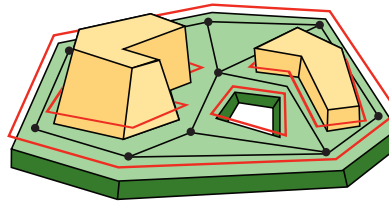


B-HAVE®

AI Navigation Module for VR-Forces

Overview

The B-HAVE Module for VR-Forces® (Brains for Human Activities in Virtual Environments) leverages advanced Artificial Intelligence (AI) technology to provide more complex and realistic behaviors within MÄK's VR-Forces simulation environment. Using the B-HAVE Module, VR-Forces entities can analyze terrain topology, intelligently navigate through complex urban environments, automatically plan and follow paths through 3D building interiors, dynamically avoid collisions with obstacles or other entities, and flee from threats. The B-HAVE Module is powered by Autodesk® Kynapse®, the leading AI technology toolkit for behavior simulation in the video game industry.



Sample B-HAVE navigation map, with viable paths in black, and obstacles and holes outlined in red.



Intelligent Navigation

B-HAVE adds more intelligent navigation to VR-Forces by extending the set of tasks available to VR-Forces users out of the box. Guided by the navigation map associated with your terrain, B-HAVE algorithms allow human entities to enter and leave buildings, go up and down stairs, realistically avoid obstacles, wander, and flee or hide from threats — all without any manual path planning. B-HAVE-enabled vehicles will maneuver through towns and cities, stopping at intersections, avoiding buildings and each other.

Custom Behavior Scripting

B-HAVE includes a built-in interpreter for the Lua lightweight programming language. From the VR-Forces GUI, you can edit custom behavior scripts in Lua, and assign these behaviors to VR-Forces entities. Lua scripts can access much of an entity's state, and can invoke Kynapse primitives.

Pattern of Life

To effectively model Pattern of Life behavior, realistic background traffic must be combined with realistic target behavior. B-HAVE makes creating realistic background traffic easy: users can either create groups of entities (people or vehicles) that move about in a constrained area or use Source and Sync Points to

USE CASES

- TERRAIN TOPOLOGY ANALYSIS
- BACKGROUND VEHICLE TRAFFIC
- PATTERN OF LIFE SIMULATION
- REALISTIC AND INTELLIGENT BEHAVIORS



create periodic streams of unique traffic which follow specific or random separation patterns. Grouped entities can be given tasks like "wander", and Source/Sync Point entities can move in specific patterns throughout a scene. Using VR-Forces scripting and B-HAVE users can then easily create global plans where target entities follow specific (and perhaps unusual) behaviors with minimal work.

Visualization

B-HAVE has the ability to visualize behavior decisions made by simulated entities, including their intended path and obstruction volumes. All of this data is displayed as part of the scene within the VR-Forces GUI. This visual tool is key for anyone designing and debugging complex behaviors and scenarios.

B-HAVE Toolkit — Kynapse for VR-Forces

The B-HAVE Toolkit allows developers to go beyond the built-in functionality of the B-HAVE Module by extending it through a C++ interface. The B-HAVE Toolkit includes the full Autodesk Kynapse SDK, along with developer access to the B-HAVE libraries that integrate Kynapse with VR-Forces.

Access Advanced Run-time Features of Kynapse

There are many features of the Autodesk Kynapse SDK that the B-HAVE Module doesn't take advantage of. By using the B-HAVE Toolkit, developers can access all the features of Kynapse to add even more advanced behaviors to VR-Forces entities. Team behaviors can be created, allowing for groups of entities to carry out tasks cooperatively and act together as a unit. Kynapse also has support for interactive terrain elements, such as doors and elevators, to influence behavior and movement of entities through the terrain. These, and all other capabilities of Kynapse, are all available to developers through the B-HAVE Toolkit.

FEATURES

- AI EXTENSION TO VR-FORCES
- AUTOMATIC PATH GENERATION
- NAVIGATE COMPLEX URBAN ENVIRONMENTS
- 3D BUILDING INTERIORS
- HIDE, WANDER, FOLLOW AND FLEE
- CROWD LAYDOWN AND TASKING
- EDIT BEHAVIOR SCRIPTS IN LUA

