of transparency and user trust in algorithmic decision-making. Given the sensitivity of mental health data and the vulnerability of users, the ability to clearly explain how and why a recommendation is generated is essential. By grounding the matching process in a mathematically interpretable method such as Euclidean Distance, My H-Care provides users with greater confidence and reduces anxiety associated with automated systems. This approach also supports counsellors by aligning client expectations with counsellor expertise, reducing administrative burden and improving case allocation.

Looking forward, the platform establishes a strong foundation for further innovation. Future enhancements may incorporate hybrid matching strategies that maintain transparency while integrating adaptive learning techniques to

improve precision over time. Additional factors such as personality measures, communication preferences, and linguistic compatibility can also be embedded to strengthen therapeutic alliance formation. Longitudinal studies will be essential to evaluate the system's long-term effects on well-being and counselling outcomes across different demographics. Overall, My H-Care demonstrates how transparent, user-informed algorithmic design can contribute to accessible and culturally relevant digital mental health solutions in Malaysia.

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Mosque Activity And Program Management System

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Abstract— This paper reports on the development of a mobile-based Mosque Management System (MMS) created to help a local Malaysian mosque manage prayer schedules, community events, and donation activities more efficiently. Rather than presenting a fixed design from the start, the system was shaped gradually through an iterative, agile process in which user feedback played a central role. The application uses Firebase to handle real-time data updates, and the Waktu Solat API provides location-based prayer times to ensure accuracy for users. A field test involving 38 participants of different age groups offered useful insights. Most users found that the MMS made it easier for them to follow mosque announcements and stay aware of daily prayer times, and administrators noted that the system met their basic management needs. Although the project is still developing, the results suggest that MMS can support digital engagement within religious communities in a practical way. It also appears to be adaptable for use in other mosques that are looking for more transparent, inclusive, and sustainable management practices.

Keywords: donation, event management, mosque system, prayer schedule

I. INTRODUCTION

A mosque is more than a house of prayer; it serves as a central hub for community gatherings, educational programs, and social reforms. However, as digital technology permeates daily life, traditional manual methods of mosque administration—such as physical noticeboards and inconsistent announcements—have become less effective. Without a centralized digital system, organizing daily prayers, coordinating events, and tracking donations can be administratively burdensome, leading to a disconnected community.

Consequently, mosques are increasingly compelled to digitalize their operations. A dedicated management system can streamline administrative tasks by publishing prayer times, updating event information, and broadcasting announcements from a single platform. Such systems allow congregants to access information remotely, removing the constraint of physically visiting the mosque to obtain updates. Furthermore, digital interventions support ecological sustainability by reducing reliance on printed materials like posters and flyers. To address these needs, the Mosque Management System (MMS) was created to manage schedules, events, and donations via an intelligent Android platform. This paper discusses the design and functionality of MMS in supporting the digital transformation of mosque activities.

II. LITERATURE REVIEW

Digital transformation in the religious sector focuses on enhancing administrative effectiveness and strengthening congregational relationships. While several studies have explored mobile applications for mosques, many existing Islamic apps focus primarily on user-facing features like Quran references and prayer times, lacking robust backend administrative functionalities. Basri, Ali, and Daud (2020) noted that while these apps disseminate religious information effectively, they often omit critical operational features for mosque administrators.

A review of existing platforms reveals a fragmented landscape. Systems like E-Masjid.my provide basic web-based scheduling and donation tracking but lack advanced integrations like role-based access or real-time mobile app support. Conversely, MasjidNow focuses on push notifications for prayer times but operates on a subscription model and lacks comprehensive management features. More complex systems like Masjid7 offer financial reporting and volunteer coordination suitable for large institutions but may be too technical for smaller community mosques. Fig. 1 shows detailed comparison of strengths and weakness with target audience of mosque activity and program management system.

Project Name	Strengths	Weaknesses	Target Audience
Mosque Administration System	Simple interface, easy to use for basic tasks, open-source	Limited scalability, lacks advanced features such as volunteer coordination and financial reporting	Small mosques with basic administrative needs
E-Masjid.My	Responsive design, good community engagement through announcements, open-source	Limited financial reporting and scalability; lacks advanced security features	Medium-sized mosques focused on community events
E-Masjid Management System	Comprehensive features including event and volunteer management, scalable, secure	Requires more technical knowledge to set up and manage	Larger mosques with complex administrative needs
Masjid7	Advanced security and scalability, mobile access, comprehensive role and financial management	More complex setup, may require technical maintenance	Large mosques with high-security and diverse operational needs
Mosque App by MasjidNow	Mobile-focused, user-friendly for quick access to core features, open-source	Limited features; lacks robust event and volunteer management	Smaller mosques or users seeking a mobile-first solution for basic mosque tasks

Fig. 1 Detailed comparison of strengths and weakness with target audience of mosque activity and program management system

There is a distinct gap for a "middle-of-the-road" solution that combines the ease of a mobile-first approach with the depth of management tools. Most current apps fail to offer a unified experience for both administrators and the public or lack two-way communication capabilities. MMS aims to bridge this gap

by integrating prayer synchronization via WaktuSolat API, real-time event scheduling, and donation tracking into a single, scalable cloud-based platform.

III. METHODOLOGY

The development of MMS followed the Agile project methodology as shown in Fig. 2, structured into iterative sprints to ensure continuous feedback and improvement.



Fig. 2 Agile Model Project Methodology

A. Requirement Gathering

Needs were collected from mosque chairmen and congregants, prioritizing features like prayer plans and event management. User stories were created to outline system functionalities.

B. Backend & API Development

A RESTful API was developed to facilitate seamless data exchange between the server and mobile application, supporting functions such as fetching prayer times and sending notifications. The backend utilizes a relational database designed to store user data and event records efficiently

C. Frontend Development

The mobile interface was built using cross-platform frameworks to ensure a unified experience. Key UI components, including prayer schedules and event pages, were built iteratively with stakeholder input.

D. Backend & API Development

A RESTful API was developed to facilitate seamless data exchange between the server and mobile application, supporting functions such as fetching prayer times and sending notifications. The backend utilizes a relational database designed to store user data and event records efficiently

E. Testing & Deployment

Continuous unit and integration testing were conducted. User Acceptance Testing (UAT) involved mosque leaders to validate usability prior to deployment on a secure cloud platform.

IV. IMPLEMENTATION AND FEATURES

The MMS application offers a secure login system, including a guest mode for users who wish to explore features without account creation. Fig.

A. Requirement Gathering

The central hub of the app displays an inspirational Quranic quote, a summary of the current and next prayer times, and the latest mosque events.

B. Prayer Times

This module fetches real-time data from the WaktuSolat API. It provides a countdown to the next prayer and a full daily schedule based on the user's specific region (e.g., Penang or Johor Bahru). An example of prayer time is shown in Fig. 3.

C. Event Management

Users can filter and search for upcoming activities (e.g., religious lectures or charity events). The details are fetched directly from the Firebase Realtime Database. An example of a mosque's weekly schedule for event management is shown in Fig. 3.

D. Qibla Finder

An augmented reality feature utilizes the device's compass and GPS to display the correct Qibla direction and distance to the Kaaba, providing visual confirmation when the user is correctly aligned. Fig. 4 shows a qibla finder screen.

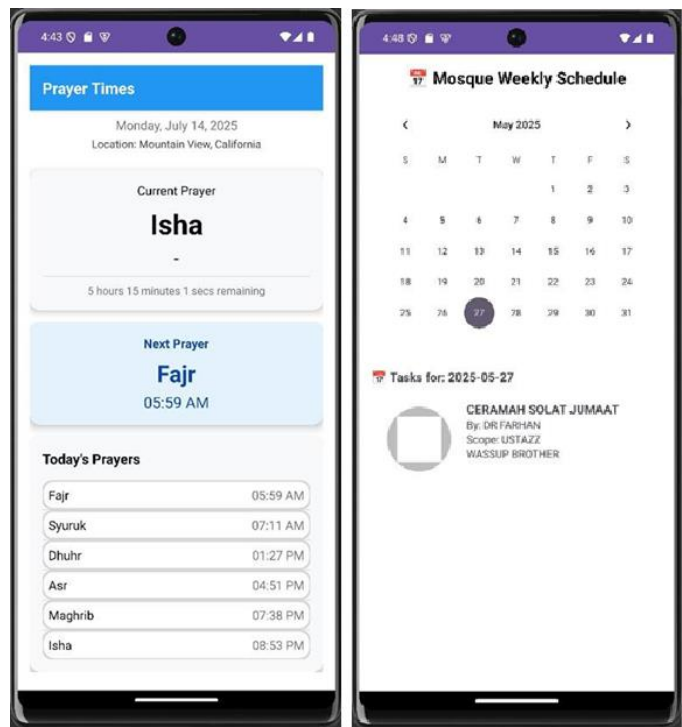


Fig. 3 Prayer times and mosque weekly schedule



Fig. 4 Qiblat Finder Screen

V. RESULT AND DISCUSSION

The system underwent field validation with 38 participants. The demographic breakdown showed a cross-generational appeal: while 47.4% of users were aged 20–25, a significant portion (26.3%) were above 40 years old. The gender distribution was balanced (52.6% female, 47.4% male), and the majority of users (65.8%) held a bachelor's degree. Notably, 76.3% of respondents had prior experience with mosque-related apps, providing them with a baseline for comparison.

A. Usability and Satisfaction

Usability testing indicated a high level of user satisfaction. The interface was praised for being clean and easy to navigate, with users able to perform key tasks like logging in and checking prayer times without assistance. 76.3% of users rated the performance as "Very Good" or "Excellent," and 100% of participants agreed that the app was suitable for mosque use and would recommend it to others.

B. Feature Functionality

Analysis of feature usage revealed that the login function achieved a 97.4% success rate. The Prayer Time module was the most critical feature, accessed successfully by 97.4% of users and cited by 71.1% as the most useful functionality for their daily lives. Users also expressed a strong desire for future features, specifically multi-language support (73.7%) and online donation facilities (47.4%).

VI. CONCLUSION

The Mosque Management System (MMS) represents a significant step in modernizing religious administration. By adhering to the Agile model, the project successfully delivered a user-friendly mobile application that integrates prayer scheduling, event management, and notifications. Field testing confirmed that the system is highly usable and well-accepted by the community, with 100% of users expressing satisfaction. MMS effectively mitigates the inefficiencies of traditional management while enhancing community engagement through digital inclusivity. Future development will focus on incorporating feedback regarding multi-language support and digital payment gateways for donations to further enhance the system's scalability and practical application.

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A Secure Prototype Design for Pre-loved Online Store Using a Cloud-based SaaS

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Abstract— The growing global demand for sustainable consumption has catalyzed the expansion of the second-hand market. However, existing platforms like OLIO, ThredUp, and Freecycle exhibit significant limitations, including narrow category focus, low user autonomy, and a lack of integrated trust and security features. This paper presents the design and development of a secure prototype for a pre-loved online store using a cloud-based Software-as-a-Service (SaaS) model tailored for the Malaysian market. The project employs an Agile methodology to iteratively develop a solution that empowers users to buy and sell items securely. The prototype incorporates key security features including a comprehensive listing system, an escrow payment mechanism to mitigate fraud, secure user authentication through Supabase, and Stripe integration for payment processing. Additional intelligent features such as AI-powered visual search and product recommendations enhance user experience. The primary outcome is a high-fidelity functional prototype that demonstrates enhanced transaction security and user engagement. The project's contribution lies in addressing identified gaps in the circular economy landscape by providing a localized, secure, and scalable platform architecture that promotes sustainable consumption, supports local communities, and reduces environmental waste through secure digital transactions.

Keywords—E-Commerce Security, Second-Hand Marketplace, Software as a Service (SaaS), Escrow Payment System, Prototype Design, Circular Economy

I. INTRODUCTION

The circular economy is gaining traction as consumers increasingly seek sustainable and affordable alternatives to new products. In Malaysia, a significant 80% of the population has engaged in second-hand purchases, highlighting a robust market potential [1]. Despite this demand, current digital platforms facilitating these exchanges are hindered by critical shortcomings, particularly in transaction security and user trust mechanisms. Studies have shown that security concerns are the primary barrier preventing wider adoption of online second-hand marketplaces, with 67% of potential users citing fear of fraud as their main concern [2]. This paper presents the design of a secure prototype for a pre-loved online store that

addresses these challenges through comprehensive security measures and user-centric design principles.

The proposed system aims to develop a specialized SaaS-based e-commerce platform that enables individuals in Malaysia to seamlessly and securely exchange pre-loved items through enhanced security features. The platform leverages modern cloud technologies and implements industry-standard security protocols to ensure safe transactions, protect user data, and build trust within the community. By focusing on security-by-design principles from the initial development phase, this prototype demonstrates how technological solutions can overcome barriers to sustainable consumption practices.

II. PROBLEM STATEMENT AND SECURITY CHALLENGES

An analysis of leading platforms reveals specific security and functionality deficiencies that this prototype seeks to overcome. OLIO excels in food-sharing and waste reduction but suffers from limited adoption for non-food items and low activity in less dense populations [3], [4]. ThredUp, while successful in fashion resale, employs a centralized model that disempowers sellers by controlling pricing and inventory selection, leading to reduced user engagement and profitability. Freecycle, operating on a gift economy, lacks modern features such as secure payment gateways and user verification, making it susceptible to scams and trust issues [5]. Table I provides a comprehensive comparison of existing platforms highlighting their limitations.

TABLE I
COMPARISON OF EXISTING SECOND-HAND PLATFORMS

Platform	Security Features	User Autonomy	Category Coverage
OLIO	Basic verification	High	Limited (food focus)
ThredUp	Payment security	Low	Fashion only
Freecycle	None	High	Wide
Proposed System	Escrow + MFA + Encryption	High	Comprehensive

These limitations create a market gap for a secure prototype that offers category inclusivity, user autonomy,

and robust, built-in security features. Key security challenges identified include: payment fraud prevention through escrow mechanisms, user authentication and verification using multi-factor authentication (MFA), secure data transmission via HTTPS and TLS encryption, transaction dispute resolution systems, and protection against common web vulnerabilities such as SQL injection, cross-site scripting (XSS), and cross-site request forgery (CSRF) [6].

III. METHODOLOGY AND SECURE SYSTEM DESIGN

This project follows an Agile methodology with two-week sprints to ensure flexibility and continuous integration of user feedback [7]. The development lifecycle progresses through five key phases: (1) requirement gathering and security threat analysis, (2) system architecture design with security components, (3) iterative development with security testing, (4) integration testing and vulnerability assessment, and (5) user acceptance testing with security evaluation. Each sprint includes security code reviews and automated security testing to identify vulnerabilities early in the development process.

A. System Architecture with Security Components

The system is designed as a multi-tenant SaaS solution following security-by-design principles, ensuring scalability, cost-effectiveness, and robust protection against security threats. The architecture implements a three-tier model with clear separation of concerns: presentation layer (client-side), application layer (business logic), and data layer (persistence). This separation enhances security by isolating different components and limiting the potential impact of security breaches.

The key components of the secure architecture are:

- Front-end: A responsive web application built using React.js with Vite to ensure a seamless user experience across devices. The client-side implements input validation, XSS protection through sanitization libraries, secure state management using React Context API, and Content Security Policy (CSP) headers to prevent code injection attacks.
- Back-end: A robust RESTful API built with Laravel framework to handle business logic, user authentication, JWT token management, and complex transaction processing. The API implements rate limiting to prevent DDoS attacks, CORS policies for cross-origin security, server-side validation for all inputs, and middleware for authentication and authorization checks on every request.
- Database & Authentication: Supabase is utilized for its PostgreSQL database with row-level security (RLS) policies that ensure users can only access their own data. Built-in authentication services provide OAuth 2.0 support, JWT-based session management, password

hashing using bcrypt with salt, and real-time capabilities with encrypted WebSocket connections.

- Payment System: Stripe is integrated to implement a custom escrow payment flow with PCI DSS Level 1 compliance. The system holds funds securely in escrow accounts, implements 3D Secure (3DS) authentication for card payments, provides webhook integration for real-time payment status updates, and ensures transaction security for both buyers and sellers with automatic refund mechanisms in case of disputes.
- AI Services: Python microservices with machine learning libraries (Scikit-learn, TensorFlow) deployed as containerized services for intelligent features. The visual search system uses Convolutional Neural Networks (CNN) for image similarity matching, while the recommendation engine employs collaborative filtering algorithms. These services communicate through secure REST APIs with API key authentication.

B. Key Security Features in Prototype

The high-fidelity secure prototype demonstrates the following critical security features and user flows designed to build trust and ensure safe transactions:

- Secure User Authentication: Multi-factor authentication (MFA) through Supabase with multiple verification methods including email verification, SMS OTP, and authenticator app support. Password requirements enforce strong passwords (minimum 8 characters with uppercase, lowercase, numbers, and special characters). Session management uses JWT tokens with short expiration times and refresh token rotation to prevent token theft. Failed login attempts trigger progressive delays and account lockout mechanisms after multiple failures.
- Escrow Payment System: A comprehensive secure checkout process powered by Stripe that implements a three-stage payment flow: (1) payment authorization when buyer initiates purchase, (2) fund holding in escrow account during item shipment, and (3) fund release to seller only after buyer confirms receipt. The system protects both buyer and seller credentials through tokenization, implements automatic refund mechanisms for disputed transactions, and maintains detailed transaction logs for audit trails. All payment data is encrypted at rest and in transit using AES-256 encryption.
- Data Protection and Privacy: Implementation of GDPR-compliant data handling practices including user consent management, right to data access and deletion, data minimization principles, and transparent privacy policies. Personal Identifiable Information (PII) is encrypted in the database, and sensitive data is masked in application logs. Regular data backup and disaster recovery procedures ensure data availability and integrity.

- **AI-Powered Visual Search:** Buyers can use this privacy-preserving feature to search items based on images instead of keywords. The system processes images locally where possible and implements differential privacy techniques to protect user search patterns. Uploaded images are not stored permanently and are automatically deleted after processing, maintaining user privacy while enhancing the shopping experience.
- **Intelligent Recommendations:** AI-based product recommendations using similarity algorithms and collaborative filtering enhance user experience without compromising privacy. The system implements federated learning principles where possible, and recommendation models are regularly audited for bias. User interaction data used for recommendations is anonymized and aggregated to protect individual privacy.
- **Real-Time Secure Notifications:** Advanced seller dashboard features for receiving orders and payment confirmations in real-time using encrypted WebSocket connections. Notifications are delivered through multiple channels (in-app, email, SMS) with user-configurable preferences. All notification data is encrypted end-to-end, and notification logs are maintained for security audit purposes.

C. Implementation and Security Testing

The implementation phase follows secure coding practices and incorporates multiple layers of security testing. Static Application Security Testing (SAST) tools are integrated into the CI/CD pipeline to automatically scan code for vulnerabilities during development. Dynamic Application Security Testing (DAST) is performed on the deployed prototype to identify runtime vulnerabilities. Penetration testing is conducted to simulate real-world attacks and identify potential security weaknesses [8]. The development team follows OWASP Top 10 guidelines to prevent common web application vulnerabilities.

Security measures implemented at the code level include input sanitization to prevent injection attacks, parameterized queries to prevent SQL injection, output encoding to prevent XSS attacks, CSRF tokens for state-changing operations, and secure session management with HTTP-only and secure cookies. All external dependencies are regularly updated and scanned for known vulnerabilities using automated dependency checking tools.

IV. SIGNIFICANCE AND EXPECTED IMPACT

The secure prototype design holds significant promise for economic, social, and environmental impact across multiple dimensions. Economically, it provides a safe avenue for individuals to generate income through selling pre-loved items and for consumers to access affordable goods with transaction protection, which is particularly valuable in times of economic uncertainty. The platform's

escrow system ensures fair transactions, reducing financial risks for both parties and potentially increasing the overall transaction volume in the second-hand market sector.

Socially, the secure platform builds trust and community around sustainable practices within Malaysia. By addressing security concerns that currently prevent many people from participating in online second-hand transactions, the platform can democratize access to the circular economy. The user-centric design ensures that sellers maintain control over their listings while buyers receive adequate protection, fostering a balanced and fair marketplace ecosystem. This contributes to building social capital and strengthening community bonds around shared sustainable values [9].

Environmentally, by promoting the secure reuse of items, the platform actively contributes to waste reduction and the conservation of resources. Studies indicate that extending the life of products through reuse can reduce carbon emissions by up to 20% compared to manufacturing new items [10]. The integration of security features throughout the prototype addresses the primary barrier to adoption in second-hand marketplaces—lack of trust—thereby enabling wider participation in the circular economy and amplifying the environmental benefits of reuse and recycling initiatives.

V. PROTOTYPE OUTCOMES AND EVALUATION METHODOLOGY

The primary outcome of this work is a fully developed high-fidelity secure prototype that serves as a proof-of-concept for the proposed architecture with integrated security and AI features. The prototype demonstrates all core functionalities in a working environment, providing a realistic representation of the final product's capabilities and security measures.

A. Evaluation Design and Participants

To validate the prototype's effectiveness and security features, a comprehensive evaluation will be conducted with 30 participants representing the target demographic of Malaysian users interested in second-hand goods. Participants will be recruited through purposive sampling to ensure representation across different age groups (18-55 years), education levels, and technical proficiency. The sample includes 15 participants with prior experience in online second-hand transactions and 15 without such experience, allowing for comparison between experienced and novice users.

B. Testing Protocol and Scenarios

The evaluation will assess both usability and security perception through a structured testing protocol. Each participant will complete a series of tasks representing real-world usage scenarios:

Seller Tasks: (1) Complete user registration with email verification and MFA setup, (2) Create detailed item listings with images, descriptions, and pricing, (3) Receive and

manage incoming orders through the dashboard, (4) Track earnings and view transaction history, and (5) Communicate with buyers using the secure in-platform messaging system.

Buyer Tasks: (1) Browse items across different categories, (2) Search for items using text search and AI visual search, (3) Apply filters and view AI-powered recommendations, (4) Complete a purchase using the secure escrow payment system with test payment credentials, and (5) Confirm receipt of items and provide feedback.

C. Evaluation Metrics

Security-specific evaluation metrics will include: (1) Perceived trust levels measured using a 7-point Likert scale questionnaire adapted from established trust in e-commerce scales [11], (2) Transaction completion rates tracking the percentage of participants who successfully complete the full purchase flow, (3) User confidence in the payment system assessed through post-task interviews, (4) Time to complete security-related tasks such as registration and MFA setup, and (5) Error rates in security-critical operations. Additionally, usability will be measured using the System Usability Scale (SUS) and task completion times. Qualitative feedback will be collected through semi-structured interviews to understand user perceptions of security features and identify areas for improvement.

VI. DISCUSSION AND FUTURE WORK

The secure prototype design presented in this paper addresses critical gaps identified in existing second-hand marketplace platforms. By implementing comprehensive security measures including escrow payments, multi-factor authentication, and data encryption, the prototype provides a robust foundation for safe online transactions. The integration of AI-powered features enhances user experience while maintaining privacy through careful implementation of privacy-preserving techniques.

Future work will focus on several key areas. First, deployment of the platform in a production environment with real users will provide valuable insights into real-world security challenges and user behavior patterns. Second, implementation of advanced fraud detection mechanisms using machine learning algorithms to identify suspicious activities and prevent fraudulent transactions. Third, expansion of the platform to include mobile applications for iOS and Android platforms, extending the security features to mobile environments. Fourth, integration with local payment gateways popular in Malaysia to increase accessibility and reduce transaction costs. Finally, development of a comprehensive analytics dashboard for administrators to monitor platform security, identify trends, and make data-driven decisions for platform improvements [12].

VII. CONCLUSIONS

This paper presents a secure prototype design for a pre-loved online store that addresses critical gaps in the existing second-hand digital marketplace landscape. By leveraging a SaaS model with integrated security features including escrow payments, secure authentication, encrypted data transmission, and comprehensive security testing, the prototype delivers a secure, user-controlled, and locally-focused platform that aligns with the principles of the circular economy. The emphasis on security-by-design throughout the development process ensures that the platform meets the evolving demands of modern consumers while addressing the primary barrier to adoption—lack of trust in online second-hand transactions. The comprehensive evaluation methodology will provide empirical evidence of the prototype's effectiveness in building user trust and facilitating secure transactions. This work contributes to the growing body of knowledge on secure e-commerce design and demonstrates how technology can enable sustainable consumption practices by providing the necessary security infrastructure to build user confidence in online second-hand marketplaces.

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Proposed of a Web-based System: Enhancing Operational Efficiency for Catering Providers

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Abstract— The food and beverage industry is the most important cornerstone of the hotel industry. Currently, some food and beverage operators still rely on manual processes, including phone reservations, paper records, and offline payments. These traditional methods significantly reduce efficiency and are prone to human error, leading to data mismatches, layout conflicts, and an inability to effectively scale up operations. While various computerized solutions have been introduced, they frequently suffer from critical limitations. Previous studies have identified that many existing systems function as standalone desktop applications with restricted geographic accessibility, or as web systems that fail to integrate essential features such as secure payment gateways or real-time supply chain management. To address these operational gaps, this project proposes the development of a Web-based Management System for Catering Provider. The Study is employed by using agile methodology, utilizing iterative sprints to allow for continuous feedback and refinement through the development lifecycle. The system is using the Laravel PHP framework for the backend and MySQL for database management to ensuring a robust and secure foundation of system, while the frontend using Vue.js to deliver a responsive user experience across devices. The project results in a dual-interface platform. The Customer Portal empowers clients to browse categorized menus, customize orders, and uniquely, submit formal quotation requests, a feature that is frequently missing in standard e-commerce systems. It also facilitates secure transactions via an integrated online payment gateway. Simultaneously, the Administrative Backend centralizes business operations, providing tools for menu CRUD operations, a visual event calendar to prevent booking conflicts, and a delivery tracking module to manage logistics. Ultimately, this system contributes to the field by automating core business processes, minimizing manual administrative workload, and significantly enhancing customer accessibility through a modern, data-driven digital solution.

Keywords: Catering Management System, Web-based Application, Hospitality Technology, Agile Methodology, Laravel PHP Framework, Online Ordering, Supply Chain Management

I. INTRODUCTION

Catering is a vital aspect of the hospitality industry, servicing events ranging from corporate functions to social gatherings. Despite the demand for high-quality service, many catering operators struggle with complex needs such as menu customization, procurement, and delivery scheduling. Historically, these operations were managed using manual

procedures like phone calls and paper records. While functional, these methods are prone to errors and inefficiencies, particularly as a business grows.

Recent studies have highlighted the need for technological adoption. Dharmarathne [1] developed a standalone system to replace manual records, while Shaikh et al. [2] proposed an internet-based system. However, these solutions have limitations: standalone apps lack remote accessibility, and some web systems rely solely on Cash on Delivery (COD), which is inconvenient for modern consumers.

This project aims to overcome these flaws by developing a holistic **Web-based Management System**. The system is designed to handle the entire ordering process for clients while providing providers with robust backend tools for effective management.

II. METHODOLOGY

This project utilizes the **Agile methodology**. Unlike the sequential Waterfall model, Agile is iterative and flexible, making it suitable for projects where requirements may evolve. The development is broken down into manageable cycles called "sprints".

- **Phase 1: Planning (Sprint 0):** Involves establishing the high-level vision and conducting a detailed requirement analysis to prioritize features like the ordering dashboard and payment gateway.
- **Phase 2: Design:** An ongoing process where UI/UX wireframes and database schemas are created at the start of each sprint.
- **Phase 3: Development:** The system is built incrementally. Early sprints focus on foundational features like menu display, while later sprints integrate the shopping cart and event scheduling modules.
- **Phase 4: Testing:** Testing is integrated throughout the process. Unit tests are performed during sprints, followed by user acceptance testing (UAT) to ensure the system is functional and bug-free.

III. SYSTEM DESCRIPTION

The proposed solution comprises three significant functional components: the **Customer Interface**, the **Catering Provider Backend**, and the **System Administration Module**.

- **Customer Interface:** This module allows clients to browse categorized menus, request quotations, place orders, and make payments via a secure online gateway. It specifically addresses the accessibility gap found in previous standalone systems by enabling remote interaction.
- **Catering Provider Backend:** This secure portal provides catering providers with essential operational tools. Features include a dashboard for menu creation and editing, a centralized event calendar for scheduling, and a delivery tracking function. This component centralizes management to minimize human error.
- **System Administration:** This role is responsible for data integrity, system maintenance, and deployment. Unlike the business-focused provider backend, this role is technical, focusing on tasks such as database backups and applying software updates rather than daily business operations.

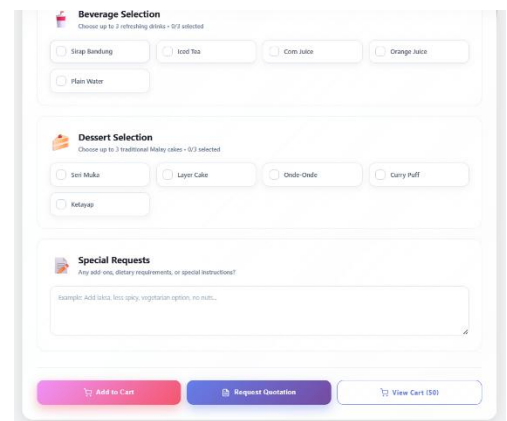
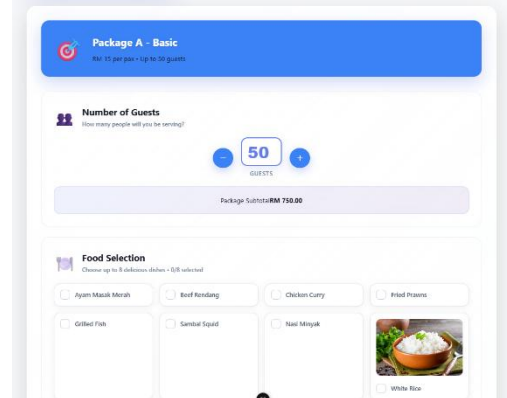
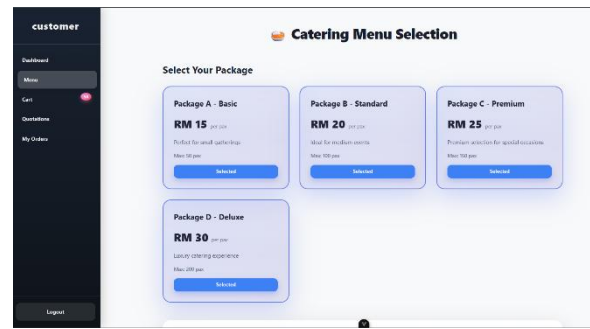


Fig. 2 Customer Ordering Interface

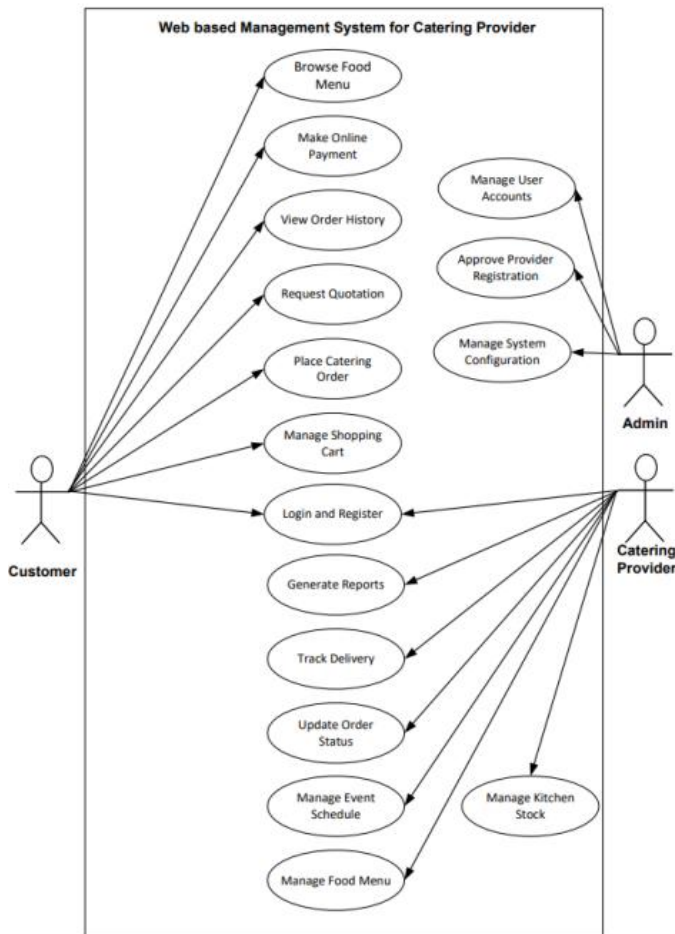


Fig. 1 Use Case Diagram of the proposed Web-based Catering Management System

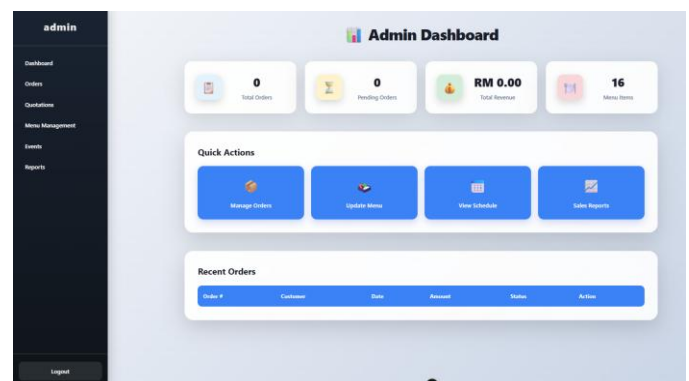


Fig. 3 Catering provider dashboard

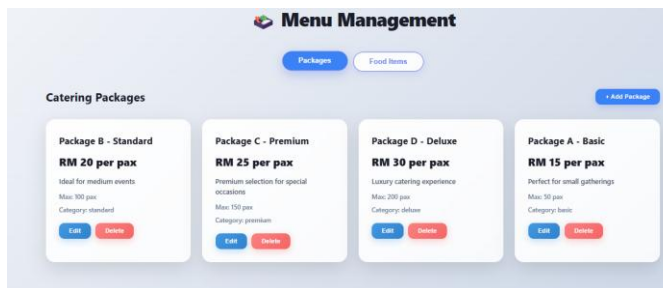


Fig. 4 Catering provider menu management module

IV. CONCLUSION

The Web-based Management System for Catering Provider offers an end-to-end modern solution that addresses significant operational gaps in the industry. For customers, it offers convenience through easy online ordering and digital payments. For business owners, it streamlines processes by managing event calendars and deliveries in a centralized setting, thereby minimizing human error and improving work efficiency.

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