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Design and Development of the EASY MATH Android Application for Interactive Mathematics Learning

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Abstract

The continuous growth of technology has a great impact on society and in the education field. With the technology, the lecturer can perform various activities to ensure the class session is more interactive and students are able to efficiently acquire knowledge. However, the students in the field of mathematical engineering face great challenges, such as boring class sessions, difficulty deriving mathematical functions, and complex calculations. Therefore, in this research study, the EASY MATH android application is designed, developed, and tested for students and lecturers. Rapid Application Development methodology is implemented to ensure that the development of the EASY MATH application stays on track. With the application, students and lecturers can perform various activities such as playing interactive games, viewing notes, and performing specific tutorials. To ensure the application is running as expected and no logic errors occur, a User Acceptance Test is conducted by selecting about 20 respondents. The result from 20 respondents indicate that EASY MATH is fully functioning and ready to be implemented in real-world environment scenarios. Thus, it can be concluded that EASY MATH is fully functioning and can be used by students and lecturers in understanding and delivering engineering mathematics. In future work, The System Usability Scale and Net Promoter Score are planned for implementation to evaluate the application's usability and user satisfaction towards the EASY MATH functionality and accessibility.

Keywords: - Technology, android application, mathematical engineering, user acceptance test, class

1. Introduction

The continuous growth of technology has a great positive impact on various aspects of society. With technology, people can communicate with each other anywhere and anytime with an internet connection (Wi-Fi, 5G, and 4G) via electronic devices such as smartphones and Personal Computers (PC) (Younes & Al-Zoubi, 2015). According to the (Georgiev, 2022), almost 10 billion mobile devices are being used by all stages of users such as students, lecturers, employers, and employees. With mobile devices, users can perform various activities such as downloading specific applications, sending emails, making phone calls, and making a video call (Zhao et al., 2022).

The advancement of technology and mobile devices also gives a great advantage to educational institutions. This is to ensure the knowledge can be transferred to the students at the fastest rate and effectively (Wekerle, Daumiller, & Kollar, 2022). For example, during the pandemic Covid-19, all educational activity including the class session via face-to-face methods is prohibited to prevent Covid-19 from spreading. Therefore, all class sessions are conducted online with the lecturer by using a specific platform such as Google Classroom and Microsoft Teams (Pratama et al., 2020; Wea & Kuki,

2021). Students are required to download and install the platform mentioned above onto their electronic device. Then the lecturer will share the class ID or class link with the students. Only then, students able to join the specific online class session with their lecturer (Dash et al., 2022).

Engineering mathematics is one of the necessary subjects that engineering students are required to obtain the attributions to graduate (Tossavainen, Rensaa, & Johansson, 2021). According to City (2021) indicates that most students face a lot of difficulty and challenges in learning in all areas of mathematics concepts. According to the authors, one of the reasons of the reason why students face difficulty in learning mathematics is students feel bored in the theorems and difficult to derive the function and differentiate the mathematical formulas. Other than that, a previous study by Kashefi et al., (2012) mentioned that too many concepts/facts, complex calculations, and poor recall of prior knowledge is the reason why students are not interested in engineering mathematics.

Therefore, effective educational interventions need to be developed to help students in engineering mathematics subject (Meyer & Fang, 2018). It is consistent with the previous study by Rohaeti (2019) mentioned that innovative teaching approaches are more effective compared to the conventional teaching method.

In this research study, the mobile application EASY MATH is designed and developed with the aim to make the class session more interactive and more enjoyable. This application can be used by the lecturer and students who enroll in the subject Engineering Mathematics at a specific educational institution. Students can use this application to help them understand each topic in mathematics. The application consists of various activities and functions related to engineering mathematics that able to help student and lecturer in delivering and understanding engineering mathematics.

The rest of this paper is structured as follows: Section 2 describes the literature review, which includes a comparison of the existing mobile application in the education field based on the recent study within the last 5 years; Section 3 discusses the methodology used in this research study to design, develop and test the mobile apps EASY MATH; Section 4 explain about the implementation of the mobile apps; Section 5 explain about the EASY MATH implementation and testing and section 6 concludes this research study.

2. Literature Review

Many researchers have done their research study to design and develop a mobile application in the education field. For example, a previous study by Jahan et al., (2021) develop an android application called North South University Grade Tracker (NSUGT). NSUGT acts as a tool for the students to track their studies activities and make them more organized. NSUGT also consists of features that implement machine learning to give students a recommended subject for the next semester.

Other than that, Song (2020) developed an android mobile learning system for Ideological and political education. This application was created with the aim to help students study anywhere and anytime related to ideological and political education. This application also makes learning more effective through the combination of intelligent education and mobile learning.

Besides that, Huaynacho and Huaynacho (2020) develop a mobile application for Laboratory Instruction Management. With the application the professor and students can control the management of laboratory instruction effectively.

However, there has no specific android mobile application developed for the subject of engineering mathematics for students in educational institutions. Therefore, this research study will develop a mobile application EASY MATH with the objective to make the teaching and learning lessons more interactive among students and lecturers.

3. Methodology

The methodology can be defined as the systematic, theoretical analysis of the method used to develop, design, validate and maintain a system (Rahman, 2022). In this research study, Rapid Application Development (RAD) is adopted for the development of the mobile application EASY MATH. This is to ensure the application development is on track and can be finished according to the specific time given. RAD consists of 4 stages which are Requirement Planning Phase, User Design Phase, Construction Phase, and Cut-Over Phase as shown in Fig. 1 (Qodim, Busro, & Rahim, 2019).

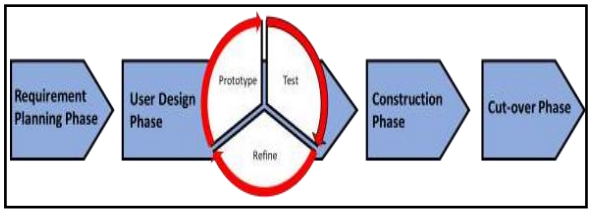

Fig. 1. Rapid Application Development

3.1 Requirement Planning Phase

In this phase, the researcher conducts a comprehensive research study to collect any related data to the mobile application in the education field. This is to identify the strength and weaknesses of the existing research study and collect any useful information that can be used in the next phase.

3.2 User Design Phase

In this phase, a prototype for EASY MATH is designed based on the requirement collected in the previous phase. The prototype of the EASY MATH application is designed using specific tools in order to demonstrate how the application should be functioning. It

should be noted that this phase will be repeated until the prototype application flow of the process is fully designed based on the requirement from the previous phase.

3.3 Construction Phase

In this phase, the EASY MATH application is developed by using a Thunkable platform. Thunkable is a platform that allows the user to develop an application without writing a single line of source code. Thunkable can be accessed by using any web browser (url: https://thunkable.com/) and any user with or without basic programming language can use this platform to develop a mobile application. Thunkable is a free and user application can be developed by simply drag and drop components of code and connecting them in blocks (Siegle, 2020).

Besides that, the Graphical User Interface (GUI) is implemented to allow the interaction between the user and the developed EASY MATH application. Other than that, a use case diagram and flow chart are also used to indicate the EASY MATH application flow of process and how the learning process is conducted among students and lecturers.

3.4 Cut-over Phase

In this phase, after the EASY MATH application is fully developed in the previous phase, testing method is implemented. This is to test and validate all the EASY MATH functionality in order to prevent any bug and error. User Acceptence Test (UAT) is used in order to ensure that all the EASY MATH application functionality is functioning as expected. Previous study by Samonte et al., (2018) and Halimah et al., (2010) implemented UAT by selecting between 10 to 15 users to verify all the developed application functionality. According to the authors, the selected user must be among the user who will use the system in the future. Other than that, the selected user must have general knowledge and information about the developed application so that the UAT can be performed more effectively.

4. Application Design and Development

To design and develop an EASY MATH mobile application, application architecture and application design are implemented to demonstrate the application flow of the process. The application architecture is the conceptual modal that represents the flow process of the proposed android application. While the system design is the process of defining the application architecture of the EASY MATH mobile application.

4.1 Application Architecture

EASY MATH consists of two components which are user, teaching, and learning. Fig. 2 illustrates the application architecture of EASY MATH.

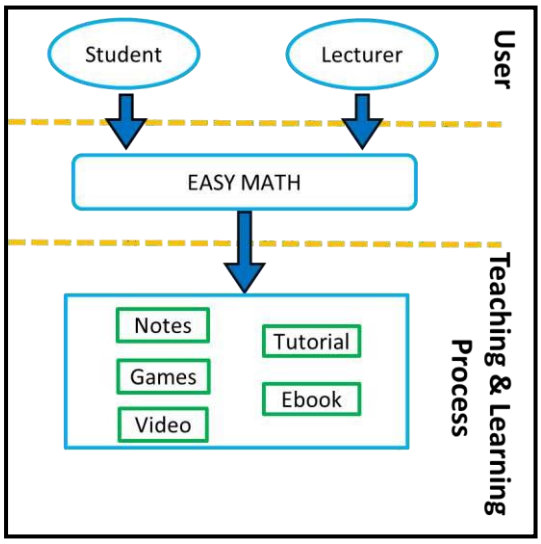

Fig. 2. EASY MATH application architecture

a) User

IPSS can be used by two types of users which is student and lecturer. Each user required to enter an email with the password for the authentication process before able to use all the functions available in the EASY MATH application.

b) Learning Process

This component refers to the function that available and can be used by the lecturer and student. EASY MATH consists of five functions for learning and teaching session which is Notes, Games, Video, Tutorial, and eBook. Therefore, students or lecturers can choose any function for interactive learning and teaching purposes.

4.2 Application Design

To demonstrate the flow of process for EASY MATH, use case diagram and flowchart is implemented. Fig. 3 illustrates the use case diagram to describe the user activity when using the EASY MATH application. Based on Fig. 3, after students and lecturers successfully log in to the EASY MATH application, they can follow various activities such as view notes, playing interactive games, playing videos, viewing eBook, and viewing tutorials/exercises.

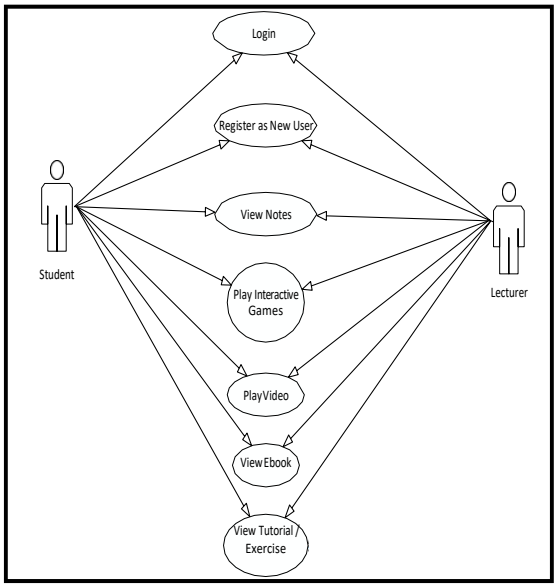

Fig. 3. EASY MATH use case diagram

Fig. 4 demonstrates the flow of the process to gain access to the EASY MATH application. Student and lecturer are required to enter their email and password and then the application will perform the validation process to check whether the user exists in the specific database. If the user credential exists in the database only then the user can log in to the application and access all the functionality provided.

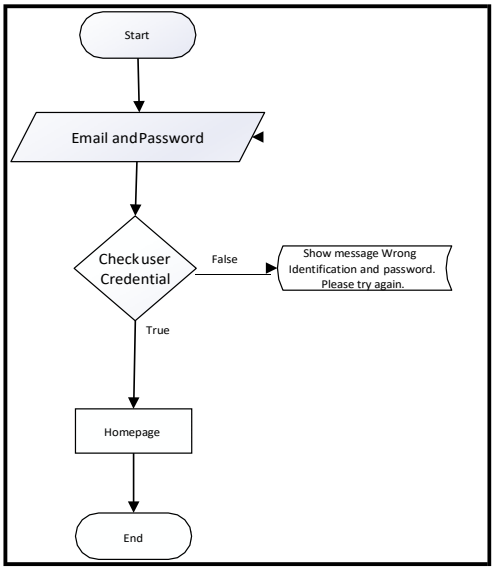

Fig. 4. EASY MATH login flowchart

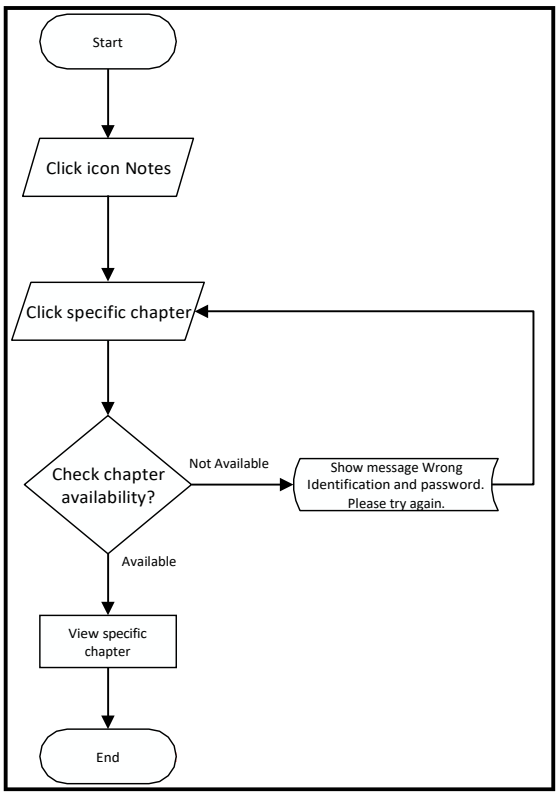

Fig. 5. Select and view specific chapter note flowchart

Fig. 5 shows the flowchart for selecting and viewing specific chapters in the EASY MATH application. Students and lecturers can view specific chapter notes by clicking the icon Notes and then clicking the desired chapter. If the selected chapter file is available only then it will display on the student and lecturer mobile phone. If the selected chapter is unavailable, then the error message is displayed, and the student and lecturer are required to select another chapter.

5. Application Implementation and Testing Result

5.1 EASY MATH Graphical User Interface (GUI)

Graphical User Interface (GUI) is the user interface that allows users (students and lecturers) to interact with the EASY MATH application. Users can perform various activities such as log in, viewing a specific chapter, playing a video, and performing specific tutorials.

Fig. 5 illustrates the GUI for user login to authenticate user credential before can use the EASY MATH functionality. Users are required to enter a registered email with a password then EASY MATH will perform the authentication process. If the authentication process is successful only then EASY MATH will redirect the user to the landing homepage as shown in Fig. 6.

Fig. 5. User login page GUI

Fig. 6. User landing page GUI

Fig. 6 demonstrates the user homepage after successful login to the EASY MATH. Based on Fig. 6, users can select/click various EASY MATH activities such as viewing notes, playing interactive games, playing videos, viewing eBook, and performing tutorials.

For example, if the user clicks notes and user required to select a specific chapter. Then if the chapter file is available only then the EASY MATH application will display the selected chapter (refer to Fig. 5).

5.2 EASY MATH User Acceptance Test (UAT)

After the EASY MATH application is fully designed and developed, User Acceptance Test (UAT) is implemented at the final stage with the aim to ensure the application is fully functioning and satisfy the need of the specific user (Afrianto et al., 2021). In this research study, 20 users are selected among the lecturers and students to test and validate all the EASY MATH functionality.

UAT sessions are conducted at a specific place and each user is required to install EASY MATH through their android electronic device. The UAT session was led by one presenter and one facilitator. User acceptance forms are distributed to each user and users are required to perform each activity available in the EASY MATH. After each user performs all activities, the user is required to fill up the form and tick whether each activity is running as expected or not.

Upon completing the UAT, the results from the testing were gathered. The results were then analyzed to determine the user's expectation towards the EASY MATH functionality. The results collected are presented as shown in Fig. 7.

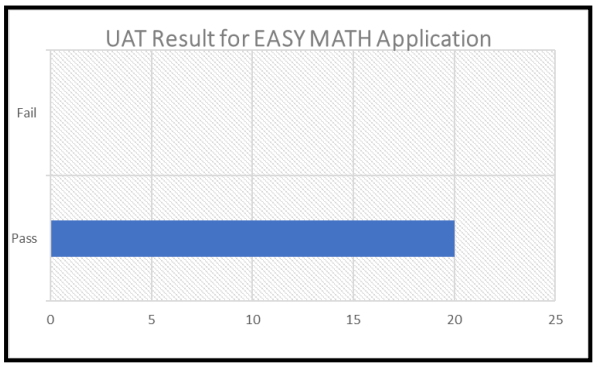

Fig. 7. UAT result for EASY MATH application

Based on Fig. 7, it can be concluded that the EASY MATH has successfully passed the UAT test. The selected users have tested and validated all the EASY MATH functionality and the result indicates that the application is running as expected and no error occurs during the UAT session. Other than that, users also agree that the EASY MATH application can help facilitate the teaching and learning lessons among the students and the lecturer.

6. Conclusion

An android mobile application EASY MATH has been designed, developed, and validated in this study. The Thunkable platform is implemented to develop the EASY MATH user interface and functionality. To ensure all EASY MATH functionality is working as expected and no logic error occurs, User Acceptance Test (UAT) is used. 20 users among the lecturer and students were selected randomly to perform the UAT session. UAT session is conducted at a specific place with the help of the presenter and facilitator.

The result from UAT session indicates that all users agree that EASY MATH are fully functioning, and no errors are recorded during the UAT sessions. Therefore, it can be concluded that EASY MATH is fully functioning and ready to be used in the large-scale scenario.

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