



First-Person Shooter Game
for Virtual Reality Headset
with Advanced Multi-Agent Intelligent

Technical Demo

Shooter Death-match Game

Round start:

- Each player is assigned to a 1 of 2 competing teams
- All players of one team are respawned at their team base location with starting weapon set and full health
- Each player can move and use weapon in order to survive or kill enemies (another team members)

Goals:

- Kill enemies reducing their health to 0
- Max survived players team wins after time-limit passed

Local goals:

- Find better weapon
- Make an ambush
- Team up with another player
- Stay alive

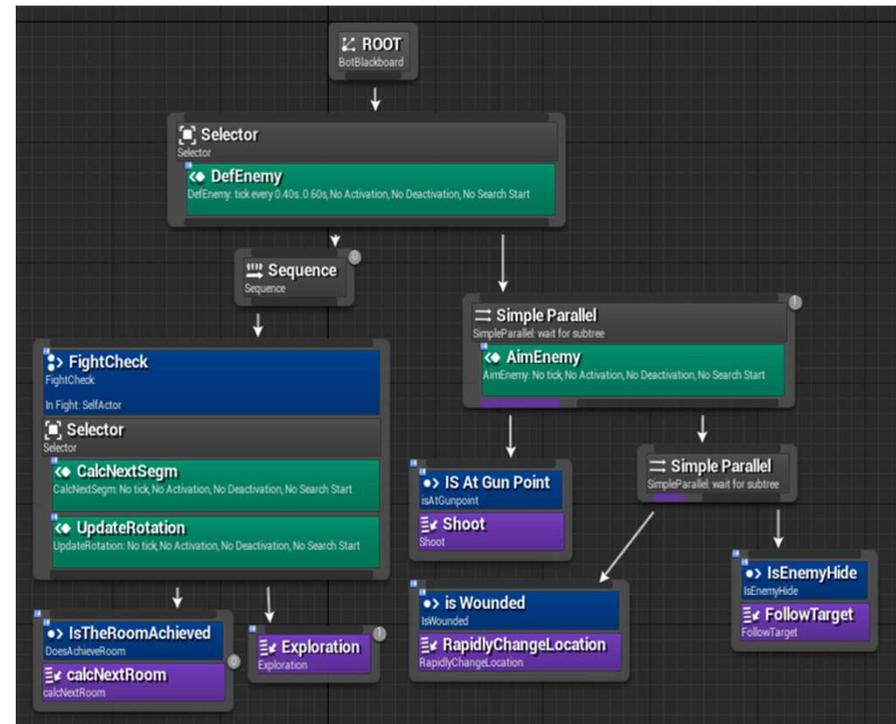
Making Decisions

BOT behavior:

We use behaviour tree for implementing BOT decision making model. At each time point only one branch is calculated.

Team cooperation:

Expert system overwrites global blackboard corresponding to the BOTs' parameters of single mode behavior



Path planning

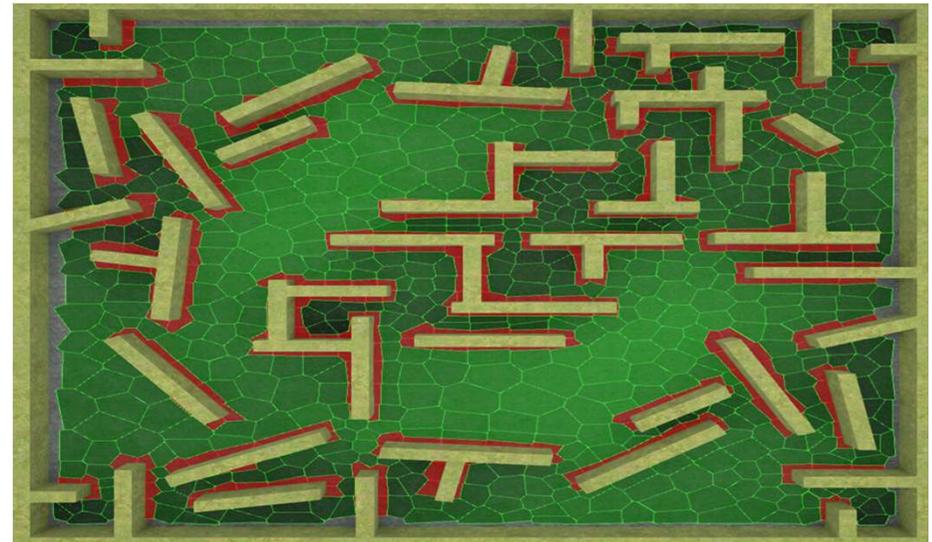
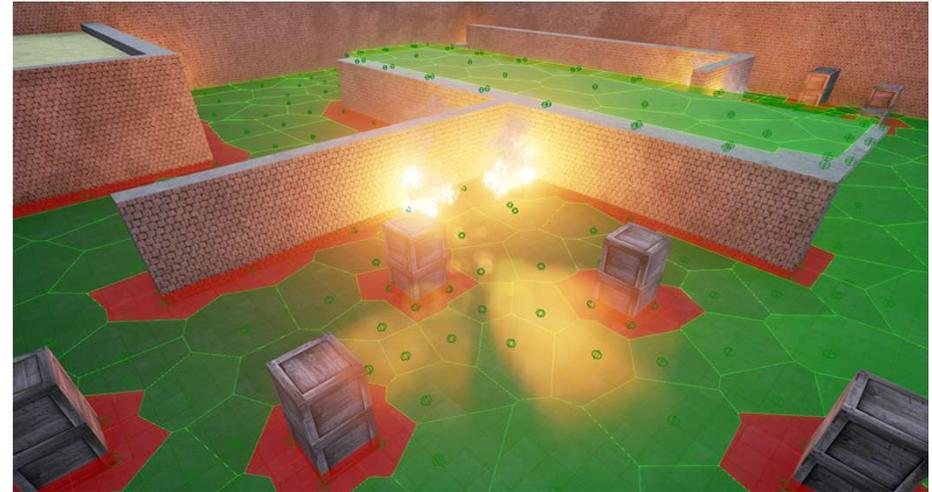
Voronoi-based navigation mesh:

A navigation mesh with the structural constraint is designed to bring game AI up to a new level.

Tactical path finding:

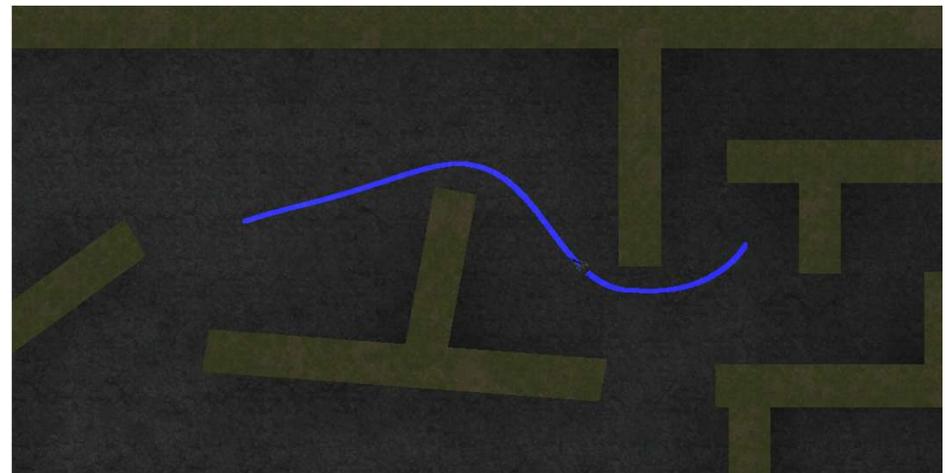
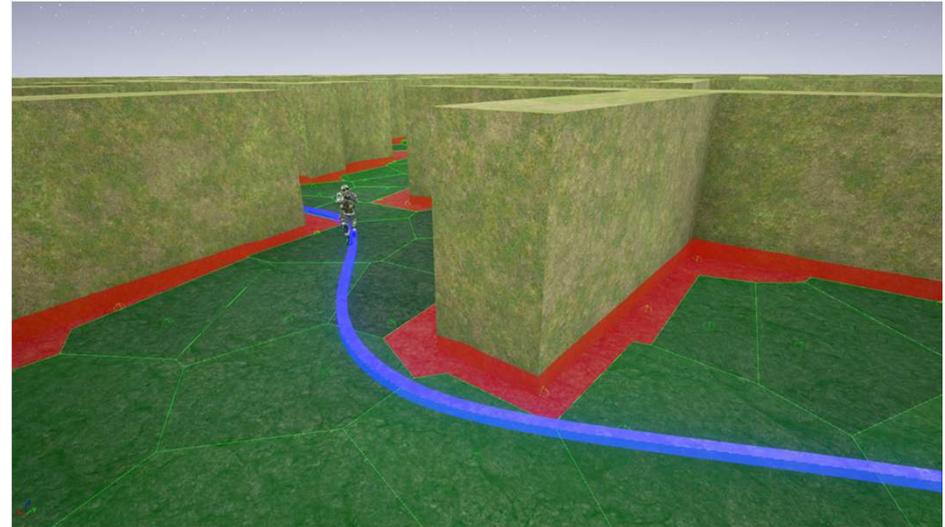
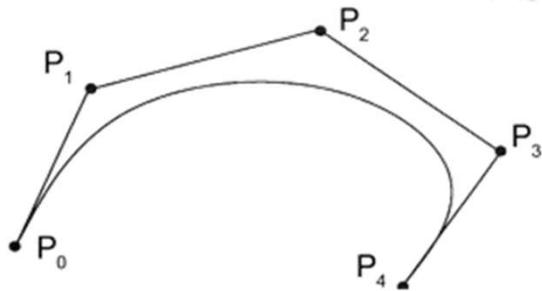
BOT is able to collect and use tactical information to solve his pathfinding tasks using tactical properties:

- Cell-to-cell Visibility graph
- Cover positions
- Sniper Positions = Cover & High Visibility of Cells' Lines



Pathfinding

Obstacle Avoiding with Smoothing:
Computed as a sequence of Voronoi cells. Path goes through several post processing steps where control points for interpolation are chosen with the use of composite Bezier curve.



Aim-Assist Techniques

Target gravity:

If several enemies appear at sight, BOT quickly recognizes enemy group aiming somewhere between them, and then chooses his target in a group according to BOT's in-combat decision patterns.



Target lock:

After choosing a target BOT aims at enemy's head and then locks his crosshairs on it, in order to eliminate the enemy in the most effective and fast manner

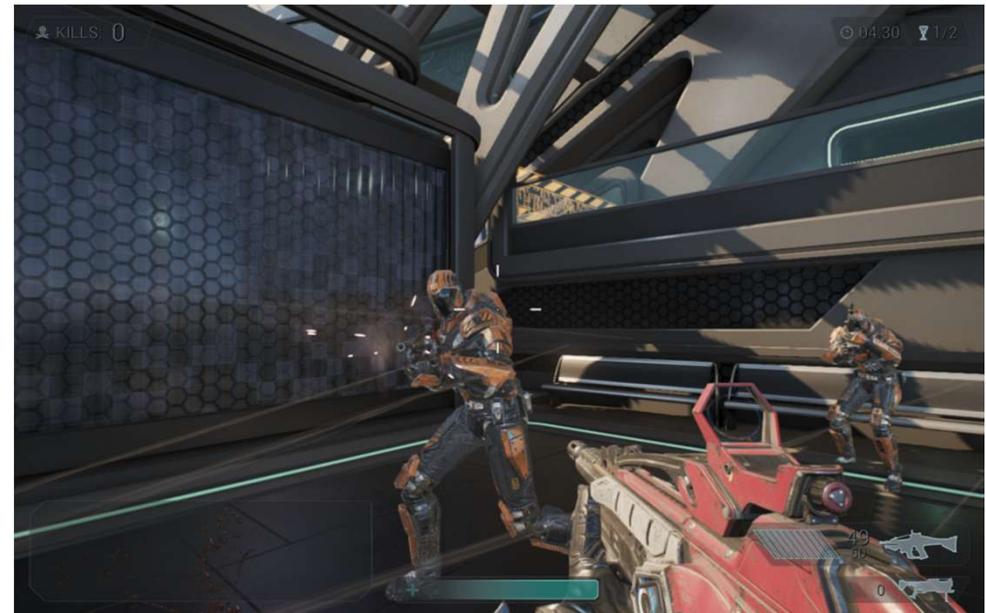


Aim-Assist Techniques

Sticky targets:

While locked target start moving BOT modifies his rotation speed in order to constantly match its crosshairs with the target position.

We use simple prediction model for sticky Targeting to increase accuracy and decrease correction phase time.

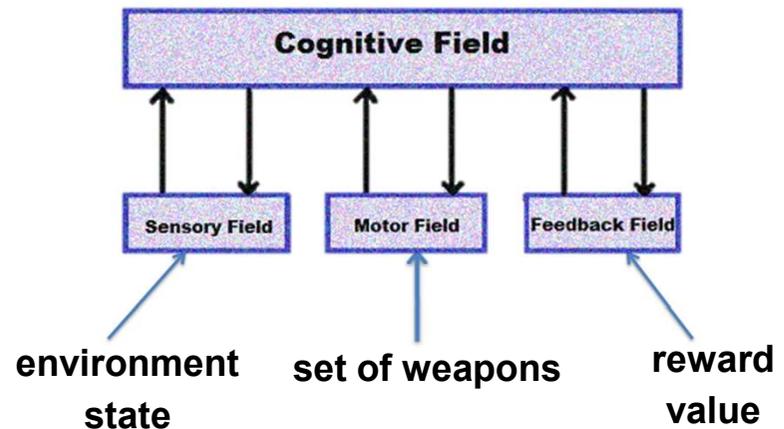
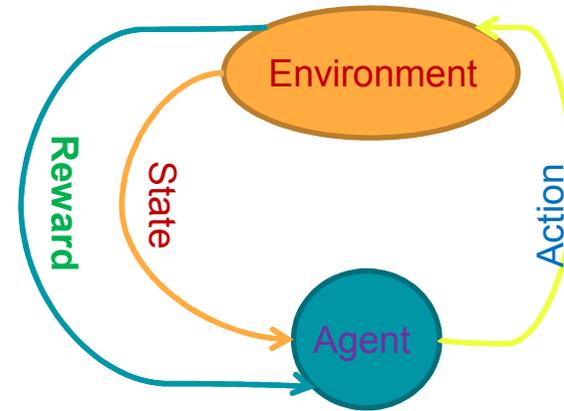


Weapon selection

Improved neural network FALCON performs reinforcement learning to train BOT select proper weapons

- rifle(high accuracy for long range),
- shot gun(close range, high damage),
- machine gun (high rate of fire),
- knife(melee range, highest damage).

BOT receives game states and selects action to perform by interacting with neural network. Reward is then calculated from environment state, such as distance, damage values, etc.



Virtual Reality

VR gives its users an amazing experience of being physically synchronized with a virtual world

BOT with human-like behavior will enhance already existing virtual reality immersion effect.

Having challenging game AI is necessary condition for a human player to believe in reality of virtual world events.



Technical Demo

User Experience:

- Play hardcore intelligent FPS in VR Headset with special controllers

Game Developers:

- Special technical mode to present learning technical parameters and demonstrate evolved BOT models

Spectator Observation:

- Participate in Alan Turing game test to identify and distinguish human and computer players

Everybody:

- New experience of shooter video-games in virtual reality