

Investigate The Use Of Computer Games Technology Within The Field Of Serious Games, As A Solution To Problems Outside The Entertainment Industry.

Abstract

- Computer Games have become a multi-billion dollar industry and the leading financial drive behind the development of 3D graphics hardware.
- Other industries are looking to games development practices in order to create real-time 3D applications.
- Serious Games are software applications which utilize technologies and development methodologies initially intended for computer games development.
- The uses of Serious Games are wide ranging but generally fall into the categories of simulation, advertising, training, and education applications.
- One of the major areas of interest in Serious Games development has been the Healthcare and Medical sector.
- Games companies, have expressed interest in branching out into the relative security of fixed contract work from large medical and defence companies over their existing developer/publisher model.
- Serious Games have become an exciting, and potentially lucrative, new frontier for game development and academic research.

Serious Games?



A serious game is an application developed with game technology and game design principals for a primary purpose other than entertainment, often to educate, train or inform.

Background



- The Bioinformatics centre at the Wyeth Translational Medicine Centre (WTMC) approached the University of Abertay Dundee with the task of researching and developing a prototype system for accessing a range of genomics data in a more intuitive way by using an interactive 3D human body interface.
- As a partial solution, I propose to investigate and provide an interactive, internet based 3D scene for use as an interface to set of data stored in a database or number of databases (developed by another student). This will consist of aspects of 3D content creation, suitable formats and pipeline issues, including content delivery and real-time rendering.
- The 3D scene will be initially stored on a web server before it is downloaded by the client.
- The client will be able to place markers within the scene which link to data in a genomics database relating to the specific location of the marker. The client application will then upload any changes made to the scene which will notify any other clients that a change has been made and allow them to download the latest version.
- The update process will also allow the scene to be modified or updated on the server side, and allow for specific levels of detail or scene subsets to be viewed more effectively (without accessing the server). When the client is connected to the internet, they will have access to current scene data which will be rendered on the client machine within the applications window using an existing 3D Rendering API.
- The markers placed within the scene by clients will either link to external data in the genomics database or are relayed back visually within the scene. The data referenced by external links will represent hyperlinks and/or queries to a database which will be displayed within a web browser while internal links may be relay within the 3D scene itself for the purpose of visualising effects of data changes within the scope of the scene. For example the expression of a certain gene may cause a visual change in colour on the surface of a specific organ, pathway or system representing the levels of gene expression in the given area. The application may be extended further to provide a real-time visualisation of data flow over time.
- This project will aim to deliver a 3D scene for the specific use as a tool in for the WTMC medical application. In the application, medical practitioners will be able to create link entities within a scene, which represents the topology of a human body (including representations of internal organs, muscles, bones, blood vesicles and the central nervous system), at positions which reflect the physical location of the data available. For example, links to data on heart conditions would be found by looking at the links attached to the heart model within the 3D body.
- In order to find the optimal solution to these problems, research will be carried out into existing or similar applications within the problem domain; specifically research in the fields of web-based 3D environments, real-time rendering, Serious Games, and user interface design. Research may also cross into aspects of database access and querying techniques from real-time applications.

Method

The program will be implemented in two distinct parts; the Framework and the Application:

Framework

The framework will provide a platform independent, re-usable underlying class library for the application. The framework will have the following features:

3D Graphics

- DirectX & OpenGL API Support Allow hardware accelerated 3D rendering on multiple hardware platforms including Windows, MAC and Linux.
- Cg & HLSL Effect Support Enable use of the programmable pipeline via effect framework and GPU shaders. This will allow more complex lighting / visual effects such as bump and gloss mapping to give a more realistic visual representation of the organs.
- 3D Model format Loading Support for DirectX (.x) file and COLLADA format mesh / scene data.
- Scene Management
 - Scene Graph.
 - View frustum culling.
 - Level of detail (LOD) meshes.
 - OCCTREE / BSP tree visibility tests.

Physics

- Implementation of PhysX API.

Sound

- FMOD Cross-platform sound API . Support audio feedback.

Input

- Read input from keyboard / mouse / XInput controller.

Networking

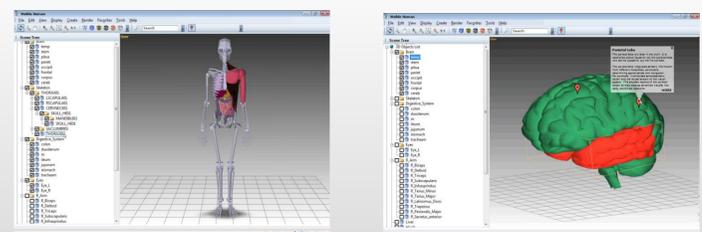
- Ability to query database via ODBC connection and SQL queries.

Application

The Application will utilize the framework library classes. The application will:

- Allow users to navigate 3d environment using mouse and user input to zoom, pan, orbit and fly-through.
- Allow Users to search the 3d scene (body) through a hierarchical graph view and an SQL query based text search.
- Allow users to click on specific regions or subsets of the body including specific organs or tissues.
- Allow users to set data markers (pins) in 3d space on various tissues, organs or systems which reference external associated research data stored in a database via a web browser.
- Allow users to search for data markers set by other users via a text based search.

Design



Draft Screen shots illustrating 3D human body scene navigation, controls, hierarchy, and data points.

Expected Outcomes

- Understand supporting theories and concepts related to the use and development of Serious Games. Locate and select appropriate material from the related literature through literature review.
- Select appropriate practical procedures and methodologies by choosing game design methods and development principals that can be used in developing a serious game for the Wyeth 3D human application.
- Apply procedures and methodology by delivering a working prototype system.
- Express relevant knowledge through detailed analysis and display thorough knowledge of subject area through evaluation and documentation.

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