Chapter 1

Introduction

1.1 Introduction

Video game industry has become one of the main stream entertainment industries in recent years. It has been forecasted by DFC Intelligence (market research firm focused on interactive entertainment and video games) that overall worldwide revenue for the video game industry to reach $70.1 billion in 2015 [3] . Most of the modern video games are developed with visually appealing 3D environments. The advancements in modern video games have created a new dimension in software development. However game developers put a significant amount of effort in designing 3D game environments which are known as game levels and at the moment this activity can take several man months or man years to complete. This process is not only time consuming but also very expensive with high end proprietary software [19, 20]. Obviously a potential solution for the problem would be to automatically arrange 3D objects in a given 3D environment. For instance, the traditional Procedural Content Generation (PCG) approaches [6, 8, 9, 14, 18] have been used to generate urban environments for games. However traditional procedural techniques for 3D environment generation are only focused on generating a specific type of 3D environments, for example 3D environments of cities. And PCG approaches are very algorithmic and do not operate based on natural factors of environment evolution. The standard method in PCG to control the generated environment is by modifying parameters of algorithms. Therefore there are no facilities to control the arrangement of objects in 3D world by applying real world natural conditions. Also the top down and centralized approach which is used in PCG, prevents game developers from using simple decentralized rules which are reusable in different environments. In contrast to the traditional approaches for 3D generation there are few researches have been conducted to study the applicability of multi agent systems for 3D environment design. These multi agent based approaches have been considered as important researches and reviewed in this report. However these systems are focused only on city generation and outcome is limited to urban environments. After conducting a literature survey on related work, we have identified that current 3D environment

generation techniques being specific to one type of environment such as city environment and the lack of customizable frameworks which are common to many types of environments as the main issue to be addressed.

It is evident from the literature that using Multi Agent Systems technology complex and interesting global behaviours can arise from simple rules that are followed by number of simple agents operate in an environment. For example the paper "Applications of Self-Organizing Multi-Agent Systems: An Initial Framework for Comparison" [7] which is presented by Carole Bernon and colleagues discusses about the emergent properties that emerge from local interactions within the system and that cannot be deduced by simply observing individual behaviors. Therefore this project postulates that emergent behaviours of multi agent technology can be used to develop a customizable framework to assist the design of 3D game environments.

1.2 Aim

To develop a customizable framework based on multi agent systems technology to assist the design of 3D game environments.

1.3 Objectives

1) To critically study about 3D game development process
2) To critically study about current software solutions for 3D game environment design
3) To study about the multi agent systems technology
4) To investigate the use of multi agent systems to solve design problems
5) To design and develop a prototype multi agent system to assist the design of 3D game environments
6) To evaluate the proposed multi agent system
7) To document the final dissertation

1.4 Resource Requirements

Hardware Requirements

- Personal computer with minimum 2 GHz dual core processor and minimum 2 GB RAM
- Open GL compatible separated 3D graphics hardware

Software Requirements

- Java development kit 1.6 and IDEs (Eclipse and NetBeans)
- Multi-agent development software (MASON)
- Open source 3D game engine (jMonkey Engine)
- Open source 3D modelling software (Blender)
- Open source image manipulation software (GIMP)

Chapter 2 of this thesis reports the state of the art of automated 3D game environment designing. It also defines the research problem to be addressed in this project. Chapter 3 describes about the Multi Agent Systems technology which is the main technology adapted for the project. Chapter 4 describes about the approach to use multi agent systems technology to solve the main problem identified in the project. The design of the proposed system is presented in Chapter 5. The implementation technologies to be used are mentioned in Chapter 6. The evaluation of the project is discussed in Chapter 7. Chapter 8 is the conclusion of the thesis and highlights some further work.

1.5 Summary

This chapter provided an introduction to the project including the background and motivation. Also it stated the aim and objectives of the project followed by the resource requirements. Finally this chapter provided an overview of the structure of this thesis. The next chapter reviews the state of the art of automated 3D game environment designing.