Augmented Reality Technology Implementation in Local Automobile Advertising

Lim Si Yi, Noorhaniza Wahid, Rahayu A Hamid, Norhanifah Murli, Muhammad Fakri Othman
Faculty of Computer Science and Information Technology,
Universiti Tun Hussein Onn Malaysia (UTHM), 86400 Parit Raja, Batu Pahat, Johor, Malaysia
nhaniza@uthm.edu.my

***Abstract*—Advertising plays a vital role in businesses. Businesses use advertising to achieve various goals and spread their brand as well as to directly sell products and services to the public. As technology advances, mobile advertising is becoming more and more critical for brands and services. Therefore, Augmented Reality (AR) technology has entered the mobile advertising industry to enable advertisers to increase consumer engagement and revenue. Hence, in this project, an implementation of AR technology for local automobile advertising on Android platform is proposed as an alternative to advertising new cars. Perodua Myvi is chosen as the case study in this implementation. By using a marker, users will have an unprecedented way to interact and view the car's exterior, features and specification regardless of time and location. This project has been developed successfully to provide an alternate method of advertising to the automobile consumer.**

***Index Terms*—Augmented Reality; Mobile Advertising; Automobile; Marker.**

I. INTRODUCTION

Augmented reality (AR) is a variation of Virtual Environment (VE). It is a technology that takes a digital device to generate the information within the virtual environment. With this technology, images, audio, video, and touch or haptic sensations can overlay in a real-time environment [1]. Today, AR has been implemented in many domains such as engineering, medical, robotics, mobile and entertainment. Mobile AR is a new emerging technology in the market. It has attracted the leading brands with a $1.5 billion revenue stream in 2015 [2]. The goal of advertising is to lead consumers purchasing the product. Recently, businesses are shifting from traditional advertising to the digital content advertising, which is seeing new growth that extends beyond traditional revenue streams [3]. The technology is capable of presenting possibilities that are difficult for other technologies to offer and meet [4]. AR works with smartphone devices and applications to bring a different experience to the users. It can bring a static print to life and become a huge selling tool for businesses.

Moreover, the use of AR advertising is still new in the local automobile industry in Malaysia. Conventionally, potential buyers will walk in any automobile showrooms to get the exact information and specification of a particular car. However, buyers are unable to remember all of the information after leaving the showroom, and it is difficult for them to imagine the exact appearance by looking at the printed pamphlet or brochures only. The research found that potential car buyers will start by comparing websites, checking out reviews, going through social media, and then searching the information online before finally visiting a dealer for test drives [5]. However, it is only accessible via an internet connection. Therefore, this paper presents the implementation of AR for advertising Perodua Myvi model in a mobile application. The application allows for a fast and immediate response to users' request.

The rest of the paper is presented as follows: related work discusses AR and its potential in the advertising industry. Next, the methodology describes the development process, followed by the section that discusses the results. Finally, the concluding remarks are presented.

II. RELATED WORK

Augmented reality with video-see-through technology is a method which explores 3D objects by using handheld devices [1]. It can be classified into two types: marker-based AR application and markerless AR application. Marker-based AR application involves image recognition where a printed black and white image acts as the marker. Upon recognising the marker, the device will be able to display the 3D model [6]. Conversely, markerless AR application does not require any printed marker. It identifies patterns, colours or some other features that may exist in camera frames. A markerless approach tries to track features in a completely unknown environment to estimate pose and requires more processing power than marker-based approaches [7].

Recently, advertising products via mobile platform have entered a new paradigm. Therefore, the mobile advertising industry has taken advantage of AR technology to increase consumer engagement, and hence increasing their earnings. Advertising through AR can create a unique user experience, which is improved from interactivity and personality compared to common 2D advertising [8]. Thus, it leads to more effective and attractive advertising and branding strategy. In addition, the cost is cheaper than television advertisements and other expensive mediums. This system is easy to use due to its mobility where customers can access anytime anywhere. According to AR market report, the technology has grown along with mobile phone technology featuring a camera and GPS [2]. Therefore, mobile AR advertising is seen to be one of the advanced technologies to be implemented in current business trend. In Malaysia, AR advertising for Proton Preve and Perodua Myvi can be found in [9] and [10], respectively. In general, the features provided by these applications include basic requirements such as car specification and features, showroom location and colour changeable function. However, some limitations exist where still pictures are used to represent the specification of the car without detailed information; users need to self-rotate the marker to view the whole perspective of the car, and

showroom location simply identifies the nearest showroom from the users' current location.

Thus, AR Your Myvi application is developed to improve those limitations. A virtual screen of the contact number and showroom's address will be displayed on the screen. Interestingly, the user can make a phone call by just clicking the call button on the virtual screen. Also, the user is able to play around with the 3D model using rotation and zooming function that gives unprecedented way to view the exterior and features of the car

III. METHODOLOGY

AR Your Myvi application is developed for the Android-based operating system. Android platform is chosen due to its flexible setup to meet user needs. In addition, Android is a Linux platform which is programmed in Java making it compatible with any platform. Unity 3D software is used as an AR engine that enables the user to interact with the application within an AR environment. There are six phases involved in the development of AR Your Myvi application: user requirement analysis, application design, object creation, marker creation, main function integration, and product release. Detail explanation of each phase will be discussed in the following topic.

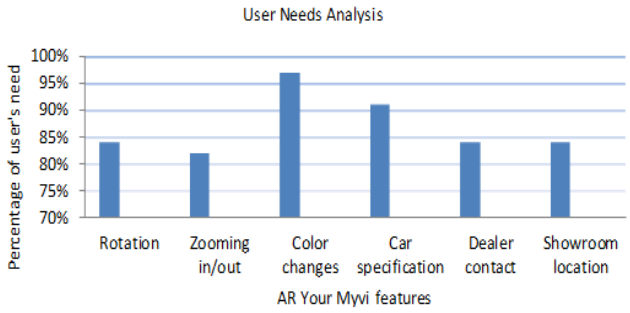

Figure 1: AR Your Myvi features requirement

A. User Requirement Analysis

Prior to development, information gathering was performed by interviewing the target users that are the Perodua car dealers and potential buyers. The purpose of the interview is to identify the minimal requirements of the application based on user preferences. Therefore, four car buyers and five car dealers from two Perodua showrooms in Johor Bahru were selected in the interview session. Figure 1 shows six features preferred by the users obtained from the interview. Overall, colour changes function is the most preferred feature with 95% interest from the users, followed by car specification with 91% interest. Meanwhile, 84% of users prefer to have functions such as rotation, dealer contact and showroom location to be included in the application. The least preferred function required by users is zooming in/out with 82% interest.

B. Application Design

Application design involves three activities that are application style, content structure, and storyboard structure. The application is designed to be used in offline mode. The application consists of four main components: object models, background, buttons and icons. Myvi car, showroom platform and projector rack are designed as 3D models. These models are then combined to create the showroom as shown in Figure 3. Text and graphic buttons, and icons are used to ease user understanding on application navigation. To enhance the presentation of the user interface, the colour green was selected as the background colour of buttons. The inspiration for the colour was taken from the design of the Perodua logo. Based on the application style, this application supports intuitive user interface and helpful information.

The content structure of this application is divided into two parts: menu and submenu. The menu provides seven functions where each menu consists of its specific submenu except for lighting. Detail explanation of each menu is described in Table 1. Afterwards, the storyboard structure which indicates the details of the interface design is prepared as a guideline to the developer before proceeds to the next phase.

Table 1
AR Your Myvi Menus and Submenus

Menu	Submenu	Decsription
Zooming	In and Out	Enable user to zoom in or zoom out the car model up to 300% zooming.
Rotation	Clockwise and Anti-clockwise	Enable user to rotate the car model, up to 3600 clockwise or anti-clockwise rotation.
Sound	Engine	Engine sound will play when engine button is pressed.
Lighting	-	Car lamp will light on when lighting button is pressed.
Information	Interior and Exterior	Descriptions include dashboard, seat, luggage, car dimension and specification.
Colour	Purple, Black, White, and Blue	Enable user to select between four colour options.
Map	Batu Pahat and Johor Bahru	In each submenu, call function is provided that enables user to call the dealer directly.

1) Object Creation

The main object of this application is Perodua Myvi 2011 model. Object creation involves the process of designing and modelling 3D model for Myvi using 3Ds Max software. Besides, the car seat and showroom are created using the same software. The process of modelling car is depicted in Figure 2. Then, the texture is applied to the car by using the material in Unity 3D.

2) Marker Creation

AR environment is produced by using Vuforia SDK. AR marker as shown in Figure 4 is created before the image is uploaded to the Vuforia website in order to generate a database file. The database is created through Target Manager to store the marker image. Then, the database is downloaded to integrate with the Unity 3D which can be used as a self-creation marker. Figure 5 shows the marker image creation framework. To launch the application on the mobile device, the AR camera and the marker must be set up. The marker will be printed on the business card and pamphlet to ease customers accessing the application at any time and anywhere in offline mode.

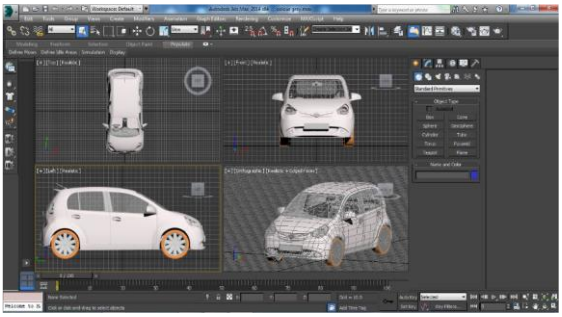

Figure 2: Myvi design and modelling

Figure 3: Main view of AR Your Myvi application

Figure 4: AR Your Myvi marker

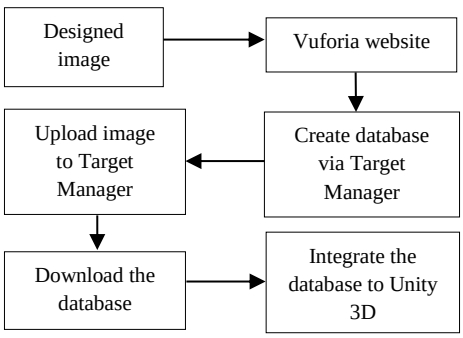

Figure 5: Framework for marker creation

C. Main Function Integration

Before the application is released, all objects and scenes are integrated that allows the user to interact and navigate through the application. In Unity, C# programming language is coded to implement the application. A code snippet for rotation function is given in Figure 6. Meanwhile, Android Application Package (*.apk*) is needed to publish the application on the mobile device. Therefore, all the necessary scenes were added to be built in the Unity 3D based on the steps given in Figure 7.

```
public void rotate ()
{
  Transform moriginalTransform = null;
  GameObject original = GameObject.Find ("original");
  if (original != null) {
    Debug.Log ("original found");
    moriginalTransform = original.transform;
    if (moriginalTransform == null)
       return;
   Quaternion oldRotation = moriginalTransform.localRotation;
   moriginalTransform.localRotation = Quaternion.AngleAxis
   (-30,Vector3.back) * oldRotation;
  }
}
```

Figure 6: A code snippet for rotation function

Step 1:	Set the resolution of the application to 1280 x 720 pixels.
Step 2:	Click the File menu and select the Build Settings.
Step 3:	Tick all the involved scenes displayed in the Scene In Built.
Step 4:	Select the Android Platform column and click on Player Settings. Put the designed image into the Default Icon part.
Step 5:	Click on Build button, and the *.apk* file was exported.

Figure 7: Steps for building the scenes in Unity 3D

IV. RESULTS AND DISCUSSION

AR Your Myvi application has been successfully developed with the size of 1280 x 720 pixels resolution and 47.7 MB memory size. Figure 8 shows the main menu of AR Your Myvi and Figure 9 shows the interface of the showroom selection function. This function allows the user to call the dealer directly from the application. This application has been tested to 15 respondents from two Perodua showrooms in Johor Bahru to get their feedback based on three criteria of the application: user acceptance, functionality and performance. Users had to rate from 1 to 5 where 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree and 5 for strongly agree Overall, none of the users had rated those criteria from 1 to 3. More than 60% users strongly agreed that this application is interesting and easy to use while 53% agreed that the application had provided new information. The results are illustrated in Figure 10. Meanwhile, the functionality of the application as depicted in Figure 11 has attracted users' attention where more than 80% users strongly agreed that the buttons are well-functioning and the multimedia elements are integrated and arranged nicely. Nevertheless, users' opinion towards the stability of the application when playing on a mobile device is about 20% different as compared to two other functionality criteria. This is because the main menu took 30 seconds to loading when they click on Home button. Also, the camera took 30 seconds to loading in auto start mode. Interestingly, more than 65% users strongly agreed that the performance criteria of the application had fulfilled their expectation as presented in Figure 12.

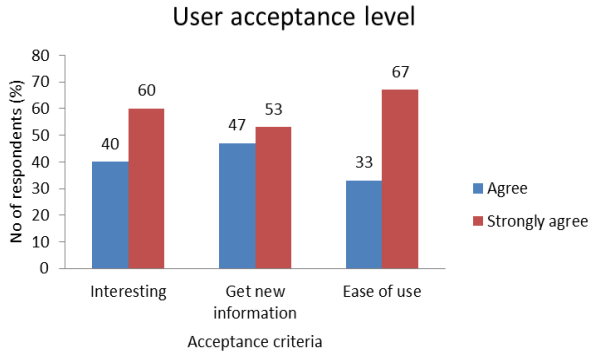

Figure 10: User acceptance level

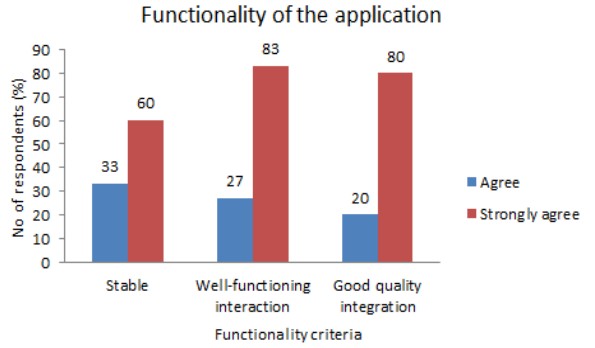

Figure 11: Functionality of the application

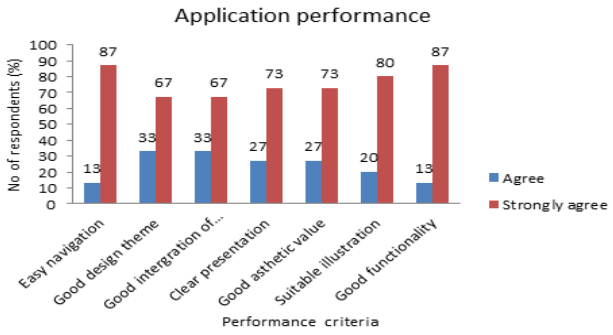

Figure 12: Performance level of the application

V. CONCLUSION

Overall, it can be concluded that the implementation of AR in automobile advertising industry has potential to enhance potential buyers to remember an experience or action related to the product, rather than a traditional advertising method involving static printed image or common text. Thus, the AR promoting ads allow the viewer a more interactive experience, possibly leading to improved retention of product information. A future enhancement is needed to improve user acceptance criteria as well as increasing performance level criteria for more convenient and user-friendly mobile AR advertising application.

ACKNOWLEDGEMENT

This study has been supported in part of the Short Term Grant (STG) Vot U367 under the Malaysia Ministry of Higher Education (MOHE) and Universiti Tun Hussein Onn Malaysia (UTHM). This research also supported by GATES IT Solution Sdn. Bhd under its publication scheme.

REFERENCES

[1] G. Kipper and J. Rampolla, *Augmented Reality: An Emerging Technologies Guide to AR*, USA: Syngress, 2013.

[2] W. Holden, *Mobile Augmented Reality Users to Approach 200 Million Globally By 2018*. Retrieved from http://www.juniperresearch.com/viewpressrelease.php?pr=225, 2011.

[3] Malaysian Communications and Multimedia Commission, Advertising Development in Malaysia. Downloaded from http://www.skmm.gov.my/skmmgovmy/files/attachments/Ad_Dev_Malaysia.pdf, 2009.

[4] A. Alkhamisi and M. Monowar, "Rise of Augmented Reality: Current and Future Application Areas," *International Journal of Internet and Distributed Systems*, vol. 1, pp. 25-34, Nov. 2013.

[5] Frost and Sullivan, iCar Asia's Digital Shift Study: Online research crucial to car buying process. New section within Mobil123 launched to fill the gap in online information sourcing for Indonesian car buyers. Retrieved from http://80www.icarasia.com/press/icar-asias-digital-shift-study-online-research-crucialto-car-buying-process-new-section-within-mobil123-launched-to-fill-the-gapin-online-information-sourcing-for-indonesian-car-buyers, 2013.

[6] S. Cawood, M. Fiala, and D. H. Steinberg, *Augmented reality: a practical guide*, NC: Pragmatic Bookshelf, 2007.

[7] P. J. Carel van Wyk and A. E. Herman, *Markerless Augmented Reality on Mobile Devices with Integrated Sensors*. Downloaded from https://pdfs.semanticscholar.org, 2013.

[8] J. Sung and K. Cho, User Experiences with Augmented Reality Advertising Applications: Focusing on Perceived Values and Telepresence Based on the Experiential Learning Theory, *Lecture Notes in Electrical Engineering*, Vol. 182, pp. 9-15, 2012.

[9] ProtonInteractive, Experience the Proton Prevé in Augmented Reality. Retrieved from https://www.youtube.com/watch?v=lFg820_OIRc, 2017.

[10] Phenostudio, Myvi phone application (augmented reality). Retrieved from https://www.youtube.com/watch?v=xdimvwoKeU8, 2017.