PTA-FTSM-2025-A197834

A WEB-BASED INTERACTIVE GAME TO KNOW UKM CAMPUS

DING FANGWEI

DR. HAZURA MOHAMED

Fakulti Teknologi & Sains Maklumat, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor Darul Ehsan, Malaysia

ABSTRACT

New students, particularly international students at universiti kebangsaan malaysia (ukm), often face difficulties in identifying faculty locations, campus facilities, and understanding the university's history. Additionally, statistics indicate that student engagement in daily physical activities remains low. To address these issues, this project aims to develop a web-based interactive game that incorporates gamification elements such as step tracking and treasure hunt challenges. The application is designed to encourage physical campus exploration while simultaneously enhancing students' knowledge about ukm. The development follows an agile methodology, allowing iterative improvements based on continuous user feedback. The resulting prototype demonstrates the potential of the application as an engaging medium for campus orientation and health promotion. It is hoped that this tool will support new students in adapting to the ukm environment and serve as a resource for both institutional introduction and active lifestyle encouragement.

INTRODUCTION

With the digital transformation of universities leading to a reduction in outdoor activity among university students. Recent study shows relationships between students' physical activity level and their mental health status. The higher the total physical activity, the better their mental health scores (Rodríguez-Romo et al., 2022). International students also face challenges which is they feel unfamiliar with their campus.This lack of familiarity can make campus life overwhelming. This study proposes a solution. To develop a gamified web application for Universiti Kebangsaan Malaysia (UKM). This application use step tracking with educational challenges and

introduce the campus and learn about UKM's history. Students will move more while engaging with their university environment.

METHODOLOGY

The project adopts an Agile development methodology, using Scrum for efficient implementation. This approach enables iterative development with continuous refinement of features based on user feedback. Development is organized into two-week sprints, focusing first on educational content and step tracking, followed by challenge systems. This structure flexible approach allows us to maintain consistent progress while adapting to emerging technical challenges and user requirements.

USER NEEDS

As students develop sophisticated lifestyles in their day-to-day college lives, they seek various and complex forms of multimedia and multi-purposed applications. This project is concerned with creating a web-based treasure hunting game system which is hoped to add on the entertainment values, health factors as well as educational functions for users. The system not only becomes a kind of entertainment activity indicator but also attempt to lead users go out and perform daily activities through games.

Utilize Google Forms to collect user identify, their residence, desired system functions, preferred rewards, and fevered challenges. The survey received 33 replies.

Based on the survey results, users include 84.8% of the international students and 15.2% of the local students, and their awareness of the campus and participation pattern differs. Because 84.8% of students live out of campus, the system must accommodate a simple and effective means of navigation as well as activity content relevant to out of campus students.

The survey results show 78.8% of students frequently use mobile apps for learning or exploring new places. From a functionality perspective, the first place in the student vote was the introduction of the school's building, accounting for 78.8%. The second place was step counting and gamified challenges about school knowledge, which also accounted for 69.7%. Third place was timer for challenges and reward system, which also accounted for 63.6%. The last place was leaderboard accounting for 60.6%.

For reward system, the results show 75.8% of students want discounts or vouchers, and 69.7% of students want virtual badges or points, and 12.1% want certificates of completion.

For challenges, 58.3% of students vote for physical activities, 33.3% of students vote for quizzes, and 16.7% of students vote for solving riddles.

This project is designed to achieve two main goals; to provide the necessary amusements and fun, while satisfying the user’s demands as well as serving their needs of fun and interactivity; and to make the system functional and expandable as much as possible. Finally, it aims at becoming an easy to use and efficient tool for enriching a campus life of various students.

SYSTEM REQUIREMENT SPECIFICATIONS

The System Requirements Specification (SRS) describes the working software to be completed and how the system will work. For the specification of system requirement, we analyse it from the perspective of functional requirement and non-functional requirement.

SYSTEM ANALYSIS AND DESIGN

The system was designed using an object-oriented approach to ensure modularity and scalability. The design phase translated user needs into system architecture, use cases, and interface flow. A use case diagram was developed to represent user interactions such as login, step tracking, treasure box unlocking, and UKM information exploration.

The three-tier architecture consists of the React.js frontend for user interaction, Firebase as the backend for authentication and database operations, and Firestore for storing user data, steps, and UKM-related content. A class diagram was also created to illustrate the relationships between key entities including User, StepHistory, TreasureBox, and LearningContent.

The system's design was guided by usability and performance requirements, ensuring compatibility across devices and ease of navigation for both local and international students.

CODING AND TESTING

The system was implemented using React.js for the frontend and Firebase for backend services, including authentication and real-time database operations. Step tracking was handled using mobile motion sensors via the devicemotion event, while treasure box challenges were triggered based on daily step counts.

Use case testing was conducted for all major functions such as user registration, login, step tracking, and challenge participation. Black-box testing ensured expected outcomes were achieved for each feature. In addition, usability testing involving 30 UKM students showed high satisfaction and ease of use, with Cronbach's Alpha values above 0.94 indicating strong reliability.

All key modules passed their respective tests and the system met the functional and non-functional requirements outlined in the planning phase.

RESULTS

Figure 1 allows users to log in using email and passwords. Includes options to register a new account or reset a forgotten password.

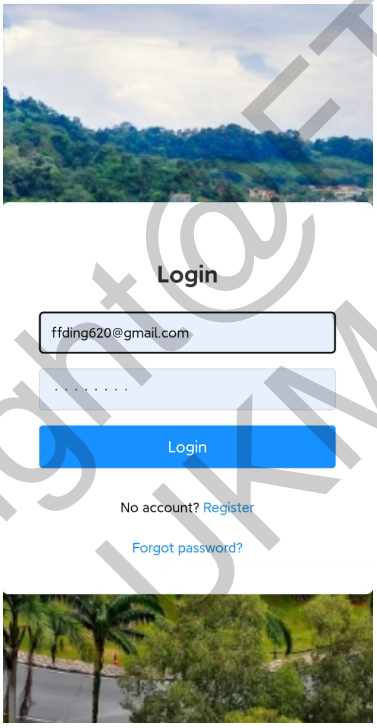

Figure 1 login page

Figure 2 displays current step count, progress bar, and step challenges. Serves as the launch point for campus exploration via the “Explore UKM” button.

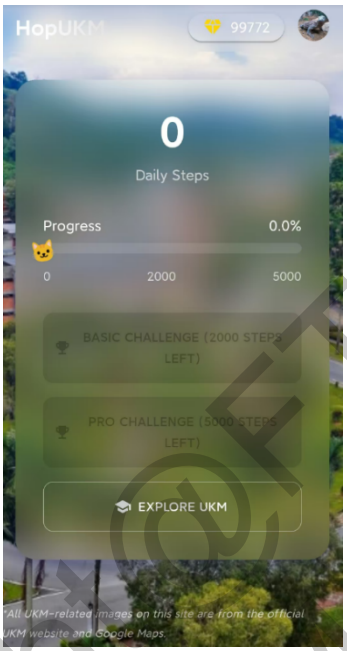

Figure 2 main page

Figure 3 shows users can edit their personal information and customize their avatar. New avatars can be unlocked using diamonds earned through completing in-app tasks, enhancing personalization and engagement.

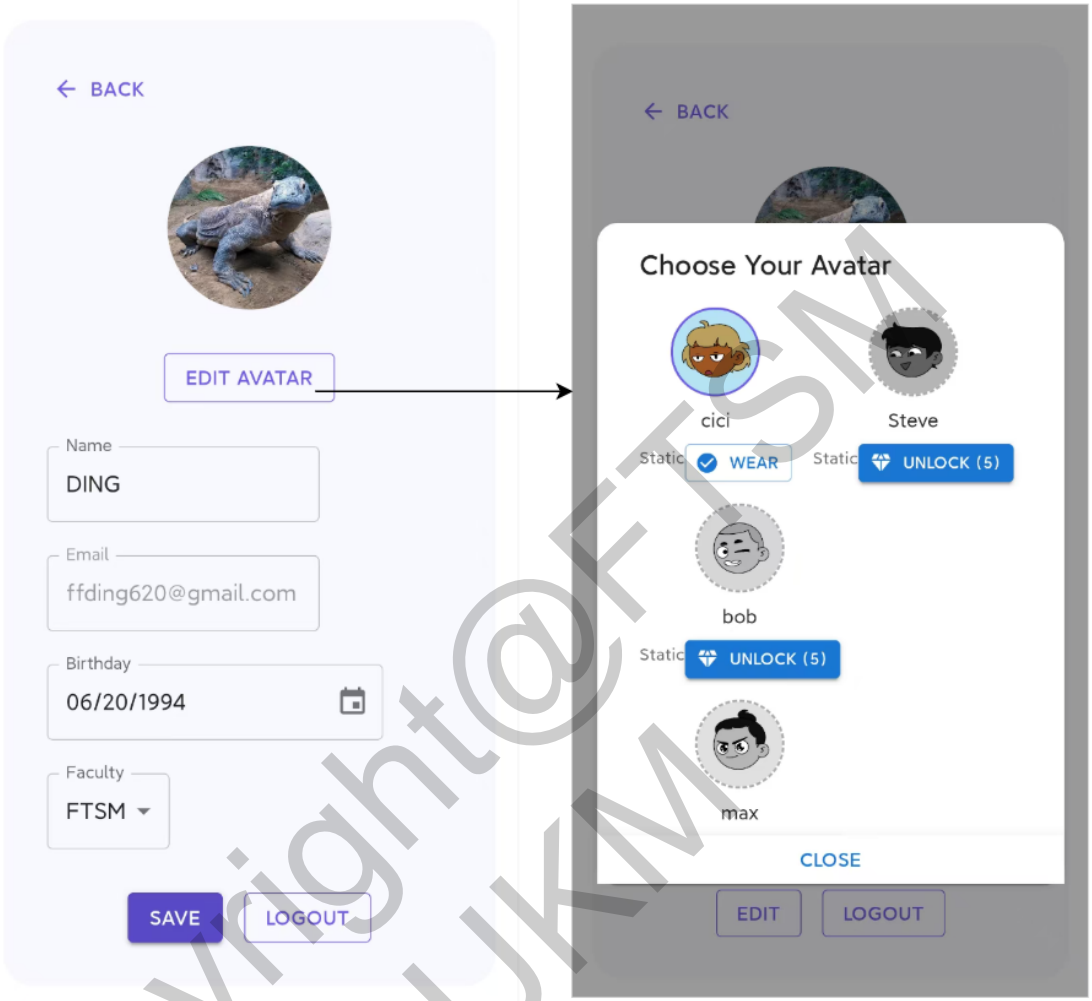

Figure 3 Profile Editing and Avatar Customization

Figure 4 illustrates the exploration flow. After clicking "Explore UKM", users are taken to a selection menu with four options: UKM History, UKM Faculty, UKM Facilities, and UKM Landmarks. Choosing UKM History opens detailed historical content about the university. Selecting UKM Faculty displays a map and a list of academic faculties and centers, each with information such as program levels and study fields. The UKM Facilities section provides access to infrastructure information like Dectar Hall, along with links to Google Maps for navigation. Lastly, the UKM Landmarks module allows students to post and browse favorite campus spots, complete with descriptions, images, and user comments—fostering a community-based recommendation system.

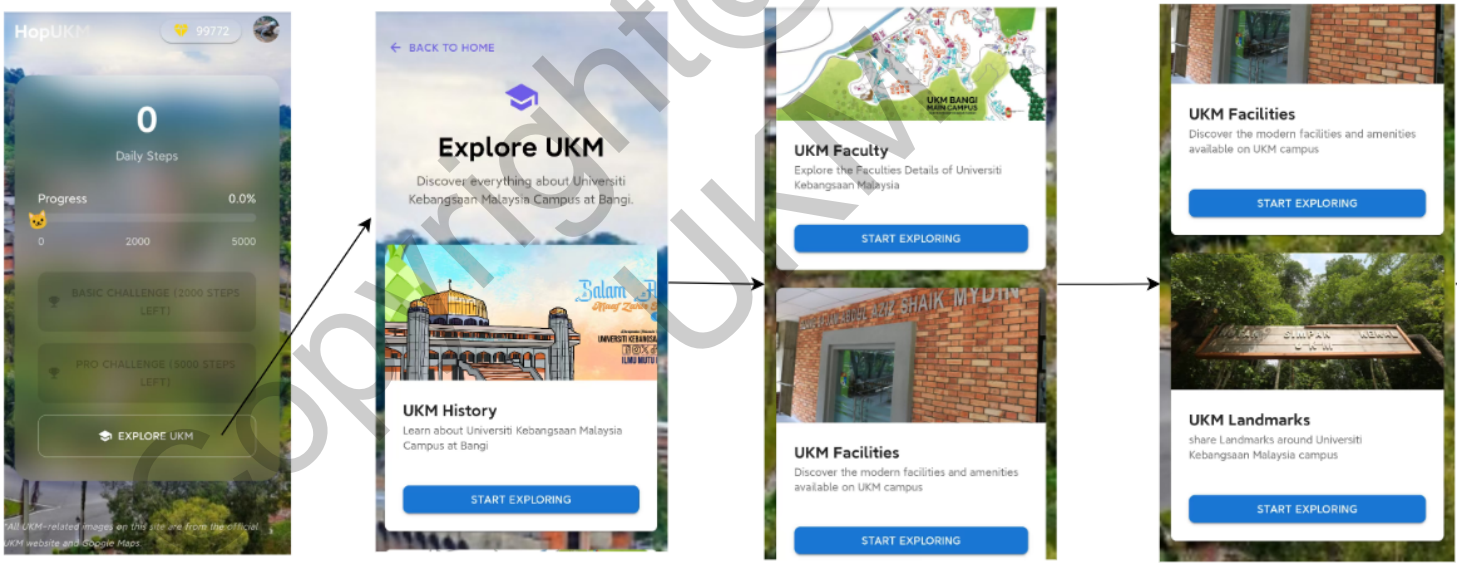

Figure 4 function in explore ukm

Figure 5 introduces the history of UKM, highlighting its founding, growth, and academic achievements. It also provides direct access to the official website and Google Maps location for user convenience.

Figure 5 ukm history

This Figure 6 allows users to view detailed information about UKM faculties and their programs. It provides direct access to the faculty's official website and displays contact information for further inquiries.

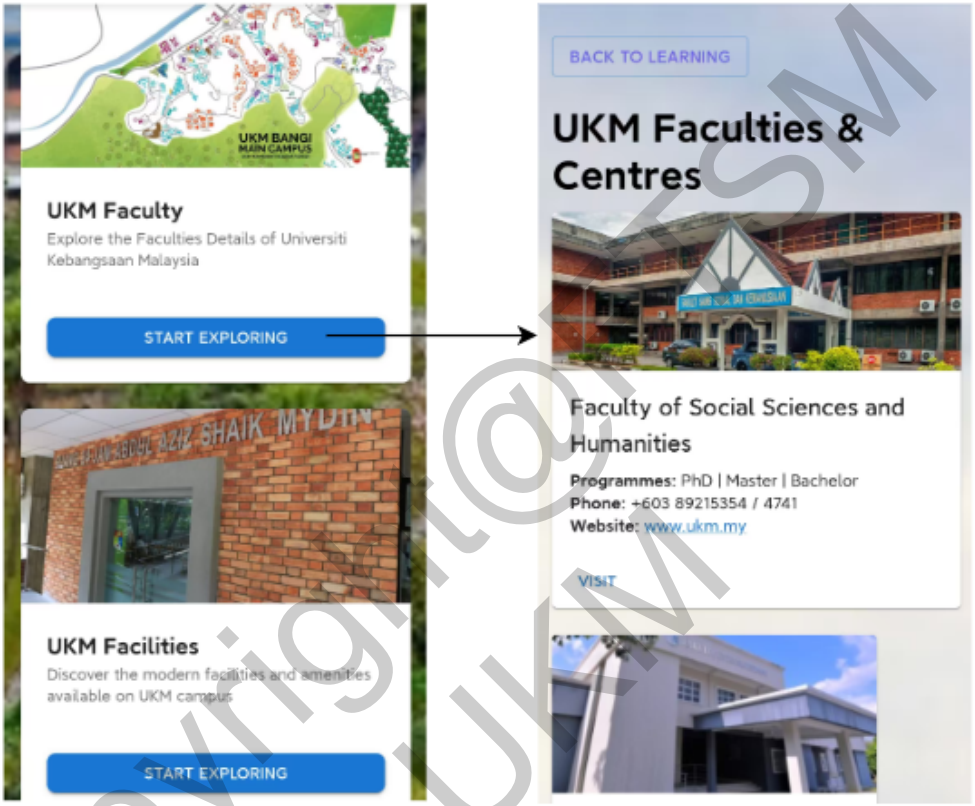

Figure 6 ukm faculty

This Figure 7 displays details of UKM facilities such as DECTAR Hall with Google Maps navigation, and allows students to share and view campus landmarks. Users can post landmark photos with descriptions and interact through likes and comments, enhancing engagement and information sharing.

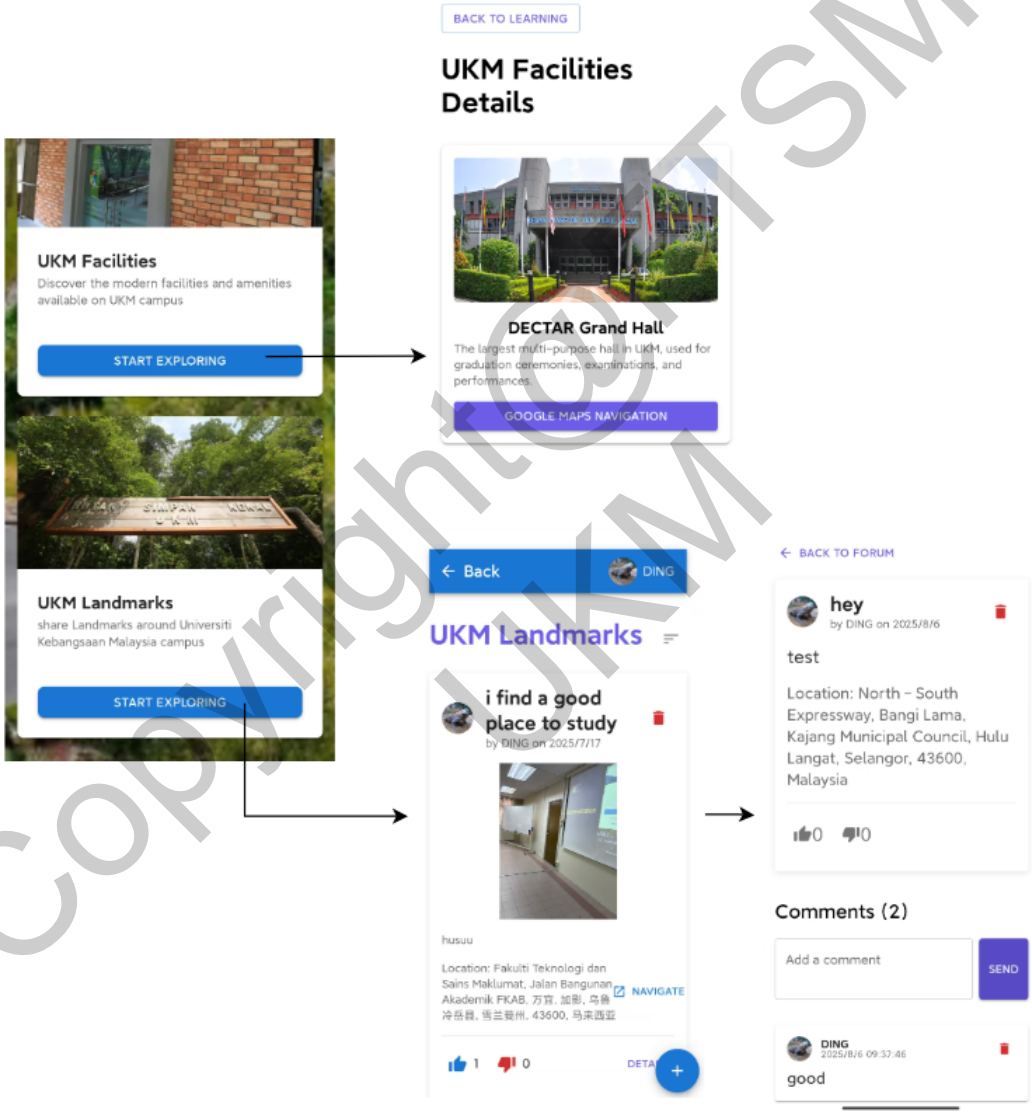

Figure 7 UKM Facilities and Landmarks Features

Figure 8 shows after reaching 2000 daily steps, users unlock a daily abbreviation quiz that tests their knowledge of UKM faculty short forms. Correct answers earn diamonds as rewards, encouraging both physical activity and campus familiarity.

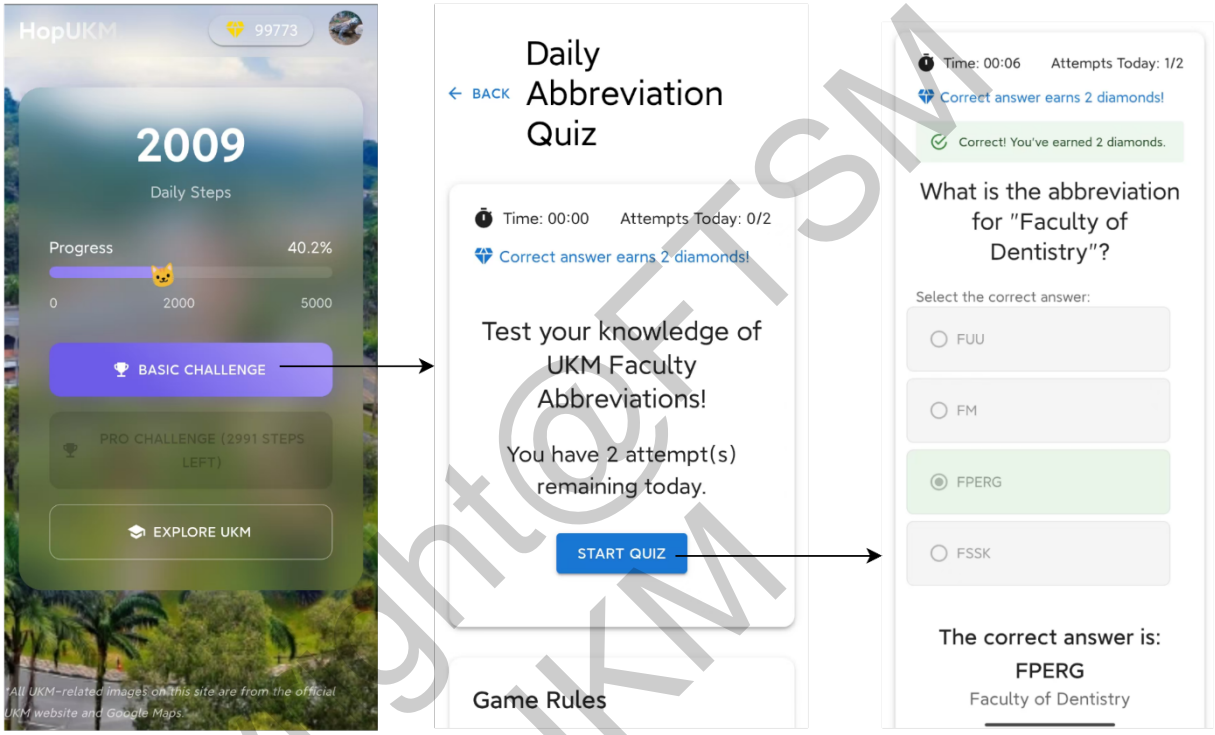

Figure 8 Daily Quiz Unlock

Figure 9 shows this puzzle game is unlocked after reaching 5000 daily steps. Players solve randomized jigsaw puzzles of various UKM faculty buildings to earn rewards and enhance campus familiarity through gamification.

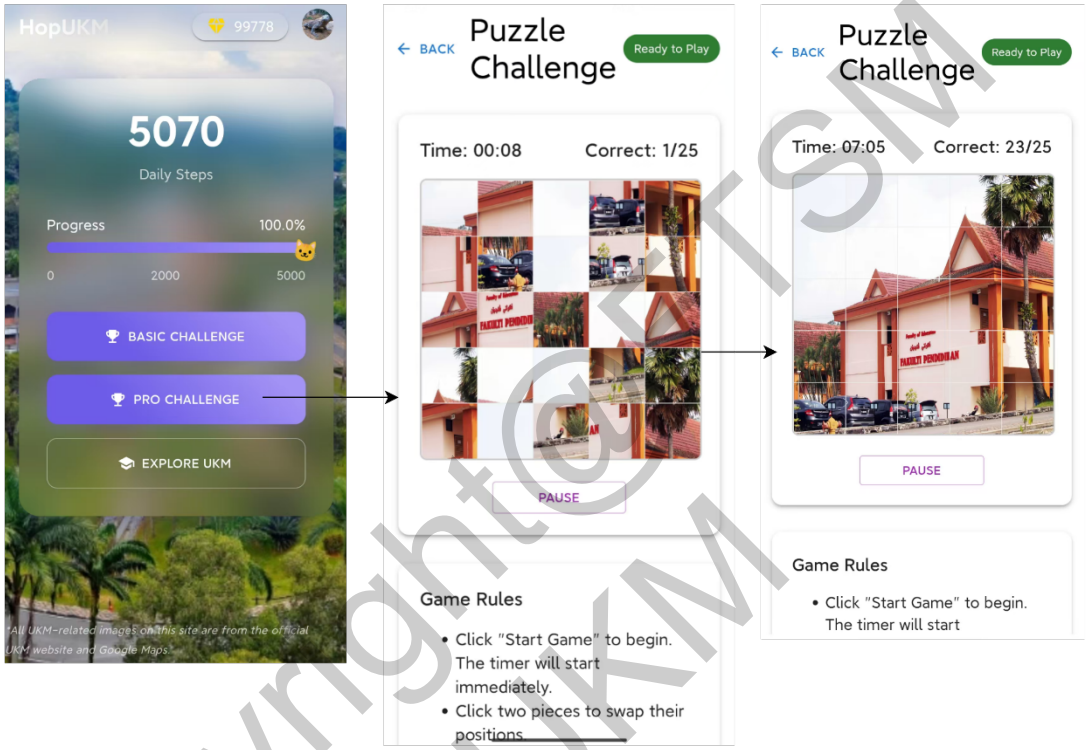

Figure 9 Pro Challenge – Faculty Puzzle Game

Figure 10 shows users can exchange collected diamonds for emoji cursor icons that appear beside their step progress bar. This feature personalizes the user experience and incentivizes continued engagement through visual customization.

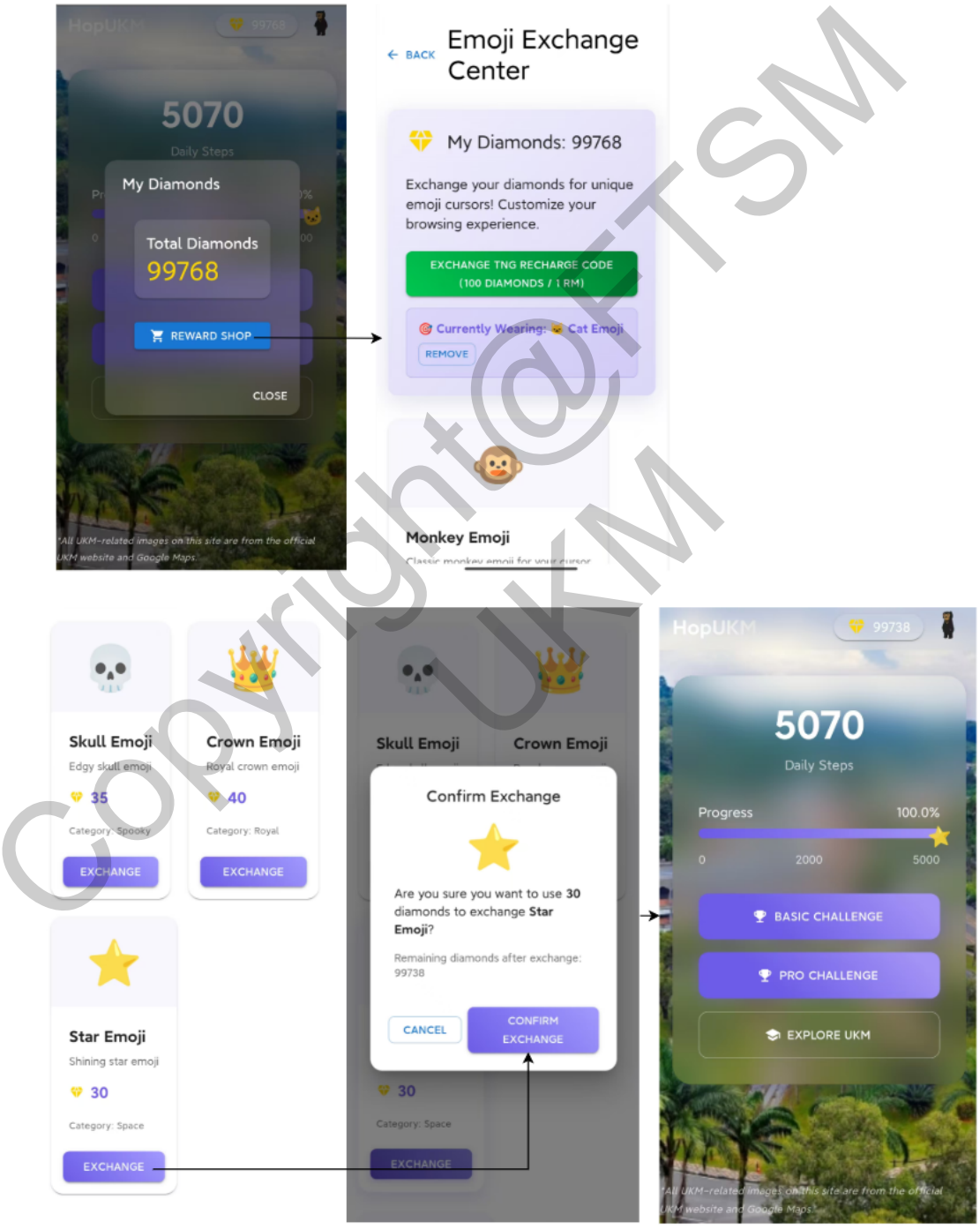

Figure 10 Emoji Exchange – Customize Progress Icons with Diamonds

Figure 11 shows the database for the system, which stores all data used in the application. An internet connection is required to view or update data. If there is no connection, the application will display a message stating that an internet connection is needed to continue. Using Firebase also helps maintain data accuracy and ensures that users always receive the most up-to-date information.

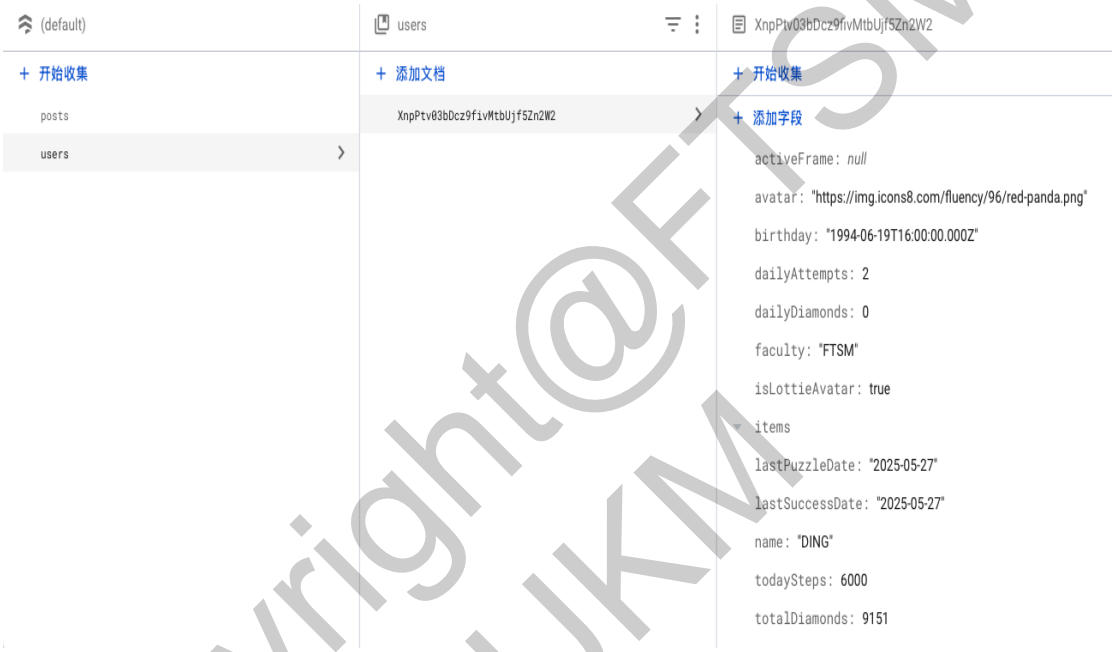

Figure 11 Firebase database

Functionality Matrix Testing

Table 1 below lists the functions within the system and their capabilities.

Table 1 Functionality Matrix Testing

ID	Function	Risk Level	Reference
F001	User Registration	High	SRS
F002	User Login	High	SRS
F003	Password Recovery	High	SRS
F004	User Logout	Low	SRS

F005	User Profile Update	Medium	SRS
F006	Track User Progress	Medium	SRS
F007	Display Progress Statistics	Medium	SRS
F008	Daily Step Tracking	High	SRS
F009	Device Synchronisation	Medium	SRS
F010	Daily Challenges	Medium	SRS
F011	Challenge Q&A	Medium	SRS
F012	Challenge Validation	Medium	SRS
F013	Reward System	Medium	SRS
F014	Display UKM Info	Low	SRS
F015	Discussion Platform	Medium	SRS
F017	Interactive Maps	Low	SRS
F018	Faculty Photos & Info	Low	SRS
F019	Facility Photos & Info	Low	SRS

USABILITY TESTING RESULTS

A usability testing survey was distributed to 30 UKM undergraduate students to evaluate the usability of the web-based interactive game, and 30 valid responses were collected. Respondents were instructed to use the system before completing the Google Form survey.

a. Respondent Demographics Analysis

A usability testing survey was distributed to UKM students to evaluate the usability of the web-based interactive game, and 30 valid responses were collected. The respondents were instructed to use the system before completing the survey via Google Form. Based on Table 2, the respondents' demographics show a clear distribution

between local and international students, with 83.3% international students and 16.7% local students.

Table 2 Demographics Analysis

	Frequency	Percent	Valid Percent	Cumulative Percent
Local Students	18	60.0	60.0	60.0
International Students	12	40.0	40.0	100.0
Total	30	100.0	100.0	

b. Reliability analysis

Reliability analysis refers to the consistency and stability of the results of an instrument in a study (Azizi Ahmad, 2010). To obtain reliability values, internal consistency was measured using Cronbach's alpha for each construct: Perceived Usefulness (4 items), Perceived Ease of Use (4 items), Ease of Learning (4 items), and Satisfaction (4 items) based on the Technology Acceptance Model (Davis, 1989). Table 3 shows the Cronbach's Alpha values for each construct tested.

Table 3 Reliability Analysis (Cronbach's Alpha)

Measurement Item Set	Cronbach's Alpha
Usefulness	.946
Ease of Use	.944
Ease of learning	.975
Satisfaction	.981

Table 3 shows that the Cronbach's alpha values for all four measurement item sets exceeded 0.9, indicating a high level of consistency and reliability (Nunnally &

Bernstein, 1994). The Satisfaction construct recorded the highest reliability value at 0.981, while the Ease of Use construct recorded the lowest reliability value at 0.944. Overall, all constructs were reliable and suitable for measuring the targeted constructs in this usability testing.

Table 4 Mean scores for all questionnaire items

Item	N*	Mean	Std. Deviation
Usefulness (US)			
Using the system would improve my understanding of the UKM campus layout.	30	4.41	1.048
Using the system enhances my effectiveness in navigating UKM.	30	4.73	.449
The system meets my needs.	30	4.44	1.050
The system saves my time during campus activities.	30	4.54	.840
Overall Mean		**4.53**	
Ease of Use (EU)			
I find the system easy to use.	30	4.71	.512
I can use the system without written instructions.	30	4.63	.698
Using the system requires minimal effort.	30	4.39	1.070
My interaction with the system is clear and understandable.	30	4.51	.898
Overall Mean		**4.56**	
Ease of Learning (EL)			
I can quickly learn how to use the system.	30	4.63	.698
The interface and buttons of the system are easy to understand.	30	4.61	.737

I can easily remember how to use the features of the system.	30	4.56	.808
I can easily learn to use the system to complete tasks such as navigation and challenge.	30	4.63	.662
Overall Mean		**4.61**	
Satisfaction (SC)			
I am satisfied with using the system.	30	4.46	.897
I would recommend this system to my friends.	30	4.37	.968
Using the system is enjoyable.	30	4.37	.968
The system works the way I want it to work.	30	4.27	1.162
Overall Mean		**4.37**	

*N = Number of respondents

The overall mean scores for all four usability constructs—Usefulness (US), Ease of Use (EU), Ease of Learning (EL), and Satisfaction (SC)—fell between 4.37 and 4.61 on a 5-point scale, placing them firmly in the "high" range (3.81–5.00). In particular, Ease of Learning (EL) achieved the highest average 4.61, suggesting that participants were able to pick up the system's features quickly and intuitively. Ease of Use (EU) followed closely with a mean of 4.56, reflecting clear, straightforward interactions, while Usefulness (US) scored 4.53, indicating that users felt the system genuinely supported their campus navigation and challenge-task needs. Satisfaction (SC), at 4.37, remained high—demonstrating strong overall approval of the user experience, even if it trailed the other dimensions slightly.

These findings echo earlier work by Sreerambhatla (2010), who reported that user satisfaction rises when a system aligns closely with its target audience's requirements. They also mirror conclusions from Ahmad Fkrudin and Badruddin (2014)

and Zhang & Adipat (2005), both of which highlight that ease of use and clear usefulness are critical drivers of positive user preference and satisfaction.

CONCLUSION

In conclusion, this project report documents the final year project titled "A Web-Based Interactive Game to Familiarize Students with the UKM Campus". The study conducted for this documentation generated many ideas and components that contributed to the completion of the project. This process was essential to identify both the strengths and weaknesses of the system as a whole.

A comparison between the system and existing gamified learning and physical activity systems highlights the unique strengths of the system by integrating detailed information about the UKM campus layout into a gamified environment, the system enables UKM students to explore and familiarize themselves with the campus through a single interactive platform. This approach goes beyond traditional methods by combining campus orientation with engaging game-based activities, providing a comprehensive and motivating experience for UKM students. Survey results conducted through Google Form showed that most users agreed with and supported the development of this system.

The objectives of this project have been achieved: a web-based interactive game system for UKM students has been successfully developed. Functional testing produced positive results, and usability testing, as the second objective, also demonstrated a high level of system usability.

7 REFERENCES

Ahmad Fkrudin, A., & Badruddin, A. (2014). User-friendly application evaluation. Journal of Technology and Society.

Azizi Ahmad. (2010). Panduan Praktikal Penyelidikan Pendidikan. PTS Professional Publishing.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319-340.

Nunnally, J.C., & Bernstein, I.H. (1994). Psychometric Theory. McGraw-Hill.

Rodríguez-Romo, G., Acebes-Sánchez, J., García-Merino, S., Garrido-Muñoz, M., Blanco-García, C., & Diez-Vega, I. (2022). Physical Activity and Mental Health in Undergraduate Students. International journal of environmental research and public health, 20(1), 195. https://doi.org/10.3390/ijerph20010195

Sreerambhatla, V. (2010). Usability in mobile interface design: An evaluation and improvement method. International Journal of Mobile Human Computer Interaction, 2(1), 1–21.

Zhang, D., & Adipat, B. (2005). Challenges, methodologies, and issues in the usability testing of mobile applications. International Journal of Human-Computer Interaction, 18(3), 293-308.

Ding Fangwei (A197834)
Dr. Hazura Mohamed
Faculty of Information Technology & Science,
National University of Malaysia