DEVELOPMENT OF 3D VIRTUAL FURNITURE CUSTOMIZATION APPLICATIONS AT HIKMAH MEBEL CIMAHI

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ABSTRACT

Hikmah Mebel is a business engages in the furniture industry. In the ordering process, product images are less attractive and do not show the entire product. This causes the customer to get a little information about the product model. Employees must confirm orders to customers as they often lose order notes, this causes the time production become longer. Business owners also have difficulty in monitoring reservations because of work outside the city. The application has custom furniture features with 3D objects and virtual reality technology, the application must be connected to the internet to make an order. Applications created with the Blender tools in the manufacture of 3D furniture objects and Unity 3D for the construction of the application. Based on the results of black box testing and interviews, this 3D virtual furniture customization application can helps business owners and employees in providing better information, assisting in recording and assisting business owners in monitoring bookings. Customers also get more information about product.

Keywords : **Virtual *Reality*, Kustom Virtual, *Furniture* 3D, Virtual *Furniture*, Unity 3D**

1. INTRODUCTION

1.1. Background Problem

The Hikmah Mebel is a furniture business addressed in Cimahi-Cihanjuang Road. Hikmah Mebel is a business engages in the furniture industry. The Hikmah Mebel do the work of making furniture when there are orders from customers (Make-to-Order).

Based on the results of interviews with business owners and customers, stated that there were several problems were found among them, when customers will make a booking and inquire examples of products, employees or business owners showed pictures that serve as an example of a product with a dirty picture of circumstances because there is a graffiti and no visibility furniture parts more like the inside and part-side other products cause the impression of less attractive on the image of the product. Customers also complained about the lack of product images for a custom selection of product model, causing customers not getting enough information about custom furniture model which will be ordered.

At the time of the execution of the production, often the occurrence of lost records of orders due to keteledoran production or booking clerk.
In booking business owners monitor the booking via phone this is because worried employees made a mistake in price that would result in the loss of customers or companies, but business owners have difficulty to be able to monitor at any time and in its entirety because of the flurry of project of cooperation between other companies that require business owners to go out of town or doing the work of the project.

The existence of these problems, then made an application Customization of the Virtual 3D Furniture are expected to make it easier for employees and business owners in dealing with existing problems in the Hikmah Mebel Cimahi.

1.2. Goal and Purpose

The intent of the research done applies to create application customization 3D virtual furniture, as a means to facilitate employees in handling booking and monitoring orders in Hikmah Mebel Cimahi.
The goal in making this customization furniture of applications is:

a. Helps employees and business owners in the service booking with picture examples of products that are more detailed and interesting.
b. Help customers find out image information products that are informative and clear.
c. Assist employees and business owners in dealing with the loss of the notes of orders.
d. Assisting business owners in monitor customer orders.

1.3. Research Methods

Here are the stages that will be done in the research.

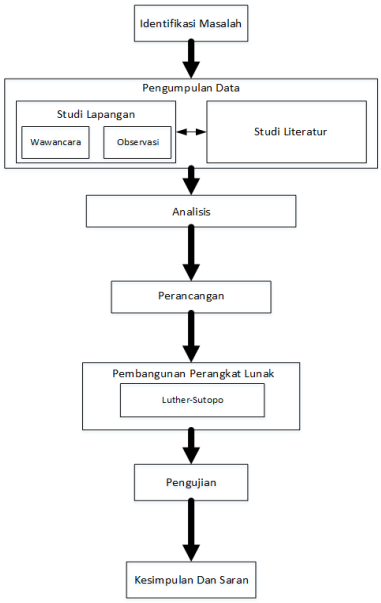


Figure 1. Stages of Reasearch

1.3.1. The Stages of Problem Identification

The stage of problem identification is required to know the problems and the causes of the problems at the Hikmah Mebel Cimahi.

1.3.2. The Stages of Data Collection

As for the data collection techniques used consisted of three ways of collecting data, including:

a. The Study of Literature
   Study the theory of a variety of literature regarding the tools used, the programming language used, programming language C # and PHP. Information search in the form of references from the internet, books, scientific journals, may take the form of articles and topics in a forum related to application development and customization of the virtual 3D furniture, and discuss with the competent parties.
b. Interview
   Data collection by direct questioning with Mr. Agus Solphin Dodo as business owners on matters relating to the problems examined.
c. Observaation
   Collect pictures of products and plunge directly into the Hikmah Mebel.

1.3.3. Stages of Analysis

At this stage of the analysis of the system performed some analysis starting from the analysis of the problem, an analysis of the running system, a functional needs analysis, analysis of non-functional requirements and others.

1.3.4. The Stages of Design

At the design stage, is to create an architecture, style, flow, product specifications, storyboards, as well as the look of the application virtual furniture 3D customization.

1.3.5. The Stages of Developtment

At the stage of application development, using the method of software development method Luther-Sutopo. The following development stage software images with luther-sutopo method..

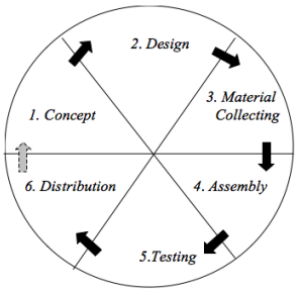


Figure 2. Luther-Sutopo Method

Explanation of the method of luther-sutopo used to make applications, can be seen in the following explanation:

a. Concept
   At this point, the user's applications, determine the types of destination applications, applications and basic rules on applications determined at this stage as the size of the target application, and others from application customization these 3D virtual furniture.
b. Design
   Stages of manufacture specs about architectural program, style, appearance and material needs or application materials for customization of the virtual 3D furniture.
c. Meterial Collecting
   The stage of gathering the ingredients to suit your needs. On the application of this material in the form of image data collection furniture products in Cimahi, Furniture Wisdom price data the price data, wood finishing and others.
d. Assembly
   This stage is the stage of creation of multimedia materials and objects for application customization based on virtual design stage.
e. Testing
   This stage of testing, done after completing the application. To do the test by running an application if there are errors or omissions.
f. Distribution
   Phase distribution is the stage of application storage in a storage medium. Such as a CD-ROM, a floppy disk or other storage media.

1.3.6. Testing

Testing is done to see if the application is already running appropriate functions and test the feasibility of the application. The test used is the black box and the interview.

1.3.7. Conclusions and Suggestions

This step describes the results of research and testing that has been done as well as advising for further research.

1.4. Review of Literature

1.4.1. Furniture

The term "furniture" is used because of the nature of the tour or its mobility off as articles in architectural interiors. The word is derived from the French furniture, namely furniture, or Germany language i.e. mobel. Understanding of furniture in General is an object that can be moved, useful for the activities of human life, from sitting, sleeping, working, eating, playing and so on, which gives comfort and beauty to the wearer. [1].

1.4.2. Product Customization

Pine/Gilmore (1999, P.76) define customization as "..producing in response to a particular customer's desires." The authors point out that is relevant to make the distinction between variety and customization. Whereas customization strives for fulfilling individual customer's needs, variety simply imvolves more choice from which the customer is able to choose. "Fundamentally, customers do not want choice; they just want exactly what they want" (Pine/Gilmore 1999, P.76). customization is intended to add increased customer perceived value to a product, since a customized product-compared to a mass produced product – increasingly fulfills the need of the customer(Svensson/Jensen 2001, p.1) [7].

When defining the term product customization it is relevant to include the product prespective which can be a physical good or a sevice. Thus, product customization can be defined as producing a physical good or a service that is tailored to a particular customer's requirements. In this context, customer involvement is an important issue, because customers dictate what the enterprise has to produce. [7].

1.4.3. Unity

Application of Unity 3D Engine is a game engine. Game engine software designed to make a game. A game engine is usually built with mengenkapsulasi some of the standard functionality that is commonly used in the making of a game. For example, the function of rendering, voice calling, network or particle creation for special effect. Most of the game engine is generally either a library or a set of functions that its use is combined with a programming language [16].

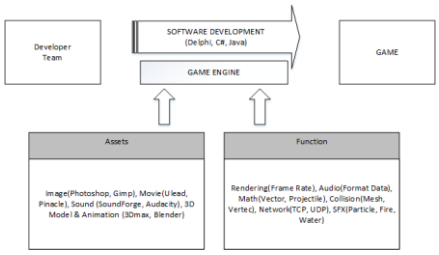


Figure 3. Unity[16]

In some cases the game engine is sometimes referred to as middleware. This is because the game engine is used as an intermediary between programming languages with data formats from various asset-generating software. This of course makes it easier for developers because no longer need to think about how to process data generated from various different software.[16]

A game engine is also usually equipped with basic graphics or computing functions that are rarely known by the developer. Game engine wraps it all to make the making process faster and easier. Some of these types of game engines are TrueVision, Irrlicht and Ogre3D.[16]

2. THE CONTENT OF RESEARCH

2.1 System architecture

Application customization of virtual furniture that will be built is based on Android and Website.

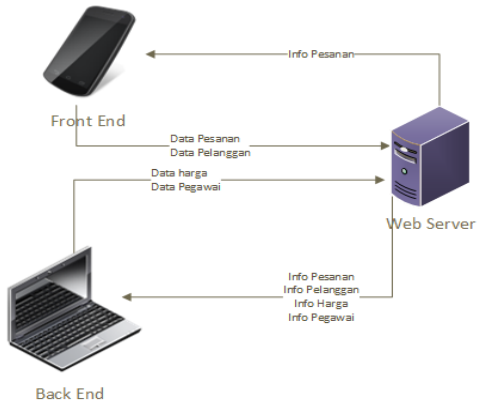


Figure 3. Description Of The System

On the system to be built, will have two interfaces i.e. Android for the Front End and Back End for the website. The Front End is part of the application that will be used by employees who can perform the selection of products, custom products and ordering products. Back End is part of the application made by business owners as the back end of the system users to manage order data, print data order data, manage employees and manage prices.

2.2. *Use Case*

Use case used to model business processes based on the perspective of the users of the system. Use case diagrams describe the State of the system environment which can be seen from the outside by the actor. Use case consists of three parts, namely the definition of actor, definition, and use case use case scenario. Use case contained in the construction of virtual 3D furniture customization it can be seen in the following image.

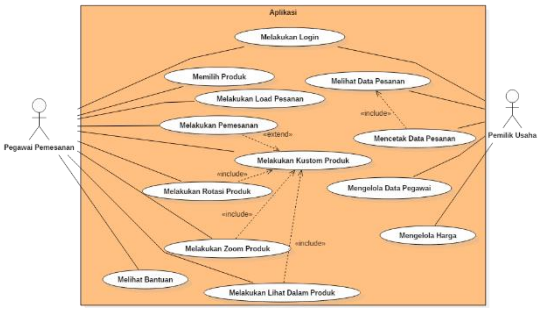


Figure 4. *Use Case*

2.2 Scenario *Use Case*

Here is a table using case scenarios do the login in the system that are actually performed, in the following table penjelasanaksi-action liquid from use cases Login.

Table 1. *Use Case Scenario* Login

Nama Use Case	Melakukan Login	
Persyaratan Terkait	-	
Tujuan Dalam Konteks	Aplikasi dapat melakukan validasi masuk ke sistem	
Kondisi Awal	Pengguna berada di tampilan login	
Keberhasilan Kondisi Akhir	Pengguna dapat mengakses aplikasi	
Kegagalan Kondisi Akhir	Pengguna tidak dapat mengakses aplikasi	
Aktor	Pegawai dan Pemilik Usaha	
Include	-	
Extend	-	
Pemicu	Pengguna menekan button login	
Aturan Utama	Langkah	Aksi
Aturan Utama	Langkah	Aksi
	1	Memasukan username dan password
	2	Menekan button login
	3	Validasi sistem login
	4	Aplikasi menampilkan menu utama
Perluasan	Langkah	Aksi Percabangan
	4.1	Aplikasi tidak dapat menampilkan menu utama

2.3 Activity Diagram

Activity diagram associated with the login scenario can be seen in the following image.

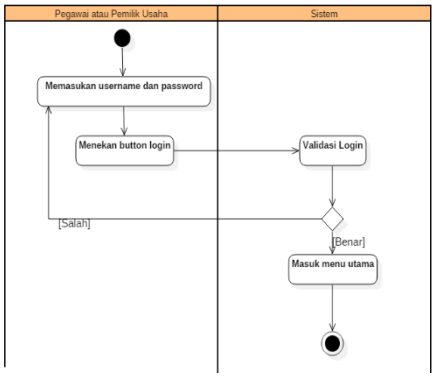


Figure 5. *Activity Diagram* Login

2.4 Class Diagram

The class describes the State (the attribute table or property) of a system, while also offering services to manipulate the situation (the method or function).

The design of the structure of the system is contained on the application virtual furniture 3D customization depicted with Class Diagrams that can be seen in the following image.

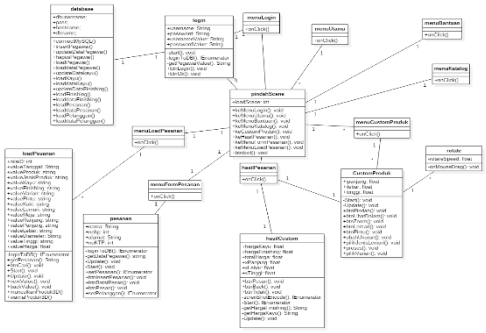


Figure 6. *Class Diagram*

2.5 Sequence Diagram

The following image is a sequence diagram login on the application virtual kustomisasiyang will be built.

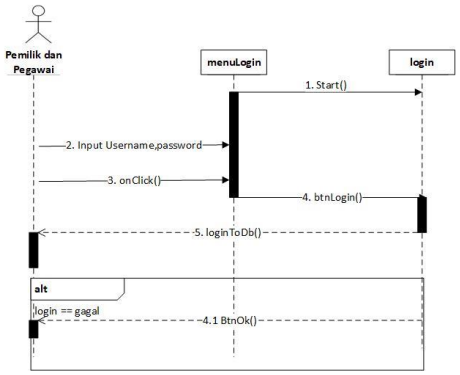


Figure 7. *Sequence Diagram* Login

2.6 Designing Menu structure

Menu structure on the application has 2 main menu i.e. main menu the main menu for employees and business owners. Here is the menu structure for employees can be seen in the following image.

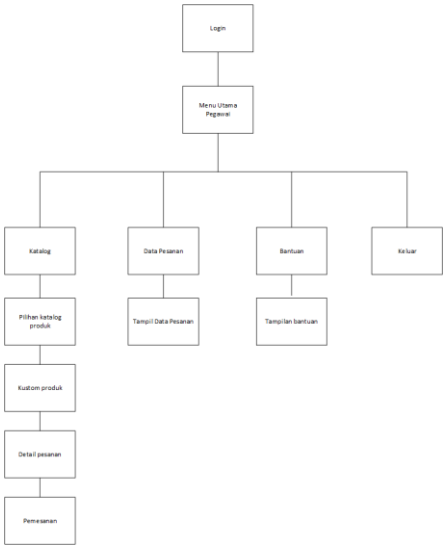


Figure 8. Main Menu Structure Of Employees

The following menu structure for display business owners can be seen in the picture below.

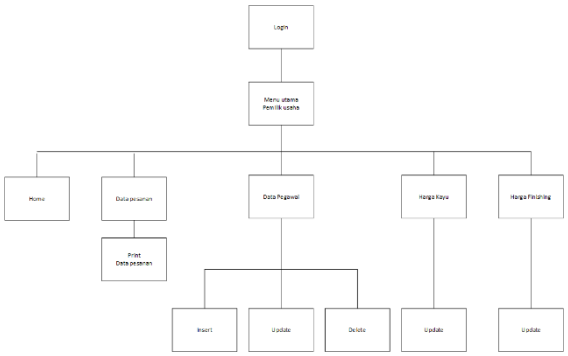


Figure 9. Main Menu Structure of Business Owners

2.7 Application implementation

Application customization of virtual furniture has a class that is used in the development of the implementation class in this application can be seen in the following table.

Table 2. Implementation of Class

No	Nama	Nama	Nama File *Executabel*	Keterangan
1	Login	menuLogin.unity	Login.cs Login.php	*Class* yang diugnakan untuk melakukan proses login.
2	pindah Scene	menuLogin. Unity menuUtama. unity menuKatalog .unity menu menuBantuan.unity customProduk.unity hasilPesanan. unity menuFormPesanan.unity	pindahScene.cs	*Class* yang digunakan untuk mengganti scene menu yang ada pada aplikasi.
3	custom Produk	customProduk.unity	customProduk.cs	*Class* yang digunakan untuk melakukan proses kustom pada produk *furniture*.
4	hasilCustom	hasilPesanan Produk.unity	hasilCustom.cs	*Class* untuk melihat detail keseluruhan dari kustom yang telah dilakukan
5	Pesanan	menuFormPesanan.untiy	Pesanan.cs Pesanan.php	*Class* untuk melakukan pemesanan dengan pengisian form data pelanggan
6	Rotate	customProduk.unity	Rotate.cs	Class untuk melakukan rotasi pada

No	Nama	Nama	Nama File *Executabel*	Keterangan
				objek di custom produk
7	loadPesanan	menuLoadPesanan.unity	loadPesanan.cs	Class untuk melakukan load pesanan pelanggan
8	Database		Database.php	*Class* untuk melakukan pengambilan data, menampilkan data, mengubah data, menambah data dan menghapus data.

2.8 *Black Box* Testing Scenario

Testing conducted by testing each process based on use case diagrams with errors are likely to occur. The test used was Black Box, performed with test input and output from the system. The following is a table of the plan a test on the system. Black box testing scenario can be seen in the following table.

Table 3. *Black Box* Testing Scenario

No	Fungsional yang Diuji	Skenario Pengujian	Jenis Pengujian
1	Melakukan login	Memasukan username dan password	*Blacx Box*
		Memilih tombol "Login"	*Blacx Box*
2	Memilih produk	Memilih gambar produk	*Blacx Box*
3		Memilih model produk	*Blacx Box*
		Memilih bahan kayu	*Blacx Box*
		Memilih bahan finishing	*Blacx Box*
		Memilih varian hpl	*Blacx Box*
		Memilih tombol 'warna'	*Blacx Box*
		Memilih *checkmark* ubah ukuran	*Blacx Box*
		Memasukan panjang ukuran	*Blacx Box*
		Memasukan lebar ukuran	*Blacx Box*
		Memasukan tinggi ukuran	*Blacx Box*
		Menekan tombol "kembali"	*Blacx Box*
		Menekan button "next"	*Blacx Box*
4	Melakukan rotasi produk	Melakukan *swipe* pada objek produk	*Blacx Box*
5	Melakukan zom produk	*Slide* pada toggle zoom	*Blacx Box*
6	Melakukan lihat dalam produk	Menekan tombol lihat dalam produk	*Blacx Box*
7	Melakukan pemesanan	Memasukan no ktp, nama, no hp dan alamat	*Blacx Box*
		Menekan tombol pesan	*Blacx Box*
8	Melakukan load pesanan	Memasukan no ktp	*Blacx Box*
		Menekan tombol cari	*Blacx Box*
9	Melihat bantuan	Menekan tombol bantuan	*Blacx Box*
		Menekan tombol kembali	*Blacx Box*
10	Melihat data pesanan	Menekan tombol "pesanan"	*Blacx Box*
11	Mencetak data pesanan	Melakukan pengisian tanggal	*Blacx Box*
		Menekan tombol cetak	*Blacx Box*
12	Mengelola data pegawai	menekan tombol pegawai	*Blacx Box*
		Menekan tombol tambah	*Blacx Box*
		Menekan tombol edit	*Blacx Box*

No	Fungsional yang Diuji	Skenario Pengujian	Jenis Pengujian
		Menekan tombol hapus	*Blacx Box*
13	Mengelola harga	Menekan tombol bahan	*Blacx Box*
		Menekan tombol edit	*Blacx Box*

2.9 Conclusion of Black Box Testing

Based on the results of the tests that have been performed using black box testing, application customization of the virtual 3D furniture can go as well in accordance with the functionality of the process that has been tested previously.

2.10 Conlusion of Interview Testing

Based on the results of the interview that was done with doing the interview directly to users, business owners, namely 2 employees and 5 customers can be summed up as follows:

Goal 1: helping employees and business owners in the service booking with picture examples of products that are more detailed and interesting. The conclusion is the application can help business owners and employees to provide service on a customers product conoh with a picture of a more detailed and interesting.

Goal 2 : Help customers find out image information products that are informative and clear. The conclusion is with applications customers can get information that is more informative and clear in doing the order.

Goal 3 : Help employees and business owners in dealing with losing records the order. Conclusion the application may make it easier for business owners and employees in dealing with frequent occurrence of losing record bookings will result in production of furniture products.

Goal 4 : Helping business owners in monitor customer orders. Conclusion the application may make it easier for business owners in doing checking customer orders as long as he has no place because he can monitor the application orders anywhere.

3. CLOSING

3.1 Conclusion

Based on the research that has been done hasl namely analysis, design and testing using black box and interviews. Then it can be retrieved the following conclusions :

a. Helps business owners and employees in providing booking information products with more detail and attractive to customers.
b. help customers find out product information more clearly.
c. Helps business owners and employees in addressing problems due to loss of the booking notes.
d. makes it easy for business owners to conduct monitoring or checking of customer orders.

3.2 Advice

Based on the results of the research, then the advice can be expressed so that the future can be an improvement and development are as follows:

a. can perform the addition or subtraction of a custom product by the user.
b. Add augmented reality simulation for the placement of the furniture will be ordered.
c. Add the feature of showing the price in real time while choosing the model, materials and size desired.

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