

The Analysis of 2D Crowd Behaviour Simulation during Emergency Situation

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Abstract— This paper will discuss about general crowd behaviour modeling during evacuation in emergency situation such as during fire breakout. Several existing simulation tools and comparison among each tool will also be discussed. The aim of this project is to develop a generic crowd model, which has the ability to demonstrate individual crowd behaviours (micro level) especially in fire emergency situation with one or more exits. The program will be able to estimate the evacuation time of panic situation during fire breakout. Apart from that, this paper also will analyze and prove that the individual agent in the simulation is able to detect and avoid collision. During panic situation, agents need to search for the exit in order to save themselves from danger. The proposed crowd simulation used agent in 2D as to simulate the crowd behaviour model while steering towards the exit.

Index Terms— Crowd Simulation, Evacuation Management, Building Architectural Planning.

I. INTRODUCTION

Human crowd behaviour is a captivating social phenomenon in the natural world. Therefore, crowd simulation has become significant research field especially in computer graphic, virtual reality, the social sciences and civil engineering. The purpose of the crowd simulation is to facilitate the understanding of the dynamics of a system and attempt to predict its future evolution. Modeling and simulation technologies have been gaining tremendous momentum in crowd dynamics research over the last few years. Various simulation architectures have been developed [1][2][3]; virtual environment representations have also been constructed for crowd simulations [4]. To represent the behaviour of crowd, a number of behaviour models have been proposed [5][6][7] with different types of modeling approaches such as flow-based models and agent-based models. In this project, we emphasis on the scenario of a fire emergency evacuation in a certain building. The aim of this project is to predict and animate human crowd behaviour and movement when in emergency and evacuation circumstances especially in fire emergency because it is hard to determine the path since the crowd can become irrational and uncontrolled. In this project, the model crowds will be put in a stress situation which is a fire emergency case; and the crowd models will attempt to rescue themselves to the safe exit by detecting

incoming collision and obstacles. The outcome from this project will be presented in a realistic 2D animated environment that is similar to the real circumstance.

II. LITERATURE REVIEW

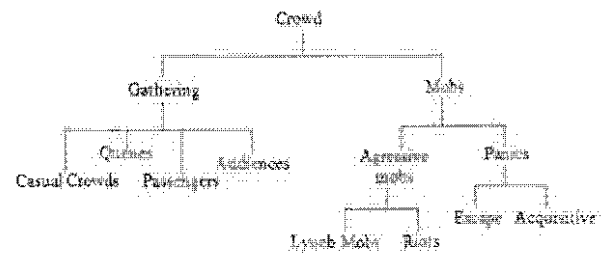


Fig 1. Classification of crowds [9]

There are differences between crowd simulation and crowd realism. Crowd Simulation defined in the context of crowd visualization means the simulation is to produce high quality visuals where it is very essential in the entertainment industries. In this industry, the crowd simulations are used as a kind of "special effect" in which crowds are generated to add visual richness to the scenes, so there is little need for a high degree of behavioural accuracy [9]. Multiple Agent Simulation System in Virtual Environment known as Massive (Massive Software), is the tool most widely used in crowd simulation system in the entertainment industry. Two of the most famous films which applied Massive tool in their productions are The Lord of the Rings (2001) and The Hobbit (2014).

Meanwhile, crowd realism is to produce realistic behaviour which is have been gaining tremendous momentum in the fields of architectural design and safety planning. Simulations are used to study how crowds would behave under certain circumstances given. With these simulations, architects are able to determine if there any deficiencies in a building design, especially the lack of emergency exits. EXODUS is a tool for evacuation simulation and pedestrian dynamics or circulation analysis. This simulation is able to predict not only how individual people interact with each other and the built