Documentation

Grid-based movement controller

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Contents

Description.

The purpose of this tool is to provide a head start for development of grid-based dungeon crawler games.

The “Grid-based movement controller” provides a basic functionality of a first-person grid-based movement system. It features a grid system based on a responsive grid unit (“Tile”). The grid system allows to decouple tile mechanics from its model if necessary and to design level art style separately from the grid. Each tile on the grid could be dynamically switched as walkable or not depending on the level design.

Key features.

This tool can be used for developing first person grid-based dungeon crawlers and games alike.

A sample level shows implementation of such elements as:

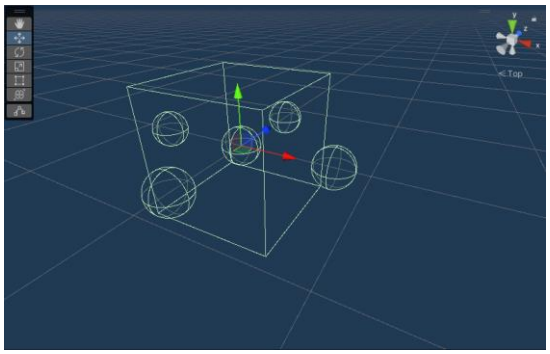
- Stairs
- Elevators and Moving platforms
- Ladder
- Tunnel
- Dynamic obstacle
- Hidden path

All these elements are featuring usage of grid system that decouples design of player's movement and level element's logic.

This is not a complete list of elements. Other level elements could be implemented as well.

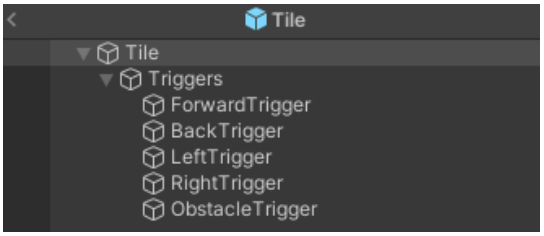
Grid-based movement system.

The core elemnt of the grid-based system is a grid unit “Tile”. The tile is a game object with a tag “Tile”, 1 box collider component, 4 triggers in each direction that are detecting other tiles on the grid and 1 trigger in the centre to detect obstacles:



Pic 1- Tile prefab view.

Each Tile object has a child object Triggers that includes 4 directional triggers and 1 obstacle trigger:

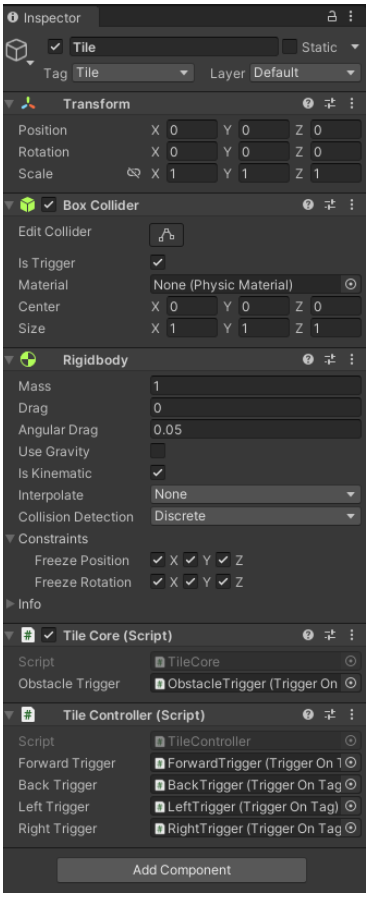


Pic 2 – Tile object hierarchy.

A model of the floor could be added as a child object of the tile if necessary.

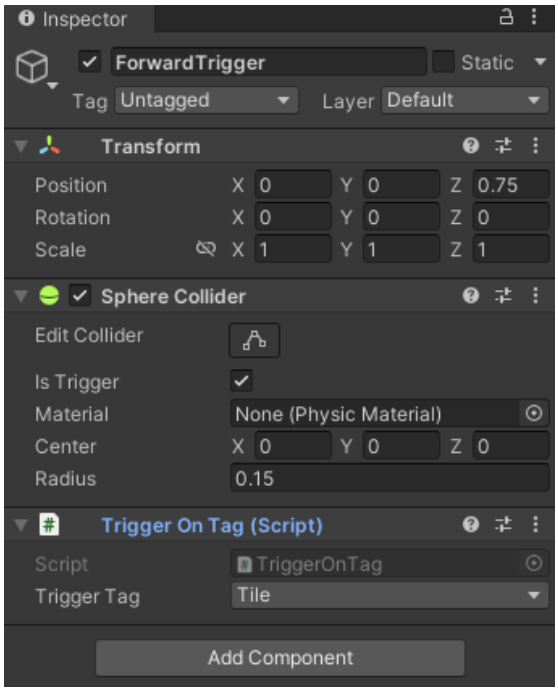
Each Tile object has these components:

- Box collider component with Is Trigger checkbox enabled. Required to define the scope of the Tile.
- A Rigidbody component with Is Kinematic checkbox enabled, all Constraints checkboxes enabled. Required to detect collider trigger events.
- TileCore and TileController components. Required to handle navigation on the grid. Refer to the class reference for details.



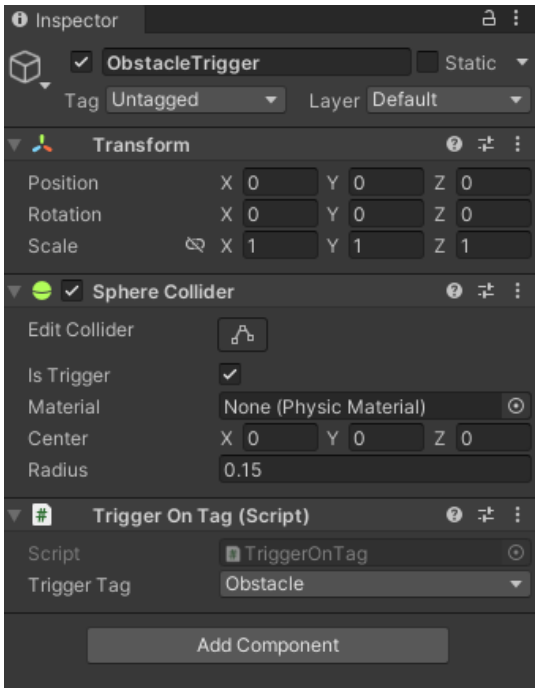
Pic 3 – Tile object components.

Each one of four directional triggers of the Tile object has TriggerOnTag component with a Trigger Tag set to “Tile” and a sphere collider component with Is Trigger checkbox enabled.



Pic 4 – Forward Trigger components (same for other directional triggers with the difference of sphere collider center values).

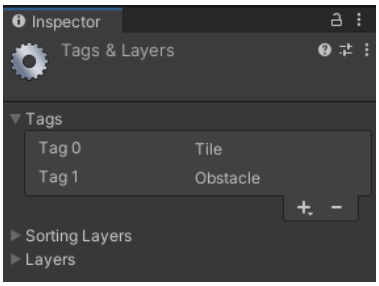
Obstacle Trigger of the Tile object has Trigger Tag set to “Obstacle”. Refer to the class reference for details on TriggerOnTag component.



Pic 5 – Obstacle Trigger components.

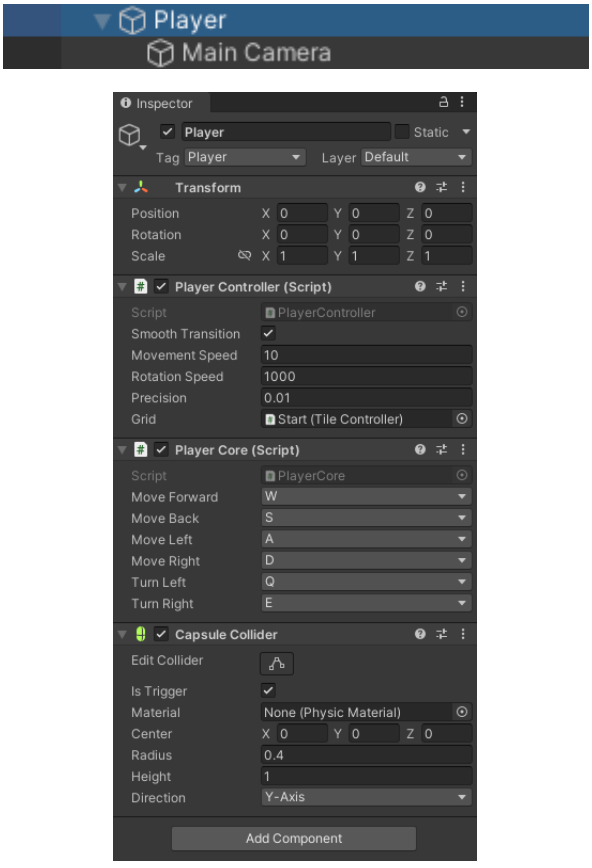
Scene set up.

1) Create Tags “Tile” and “Obstacle”:



Pic 6 – Required additional tags.

2) Create a level with a grid using the Tile prefab from the sample scene or create a new Tile with components as explained in grid-based movement system part. Create elements within the level.
3) Create a Player game object, put Main Camera as a child object of the Player game object.
4) Add PlayerCore, PlayerController and a Capsule Collider component to the Player game object. Assign a starting tile of the grid to the PlayerController component’s property “Grid”. Adjust parameters in the PlayerController component and movement keys in the PLayerCore component:

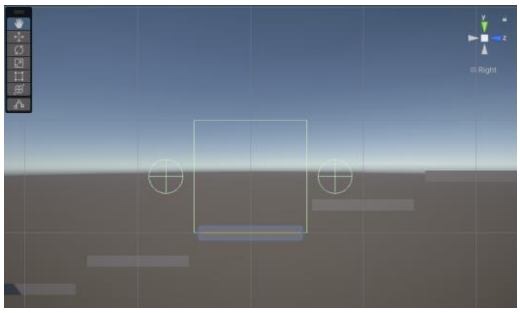


Pic 7 – Player game object’s components set up.

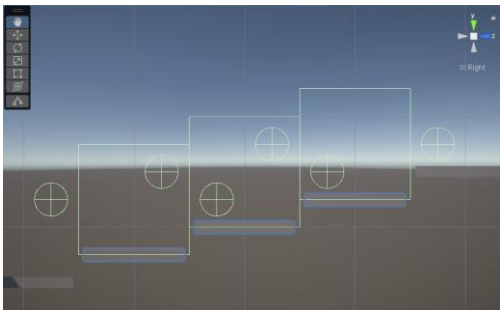
Level elements implementation.

- Stairs

Each tile is shifted by Y axis, but the trigger still intersects the next tile's box collider. And a player controller will move towards the next tile's position (elevated by a delta Y related to the current tile):



Pic 8 – Tile collider with its Forward and Back triggers.

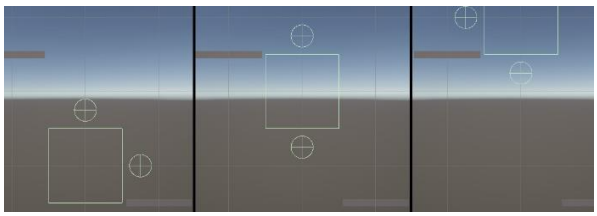


Pic 9 –Forward and Back triggers intersections with adjacent tile colliders.

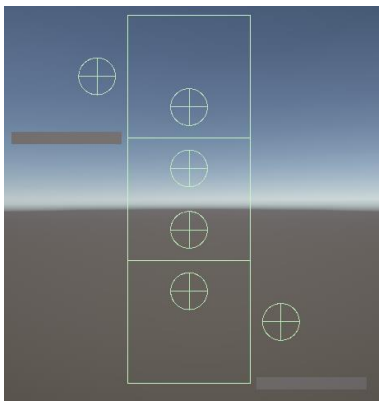
- Ladder

Ladder in a sample level example requires ForwardTrigger and BackTrigger's positions to be adjusted.

Every Forward and Back trigger of each ladder's tile should be adjusted to intersect next adjacent tile vertically instead of horizontal placement for the rest of the tiles on the grid. That allows player to move vertically when moving to the next tile.



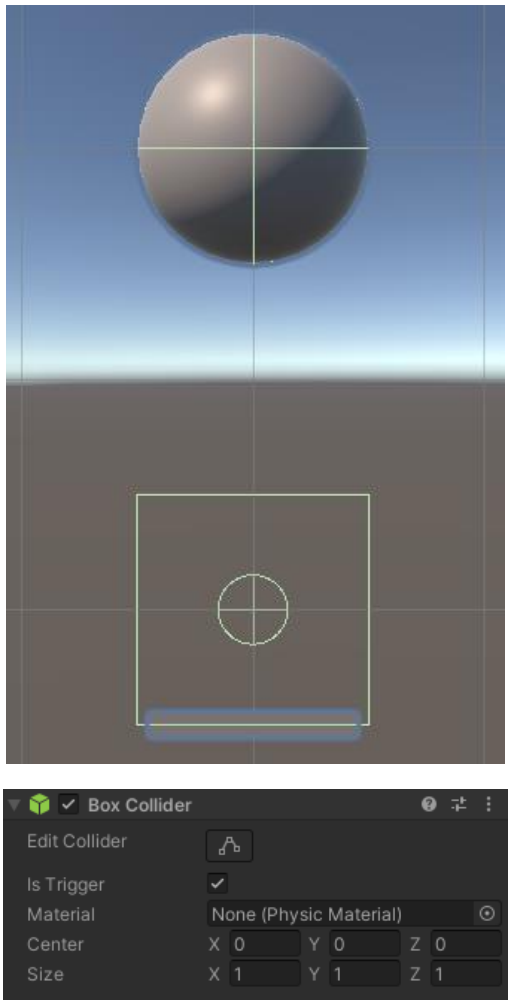
Pic 10 – Ladder tiles: Tile collider with Forward and Back triggers.



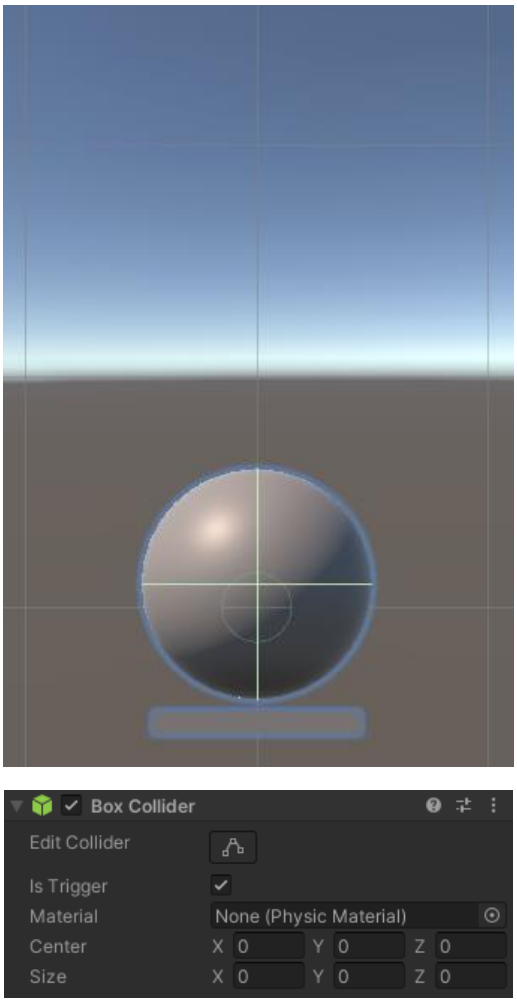
Pic 11 – Forward and Back triggers placement in the ladder and their intersections with adjacent vertical tiles.

- Obstacle

When obstacle touches the tile's obstacle trigger (sphere collider), tile's main collider (box collider) disappears. That causes adjacent tiles not to be able to "see" this tile. Therefore, they cannot provide player with the "next tile's" position and player cannot move towards it.



Pic 12 – Obstacle and tile interaction. Tile is "walkable".



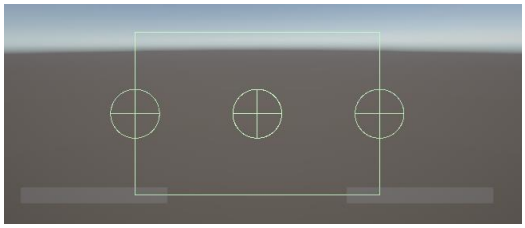
Pic 13 – Obstacle and tile interaction. Tile is not "walkable".

- Hidden Path

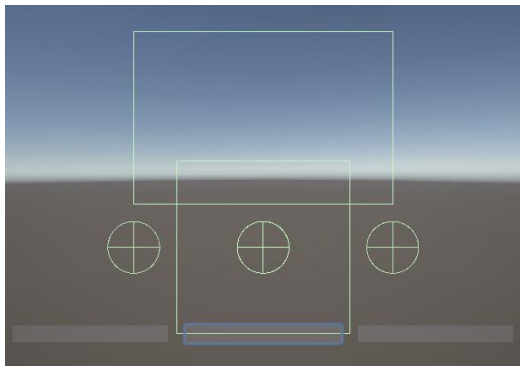
Obstacle mechanics could be also used for walls, doors, hidden rooms, or hidden paths that could be entered on condition (for example a player could fly above the water tiles if casted a spell) and so on.

In the sample scene a hidden path is given as an example of such level element. And it will open a path across the gap on the grid when the player is next to it after pressing space. Refer to the script reference for details.

Hidden path is a game object tagged as “Obstacle” and a Tile set as a child object of the Hidden path object. To open the path a box collider of the hidden path object should be elevated above the obstacle trigger of the tile to make the tile “walkable”:



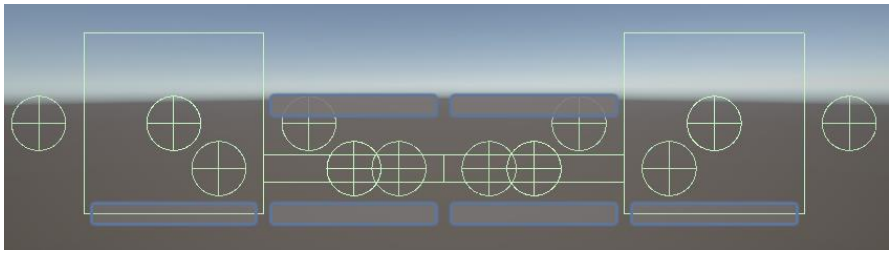
Pic 14 – Hidden Path. Tile “unwalkable”.



Pic 15 – Hidden Path. Tile “walkable”.

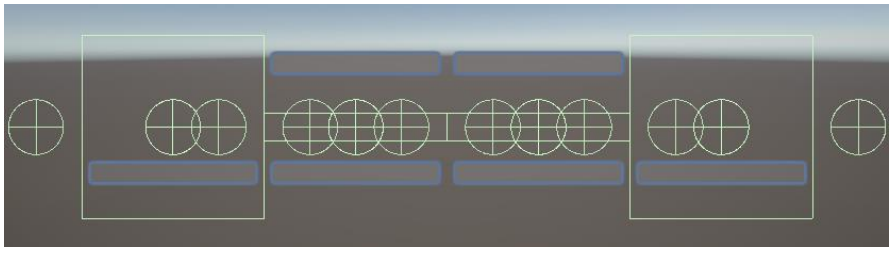
- Tunnel

Tunnel’s inner tiles have shorter main colliders, which makes them unwalkable for the outer tiles:



Pic 16 – Tunnel. Inner tiles “unwalkable” for the outer tiles.

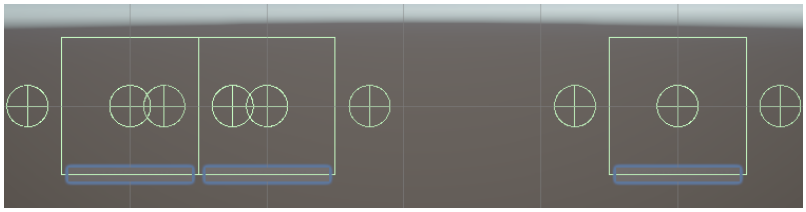
To move through the tunnel, the outer tile of the tunnel should be descended for its trigger to reach the first tunnel’s tile collider so it could be returned as a next walkable tile. After player crouches inside the tunnel, player will follow the tunnel’s design according to the grid:



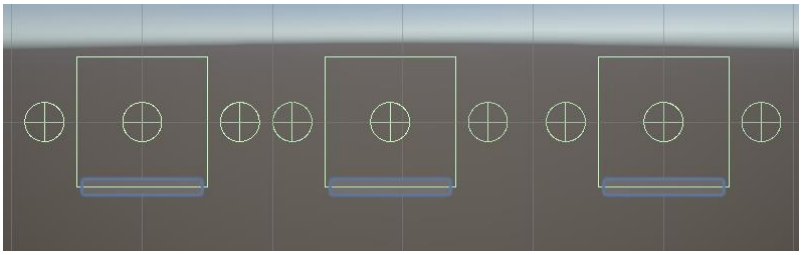
Pic 17 – Tunnel. Inner tiles “walkable” for the outer tiles.

- Moving platforms

Moving platforms simply utilize the Tile grid unit. Player can only step on and off the platform if standing on a grid tile which is in a close proximity to the platform to be able to identify it as an adjacent tile:



Pic 18 – Horizontal moving platform. The platform is “walkable” for the left Tile and “unwalkable” for the right Tile.



Pic 19 – Horizontal moving platform is “unwalkable” for both left and right Tiles.

Vertical moving platform could be designed in a similar way. Refer to the ample scene for the example of the implementation of the vertical moving platform.

Script reference.

Navigation

Classes

TileCore

Description

Defines a tile. Each Tile game object should have this component. It has obstacle collider which will be triggered when an “Obstacle” tag has been detected. Tile is “unwalkable” when an obstacle is detected.

Properties

obstacleTrigger	refers to the TriggerOnTag component which will have “IsTriggered” property true if an object with the tag “Obstacle” intersects its collider.

Fields

tileCollider	main collider of the Tile object.
colliderDefaultSize	default size of the main collider.

Private Methods

Start	initializes tileCollider and colliderDefaultSize.
Update	adjusts tileCollider’s size depending onobstacleTrigger’s “IsTriggered” property.

TileController

Description

Provides functionality that is responsible for a grid-based movement. Has 4 triggers that represent 4 directions. Returns an adjacent tile object when the player is moving in a specified direction.

Properties

forwardTrigger	refers to the TriggerOnTag component of the “Forward” trigger object.
backTrigger	refers to the TriggerOnTag component of the “Back” trigger object.
leftTrigger	refers to the TriggerOnTag component of the “Left” trigger object.
rightTrigger	refers to the TriggerOnTag component of the “Right” trigger object.

Public Methods

GetTile	returns adjacent tile depending on the provided parameter “direction”.

Private Methods

ForwardTile	returns TileController component of the adjacent tile in the forward direction if the forwardTrigger’s property “IsTriggered” is true, otherwise returns itself.
BackTile	returns TileController component of the adjacent tile in the back direction if the backTrigger’s property “IsTriggered” is true, otherwise returns itself.
LeftTile	returns TileController component of the adjacent tile in the left direction if the leftTrigger’s property “IsTriggered” is true, otherwise returns itself.
RightTile	returns TileController component of the adjacent tile in the right direction if the rightTrigger’s property “IsTriggered” is true, otherwise returns itself.

Enumerations

Direction

Description

Keeps directions with values of their Euler degrees.

Properties

Forward	Keeps value of 0 degrees
Left	Keeps value of 270 degrees
Back	Keeps value of 180 degrees
Right	Keeps value of 90 degrees
Round	Keeps value of 360 degrees

Player

Classes

PlayerCore

Description

Defines movement keys. Requires PlayerController component.

Properties

`moveForward`	`defines the key code for the step forward`
`moveBack`	`defines the key code for the step back`

moveLeft	defines the key code for the step left
moveRight	defines the key code for the step right
turnLeft	defines the key code for the turn left
turnRight	defines the key code for the turn right

Private Methods

Start	initializes the PlayerController component.
Update	executes PlayerController component's methods depending on the key pressed.

PlayerController

Description

Uses the grid-based tile map to perform movement and rotation functionality.

Properties

smoothTransition	defines wather player's movement and rotation instant or not.
movementSpeed	defines movement speed.
rotationSpeed	defines rotation speed.
precision	defines how precise player should be placed on the Tile's position.
grid	defines the start tile of the grid.
IsBusy	is true when player is moving or rotating.

Fields

currentDirection	direction player's camera is facing. Defined by Enumeration "Direction"
targetTile	Next tile player should move towards.
TargetRotation	rotation player should rotate towards.

Private Methods

Start	initializes currentDirection field as "Forward". Initializes targetTile field as grid parameter. Initializes targetRotation based on currentDirection value.
Update	executes Move and Rotate methods if IsBusy property is true (targetTile assigned but not yet reached or targetRotation changed but not yet reached).
Move	moves player towards the targetTile's position.
Rotate	rotates player towards targetRotation's Euler angles.
LocalDirection	returns the direction relative to the current direction based on provided parameter. (ex:

	currentDirection is Left, parameter direction is Left, returns Back)

Public Methods

MoveTowards	reassigns a new targetTile based on provided “direction” parameter relative to the current direction.
RotateTowards	reassigns currentDirection based on provided “direction” parameter relative to the current direction.

Helpers

Classes

TriggerOnTag

Description

A helper component that has a state “IsTriggered” when detecting a specified tag. All Tags should be specified in a Tag enum. Used by TileController to identify adjacent tiles, a tag “Tile” is specified for that. Can be used by other components to identify proximity with an object of a certain tag.

Properties

triggerTag	defines the tag that should set the state of the component to “IsTriggered”.
IsTriggered	defines the state of the component. True if gameobject’s collider intersects a collider of the object with the specified Tag.
TriggerObject	a game object with the specified tag that intersects this component’s game object.

Private Methods

OnTriggerEnter	sets “IsTrigger” to True if interacts with the object of specified Tag. And saves the object as the TriggerObject property.
OnTriggerExit	sets “IsTrigger” to False if stops interacting with the object of the specified Tag. And assigns null to the TriggerObject.

Enumerations

Tag

Description

Keeps tags that could be referenced in code.

Level

Classes

HiddenPathController

Description

Hides/reveals the path by elevating the main collider over the obstacle collider of the walkable tile.

Properties

maxElevation	y value of relative elevation for the main collider.
revealPath	the Key Code that triggers Hiding/Revealing the path.
revealTileModel	A model of the tile to be revealed.

Private Methods

Start	initializes a trigger on tag component, reveal collider (main collider assigned to the object that is tagged as “Obstacle”) and the default reveal collider position.
Update	holds functionality for hiding and revealing the path.

CrouchController

Description

CrouchController component descents the Tile’s position which this component assigned to.

Properties

crouch	the Key Code that triggers the Descent functionality.
descension	y value of relative descension of the Tile’s position.

Private Methods

Descent	Descents the game object’s position for the given descension value provided in the component’s properties.