Designing Android User Interface for University Mobile Library

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***Abstract*—Nowadays, university library management system is rapidly developed. One of the digital system applications is through Android mobile application. Based on these facts, university library enhances the development and intensify library flexibility through the features provided. This study proposes a user interface design system according to the users' needs and measure the ease of use and usability of mobile library application. The user interface has been tested using usability evaluation to ensure the usability and ease of use of the library university for all group of people. Generally, the usability testing evaluation showed satisfying result. In addition, based on the gender and faculty parameter analysis of variance, the data are not statistically significant because of the overlapping error in several factors of the test.**

Keywords— Android, Library Management System, User Interface Evaluation, Mobile Library

I. INTRODUCTION

In university, library is a place where the facility of resources to support educational process without any borrowing charge are provided for every students, staffs, and lecturers. [1] In recent years, mobile library is rapidly developed to ease the users using the library system and follow the development of technology. Most of them are using Android platform because it has been more popular than any other platform since it holds more numbers of users. Android platform is also an open source by Google which ease the developer to modify and create their project based on their needs. Its operating system is created along with the Google Play Store feature which enable the developer to distribute the application to be used by the user which is relatable and convenient with the needs of mobile library application. [2]

Most of the library university has rapidly developed digital system to intensify library flexibility and reduce the effort of maintain the daily management system. [1] This research was concerning to enhance and improve the library facilities and functionality by understand the user needs through the features provided in the mobile library application. Furthermore, the application will allow people in the university circumstances explore different collections and reduce time while looking at the collections and having interaction with the librarian.

To support the library facilities, we propose a user interface design of mobile library according to the users' needs and measure the ease of use and usability of mobile library application. Thus, more quality and functionality service provided for user. The aim of the study is to understand user interface elements of a mobile application that affects user experience based on the user needs. The prototype version is developed to evaluate the user experience towards the system.

II. LITERATURE REVIEW

A. Library in University

Historically, library is aimed and design for all people from different community. By the time, development and growth of university library is change according to the needs from visitor. Nowadays, library not only provide physical books but also audio and visual media as it is now become a digital library. Moreover, university library holds important part to supports education and research. [4] Leading role of university library is supporting every research under university curricula which provide learning resource and tools to fulfil information services for personal or community needs. Indirectly, university achievements are influenced by the library current situation and administrative since it is an important department. [5]

Library university concept explained above has already implemented which aimed to support academic process and research activity for all people involved in this university. Its existence is providing variety of resources collection including books, academic database journals, online case, and financial data. Other facilities are a discussion room available to use by the students and lecturers as a study area. Moreover, a digital concept by using website and self-borrowing system in physical library is implementing to keep update and relevant with nowadays technology. [6]

B. Mobile based Library System

There are several studies of mobile library development that has been published before. Those are Blue-Droid and VESIT. Through the developed system, people are helped to do library activity such as exploring library collections including journal and books and reissuing the borrowed book which supported by SQL database and encryption algorithm. [7] [8] In order to evaluate the conceptual model and examine the data using technology acceptance model and least partial least square to measure the user attention and attitude. [9]

Furthermore, an evaluation towards the user interface design was conducted to test the interaction and navigation through several use cases related to the features provided. [10] The user interface also tested to evaluate the attractive aesthetical design towards the mobile application development. [11] This study implements several techniques for developing mobile application. The user interface design and features provided becoming the main attraction for the user to use the application. This study is focus on evaluation testing for the user interface design based on the usability, design mapping and accessibility of the mobile application.

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TABLE I. SOME RELATED STUDIES

Author	Problem or Purpose of Study	Methodology and Findings	Remark
Bhattacharya, 2014	The manual system of library takes a lot of time for looking a single book.	Using SQLite as database, encryption-decryption algorithm, and dataflow diagram. The system developed with cost efficiently.	The system needs to be tested and can be increased with several capabilities performances.
A. Lalwani, C. Bhure and P. R. L, 2017	Provide a platform to explore books, journals, and reduce time consuming to reissuing book	An Android application with SQL database server 2000 to help the student view all library collections	The system will be unavailable when the library is closed.
H.-Y. Yoon, 2016	Applied TAM in mobile library apps for academic libraries to measure affect user attitude and intention	Technology acceptance model and partial least squares to assess the conceptual model and examine the data.	The system should consider satisfaction and perceived usefulness to promote mobile library services' usage.
A. C. d. Barros, R. Leitao and J. Ribeiro, 2014	Design and usability evaluation focused on interaction and navigation	Procedure and finding of usability testing with several use cases related to the design, navigation, and visual design.	The evaluation should describe the user experience within the preferable context.
C. Y. Wong, C. W. Khong and K. Chu, 2012	Practice and education of user centred interface design towards mobile application development	UI design process model implemented in the institute to get attractive aesthetical visual	The conceptual wireframe should be clearer

III. METHODOLOGY

Generally, the development processes are based on the design interactive system evaluation phase. Those elements are as it is shown in fig.1.

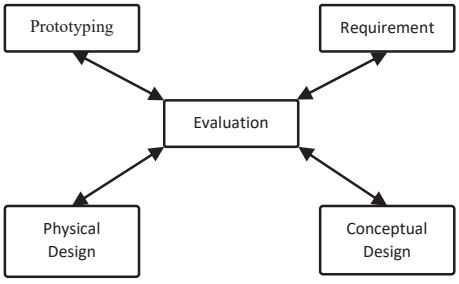

Fig. 1. Evaluation elements

A. Development Process

The mobile application development built based on the design that was made to fulfil users' suggestions and based on the previous existing system features. The development will be considered as final system if it has satisfied users in the system evaluation and testing. This study is developed using a systematic approach of design interactive system including system specification (requirement and system analysis), user interface design, implementation and unit testing. [8]

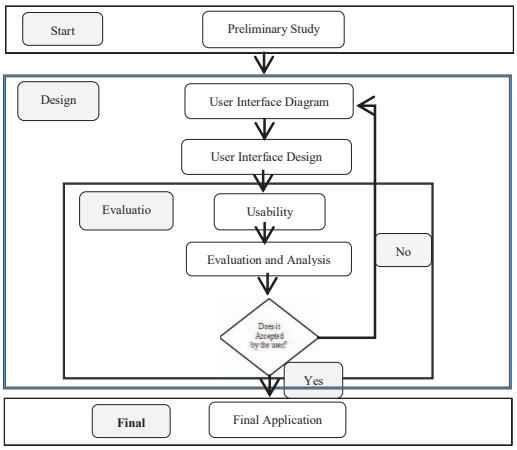

Fig. 2. Development Process Diagram

B. Data collection Technique

The library mobile application has been testing to ensure that the user interface design is usable, accessible and easy to use for every group of people. By using questionnaires, user performs the scenarios and answer the questions given.

The questions were divided into four parts [13]:

1) User background (gender, cohort, place of origin, and age)
2) System usability (use of terms, character reading, clearness and organization of information given)
3) Design mapping (usage of icon, white space functionality, and font)
4) User satisfaction (ease of use, accessibility, and users' recommendation)

IV. USER INTERFACE DESIGN

A. Preliminary Study

TABLE II. PRELIMINARY STUDIES QUESTIONS

Questions
What is your faculty?
What is your gender
What is your cohort?
What is your origin?
What is your age?
How long have you been familiar with mobile application?
Do you agree if university library has Android Mobile Application?
Will you use the apps if we have Android mobile application for the library system?
Do you think mobile application for university library will be beneficial?
What is the most important feature of the Application that make you want to use it?

Preliminary study was conducted using questionnaire to 72 students in the university with the detail question listed in Table II. In this paper, we define user interface according to two factors. First, conducting a preliminary study to understand and investigate the user requirement before creating the system. Second, by combining the feature in the previous system exist in the website. The preliminary study has been conducted to university students from three different faculties. An online questionnaire that consist of 10 questions has distributed and 72 valid responses had been collected. Female respondent dominates the population with total percentage of 56.94% and the rest is male with 43.06% who are mostly aged at 21 years old and have been familiar with mobile application for more than 5 years.

Not only agree about the existence of Android mobile library application, 93.06% also willing to use the system because based on the survey, the system is beneficial for the students. In addition, there are several suggestions of features are chosen such as 86.11% for online borrowing book, 75% for extend borrowing books duration and 70% for online search catalogue as it is shown in Figure 3. As a conclusion from preliminary survey, there are three features that suggested the most by the respondents with percentage more than 70%, including online borrowing book, online catalogue search, and extend duration for borrowing book.

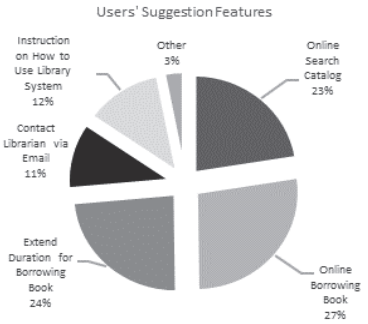

Fig. 3. Users' Suggestion Features

B. Features

According to the preliminary research and the previous existing system. The previous system's features are show the detail book loan of the system, read and download journal, and call librarian. By these facts, the unification of the features will be as follows

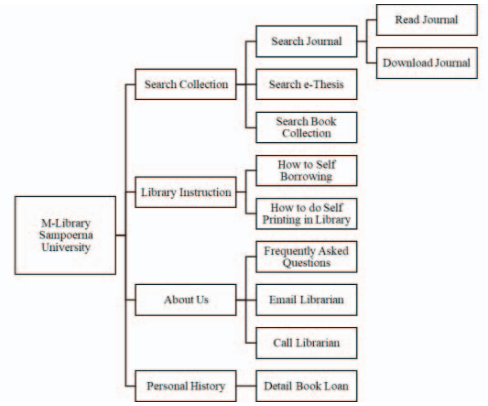

Fig. 4. Mobile Library Features

C. User Interface Diagram

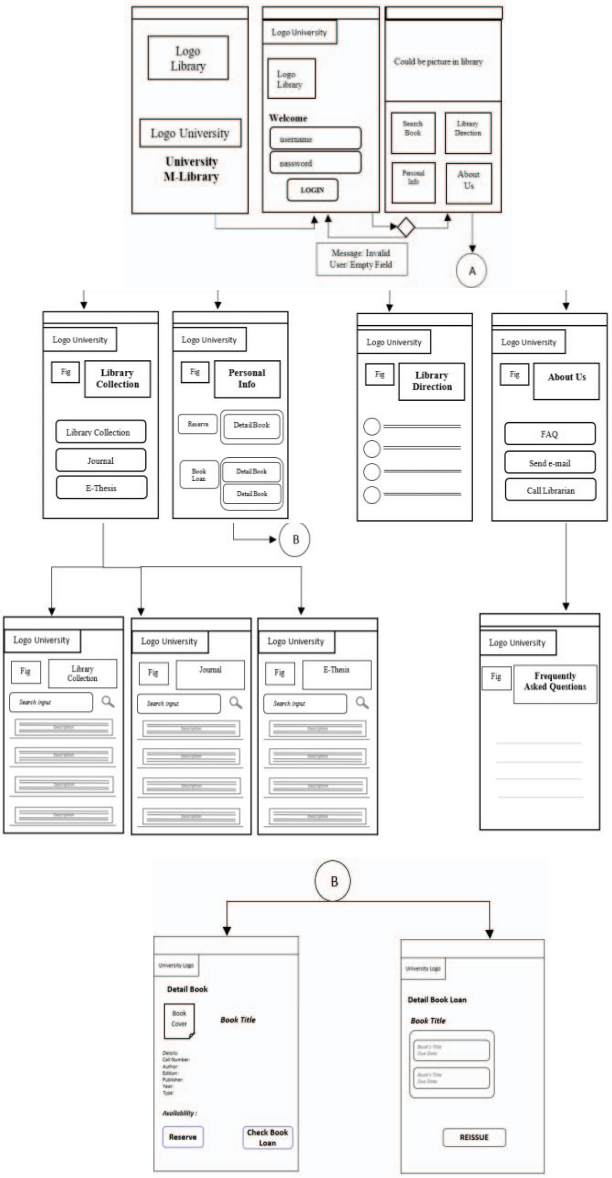

Fig. 5. Users' Suggestion Features

User interface diagram consist of thirteen screen and each of the screen define one or more feature as it is defined in fig.5. The user interface concept is interactive and simple use mapping. In main menu, there are four menu that will direct the to each detail. Furthermore, the screens are designed with minimum words to provide a user-friendly interface while using the application. Based on the diagram on Fig. 5, a low fidelity prototype is developed to be tested and evaluate with the user.

V. User Interface Design Prototype Evaluation

TABLE III. Number of Participants

Total	Gender		Faculty		
	Female	Male	A	B	C
30	15	15	9	18	3

The result from questionnaires are as there were thirty participants involved in this user interface design prototype testing with segmentations are based gender and faculty

A. Usability Evaluation Result

TABLE IV. SUMMARY OF USABILITY EVALUATION

	Gen.	Gender		Faculty		
		Female	Male	A	B	C
Use of terms	4.17	4.33	4	4	4.33	4.22
Screen's character reading	3.97	4.13	3.8	3.78	4.33	4
Prompts for input	3.97	4.07	3.87	3.78	4	4.06
Clearness of information	3.93	4.07	3.8	3.78	4	4
Information are well organized	4.07	4.2	3.93	4	4	4.11
Easiness to find the information	4.03	4.2	3.87	3.67	4.67	4.11

From the summary data of usability in Table IV and the usability evaluation data on Table V, an analysis using ANOVA can be conducted to investigate the confidential using gender and faculty as the parameter. The data evaluation result is not statistically significant with p-values more than 0.05 and the F value is less than the critical value. It implies that gender and faculty does not give impact to the system usability.

TABLE V. DATA ANALYSIS USING ANOVA

Source of Variation	*SS*	*df*	*F*	*P-value*	*Critical value*
Based on gender and faculty	0.0017	1	1.0581	0.3508	6.6079
Error	0.0082	5			
Total	0.0933	11			

B. Design Mapping Evaluation

TABLE VI. SUMMARY OF DESIGN MAPPING EVALUATION

	General	Gender		Faculty		
		Female	Male	A	B	C
Icon represent features	3.97	4.13	3.8	3.89	4.33	3.94
Mapping has too much white space	3.8	3.73	3.867	3.67	4.33	3.78
Functional font and white space	3.77	3.8	3.733	3.89	3.67	3.72

TABLE VII. DATA ANALYSIS USING ANOVA

Source of Variation	*SS*	*df*	*F*	*P-value*	*Critical Value*
Based on gender and faculty	0.007188	1	3.04443	0.223133	18.51282
Error	0.004722	2			

From the summary data of design mapping in Table VI and the design mapping evaluation data on Table VII, an analysis using ANOVA can be conducted to investigate the confidential using gender and faculty as the parameter. The data are not statistically significant with p-values more than 0.05 and the F value is less than the critical value. It implies that gender and faculty does not give impact to the design mapping of the system.

C. User Satisfaction Evaluation

TABLE VIII. SUMMARY OF USER SATISFACTION EVALUATION

	Gen.	Gender		Faculty		
		Female	Male	A	B	C
I would recommend it to a friend	3.83	4.07	3.6	3.56	3.33	4.06
Overall, I am satisfied with it	3.87	4	3.73	3.78	3.67	3.94
The system is accessible for all group of people	3.87	4.07	3.67	3.44	3.67	4.11

From the summary data on Table VIII user satisfaction evaluation data on Table IX, an analysis using ANOVA can be conducted to investigate the confidential using gender and faculty as the parameter. The data evaluation result is not statistically significant with p-values more than 0.05 and the F value is less than the critical value. It implies that gender and faculty does not give impact to the user satisfaction towards the system.

TABLE IX. DATA ANALYSIS USING ANOVA

Source of Variation	*SS*	*df*	*F*	*P-value*	*Critical value*
Based on gender and faculty	0.024278	1	14.68	0.0619	18.513
Error	0.003307	2			
Total	0.036191	5			

D. Data Analysis

Based on the ANOVA two factor test, gender and faculty, the data is not statistically significantly since the p-value is greater than the $\alpha = 0.05$ and F value is not in the range of critical value. These conditions are affected by the overlapping standard error more than 5% in several different elements, both on gender and faculty.

1) *Usability*

The overlapping happened on the 'prompt for input' and 'information is well organized' elements on gender, and all the elements on faculty contribute overlapping standard error more than 5%.

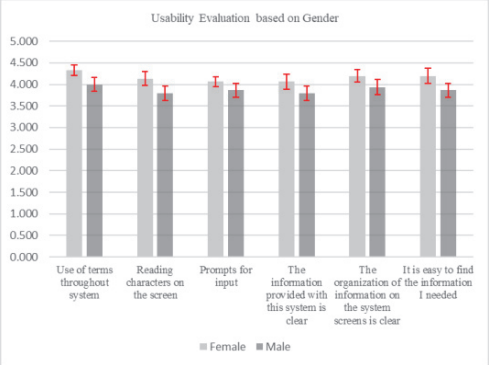

Fig. 6. Usability Evaluation based on Gender

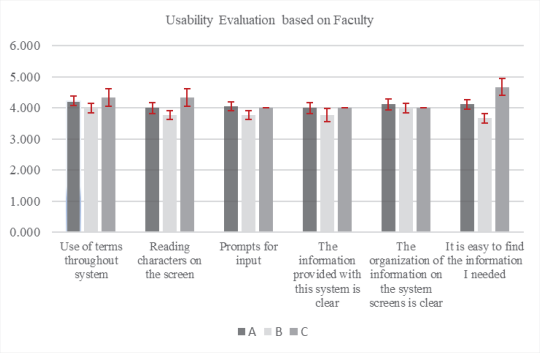

Fig. 7. Usability Testing based on Faculty

2) *Design Mapping*

The overlapping happened on the 'font, space, and the use of white space is functional' element on gender and faculty which contribute overlapping standard error more than 5%.

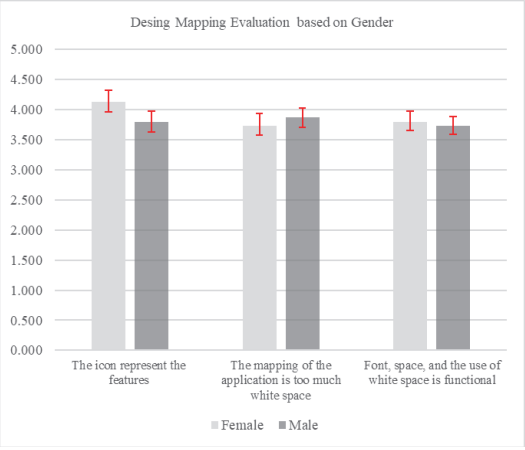

Fig. 8. Design Mapping Evaluation based on Gender

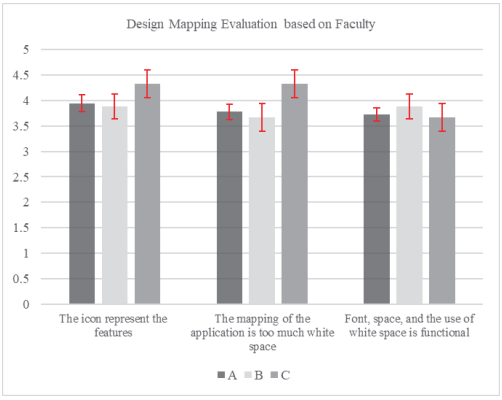

Fig. 9. Design Mapping Evaluation based on Faculty

3) *User Satisfaction*

The overlapping happened on all element on faculty which contribute overlapping standard error more than 5%.

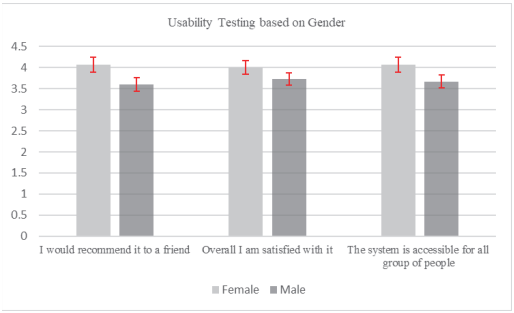

Fig. 10. User Satisfaction Evaluation based on Gender

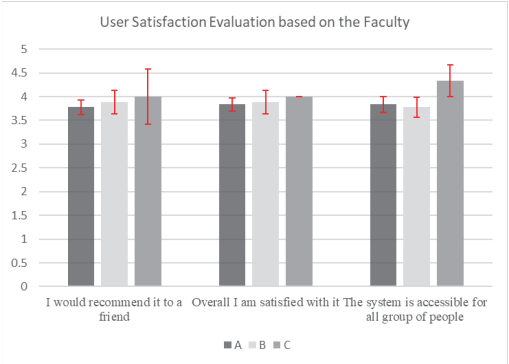

Fig. 11. User Satisfaction Evaluation based on Faculty

VI. CONCLUSION

In this study, user interface has been designed for library university. The system providing several features suggested from preliminary study and previous existing system that ease the user to interact with the library system. It allows the user to explore library collection, interact with the librarian, borrow and renew the book loan, and looking at their own personal history. The usability evaluation towards the

system has already done by looking at the usability, design mapping and user satisfaction. As a result, the analysis of variance result is not statistically significant according to gender and faculty as the parameter because of the overlapping error more than 0.05 on several elements. It implies that gender and faculty does not give impact on the usability system, design mapping and user satisfaction of the system.

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