

3D Modelling Editor for Mobile Application using Augmented Reality Technology

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Abstract. Augmented Reality (AR) is a combination of real and virtual objects that partially merged in a single environment. AR allows the user to interact with the virtual images using real objects as a medium. However, there are very rare to find that 3D modelling editor for mobile application that implement an AR technology even in this era of rapid development of technology. Therefore, this project proposes a development of 3D modelling editor with implementation of an AR technology by using Unity3D and Vuforia SDK. Through this application, users can experience AR environment while modify their 3D model and indirectly, users can feel more satisfied while modifying the 3D models. And the application's name is VoxelSwatches. This application interacts with the augmented display with the ability to edit the colour of the selected object and produce an instantaneous change in colour of the object. In addition, this application also provides the colour swatches panel and three different 3D model. They just need to aim on the marker by using their mobile phone's camera and the app will recognize a corresponding app and displays the augmented display as the user can interact with. The interface VoxelSwatches are developed as an AR environment by using Unity3D and Vuforia SDK, real hand as the interaction tool and basic cubes as the 3D objects. Finally, the result is the complete prototype VoxelSwatches with implementation of AR environment.

Keywords: 3D Modeling, Augmented Reality, Virtual Reality, 3D Modelling Editor

1 Introduction

Peoples nowadays using their smartphone to create or modify 3D model, either as professional or just want to learn or make a fun while creating any 3D model. People would like to make 3D models of the world around them by using their own smartphone [1]. Unfortunately, there are very rare to find that 3D modelling editor for mobile application that implement an AR technology even in this era of rapid development of technology. The aim of this project is to develop a 3D modelling editor for mobile application with the implementation of an AR technology. There are three objectives of this project, which is, to study the issues in 3D modelling editor for mobile application in AR environment, to design 3D modelling editor for mobile application with the implementation of AR technology and to implement 3D modelling editor for mobile application using AR technology.

Meanwhile the scopes of this application are the running platforms only in IOS devices, the development is limited to testing phase, the display of the application is vertical view this application only detect one markers at one time, the 3D model created is limited in the shape of cubical, the application develops in Unity 3D and Vuforia SDK, the

application be able to interact with augmented display, the 3D model in this application only limited to three model, the application be able to change the colour of the 3D model, the markers of this application only limited to one specified designed logo(VS), the target of this application is to children (age 10 – 12), teenagers and 3D modelling editors and the current function of the editor in this application is limited to edit the colour of the selected model.

2 Background

As opportunity of this situation, 3D modelling editor for mobile application with the implementation of AR technology was developed. This project develops an effective and intuitive 3D modelling editor in AR environment and provides robust interaction technique between real and virtual elements in AR application. The most interesting aspect is that it brings to the users the illusion of editing the 3D models in the real world. And the ultimate goal is to make the users more satisfied in editing the 3D models. In this project, a modeling editor, named VoxelSwatches, is proposed to take those advantages of AR.

2.1 Interaction Techniques in AR Handheld Interface

There are user interface issues where an AR enabled mobile phone or wearable technologies that acts as an interaction device. The traditional 3D spatial manipulation is being improved to apply to this new platform in AR. The high tangibility of the device and its button interface makes it becomes interesting compare to spatial manipulation techniques use HMD with the users hands free to interact with the virtual object, either directly or using an input device such as a mouse or digital glove [2] describes object manipulation techniques have implemented on a mobile phone.

2.2 Spatial 3D Object Editing in AR Environment

2.2.1 Changing Characteristic

Changing characteristics of points and its associated virtual objects involves appearance and geometry parameters, such as colour, light, shininess, transparency, shape and size [3]. This action on points and its associated virtual objects changes its parameters and can be executed on one or several elements, depending on the commands.

2.2.2 Behavior

In the AR environment, points are translated in relation to a base reference, keeping the reference orientation. Virtual objects can be translated and rotated in relation to the respective point reference. An object movement consists in translating or rotating it relative to the point reference. Particularly, the base movement such translation or rotation, takes all associated points with it [3]. Therefore, the movement of points and virtual objects allows the reorganization of the AR environment while the movement of the base allows the visualization of the AR environment by another point of view.

2.2.3 Behavior

Points and virtual objects can present behaviors, which allow them to react in a simple or complex way, as a result of user interactions with them or with other elements of the AR environment and even as a result of a system state changing. The behavior is a small program or configuration associated with points and virtual objects, which can be activated or deactivated by the user. In the creation phase, the behaviors are deactivated by default. When the behavior is activated, it tests the system parameters and imposes specific behaviors in each case, interacting with the user, other virtual objects and system state. The behavior capacity of points and virtual objects allows the development of complex and intelligent AR environments [4].

3 Method

3.1 Project Methodology

In order to construct AR technique in 3D Modelling Editor, AR environment with high real-time performance for virtual world need to be mixed with our real world, there are five phases of project development planned, which are preliminary investigation and data collection of AR for 3D modelling editor, design the well-suited Interactive 3D Modelling Editor using AR, develop AR Mobile Based Application for 3D Modelling editor, Integrate 3D Modelling Editor with AR for mobile application and evaluation.

3.2 Features Based Tracking

During this development, Vuforia package was used in order to track the target image by using Vuforia target manager. The Vuforia target manager is a web based tool that enables developer to create and manage target databases online. To begin working with the Target Manager, the developer needs a Vuforia developer account. The step includes create device database in target manager, upload target via target manager, download device target market and integrate device database into Vuforia engine. Figure 1 shows the example of target image before upload and after upload to manager target database in order to tracking the features.

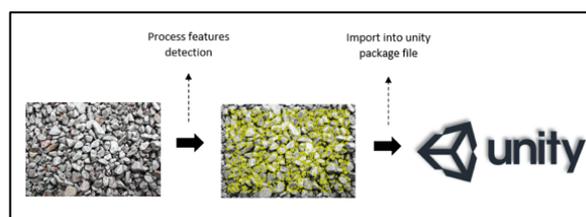


Fig 1. Process of generating Unity package file based on image

3.3 System Design

Some virtual button and objects was designed for user to interact with the application. Objects here were defined as 3D object, which is a cube was used in order the model look like 3D object. Basically, the interface is designed based on the products colour and identity to ensure user experience is preserved. The usage of these elements will be briefed more by

using the use case diagram of the project which as in Figure 2. The use case show that the user can view tutorial on how to use the system by clicking on the tutorial button. Next, the user can select the camera button at the home page in order to edit the models. User can choose either change the 3D models or change the colour of the model at the first after marker was detected. User need to choose colour from the colour swatches panel before applying the colour to the models. While user change the colour, user also can change to another model and continue to colour the new model. However, user still can choose the previous model and continue colouring the model.

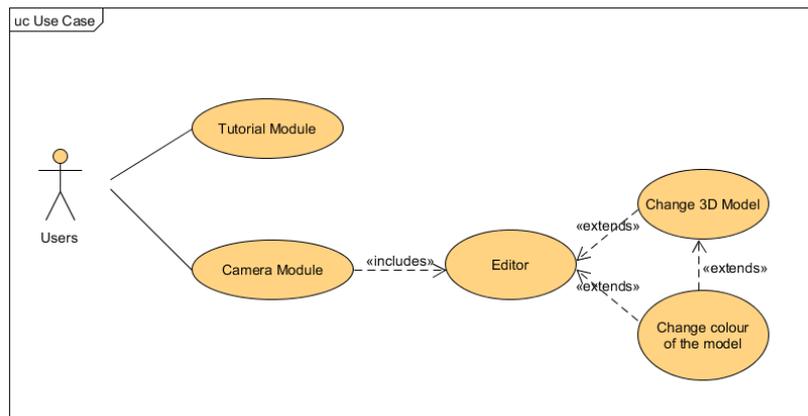


Figure 2 Use case diagram

4 Implementation

The implementation of this application is developed for mobile application in AR environment. Unity3D provides variety plugin and tools in an easy way to develop a mobile based application. Meanwhile, the system is using Vuforia SDK as the library for features based tracking technique. For the Graphical User Interface (GUI), all buttons and texts on the screen for website are using Unity Asset Store called NGUI. The system is named VoxelSwatches and home page is as shown in Figure 3.



Figure 3 Home page

4.1 View Tutorial

This tutorial page only shows the steps on how to start use this application. This tutorial page only has one button, which home button. The function of this home button is to go back to the home page. There were 4 steps given on this tutorial page. The first step is user need to click on camera button. The second step is user need to find a VS logo marker and followed by third step, which is user need to scan that marker. The final step is the user can start to choose and colour the selected object.

4.1 Change the models and change the colour of the models

After user scan the VS logo marker, user can start use the corresponding button and apply to the 3D objects. Which is, user can change the model by clicking the model button as presented in Figure 4. The main function of this application where the user need to colour the 3D object in AR environment in order to preserve the satisfaction while colouring the model. There is only the simple process was taken in order user to choose and apply the selected colour from the colour swatches to the model. As example, users can simply click their favorite colour from colour swatches panel and the selected colour will be shown in colour fill panel as shown in Figure 5(a). And the next process, user need to choose and click the part of the model (head, eye, body, hand and etc) in order to apply the selected colour as shown in Figure 5(b). And user can repeat all the process by colouring the next part of the model.

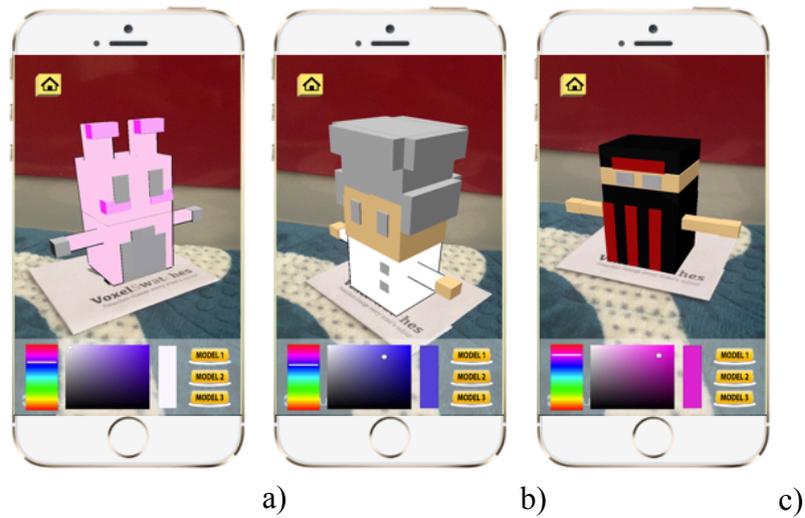


Figure 4 Editor page; a) User click on model 1 button b) User click on model 2 button c) User click on model 3 button

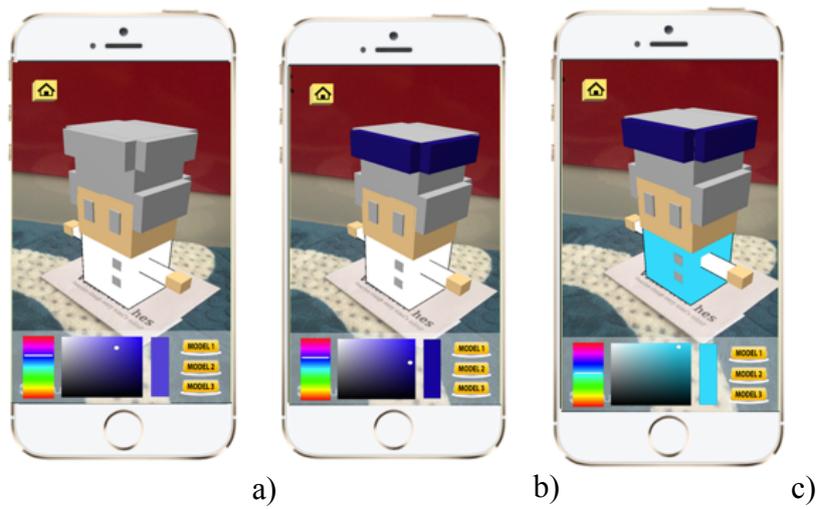


Figure 5 Process taken in order to change the colour of the model

5 Testing

5.1 Usability Testing

Usability testing will help the developers to detect any bugs or failure of the system. This testing is carried out by alpha testing of the survey with 10 correspondents within range 15 to 24 of age. From the survey, it can be concluded that 50% out of 10 users with

background of Technology and Computer Science is the most heard and have experience with Augmented Reality. Based on the survey, the system's flow allow responses perform the task quickly as the feedback for speed of response is great which 50% out of all responses is only when they have great understanding of the system's flow which hold for 60%. After all, the process of marker detection and colouring the model is successfully supported by the feedback from responses that 50% agreed that the system is great on ideal time taken for the 3D model to pop out on the mobile screen and 90% also choose great for the smoothness of the colouring the 3D object.

6 Conclusion

The final objective was to implement 3D modelling editor using AR technology. This objective was achieved with the application ready to be used within iOS. This was proven earlier in Implementation with the mention of project analysis, development flow, project environment and application development. The overall subchapters described each of the steps above in great detail. Together with the above implementations and testing, the project outcome together with the steps taken to test it.

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