IPRO 329

Radiation Control Technician Training Simulation

Spring 2007

Table of Contents

1. Introduction

IPRO 329 entitled Edutainment attempts to entertain as well as educate simultaneously. Past successes include *Scholars of the Lost Exhibit*, a math and science computer game written for fourth graders, *College Pursuit*, a financial aid computer game for college-bound high school students, and *Credit Safe*, a credit card management computer tool for teenagers.

While IPRO 329 takes great pride in past achievements, we have set the bar even higher this semester. We have taken on the task of developing a computer simulation to help Radiological Control Technicians (RCTs) prepare for their oral certification board.

We anticipate recognition not only from the IPRO office, but also genuine interest from organizations that have RCTs working in their facilities. Our goal this semester was create one scenario as a proof of concept. If we demonstrate that there is an interest in our proof of concept, a long-term objective would be to convert this IPRO into an EnPRO. The EnPRO could develop and market additional scenarios based on input from the interested customers.

2. Background

This semester our target audience is the Department of Energy (DOE). More specifically, we are aiming at helping Radiation Control Technicians (RCTs) who are preparing for their oral certification boards. Our goal this semester is to design, develop, program, and test a computer-based scenario-driven exercise that will simulate the skill-set tested in the oral board. Our intent is to provide the DOE with a proof of concept consisting of one fully programmed scenario as well as at least two additional fully designed scenarios.

Currently, Radiological Control Technicians (RCT's) have to pass an oral examination that tests their problem solving and critical thinking skills, along with their knowledge of protocol and equipment. In order to prepare for this examination, many supervisors conduct mock boards. Along with preparing scenarios and questions, several people must sit on the board. This often takes three or more supervisors away from their normal duties. Our game, the RCT Training Simulation, will help said candidates practice and prepare for their examination without the wasted man-hours and logistics of a mock board.

Previously, some DOE facilities have had computer-based training in the form of multiple-choice questions. This is useful to some extent; however, mock oral boards are still required to take a candidate through a full scenario. The basis for our knowledge of the process for certifying RCTs came from Laurie Friedman, one of our advisors. He previously managed the health physics aspects for a large radiological remediation construction project under contract at Oak Ridge National Laboratories, a DOE facility.

When we began looking for users to test our product we contacted health physicists at Argonne National Laboratory. The people we spoke to were very interested in our concept. They stated that they are always looking for good training material. Although they have personnel assigned to develop training, it is usually an additional duty and beyond the scope of their abilities to design a simulation such as ours. They were impressed that we were using Macromedia Flash as the platform to code the simulation.

3. Purpose & Objectives

Our main objectives for this semester were as follows:

- Develop a proof of concept; show that the game is feasible and effective
- Lay a solid foundation for further additions to the game, including extra scenarios
- Give the group members a positive team experience and skills for their careers
- Hold the game to a high enough standard that it would be easily marketed

Our group is broken into two main teams: Design Team (DT) and Programming Team (PT). The project team leader along with the PT and DT team leaders form the Project Management (PM) team. The objectives of these teams were as follows:

Design Team

- Work with Programming Team to implement precise and logical scenarios.
- Design a packet for usability testing once the programming is completed.
- Create an informative and thorough end of semester presentation for IPRO day.

Programming Team

- Create a working computer-based scenario that assesses the problem solving and critical thinking skills that are required of a Radiation Control Technician.
- Make the training tool entertaining for the user so that they would want to try additional scenarios.
- Implement audio stimulation to add realism.
- Develop simple and easy to use controls so that the focus is on problem solving, not figuring out how to maneuver through the scenario.

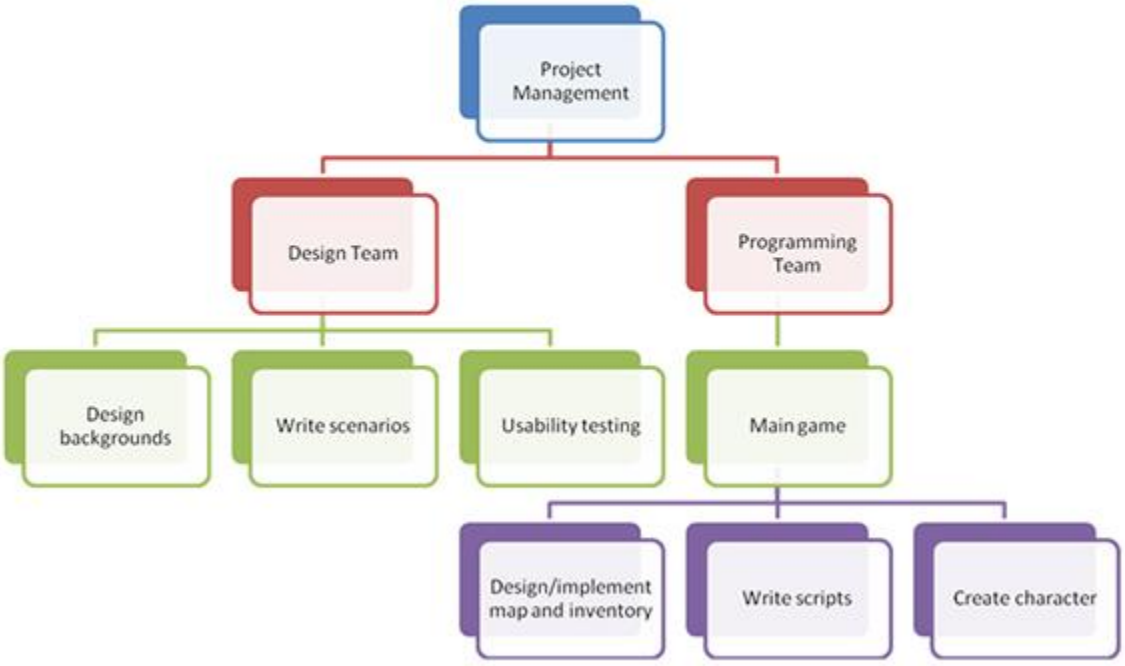
Project Management

- Use backwards planning to develop work schedules and task lists.
- Allot at least half of our meeting time for sub-team meetings.
- Brief the group and advisors weekly on team progress.

4. Methodology

Development Hierarchy

Since our team was split into two main teams, our tasks were separated and assigned to the appropriate sub-team. The major tasks for the semester were broken down as follows:



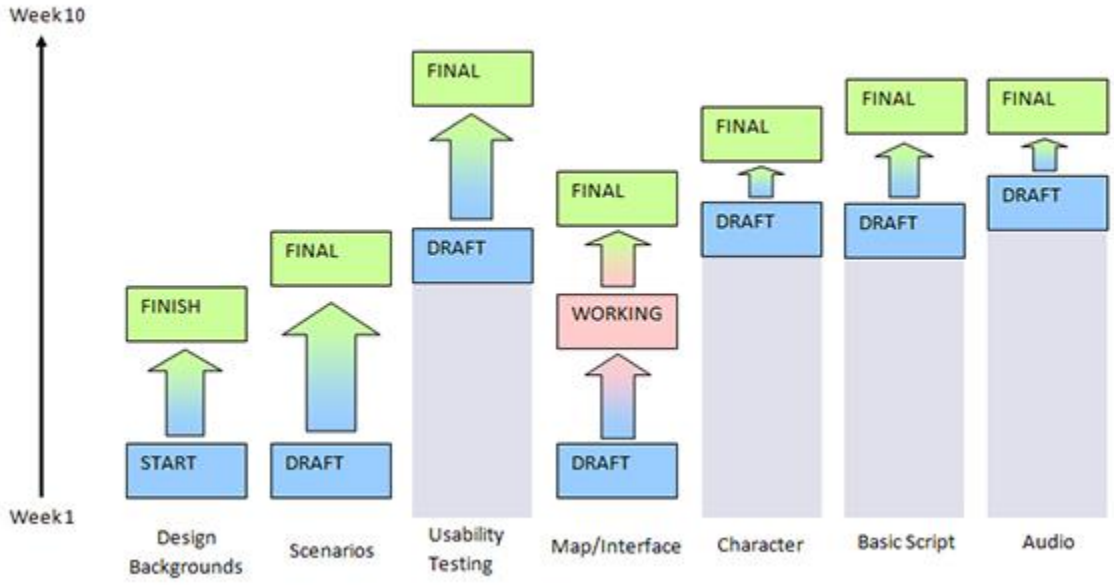
Development Timeline

Our IPRO needed a timeline that allowed for each team to work efficiently, but also deliver items to other teams that needed them to continue. We came up with a schedule that was roughly broken into two phases.

The first phase was mainly utilized for prep work; the Design team focused on drawing the game's backgrounds and developing its scenarios, while the Programming team worked to code an interface. Each team could work independently from each other for these tasks, which was good for the beginning of the semester. As the team's neared completion of their respective goals, the results became more and more cohesive. This phase lasted until about week 5 of the

semester. On the image below, our Development Timeline, this phase is made up of each activity with a "final" box close to the center of the graph.

The second phase of the semester was geared towards the completion of the game, and preparing for IPRO day. The design team, having finished all the material it would be contributing to the creation of the game itself, switched its focus to coming up with the game's usability testing packet. After obtaining certification for the IPRO from the university's IRB board, the design team began working on the visuals for our IPRO day presentation and exhibit. Meanwhile, the Programming team worked on coding the remainder of the game. With the backgrounds from the Design team, and the interface in place, they created the in-game RCT tools, simulated radiation contamination, and the scripts that would drive the game's randomized scenarios. Only one script was created for the purposes of testing the game, but others can be added in the future. This phase is shown on the Development Timeline as all the activities with a "final" status near week ten.



5. Assignments

Project Management

Keith McManus – Team Leader

Keith is a newcomer to IPRO. He is a graduate student in the Health Physics Professional Science Master's (PSM) program. He is also a captain in the U.S. Army. In addition to his leadership and management skills, Keith is considered a subject-matter expert (in-training) in the Health Physics field. He was responsible for creating a list and sourcing pictures of tools that the RCT (player) might need.

Christopher Hahn – Design Team Leader

Chris is the head of the design team. His main role in the team is keeping everyone on task and up to speed with project developments. He is also tasked with prioritizing the workload for the team. He worked closely with Tony on the revision of the Flash backgrounds to make sure they were consistent with the game's setting. His main focus for the remainder of the semester will be the major IPRO deliverables, while his team completes the design of the presentation and usability packet.

James Aguirre – Programming Team Leader

James is the head of the programming team. He has been working with his group to get a working product in time to have product testing and revision if necessary. James schedules out tasks and also facilitates the group's feedback to improve or make certain tasks simpler. He has worked on and completed the inventory items and functions list and is helping with the completion with the text-based interaction in the game.

Design Team

Anthony Smith

Tony is the main Macromedia Flash designer because his computer art skills exceed the rest of the group. Since all of the design is completed, Tony will begin working on usability testing packets as well as visual aids for out IPRO Day presentation. He has also taken minutes for each of our group meetings and posted a copy to iGroups.

Shravani Pasupneti

Shravani developed detailed written scenarios as well as designing several of the rooms in Flash. She is now poised to develop testing materials and preparing the documentation necessary to receive IRB approval for our usability tests. She will then focus on the script for our final presentation, along with providing content for the webpage.

Joseph Crowley

Joseph worked to develop the written scenarios along with Shravani. Earlier in the semester he contributed to the creation of the backgrounds for the game in Flash. He will focus on providing content for the website, creating the abstract for the final presentation, and organizing the power point presentation for IPRO day.

Programming Team

Yun Tan

Yun is the primary person working with the interface to get the game working correctly. He has created the interface, the map, and the inventory along with the corresponding buttons that appear in the interface for the map and inventory. He is currently working on linking the map buttons to the corresponding backgrounds that they go with. After this task is completed, he will add in the contaminated object with the corresponding sound file that go with the object.

Jason Kloepping

Jason is working on the scenario to implement how the game progresses. To keep the game from jumping around, we are allowing access into the rooms based on the progress of the game. Jason is the person who is creating the mapping of the progress to the availability of the rooms. He has also worked on the completion of the inventory item and function list. Along with looking through the scenario Jason is compiling a list of possible questions and answers to be used in a text-based interaction with characters in the game.

Brandon Potocki

Brandon created the map layout used in the interface. He is also working on the development of the radiation output, (how the sound should interact with distance from the radiation source). Along with this, he is working on the probe and its functions; the probe can be used in different ways to determine the classification of the radiation. Brandon also played an instrumental role in finishing the item and functionality list.

Team Advisors

Susan Feinberg

Susan has been the leader of this IPRO for several semesters. She has prize-winning experience in game design with past IPROs. In addition, she brings expertise in usability testing and human factors design to the team.

Laurence Friedman

Laurie is the subject matter expert for the content in this project. He is a Certified Health Physicist and has administered oral certification boards to RCTs in the past. He is a great asset in the reviewing, testing, and marketing, of our product.

Event	Date
Estimate of Contamination Readings	20 March
Linking Map to Backgrounds	20 March
Opening of Map Locations in Scenario	20 March
Add Contaminated Objects for Scenario	22 March
Finish Scenario (First Draft)	25 March
Test Scenario	25 March
Finish Scenario	29 March
Testing Packets Prepared	29 March
Meeting Minutes Due	6 April
Beta Testing	17 April
Draft Deliverables Due	17 April
Mock IRPO Day Presentation	19 April
Fix Errors	27 March
Begin User Testing	20 April
IPRO Day Presentation Due	25 April
IPRO Day Deliverables Due	26 April
IPRO Day	27 April

Tasks and Goals	Team
Create computer-based scenario driven exercise	Programming
Develop three complete scenarios for future development	Design
Compile final report	Project Management
Compile all weekly reports	Project Management
IPRO Poster	Design
IPRO Website	Design
Compile and Practice Presentation	All

Project Management - Task Breakdown

Task	Start Date	End Date	Man Hours
Keith McManus			
Conduct usability test	4/20/2007	4/20/2007	6
Conduct beta test	4/17/2007	4/17/2007	2
Final Report	4/20/2007	4/26/2007	6
Review IPRO deliverables	4/15/2007	4/26/2007	4
Submit guest list and team list	4/18/2007	4/18/2007	1
Coordinate user testing	3/28/2007	4/20/2007	3
Presentation practice	4/12/2007	4/26/2007	5
Midterm Report	3/17/2007	3/23/2007	6
Develop grading criteria	3/1/2007	3/6/2007	1
Long term calendar	2/20/2007	2/22/2007	1
Form sub-teams	2/1/2007	2/6/2007	1
Develop agenda for meetings	2/1/2007	4/26/2007	6 (.5 per week)
Brief team update	2/20/2007	4/26/2007	2 (.25 per week)
Christopher Hahn			
Practice presentation with team	4/12/2007	4/17/2007	3
Work with team leaders to finalize deliverables on CD	4/5/2007	4/12/2007	10
Conduct usability test	4/20/2007	4/20/2007	6
Design Layout/Content for IPRO website	3/29/2007	4/5/2007	10
Usability Testing - oversee creation of packet	3/22/2007	3/27/2007	5
Midterm Report	3/17/2007	3/23/2007	6
Develop project plan	3/3/2007	2/16/2007	5
Long term calendar	2/20/2007	2/22/2007	1
Brief sub-team update	2/20/2007	4/26/2007	2 (.25 per week)
Attend PM workshop	2/3/2007	2/3/2007	4
James Aguirre			
Midterm Report	3/17/2007	3/23/2007	6
Develop project plan	3/3/2007	2/16/2007	5
Long term calendar	2/20/2007	2/22/2007	1
Brief sub-team update	2/20/2007	4/26/2007	2 (.25 per week)
Attend PM workshop	2/3/2007	2/3/2007	4
Inventory and Functionality List(Test)	2/19/2007	3/1/2007	2
Inventory and Functionality List(Final)	3/1/2007	3/6/2007	2
Probe Design	3/20/2007	3/27/2007	3
Program Inventory Functions	3/27/2007	3/30/2007	5
Scenario Checklist	3/27/2001	3/30/2007	2
Presentation practice	4/12/2007	4/26/2007	5

Design Team - Task Breakdown

Task	Start Date	End Date	Man Hours
Tony Smith			
Design target population survey for suability test packet	3/20/2007	3/22/2007	2
Assist with compilation of usability test packet items	3/22/2007	3/27/2007	3
Compile meeting minutes/pictures for deliverables CD	3/29/2007	4/3/2007	3
Provide content for IPRO website	4/3/2007	4/5/2007	2
Create science board displays for presentation	4/5/2007	4/12/2007	10
Practice presentation with team	4/12/2007	4/17/2007	5
Conduct usability test	4/20/2007	4/20/2007	6
Shravani Pasupneti			
Complete IRB documentation for usability testing	3/20/2007	3/22/2007	2
Assist with compilation of usability test packet items	3/22/2007	3/27/2007	3
Provide content for IPRO webpage	3/27/2007	4/5/2007	5
Write presentation script for design team contributions	4/5/2007	4/12/2007	10
Design abstract for IPRO day	4/17/2007	4/24/2007	5
Practice Presentation with team	4/12/2007	4/17/2007	5
Conduct usability test	4/20/2007	4/20/2007	6
Joseph Crowley			
Design debriefing form for usability test packet	3/20/2007	3/22/2007	2
Assist with compilation of usability test packet items	3/22/2007	3/27/2007	3
Provide content for IPRO webpage	3/27/2007	4/5/2007	5
Create power point for final presentation	4/5/2007	4/12/2007	10
Practice Presentation with team	4/12/2007	4/17/2007	5
Conduct usability test	4/20/2007	4/20/2007	6

Programming Team - Task Breakdown

Task	Start Date	End Date	Man Hours
Yun Tan			
Interface	2/15/2007	2/22/2007	10
Map and Inventory Buttons on Interface	2/22/2007	2/27/2007	3
Fill in the Inventory with Cropped Items	2/27/2007	3/6/2007	3
Add Map to Map Button	2/27/2007	3/6/2007	3
Add the Starting Background	3/6/2007	3/8/2007	1
Connect Map Buttons to Backgrounds	3/8/2007	3/19/2007	5
Create the Intro Video	3/19/2007	3/26/2007	10
Add Contamination for Scenario	3/26/2007	3/28/2007	1
Brandon Potocki			
Conduct usability test	4/20/2007	4/20/2007	6
Map Layout	2/8/2007	2/16/2007	5
Inventory and Functionality List(Test)	2/19/2007	3/1/2007	2
Inventory and Functionality List(Final)	3/1/2007	3/6/2007	2
Radiation Audio Output	3/8/2007	3/20/2007	2
Code to Hide Map Areas	3/20/2007	3/27/2007	10
Program Inventory Functions	3/27/2007	3/30/2007	5
Scenario Checklist	3/27/2001	3/30/2007	2
Jason Kleopping			
Conduct usability test	4/20/2007	4/20/2007	6
Inventory and Functionality List(Test)	2/19/2007	3/1/2007	2
Inventory and Functionality List(Final)	3/1/2007	3/6/2007	2
Scenario Map Walkthrough	3/8/2007	3/20/2007	3
Keyword Database	3/8/2007	3/20/2007	3
Code to Hide Map Areas	3/20/2007	3/27/2007	10
Program Keyword Database	3/27/2007	3/30/2007	3

6. Obstacles

Design Team

Our biggest obstacle was the lack of experience in the design team with using Macromedia Flash to create visuals. We each tried to complete the early work on designing rooms and quickly found that Tony was the most talented. He handled the final revisions of most backgrounds at that point, as he could complete them more quickly and professionally than the other team members. We allocated non-artistic work to the rest of the design team to contribute to the overall progress of the IPRO.

Since nobody on the design team has created a usability test in the past, it was a challenge to create one that provides the group with enough organized feedback to effectively judge our progress. Our advisor, Susan Feinberg, has dealt extensively with usability tests and was a valuable source of guidance. Her advice helped us complete our task much more effectively.

Programming Team

The programming team only has one member who is proficient with Macromedia Flash, which makes it hard to distribute the actual programming evenly throughout the group. It also makes it difficult to move forward if there is an obstacle that he cannot figure out. This game also takes a lot more code in comparison to previous years. Programming changes stretched up to the night before usability testing. In the end, we had a quality working scenario, but it was a tense week before testing.

Project Management

Our major obstacle to overcome is creating a compressed time table to produce a proof of concept. It does not make sense for this IPRO to waste several semesters on this venture if there is not going to be an interest in what we produce. Therefore, we attempted to get a bare-bones prototype out to the folks who would use such a tool to see if it would be something valuable. However, with the reality that we would not be able to program complicated scenarios in such a short time frame, we have developed several scenarios on paper.

7. Results

Usability Testing

Our IPRO team had the amazing opportunity to test our game's prototype at Argonne National Labs. This was a very beneficial experience for many reasons. From a design standpoint, the feedback we received from the trained Radiological Control Technicians who tested our game was invaluable. These are the men and women who would benefit the most from the game's creation, and knowing what changes would help them in the future can only guide our project in the right direction. Also, it was a very motivating experience to see professionals in the field of health physics playing our game. Six of Argonne's technicians agreed to test our game for us, and their positive attitudes and constructive criticism made all the work our group has put into the game this semester worth it. Finally, this testing helped us achieve one of our IPRO's main goals; establishing a proof of concept for the game. With the approval of real RCT's, it is clear that with more polish and sophistication, this game could serve as a very useful tool in the professional world.

Team Results

Design Team

- Developed backgrounds for each room in the simulation
- Created three basic scenarios for the initial proof of concept.
- Our expert consultant reviewed and approved our scenarios and background rooms.
- Finalized and delivered all design products for use by the programming team.

Programming Team

- Developed a user interface for the training tool
- Created an item list along with corresponding effects in the scenario
- Programmed a tool grid with pictures that can be viewed by selecting a tab
- Developed usage errors to notify the users when an incorrect tool is chosen.

Project Management

- Developed and established grading criteria.
- Created a work / brief cycle which increased productivity.
- Generated an agenda for each meeting.
- Constructed task lists based on a 4-week cycle.

8. Recommendations

Based on the results of our usability testing, we recommend that this project be continued during future semesters. The framework for several scenarios has already been developed.

Due to the small size of our team this semester, most members were overworked. Next semester's team should have a minimum of 12 students. The major obstacle for future development will be computer-programming specialists with an in-depth knowledge of the Macromedia Flash programming platform. Therefore, at least two team members must have Flash experience.

An ideal team composition would include 4 computer science majors (2 with Flash experience), 2 marketing or communications majors, 1 health physics major, 1 design major, and 4 major immaterial.

The skill set in Radiological Control Technicians working for the Department of Energy is very similar to the skills required of a Radiation Protection Supervisor working in commercial power production facilities. Therefore, we should also try to market this tool to Exelon and other companies involved in nuclear power production.

9. References

We used several websites to find common pictures of tools used by radiation control technicians. These include:

www.nukeworker.org

www.ludlums.com

www.ndsproducts.com

We used Macromedia Flash to code the simulation

www.macromedia.com

We followed the application materials for IIT's Institutional Review Board for human testing.

10. Acknowledgements

IIT Faculty

Andrew Howard, PhD., of the BCPS Department performed beta testing of our simulation prior to our usability testing at Argonne National Laboratory. His help was instrumental in populating our text data base as well as fixing logic errors in our scenario.

Carlo Segre, PhD., of the BCPS Department provided us with contacts within the Environmental Health & Safety Office of Argonne National Laboratory. Through him, we were able to set up usability testing of our simulation.

Argonne National Laboratory

Steve Butala, CHP, of the EH&S office, provided us with an on-site facility and six personnel to conduct a usability test of our simulation.

11. Team Roster

Faculty Advisors
Susan Feinberg
Laurence Friedman

Team Leader
Keith McManus

Students
James Aguirre
Joseph Crowley
Christopher Hahn
Jason Kloepping
Shravani Pasupneti
Brandon Potocki
Anthony Smith
Yun Tan

12. CD-ROM Table of Contents

Table of Contents

IPRO 329 Edutainment CD-ROM

Files	Description
329presentation.ppt	PowerPoint presentation for IPRO Day
abstract_inside.jpg	Abstract (Inside portion)
abstract_outside.jpg	Abstract (Outside portion)
Beta_test_observation.doc	Beta test observation notes
Consent_Form.doc	Consent form for usability testers
design_team_report_sections.doc	Design team Individual report
IPRO329_IRBForm_testingscript.doc	IRB documentation
IPRO329_UserExperience_IRBApplication_S07.doc	IRB documentation
Likert_Test.doc	Liker test
Midterm_Report_Final_Version_231400MAR2007.doc	Midterm Report
Project_Plan_329_S07.doc	Project plan
S07_Syllabus_iPro_329.doc	IPro 329 Syllabus
Table of Contents.txt	This file
Team_Participants_and_Guest_List.doc	Guest list for IPro Day
Usability_Testing.doc	Usability testing procedure
User_Input_Form.doc	Usability test input sheet
Final Report.doc	Final Report
Website link.lnk	Link to website on disc

Folder	Description
Game	Radiological Control Technician Training Simulation
Games Files	Misc. Files created during production of simulator
Meeting Minuets	All our meeting minuets
other presentation files	Older presentation files
pics	Pictures from team and Testings
References for main deliverables	References for main deliverables
Website	Contains all the files from website