Rui Tao

CSYE 7270

2025-12-8

Teaching Behavior Tree AI with a NPC in Unreal Engine 5

Complete Tutorial on NPC Patrol (UE5 Blueprints)

1. Introduction

1.1 What is game AI?

Game artificial intelligence is dedicated to creating agents capable of responding credibly to player actions and the game environment. Modern games utilize AI technology to enable characters to patrol, converse, engage in combat, avoid obstacles, and interact with the game world.

1.2 Why Behavior Trees?

Behavior Trees are widely used in AAA games because they:

- Are modular and scalable
- Provide clear visualization
- Support hierarchical decision making
- Allow designers and engineers to collaborate efficiently
- Built-in debugging makes learning ideal

Game examples:

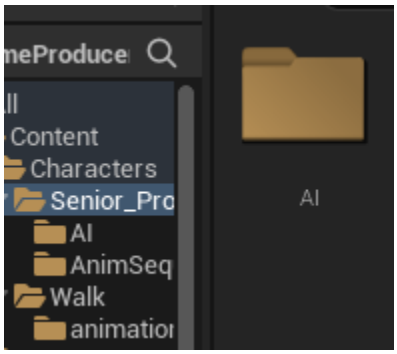
2. Implement a complete AI behavior for “Guiding NPCs” using UE5 Behavior Trees:

   Patrol. Teach students how to build this from scratch through tutorials and videos.

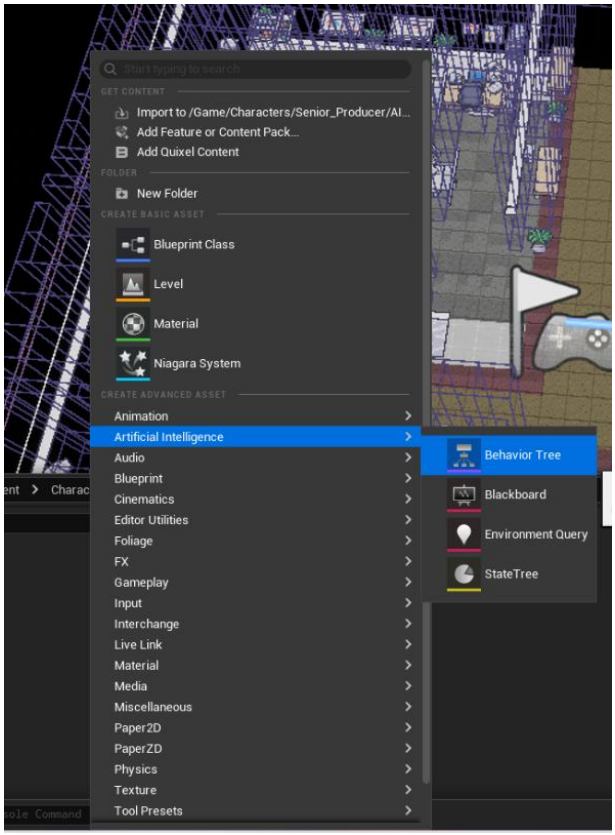
   NPC Specific Behavior Design:

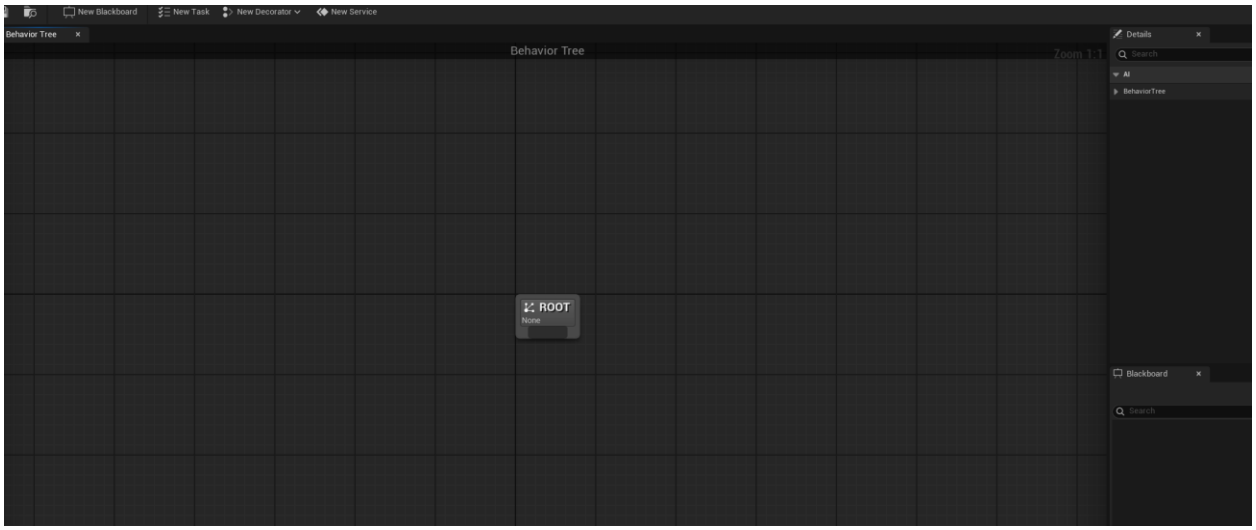
   Patrol: Patrol within a designated area

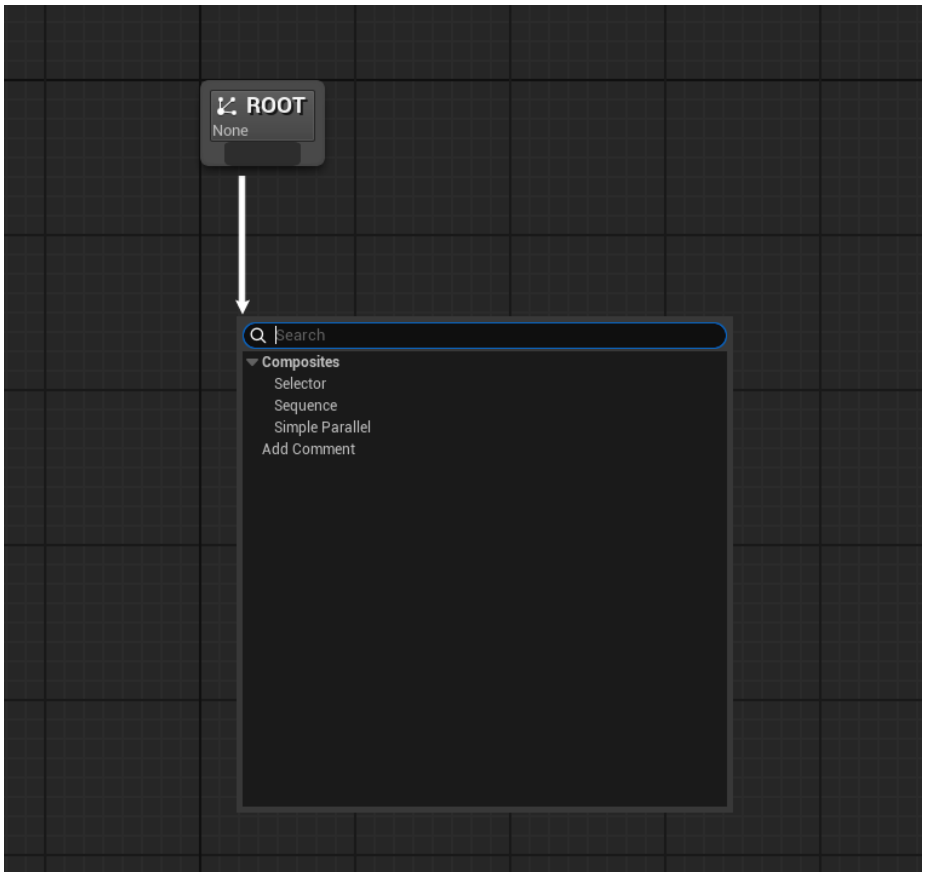
2.1 Create a new folder called AI to save AI Behavior tree.

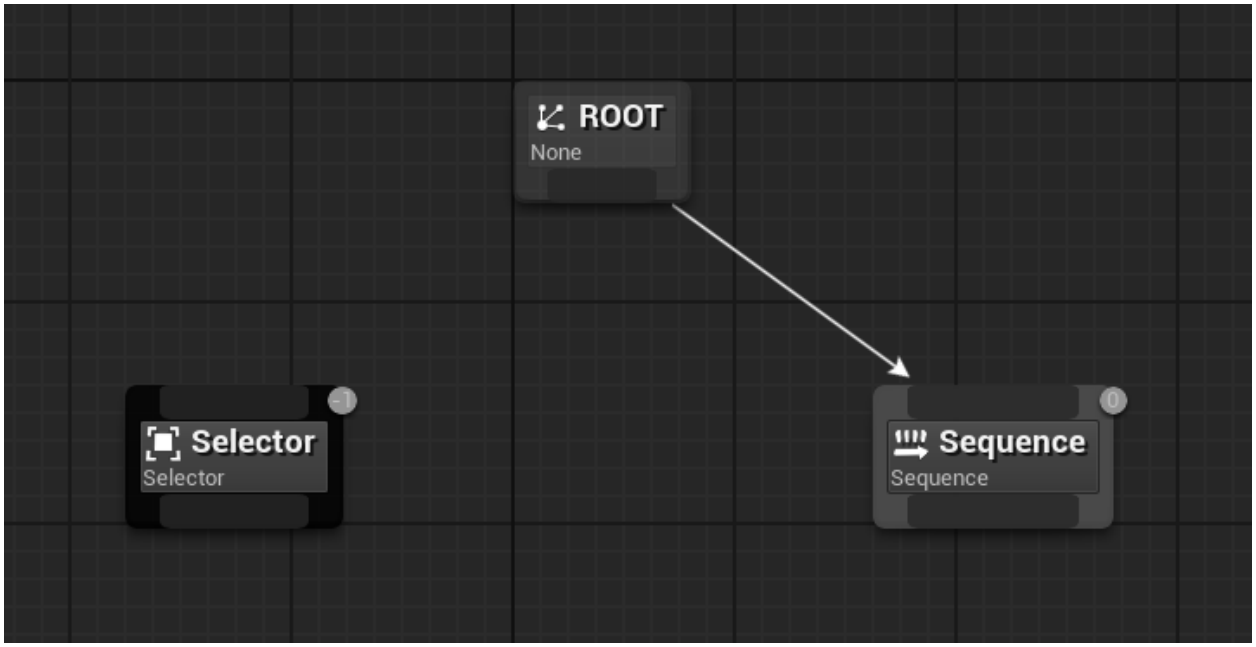


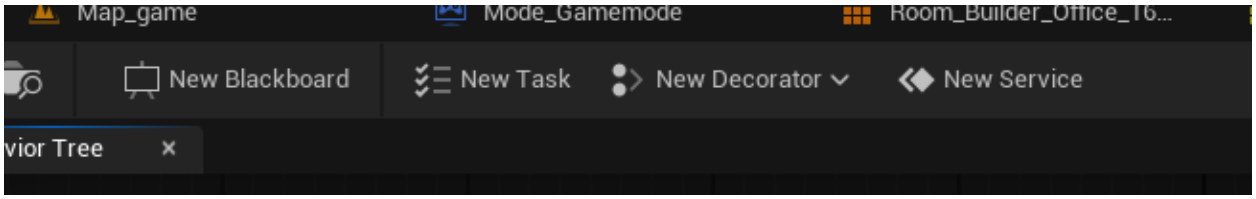
2.2 Create Behavior tree in this folder.

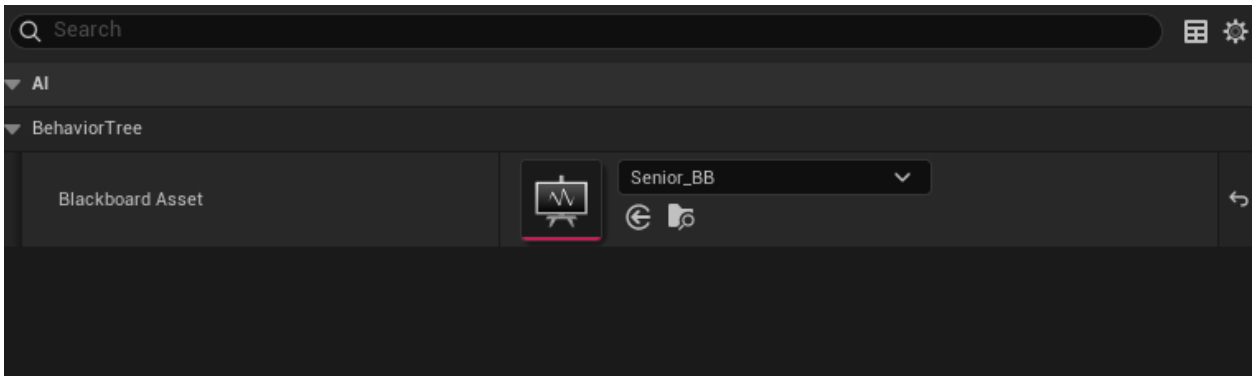

Start typing to search
GET CONTENT
Import to /Game/Characters/Senior_Producer/AI...
Add Feature or Content Pack...
Add Quixel Content
FOLDER
New Folder
CREATE BASIC ASSET
Blueprint Class
Level
Material
Niagara System
CREATE ADVANCED ASSET
Animation
Artificial Intelligence
Audio
Blueprint
Cinematics
Editor Utilities
Foliage
FX
Gameplay
Input
Interchange
Live Link
Material
Media
Miscellaneous
Paper2D
PaperZD
Physics
Texture
Tool Presets
Behavior Tree
Blackboard
Environment Query
StateTree

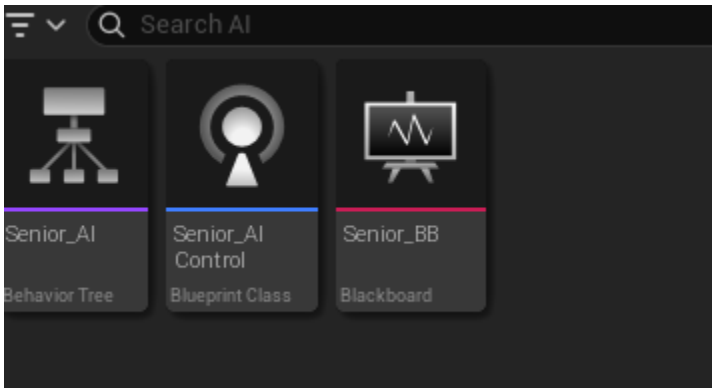

New Blackboard
New Task
New Decorator
New Service
Behavior Tree
Behavior Tree
Zoom 1:1
Details
Search
AI
BehaviorTree
ROOT
None
Blackboard
Search

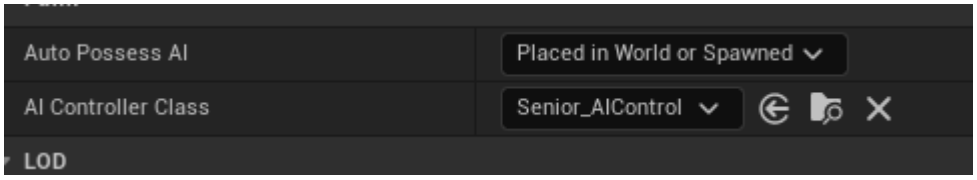

ROOT
None
Search
Composites
Selector
Sequence
Simple Parallel
Add Comment

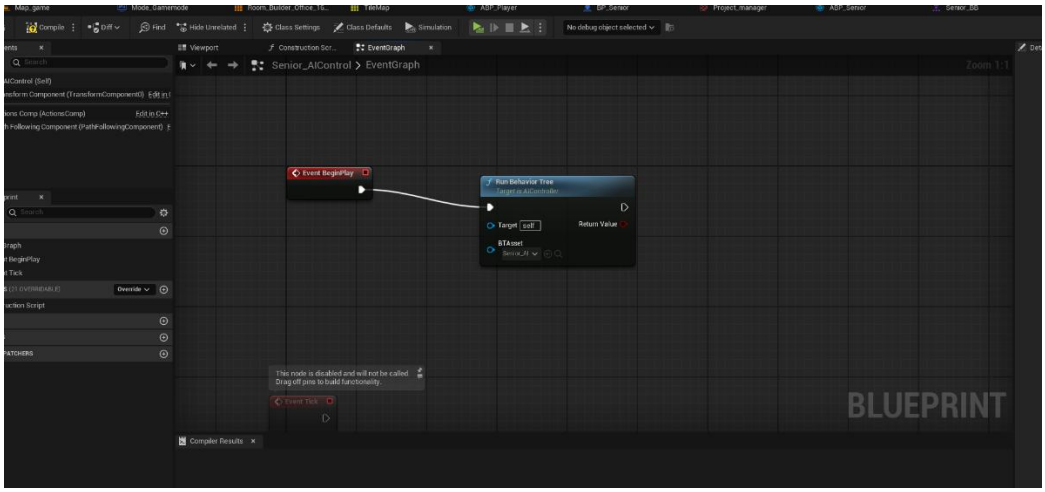

ROOT
None
Selector
Selector
Sequence
Sequence

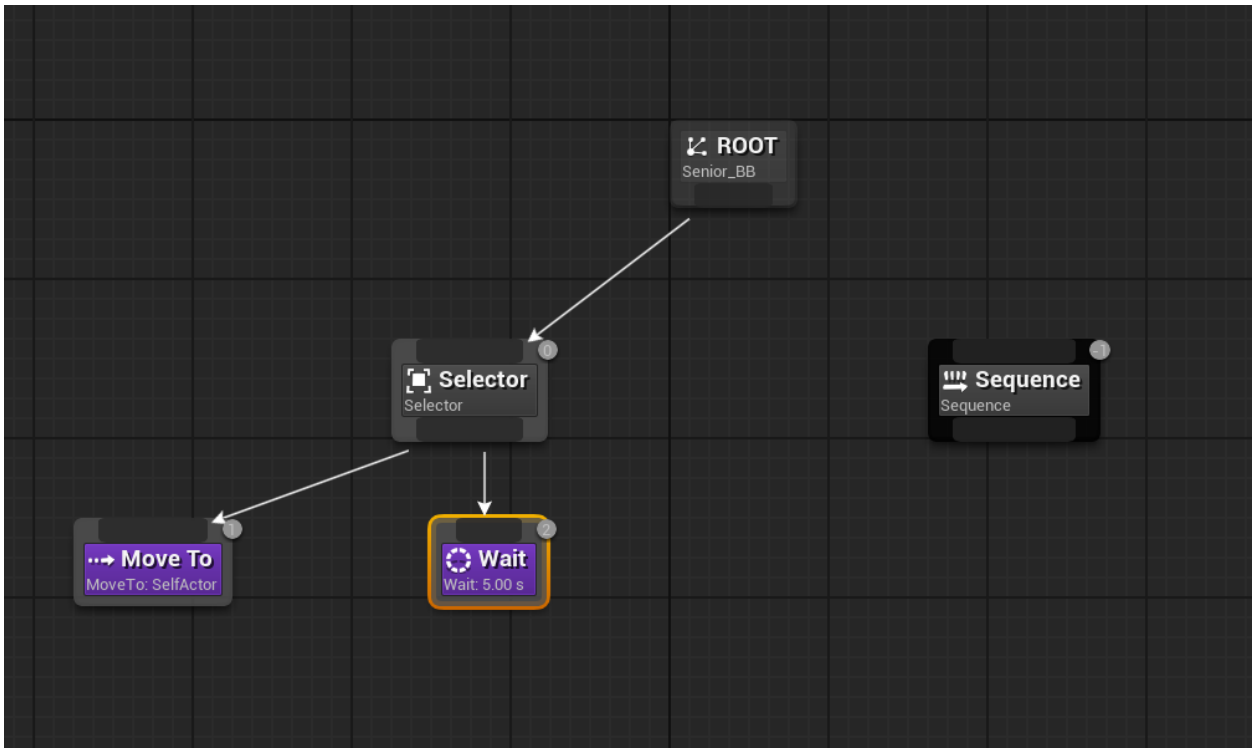

Map_game
Mode_Gamemode
Room_Builder_Office_16...
New Blackboard
New Task
New Decorator
New Service
vior Tree

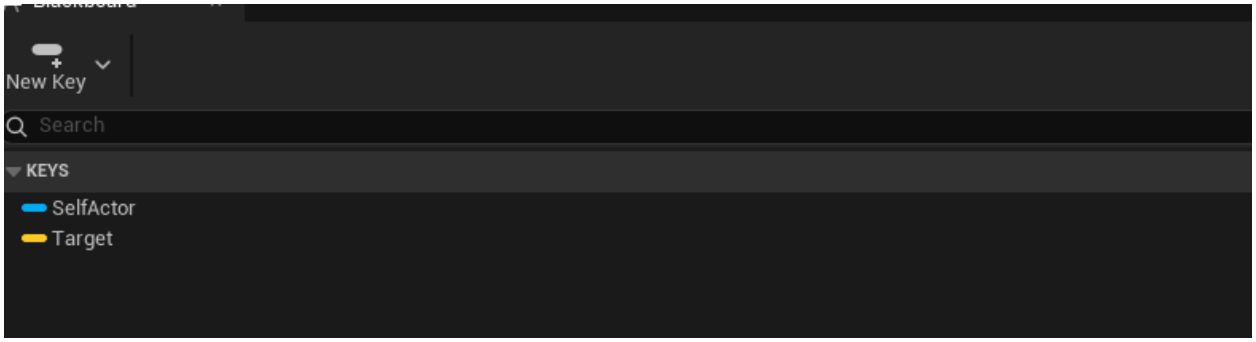

Search
AI
BehaviorTree
Blackboard Asset
Senior_BB

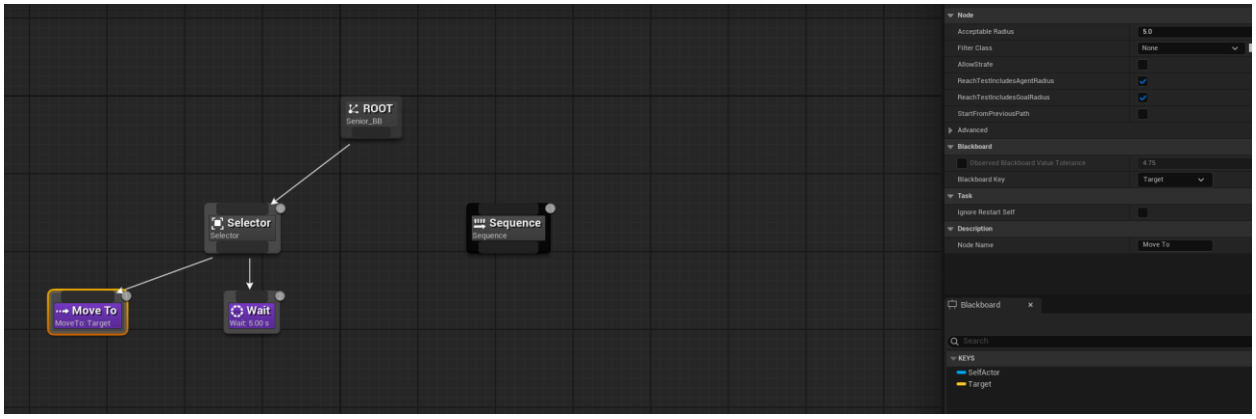

Search AI
Senior_AI
Behavior Tree
Senior_AI Control
Blueprint Class
Senior_BB
Blackboard

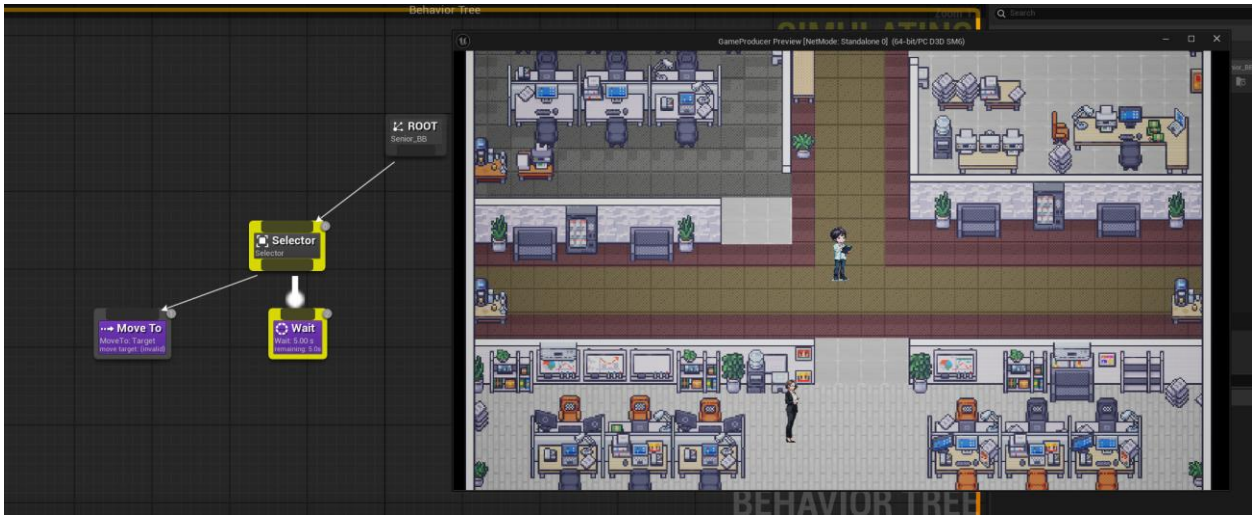

Auto Possess AI
Placed in World or Spawned
AI Controller Class
Senior_AIControl
LOD

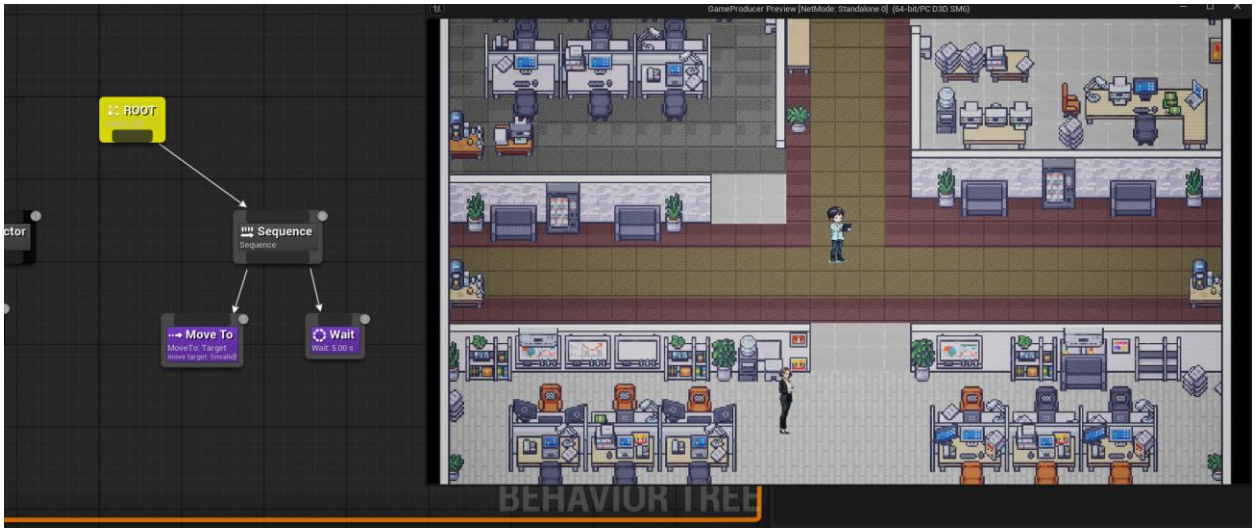

Senior_AIControl > EventGraph
Event BeginPlay
Run Behavior Tree
Target
self
Return Value
BTAsset
Event Tick
BLUEPRINT

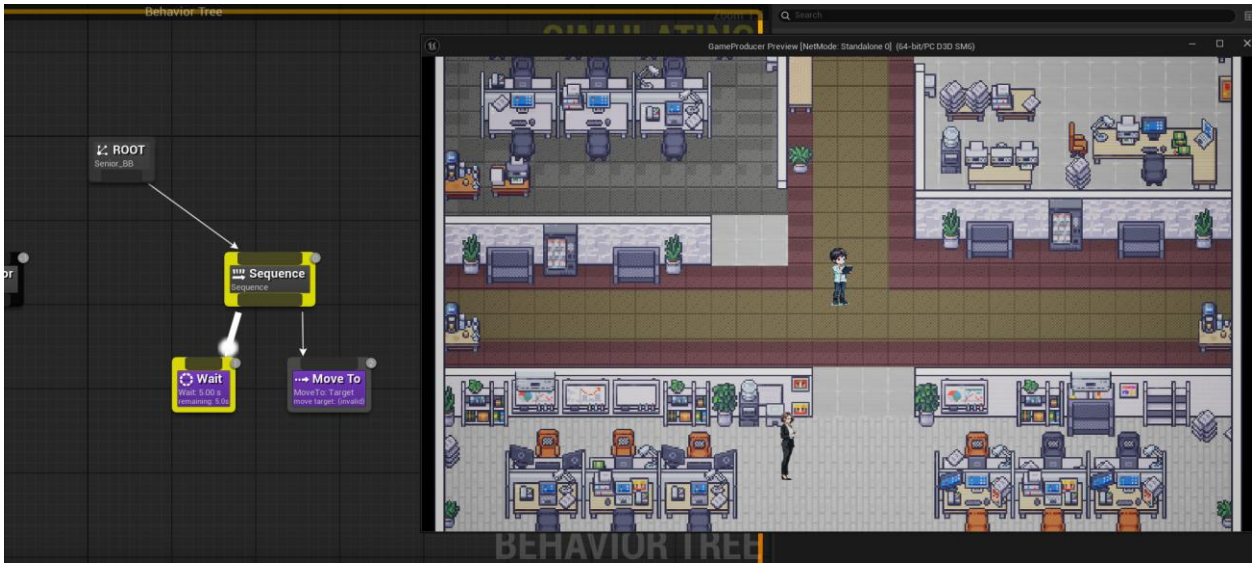

ROOT
Senior_BB
Selector
Selector
Sequence
Sequence
Move To
MoveTo: SelfActor
Wait
Wait: 5.00 s

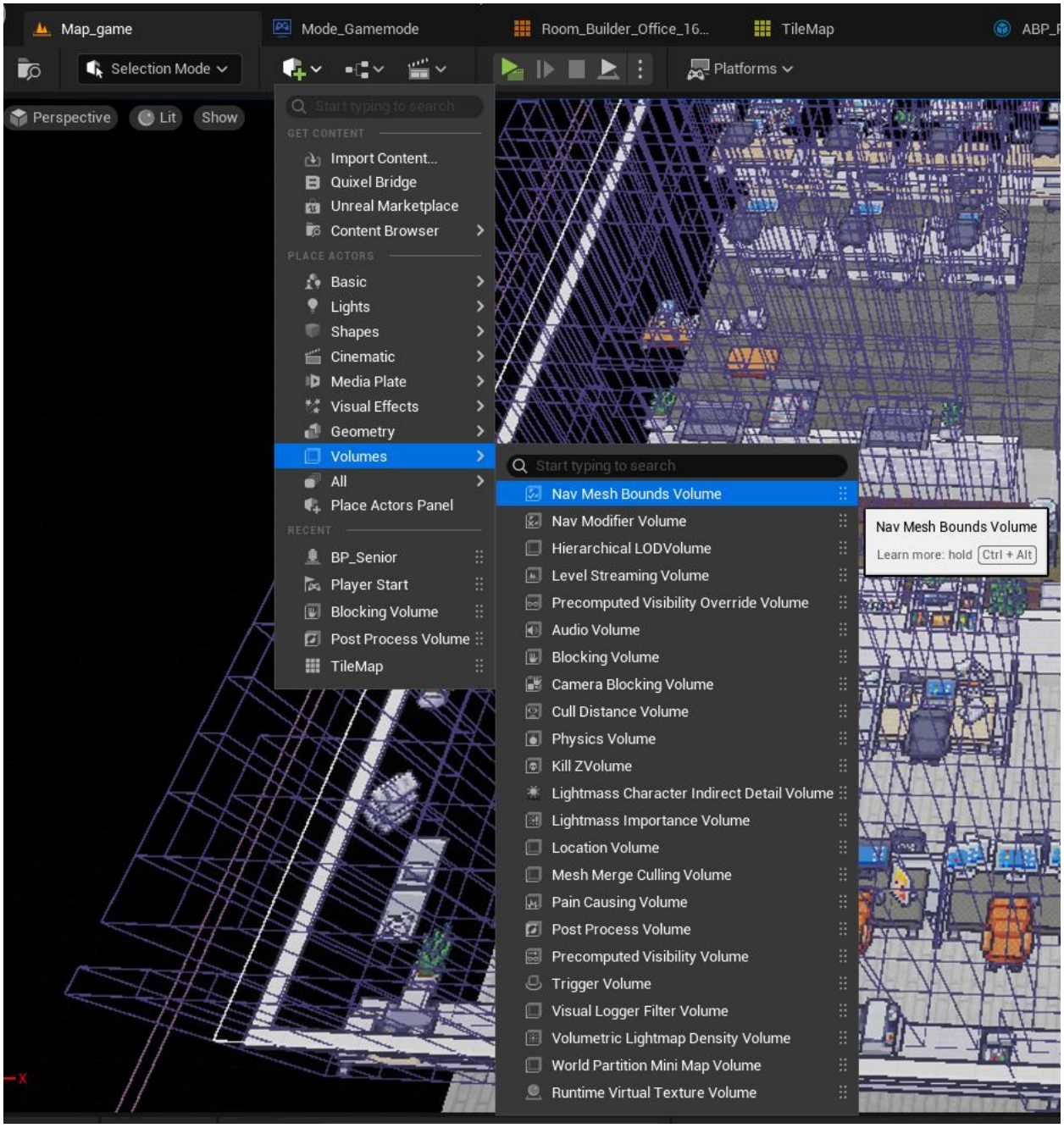

New Key
Search
KEYS
SelfActor
Target

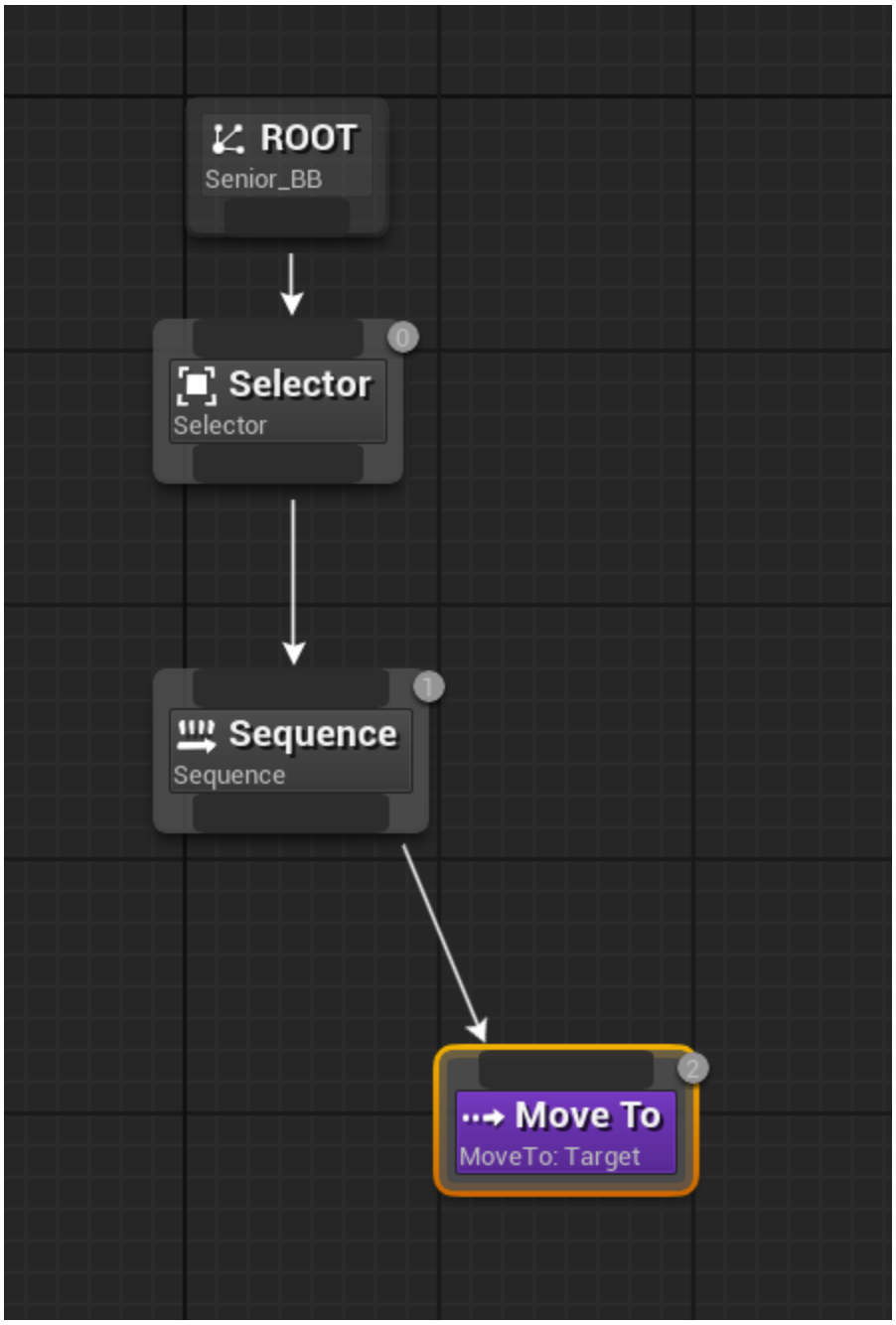

ROOT
Senior_BB
Selector
Selector
Sequence
Sequence
Move To
MoveTo: Target
Wait
Wait: 5.00 s
Node
Acceptable Radius
5.0
Filter Class
None
AllowStrafe
ReachTestIncludesAgentRadius
ReachTestIncludesGoalRadius
StartFromPreviousPath
Advanced
Blackboard
Observed Blackboard Value Tolerance
4.75
Blackboard Key
Target
Task
Ignore Restart Self
Description
Node Name
Move To
Blackboard
Search
KEYS
SelfActor
Target

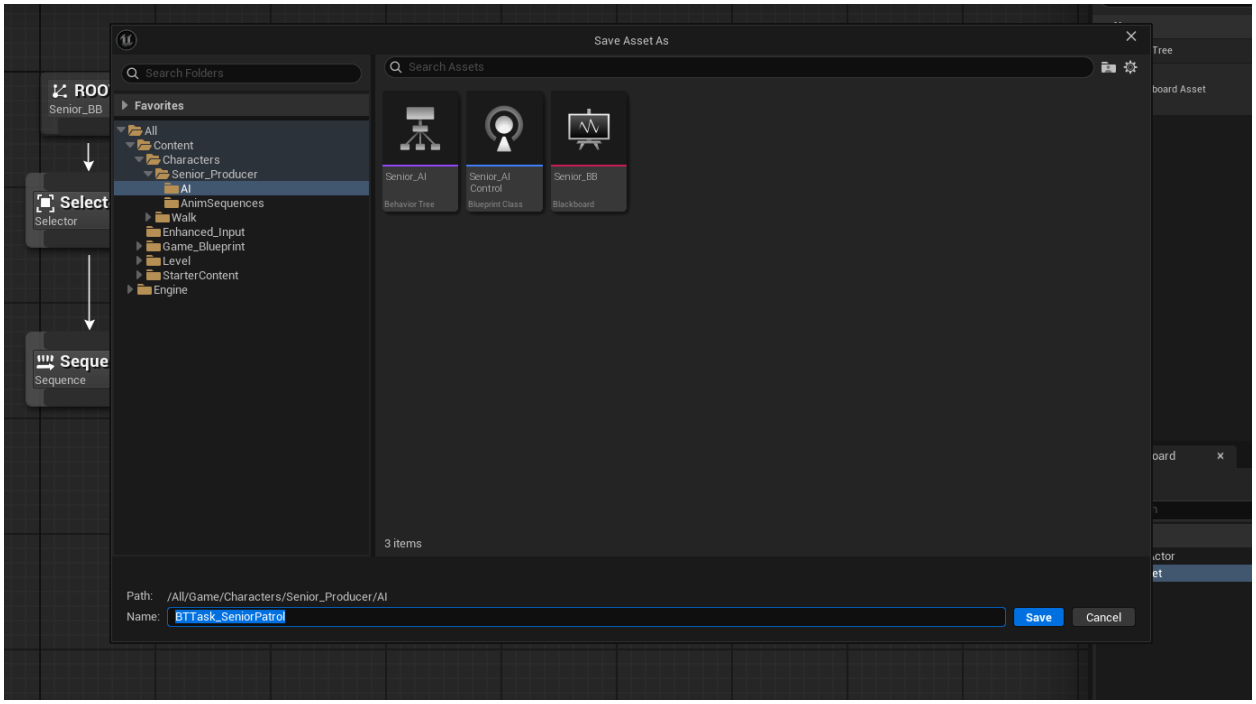

Behavior Tree
GameProducer Preview [NetMode: Standalone 0] (64-bit/PC D3D SM6)
ROOT
Senior_BB
Selector
Move To
MoveTo: Target
move target: (invalid)
Wait
Wait: 5.00 s
BEHAVIOR TREE

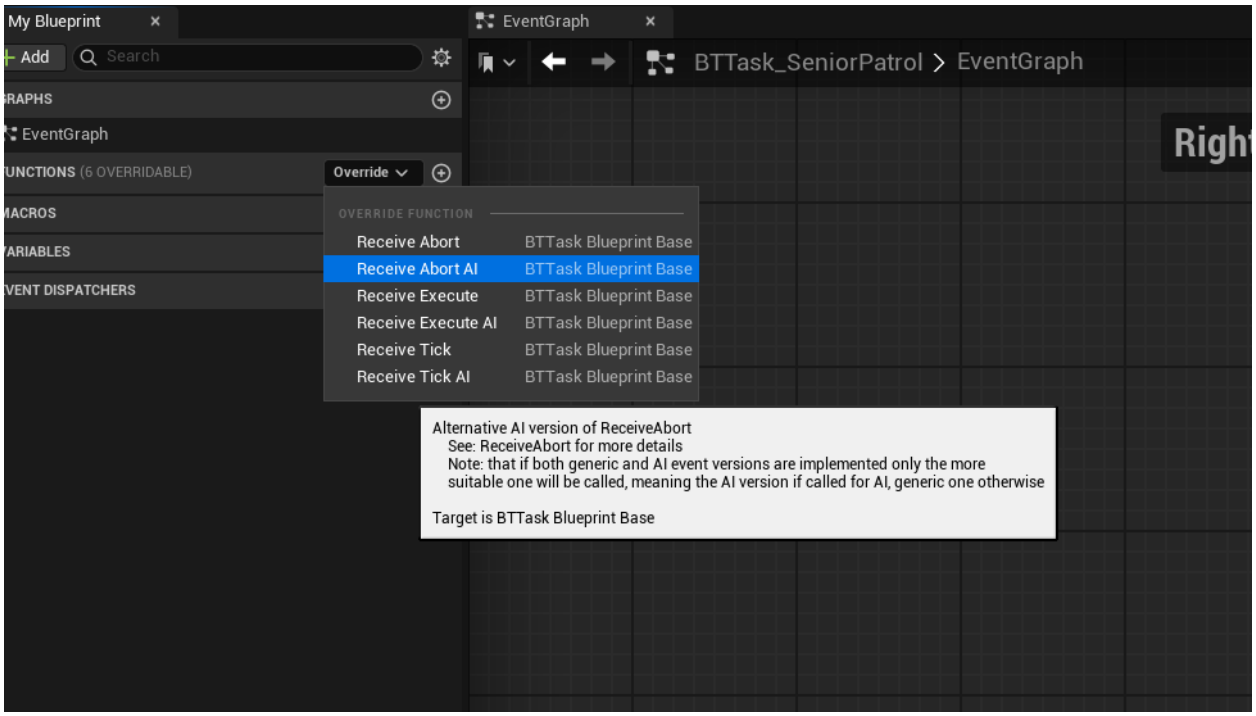

GameProducer Preview [NetMode: Standalone 0] (64-bit/PC D3D SM6)
ROOT
Sequence
Move To
MoveTo: Target
move target: (invalid)
Wait
Wait: 5.00 s
BEHAVIOR TREE

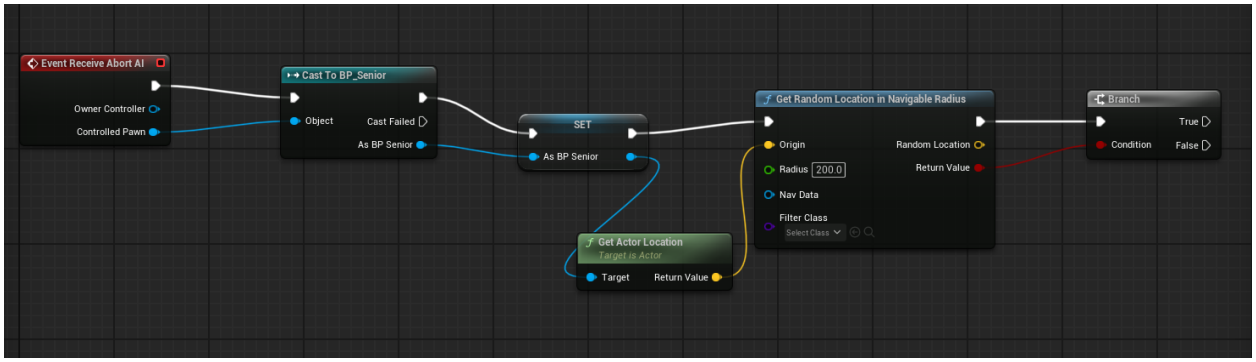

Behavior Tree
GameProducer Preview [NetMode: Standalone 0] (64-bit/PC D3D SM6)
ROOT
Senior_BB
Sequence
Wait
Wait: 5.00 s
Move To
MoveTo: Target
move target: (invalid)
BEHAVIOR TREE

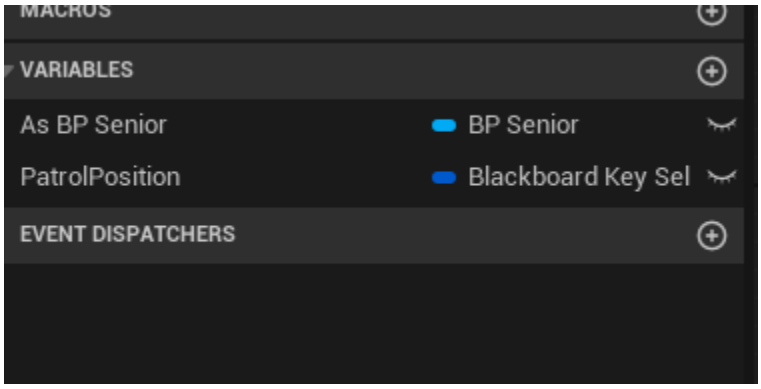

Map_game
Mode_Gamemode
Room_Builder_Office_16...
TileMap
Selection Mode
Platforms
Perspective
Lit
Show
Start typing to search
GET CONTENT
Import Content...
Quixel Bridge
Unreal Marketplace
Content Browser
PLACE ACTORS
Basic
Lights
Shapes
Cinematic
Media Plate
Visual Effects
Geometry
Volumes
All
Place Actors Panel
RECENT
BP_Senior
Player Start
Blocking Volume
Post Process Volume
TileMap
Start typing to search
Nav Mesh Bounds Volume
Nav Modifier Volume
Hierarchical LODVolume
Level Streaming Volume
Precomputed Visibility Override Volume
Audio Volume
Blocking Volume
Camera Blocking Volume
Cull Distance Volume
Physics Volume
Kill ZVolume
Lightmass Character Indirect Detail Volume
Lightmass Importance Volume
Location Volume
Mesh Merge Culling Volume
Pain Causing Volume
Post Process Volume
Precomputed Visibility Volume
Trigger Volume
Visual Logger Filter Volume
Volumetric Lightmap Density Volume
World Partition Mini Map Volume
Runtime Virtual Texture Volume
Nav Mesh Bounds Volume
Learn more: hold Ctrl + Alt

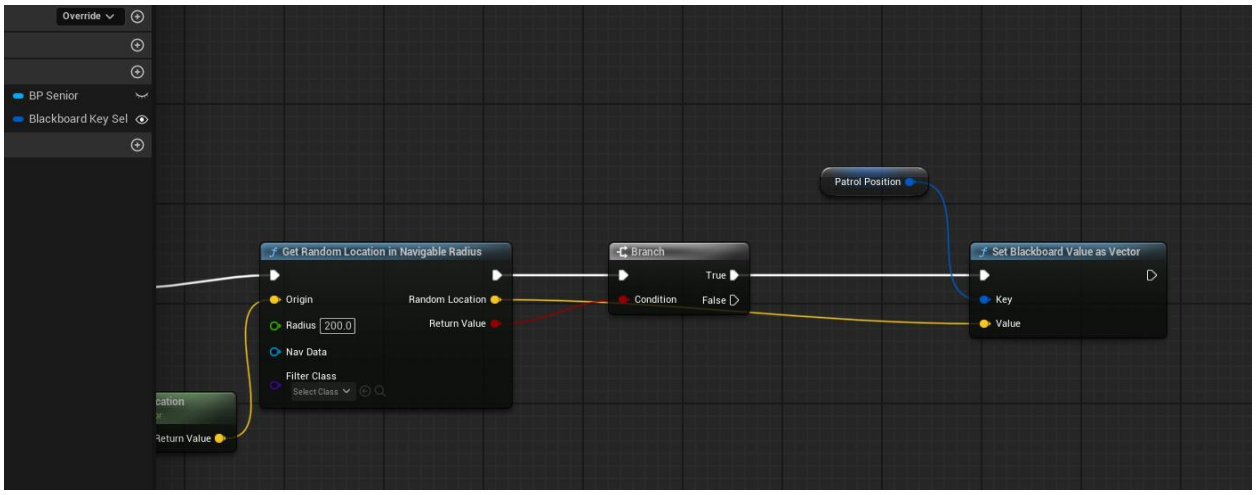

ROOT
Senior_BB
0
Selector
Selector
1
Sequence
Sequence
2
Move To
MoveTo: Target

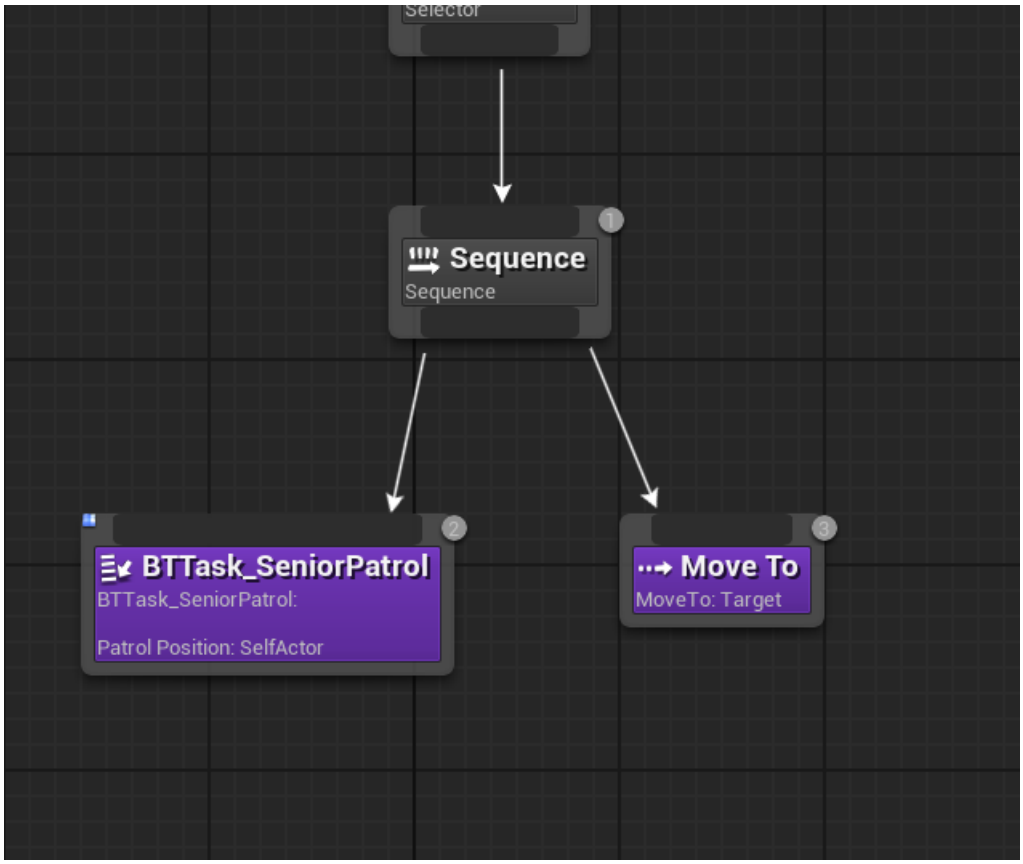

Save Asset As
Search Folders
Search Assets
Favorites
All
Content
Characters
Senior_Producer
AI
AnimSequences
Walk
Enhanced_Input
Game_Blueprint
Level
StarterContent
Engine
Senior_AI
Behavior Tree
Senior_AI Control
Blueprint Class
Senior_BB
Blackboard
3 items
Path: /All/Game/Characters/Senior_Producer/AI
Name: BTTask_SeniorPatrol
Save
Cancel

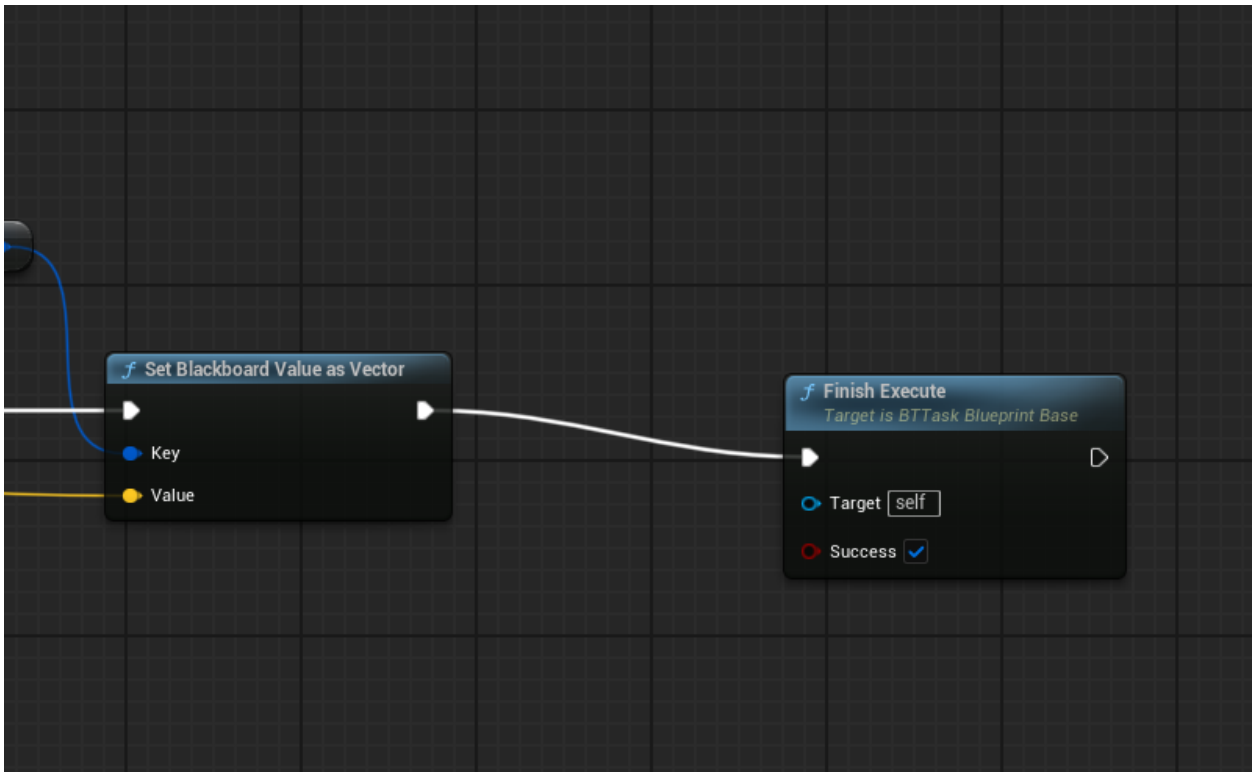

My Blueprint
Add
Search
EventGraph
BTTask_SeniorPatrol > EventGraph
Override
OVERRIDE FUNCTION
Receive Abort BTTask Blueprint Base
Receive Abort AI BTTask Blueprint Base
Receive Execute BTTask Blueprint Base
Receive Execute AI BTTask Blueprint Base
Receive Tick BTTask Blueprint Base
Receive Tick AI BTTask Blueprint Base
Alternative AI version of ReceiveAbort
See: ReceiveAbort for more details
Note: that if both generic and AI event versions are implemented only the more suitable one will be called, meaning the AI version if called for AI, generic one otherwise
Target is BTTask Blueprint Base


Event Receive Abort AI
Owner Controller
Controlled Pawn
Cast To BP_Senior
Object
Cast Failed
As BP Senior
SET
As BP Senior
Get Random Location in Navigable Radius
Origin
Radius 200.0
Nav Data
Filter Class
Select Class
Random Location
Return Value
Branch
True
Condition
False
Get Actor Location
Target is Actor
Target
Return Value


MACROS
VARIABLES
As BP Senior
BP Senior
PatrolPosition
Blackboard Key Sel
EVENT DISPATCHERS


Override
BP Senior
Blackboard Key Sel
Patrol Position
Get Random Location in Navigable Radius
Origin
Radius 200.0
Nav Data
Filter Class
Select Class
Random Location
Return Value
Branch
True
Condition
False
Set Blackboard Value as Vector
Key
Value


Selector
Sequence
Sequence
BTTask_SeniorPatrol
BTTask_SeniorPatrol:
Patrol Position: SelfActor
Move To
MoveTo: Target


Set Blackboard Value as Vector
Key
Value
Finish Execute
Target is BTTask Blueprint Base
Target
self
Success

3. Student Exercises:

To reinforce learning, students are encouraged to:

Add idle animations during patrol

Implement a visible warning when detecting player

Add delay before returning to patrol after chasing

Extend behavior using custom Blackboard conditions

4. Debugging Guide:

4.1 Behavior Tree Realtime Debugging

Debugging elements	Description
Node Hghlighting	Path of the currently executing action node
Decorator Status	True/False condition evaluation change
Task Execution Result	Success / Fail - whether to trigger next behavior
Key point	If a behavior tree node is not highlighted in green, it indicates that the logic never reached that node.

4.2 NavMesh Debugging: Press P to display the NavMesh coverage area (green).

Questions	Reason	Solution
NPC does not move	NavMesh does not cover the NPC's current position.	Make NavMeshBoundsVolume bigger
Green area is not connected	Terrain obstruction or excessive elevation difference	Adjust Height / Obstacle Avoidance Settings
Move to not success	Insufficient walkable points	Increase movable areas

4.3 Normal Bug Check Table

Questions	Possible Reason	Inspect Location
NPC does not move	Did not set AIController/Behavior Tree	BP_NPC→Pawn→AI Controller Class
AIController display none	Not automatically controlled AI	Auto Possess AI → Placed in World
MoveTo stuck	AcceptableRadius too small	MoveTo Node Settings

AI Citation
ChatGPT