Plan A: Stopping an Active Shooter Simulation of an Active Threat Scenario

Paige Li and Victor Chen | Mentored by Dr. Jory Denny

http://www.mathcs.richmond.edu/~jdenny

Problem & Motivation

Motivation

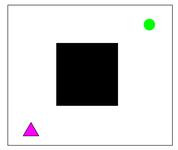
- Provide a preparational tool for law enforcement and campuses to help prepare for active threat crises
- Develop an accurate and realistic model of active threat situations by combining a multi-agent system with a physically-based simulator

Problem

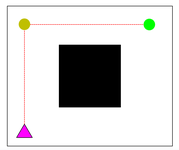
- How can we model active threat scenarios accurately?
- How can we realistically simulate human behaviors and reactions in these situations?

Agent Overview

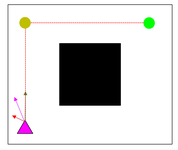
Behaviors
Determines what goal the agent needs to reach



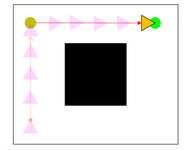
Motion Planner
Determines subgoals needed to avoid obstacles



Local Controller
Determines a force to accelerate the agent



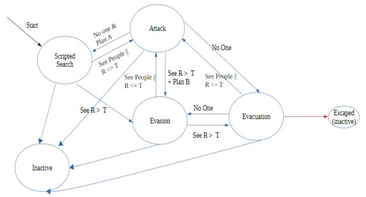
Motion Model
Alters the agent's position and velocity



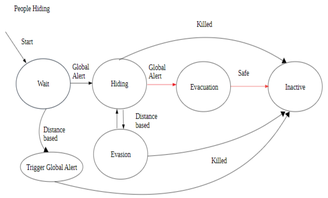
Multi-Behavior

- We chose to represent our three complex behaviors (Threat, Responder, Person) as state transition diagrams.
- Each state in this diagram is a smaller and simpler behavior
- Transitions between states represent events in the scenario.

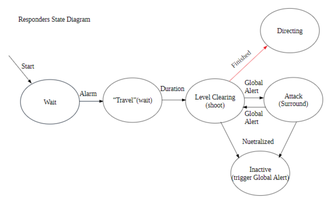
Threat:



People:



Responder:

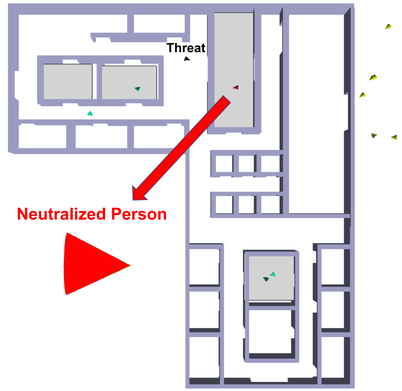


Active Threat Scenario

Initial State

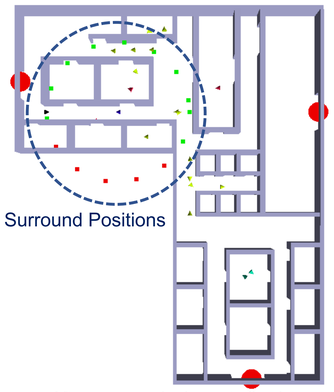
Threat and responders start outside the building. People loiter around inside the structure.

Attack State



Threat attacks people in view range. This sends an alert to other people in the building to hide and to the responders to enter the building.

Surround State



After a responder is neutralized, other responders will create a surrounding formation around that agent's position.

Future Work

- Experimentally analyze our approach
- Improve efficiency and complexity of current behaviors
- Simulating these behaviors in multi-level buildings
- Improving graphical display

References

- Rodriguez S., Denny J., Zourntos T., Amato N.M. (2010) Toward Simulating Realistic Pursuit-Evasion Using a Roadmap-Based Approach. In: Boulic R., Chrysanthou Y., Komura T. (eds) Motion in Games. MIG 2010. Lecture Notes in Computer Science, vol 6459. Springer, Berlin, Heidelberg
- Burchan Bayazit, O & Lien, Jyh-ming & Amato, Nancy. (2003). Better Group Behaviors Using Rule-Based Roadmaps. Springer Tracts in Advanced Robotics. 7.