Aggregation Diagram

Graphical user interface

Description automatically generated

Application

Description automatically generated with medium confidenceDiagram

Description automatically generated with medium confidenceDiagram

Description automatically generated with medium confidenceA picture containing application

Description automatically generatedInheritance Diagram

Text

Description automatically generated with medium confidence

Graphical user interface, text, application

Description automatically generatedClass Diagram

Text

Description automatically generated

Shape

Description automatically generated with low confidence

Text

Description automatically generated with medium confidenceA picture containing text

Description automatically generatedGraphical user interface, text, application, chat or text message

Description automatically generatedA picture containing text

Description automatically generatedText

Description automatically generated with medium confidenceGraphical user interface, text, application

Description automatically generatedText

Description automatically generated with low confidenceA picture containing shape

Description automatically generatedA black screen with white text

Description automatically generated with low confidence%3CmxGraphModel%3E%3Croot%3E%3CmxCell%20id%3D%220%22%2F%3E%3CmxCell%20id%3D%221%22%20parent%3D%220%22%2F%3E%3CmxCell%20id%3D%222%22%20value%3D%22PlayerGroundedState%22%20style%3D%22swimlane%3BfontStyle%3D2%3Balign%3Dcenter%3BverticalAlign%3Dtop%3BchildLayout%3DstackLayout%3Bhorizontal%3D1%3BstartSize%3D26%3BhorizontalStack%3D0%3BresizeParent%3D1%3BresizeLast%3D0%3Bcollapsible%3D1%3BmarginBottom%3D0%3Brounded%3D0%3Bshadow%3D0%3BstrokeWidth%3D1%3B%22%20vertex%3D%221%22%20parent%3D%221%22%3E%3CmxGeometry%20x%3D%22800%22%20y%3D%22600%22%20width%3D%22140%22%20height%3D%2260%22%20as%3D%22geometry%22%3E%3CmxRectangle%20x%3D%22230%22%20y%3D%22140%22%20width%3D%22160%22%20height%3D%2226%22%20as%3D%22alternateBounds%22%2F%3E%3C%2FmxGeometry%3E%3C%2FmxCell%3E%3CmxCell%20id%3D%223%22%20value%3D%22move\_input%3A%20Vector2D%22%20style%3D%22text%3Balign%3Dleft%3BverticalAlign%3Dtop%3BspacingLeft%3D4%3BspacingRight%3D4%3Boverflow%3Dhidden%3Brotatable%3D0%3Bpoints%3D%5B%5B0%2C0.5%5D%2C%5B1%2C0.5%5D%5D%3BportConstraint%3Deastwest%3B%22%20vertex%3D%221%22%20parent%3D%222%22%3E%3CmxGeometry%20y%3D%2226%22%20width%3D%22140%22%20height%3D%2226%22%20as%3D%22geometry%22%2F%3E%3C%2FmxCell%3E%3CmxCell%20id%3D%224%22%20value%3D%22%22%20style%3D%22line%3Bhtml%3D1%3BstrokeWidth%3D1%3Balign%3Dleft%3BverticalAlign%3Dmiddle%3BspacingTop%3D-1%3BspacingLeft%3D3%3BspacingRight%3D3%3Brotatable%3D0%3BlabelPosition%3Dright%3Bpoints%3D%5B%5D%3BportConstraint%3Deastwest%3B%22%20vertex%3D%221%22%20parent%3D%222%22%3E%3CmxGeometry%20y%3D%2252%22%20width%3D%22140%22%20height%3D%228%22%20as%3D%22geometry%22%2F%3E%3C%2FmxCell%3E%3C%2Froot%3E%3C%2FmxGraphModel%3E

A picture containing text

Description automatically generated

Text

Description automatically generated with low confidence

A picture containing shape

Description automatically generated

Text

Description automatically generated with medium confidence

Text

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A picture containing shape

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A picture containing graphical user interface

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Text, application

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Graphical user interface, text, application

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A black rectangle with white text

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Text

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A black screen with white text

Description automatically generated with low confidenceGraphical user interface

Description automatically generated with low confidence

Shape

Description automatically generated with low confidence

A picture containing shape

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Algorithms

Linear Interpolation: This algorithm will interpolate between two values using an interpolant. This is used to find a point some fraction of an amount along a line between two endpoints.

*function* lerp(a, b, lerp\_amount) *do*

*return* ((a \* (1 - lerp\_amount)) + (b \* lerp\_amount))

*end*

Sign: This algorithm returns the sign of an input. If the input is greater than or equal to 0 then 1 is returned. Otherwise, zero is returned.

*function* sign(flt) *do*

*if* flt >= 0 *do*

*return* 1

*end*

*else* *do* *return*

*return* -1

*end*

*end*

RigidBody2D.AddForce: This algorithm uses the physics equation f=ma to apply a force to a physics body.

I had first seen this algorithm used in Unity and I have researched how ForceMode is used and I have implemented this algorithm partially in Python as I have only used the ForceModes Force, Impulse and Acceleration in my code.

The function has arguments:

* Force: This is represented using a 2D vector
* DeltaTime: The time difference between when the previous frame that was drawn and the current frame was drawn
* ForceMode: Dictates the way that the force is applied to the body

Graphical user interface

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Camera.UpdateScroll: This function updates the x scroll value and the y scroll value for the camera. This ensures that the player is always on the screen when playing.

*set* scroll\_x = scroll\_x + int((entity\_x - scroll\_x  - int((display\_surface\_width + target\_rect\_width) / 2)) \* 0.2)

*set* scroll\_y = scroll\_y + int((entity\_y - scroll\_y  - int((display\_surface\_height + target\_rect\_height) / 2)) \* 0.2)

*set* scroll\_x =  min(max(0, scroll\_x), level\_width - display\_surface\_width)

*set* scroll\_y =  min(max(0, scroll\_y), level\_height - display\_surface\_height)

Level.GenerateLevelData: This function generates a LevelData object which is a typed dictionary.

The tiles are placed into a dictionary where the key is tuple that signifies the chunk co-ordinate that the tile is in.

The position of the player and a LevelFinish object.

The LevelData object is generate from a level section in an LDTK JSON file.

The chunk co-ordinate of a tile is determined by the following algorithm:

chunk\_x = tile\_rect\_x // chunk\_size

chunk\_y = tile\_rect\_y // chunk\_size

*set* tiles = []

*set* player\_position = [-1, -1]

*foreach* (layer in layer\_instances) *do*

*switch* (layer\_identifier) *do*

*case* "AutoTiles":

*foreach* (tile in auto\_tile\_layer) *do*

*//generate\_level\_tile*

                tiles.append(level\_tile)

*end*

*break*

*case* "Tiles":

*foreach* (tile in tile\_layer) *do*

*//generate\_level\_tile*

            tiles.append(level\_tile)

*end*

*break*

*case* "Entities":

*foreach* (entity in entity\_instances) *do*

*switch* (entity\_instance\_identifier) *do*

*case* "Player":

*set* player\_position = entity\_position

*break*

*case* "Finish":

*//generate\_level\_finish\_object*

*set* level\_finish = level\_finish

*break*

*end*

*end*

*end*

*end*

One part of the `player\_run\_state` update function calculates the force necessary to apply to the player.

This works by first calculating the speed the player is trying to reach (target\_speed) and then calculating an acceleration rate based on the target speed.

The speed difference is then calculated and the acceleration rate is multiplied by the speed difference.

This means that if the difference between the player’s current x velocity is close to the target speed then only a small force is applied.

An extra force is also applied to decrease the time it takes to change direction.

*set* target\_speed = x\_move\_input \* player\_run\_speed

*set* speed\_difference = target\_speed - player\_x\_speed

*if* abs(target\_speed) > 0 *do*

*set* acceleration\_rate = player\_acceleration\_rate

*end*

*else* *do*

*set* acceleration\_rate = player\_deceleration\_rate

*end*

*set* movement = pow(abs(speed\_difference) \* acceleration\_rate, self.player.velocity\_power) \* sign(speed\_difference)

*//add the force the player with ForceMode FORCE and pass in delta\_time*

*if* abs(target\_speed) == 0 *do*

    friction = sign(player\_x\_speed) \* min(abs(player\_x\_speed), self.player.friction

    )

*//add the friction force to the player with ForceMode IMPULSE*

*end*

Data Dictionary

|  |  |  |
| --- | --- | --- |
| Variable Name | Data Type | Use |
| config | NeaGameConfig | Stores the configuration for the game |
| nea\_game | NeaGame | Creates the root window for the application that controls which window is shown each frame |
| screen | pygame.Surface | The screen that the display\_surface is scaled onto. |
| display\_surface | pygame.Surface | A smaller surface where tiles and entities are rendered. This surface is then scaled up to the size of the screen |
| engine | Engine | Provides an interface to update and access the time difference between when the previous frame was drawn and when the current frame was drawn |
| clock | pygame.time.Clock |  |
|  |  |  |