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# The Development of a Rental Equipment Mobile Application for UiTM Shah Alam Malay and Bumiputera Students (Rent2U)

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### ABSTRACT

This project is regarding the development of a mobile application for rental equipment for UiTM Shah Alam Malay and Bumiputera students. The reason for the development of this project is to help the Malay and Bumiputera students to rent items and equipment they needed. Based on the previous study, most students in UiTM Shah Alam are those who have financial problems and came from a low-income family or household, known as B40. Therefore, this mobile application for rental equipment would be able to solve problems such as the inability in buying new items and belongings (or equipment). In some cases, students are required to have specific items to attend a one-time event without overspending and are unable to explore new hobbies due to financial limitations. As such, this project aims to develop an Android-based mobile application called Rent2U that can help UiTM Shah Alam students, especially those who come from a B40 family to rent items, and equipment they needed. The objectives of this project are to identify the requirements, to design and develop the equipment rental mobile applications for UiTM Shah Alam students. The chosen methodology for the development of this mobile application is Mobile Application Development Lifecycle (MADLC) and covered up until the testing phase only. The outcome of this project is the mobile application for rental equipment, which has features like geolocation to find nearby items and equipment for rentals, a search function to find items and equipment and push notifications to alert the users about the listings that have been created by them for rental. Hence, the significance of this project is that it can help the students in need to rent and lend items and equipment by providing them a platform to lend their belongings, and at the same time be able to rent items and equipment they like or need. For future enhancements, this application may include a variety of options for the users to pay such as online banking, and credit card, among others. In addition, this application may also include goods and equipment verification to avoid renting any dangerous items.

## 1. Introduction

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Universiti Teknologi MARA (UiTM) is one of the public universities in Malaysia that has almost 100% of Malay and Bumiputera students. The purpose of this university establishment is to help Bumiputera and Malay populations who are poor, and unable to pursue higher education. Generally speaking, most students in UiTM were from a low-income of family background. Looking at this scenario, an application named Rent2U has been developed to reduce the burden of the students from buying any equipment or products they need, to renting them by using this mobile application. Indirectly, this will encourage the students to spend wisely and consciously on important equipment. Another crucial factor is time. In this sense, they have to go to a particular location to rent any product such as vehicles, electronics, or clothes for renting or buying, and wait for their response [1]. Moreover, when the duration of usage is short, renting is preferred, and more economical. Whereas buying is preferred, and more practical for longer durations of usage [2]. This will help potential users to rent items and equipment which are needed temporarily, instead of purchasing them, saving the trouble of single usage [1]. Hence, the project is aimed to develop an Android-based mobile application called Rent2U that can help Malay and Bumiputera UiTM Shah Alam students to rent items and equipment they needed. The reason for choosing Android is because it has a large community of writing applications (“apps”) developers that extend the functionality of the devices [3]. This project development aims to solve problems that students often face, such as, unable to afford items and equipment, in need of one-time use of goods, costumes to attend an event, or equipment to explore new hobbies. This application also seeks to help in making the process of renting and lending among students much easier than it is now. The current practice of renting and lending are ambiguous, and the lack of a proper platform for them is what motivates the development of this application.

The UiTM Shah Alam students came from different family backgrounds. Some of them have a financially stable family to support them, and some do not. Not all of them are fortunate enough to buy and afford new things such as clothes, notebooks, or gadgets. Students, out of 200, 185 of them (92.5 percent) are classified as multidimensionally poor, 13 students (6.5 percent) were in the average level of poor, and only 2 students (1 percent) are classified as hardcore level of deprivation [12]. As these events are one-time events, students are reluctant to splurge as the items purchased would be unnecessary post-event. As they have the ability to explore and try new hobbies, nearly 4 in every 5 millennials would rather spend money on an ‘experience’ than on buying an item [4]. They prefer to use items for a short period for hobbies, and experience rather than purchasing them. It means that they can save for other necessities in future.

## **2. Literature Review**

Nowadays, several peer-to-peer marketplaces enabled by the Internet and mobile devices have appeared to ease the process of goods and services rental for a short period [5]. There is an increasing trend of providing services via the use of the mobile application with a majority of those services coming from services like ridesharing, room rental, goods rental, and so on [8]. The reason for this trend is probably because users do not use technology just to tell people about their life, opinions, or images and videos, but these people also use the technologies to rent out their goods and services [13]. Other than that, sharing personal goods or belongings gives these people the chance to earn extra income while enabling them to reduce costs or just be a part of the online peer-to-peer marketplace community [14]. The concept of the rental market is targeted at those who avoid wasting money on items that are to be used for a short time so, leasing or renting those items makes it cheaper and more convenient for them [6]. In today’s world, there seems to be a mobile application for everything that could think of [7]. For instance, there are applications for short-term car rental,

for instance, *Getaround* and *RelayRides*, short-term room or space rental such as *Airbnb*, peer-to-peer clothes and accessories rentals such as *StyleLend*, and so on [5]. Furthermore, there are also applications for students to exchange or rent books among themselves, swap clothes by renting clothing and accessories, and the application to rent or exchange children's toys in which by using these applications, users can rent unlimited physical goods, instead of purchasing them from traditional retailers [13]. Mobile applications are lightweight, pre-defined software programs designed to operate on mobile devices such as smartphones, tablets, and feature phones [8]. These mobile applications are made up of executable files that are downloaded directly to the user's mobile device while it is stored locally in the device, and they are distributed through dedicated application stores such as *Google Play Store* for *Android* and *Apple App Store* for *iOS* [9]. Currently, our smartphones are readily available with various third-party applications through the online markets or application store and the number of applications is growing continuously while on the other hand, pre-installed applications such as web browser, text messenger, email and others are also available [10]. Over time, the smartphone industry has expanded beyond what anyone could have expected and today, there are many platforms available on the market such as *Android*, *iOS*, *Windows*, and various frameworks that build mobile applications [16]. The emergence of various mobile application platforms like *Android* and *iOS* in the mobile phone market is pushing developers to build mobile applications with the same content repeatedly to make sure they are available on every possible platform [11]. Besides, mobile application platforms are important to determine functions and features that are accessible on mobile devices like thumbwheel, keyboards, WAP, syncing with applications, and others [10].

### 3. Research Methodology

The Mobile Application Development Life Cycle (MADLC) is defined as the best model to develop a mobile application where this approach can help the development of a mobile application project that runs smoothly and is organized [15]. The MADLC consists of several phases, which are, the identification phase, design phase, development phase, prototyping phase, testing phase, implementation phase, and maintenance phase. However, this project is covered until the testing phase only because there is no integration with the payment gateway thus, it cannot be deployed.

#### 3.1 Phase 1: Identification Phase

To begin with, an interview has been conducted with one of the students of the College of Computing, Informatics, and Mathematics (formerly known as the Faculty of Computer and Mathematical Sciences) of UiTM Shah Alam (refer to Appendix A) along with an online survey that consists of a total of 11 respondents (refer to Appendix B) as the study's target participants since the samples that have been selected must have the characteristics of the population to be studied so that the information obtained through the study can provide a statement or a general picture of the entire population being studied [17]. This information was required to gather information such as problems, objectives, scope, significance, and user requirements for the development of the Rent2U mobile application. The online survey was created with Google Forms as its platform, and distributed to *WhatsApp* groups, and friends. Next, project-related literature has been retrieved and reviewed from online journals, articles, and research papers that are related to the development of mobile application elements and design. In the conclusion of this phase, the objectives, scope, significance, and user requirements have been identified.

### 3.2 Phase 2: Design Phase

The next stage or phase of the MADLC after all requirements have been identified and documented is the design phase. In this phase, the goal was to fulfil the next objective of this project which is, to design the Rent2U mobile application. The low-fidelity storyboard was created using paper prototyping while the user interface design was made using *MarvelApp*. Subsequently, the use case diagram was created using an online tool called *Draw.io* to illustrate the user's interaction with the mobile application. Meanwhile, the database for this project was designed based on the hierarchical model because *Rent2U* uses the NoSQL database of Firebase Realtime Database. Therefore, the results of the design phase were the low-fidelity storyboard, use case diagram, hierarchical database model diagram, and low-fidelity user interface design.

### 3.3 Phase 3: Development Phase

In the development phase, the proposed project of the mobile application was coded and followed the design that has been made in the previous phase. In this phase, the third objective which is to develop Rent2U mobile application was carried out. *Android Studio* was used as the software to develop and build the application. In order to provide the intended features and functions, the *Google Maps API* was also used for the development purposes of the Rent2U mobile application. In addition, the NoSQL database of Firebase was integrated into the database development of this project.

### 3.4 Phase 4: Prototyping Phase

Prototyping is the fourth phase of the MADLC methodology. After completing the development phase, the prototyping phase started. In this phase, the mid-fidelity prototype of the Rent2U mobile application was created using *Android Studio* as its platform. The purpose of the mid-fidelity prototype is, it works as a semi-finished product that focuses on functions, and processes, and provides the simplest framework, and elements of the system. Then, the mid-fidelity prototype was evaluated and analyzed to understand and make necessary improvements, and changes for the high-fidelity prototype. Following this, the high-fidelity prototype for Rent2U was created with a better user interface and functions.

### 3.5 Phase 5: Testing Phase

The testing phase is the fifth phase of MADLC after the prototyping phase. This phase was said to be one of the most crucial stages among other stages. The purpose of this phase is to conduct testing on the functions of the initial version of the Rent2U mobile application. The prototype was delivered and tested by the users to get their feedback. Two UiTM Shah Alam students were selected as users in this testing phase. Users tested the application to ensure that the intended features and functions work as they were meant to. The functions that were tested by the users include registration and login into the application, finding the nearby goods and equipment for rental, using the search bar to find goods or equipment, creating an item listing to lend, renting an item from other users, and viewing their rental history. Then after, they were interviewed with questions regarding the application. All feedback from them was collected and revised to do necessary changes or adjustments as needed. In addition, a detailed list of tasks and questions was made to make sure that the testing process runs smoothly.

## 4. Analysis and Discussion

### 4.1 Objective 1: To Identify the Requirements for Equipment Rental Mobile Application for UiTM Shah Alam Students (Rent2U)

In order to complete the execution of this study, the first objective is to identify the requirements for equipment rental application at UiTM Shah Alam (Rent2U) need to be achieved. According to the outcomes of the online survey that has been conducted, 9 out of 11 respondents (82 percent) stated that it is helpful, and beneficial to have a mobile application that enables UiTM Shah Alam students to rent and lend items or equipment to other students. Students also stated that they can save their money from buying expensive items, and get them at a cheaper price than market price by renting. It means that they can save for other necessities they might need. Therefore, based on the survey results, it is concluded that a mobile application can be developed as a platform for peer-to-peer rental among the students in UiTM Shah Alam. In order for an application to be considered successful, design requirements stated that the essential characteristics must be met by the design. Design requirements are usually retrieved from existing similar mobile applications with similar features and functions. The basic functions of peer-to-peer mobile applications such as, login/register, search, rent items and equipment, and checkout were included in the Rent2U mobile application. As for the application added value, implementation of *Google Maps API* was included to allow users to look for nearby equipment listings around their vicinity.

### 4.2 Objective 2: To Design an Equipment Rental Mobile Application for UiTM Shah Alam Students (Rent2U)

The requirements that were gathered in the first objective are crucial for the accomplishment of this second objective where the requirements were evaluated to design the application interface of the Rent2U mobile application. The rental process of this application is the key as it shows the flow of this application. The two main components of the design of the Rent2U mobile application are the storyboard, and hierarchical model. These two important designs were used as guidelines for the development of the mobile application.

#### 4.2.1 Flowchart

The flowchart acts as a guide to a system or program's process flow. It provides users with a clear understanding of how to use the system correctly and how this system will function [18]. The flowchart below shows the overall flow of the Rent2U mobile application framework that was illustrated using online software called *Draw.io* which can be seen in Figure 1.

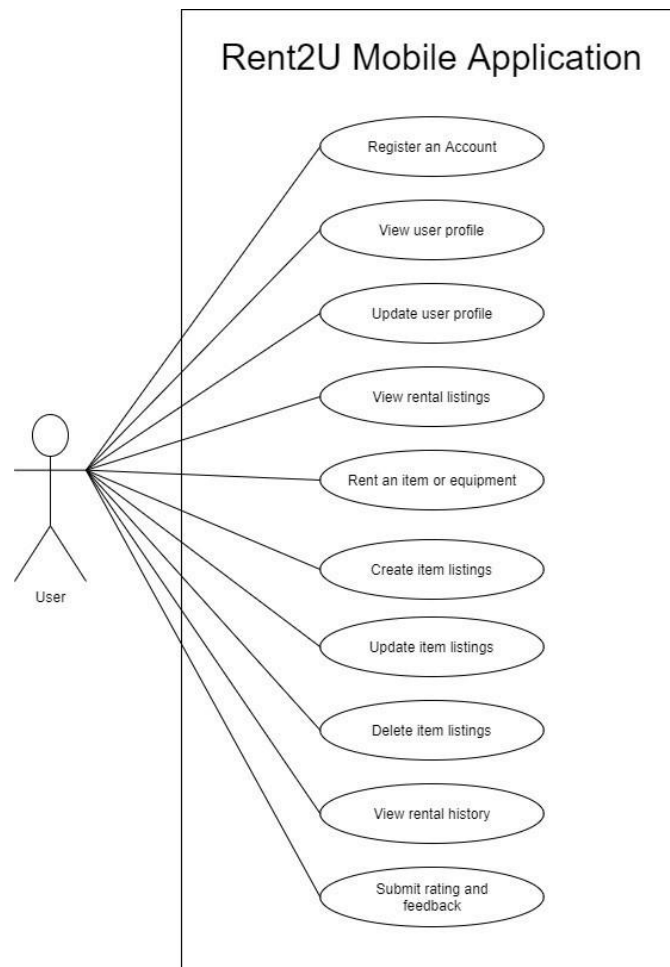


Fig.1. Flowchart of Rent2U

#### 4.2.2 Use case diagram

The relationship between elements and the process can be illustrated in the form of a use case diagram. A use case diagram is a description of the relationship of a user with the system that illustrates the user's relationship with the multiple use cases in which the user is involved. The Unified

Modelling Language (UML) was used to demonstrate the use case diagram for the Rent2U mobile application. Figure 2 below shows the overall view of the activities.

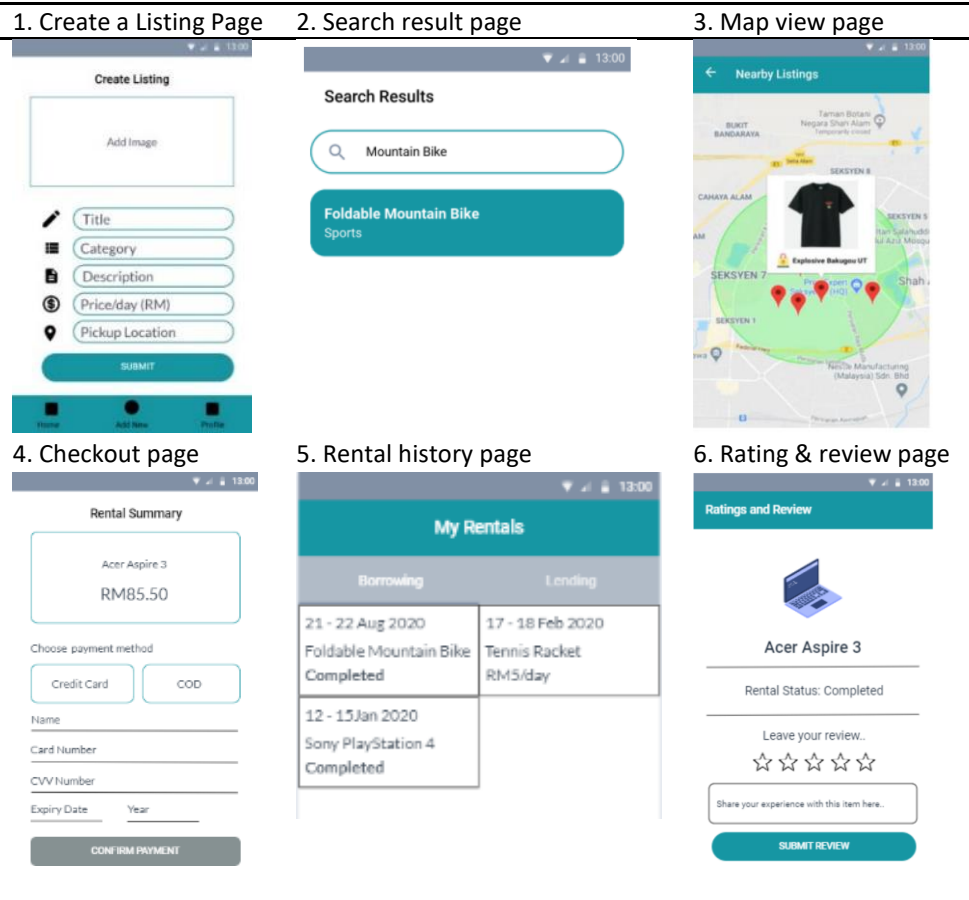


**Fig. 2.** Use case diagram of Rent2U

#### 4.2.3 Storyboard

A storyboard represents the main features and functions of the Rent2U mobile application. The storyboard works as an early illustration of the design of the mobile application before it was developed with the intended functionalities. The storyboard below shows the early interfaces of Rent2U mobile applications which are undoubtedly interconnected with each other. Table 1 below, shows the storyboard of the low-fidelity prototype for the main features that were included in the mobile application.

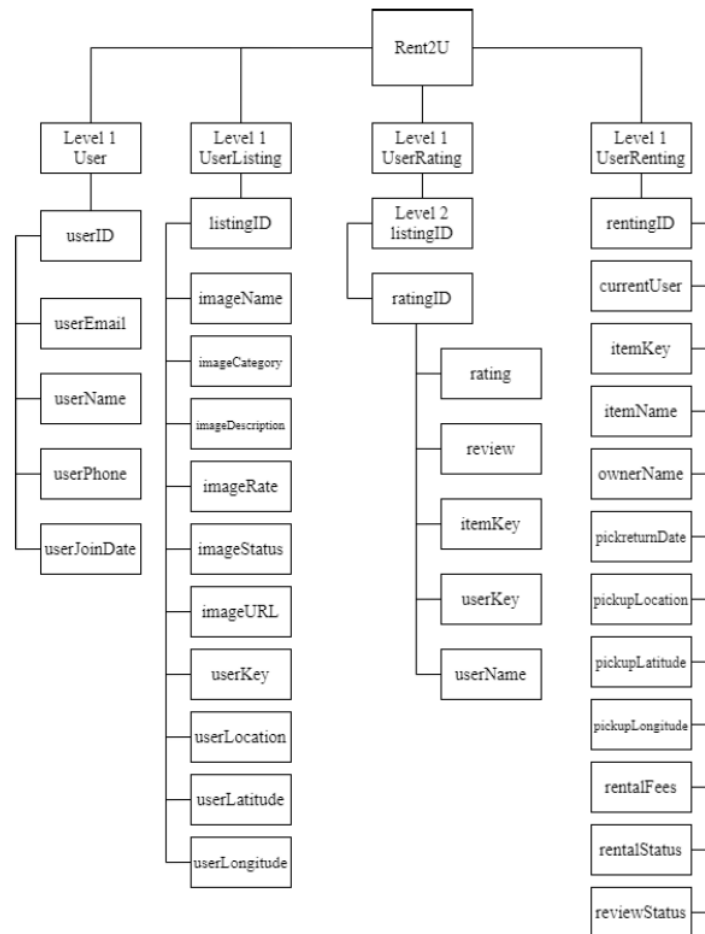
**Table 1**  
 Storyboard of a low-fidelity prototype for Rent2U



#### 4.2.4 Hierarchical model

The database design within the application of Rent2U mobile application can be illustrated using *Draw.io* in the form of a hierarchical model as shown in Figure 3.

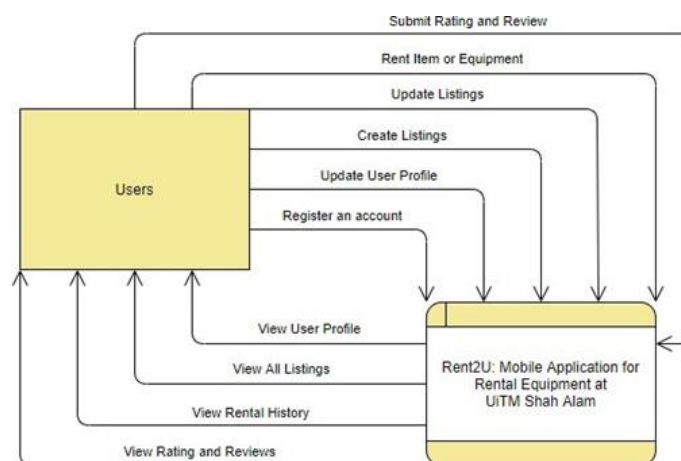




**Fig. 3.** Hierarchical model of Rent2U

#### 4.2.5 Data flow diagram (DFD)

A data flow diagram is a way of describing the flow of information through a system or procedure. The DFD also offers details about each entity’s outputs, and inputs and the process itself. There is no control flow for a data flow diagram, no decision rules, and no loops. Furthermore, there are two types of data flow diagrams that can be used to represent how the Rent2U mobile application’s data flow throughout the application. The two types of DFD are Context diagram (Figure 4) and Diagram 0 (Figure 5) to show how the data moves.



**Fig. 4.** Context diagram

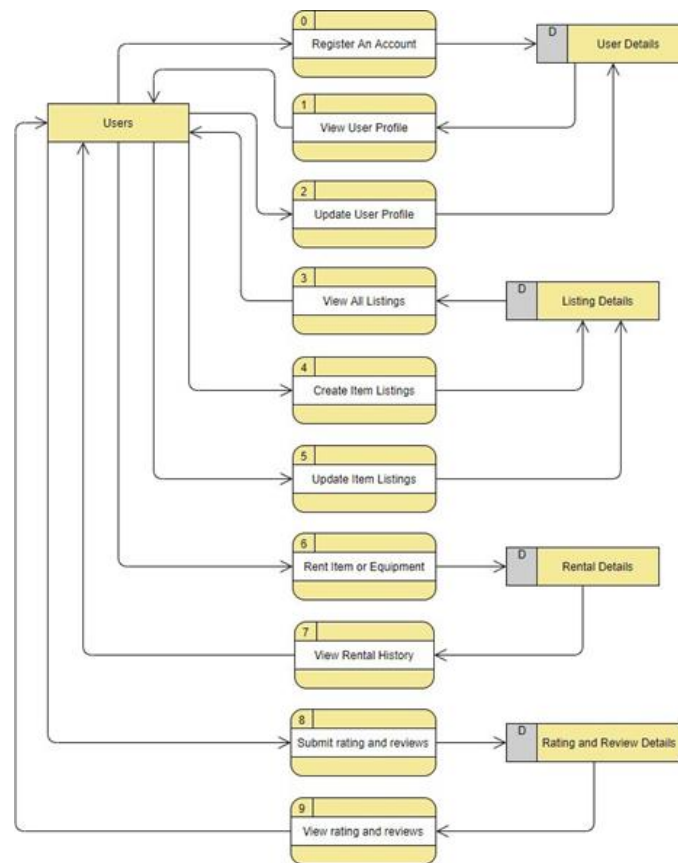

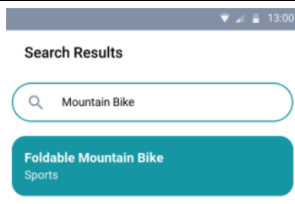
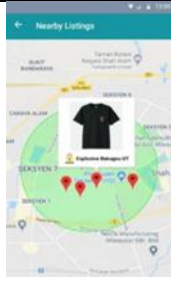




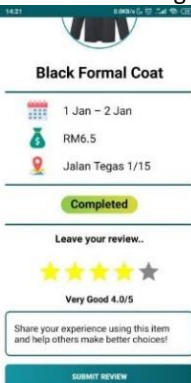
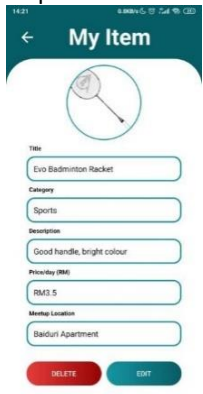


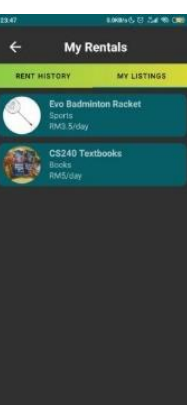


Fig. 5. Diagram 0

#### 4.3 Objective 3: To Develop an Equipment Rental Mobile Application for UiTM Shah Alam Students (Rent2U)

In the third objective of this project, the Rent2U mobile application was developed and ensured that its specifications matched the requirements mentioned before. The prototype of the Rent2U mobile application can be referred to in Table 2. Despite that, the mobile application must go thorough and detailed user testing to see whether it suits the users, and allows for further enhancement or changes. As a result, user testing was done to analyze the features, and functions of the application. All the results from the user testing and interviews that have been conducted were recorded based on the test procedures provided to the testers. The results of the user testing that has been performed by two UiTM Shah Alam students, as well as the interview are outlined in Table 3 and Table 4 respectively. Based on these comments from the testers, it was used as a component to further improve the application where needed.

**Table 2**  
 Rent2U high-fidelity system prototype

1. Splash screen	2. Login page	3. Home page
		
		
		
		

**Table 3**  
 User Testing Result

Users/tasks	User 1	User 2
1. Launch the Rent2U mobile application	Functional Good interface	Functional Good logo
2. Sign up and log in for the first time	Functional Understandable	Functional. I like it very much
3. Find the nearest goods or equipment for rental	Functional Clickable markers	Functional Understandable
4. Use the search bar to find goods or equipment	Functional. But need to change some elements	Functional. I found items quickly without a problem
5. List an item or equipment	Functional. The form should be adaptive	Functional. Can improve somewhere
6. Rent an item from the application	Functional. Good design and is easy to understand	Functional. I was able to rent items successfully
7. View rental history	Functional. Need time to look for it	Functional. Found it without a hassle

**Table 4**  
 Interview Result

Users / questions	User 1	User 2
1. What are your expectations when you are using this mobile application?	Can rent items and equipment from the application.	I can rent items using the application
2. What are your expectations when you are using this mobile application?	I think it is a little dark, but I like the design.	It is good. There are no issues.
3. What are your thoughts on the icons, labels, and buttons in this mobile application?	The icons, labels, and buttons can be understood easily	They are placed properly, and I had no issues as well.
4. Does this application be able to help students who are unable to afford new goods and equipment? If yes, in what way?	Yes, because not everyone can afford to buy new things for themselves.	Absolutely. They can make use of this application to get items at a lower price.
5. On a scale of 1 to 10, how easy it is for you to navigate through this mobile application?	I give 8 out of 10. I can navigate smoothly with almost no problem.	I give a solid 9 out of 10. There were no problems for me.
6. On a scale of 1 to 10, what is the overall rating that you can give for this mobile application?	I give it 8 out of 10. I like the user experience, but it can be improved a little bit more	Overall, a solid 9. There can be improvements.
7. Are there any suggestions that you can give to improve this mobile application?	Maybe you can add a notification to alert both the renter and lender when the rental expires.	I think there should be an admin to monitor what items or equipment are listed on the application.

Based on the user testing results, the features and functions of the Rent2U mobile application were working as intended. Both testers said that they like the design, and had no problems with it. Then, both testers agreed that this application can help students who might be struggling financially. On a scale from one to ten, the testers gave a rating of 8 and 9 respectively towards the ease of navigation in the Rent2U mobile application. This shows that the application can be used without problems as they can go through the application on their own.

## 5. Conclusions

Essentially, this project is done to understand how the Rent2U mobile application can help the Malay Bumiputera students, especially the B40 group in UiTM Shah Alam to rent or lend items and equipment that they need with ease. This group of students can make money by renting their items and save money by only renting items instead of buying new items. In conclusion, the mobile application of Rent2U can be improved further by implementing the future recommendations that were mentioned above like having an administrator dashboard as well as implementing the notification feature. With these future works to be done, Rent2U can reduce the existing flaws that might currently exist in the application and help the items and equipment rental process run smoothly.

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