AR FURNICAM: A MOBILE AUGMENTED REALITY APPLICATION OF R.C. GAMBOA FURNITURE

Morris Alvein I. Batilo
Lyceum of the Philippines University – Batangas
09072468164
morrisalveinbatilo@lpubatangas.edu.ph

Philip D. Maputi
Lyceum of the Philippines University – Batangas
09453083492
philipmaputi@lpubatangas.edu.ph

James Chester R. Dangel
Lyceum of the Philippines University – Batangas
09202141798
jameschesterdangel@lpubatangas.edu.ph

Ramer C. Maputi
Lyceum of the Philippines University – Batangas
09165337012
ramermaputi@lpubatangas.edu.ph

ABSTRACT

The study titled "AR FurniCam: A Mobile Augmented Reality Application of R.C. Gamboa Furniture aimed to provide a new marketing strategy that will help to boost the market and popularity of "R.C. Gamboa Furniture". One of the problems of the company is that they are not so popular like other competing companies. They do not even have a Facebook page or website that can help to boost their popularity, and most of their customers are just walk-in from Batangas and Lipa areas only. This mobile application will help the company in advertising their products in an innovative way through the mobile augmented reality application. The mobile application transformed the 2D target images, which is registered on Vuforia to a realistic 3D model that the user can move, zoom in, zoom out and rotate the furniture to give different angles and for better viewing. This application was develop using Unity, Microsoft Visual Studio, Sketch Up and Vuforia. It will work using Android from Jelly Bean 4.0 to Oreo 8.1 version.

KEYWORDS: *3D model, Augmented Reality, mobile applications*

1.0 INTRODUCTION

R.C. Gamboa Furniture is a one-stop furniture shop located in Gen.Luna St., Sabang, Lipa City and it is near the highway. It gives the customers and visitors the best quality of furniture that will fit their home and the best quality of customer service that provide the shopping experience of the valuable customer remarkable.

One of the problems of R.C. Gamboa Furniture is the company is not so popular like other. The company do not have a Facebook page or even a website that will boost their popularity. Therefore, the customers of the company are the people of Batangas especially on Lipa and the other customers are just walk-in. The company wants to have customers not just

in Batangas but also on other city or province to increase their income and popularity.

The researchers chosen R.C. Gamboa Furniture as the target beneficiary to help the company to create a new marketing strategy that is appealing to the customer and to increase the company's popularity. The mobile augmented reality application show the furniture and products in an innovative and modern way that encourage and convince the customer to buy the company's products.

Mobile application is the instrument used to augment the furniture and other products of R.C. Gamboa Furniture for the customer's view. Instead of showing only the brochures of products and furniture to the customers, the researchers used the mobile augmented reality application to show the products in a modern and innovative way. The user can visualize the three-dimensional view of the specific furniture or product. There are features that enhanced the viewing of the customers on the furniture like moving the furniture, zoom in, zoom out and rotate. There is also a feature that the name, prize and other details are visible. The main purpose of the project is to show the furniture and products in a modern and innovative way.

The researchers developed a mobile augmented reality application that helps the company's marketing strategy that is appealing to the customer. The software combines real and virtual also registered in three- dimensional. This mobile augmented reality application is for the customers of R.C. Gamboa Furniture to view the products in a modern way. The mobile application will show the three-dimensional view of the furniture.

The researchers used different software like Unity 3D, Sketch Up, Microsoft Visual Studio, Adobe Photoshop and Vuforia. C# is the programming language used to develop the application. The mobile augmented reality application that the researchers developed is limited only for android users with minimum requirement of Jelly Bean 4.0 while the highest compatible version of operating system is Oreo 8.1. The application can be only use in smartphones. The application not covers the augmented reality of the furniture shop itself and it only covers the furniture and products. In addition, it does not have a feature of virtual reality.

1.1 Objectives of the Study

This capstone project titled "AR FurniCam: A Mobile Augmented Reality Application of R.C. Gamboa Furniture" aimed to attain the following objectives:

1. To use mobile augmented reality application for the customers of R.C. Gamboa Furniture shop;

2. To provide an innovative and modern way of viewing furniture and products as part of marketing strategy of the company;

3. To use Unity 3D, Sketch Up and Microsoft Visual Studio in developing the Augmented Reality.

2.0 LITERATURE REVIEW

Augmented Reality

Amy Nordrum (2016) in her article "The Fuzzy Future of Virtual Reality and Augmented Reality", discussed last 2016 the Gartner Hype Cycle, the augmented

reality and virtual reality application will make a great difference on the technology from the trough of disillusionment to slope of enlightenment. Moreover, the modern era will adopt it within five to ten years." [1] The researcher's goal on the study is also to promote augmented reality and its adoption on Lipa City.

Teka S. Perry (2016) in her article "Augmented Reality: Forget the Glasses" discussed that the light-field concept will have a great impact on the technology because through this light field it will make the virtual image to be mixed with real image for the better display. [2] The researchers will also show that the light-field approach for AR will help to show a virtual image to be more realistic.

Eric E. Sabelman (2015) in his article "The Real-Life Dangers of Augmented Reality" discussed one of the negative effects of the augmented reality on your movements and reflexes. Based on the rigorous studies, some of the examples are misjudging the speed of incoming motor or cars, underestimating your reaction time and ignoring some hazards. [3] The study says that although AR can have some negative effects such as the way people perceive the real world but then AR can also affect the focus of the person.

According to Z. Huang et al. (2014), the developers experiencing a hard time on designing the interface or 3D models of Augmented Reality system. However, CloudRidAR can help the developers. It is a cloud-based architecture for the mobile augmented reality. It also helps in rendering the subsystem. [4] The researchers will also use MAR or Mobile Augmented Reality application in their study, but the researchers will not use cloud.

According to F. Pernici, A. Del Bimbo (2014), there is a great method that can improve the virtual models in the mobile augmented reality application called ALIEN. This method is a tracking and extraction method that can provide a more realistic view on the Augmented Reality. [5] The researchers will also use MAR applications in their study and the goal of the researchers is for the user to have a great AR experience.

According to Z. Huang et al. (2014), based on the Big Data Driver mobile augmented reality application there are lot of category helping the people like health, tourism, retail and public service. These are the data driven examples for the application of augmented reality in real life. [6] The researcher's category in their study is also application in retail to improve the marketing strategy of the company and to enhance the shopping experience of the customers.

According to Z. Huang et al. (2014), Augmented Reality and Mobile Augmented Reality Application must follow the guidelines and laws to avoid the leakage of privacy. Because privacy nowadays is very important to each one of us, it is our individual unique data that can be used by other on malicious purposes. [7] The researchers also have a great concern on privacy. The researchers will take pictures from the company not on the internet.

According to Piekarski, B. Thomas (2012), there is a vision based tracking method used on the application of Mobile Augmented Reality games. One of the example of it is ARQuake an outdoor augmented reality game, which is a single player only. It has a virtual reality feature and real buildings are model. [8] The

researchers' goal on the study is also to view the products like in the real world.

According to Google Glass Project (2013), they have a great idea to improve the Mobile Augmented Reality Application. It is the AR glasses it is the transformation of AR from the tracking of mobile devices to AR glasses, the user can view the augmented models on the glasses but there is also a negative effect on the facial recognition and path finding. [9] The researchers' goal on the study is also to bring the company into the new level of business plan through the application of MAR.

According to S. J. Yohan et al. (2014) there is a mobile augmented reality application used by the soldiers on their trainings. It can help them on familiarizing the battlefield environment through the application of augmented reality. This application called BARS. [10] The researcher's goal on the study is also the application of Augmented Reality to make the researcher's project possible to show the structures of the furniture and its background.

According to D. Schmalstieg, D. Wagner, (2012) Medienwelted is a Mobile Augmented Reality application for Technisches Museum Wien in Vienna. This are developed to manipulate and communicate with real objects and at the same time the user will enjoy the fun experience and they will have more knowledge about the exhibit. [11] The researchers' goal on the study is also to communicate the client in the real object using augmented reality.

According to J. Irizarry, M. Gheisari et al. (2012), there is a mobile augmented reality application that will help the facility managers to gain access on the building information. This application called InfoSPOT and it augments the facility mangers' situation awareness. In addition, it will help to solve problems and help in decision making [12] The researchers' goal is also to make the object view of real object so that they will see if they will like it or not.

Tam Harbert (2018) in his article "The Legal Hazards of Virtual Reality and Augmented Reality apps" one of the future effects of the Virtual Reality and Augmented reality. The legal hazards of virtual and augmented reality applications is also important. The lawyers had a legal questions are emerging that could trip up Virtual Reality and Augmented Reality applications.

Monica Rozenfield (2017) in her article "Immerse Yourself in New Worlds with Augmented Reality and Virtual Reality" there many applications and help in the real life on augmented reality and virtual reality applications. One of the best application is on health care, Virtual reality application based therapy will help to assess and tread and post-traumatic stress disorder. [14] This research study can be a therapy to some disorders and AR can be a great help to a person's situation in life.

Augmented Reality in Business

Adam C. Uzialko (2017) in his article "Augmented Reality Check: Innovative Ways Businesses are Embracing AR", augmented reality also can boost the sales of the company and it can change the way the customer approach in business. In manufacturing or retail, they a new way to engage with customer, consumers and business minded. [15] The researchers' goal on the study is also to promote AR to the students and customers

who want to buy their products and to use AR on business applications.

Kevin Rands (2017) in his article "5 practical ways AR can be used in business today" discussed the augmented reality application on the business today is a great help on the marketing part, it also no a futuristic technology but it is a technology that can be applied now and it can be improved to make a better help. The applications of augmented reality plays a great role and increase productivity and profitability. Moreover, there are many practical ways that Augmented Reality helps business field. [16] The researcher's goal on the study is also to discuss that Augmented Reality can also be applied in business nowadays to improve company's overall productivity.

Furniture Business using Augmented Reality

Danielle Braf (2016) mention in his article "Sell your furniture online in five simple steps" Lighting plays an important role on the augmented reality application. He said that natural lighting is better than flash because the natural lighting will not create dark parts or shadows that can affect the viewing of user. It also important that the image of the furniture was needed to include in a lifestyle setting. [17] The article describes the importance of photography, which includes the detail picture of an item in furniture selling.

According to the article, titled "Augmented Reality in Furniture" Ikea is a one of the best catalogue app that was made by the developers in augmented reality application on business. The user can use the smartphones camera to place the furniture in the real room. The application will automatically scale the items to real dimensions. [18] The researchers will also use augmented reality application to show the furniture in a modern way and the application that the researchers will develop is a great example of usability and marketing.

According to the article titled "Augmented Reality in Furniture" one of the best concept of the business nowadays is try it before you can buy it. This concept is a win win situation for both of the parties. Through the mobile augmented reality application, the customer can view the furniture in an innovative way giving them a perception if the furniture will fit on their home. [19] The researchers will also use the concept of AR technology to get the attention of the customers and potentially increase the sale of the company.

According to the article titled "Augmented Reality in Furniture" One of the furniture company created an augmented reality application that will help them to increase their sales and the engagement of the shoppers who have bought their products. Houzz application place a digital furniture items in a room before buying. [21] The researcher's application have the same feature of Houzz, the AR FurniCam will also help the perception of the customer on buying the furniture if it is best on their home.

According to the article titled "Augmented Reality in Furniture" Wayfair is a US online furniture company and decor retails made a mobile augmented reality application last 2016. This application will enable the buyers to view the 3D model of the furniture that you can rotate it on different angles. [22] The researchers will also develop an application that the user can view the

digital image of the furniture and can see the different angles of it.

3.0 METHODS

Among all the methodologies, the researchers choose to use the Mobile Application Development Life Cycle because in this method ensures that the user did not waste valuable resources and time during the mobile application development phase. The chosen method has five phases discovery phase, design phase, development and testing phase, deployment phase and maintenance and update phase that help the researchers to develop the application.

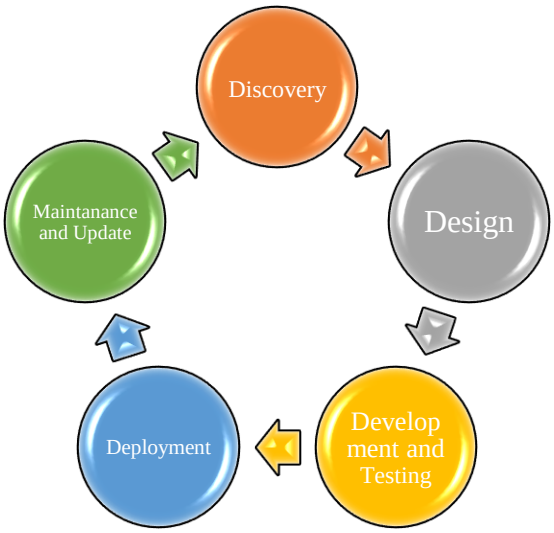

Figure 1. Mobile Application Development Life Cycle

Discovery Phase

In discovery phase, the researchers had collaboration and sharing of ideas with the guide of the capstone adviser to create a great concept and consulted the dean, Mrs. Roselie B. Alday, who helped the researchers to come up to an innovative topic. The researchers collected the needed data and information using internet and library. Some desktop and mobile applications must be downloaded in order to develop the mobile augmented reality application. Through the help of YouTube, a video-sharing website, the researchers searched different tutorial videos to understand and figure out what are the different methods and steps that help to create the project.

The researchers target users are the customers of R.C. Gamboa Furniture. In addition, the researchers conducted an interview to the manager of R.C. Gamboa Furniture to know the market of the company. The loyal customers of the company are the people of Batangas province. The marketing style of the company is wholesale and retail to boost the company's income. The suppliers of the company are from Manila like Moonhouse Marketing, BRC Furniture, Benjie Shop Furniture and Deo Foam. The manager visualize that the application to be developed by the researchers will help the company to have a new marketing strategy that is appealing to the customers.

Design Phase

In design phase, the researchers have created a user interface design that is simple, user-friendly and efficient as possible but it must be appealing to the users. Considering the mixture of colors, it must complement with each other and not painful in the eyes. Consistency on the type of font is also considered and it must be easy to read and understand. The interface is clear and easy to navigate, and it is interactive. The researchers used some of the Adobe Products like Photoshop in designing the interface and making the

company logo because the R.C. Gamboa Furniture has no company logo for the application. Moreover, the researchers came up with the ideas on how to create a flowchart for the user interface design. On designing the interface the researchers also considered that it is related to the furniture or furniture shop.

Development and Testing Phase

In development and testing phase, the software that the researchers used are Unity 3D, Sketch Up, Vuforia and Microsoft Visual Studio to develop the mobile augmented reality application. The programming language used is C#. The researchers took the sample brochures of furniture from the company for the application. The mobile application is compatible only for android smartphones. The target users of the application are the customers of R.C. Gamboa Furniture shop.

The researchers tested and verified all the application process to avoid bugs and errors. In addition, to ensure that the users are satisfied in using the mobile augmented reality application. All the buttons were tested if they are responsive and functioning well. Three-dimensional models tested if it is animating. Two-dimensional images tested, if the android mobile phone camera detects it. The background music and the text speech created tested to hear it clearly.

Deployment Phase

In deployment phase, the mobile augmented reality application is 100 percent done on all of the previous phases and will proceed to deployment. The researchers handed over the mobile application to the company and the researchers had a dry run of the application showing the features and giving a tutorial on how to use the application. Moreover, the target users tried, which is the furniture shoppers. The researchers also had a dry run with some of their classmates and friends to have a different suggestion that helped to improve the mobile augmented reality application. The researchers uploaded the application to Google Play Store to advertise the application.

Maintenance and Update Phase

In the final phase, the researchers will continue providing necessary maintenance and updates of the mobile application. The company and the shoppers were asked by the researchers for the feedback, suggestions, recommendations, and revisions to improve the development of the application and for the future version of the mobile augmented reality application. The researchers asked questions to R.C. Gamboa furniture shoppers to figure out if the mobile augmented reality application is useful and if it is appealing to the shoppers.

Flowchart

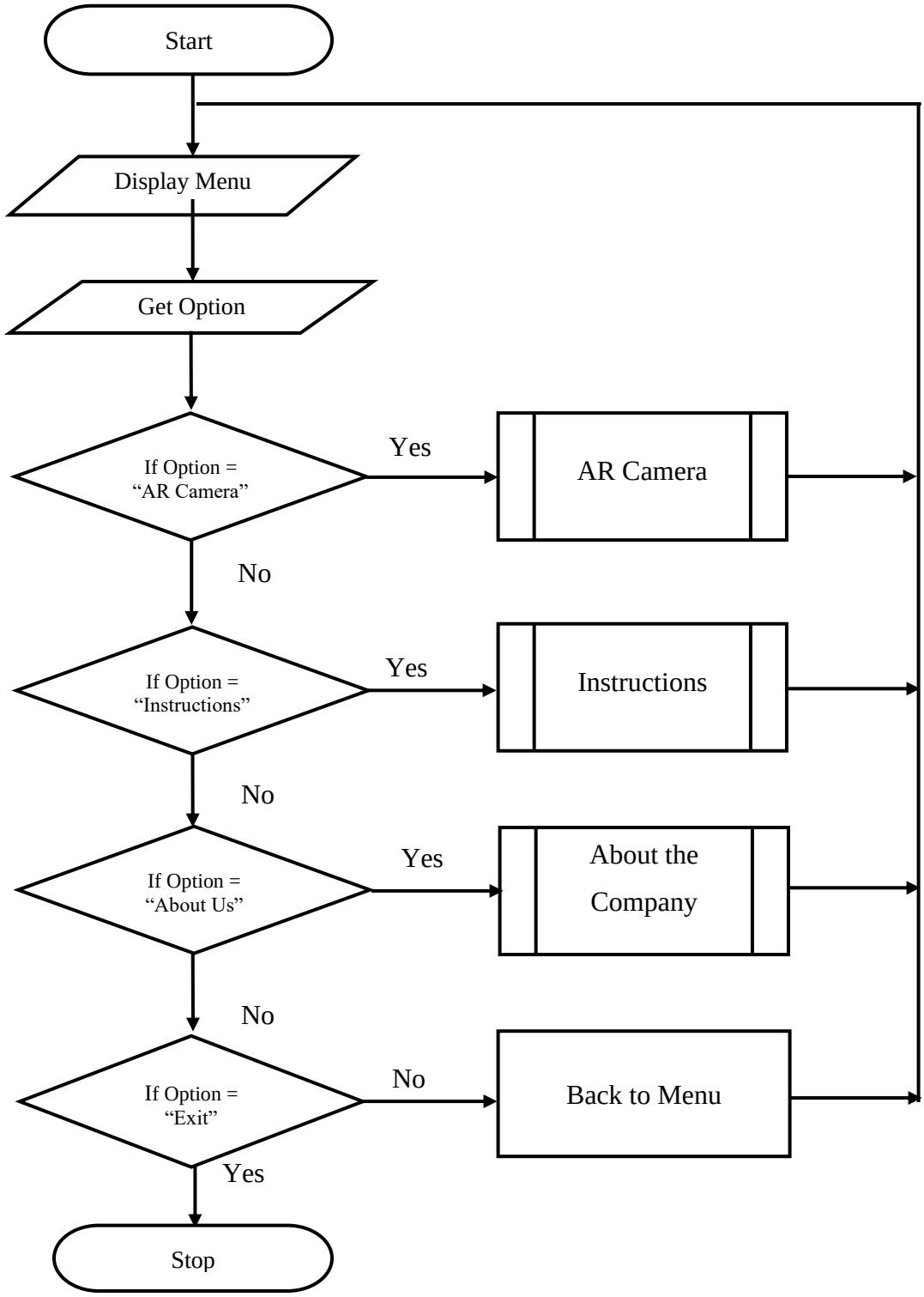

Figure 2. Menu

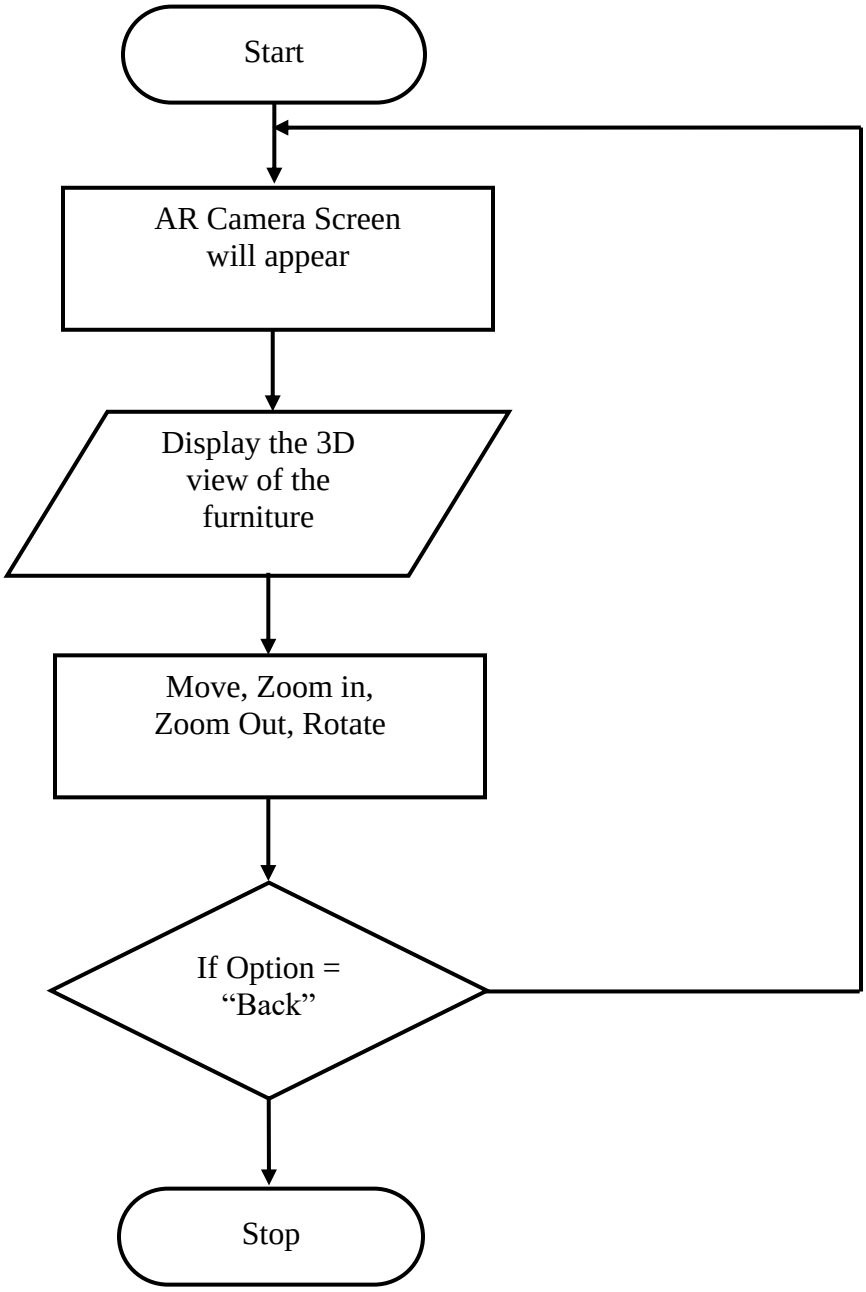

Figure 3. AR Camera

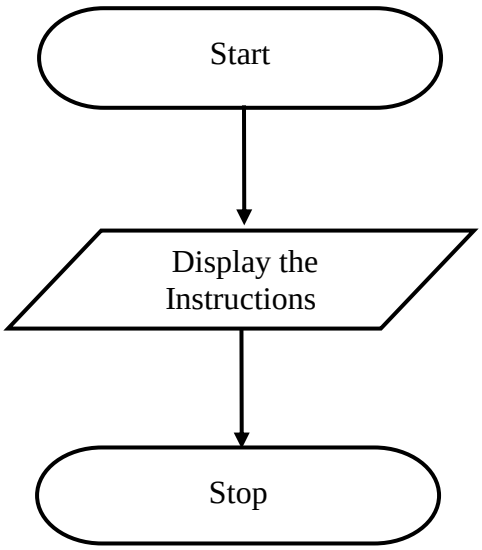

Figure 4. Instructions

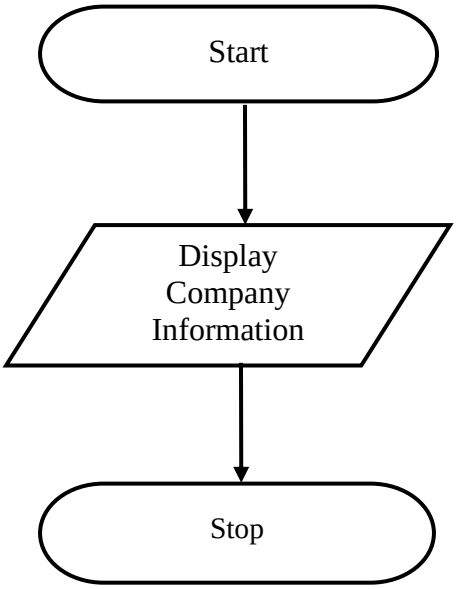

Figure 5. About the Company

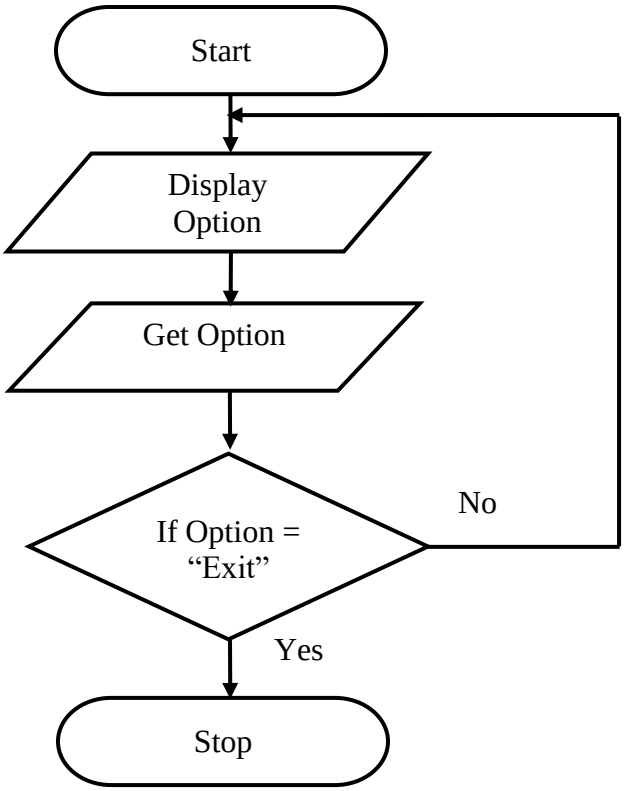

Figure 6. Exit

4.0 DISCUSSIONS
Screen Layout

Figure 7. Loading Screen (Unity Logo)

Figure 7 shows the loading screen that displays the unity logo which that application was made

Figure 8. Loading Screen (Company Logo)

Figure 8 shows the loading screen that displays the R.C. Gamboa Furniture logo

Figure 9. Main Menu Screen

Figure 9 displays the menu buttons: About the Company, AR Camera, Instructions, PDF, Mute and Exit button.

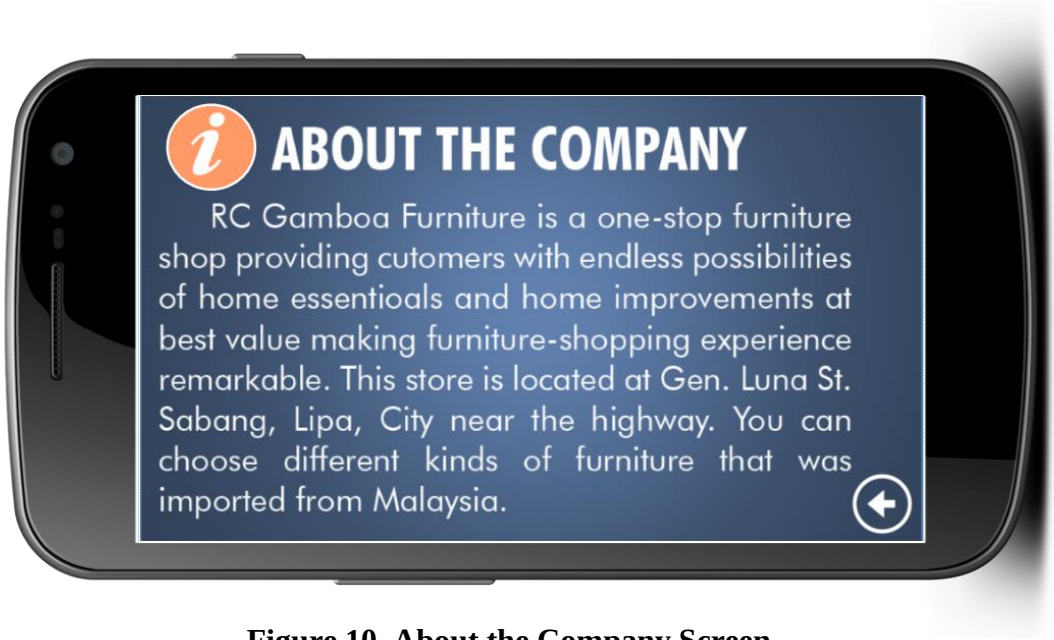

Figure 10. About the Company Screen

Figure 10 displays the brief summary about the R.C. Gamboa Furniture.

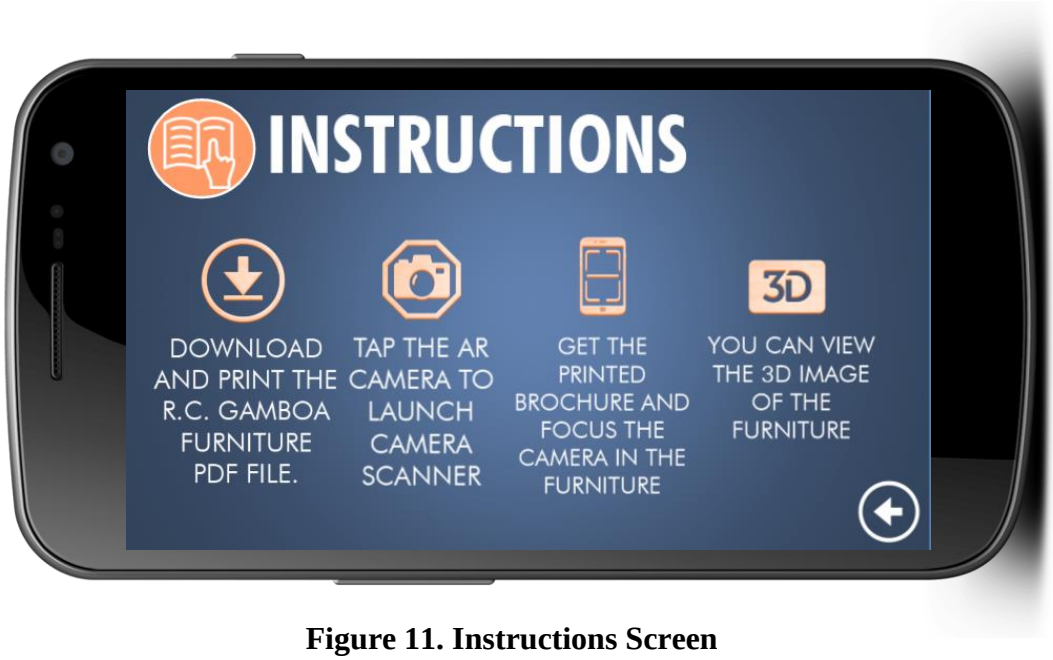

Figure 11. Instructions Screen

Figure 11 displays the step by step instructions on how to use the application. Also, there is a back button at the bottom right part of the screen and by tapping it the user will back to main menu.

Figure 12. AR Camera Screen

Figure 12 displays the 3D Furniture model that the user can move, zoom in, zoom out and rotate. Also, there is a back button at the bottom right part of the screen and by tapping it the user will back to main menu.

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The study titled "AR FURNICAM: A Mobile Augmented Reality Application for R.C. Gamboa Furniture" goal is to provide an innovative and modern way of viewing furniture and products as part of the marketing strategy of the company. From the 2D images or brochure of the company, the application can transform it into a realistic 3D model, which the user can move, zoom in, zoom out and rotate it for the users can view the furniture design clearly. It is the combination of the real scene viewed by the user and the virtual scene from the smartphone.

The mobile augmented reality application helps the company to boost its popularity through uploading the application on Play Store so it will be one tap away from the customers or for the users finding a furniture. The user will simply download the application and follow the instructions to be able to visualize the products of the company from their home. Through the application it can give the company more customers because the furniture is easy to view and access especially now on the modern era. The application will work using Android from Jelly Bean 4.0 to Oreo 8.1 version.

Conclusions

Based on the findings of the study about Mobile Augmented Reality for furniture, the following conclusions were drawn:

1. The use of Augmented Reality is a great way for the customers to be more interested on the furniture of the company. By using the application, the customer will be familiarized on the furniture and leading to increase the chance of the customer to buy the furniture.

2. The Mobile Augmented Reality Application helps to boost the market of the company and it is a unique marketing strategy that the customers can view the furniture easily by just one tap from their home. Moreover, it is a unique and innovative way of showing the furniture to the valuable customers.

3. Different software like Unity 3D, Sketch Up, Adobe Photoshop and Microsoft Visual Studio are great help on developing the mobile augmented reality application and in enhancing the design of the user interface.

Recommendations

The following recommendations are hereby forwarded: The AR FurniCam: A Mobile Augmented Reality Application for R.C. Gamboa Furniture is recommended to the customers of the company and other users who are finding a furniture to be able to easily view the furniture in innovative way in just one tap. For the other furniture companies to have this kind of application that will help their marketing strategy to have more customers. For the developers and future developers who will study similar topic, to have more features like a virtual background of the customers house to be able for them to visualize the furniture if it fits on their home. In addition, it can rotate upside down not just from left to right. Moreover, to have a virtual reality feature, it is highly recommended that the future developers must develop it in other operating system like iOS.

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APPENDICES

Code Listing

BACK TO MAIN MENU

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class BackToMain :
MonoBehaviour {

        public void SceneSwitcher(){
                Application.LoadLevel(0);

}
}
```

CALL THE AR CAMERA SCENE

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class Interface : MonoBehaviour {




public void SceneSwitcher(){

Application.LoadLevel(1);
}
}
```

Open PDF Link

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class OpenPdfLink :
MonoBehaviour {

        public void PDFbutton(){


        Application.OpenURL("https://dri
ve.google.com/drive/folders/163iYD0Xpg
6KgBHrUrKByqRlNA5E2jjGP?usp=shar
ing");

}

}
```

User's Manual

System Requirements

- The mobile application is for Android users only
- The required minimum operating system for this version is from Jelly Bean to Oreo.
- The required RAM (Random Access Memory) is 1 GB or hogher.

How to have the mobile application on your phone:

1) Launch the Google Playstore application on your smartphone.
2) On the search bar, type "AR FurniCam" and download the application.
3) Launch the application by tapping the AR Furnicam icon or logo on the smartphone' menu.

Instructions

1) On the Main Menu, tap the PDF button that will leads you to the link of Google Drive shared folder that contains the target images that you need. Download and print it or you can open it on another device or laptop.
2) By tapping the 'Instructions' button on the main menu that will give you also a guide in using the application.
3) Tap the 'AR Camera' button and point the camera on the printed target images or on the target images form another device.
4) The 3D furniture model will appear once the AR Camera recognize the target images
5) You can move, zoom in, zoom out and rotate the 3D image for the best viewing.
6) On the Main Menu, you can tap the 'About the Company' button to know a brief summary about the company.
7) Also, on the main menu you can tap the mute button to turn off the music.

CURRICULUM VITAE

Batilo, Morris Alvein I.
Address: #364 sitio riverside Itlugan Rosario, Batangas
Email: Alveinmorris@gmail.com
Contact Number: 09072468164

Personal Information:

- Fathers Name: Kennedy C. Batilo
- Mothers Name: Editha I. Batilo
- Date of Birth: April 17, 1996
- Religion: Roman Catholic
- Nationality: Filipino
- Marital Status: Single

Education:

- **Elementary:** Sto Niño Formation and Science School (2003 – 2009)
- **High School:** Sto Niño Formation and Science School (2009 – 2013)
- **Tertiary:** Lyceum of the Philippines University Batangas (2015 – Present)

CURRICULUM VITAE

Dangel, James Chester R.
Address: Sta Clara Ibaba Batangas City
Email: jcdangel16@gmail.com
Contact Number: 09202141798

Personal Information:

- Fathers Name: Domingo W. Dangel
- Mothers Name: Cora R. Dangel
- Date of Birth: January 7, 1998
- Religion: Roman Catholic
- Nationality: Filipino
- Marital Status: Single

Education:

- **Elementary:** University of Batangas (2005 - 2011)
- **High School:** University of Batangas (2011 - 2015)
- **College:** Lyceum of the Philippines University Batangas (2015 – present)

CURRICULUM VITAE

Maputi, Philip D.
Address: Matala, Ibaan, Batangas
Email: maputiphilipd@gmail.com
Contact Number: 09453083492

Personal Information:

- Fathers Name: Rolando A. Maputi
- Mothers Name: Lucy D. Maputi
- Date of Birth: November 19, 1999
- Religion: Roman Catholic
- Nationality: Filipino
- Marital Status: Single

Education:

- **Elementary:** Saint James Academy (2005 - 2011)
- **High School:** Saint James Academy (2011 - 2015)
- **College:** Lyceum of the Philippines University Batangas (2015 – present)

CURRICULUM VITAE

Maputi, Ramer C.
Address: #346 Talaibon, Ibaan, Batangas
Email: ramermaputi@lpubatangas.edu.ph
Contact Number: 09165337012

Personal Information:

- Fathers Name: Ramon A. Maputi
- Mothers Name: Merlinda C. Maputi
- Date of Birth: September 5, 1996
- Religion: Roman Catholic
- Nationality: Filipino
- Marital Status: Single

Education:

- **Elementary:** ACTS Christian Academy (2002 – 2008)
- **High School:** Saint James Academy (2008 – 2012)
- **Tertiary:** Lyceum of the Philippines University – Batangas (2016 – Present)