**3D Virtual Reality Educational Programming Game Using Unity3D, Blender and Google Cardboard**

**Chua, Vaughn Victor A.**

Institute of Computer Science, University of the Philippines Los Baños

Los Baños, Laguna

[vaughn.chua27@gmail.com](mailto:vaughn.chua27@gmail.com)

**ABSTRACT**

With the rise of virtual reality technology in the world, many games are being developed on different platforms and one of those is the Android platform. The project develops a 3D educational programming game that touches the gaming side of the users and as well as the learning experience for programming. The game can become an inspiration for other aspiring game developers to create an educational game. The game being developed is using Unity3D game engine and the 3D models is created in Blender. Google Cardboard will then be used as a medium for the virtual reality side of the game.

**INTRODUCTION**

These past few years, the 3-Dimensional or 3D system in the virtual world has been developed and is currently being used on different fields as a medium for relaying more accurate and more precise representation of real-world models. One product of the 3D system is the Virtual Reality technology which is currently being used in various fields of science. Even the everyday smart phones that the general public use can already be a viable medium for the Virtual Reality technology and it is made possible by using devices that carry out the virtual reality system. The general public may already have access to virtual reality devices but the developers of the said devices continuously improve their technology for the sake of their consumers’ enjoyment of the virtual reality system.

According to the researcher’s observations, when it comes to video games in general, the age bracket that mostly plays video games is between ages 15 and 25 which are considered as the teenager to young adolescent people. The teenagers seek video games that satisfy their thirst for playing; with the emergence of smartphones, these video games are now easily accessed by many because they are very portable. Teenagers who are still studying in their high school or collegiate levels are prone to playing games on their smart phones because most of the time, what they hold these days are smart phones.The problem is that most of the games that people play, when they have the free time to do so, are only for time-killing and many of those games are just for the sake of entertainment because of the game genres that they play in. With that, it can be said that there is no room for learning on the educational aspect.

This study is intended for making an android platform virtual reality game using a virtual reality device which caters the entertainment aspect that the general public want and also the educational aspect that they need. This study will be focusing on the people who want to learn programming, may it be that their major course tackles programming or that these are beginners on programming. The game

will take on the basic aspects of programming which includes using loops, conditional statements, etc…

The in-game elements will be interactive that the players will have no chance of being bored as they play the game. Lastly, this study may be a breakthrough of the traditional learning of programming which is taught using PowerPoint slides. The Institute of Computer Science can make

new ideas from the study and create more 3D educational games that suit the different aspects of computer science.

**Related Work**

The following will tackle the works of different authors in relation to this study. According to the journal entitled: *Interactive Virtual 3D gallery using motion detection of mobile device* [Sinthanayothin et al., 2011],

*“The system will allow users to take pictures with the mobile device and exhibit in the form of virtual 3D gallery and navigate or walk through in the gallery by pressing the button or moving the device”*.**[1]**

The result of this is a success in which they can navigate through the whole 3D gallery. According to Deponti, D et al. [2009], the journal stated that they will have created an android-based application for wrist rehabilitation and creating a prototype therapy in which they are focused on the healthcare of seriousgamers who are using most of their wrists. **[2]**In the journal of Sontisirkit, S. [2014], the author compared the differences of each virtual reality devices and what they are capable of doing and in the author’s conclusion she said that in the next 2 years to come, Virtual reality will be widely used on different industries and one of them is on the education aspect. **[3]** A game has been developed by Cheng B et al. [2015] and is entitled *Corgi Defence*. It is a puzzle game in which players are required to solve in the virtual reality world. The authors’ conclusion is that the game is enjoyable however it is still being limited by the hardware in recognizing hand gestures. **[4]**

According to Patil, P. et al. [2015], their study is about the *Cross-platform Application Development Using Unity Game Engine*. In this, the authors talked about how Unity3D is being used as a game engine and its power to create and present games to different platforms including Android, iOS, Windows etc… In the end of their study, they created an Air Hockey game in which it can be ported to different platforms.**[5]** In the Journal *User-defined gestures for Agumented Reality with Smart Phones* by Madeddu, F [N.D.], the author tackles the different effects on the user interactions by testing the selection, zoom and rotation on the mobile phones of 15 participants using Google Cardboard.**[6]** According to an article by Shubber K [2014], the time of virtual reality has come at last with the Google Cardboard. The author discussed the features of Google Cardboard and how it is similar to the other devices.**[7]** In the journal of Callaghan, M. [2014], the author stated that “*This type of business model depends on the ability to record, analyze and interpret analytics and metrics to finesse the user experience and plan future iterations of a product to ensure a high level of user retention and monetization”***[8].**

**METHODOLOGY**

The game will be developed using Unity and Blender. Both technologies are open-sourced and easy to use. After developing the game, it will be ported as an .apk file to be transferred to android smart phones and from that, the virtual reality device called the Google Cardboard, will be used as the medium for the 3D virtual reality feel of the game. The study will be using Google Cardboard for the reason that among the mentioned Virtual Reality devices earlier, Google Cardboard is the cheapest of them all. Using Unity is the current best choice to develop the game proper because it is mainly a game engine and is easily accessible. Blender will be the one responsible for modelling 3D meshes because it is 3D modelling software with a game engine.

Blender’s game engine won’t be used in the study mainly because Unity offers more features than Blender and has a more stable and faster engine.

The Unity game engine can create Google Cardboard compatible applications by using the add-on feature called Cardboard Software Development Kit (SDK). This allows creating tasks and functionalities that are capable for the split screen and button needed in Google Cardboard. The process of developing the game will be as follows:

1. *Game Design* –This will be the most important part of the development process because this is the main component on how the game will work from the beginning to the end. The design for this study’s game will be a on a linear basis. Using the in-game objects, the player can solve various problems in the area so that he/she can move to another area.
2. *Map Creation and Player functionalities*- This is under the Game Design step. Unity’s Unity3D feature creates the map for the game. Along this, C# will be the main scripting language when coding for the player movements and other game elements. C# will also be the main code for Cardboard SDK.
3. *Player and Object Modelling* – Blender uses vectors and meshes for smooth modelling of 3D objects, the player along with the in-game objects will be modelled here and will be imported to Unity after.
4. *Porting to Android Smartphones* – Unity has its own porting feature for different device platforms; one of those is the Android platform in which the game will be deployed. The resulting product of the ported game developed in Unity will be in .apk file format.
5. *Usage of Google Cardboard* – Usage of Google Cardboard requires users to have a smartphone with a *Gyroscope* because this allows a person’s phone to move accordingly to the user’s head movements while wearing the Google Cardboard.

The interaction between the game and the user will be as follows:

1. The user will input or execute a command,
2. The game will receive the command and return the correct action for the user input.
3. Upon completing the task required, the game lets the user to move to the next challenge of the game.

**EVALUATION**

The game will be evaluated by checking the user’s level of enjoyment of the game, the level of difficulty of each puzzles/problems presented, the time that they finished the game and how well did they learn from it. The users that will be picked to test the game will be divided into two groups of players; the first group of players are the ones knowledgeable of basic programming commands while the other group are players that are complete beginners when it comes to programming. The users that will be chosen are teenagers; they can be a high school student or a college student. Also, the users will be asked if they want to repeat the game and if they have suggestions for improving the game. After recording the feedbacks, the researcher will now be able to point out where to improve the game and what other factors the game lacks. There will be 30 users that will be testing the game. 30 testers will be enough for the data gathering since playing the game takes time.

**TIMELINE**

Planning the game design will take 1 to 2 weeks. Creating the game design will take 2 to 3 weeks. Modelling the 3D mesh and other in-game objects will take up to 2 weeks. Integrating the 3D models to the main game will take 3 to 5 days. Porting of the game into android platform will take less than a day. Finding test users and testing the game will take 1 to 2 weeks.

**REFERENCES**

# Sinthanayothin, N. Wongwean, and W. Bolsithi. 2011. Interactive virtual 3D gallery using motion detection of mobile device. (26-28 Sept 2011). Retrieved October 30, 2015 from: <http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=6061538&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D6061538>

# D. Deponti, D. Maggiorini, and C. Palazzi. 2009. DroidGlove: an android-based application for wrist rehabilitation. (12-14 Oct. 2009). Retrieved October 30, 2015 from: <http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=5345442&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D5345442>

1. Sra Sontisirkit. 2014. Special study on virtual reality technology: virtual reality head-mounted display and interaction device. (August 2014). Retrieved October 31, 2015 from: <http://sralife.com/workblog/oculus_2014/assets/docs/paper_oculus_2014.pdf>

# B. Cheng, M. Ketcheson, J. van der Kroon, and T.C. N. Graham. 2015. Corgi defence: building in a virtual reality environment. (2015). Retrieved October 31, 2015 from: <http://dl.acm.org/citation.cfm?id=2810268>

1. P. Patil and R. Alvarez. 2015. Cross-platform application development using unity game engine. (4 April 2015). Retrieved October 31, 2015 from: <http://www.ijarcsms.com/docs/paper/volume3/issue4/V3I4-0004.pdf>
2. F. Madeddu. N.D. User-defined gestures for augmented reality with smart phones. (N.D). Retrieved October 31, 2015 from: <http://library.uncw.edu/uploads/pdfs/23.pdf>
3. K. Shubber. 2014. Observer review discovery pg. 22. (3 August 2014). Retrieved. November. 3, 2015 from: <http://library.uncw.edu/uploads/pdfs/23.pdf>
4. M. Callaghan, N. McShane, and Gomez Eguiluz. 2014. User game analytics to measure student engagement/retention for engineering education. (26-28 Feb. 2014). Retrieved Nov. 3, 2015 from: <http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=6784174&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D6784174>
5. Unity3d. 2015. About unity3D. (2015). <https://unity3d.com/learn>
6. Blender. 2015. About Blender. (2015). <https://www.blender.org/>
7. Google Cardboard. 2015. About google cardboard(2015). <https://www.google.com/get/cardboard/>