1 Revised Project Description

The purpose of this project is to develop a prototype system which simulates the actions of small-medium groups of related entities. Further, while the holistic view of these entities’ activities should appear directed, the process which governs their behavior should be directed from only local scale. With this approach, the author believes that it will be easier to identify, manage, and utilize information transfer and communication between sets of entities.

It is hoped that the final deliverable from this project will point the way to an effective implementation of a similar system for the context of Massively-Multiplayer Online (MMO) games. Specifically, the system should allow the human players in such games to have a dynamic impact on the creatures of the world. Such a system would model movement, resource acquisition, and fight or flight responses from AI controlled elements, as those entities would attempt to do what is best for them.

2 User Feedback

At this time, there is no concrete user feedback on the system, as it is not in a production stage where it is attached to a playable system.

However, some barriers have been identified which would represent serious concerns for the target audience:

- Speed Calculating actions for all entities at every step-point and searching for solutions must not take too long, otherwise the system will not be able to run in real-time. Care should be taken to only perform calculations which are likely to be fruitful, and to provide heuristics which will narrow down search-spaces when looking for actions for the AI to perform.

- Space If each entity maintains all of its state locally, the simulation may require too much system memory to be viable once the number of AI entities increases. Care should be taken to reduce memory overhead where valid by sharing complex data models (ala Flyweight). However, this does not mean that it should be valid for entities to share data with one another if they should not be able to communicate in the simulation.

3 System Design

3.1 Overview
3.2 Environment

The Environment is a representation of the world that the AI entities will operate in. It provides an authoritative source for information such as an entity’s present location, the locations of resource nodes, as well as the location of other entities. The Environment, because of its authority, also serves as the provider for such data; entity’s make requests of such data from the Environment when current data is needed, and it is responsible for only granting entities the data that they should be able to access.

A specific example of this is the gathering of percepts for an entity. In each step of the simulation, the Environment’s “GrantPercepts” function will be called on each entity in the system. The Environment will query the entity for its sight and auditory characteristics, and then perform a search of the world for other entities or objects which are sufficiently close. That data is then stored as timestamped location data on the entity.

3.3 Entities

Entities represent an individual which the AI controls, which have sets of needs which should be satisfied. To help an entity accomplish this, they have sets of capacities, or Actions, which they can take to affect the world. Entities are established with a particular faction, which denotes the sets of other entities which they are likely to align with, if given a chance.

3.4 Groups

Groups are temporary sets of entities which are generated during each phase. A group represents a set of entities of a similar faction which can communicate. By communicating, they share information about the world (their Percepts), as well as sharing their needs and capacity. During each simulation step, the Groups which can communicate are established. Entities which are not in a position to communicate with others are placed in a group of one, allowing for the same decision making procedures to be used. Once Groups are determined for the phase, the needs and capacities of all constituents are aggregated. A search is then performed to try to find a solution which satisfies the greatest number of high priority needs of the group’s constituents. In this way, segments of a population can make group decisions.

4 Prototype and Implementation

At this stage, the Environment for the system is established – entities can be placed in the world and can detect other entities and statics which are close to them. Currently, they do not have the capacity to attempt to satisfy their needs by searching for solutions in the set of actions.
5 Evaluation Plan

The success of this step can be judged by the current infrastructure developed (the Environment and Sensing components), and how that construction of the simulation will allow the whole system to move forward in a systematic and correct sense. Further, the overall architecture of the system can be analyzed to determine the validity of its application to the problem domain, in terms of speed and correctness.