



Chapter in Book


UMAI: A Digital Menu via Augmented Reality Technology on Mobile Apps

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Abstract: A menu is one of a food and beverage company's most significant communication, marketing, and selling tools. An effective menu design should communicate the brand, the vision, the ambience, the food offerings, and the overall experience a guest can expect to enjoy. The problem that always occurs at the restaurant is customers took a long time to order and get confused about what to order due to a lack of information available on the menu. Food information on the printed menu is limited due to insufficient space. This will lead to unclear details about the food that they might order. The traditional printed menu is lack multimedia elements thus making it less interesting. Sometimes the utilization of font, font colour, and image on the menu is not sufficient. An effective menu should be introduced to help attract more customers. This can be delivered by applying the Augmented Reality (AR) menu to enhance the user's experience in choosing better food. Thus, this study aims to develop an AR menu to increase users' ordering experience. AR technology closely mimics the real food that will be served, and the quality of the visual displays and colours used in AR can have an impact on one's immersion in the dining experience. 20 participants were recruited to test and evaluate the application and System Usability Score (SUS) is used to evaluate this application. The results of the evaluation represent that this application shows a promising result to increase users' ordering and dining experience.

Keywords: menu; augmented reality.



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1. INTRODUCTION

A restaurant is a gathering place for many people to enjoy their favourite dishes (Aulia et al., 2017). The menu provided by the restaurants will show various type of food that is available, and usually will give the first impression to the customer. A menu is one of a food and beverage company's most significant communication, marketing, and selling tools (Sahin, 2020). An effective menu design should communicate the brand, vision, ambience, and overall experience a guest can expect to have. A problem that always occurs at the restaurant is customers usually took a long time to order, and they tend to get confused about what to order. This is true due to the lack of information available on the printed menu. Based on this issue, an effective menu should be developed to help customers and thus increase their dining experience. This study proposed an Augmented Reality (AR) menu to enhance the user experience in choosing their food. AR is a technologically augmented version of the real world

that is created using digital visual elements, music, or other sensory stimulation. Thus, it also provides content with adequate information about the food available in the restaurant and simplifies the choices of food for customers.

2. METHOD & MATERIAL

The software development model chosen to be used for this project is the ADDIE model. The term ADDIE stands for analysis, design, development, implementation, and evaluation, which are the five steps of the development process.

2.1 Analysis

The information and the data required for this project are gathered from all available sources. The data gathered was utilized to explain and clarify the project's problem, as well as give a response to the crisis. As an outcome, the project can be completed on time. In this phase, the issues concerning paper-based menu are lack of information of the food and paper-based menu causes wastage of money and time are being discovered. The data are collected through journals, article, books, and trusted website as preferences. The task that must be accomplished in this project is to create and select a good project title, problem statement, objective, project scope, and project significance. Moreover, the possible problems the project might encounter were predicted during this stage. Analysing the difficulties that the project might encounter was a big aid that helped to accomplish the objectives of the project. The cost of building the application is calculated so that it fits within the client's budget. The hardware and software requirements needed during the development phase are being discussed with the client. This is to ensure that all the requirements are fulfilled so that the development process can run smoothly. Furthermore, in this phase, basic research on the effective tools to be used and their equivalents was conducted. A small comparison was made between the AR SDK platforms and the development platform to be used in this project and the purpose of it is also considered.

2.2 Design

The idea of the plot is visualized in a storyboard. The storyboard's purpose is to help the developer manage their ideas and understand how the apps will work. Figure 1 shows storyboard in this project. The menu page consists of 3 text box which is the title page, food name and food price. There are 2 buttons use for adding to cart and choose filter options. User can see list of food available in this page. Menu bar will navigate the user to other pages such as Main menu, AR menu, basket, bill, and admin page. After that, is the filter popup users with dietary restriction can use this filter to help them in choosing suitable food based on their dietary. Continue with Basket page, basket page is where all the orders that have been chosen by customers are located. In this page, user can customize their food whether they want to add. Lastly, Bills page bill page is where users can view their bill. User will see the details of their order with the total price.

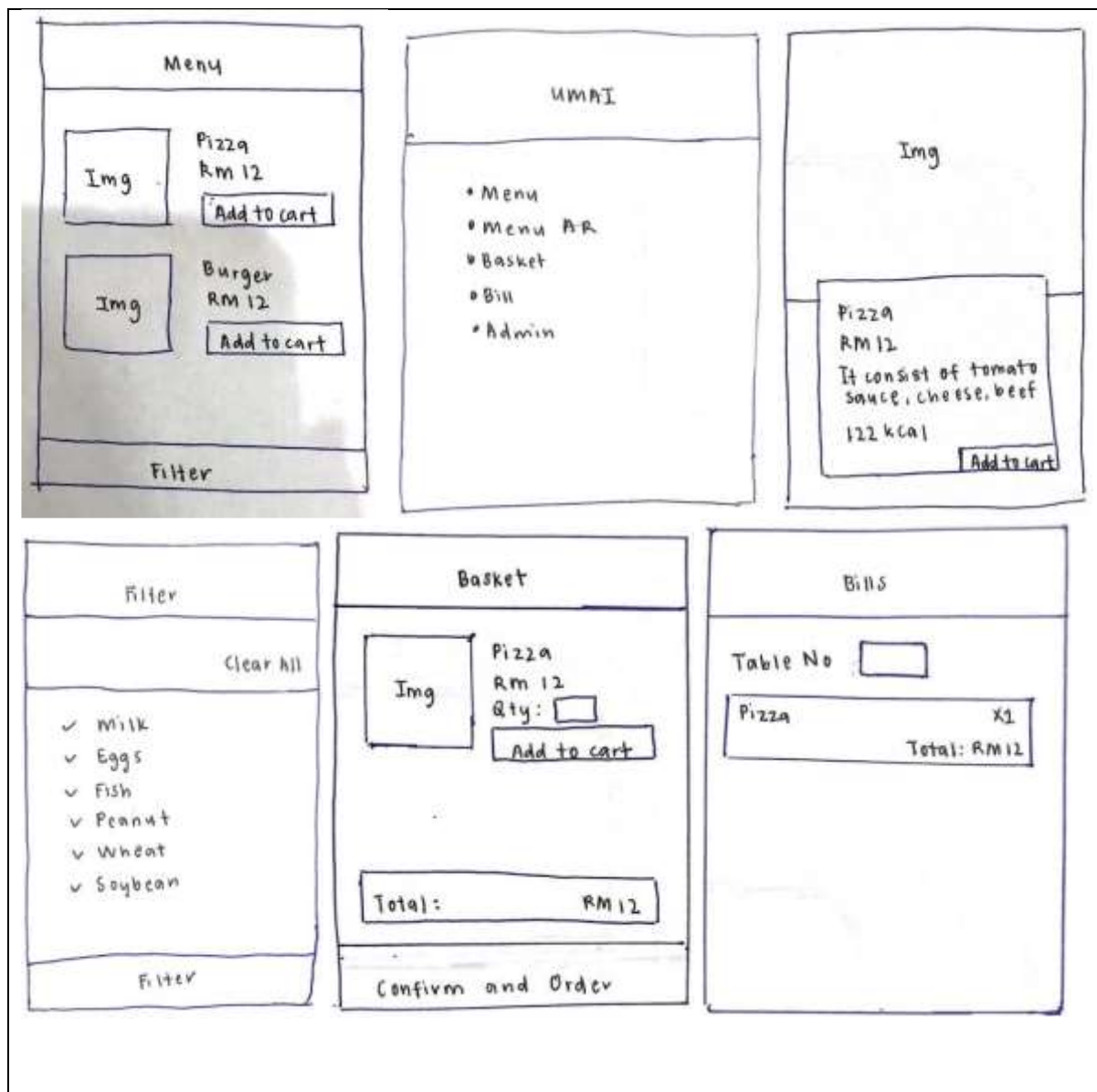


Figure 1. Storyboard of UMAI's application

2.3 Development

In the development phase, the most important is to use the appropriate programming language and application engine to define the software and hardware requirement to recheck the development of the project. The related prototypes with format details and refinement need to be prepare. The software and hardware requirements for this project are critical for the development of the Umai: a digital menu through augmented reality apps. This section explains the requirements that have been chosen for the project's construction and development. To begin with, the application engine used for this project is Android Studio. It functioned as an environment to develop apps for Android phones and tablets. Besides that, blender is chosen for modelling food 3D models because it has a very intuitive and easy to understand modeling workflow. Next, the programming language that will be used through this application is Java. Following that, Sceneform is a high-level scene graph API and an Android Studio plugin for importing, viewing, and building 3D assets to render realistic 3D scenes. With the help of Firebase's real-time database, users can store and sync data instantly. Table 1 shows the software requirements for the application. The hardware requirements must also be addressed to develop the smooth development activities without facing any problem that related with the hardware and time

taken for development process will be reduced. Table 2 below shows the specification of hardware in this project.

Table 1. SUS scores and total scores given by the respondent

Features	Software
Application Engine	Android Studio
3D Modeling	Blender
Programming Language	Java
Augmented Reality	Sceneform
Database	Firebase

Table 2. SUS scores and total scores given by the respondent

Hardware	Specification
Operating System	Microsoft Windows 10 64-bit
Storage	1TB
RAM	6GB
Mobile Phone OS	Android

2.4 Implementation

The implement phase involves the change of plan into action. Preparing the user before utilizing the application will help increment their comprehension and familiarity with the content and materials. The Android operating system will be used to develop the app. The participants of this mobile application are a restaurant owner and a customer. During the implementation phase, each prototype iteration was built, was based on the system analysis and design set earlier. The phase involves developing the AR application using the Sceneform SDK and Blender. Thus, during the implementation phase, a working prototype and confirmation that all the functionalities of the system successfully work.

2.5 Evaluation

The targeted audience of the evaluation phase is to include customer of the restaurant and the owner of the restaurant. At least 20 participants are assigned to undergo this testing. The System Usability Scale (SUS) as shown in Figure 2 is chosen as the instrument to determine whether the application is relevant to the demands of the user and may aid in the detection of any problems discovered during testing. The evaluation will be conducted through online. A link will be sent to the participants for instructions before the evaluation begins. First, participants will need to download the application on their mobile phone. Next, they need to test the usability of the mobile application for 5 minutes at least. After that finished, the participants are required to answer the survey. Survey will be asked via Google

Form. When the survey is completed, the data is collected and analyzed to produce the results. We can obtain whether the objectives this mobile application is accomplished by doing the evaluations.

The System Usability Scale Standard Version		Strongly Disagree					Strongly Agree				
		1	2	3	4	5	1	2	3	4	5
1	I think that I would like to use this system frequently.		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2	I found the system unnecessarily complex.		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3	I thought the system was easy to use.		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4	I think that I would need the support of a technical person to be able to use this system.		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5	I found the various functions in this system were well integrated.		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6	I thought there was too much inconsistency in this system.		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	I would imagine that most people would learn to use this system very quickly.		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8	I found the system very awkward to use.		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9	I felt very confident using the system.		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10	I needed to learn a lot of things before I could get going with this system.		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 2. System Usability Scale

3. FINDINGS

The goal of the testing with the system usability scale (sus) was to determine the level of usability of the developed application. To calculate sus score, firstly, sum the score contribution for each item. The likert-scale for the question is where one indicates ‘strongly disagree’, two indicate ‘disagree’, three indicate ‘neutral’, four indicate ‘agree’ and five indicate ‘strongly agree’. For items 1,3,5,7 and 9 which are odd number questions, add the total scores for all odd-numbered questions, then deduct 5 to get odd score. But for items 2,4,6,8 and 10, add the total scores for all even-numbered questions, then subtract 25 to get even score. Add the total score and multiply by 2.5. The SUS score will be range of 0 to 100.

4. DISCUSSION

After calculating the final sus score, it must be interpreted to demonstrate whether the system's performance is excellent or poor by combining all the scores and scaling them from 0 to 100. As a result of this. Umai's application prototype usability score is 75.38, indicating grade B or good grade. Figure 2 depicts a common approach for interpreting sus scores and Table 3 shows the final sus score calculation. Figure 3 shows the interpretation of SUS score.

Table 3. SUS scores and total scores given by the respondent

Respondents	SUS Score
R1	75
R2	85
R3	82.5
R4	77.5
R5	75
R6	85
R7	77.5
R8	67.5
R9	85
R10	67.5

R11	77.5
R12	52.5
R13	77.5
R14	75
R15	70
R16	75
R17	70
R18	77.5
R19	80
R20	75
TOTAL	75.38

SUS Score	Grade	Adjective Rating
> 80.3	A	Excellent
68 – 80.3	B	Good
68	C	Okay
51 – 68	D	Poor
< 51	F	Awful

Figure 3. Interpretation of SUS Score

5. CONCLUSION

A menu is an important part of a restaurant. It always gives the very first impression from the customers. A customer will always look at the menu to see the availability and choices. If the menu is too long and only listing the name of the dish and the price, the customer cannot imagine what the food will look like, or they may get the wrong impression about the food. The printed menu has limitations in that there is not enough information and not enough space to show the pictures. This application has undergone the SUS evaluation. There are both positive and negative comments from users in the evaluation results. In terms of positive response, consumers love using the application because ordering a digital menu that is integrated with augmented reality technology is a fresh experience, and they are fascinated by the features of the 3D model that shows after scanning the marker. On the other hand, some people who aren't used to technology, particularly the elderly think that using technology every day is a lot of work. Future work should consider developing an application specifically for the elderly so that everyone could enhance their ordering and dining experience.

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