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Development of Japanese Language Learning Application with Word Tracing Approach

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Abstract: Foreign language learning has grown in importance in Malaysian higher education due to the globalization, industrialization, and economic needs. The Japanese language is both a popular and challenging foreign language to learn. The existing applications to learn the Japanese language that have been researched are lack of word tracing implementation and lack of multimedia elements such as graphics and audio. Therefore, this project is aimed to develop a Japanese language mobile learning application named Japanese Diary implementing word tracing approach based on Multimedia Mobile Content Development (MMCD) methodology. This project's target users are Universiti Tun Hussein Onn Malaysia (UTHM) students aged 18 to 25. Positive findings with an average of 89.13% were obtained through user acceptance testing based on Technology Acceptance Model (TAM). This application is expected to assist students learn the fundamentals of Japanese through lesson and quiz modules, and a katakana syllabus for word tracing is suggested for future development.

Keywords: Mobile Learning Application, Japanese Language, Hiragana, VARK Approach, Word Tracing Approach

1. Introduction

Japan is the second most popular country for continuing studies in 2018 after the United Kingdom. Throughout this scenario, because of the demand for education in the globe, and because most Japanese people do not wish to practice languages other than their native tongue, Japanese has become a very significant language [2]. Japanese language is the study which is related to and involves kanji, hiragana and katakana [3]. Hiragana is the basic requirement for a beginner to be proficient in the fundamentals of Japanese language [4]. The way words are written and pronounced is one of the most difficult aspects of Japanese language learning. Therefore, the word tracing approach used in this proposed application is to focus on guiding students on writing the correct Japanese words step by step. Students learn how to form letters correctly by tracing as a self-guided activity.

After looking into various products now available on the market, some of them are lacking in sufficient detail. Some applications (Simple Hiragana, Learn Japanese-Hiragana-Romaji, and Vocab: Learn Japanese & JLPT) did not provide students a voice so they are unable to quickly retain the

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information from the application and cannot learn how to pronounce the term. In addition, they use pictures that are too dull for university students, which deters them from learning the Japanese language. Therefore, the Japanese language mobile learning application, Japanese Diary is proposed to be developed to help university students learn the fundamentals of Japanese language and most importantly to be able to memorize the Japanese words by tracing it.

The objectives of this study are to design a Japanese Diary, a Japanese mobile learning application using VARK approach, to develop a Japanese Diary, a Japanese mobile learning application by implementing word tracing approach on Android platform, and to perform functional testing and user acceptance testing on the developed application, Japanese Diary to the target user. The proposed application is developed for students of Universiti Tun Hussein Onn Malaysia (UTHM) aged from 18 to 25 years old to learn the level 1 of Japanese language. A Japanese lecturer, Madam Junko Hiyama, from Universiti Tun Hussein Onn Malaysia, Parit Raja, Johor has been consulted as the Subject Matter Expert (SME) in this project. Furthermore, the application's content is based on the topic covered in the UTHM module for UHB10802 Japanese Communication 1 course [5].

There are two modules in the Japanese Diary application, which are Lesson Module and Quiz Module. In the Lesson Module, there will be three sections which are Alphabet, Vocabulary and Grammar. In the Alphabet, the requirement is to build up the hiragana words with audios to help university students remember easily. Basic phrases and vocabulary for the first level of Japanese language, such as daily greetings, family, numbers, and days of the week are provided in the vocabulary section. Personal pronouns and a video of self-introduction will be designed for this section of grammar. To make it easier for the user to follow along with the learning content, the user will be provided with a clear and accurate pronunciation of the Japanese word. In the Quiz Module, there will be four sections which are Listening, Reading, Writing and Quiz Game. Ten questions have been provided in the Listening, Reading, and Quiz Game respectively for university students to respond to. Users could discover the word that best describes the presented graphic in Quiz Game. In Writing, university students need to trace the hiragana words step by step.

The remaining parts of the paper are organized as follows: the study domain, technology used, and findings of comparative analysis are discussed in Section 2. Section 3 discusses the Multimedia Mobile Content Development (MMCD) methodology and the output of each phase of this project. Moreover, Section 4 states the results and discussion, and Section 5 presents the conclusion of the project.

2. Related Work

In this section, the domain of study, the technology used, and findings of the comparative analysis are discussed.

2.1 Japanese Language

Japanese is one language that has a different form of language than other languages. Therefore, difficulties in comprehending Japanese arise due to the fact that forms of language can be considered from the form of the letters, grammar, the variety of languages used, and the sentence constructions that are used. The current study will concentrate on hiragana, a Japanese syllabary. The Japanese developed two syllabaries, hiragana and katakana, each with 46 characters, to supplement the imported Chinese logograms. Only one of the syllabaries is required to write Japanese. Japanese books are written with a combination of Chinese characters and syllabaries, making them easier to read than the syllabary alone since the Chinese characters provide clues for breaking the text into word or meaning units [6]. A fixed order of strokes determines the formation of each letter in hiragana, as well as each Chinese character. To learn how to write a letter, each of its elements is first learn how to trace in a specific order, which is established by a set of rules. There are three different forms of stroke endings in hiragana as shown in Table 1. They are “hooked”, which is a brief stop followed by a sudden reversal of pen tip movement at the end, “sweep”, which is a fast sweeping motion of the pen tip without direction change, and “stop”,

which is a slowing down to stop the pen tip to end the stroke. Every element in hiragana letters includes one of the three sorts of endings listed above, however the direction varies.

Table 1: Three ways to end a stroke: "hooked", "sweep", and "stop"

hooked	
sweep	
stop	

2.2 Technology / Method Used

Two technologies or methods have been applied in this project. Firstly, there is the VARK model of learning style, which is made of the Visual (V), Aural (A), Read/Write (R), and Kinesthetic (K) components respectively as shown in Figure 1. The learning effectiveness of the learners can be improved by using an excellent style of teaching that is matched to their individual preferences as students. Visual and writing are always necessary components when it comes to learning a language. To recognise and comprehend the structure of a language, the first step for a student is to get familiar with the writing system of that language. While this is going on, the information that corresponds to what is written is provided by the visual. After obtaining this knowledge, it will be processed in the mind, which is a necessary step in the process of becoming fluent in a language. Therefore, a mobile application that is able to give visual and written learning media such as graphics, video, and audio will offer students a unique learning experience that will pique their attention and present them with a unique learning opportunity.

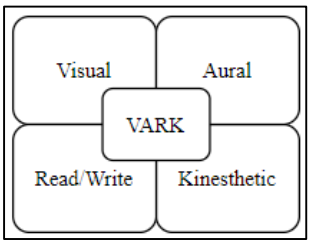


Figure 1: VARK model [7]

Secondly, word tracing approach or writing is sometimes referred to as a "frozen gesture" since it preserves the traces of hand gestures across time. It is generally accepted that one of the characteristics that sets our species apart from others is the ability to write [8]. In addition, unlike skills such as reaching, pointing, walking, or speech, the ability to write by hand does not just develop on its own even if a child is brought up in a normal human environment; rather, it almost always requires a significant amount of social training [9]. It is common knowledge that students spend the majority of their time at school writing by hand. Handwriting is still a crucial developmental skill for a student to learn, despite the prevalence of computers in today's society [10]. The comparative analysis of existing applications and the proposed application are discussed in the next subsection.

2.3 Comparative Analysis

In this section, there are obvious comparisons that can be made to distinguish differences between the existing applications, which are Simple Hiragana [11], Learn Japanese-Hiragana-Romaji [12], and Vocab: Learn Japanese & JLPT [13] with the proposed application, Japanese Diary. The six features are discussed between the existing applications and the proposed application in Table 2. It includes the operating system, module, interface design, alphabet tracing, multimedia elements, and exit pop up.

Table 2: Comparison between existing applications and proposed applications

Features	Simple Hiragana	Learn Japanese-Hiragana-Romaji	Vocab: Learn Japanese & JLPT	Japanese Diary
Operating System	Available for Android version 4.0 and above		Available for Android version 5.0 and above	Available for Android version 4.4 and above
Module	Test, draw and overview module	Katakana and hiragana module	Beginner and expert module	Lesson and quiz module
Interface Design	Not good-looking since did not include graphics			Well design with video and graphics
Alphabet Tracing	Available but there is no distinction between correct and wrong after writing	Not available		Available and have distinction between correct or wrong after writing
Multimedia Elements	Text		Text and audio	Text, graphics, audio and video
Exit Pop Up	Exit only			Exit confirmation

Based on Table 2, the existing applications did not have good-looking interface design and only used a maximum of two multimedia elements. Secondly, the existing applications did not apply an alphabet tracing with the distinction between correct or wrong after writing. Thirdly, the existing applications did not have exit confirmation pop-out. However, the proposed application designed a well-looking interface since it consists of graphics and video. The proposed application also applied various multimedia elements such as text, graphics, audio and video. Moreover, an alphabet tracing will be applied to the proposed application and can distinguish between correct or wrong after writing. Lastly, the proposed application will pop up an exit confirmation when the user clicks the quit button.

3. Methodology

The Multimedia Mobile Content Development (MMCD) refers to a methodological approach that was developed specifically for the process of creating a mobile learning application [14]. Hence, it is selected and applied in this project. Figure 2 shows the 5 stages of the MMCD methodology.

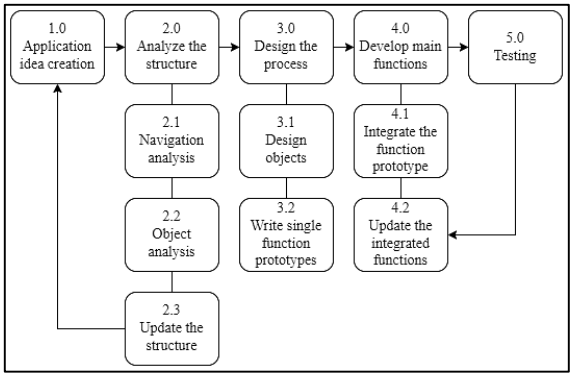


Figure 2: MMCD methodology [14]

3.1 Application Idea Creation

The first stage of the MMCD methodology is the application idea creation. In this stage, the information required before the design and development of the application begins is prepared. The requirements of the users have been determined using two different information gathering approaches. Firstly, an interview was carried out with the Subject Matter Expert, Madam Junko Hiyama, who is a lecturer in the Japanese language at Universiti Tun Hussein Onn Malaysia. The transcript is attached in Appendix A. In addition, a short questionnaire is prepared and distributed to the target users who are students at Universiti Tun Hussein Onn Malaysia (UTHM) aged from 18 to 25 via the Google Form. A total of 40 responses from UTHM students have been collected as attached in Appendix B. To summarize, the majority (95%) of respondents prefer to learn Japanese using a mobile device over other methods, and 60% agree that word tracing technology should be used in the application. The results of user requirement analysis tabulate in Table 3. Table 4 shows the application idea creation checklist.

Table 3: User requirement analysis

Stakeholder Category	Role in product	Design implications	Actions Needed
Subject Matter Expertise (UTHM Japanese lecturer)	Content consultant expert in the related field	Based on the interview, simple user interface design	• Use icon-based buttons instead of text buttons • Used UD Kyokasho font as the standard theme font for Japanese words. • Sizes and shapes of each button are consistent.
		Easy to navigate	• Includes universal navigation buttons that are able to navigate to relative pages.
		Reliable content	• Use the appropriate material provided in the course Japanese Communication 1.
		Multimedia content	• Use graphics, audio and video to attract student's interest.
General User (UTHM student from 18 to 25 years old)	End-user of the proposed application	Based on the questionnaire, the user preferences	• The application should be developed in offline mode which allows users to access it whenever and anywhere they like. • The application should be developed on mobile devices.

Table 4: Application idea creation checklist

Item	Description
Type of Application	Mobile Learning
Target Device	Android-based smartphone
Target Users	UTHM students between 18 and 25 years old
Subject Matter Expert (SME)	Madam Junko Hiyama, Japanese language lecturer of UTHM
GUI (Graphical user interface)	Splash screen, Main Menu, Lesson module, Quiz module

Item	Description
Images	Images of hiragana alphabet, vocabulary, icons and buttons
Video	Self-introduction in Japanese
Audio	Pronunciation of hiragana and sound effects
Application Synopsis	Japanese Diary is a mobile learning application in which university students can learn the fundamentals of Japanese language. The application provided graphics, video and audio to deliver the learning content.

3.2 Analyzed the Structure

The structure of the application to be developed is analysed in the second stage of the MMCD methodology. In this stage, the navigation and object analysis are conducted. The navigational structure and overall flowchart are shown in Figure 3 and Figure 4 respectively. Meanwhile, Appendix B includes the remaining flowcharts for each module. The content structure can be referred to in Appendix C. Functional and non-functional requirements are listed in Table 5 and Table 6.

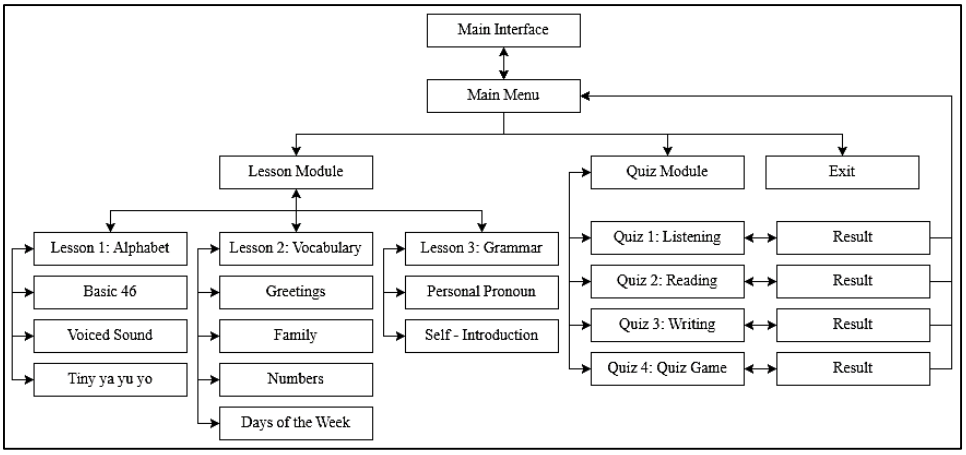


Figure 3: Navigational structure

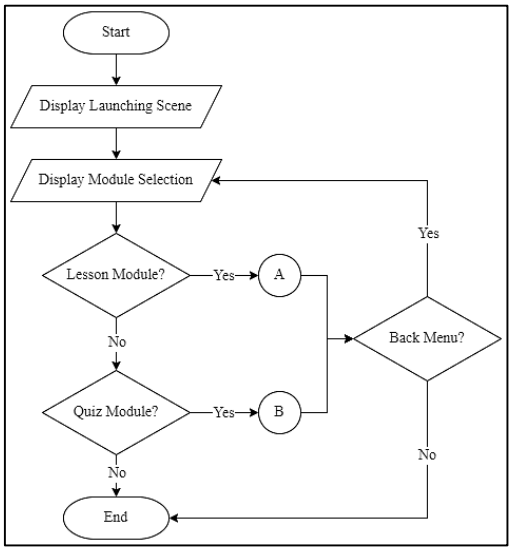


Figure 4: Application overall flowchart

Table 5: Functional requirements

Functional requirement	Description
User interaction support	• The application should allow users to select a module by clicking on the buttons in the main menu. • The application should allow users to exit the system by pressing the exit button. • The application should allow users to navigate throughout the application by using appropriate buttons. • The application should allow users to listen to the pronunciation by pressing the audio button. • The application should allow users to give input by pressing on the answer in the quiz module. • The application should allow users to replay the quiz by pressing the retry button.
Provide learning content	• The application should allow users to learn the Japanese language in level 1 through audio form. • The application should allow users to know how to trace the hiragana words.
Autonomous system activity	• The application should determine whether users selected the correct answer while answering the questions in the quiz module. • The application should determine whether the hiragana word writing is accurate after users trace the alphabet. • The application should calculate the total star collected at the end of the writing.

Table 6: Non-functional requirements

Non-functional requirement	Description
Usability	• The application should be able to access at anytime and anywhere. • The application should be use simple words to deliver learning content
Implementation	• The application should be compatible with an Android mobile device with Android version 4.4 and above.
Performance	• The application should operate completely offline. • The application should be able to load all the modules. • The application should have an average response time between click and reaction shorter than 3 seconds.
Legal	• The application should only allow the user to access the content within it but cannot edit or modify the content.

3.3 Design the Process

Design of the process is the third stage of the MMCD approach. This stage consists of designing objects and the scripting of a single function prototype. The prototype for the alphabet and vocabulary in the Lesson module, and also the listening and quiz game in the Quiz module will be completed at the end of this process. Authoring tools such as Adobe Photoshop, Adobe Illustrator, Adobe Premiere Pro, and Canva are used to create images, video and storyboard in this project. Meanwhile, Unity software is used to compile the assets with scripting. Table 7 shows the button design, while Table 8 shows the interface design.

Table 7: Button design

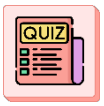
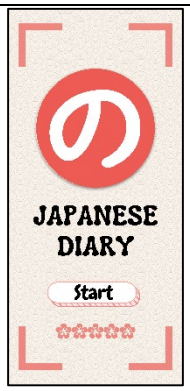
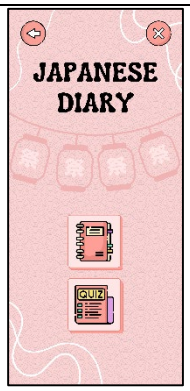
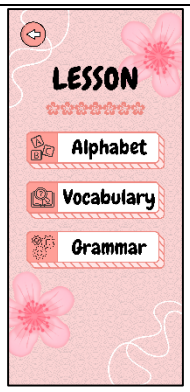
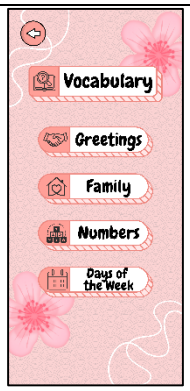
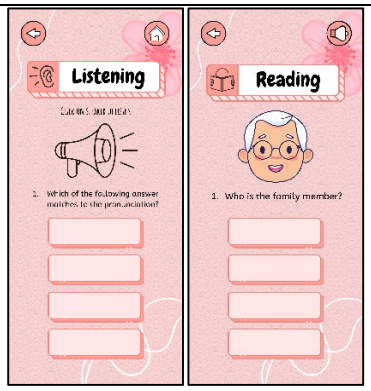
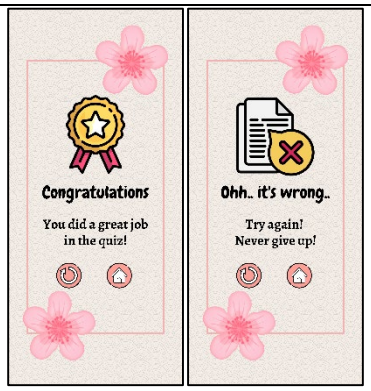
Button	Description	Button	Description
	This is a start button.		This is an answer option button.
	This is a Lesson module button.		This is a Quiz module button.
	This is an Alphabet, Vocabulary, Grammar, Listening, Reading, Writing and Quiz Game buttons.		This is a Hiragana, Greetings, Family, Numbers, Days of the Week, Personal Pronoun and Self-Introduction buttons.
	This is a back button.		This is a next button.
	This is a home button.		This is a retry button.
	This is a sound button.		This is a play button.
	This is a pause button.		This is a stop button.
	This is a menu button.		This is an exit button.
	This is a previous button.		This is a forward button.
	This is a restart button.		This is an eraser button.

Table 8: Interface design

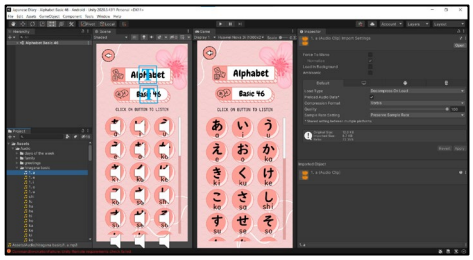
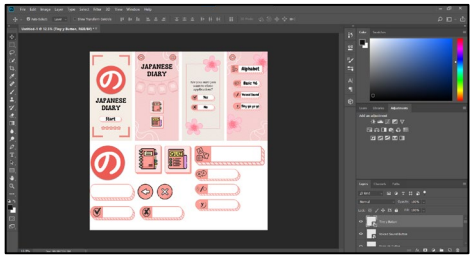
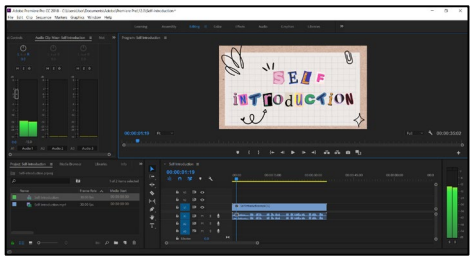
Interfaces	Description	Interfaces	Description
	This is the startup interface of the proposed application. User clicks the start button to go to the module selection interface.		This is the module selection menu that contains four buttons including Lesson, Quiz, back and exit buttons.
	The interface of the Lesson module contains Alphabet, Vocabulary and Grammar buttons.		The interface of the Alphabet section. There are four buttons. Total of 104 hiragana with audio is able to let the user listen to the pronunciation.
	The interface of the Vocabulary section contains four buttons and navigates to each section respectively.		The interface of the Grammar section contains Personal pronoun and a self-introduction video.
			

Interfaces	Description	Interfaces	Description
	This is the Quiz module interface with Listening, Reading, Writing and Quiz Game buttons.		The interface of the Listening and Reading section. Sound button is provided.
	The interface of Writing. There are different colour pencil options, menu and sound buttons. A timer located at the upper left corner to record the star collected for each hiragana writing.		The interface of Quiz Game. There are restart and eraser buttons.
	This is the correct and wrong answer interface in Listening and Reading sections. There are restart and home buttons.		This is the exit interface. There is a yes button to exit and no button to return the module selection interface.

3.4 Develop Main Function

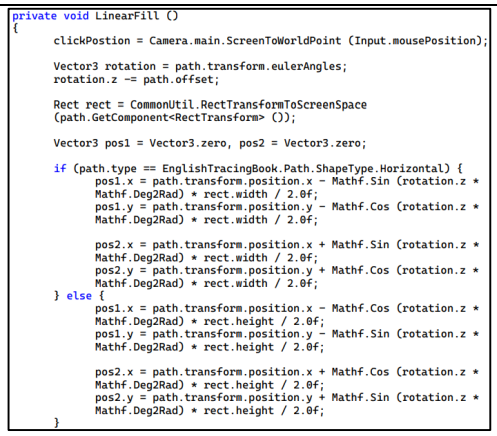
The main functions of the proposed app will be implemented at this phase. The process included creating assets for the app and integrating them into Unity. The application contains three multimedia components. According to Table 9, it includes audio, graphics and video.

Table 9: Application assets development

Assets	Development	Description
Audio		The Japanese Diary application uses the Moving Picture Experts Group Layer-3 Audio (MP3) format for its audio files. It was recorded by Madam Junko Hiyama, who is both a Japanese lecturer at UTHM and a SME for this project. This is necessary to assure proper pronunciation.
Graphic		The Canva website is used for the storyboard's creation. Elements such as buttons, photos, and application icons are exported from designs and integrated into Adobe Photoshop. The tracing path of hiragana in the Writing section was created using Adobe Illustrator.
Video		Adobe PremiumPro was used to create the self-introduction video in Grammar lesson. To execute animation and complete video creation, the content required for video development, such as audio and images, is added to the scene and dragged to the timeline.

In addition, the application's main functions are enabled through new C# scripts. Among these functions is the integration of a game manager and quiz manager. Table 10 explains both of these steps. Meanwhile, Table 11 shows the developed application's interfaces.

Table 10: Integration in Unity

Functions	C# Scripts	Description
Game manager (Writing section)		There is a script named GameManager that handles the Writing section and applies it for each path of hiragana. The horizontal and vertical fill method is implemented with the LinearFill() function. Horizontal fill methods use a left or right fill origin, while vertical fill methods use a top or bottom fill origin.

```
private void LinearFill ()
{
      clickPostion = Camera.main.ScreenToWorldPoint (Input.mousePosition);

      Vector3 rotation = path.transform.eulerAngles;
      rotation.z -= path.offset;

      Rect rect = CommonUtil.RectTransformToScreenSpace
      (path.GetComponent<RectTransform> ());

      Vector3 pos1 = Vector3.zero, pos2 = Vector3.zero;

      if (path.type == EnglishTracingBook.Path.ShapeType.Horizontal) {
            pos1.x = path.transform.position.x - Mathf.Sin (rotation.z *
            Mathf.Deg2Rad) * rect.width / 2.0f;
            pos1.y = path.transform.position.y - Mathf.Cos (rotation.z *
            Mathf.Deg2Rad) * rect.width / 2.0f;

            pos2.x = path.transform.position.x + Mathf.Sin (rotation.z *
            Mathf.Deg2Rad) * rect.width / 2.0f;
            pos2.y = path.transform.position.y + Mathf.Cos (rotation.z *
            Mathf.Deg2Rad) * rect.width / 2.0f;
      } else {
            pos1.x = path.transform.position.x - Mathf.Cos (rotation.z *
            Mathf.Deg2Rad) * rect.height / 2.0f;
            pos1.y = path.transform.position.y - Mathf.Sin (rotation.z *
            Mathf.Deg2Rad) * rect.height / 2.0f;

            pos2.x = path.transform.position.x + Mathf.Cos (rotation.z *
            Mathf.Deg2Rad) * rect.height / 2.0f;
            pos2.y = path.transform.position.y + Mathf.Sin (rotation.z *
            Mathf.Deg2Rad) * rect.height / 2.0f;
      }
```

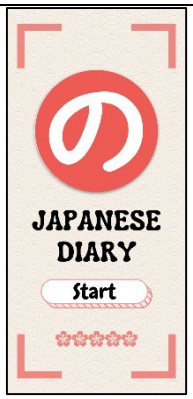
Functions	C# Scripts	Description

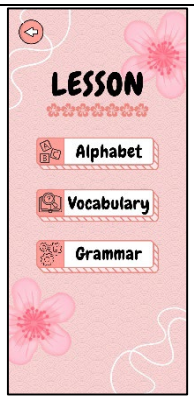
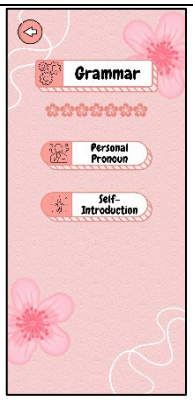
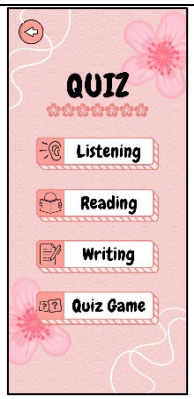
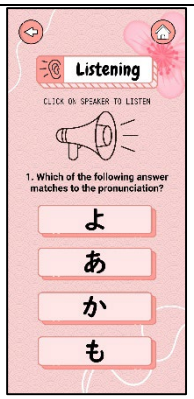
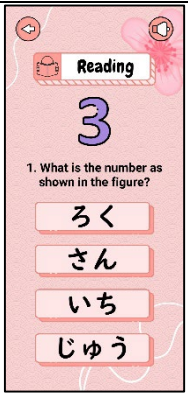
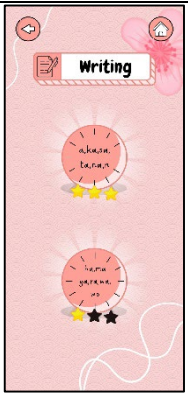
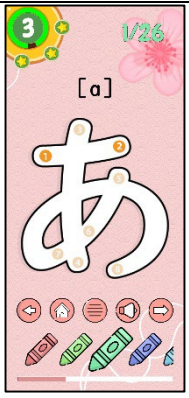
Game manager (Writing section)	`private void RadialFill ()`
	`{`
	`clickPostion = Camera.main.ScreenToWorldPoint (Input.mousePosition);`
	`direction = clickPostion - path.transform.position;`
	`angleOffset = 0;`
	`clockWiseSign = (pathFillImage.fillClockwise ? 1 : -1);`
	`if (pathFillImage.fillOrigin == 0) {`
	`angleOffset = 0;`
	`} else if (pathFillImage.fillOrigin == 1) {`
	`angleOffset = clockWiseSign * 90;`
	`} else if (pathFillImage.fillOrigin == 2) {`
	`angleOffset = -180;`
	`} else if (pathFillImage.fillOrigin == 3) {`
	`angleOffset = -clockWiseSign * 90;`
	`}`
		Furthermore, the RadialFill() function is used to implement the radial 90°, 180°, and 360° fill method. The fill origin starts from bottom, right, top, or left for 180° and 360° while the fill origin starts from bottom left, top left, bottom right or top right for 90°.

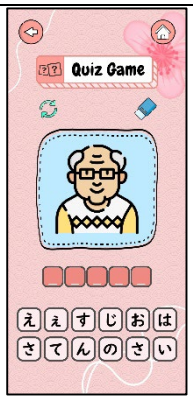
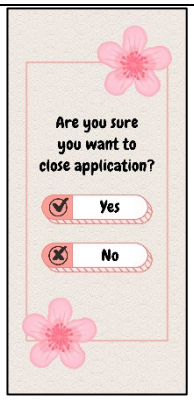
Quiz manager (Quiz Game section)	`void SetQuestion()`
	`{`
	`gameStatus = GameStatus.Playing;`
	`answerWord = questionDataScriptable.questions [currentQuestionIndex].answer;`
	`questionImage.sprite = questionDataScriptable.questions [currentQuestionIndex].questionImage;`
	`ResetQuestion();`
	`selectedWordsIndex.Clear();`
	`Array.Clear(wordsArray, 0, wordsArray.Length);`
	`for (int i = 0; i < answerWord.Length; i++)`
	`{`
	`wordsArray[i] = char.ToUpper(answerWord[i]);`
	`}`
	`for (int j = answerWord.Length; j < wordsArray.Length; j++)`
	`{`
	`wordsArray[j] = (char)UnityEngine.Random.Range(12356, 12438);`
	`}`
	`wordsArray = ShuffleList.ShuffleListItems<char>(wordsArray.ToList()).ToArray();`
	`for (int k = 0; k < optionsWordList.Length; k++)`
	`{`
	`optionsWordList[k].SetWord(wordsArray[k]);`
	`}`
	`}`
		The Quiz Game section is handled by a script named QuizManager. To access the question and answers that have been stored as the scriptable object, the SetQuestion() function must be executed. Two variables 'questionImage' and 'answerWord' will be used to store all questions and its corresponding answer. The question is given in the type of graphics.

	`if (currentAnswerIndex == answerWord.Length)`
	`{`
	`correctAnswer = true;`
	`for (int i = 0; i < answerWord.Length; i++)`
	`{`
	`if (char.ToUpper(answerWord[i]) != char.ToUpper (answerWordList[i].wordValue))`
	`{`
	`correctAnswer = false;`
	`wrongSound.Play();`
	`break;`
	`}`
	`}`
	`if (correctAnswer)`
	`{`
	`Debug.Log("Correct Answer");`
	`correctSound.Play();`
	`gameStatus = GameStatus.Next;`
	`currentQuestionIndex++;`
		It is a code segment for verifying the responses that are entered by the users. Comparisons will be made between the characters that were chosen and those that were found in the answer that was correct. If all character match, the question is answered.

Table 11: Interface of the developed application

Module	Interfaces	Module	Interfaces
Startup interface		Module selection	

Module	Interfaces	Module	Interfaces
Lesson module		Alphabet section	 
Vocabulary section	 	Grammar section	 
Quiz module		Listening section	
Reading section		Writing section	 

Module	Interfaces	Module	Interfaces
Quiz Game section		Quit interface	

3.5 Testing

The application development process is incomplete without the testing phase. The final step of the MMCD process is testing for functionality and user acceptance. If problems are discovered here, work will be moved back to fix the integrated functionality from the previous phase. Table 12 shows the results of the functional testing, and Section 4 describes the user acceptance testing.

Table 12: Functional testing

Test	Expected Result	Actual Result	Correction Action
Back button	Back to the previous interface.	Works well as expected.	Not needed.
Audio button	Play audio clips when clicked.		
Retry button	Retry the quiz.		
Play button	Play video clips when clicked.		
Pause button	Pause video clips when clicked.		
Stop button	Stop video clips when clicked.		
Exit button	Show exit interface when clicked.		
Color pencil	Select pencil options.	The pencil is unable to select.	Two commands were introduced to the code to enable the pencil options animator selection.
Animation	Play the win quiz animation.	The animation does not appear after writing completely.	A script has been added to trigger the "well done" animation after writing hiragana.
Word tracing output result	Display correctness of hiragana strokes.	Some hiragana are unable to trace accurately.	A script is added in Adobe Illustrator to break the stroke properly.

Several errors were found, as shown in Table 12. The EnableSelection and DisableSelection command is implemented to allow the pencil selection in the Writing section of the Quiz module. The WinDialog C# script also fixes the animation issue after hiragana writing. Moreover, the writing path of some hiragana words makes them difficult to trace, so a script is created in Adobe Illustrator to correctly break the stroke. Finally, during the process of developing the project's APK, a problem was encountered in the Gradle file; this was fixed by adding a project keystore to player publishing settings.

4. Results and Discussion

This section presents data and analysis of user acceptance testing. The testing is carried out to see how well the application is received positively by users. In this project, the Technology Acceptance Model (TAM) [15] is adopted and applied. Google Drive was used for distributing the app to its target audience of UTHM students aged 18–25, coupled with a Google Form survey. Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Attribute of Usability (AU), and User Satisfaction (US) are the four items measured by the questionnaire. The survey also uses a 5-point Likert scale, with responses including ‘strongly disagree’, ‘disagree’, ‘neutral’, ‘agree’, and ‘strongly agree’. There was a total of 70 responses and the findings were looked at.

Based on Figure 5(a), an average of 36.08% of respondents agreed that the app was easy to use, and 57.50% strongly agreed. The number of people who said they agreed or strongly agreed makes up to more than half, so the Japanese Diary app can be implemented. Figure 5(b) shows that an average of 34.86% of respondents agreed and 49.14% strongly agreed that the application's information helps Japanese learners. However, 0.29% of respondents strongly disagreed and 2.86% disagreed.

Figure 5(c) shows that an average of 35% of respondents found the Japanese Diary app satisfactory and 55.36% were very satisfied. However, 0.36% disagreed that the Writing section's word tracing feature performed effectively and provided correct feedback. This is because the quality of the user's phone screen and fingerprint can drastically alter the accuracy of word tracing, for example, users may dip their fingers in goop before writing. Figure 5(d) also shows that an average of 34.64% of respondents are satisfied and 53.93% are extremely satisfied with the overall performance of the Japanese Diary app. In conclusion, the Japanese Diary application succeeded in user acceptance testing with positive feedback from the intended users.

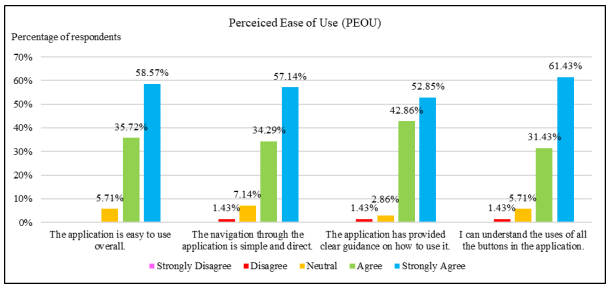


Figure 5(a): Analysis of perceived ease of use

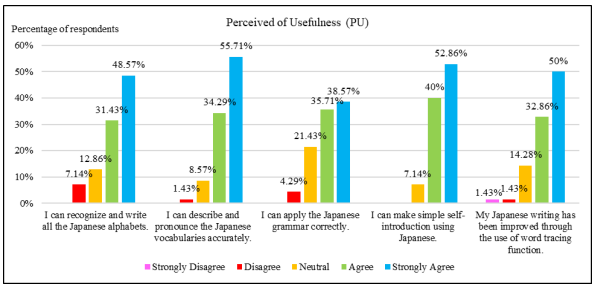


Figure 5(b): Analysis of perceived of usefulness

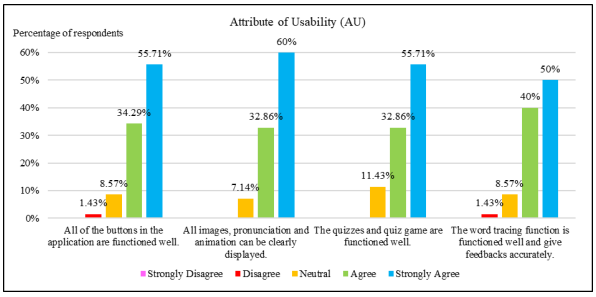


Figure 5(c): Analysis of attribute of usability

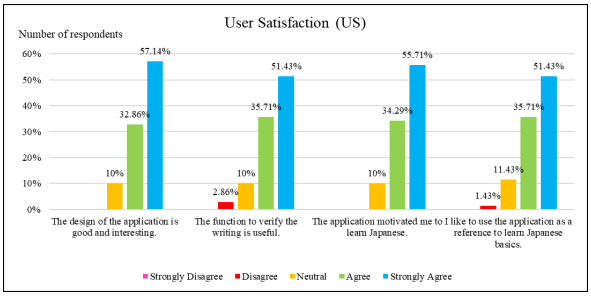


Figure 5(d): Analysis of user satisfaction

5. Conclusion

Based on the analysis of testing results, the Japanese Diary application is appropriate for the target users to learn basic Japanese at the level 1. All three objectives of this project were entirely achieved by incorporating graphics, audio and writing features into the application in order to satisfy the visual, auditory and written learning styles of the VARK system. Secondly, successfully implementing an approach for evaluating the correctness of hiragana writing based on word tracing. After the development phase had been completed, functional and user acceptance testing was conducted. Using the Multimedia Mobile Content Development (MMCD) methodology, this project was completed on schedule. Furthermore, Table 13 outlines the advantages and limitations of the Japanese Diary application. Last but not least, some recommendations were obtained to enhance the application for future work. First, provide additional lessons, such as an introduction to the history of Japanese, and dialogues for various situations, such as those used in restaurants, airports, and other places. Furthermore, katakana words can be introduced to the application to widen users' knowledge of the Japanese language. Additionally, it is suggested that all voiced sound and tiny ya yu yo categories be added to the writing section. Moreover, additional question sets can be introduced to the Quiz module.

Table 13: Advantages and limitations of the Japanese Diary application

Advantages	Limitations
• Provides a comprehensive learning package that includes lessons on Japanese fundamentals and quizzes designed for Japanese beginners	• Only provides Japanese basics such as the hiragana alphabet, four categories of vocabulary and two categories of grammar.
• All Japanese vocabularies and grammar are presented with pictures and audio pronunciations	• No katakana alphabets have been included in the application.
• Provides a section in the Quiz module that allows the user to practise writing hiragana.	• Writing section lacks certain voiced sounds and the tiny ya yu yo categories.
• The unlockable features in the writing section encourage the user to complete all the provided hiragana while also collecting all the stars.	• Only one set of questions provided in the Listening, Reading, and Quiz Game sections. Hence, the questions won't change no matter how many times the user takes it.
• Has a high level of user acceptance because it is simple to use with provided instructions and engaging design.	

Acknowledgment

The authors would like to thank the Faculty of Computer Science and Information Technology, Universiti Tun Hussein Onn Malaysia for its support.

Appendix A

This section presents the transcript of the user analysis for this project mentioned in Section 3.1.

Table 14: Transcript of the user analysis

Mei Hui	:	Good morning, Madam Junko Hiyama. I am Tee Mei Hui from Faculty Computer Science and Information Technology (FSKTM). I am a degree student at UTHM and currently conducting my final year project which is to develop a mobile learning application for Japanese language with word tracing approach. I am here to invite madam to take part in this interview session to help finish this project. Could you please introduce yourself before we begin?
Junko Hiyama	:	Hello, Ohayougozaimasu, you can call me Sensei. I am originally from Japan and am currently teaching UHB10802 Japanese Communication 1 at UTHM.
Mei Hui	:	Yes, Sensei, do you think Japanese Language is one of the popular international language subjects among UTHM students?
Junko Hiyama	:	Yes, I do. They are motivated before beginning to learn the Japanese language, but some students struggle with memorising hiragana and a large vocabulary.
Mei Hui	:	Okay, Sensei, I would like to know whether hiragana is essential for university students to master the Japanese language?
Junko Hiyama	:	Yes, it is a fundamental requirement for a beginner, and students should learn to write and memorise the hiragana.
Mei Hui	:	Is there any method that Sensei used to teach Japanese?
Junko Hiyama	:	Yes, we usually use audios that relate to the images when teaching Japanese to university students. We will also let students write hiragana words in all exams and assignments as a self-guided activity to learn how to form letters correctly by tracing. This is because hiragana writing is not systematic by nature because it has been modified by kanji, and it is not systematic like the Korean letter, which is the hangeul alphabet.
Mei Hui	:	So, Sensei, I am designing the application with the target user between the ages of 18 and 25. In your opinion, what kind of user interface should I apply to the application?
Junko Hiyama	:	I will suggest that the language used in the application for both English and Japanese words is simple and easy to understand for beginners.
Mei Hui	:	Okay. Please allow me to share with you my storyboard, which is the design of the application. Do you have any suggestions for improving the design?
Junko Hiyama	:	Yes, a section for writing with a stylus should be added to the application, and audio can be added for all examples so students can remember and memorise the differences. Also, the finals of the Japanese word focus on hiragana will be enough instead of katakana.
Mei Hui	:	Noted. Sensei, do you think implementing the word tracing approach in the application is effective?
Junko Hiyama	:	Yes, it is a good idea, if you can develop some tools to help university students overcome the difficulty of memorising hiragana and vocabulary, it will be beneficial.
Mei Hui	:	Alright, Sensei, I will try to modify that. Do you have anything else to add?
Junko Hiyama	:	Finally, for hiragana fonts, I recommend the "UD Kyokasho" series.
Mei Hui	:	Okay. That's all from me. Thank you so much for taking the time to assist me.
Junko Hiyama	:	Arigatou, good effort to make the application!

Appendix B

This section shows the results of the questionnaires for user requirement analysis mentioned in Section 3.1 and also Section 3.2's remaining module flowcharts are shown in Figures 7(a) and 7(b).

40 responses are collected from respondents who are UTHM students aged between 18 and 25 years old. The highlighted issues are presented in Figure 6(a) and Figure 6(b).

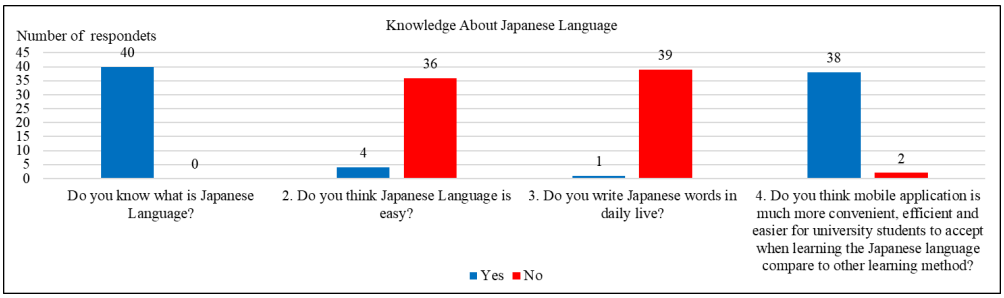


Figure 6(a): Knowledge about Japanese Language analysis

According to Figure 6(a), the knowledge about Japanese Language analysis showed that 40 respondents knew what the Japanese Language is. At the same time, 36 respondents stated that learning Japanese is difficult. Moreover, the majority of respondents, 39 students, did not write Japanese words in their daily lives. Lastly, 38 respondents agreed that mobile applications are far more convenient, efficient, and easier for university students to accept when learning Japanese than other methods.

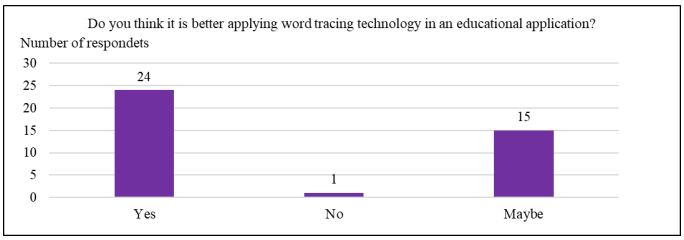


Figure 6(b): Applying word tracing technology

According to the bar chart in Figure 6(b), 24 respondents agreed that word tracing technology is better applied for educational applications. It is followed by 15 respondents who may have agreed with the statement and one who disagreed with the statement.

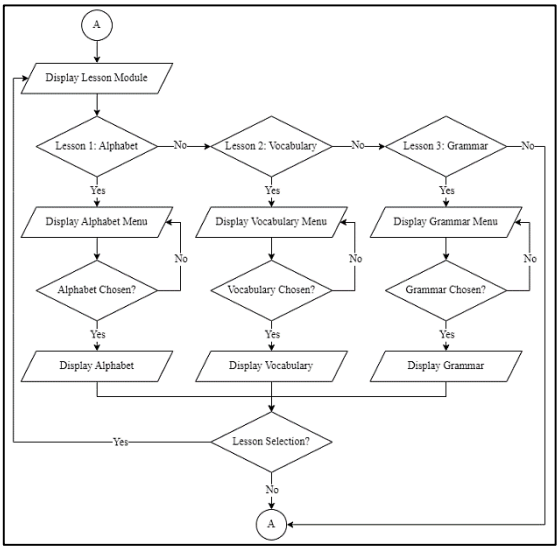


Figure 7(a): Lesson module flowchart

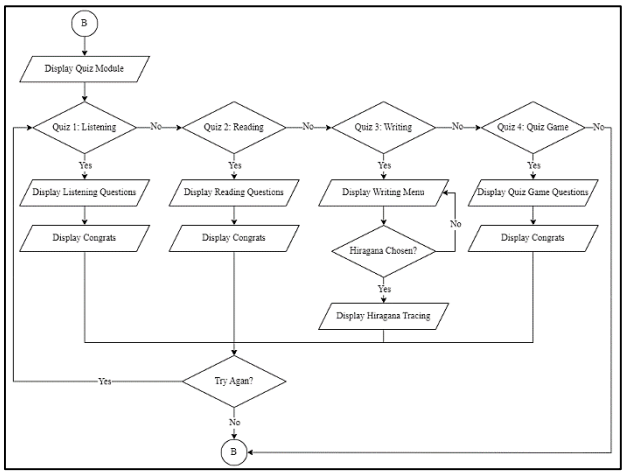


Figure 7(b): Quiz module flowchart

Appendix C

This section presents the content structure mentioned in Section 3.2.

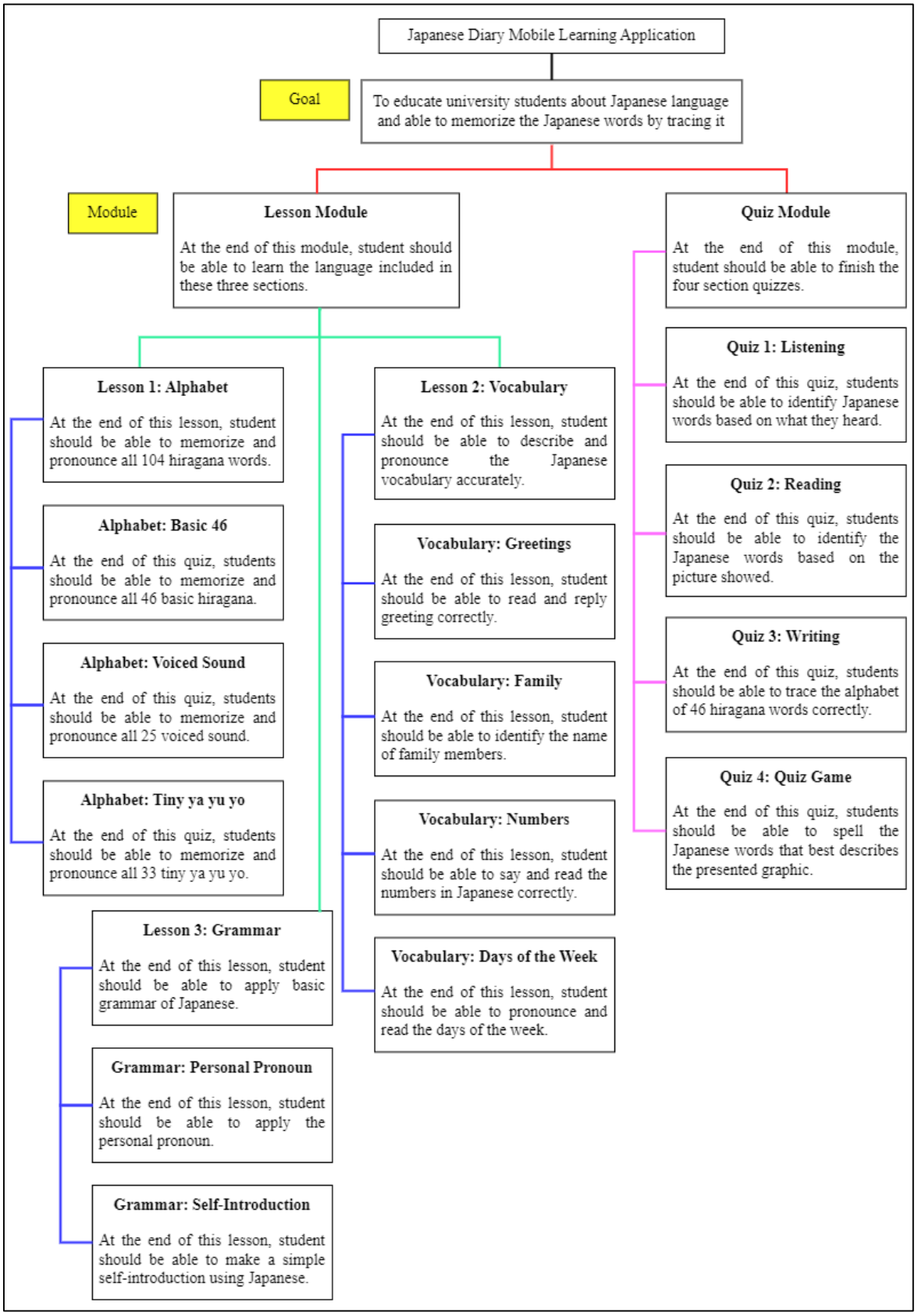


Figure 8: Content structure

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