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3d Game Design And Developmentof 3d Shooter Game Using Xna

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ABSTRACT
This paper will mainly discuss the 3D game engine and various technologies involved in the development of 3D game.Firstly, it discusses the design of 3D game engine and various genres of 3D game.Secondly,it focuses on various technologies and various tools required to develop a 3D game.It proposes the basic layout of the shooter game and its implementation.
Keywords – *Direct X,MAYA,3D game engine,3D games,XNA.*

I. INTRODUCTION

Gaming industry is one of the booming industries in today's world. Video games are becoming a huge sensation among people. This is basically due to innovations in technology such as high quality graphic cards and faster processors. These improvements have also led to the development of 3D games, which provide an unrestricted environment and rich graphics to the users as compared to 2D games. Moreover, 3D graphics also present a more realistic picture.

3D shooter games have gained a lot of popularity among people in recent times. There are different categories of 3D shooter games like first person shooter (FPS) and third person shooter. The first person shooter consists of a perspective of the main character of the game that is carrying some sort of weapon.

OpenGL is the foremost environment for developing portable interactive 3D graphics applications, since its introduction in 1992 and has become the industry's most extensively used and supported 3D graphics application programming interface (API).It has brought many applications to computer platforms. There are many game development software available in use while many of them are based on the OpenGL platform .[4]

II. LITERATURE SURVEY

In the latest years, a lot of research has been done to develop games. Zachary Horst studied 3D game engines in detail [3].Earlier, Q.Lin, and R.Wang proposed an OpenGL based C++ implementation of a 3D first person shooting game [4]. They depended on C++ for the implementation of shooter game but the problem was that the advanced features that C++ offered took off too much processing power and that was simply unacceptable to a game programmer. With the advent of XNA, J.Linhoff and A. Settle did a detailed research on XNA framework and studied how to use it [5].Furthermore, Xia San-ao suggested that animation software's like Maya prove to be the strongest 3D development software.[6].By analysing various features of various game engines we have proposed a game design and development idea.

III. 3D GAME ENGINE

For the player, how the game looks, feels and plays is of the utmost importance. Meanwhile, for the game designer and programmer, the most important part of a video game is the game engine. The game engine is primarily an executable software application that provides an environment for the development and test running of game logic, and for the incorporation of corresponding game art, to ultimately produce a playable game.[7]With the sharp improvement of graphics in the later years, a new challenge is to create better interfaces to amplify the experience of game players.The most complex form of game development engine is the 3D engine.

A.Contents Of a 3D Game Engine

Generally speaking, a 3D game design engine first provides two primary depositories for creative materials used in the game being designed: game logic and game art. The game logic contains program code that controls game play behaviors such as dialogue, player movement and boundaries, weapon behavior and capabilities, and the other elements that combine to make a computer game. The game logic, in turn, tells the game art what it needs to access.

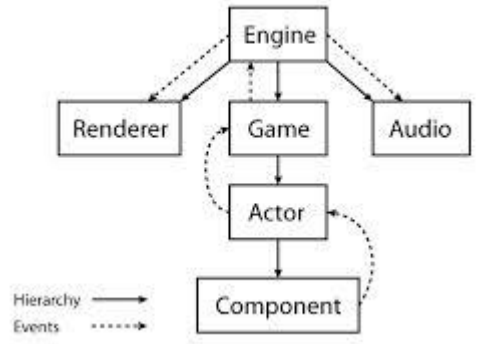

Fig. 1 3D Game Engine Hiearchy

IV. DIFFERENT GAME GENRES

The video games in the market today focus on many different styles of play. The three most popular and mainstream, however, are the First-Person Shooter, the Real-Time Strategy, and the Role-playing game. Each of these game types offers a different outlook upon graphics engines and their development.

A.*First-Person Shooter(FPS)*

Most popular games are from this genre. They consist of a view from the eyes of the main character of the game who is usually operating some type of weapon. The focus of the graphics is on the weapons and other non-player characters .The graphical features are highly detailed.

Fig. 2 First Person shooter game view

B.Real-Time Strategy

Real-Time Strategy games allow the user to take control of a certain amount of units over a small or large map. The user typically has a view from above a 2D, or more recently, 3D map.

Fig. 3 Real-time strategy game view

C.Role-Playing or Third-Person Shooter game

Role-playing games turn the user into a fictional character.They employ a third-person view of the character.

Fig. 4 Third-person game view

V. 3D GAME CONCEPTS

1)Vectors: Vector is a quantity, which possesses both magnitude and direction. It can be used to denote positions of objects in 3D video games the concept of vector can be applied to detect collision when the bullet hits the target in shooter games. The bullet as well as target can be modelled and checked against each other.

2)Matrices:A matrix is a rectangular table of elements. The graphical part of the game requires the use of matrix for game development. We can easily change the coordinates of points and vectors easily from one coordinate system to another with the help of matrix.

3)Transformations: Transformations from local coordinate system to 3D coordinate system are done using scaling and rotation.

VI. PROPOSED 3D GAME DESIGN AND DEVELOPMENTOF A SHOOTER GAME

A.*Game Design*

The proposed designing of a 3Dshooter game has the following stages:

a.Game interface design-It will contain a fixed game arena in which the player and other non-player characters will be present.It will consist of a shooter which has a weapon to shoot the target and target boards which keep appearing randomly.

b.Game Play-The gameplay is very simple. The only goal is to shoot the target board. The target boards appear randomly in all directions. The target board disappears as soon as the fired bullet hits the target and collision takes place. A new target board appears after that.100 points are awarded on shooting the target correctly.

Game has a single-player mode only. The game provides a third person view in 3D environment. The player controls the main character of the game. The main character can run and walk in all possible directions. Arrow keys as well as gamepad can be used to navigate the character.

c.Character creation-3D modeling is the basic step for game designing and character development.Various animation softwares are available such as Maya which can be used for modelling.Creating models in OpenGL is straight forward. There are several coordinate spaces available in OpenGL as object, world, camera, screen coordinates etc. 3D coordinates of the object should be specified first w.r.t. object coordinates then can be transferred to screen coordinates at last through several steps based on our requirement. In XNA,3D models are converted into .fbx format and then exported to XNA framework for final implementation.

We have suggested the following character design for 3D shooter game:

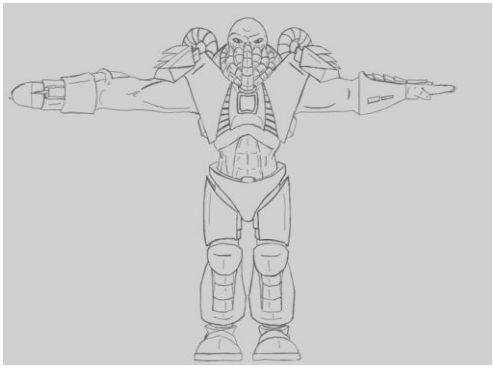

Fig.5 Suggested character design

Character creation steps include the following:

1)Modelling-It mainly consists of Polygon Modelling.Polygons are used to create 3D models. Vertices, edges and faces are the 3 basic components of polygon. These three basic components are used to modify polygons. Several faces are connected together to create a network of faces, which is known as polygon mesh.3D polygon models are created by using polygon meshes.[10]

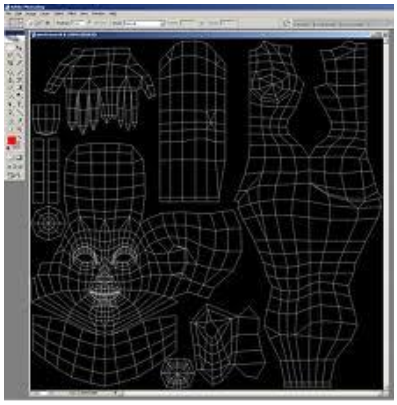

Fig.6 Polygon meshes

2)Sculpting-Digital sculpting, also known as Sculpt Modelling involves manipulation of a digital object by pushing, pulling or grabbing.

Fig.7 Digital Sculpting of character

3)Texturing:It can be done in Adobe Photoshop

Fig.8 Textures

4)Providing skeleton and skinning-Skeletons are stratified and hinged structures. Skeletons are used to do binding of models. The disfigured model is provided with a basic structure and support by using the skeleton.

The deformable models are bound to a skeleton using skinning. Generally, the mangled objects are polygonal surfaces. The shapes of theses geometrical objects are determined by the movement of the skeleton's joints. After providing skeleton, skinning of the character is done.

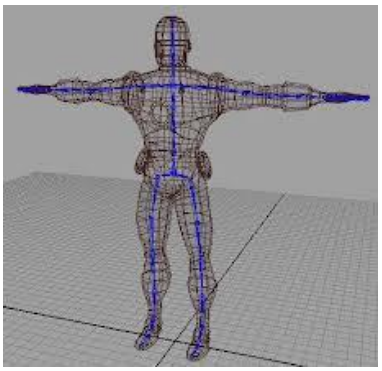

Fig.9 Providing Skeleton

5)Shading-Shaders are programs mainly run by the graphical processing unit to do rendering or produce prominent effects such as lighting,coloring or shading in an image.

Shader languages are used for shading. Earlier, Assembly was the main shader language but later high-level shader languages were introduced due to good hardware capabilities.

There are various types of shader languages such as GLSL(OpenGL shader language),NVidia Cg language,the High-level shader language or High-level shading language (HLSL) .The High-level Shader language is developed by Microsoft. It is mainly used by XNA and DirectX.HLSL programs come in three forms: vertex shaders, geometry shaders, and pixel (or fragment) shaders.Pixel shaders, also known as fragment shaders, compute colour and other attributes of each fragment.[11]

d.Camera setting-For camera setting, several functions can be used to view in a particular direction.Orthogonal projections,vectors and several coordinates are specified for camera setting.
e.Collisions-Collisions are required in the 3D games as the user should not be allowed to go through the rigid objects like buildings and enemies. A simple method called bounding boxes is used to handle collisions in 3D games. A virtual box is created with bounding minimum and maximum x and z coordinates (base). We check against those virtual bounding boxes wenever the player makes a move. [4]

f.Animations-Handling animations needs special attention. Maya software can be used to handle animations for 3D shooter game.MAYA provides tools to bring the animated characters to life. We can control the 3D character by using the various animation techniques provided by Maya.
There are various types of animation in Maya such as keyframe animation,non-linear animation,dynamic animation,motion capture animation etc.To achieve the desired motion effects we can split,duplicate and blend different animation clips using the non-linear animation.We can create separate animation clips for the character such as different positions during walking and running and then blend them to produce the required animation.Dynamic animation lets you create realistic motion. We can use dynamic motion to show bullet firing in our shooter game.

B.*Game development*

Game engine will bring all of the following engines together to create the game. Graphics engine will be responsible for rendering text, 2D images, and 3D models on screen.Various Game development tools can be used such as:

a) Microsoft DirectX SDK
b) XNA Game Studio 3.0 and above
c) MAYA /Unity 3D /Blender/ZBrushfor character creation.

C.Implementation

The basic game functionality can be done in XNA in conjuction with C#. The 3D models created using Maya are converted into.fbxformat.The models are brought in XNA framework by using this format.The scripting can be done using C#.The classes provided by XNA framework stores all the data we need for drawing model on screen.XNA's content manager manages all models and provides various methods which are used to load the 3D model from file to XNA's model class For our shooter game,various mesh objects such as model mesh for arms and legs form a part of the XNA's model class. The rendering process which includes the creation of projection matrix is also managed by XNA.[12]

The basic functionality of the game is described through the game loop.

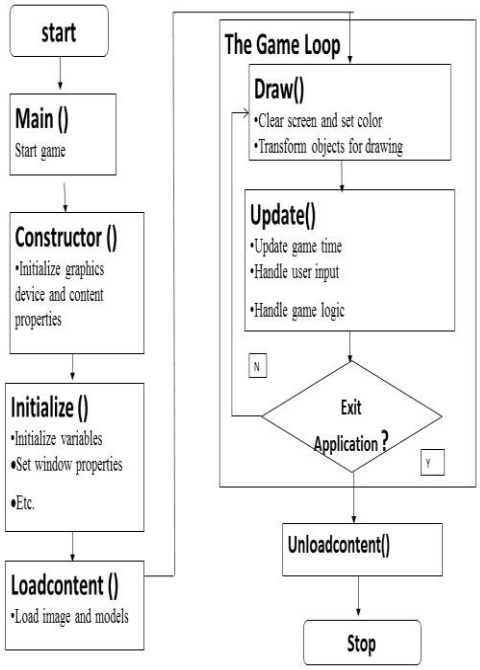

Fig.10 Game Loop in XNA

VII. CONCLUSION

In this paper by studying the features of XNA in alliance with C# we have observed how it proves to be an excellent framework and how it can be used to develop a 3D shooter game.We have also analysed the great work done by various animation softwares such as MAYA.We have seen how these softwares offer intuitive UIs that are easy to learn and navigate, making the process of creating 3D art as manageable as it could ever.

REFERENCES

[1] N. Landry, "Microsoft XNA: Ready for Prime Time?",CODE Magazine, vol. Sept/Oct, 2007.
[2] T. Miller, "Managed DirectX 9 Graphics and Game Programming",Sam's Publishing, 2004.
[3] Zachary Horst, "3-Dimensional Video Game Engines", Villanova University, Villanova, 2009.
[4] Q. Lin, Z. Zhao, D. Xu, R. Wang, "Design and implementation of an OpenGL based 3D first person shooting game".In Transactions on edutainment V, Zhigeng P. Adrian, D. Cheok, W. Müller, X. Yang (Eds.), S.Verlag, B. Heidelberg, pp. 50-61, 2011.
[5] J. Linhoff and A. Settle, "Teaching game programming using XNA," ACM SIGCSE Bulletin, vol. 40, no. 3, pp. 250–254, 2008.
[6] Xia San-ao , "Application Of Maya In Film 3DAnimation Design'',Computer Research

and Development (ICCRD), 3rd International Conference, Volume 2,pp.357 – 360,2011

[7] Lars Bishop, David Eberly, Turner Whitted, Mark Finch, Michael Shantz. "Designing a PC Game Engine" IEEE Computer Society Press, CA, 1998.

[8] Pallab Dasgupta ,Mohammed Haque. "Architectural/Engineering Visualization using Game Engine" Construction Science Department, Texas A&M University, 2008.

[9] Autodesk Inc,The Art of Maya,5th edition,2007.

[10] Microsoft; "Shader Stages (Direct3D 10)", http://msdn.microsoft.com/en-us/library/bb205146 (VS.85).aspx. Retrieved May 26, 2008.

[11] Microsoft; "Overview of the Application Model", http://msdn2.microsoft.com/en-us/library/bb203873.aspx.Retrieved October 6, 2007.