Game Development for Engineering Education

by

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GAME DEVELOPMENT FOR ENGINEERING EDUCATION

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MODSIMWORLD 2007
OUTLINE

- Game Development (Process)
- Game Development Tools
- Implementation Tools
- Materials Education Game Environment
- Virtual Cleanroom
- E-learning as game-like environments
  + CLDT
  + CPR Tool
Development requires a number of steps – from initial idea to released product:

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MY GAME DEVELOPMENT HISTORY

× Started game development in 2005
× Questions asked:
  + What tools are out there?
  + What do I need to know to develop a 3D computer game?
  + What about XBox games? Playstation, Wii (recently)
  + Where do I find these things?

+Google search!!!
  × Google is now a verb in the Oxford English Dictionary!
GOOGLE SEARCH!
× Search “3D game development tools”
Engines/Authorware for Non-Programmers

- **2D Shooter Game Creator** The 2D shooter game creator will let YOU create your own games, in the style of classic lightgun games, e.g. Time Crisis
- **3D Adventure Studio** an editor for creating adventure games in style of Gabriel Knight 3 (WIN)
- **3DCakeWalk** allows the development of commercial quality games with all the “state of art” features you will find in today’s leading games
- **3D Game Engine** alpha release of an unfinished 3D game engine (DOS/GNU/Linux)
- **The 3D Game Maker** point & click 3D game creator (Win)
- **3D Game Studio** produce 3D realtime applications - demos, adventures, role playing, action, advertising, or racing games - without programming skills (WIN)
- **3D Rad** a programmable, user-friendly, 3D real-time engine (WIN)
- **Abstract RTS Engine** An RTS engine under development intended for user-produced rules, AI, and media modules (mods)
- **ADePT** adventure developing and playing toolkit
- **ADeIFT** a simple, yet powerful IF game designer (WIN)
- **Adventure Book** CYOA creator
- **Adventure Builder** text adventure authoring system (DOS/WIN)
- **AdventurEd** system in development for creating graphical adventure games (Amiga)
- **Adventure Game Engine** engine for creating graphical first-person adventure games with full support for inventory, save/load games, inventory, puzzles, conversations, full motion video, cutscenes (WIN)
- **Adventure Game Studio** make your own point and click adventure games without programming; recently rewritten, now supports the
× Too many products out there!
× Some free and some not...
× Which one do I choose? What will my students’ learning curve be? Etc..
× So, categorized them
  + Game Development Tools
  + Implementation tools
GAME DEVELOPMENT TOOLS

- 2D game development tools
  + Game Editor
    - interactive multimedia tool for game development
    - simple and intuitive interface
    - develop 2D games for personal computers and mobile devices!
  + Sphere
    - 2D RPG (Role Playing Game) engine
    - allows people with not much programming experience to create role-playing games
3D game development tools

- **3D Game Maker**
  - uses a point and click interface
  - simple to use
  - allows one of 8 genres
  - pick from pre-made characters
  - good for developing games by changing set capabilities
3D Gamestudio

- number of versions with increased capability
- development system for virtual worlds, simulations and 2D and 3D computer games.
- combines lite-C programming language and
  - a high end 3D engine and a 2D engine,
  - a physics engine,
  - level, terrain and model editors,
  - a template system for creating games without programming, and
  - huge libraries of 3D objects, artwork and ready-assembled games.
GAME IMPLEMENTATION TOOLS

× Game Environment Creation
+ 3D Rendering systems

× Autodesk 3Ds Max
  * generate realistic characters
  * create rich and complex design visualization
  * used for shading, texturing, lighting, and rendering on projects ranging from feature films to television commercials to music videos

× Autodesk® Maya®
  * software is a powerful, integrated 3D modeling, animation, effects and rendering solution
  * used for modeling and creature work
Gaming Engines

× Delta3D (open source)
  * Full gaming engine
  * Includes 3D environment editor

× GarageGames' Torque
  * whole game development approach
  * provide the technology, framework, methodology, tools where you provide the creativity and the drive to make your game.

× Irrlicht Engine (free)
  * open source high performance realtime 3D engine
  * written and usable in C++
  * completely cross-platform, using Direct3D and OpenGL
  * character animation system
  * powerful, customizable and easy to use 2D GUI System with Buttons, Lists, Edit boxes
Gaming Engines for console game development

× Microsoft’s XNA Game Studio Development Express (free),
  * cross platform Next generation Architecture
  * will enable any one to make a game for the Xbox 360 and Windows XP platforms.
  * developed games can be distributed with the free XNA Framework to be able to run the games

× idTech2 (Quake 2 gaming engine)
  * open source
  * 3D environments
  * software renderer
  * colored lighting effects
The UnrealEngine2 Runtime: Demo Version

- for non-commercial and educational use
- cross-platform, real-time 3D rendering solutions
- Runtime provides a stable, robust platform for interactive walkthroughs and simulations.
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CURRENT PROJECTS
Materials Education Game (MEG) environment is an environment that was developed for use in a Materials Science educational game. This environment uses the principles of gaming for teaching a core concept in Materials Engineering. Autodesk's 3dsMax was used for the graphics generation and animation.
SAMPLE GAME LEVEL INTEGRATION

MEG Intro.

Level 1 Identification
The user has to navigate the environment to 'pick' the correct structure provided in the task given.

Level 2 Association
Level 2-1
The user would be given tasks that show them a particular structure and the user would have to identify the structure name.

Level 2-2
User is given a material and would have to pick a structure that corresponds to that material.

Level 3 Coordinates
Level 3-1
The user identify the coordinates of a highlighted atom within a structure.

Level 3-2
Given the coordinates, have the user navigate through the environment to reach the correct atom.
Demonstration
INTERACTIVE VIRTUAL CLEANROOM ENVIRONMENT
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E-LEARNING

- E-learning as game-like environments
  + Take a fully functional e-tool and add a timer: for example, creates a game-like environment where students can use the tool to see how quickly they can answer the questions.
  + Creates a competitive environment while at the same time assessing the student knowledge.
  + Also, providing success rate allows use in the classroom by teachers for assessment.
CLDT implements a novel approach to online learning which is the development of web-based online practice tools.

+ randomly generate problem statements
  × (not randomly choose from a list) and
+ allow students to solve problems through a step-by-step process
+ Assess responses at each step ‘Just In Time’ (JIT)

× Built using Adobe Macromedia Flash ActionScript
× Portable and web-based ➔ available any time, anywhere
Demonstration
OTHER E-TOOLS DEVELOPED

- Chain and product rule tools (college calculus level)
- Again, adding timers and providing success rate make for a game-like environment
HINT EXAMPLE

1. Enter values for \( u \)?
   \[ u = (7x^2 + 6x^6) \]
   Submit  Reset

2. Differentiate \( f(u) \) and \( f'(u) \)?
   \[ f(u) = \]  \[ f'(u) = \]
   Submit  Reset

3. Since \( u = g(x) \) differentiate \( g'(x) \)?
   \[ g'(x) = \]
   Submit  Reset

4. Complete the Chain Rule?
   \[ f'(x) = \]
   Submit  Reset

HINT: Given \( R(x) = (4x^2 + 2x + 1)^4 \)
then \( u = g(x) = (4x^2 + 2x + 1) \)

Achieving with excellence...

Options:
- Chain Rule Intermediate
- New Equation  Reset All
1. Enter values for \((u)\)?
\[ u = (x^4 - 9x^2) \]
Submit Reset

2. Differentiate \(f(u)\) and \(f'(u)\)
\[ f(u) = u^3 \]
\[ f'(u) = 3u^2 \]
Submit Reset

3. Since \(u = g(x)\) differentiate \(g'(x)\)?
\[ g'(x) = \]
Submit Reset

4. Complete the Chain Rule?
\[ f'(x) = \]
Submit Reset

Warning
You must enter some acceptable inputs before you can proceed.
Acceptable inputs include:
0 1 2 3 4 5 6 7 8 9
* + () u^A
Please recheck the values entered.
OK

Achieving with excellence...

Options:
- Chain Rule Intermediate
- New Equation
- Reset All
\[ h(x) = (5x^6 - x)(3x^2 + 9x^3) \]

1. Enter the values for \( u \) and \( v \):
   \[ u = (5x^6 - x) \quad v = \quad \]
   Submit Reset Submit Reset

2. Differentiate \( \frac{du}{dx} \) and \( \frac{dv}{dx} \):
   \[ \frac{du}{dx} = \quad \frac{dv}{dx} = \quad \]
   Submit Reset Submit Reset

3. Enter the values for \( \frac{u}{v} \) * \( \frac{dv}{dx} \) and \( \frac{v}{u} \) * \( \frac{du}{dx} \):
   \[ \frac{(u)}{v} \cdot \frac{dv}{dx} = \quad \frac{(v)}{u} \cdot \frac{du}{dx} = \quad \]
   Submit Reset Submit Reset

4. Complete the Product Rule:
   \[ \frac{(uv)}{dx} = \quad \]
   Submit Reset
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