CRoPS (Combined Roadmap and Potentials for Swarms)

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Namespace Documentation

5.1 boid Namespace Reference

Classes

- class Boid

  Class which represents one boid.

Functions

- def guassianFunc

  Gamma function used to give a probability distribution of the flock in order to choose an appropriate neighbour.

Variables

- string __author__ = "Alex Wallar <aw204@st-andrews.ac.uk>"

5.1.1 Function Documentation

5.1.1.1 def boid.guassianFunc (*dX*, *dAvg* = `10`, *dSigma* = `1`)

Gamma function used to give a probability distribution of the flock in order to choose an appropriate neighbour.

Parameters

dX	Distance from the boid to the prospective neighbour
dAvg	Dynamic variable used to define the average prospective Distance
dSigma	Standard deviation of the average distances

Definition at line 21 of file boid.py.

Here is the caller graph for this function:

5.1.2 Variable Documentation

5.1.2.1 string boid.__author__ = "Alex Wallar <aw204@st-andrews.ac.uk>"

Definition at line 3 of file boid.py.

5.2 boidsimulation Namespace Reference

Classes

- class FlockSim

  Main class for that is used for the simulation and display of the flock.

Variables

- string __author__ = "Alex Wallar <aw204@st-andrews.ac.uk>"

5.2.1 Variable Documentation

5.2.1.1 string boidsimulation.__author__ = "Alex Wallar <aw204@st-andrews.ac.uk>"

Definition at line 4 of file boidsimulation.py.

5.3 configuration Namespace Reference

Classes

- class Configuration

  Static class that holds important global variables.
- class PolyFileConfiguration

  Extends the Configuration class.

5.4 dijkstra Namespace Reference

Functions

- def Dijkstra

Find shortest paths from the start vertex to all vertices nearer than or equal to the end.

- def shortestPath

  Find a single shortest path from the given start vertex to the given end vertex.

5.4.1 Function Documentation

5.4.1.1 def dijkstra.Dijkstra (*G, start, end* = None)

Find shortest paths from the start vertex to all vertices nearer than or equal to the end.

```
The input graph G is assumed to have the following
representation: A vertex can be any object that can
be used as an index into a dictionary.  G is a
dictionary, indexed by vertices.  For any vertex v,
G[v] is itself a dictionary, indexed by the neighbors
of v.  For any edge v->w, G[v][w] is the length of
the edge.  This is related to the representation in
<http://www.python.org/doc/essays/graphs.html>
where Guido van Rossum suggests representing graphs
as dictionaries mapping vertices to lists of neighbors,
however dictionaries of edges have many advantages
over lists: they can store extra information (here,
the lengths), they support fast existence tests,
and they allow easy modification of the graph by edge
insertion and removal.  Such modifications are not
needed here but are important in other graph algorithms.
Since dictionaries obey iterator protocol, a graph
represented as described here could be handed without
modification to an algorithm using Guido's representation.

Of course, G and G[v] need not be Python dict objects;
they can be any other object that obeys dict protocol,
for instance a wrapper in which vertices are URLs
and a call to G[v] loads the web page and finds its links.

The output is a pair (D,P) where D[v] is the distance
from start to v and P[v] is the predecessor of v along
the shortest path from s to v.

Dijkstra's algorithm is only guaranteed to work correctly
when all edge lengths are positive. This code does not
verify this property for all edges (only the edges seen
before the end vertex is reached), but will correctly
compute shortest paths even for some graphs with negative
edges, and will raise an exception if it discovers that
a negative edge has caused it to make a mistake.
```

Parameters

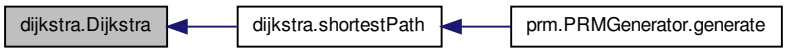
G	The graph dictionary to be searched
start	Starting node
end	End node

Returns

Something important

Definition at line 53 of file dijkstra.py.

Here is the caller graph for this function:



5.4.1.2 def dijkstra.shortestPath (*G, start, end*)

Find a single shortest path from the given start vertex to the given end vertex.

```
The input has the same conventions as Dijkstra().
The output is a list of the vertices in order along
the shortest path.
```

Parameters

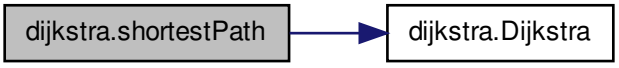
G	The graph dictionary to be searched
start	The starting node
end	The ending node

Returns

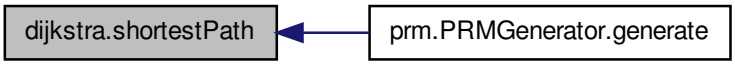
A list of the nodes that lie on the shortest path from start to end in G

Definition at line 89 of file dijkstra.py.

Here is the call graph for this function:



Here is the caller graph for this function:



5.5 gatherstats Namespace Reference

Functions

- def generateStats

  Generates the statistics and saves them in a well known location.

Variables

- list mapList

  A list of dictionaries used to store the map files, starting and ending points of the boids.
- testList = mapList

5.5.1 Function Documentation

5.5.1.1 def gatherstats.generateStats (*mapFile, iterations, startPoint, endPoint*)

Generates the statistics and saves them in a well known location.

Parameters

mapFile	The file that stores information about the environment
iterations	the number of experiments to run per number of bots
startPoint,endPoint	Defines the starting and ending points of the flock

Definition at line 14 of file gatherstats.py.

5.5.2 Variable Documentation

5.5.2.1 list gatherstats.mapList

A list of dictionaries used to store the map files, starting and ending points of the boids.

Definition at line 47 of file gatherstats.py.

5.5.2.2 gatherstats.testList = mapList

Definition at line 81 of file gatherstats.py.

5.6 goal Namespace Reference

Classes

- class CircleGoal

  Object that holds data about a goal modelled as circular configuration space.

Variables

- string __author__ = "Alex Wallar <aw204@st-andrews.ac.uk>"

5.6.1 Variable Documentation

5.6.1.1 string goal.__author__ = "Alex Wallar <aw204@st-andrews.ac.uk>"

Definition at line 3 of file goal.py.

5.7 mapparser Namespace Reference

Functions

- def mapVal

  Maps a value that is between in_min and in_max to a value between out_min and out_max.
- def mparse

  Parses a map file into a list of obstacles.

5.7.1 Function Documentation

5.7.1.1 def mapparser.mapVal (*x, in_min, in_max, out_min, out_max*)

Maps a value that is between in_min and in_max to a value between out_min and out_max.

Parameters

in_min	The minimum value that the input value could be
in_max	The maximum value that the input value could be
out_min	The minimum value that the output value could be
out_max	The maximum value that the output value could be

Returns

A scaled value based on a given input

Definition at line 16 of file mapparser.py.

Here is the caller graph for this function:

5.7.1.2 def mapparser.mparse (*filename, staticObstacleList =* `list()`, *kwargs*)

Parses a map file into a list of obstacles.

Parameters

filename	The file name of the map file

Returns

A list of obstacles

Definition at line 31 of file mapparser.py.

Here is the call graph for this function:

5.8 obstacle Namespace Reference

Classes

- class PolyObstacle

  Object that represents the an obstacle represented by a series of points (in the node list) which make up a set of lines.

Variables

- string __author__ = "Alex Wallar <aw204@st-andrews.ac.uk>"

5.8.1 Variable Documentation

5.8.1.1 string obstacle.__author__ = "Alex Wallar <aw204@st-andrews.ac.uk>"

Definition at line 4 of file obstacle.py.

5.9 priodict Namespace Reference

Classes

- class priorityDictionary

5.10 prm Namespace Reference

Classes

- class PRMGenerator

  Class used to hold methods and variables that are important for the global path planning problem.

5.11 test_sim Namespace Reference

Variables

- dictionary mapDict

  Main module to run for testing purposes.
- tuple flockSize = int(sys.argv[2])
- list startPoint = mapDict[sys.argv[1]]
- list endPoint = mapDict[sys.argv[1]]
- list mapFilePath = sys.argv[1]
- obstacleFilePath = None
- dynamicObstacleAutoGenerate = False
- int generateTarget = 0
- list arg = sys.argv[3]
- tuple fs

5.11.1 Variable Documentation

5.11.1.1 list test_sim.arg = sys.argv[3]

Definition at line 54 of file test_sim.py.

5.11.1.2 test_sim.dynamicObstacleAutoGenerate = False

Definition at line 50 of file test_sim.py.

5.11.1.3 list test_sim.endPoint = mapDict[sys.argv[1]]

Definition at line 47 of file test_sim.py.

5.11.1.4 tuple test_sim.flockSize = int(sys.argv[2])

Definition at line 45 of file test_sim.py.

5.11.1.5 tuple test_sim.fs

Initial value:

```
1 = bs.FlockSim(
2             flockSize,
3             startPoint,
4             endPoint,
5             map_file=mapFilePath,
6             obstacle_file=obstacleFilePath,
7             auto_gen_obst=dynamicObstacleAutoGenerate,
8             auto_gen_number=generateTarget
9         )
```

Definition at line 61 of file test_sim.py.

5.11.1.6 tuple test_sim.generateTarget = 0

Definition at line 51 of file test_sim.py.

5.11.1.7 dictionary test_sim.mapDict

Initial value:

```
1 = {
2          "maps/scene2.map": {
3              "startPoint": (494, 213),
4              "endPoint": (404, 20)
5          },
6          "maps/scene3.map": {
7              "startPoint": (356, 42),
8              "endPoint": (852, 450)
9          },
10          "maps/scene1.map": {
11              "startPoint": (50, 50),  # (50, 600)
12              "endPoint": (980, 30)
13          },
14          "maps/empty.map": {
15              "startPoint": (50, 50),  # (50, 600)
16              "endPoint": (980, 590)
17          },
18          "maps/s.map": {
19              "startPoint": (80, 80),  # (50, 600)
20              "endPoint": (980, 30)
21          },
22          "maps/maze.map": {
23              "startPoint": (50, 50),  # (50, 600)
24              "endPoint": (950, 30)
25          },
26          "maps/maze2.map": {
27              "startPoint": (50, 70),  # (50, 600)
28              "endPoint": (950, 30)
29          }
30      }
```

Main module to run for testing purposes.

Definition at line 10 of file test_sim.py.

5.11.1.8 list test_sim.mapFilePath = sys.argv[1]

Definition at line 48 of file test_sim.py.

5.11.1.9 test_sim.obstacleFilePath = None

Definition at line 49 of file test_sim.py.

5.11.1.10 list test_sim.startPoint = mapDict[sys.argv[1]]

Definition at line 46 of file test_sim.py.

Chapter 6

Class Documentation

6.1 boid.Boid Class Reference

Class which represents one boid.

Public Member Functions

- def __init__

  Initializes all of the variables given as input to the constructor used by the boid.
- def sumDivide

  Special sort of reduce that sums components in a list of vectors and divides each final component with a certain number.
- def norm

  Gets the distance between two points.
- def getVar

  Gets multiple variables from a list with one call.
- def obstacleFunc

  Defines the potential between a boid and an obstacle.
- def mag

  Gets the magnitude of a vector.
- def sigmoidFunc

  Defines a sigmoidal curve used for goal attraction and for boid repulsion.
- def inGoal

  Checks if a piont is in the current goal.
- def inWorld

  Checks if a point is in the world.
- def pointAllowed

  Checks if a point is inside or collides with any of the obstacles.
- def initFunctionParameters
- def setBoidList

  Setter method used to set the list of boids.
- def updatePositionBuffer

  Updates the position buffer.
- def findMax

  Gets the n maximum values from a list.
- def reduceWeightValues

  Works in cohesion with sumDivide.

- def getDirectionVector

  Gets a scaled direction vector from an unscaled vector.
- def getObstacleVectorList

  Gets the potential vectors to a boid due to the repulsive obstacle field.
- def getGoalVector

  Gets the potential vectors to a boid due to the attractive goal field.
- def getBoidVectorList

  Gets the potential vectors to a boid due to the repulsive boid field.
- def getNeighborVectorList

  Gets the heading vectors of the neighbours.
- def setNewGoal

  Sets the new goal.
- def determineRandomWalk

  Increments the random walk counter, changes the current goal if necessary.
- def determineNewPath

  When the boid is stuck, it reweights the roadmap and finds a new suitable path.
- def update

  Updates the boid's heading and position due to the potential fields.
- def draw

  Draws the boid as a pygame circle in the pygame screen.

Public Attributes

- gammaFunc

  Function used to choose a neighbour.
- prmGen

  Class which holds the details about the global path planner.
- screen

  PyGame screen.
- radius

  Radius of the boid.
- heading

  Initial random heading.
- dim

  Dimensions of the screen.
- ySize
- neighborSize

  Number of neighbours that will influence the boid.
- color

  Unique color used to distinguish the boid (only used in debugging and visualization)
- speed

  Maximum speed of the boid.
- obstacleList

  List of obstacles that were parsed by mapparser.
- goalList

  Goals used by the boid.
- goalCounter

  Used to store what goal the boid is currently looking at.
- goal

  Initializes the current goal.

- stuck

  Defines if the boid is stuck.
- sPos

  Starting position of the boid.
- ePos

  Position of the boids.
- position

  Sets the position of the boid.
- positionBuffer

  Used to tell if the boid is stuck or not.
- goalNodes
- roadmap
- endIndex
- obInfluenceR

  The radius of influence used when filtering the number of obstacles it needs to check.
- bInfluenceR

  The radius of influence used when filtering the number of boids it needs to check.
- obBeta

  Priori constant for obstacle repulsion (increasing it gives more priority to the repulsive obstacle field)
- gAlpha

  Scales the value returned by the sigmoid function for goal attraction.
- gBeta

  Helps scale the value returned by the sigmoid function for goal attraction.
- gDelta

  Constant that is used in the sigmoidal curve for goal attraction.
- gConst

  Priori constant for goal attraction (increasing it gives more priority to the attractive goal field)
- bAlpha

  Scales the value returned by the sigmoid function for boid repulsion.
- bBeta

  Helps scale the value returned by the sigmoid function for boid repulsion.
- bDelta

  Constant that is used in the sigmoid curve for boid repulsion.
- bConst

  Priroi constant for boid repulsion (increasing it gives more priority to the repulsive boid field)
- stuckConst

  Amount of movement in the position buffer needs to be less that this value for a boid to be considered stuck.
- stuckDAvg

  The average distance from a neighbour when a boid is stuck.
- stuckDSigma

  The standard deviation for a neighbour probability distribution Helps boid pick closer neighbours when it is stuck.
- nStuckDAvg

  The average distance from a neighbour when a boid is not stuck.
- nStuckDSigma

  The standard deviation in a neighbour distance distribution when the boid is not stuck.
- randomWalkX

  Maximum x random walk.
- randomWalkY

  Maximum y random walk.
- randWalkCount

  Stores the number of times a random walk has occurred.

- headWeightList

  Weights how much the previous heading affects the new heading.
- boidList
- compWeightList

6.1.1 Detailed Description

Class which represents one boid.

Definition at line 30 of file boid.py.

6.1.2 Constructor & Destructor Documentation

6.1.2.1 def boid.Boid.__init__ (*self, _sPos, _ePos, _speed, _xSize, _ySize, _neighborSize, _gammaFunc, _obstacleList, _goalList, _prmGen, _screen, _color*)

Initializes all of the variables given as input to the constructor used by the boid.

Parameters

self	The object pointer
_sPos	The starting position of the boid (some noise added when initializing the flock)
_ePos	The ending position of the flock
_xSize	The size of the x axis of the pygame screen
_neighbourSize	The number of neighbours that will influence the boid's heading
_obstacleList	List of obstacles generated by mapparser
_goalList	List of goals used by the boid
_prmGen	Object that stores all of the data about the global planner
_screen	PyGame screen
_color	Unique color used for debugging purposes

Returns

An instance of a boid

Definition at line 55 of file boid.py.

6.1.3 Member Function Documentation

6.1.3.1 def boid.Boid.determineNewPath (*self*)

When the boid is stuck, it reweights the roadmap and finds a new suitable path.

Definition at line 653 of file boid.py.

Here is the call graph for this function:

Here is the caller graph for this function:

6.1.3.2 def boid.Boid.determineRandomWalk (*self*)

Increments the random walk counter, changes the current goal if necessary.

Returns

New random walk vectors where the maximum component value is determeined by the randomWalk fields

Definition at line 626 of file boid.py.

6.1.3.3 def boid.Boid.draw (*self*)

Draws the boid as a pygame circle in the pygame screen.

Definition at line 768 of file boid.py.

6.1.3.4 def boid.Boid.findMax (*self, searchThrough, counter*)

Gets the n maximum values from a list.

Parameters

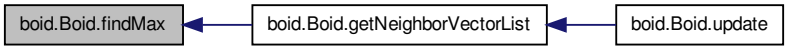
searchThrough	The list that the maximums will be extracted from
counter	The number of values to be extracted

Returns

A list of the counter maximum values from searchThrough

Definition at line 392 of file boid.py.

Here is the caller graph for this function:



6.1.3.5 def boid.Boid.getBoidVectorList (*self*)

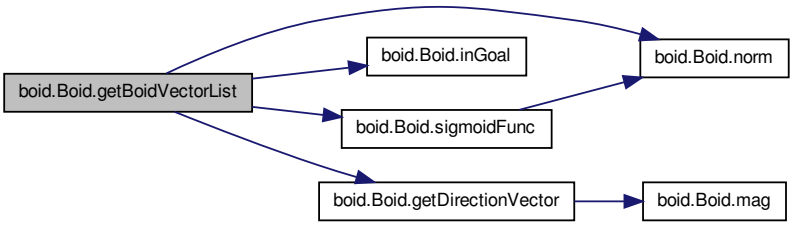
Gets the potential vectors to a boid due to the repulsive boid field.

Returns

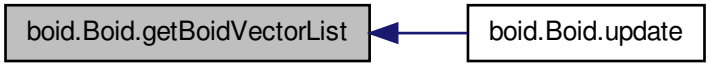
A list of scaled vectors that will be used to determine the influence of the boids on the heading. ALso returns the sum of the potential

Definition at line 521 of file boid.py.

Here is the call graph for this function:



Here is the caller graph for this function:



6.1.3.6 def boid.Boid.getDirectionVector (*self, vector*)

Gets a scaled direction vector from an unscaled vector.

Parameters

vector	Vector to be scaled

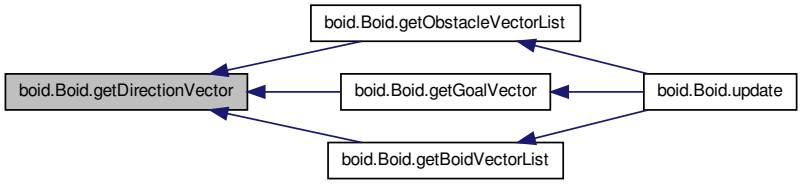
Returns

A vector whose maximum magnitude is less than the specified maximum speed

Definition at line 425 of file boid.py.

Here is the call graph for this function:

Here is the caller graph for this function:



6.1.3.7 def boid.Boid.getGoalVector (*self*)

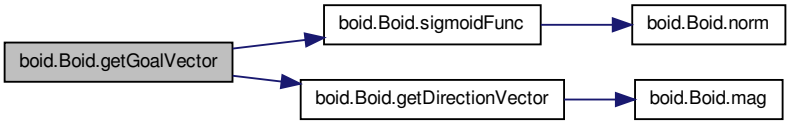
Gets the potential vectors to a boid due to the attractive goal field.

Returns

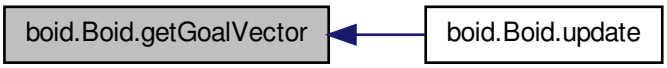
A list of scaled vectors that will be used to determine the influence of the goal on the heading. Also returns the sum of the potential values

Definition at line 490 of file boid.py.

Here is the call graph for this function:



Here is the caller graph for this function:



6.1.3.8 def boid.Boid.getNeighborVectorList (*self*)

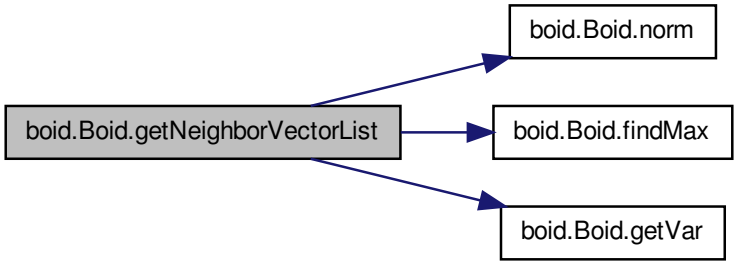
Gets the heading vectors of the neighbours.

Returns

A list of scaled vectors that represent the neighbour headings. Also returns the indicies in the boid list in which the neighbours are stored

Definition at line 576 of file boid.py.

Here is the call graph for this function:



Here is the caller graph for this function:

6.1.3.9 def boid.Boid.getObstacleVectorList (*self*)

Gets the potential vectors to a boid due to the repulsive obstacle field.

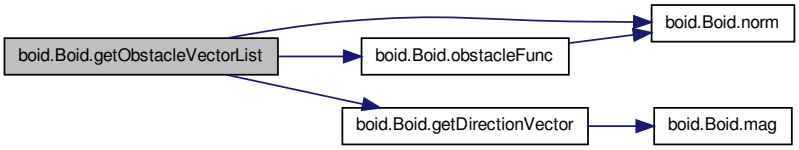
Returns

A list of scaled vectors that will be used to determine the influence of obstacles on the heading. Also returns the sum of the potential values

```
for ob in self.obstacleList:
    pygame.draw.circle(
self.screen,
(255,0,255),
map(int, ob.getPoint(self.position)),
2
    )
```

Definition at line 438 of file boid.py.

Here is the call graph for this function:



Here is the caller graph for this function:

6.1.3.10 def boid.Boid.getVar (*self, searchList, ind*)

Gets multiple variables from a list with one call.

Parameters

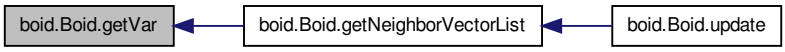
searchList	The list that the values will be taken from
ind	the indicies that will be queried

Returns

A list of values from search list

Definition at line 189 of file boid.py.

Here is the caller graph for this function:



6.1.3.11 def boid.Boid.inGoal (*self, p*)

Checks if a piont is in the current goal.

Parameters

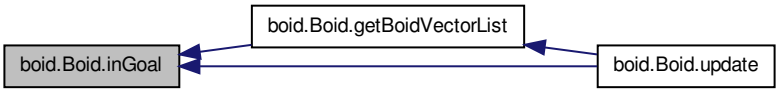
p	The point that is going to be checked

Returns

A boolean value representing if the point is in the current goal

Definition at line 250 of file boid.py.

Here is the caller graph for this function:



6.1.3.12 def boid.Boid.initFunctionParameters (*self*)

Definition at line 286 of file boid.py.

6.1.3.13 def boid.Boid.inWorld (*self, p*)

Checks if a point is in the world.

Parameters

p	The point that is going to be checked

Returns

A boolean value representing if the point is in the world

Definition at line 265 of file boid.py.

6.1.3.14 def boid.Boid.mag (*self, vec*)

Gets the magnitude of a vector.

Parameters

vec	A vector represented as a list

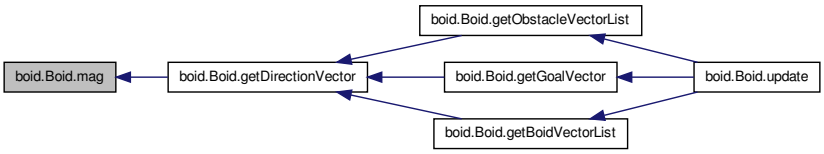
Returns

The magnitude of the vector

Definition at line 218 of file boid.py.

Here is the call graph for this function:

Here is the caller graph for this function:



6.1.3.15 def boid.Boid.norm (*self, p1, p2*)

Gets the distance between two points.

Parameters

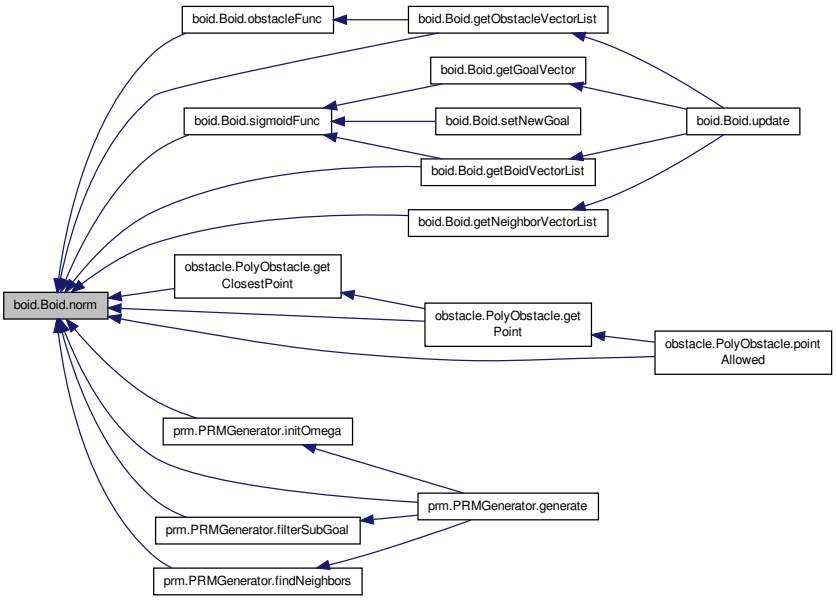
p1,p2	points whose distance will be returned

Returns

The Euclidean distance between p1 and p2

Definition at line 170 of file boid.py.

Here is the caller graph for this function:



6.1.3.16 def boid.Boid.obstacleFunc (*self, beta, b, o*)

Defines the potential between a boid and an obstacle.

Parameters

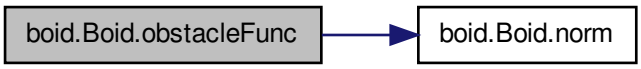
beta	Constant used to increase the weight of the function
b	The boid that is being comapred
o	The obstacle that is being compared

Returns

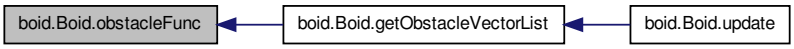
A value representing the potential between b and o

Definition at line 200 of file boid.py.

Here is the call graph for this function:



Here is the caller graph for this function:



6.1.3.17 def boid.Boid.pointAllowed (*self, p*)

Checks if a point is inside or collides with any of the obstacles.

Parameters

p	The point that will be checked

Definition at line 278 of file boid.py.

6.1.3.18 def boid.Boid.reduceWeightValues (*self, wList, vList*)

Works in cohesion with sumDivide.

Weights values in a list and divides by the sum of those weights

Parameters

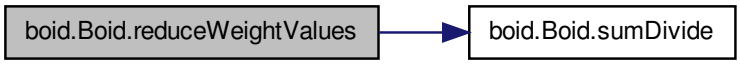
wList	List of Weights
**vList*	Values that will be weighted

Returns

An average vector that represents the average heading due to the potential fields

Definition at line 412 of file boid.py.

Here is the call graph for this function:



6.1.3.19 def boid.Boid.setBoidList (*self, _boidList*)

Setter method used to set the list of boids.

Parameters

_boidList	The list of boids in the flock

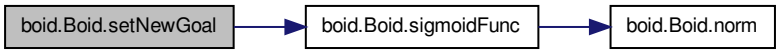
Definition at line 370 of file boid.py.

6.1.3.20 def boid.Boid.setNewGoal (*self*)

Sets the new goal.

Definition at line 606 of file boid.py.

Here is the call graph for this function:



6.1.3.21 def boid.Boid.sigmoidFunc (*self, alpha, beta, delta, const, b_r, g_r, b_pos, g_pos*)

Defines a sigmoidal curve used for goal attraction and for boid repulsion.

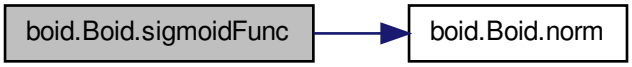
Parameters

alpha,beta,delta,const	Constants that are used to modify the shape of the curve
b_r,b_pos	The radius and position of the boid

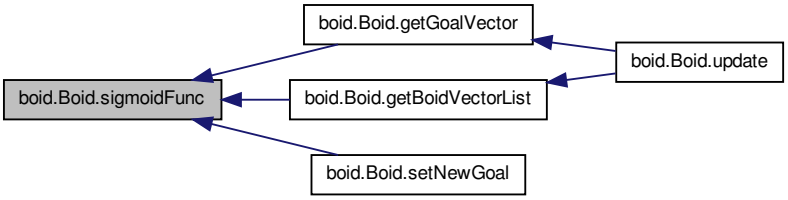
g_r,g_pos	The radius and position of a goal / boid

Definition at line 231 of file boid.py.

Here is the call graph for this function:



Here is the caller graph for this function:



6.1.3.22 def boid.Boid.sumDivide (*self, lt, s*)

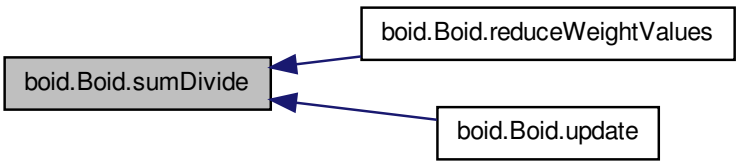
Special sort of reduce that sums components in a list of vectors and divides each final component with a certain number.

Parameters

self	The object pointer
lt	List of vectors that will be summed over and divided
s	Number that will divide each component by at the end

Definition at line 149 of file boid.py.

Here is the caller graph for this function:

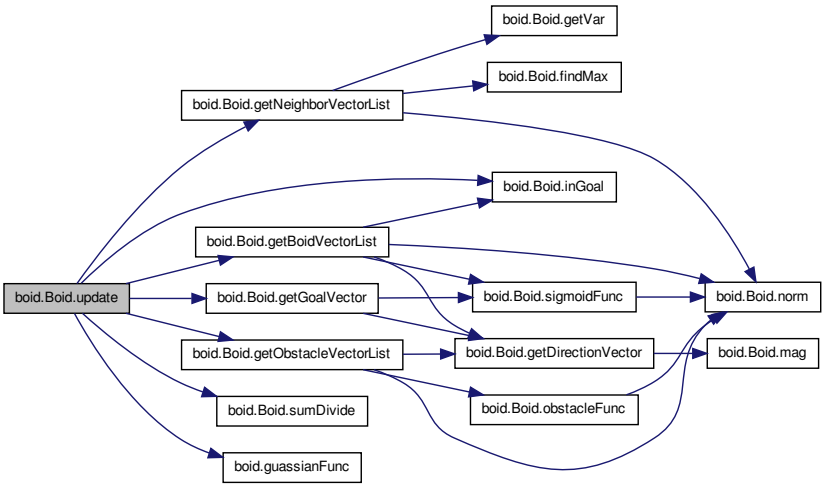


6.1.3.23 def boid.Boid.update (*self*)

Updates the boid's heading and position due to the potential fields.

Definition at line 690 of file boid.py.

Here is the call graph for this function:



6.1.3.24 def boid.Boid.updatePositionBuffer (*self*)

Updates the position buffer.

Returns

The displacement of a boid over a certain number of frames

Definition at line 378 of file boid.py.

6.1.4 Member Data Documentation

6.1.4.1 boid.Boid.bAlpha

Scales the value returned by the sigmoid function for boid repulsion.

Definition at line 319 of file boid.py.

6.1.4.2 boid.Boid.bBeta

Helps scale the value returned by the sigmoid function for boid repulsion.

Definition at line 323 of file boid.py.

6.1.4.3 boid.Boid.bConst

Priroi constant for boid repulsion (increasing it gives more priority to the repulsive boid field)

Definition at line 331 of file boid.py.

6.1.4.4 boid.Boid.bDelta

Constant that is used in the sigmoid curve for boid repulsion.

Definition at line 327 of file boid.py.

6.1.4.5 boid.Boid.bInfluenceR

The radius of influence used when filtering the number of boids it needs to check.

Definition at line 295 of file boid.py.

6.1.4.6 boid.Boid.boidList

Definition at line 371 of file boid.py.

6.1.4.7 boid.Boid.color

Unique color used to distinguish the boid (only used in debugging and visualization)

Definition at line 87 of file boid.py.

6.1.4.8 boid.Boid.compWeightList

Definition at line 731 of file boid.py.

6.1.4.9 boid.Boid.dim

Dimensions of the screen.

Definition at line 80 of file boid.py.

6.1.4.10 boid.Boid.endIndex

Definition at line 136 of file boid.py.

6.1.4.11 boid.Boid.ePos

Position of the boids.

Definition at line 111 of file boid.py.

6.1.4.12 boid.Boid.gAlpha

Scales the value returned by the sigmoid function for goal attraction.

Definition at line 303 of file boid.py.

6.1.4.13 boid.Boid.gammaFunc

Function used to choose a neighbour.

Definition at line 58 of file boid.py.

6.1.4.14 boid.Boid.gBeta

Helps scale the value returned by the sigmoid function for goal attraction.

Definition at line 307 of file boid.py.

6.1.4.15 boid.Boid.gConst

Priori constant for goal attraction (increasing it gives more priority to the attractive goal field)

Definition at line 315 of file boid.py.

6.1.4.16 boid.Boid.gDelta

Constant that is used in the sigmoidal curve for goal attraction.

Definition at line 311 of file boid.py.

6.1.4.17 boid.Boid.goal

Initializes the current goal.

Definition at line 102 of file boid.py.

6.1.4.18 boid.Boid.goalCounter

Used to store what goal the boid is currently looking at.

Definition at line 99 of file boid.py.

6.1.4.19 boid.Boid.goalList

Goals used by the boid.

Definition at line 96 of file boid.py.

6.1.4.20 boid.Boid.goalNodes

Definition at line 132 of file boid.py.

6.1.4.21 boid.Boid.heading

Initial random heading.

Definition at line 70 of file boid.py.

6.1.4.22 boid.Boid.headWeightList

Weights how much the previous heading affects the new heading.

Definition at line 363 of file boid.py.

6.1.4.23 boid.Boid.neighborSize

Number of neighbours that will influence the boid.

Definition at line 83 of file boid.py.

6.1.4.24 boid.Boid.nStuckDAvg

The average distance from a neighbour when a boid is not stuck.

Definition at line 347 of file boid.py.

6.1.4.25 boid.Boid.nStuckDSigma

The standard deviation in a neighbour distance distribution when the boid is not stuck.

Definition at line 351 of file boid.py.

6.1.4.26 boid.Boid.obBeta

Priori constant for obstacle repulsion (increasing it gives more priority to the repulsive obstacle field)

Definition at line 299 of file boid.py.

6.1.4.27 boid.Boid.obInfluenceR

The radius of influence used when filtering the number of obstacles it needs to check.

Definition at line 291 of file boid.py.

6.1.4.28 boid.Boid.obstacleList

List of obstacles that were parsed by mapparser.

Definition at line 93 of file boid.py.

6.1.4.29 boid.Boid.position

Sets the position of the boid.

Definition at line 114 of file boid.py.

6.1.4.30 boid.Boid.positionBuffer

Used to tell if the boid is stuck or not.

Definition at line 125 of file boid.py.

6.1.4.31 boid.Boid.prmGen

Class which holds the details about the global path planner.

Definition at line 61 of file boid.py.

6.1.4.32 boid.Boid.radius

Radius of the boid.

Definition at line 67 of file boid.py.

6.1.4.33 boid.Boid.randomWalkX

Maximum x random walk.

Definition at line 354 of file boid.py.

6.1.4.34 boid.Boid.randomWalkY

Maximum y random walk.

Definition at line 357 of file boid.py.

6.1.4.35 boid.Boid.randWalkCount

Stores the number of times a random walk has occurred.

Definition at line 360 of file boid.py.

6.1.4.36 boid.Boid.roadmap

Definition at line 135 of file boid.py.

6.1.4.37 boid.Boid.screen

PyGame screen.

Definition at line 64 of file boid.py.

6.1.4.38 boid.Boid.speed

Maximum speed of the boid.

Definition at line 90 of file boid.py.

6.1.4.39 boid.Boid.sPos

Starting position of the boid.

Definition at line 108 of file boid.py.

6.1.4.40 boid.Boid.stuck

Defines if the boid is stuck.

Definition at line 105 of file boid.py.

6.1.4.41 boid.Boid.stuckConst

Amount of movement in the position buffer needs to be less that this value for a boid to be considered stuck.

Definition at line 335 of file boid.py.

6.1.4.42 boid.Boid.stuckDAvg

The average distance from a neighbour when a boid is stuck.

Used to pick closer neighbours when stuck to help get out of the situation

Definition at line 340 of file boid.py.

6.1.4.43 boid.Boid.stuckDSigma

The standard deviation for a neighbour probability distribution Helps boid pick closer neighbours when it is stuck.

Definition at line 344 of file boid.py.

6.1.4.44 boid.Boid.ySize

Definition at line 80 of file boid.py.

The documentation for this class was generated from the following file:

- code/boid.py

6.2 goal.CircleGoal Class Reference

Object that holds data about a goal modelled as circular configuration space.

Public Member Functions

- def __init__

  Creates an instance of the CircleGoal.
- def draw

  Draws the circle onto the pygame screen.

Public Attributes

- screen

  PyGame screen used to draw the circle goal.
- colors

  List of colors given by PyGame.
- radius

  The radius of the circle goal.
- position

  The position of the circle goal.

6.2.1 Detailed Description

Object that holds data about a goal modelled as circular configuration space.

Definition at line 12 of file goal.py.

6.2.2 Constructor & Destructor Documentation

6.2.2.1 def goal.CircleGoal.__init__ (*self, _radius, _position, _screen*)

Creates an instance of the CircleGoal.

Parameters

_radius	The radius of the circle goal
_position	The position of the circle goal
_screen	The pygame screen used to draw the circle

Definition at line 20 of file goal.py.

6.2.3 Member Function Documentation

6.2.3.1 def goal.CircleGoal.draw (*self*)

Draws the circle onto the pygame screen.

Definition at line 38 of file goal.py.

6.2.4 Member Data Documentation

6.2.4.1 goal.CircleGoal.colors

List of colors given by PyGame.

Definition at line 26 of file goal.py.

6.2.4.2 goal.CircleGoal.position

The position of the circle goal.

Definition at line 32 of file goal.py.

6.2.4.3 goal.CircleGoal.radius

The radius of the circle goal.

Definition at line 29 of file goal.py.

6.2.4.4 goal.CircleGoal.screen

PyGame screen used to draw the circle goal.

Definition at line 23 of file goal.py.

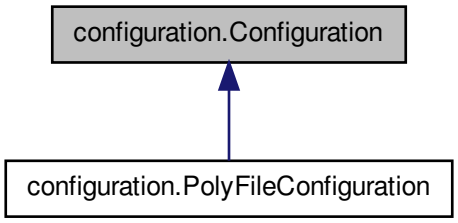
The documentation for this class was generated from the following file:

- code/goal.py

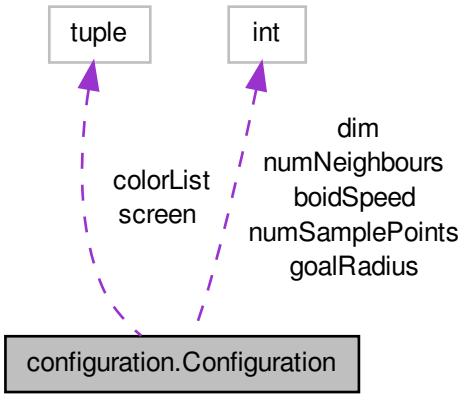
6.3 configuration.Configuration Class Reference

Static class that holds important global variables.

Inheritance diagram for configuration.Configuration:



Collaboration diagram for configuration.Configuration:



Static Public Attributes

- int dim = 1000

  Dimensions of the screen.
- int numSamplePoints = 300

  Number of sample points to use in the PRM.
- int goalRadius = 20

  Defines the radius of all goals.
- int boidSpeed = 30

  Maximum speed of the boids.
- int numNeighbours = 3

  Number of neighbours the boids will influence a boid's heading.

- tuple screen = pygame.display.set_mode(dim)

  The screen used to draw the simluation.
- tuple colorList

  The list of colors (used for debugging purposes)

6.3.1 Detailed Description

Static class that holds important global variables.

Definition at line 16 of file configuration.py.

6.3.2 Member Data Documentation

6.3.2.1 int configuration.Configuration.boidSpeed = 30 [static]

Maximum speed of the boids.

Definition at line 28 of file configuration.py.

6.3.2.2 tuple configuration.Configuration.colorList [static]

Initial value:

```
1 = map(
2          lambda k: color.THECOLORS[k],
3          color.THECOLORS.keys()
4      )
```

The list of colors (used for debugging purposes)

Definition at line 38 of file configuration.py.

6.3.2.3 int configuration.Configuration.dim = 1000 [static]

Dimensions of the screen.

Definition at line 19 of file configuration.py.

6.3.2.4 int configuration.Configuration.goalRadius = 20 [static]

Defines the radius of all goals.

Definition at line 25 of file configuration.py.

6.3.2.5 int configuration.Configuration.numNeighbours = 3 [static]

Number of neighbours the boids will influence a boid's heading.

Definition at line 32 of file configuration.py.

6.3.2.6 int configuration.Configuration.numSamplePoints = 300 [static]

Number of sample points to use in the PRM.

Definition at line 22 of file configuration.py.

6.3.2.7 tuple configuration.Configuration.screen = pygame.display.set_mode(dim) [static]

The screen used to draw the simluation.

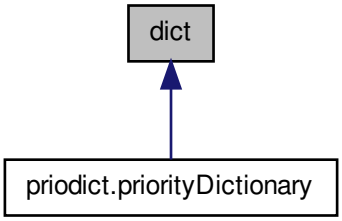
Definition at line 35 of file configuration.py.

The documentation for this class was generated from the following file:

- code/configuration.py

6.4 dict Class Reference

Inheritance diagram for dict:



The documentation for this class was generated from the following file:

- code/priodict.py

6.5 boidsimulation.FlockSim Class Reference

Main class for that is used for the simulation and display of the flock.

Public Member Functions

- def __init__
  Initializes the flock and the display mechanism (PyGame)
- def avg
  Gets the average of a list.
- def getStats
  Gets runtime statistics about the simulation and writes it to a file.
- def getBoidData
  Writes all of the boid positions to a file.
- def animate
  Renders and then allows interactive playback of the swarm simulation data.
- def init_prm
  Initializes the PRM generator used for the global planner.
- def render

Renders the scene.

- def play

  Plays the scene after it has rendered.

Public Attributes

- done

  Tells if the flock has reached the end goal (used again to see if the escape or space bar were hit to stop the rendering)
- BLACK

  Defines the color black.
- WHITE

  Defines the color white.
- font

  The font that is used for displaying the frame number.
- dim

  The dimensions of the PyGame screen.
- config

  The configuration object (in this case the configuration is defined by an exterior file)
- sPos

  The starting point of the flock.
- ePos

  The position of the last goal for the flock.
- surfaceList

  Variable used to store the list of surfaces for simulation playback.
- iterations

  Maximum number of iterations.
- frameCounter

  Counts which frame the user is on for the playback (don't know why it is set to -2, it just works)
- counter

  Global counter used for the rendering and the playback.
- flockSize

  The size of the flock (number of boids)
- mapFile

  The file that contains the data about the obstacles.
- dataFile

  The file that the statistics data will be written to.
- obstacleFile

  File containing the obstacles map points.
- auto_gen_obst

  Auto Generate Random obstacles Flag.
- auto_gen_number

  Number of random dynamic obstacles to generate.
- startTime
- numInGoal

6.5.1 Detailed Description

Main class for that is used for the simulation and display of the flock.

It also is used to gather statistics about the flock and present them in a useful manner.

Definition at line 17 of file boidsimulation.py.

6.5.2 Constructor & Destructor Documentation

6.5.2.1 def boidsimulation.FlockSim.__init__ (*self, flockSize, startPoint, endPoint, kwargs*)

Initializes the flock and the display mechanism (PyGame)

Parameters

flockSize	The size of the flock (number of boids)
startPoint	The macro starting position of the flock
endPoint	The last goal point for the flock
_mapFile	The file containing details about the obstacles
_dataFile	The file that the data will be exported to

Definition at line 33 of file boidsimulation.py.

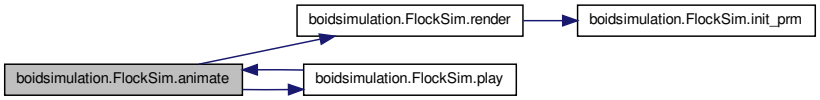
6.5.3 Member Function Documentation

6.5.3.1 def boidsimulation.FlockSim.animate (*self*)

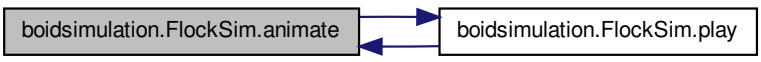
Renders and then allows interactive playback of the swarm simulation data.

Definition at line 167 of file boidsimulation.py.

Here is the call graph for this function:



Here is the caller graph for this function:



6.5.3.2 def boidsimulation.FlockSim.avg (*self, l*)

Gets the average of a list.

Parameters

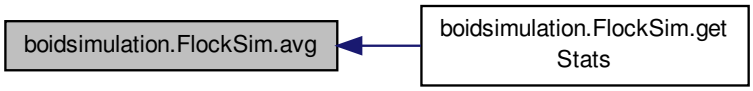
l	The list to be averaged

Returns

l The average value in list l

Definition at line 99 of file boidsimulation.py.

Here is the caller graph for this function:



6.5.3.3 def boidsimulation.FlockSim.getBoidData (*self*)

Writes all of the boid positions to a file.

Definition at line 143 of file boidsimulation.py.

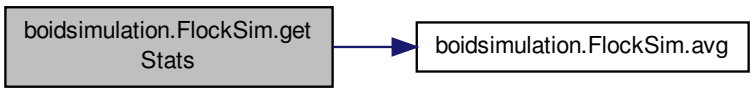
6.5.3.4 def boidsimulation.FlockSim.getStats (*self*)

Gets runtime statistics about the simulation and writes it to a file.

Currently, the statistics being gathered are the current time that has passed, the average distance between the boids, the average minimum distance between the boids, and the number of boids that have finished

Definition at line 112 of file boidsimulation.py.

Here is the call graph for this function:



6.5.3.5 def boidsimulation.FlockSim.init_prm (*self*)

Initializes the PRM generator used for the global planner.

Also sets the boid list for the rest of the flock

Definition at line 176 of file boidsimulation.py.

Here is the caller graph for this function:

6.5.3.6 def boidsimulation.FlockSim.play (*self*)

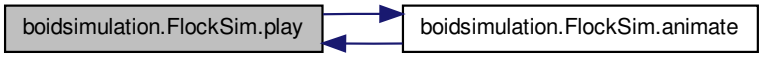
Plays the scene after it has rendered.

Iterates through surfaces that have been stored in surfaceList and blits the new surface on the screen

Definition at line 264 of file boidsimulation.py.

Here is the call graph for this function:

Here is the caller graph for this function:



6.5.3.7 def boidsimulation.FlockSim.render (*self*, *forPlay* = `False`)

Renders the scene.

This means that the time taken for the boids to reach the goal in this function is that actual amount of computational time needed.

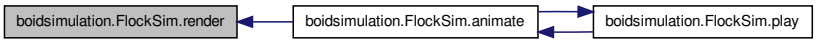
Parameters

forPlay	Specifies if the surface data should be recorded for animation

Definition at line 205 of file boidsimulation.py.

Here is the call graph for this function:

Here is the caller graph for this function:



6.5.4 Member Data Documentation

6.5.4.1 boidsimulation.FlockSim.auto_gen_number

Number of random dynamic obstacles to generate.

Definition at line 91 of file boidsimulation.py.

6.5.4.2 boidsimulation.FlockSim.auto_gen_obst

Auto Generate Random obstacles Flag.

Definition at line 88 of file boidsimulation.py.

6.5.4.3 boidsimulation.FlockSim.BLACK

Defines the color black.

Definition at line 41 of file boidsimulation.py.

6.5.4.4 boidsimulation.FlockSim.config

The configuration object (in this case the configuration is defined by an exterior file)

Definition at line 54 of file boidsimulation.py.

6.5.4.5 boidsimulation.FlockSim.counter

Global counter used for the rendering and the playback.

Definition at line 73 of file boidsimulation.py.

6.5.4.6 boidsimulation.FlockSim.dataFile

The file that the statistics data will be written to.

Definition at line 82 of file boidsimulation.py.

6.5.4.7 boidsimulation.FlockSim.dim

The dimensions of the PyGame screen.

Definition at line 50 of file boidsimulation.py.

6.5.4.8 boidsimulation.FlockSim.done

Tells if the flock has reached the end goal (used again to see if the escape or space bar were hit to stop the rendering)

Definition at line 38 of file boidsimulation.py.

6.5.4.9 boidsimulation.FlockSim.ePos

The position of the last goal for the flock.

Definition at line 60 of file boidsimulation.py.

6.5.4.10 boidsimulation.FlockSim.flockSize

The size of the flock (number of boids)

Definition at line 76 of file boidsimulation.py.

6.5.4.11 boidsimulation.FlockSim.font

The font that is used for displaying the frame number.

Definition at line 47 of file boidsimulation.py.

6.5.4.12 boidsimulation.FlockSim.frameCounter

Counts which frame the user is on for the playback (don't know why it is set to -2, it just works)

Definition at line 70 of file boidsimulation.py.

6.5.4.13 boidsimulation.FlockSim.iterations

Maximum number of iterations.

Definition at line 66 of file boidsimulation.py.

6.5.4.14 boidsimulation.FlockSim.mapFile

The file that contains the data about the obstacles.

Definition at line 79 of file boidsimulation.py.

6.5.4.15 boidsimulation.FlockSim.numInGoal

Definition at line 228 of file boidsimulation.py.

6.5.4.16 boidsimulation.FlockSim.obstacleFile

File containing the obstacles map points.

Definition at line 85 of file boidsimulation.py.

6.5.4.17 boidsimulation.FlockSim.sPos

The starting point of the flock.

Definition at line 57 of file boidsimulation.py.

6.5.4.18 boidsimulation.FlockSim.startTime

Definition at line 209 of file boidsimulation.py.

6.5.4.19 boidsimulation.FlockSim.surfaceList

Variable used to store the list of surfaces for simulation playback.

Definition at line 63 of file boidsimulation.py.

6.5.4.20 boidsimulation.FlockSim.WHITE

Defines the color white.

Definition at line 44 of file boidsimulation.py.

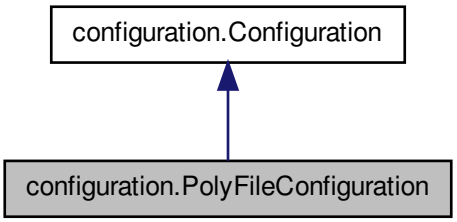
The documentation for this class was generated from the following file:

- code/boidsimulation.py

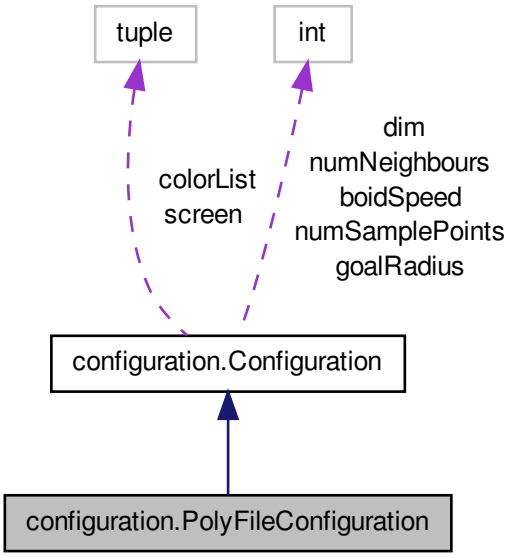
6.6 configuration.PolyFileConfiguration Class Reference

Extends the Configuration class.

Inheritance diagram for configuration.PolyFileConfiguration:



Collaboration diagram for configuration.PolyFileConfiguration:



Public Member Functions

- def parseDynamicObstacles

  Parses the obstacle map file and creates polygon objects with random behaviour by default.
- def autoGenerateDynamicObstacles

  Auto generate dynamic obstacles.
- def initVars

  Parses the file to get the obstacle list.

Public Attributes

- nodes
- obstacleList

  List of obstacles parse static obstalces.
- auto_gen_obst
- auto_gen_number
- startPoint

  Starting point.
- endPoint

  Ending point.
- prmGen

  Object containing variables and mehtods for the global planner.
- goalList

  List of intermediate goals derived by the global planner.
- boidList

  List of boids in the flock.

Additional Inherited Members

6.6.1 Detailed Description

Extends the Configuration class.

This configuration gets the obstacles from .map files that have been created.

Definition at line 49 of file configuration.py.

6.6.2 Member Function Documentation

6.6.2.1 def configuration.PolyFileConfiguration.autoGenerateDynamicObstacles (*self*)

Auto generate dynamic obstacles.

Definition at line 105 of file configuration.py.

6.6.2.2 def configuration.PolyFileConfiguration.initVars (*self, startPoint, endPoint, flockSize, kwargs*)

Parses the file to get the obstacle list.

Creates a PRM generator to create a global map of the environment. Gets the list of intermediate goals. Also, creates the list of boids used in the simulation

Parameters

startPoint	The starting point for the boids
endPoint	The ending point for the boids
flockSize	The size of the flock (number of boids)
filename	The name of the file that contains the environment map

Definition at line 171 of file configuration.py.

6.6.2.3 def configuration.PolyFileConfiguration.parseDynamicObstacles (*self, dynamic_obstacles_fp*)

Parses the obstacle map file and creates polygon objects with random behaviour by default.

All obstacles (static/dynamic) obtains a list each other in the form of a list.

Definition at line 57 of file configuration.py.

6.6.3 Member Data Documentation

6.6.3.1 configuration.PolyFileConfiguration.auto_gen_number

Definition at line 180 of file configuration.py.

6.6.3.2 configuration.PolyFileConfiguration.auto_gen_obst

Definition at line 179 of file configuration.py.

6.6.3.3 configuration.PolyFileConfiguration.boidList

List of boids in the flock.

Definition at line 205 of file configuration.py.

6.6.3.4 configuration.PolyFileConfiguration.endPoint

Ending point.

Definition at line 188 of file configuration.py.

6.6.3.5 configuration.PolyFileConfiguration.goalList

List of intermediate goals derived by the global planner.

Definition at line 202 of file configuration.py.

6.6.3.6 configuration.PolyFileConfiguration.nodes

Definition at line 112 of file configuration.py.

6.6.3.7 configuration.PolyFileConfiguration.obstacleList

List of obstacles parse static obstalces.

Definition at line 174 of file configuration.py.

6.6.3.8 configuration.PolyFileConfiguration.prmGen

Object containing variables and mehtods for the global planner.

Definition at line 191 of file configuration.py.

6.6.3.9 configuration.PolyFileConfiguration.startPoint

Starting point.

Definition at line 185 of file configuration.py.

The documentation for this class was generated from the following file:

- code/configuration.py

6.7 obstacle.PolyObstacle Class Reference

Object that represents the an obstacle represented by a series of points (in the node list) which make up a set of lines.

Public Member Functions

- def __init__

  Creates a PolyObstacle instance and initializes certain global variables.
- def removeSelfFromObstacleList

  Removes self from obstacle list.
- def norm

  Gets the Eulidean distance between p1 and p2.
- def estimatePoly

  Tries to estimate the polygon as a circle (very useful for environments with many obstacles i.e.
- def detectCollision

Detects a if there is a collision with the obstacle and the line <pStart, pEnd>

- def getClosestPoint

  Gets the closest point on line <a, b> to point p.

- def rayintersectseg

  Determines if a ray from point p intersects with an edge, edge.

- def pointInPoly

  Determines if a point p is inside the polygon represented by this PolyObstacle object.

- def pointAllowed

  Checks if a point is allowed, meaning no collisions occur.

- def getPoint

  Gets the closest point from the polygon to p.

- def getRadius

  Gets the 'radius' of the checking point.

- def checkCollisionWithOtherObstacles

  Check to see if there is a collision with a static obstacle.

- def translate

  Translate obstacle.

- def determine_last_direction
- def change_direction

  Change direction.

- def draw

  Draws the polygon on the PyGame screen.

Public Attributes

- nodes

  A list of nodes used to represent the vertices.

- colors

  A dictionary of colors defined in pygame.

- screen

  The PyGame screen that is used to draw the obstacle.

- boundary

  Bondaries of the simualation.

- dynamic

  Defines wether the obstacle is dynamic or not.

- velocity

  Velocity of the obstacle.

- displacement

  The displacement of the obstacle.

- max_displacement

  Max displacement allowed.

- obstacles

  List of static obstacles.

- avgPoint

  The average point in the polygon.

- maxDist

  The maximum distance from any vertex and the average point.

6.7.1 Detailed Description

Object that represents the an obstacle represented by a series of points (in the node list) which make up a set of lines.

These lines represent the exterior of an obstacle

Definition at line 18 of file obstacle.py.

6.7.2 Constructor & Destructor Documentation

6.7.2.1 def obstacle.PolyObstacle.__init__ (*self, _nodes, _screen, kwargs*)

Creates a PolyObstacle instance and initializes certain global variables.

Parameters

_nodes	A list of nodes used to represent the vertices of the polygon
_screen	The PyGame screen that is used to draw the obstacle

Definition at line 27 of file obstacle.py.

6.7.3 Member Function Documentation

6.7.3.1 def obstacle.PolyObstacle.change_direction (*self, force_change* = `False`, *direction* = `None`)

Change direction.

Definition at line 434 of file obstacle.py.

Here is the call graph for this function:

Here is the caller graph for this function:

6.7.3.2 def obstacle.PolyObstacle.checkCollisionWithOtherObstacles (*self, node*)

Check to see if there is a collision with a static obstacle.

Definition at line 359 of file obstacle.py.

Here is the call graph for this function:

Here is the caller graph for this function:

6.7.3.3 def obstacle.PolyObstacle.detectCollision (*self, pStart, pEnd*)

Detects a if there is a collision with the obstacle and the line <pStart, pEnd>

Parameters

pStart	The starting point of the line
pEnd	The ending point of the line

Returns

A boolean value representing if a collision occurred

Definition at line 114 of file obstacle.py.

6.7.3.4 def obstacle.PolyObstacle.determine_last_direction (*self*)

Definition at line 418 of file obstacle.py.

Here is the caller graph for this function:

6.7.3.5 def obstacle.PolyObstacle.draw (*self*)

Draws the polygon on the PyGame screen.

Definition at line 478 of file obstacle.py.

Here is the call graph for this function:

6.7.3.6 def obstacle.PolyObstacle.estimatePoly (*self*)

Tries to estimate the polygon as a circle (very useful for environments with many obstacles i.e.

a random field of obstacles)

Definition at line 81 of file obstacle.py.

6.7.3.7 def obstacle.PolyObstacle.getClosestPoint (*self, a, b, p*)

Gets the closest point on line <a, b> to point p.

Parameters

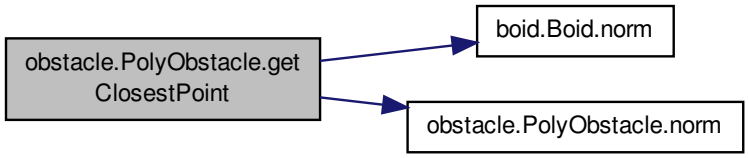
a	The starting point on the line
b	The ending point of the line
p	The point in which the closest distance will be checked

Returns

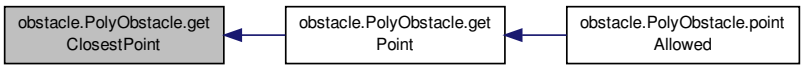
The closest point on line <a, b> to point p

Definition at line 171 of file obstacle.py.

Here is the call graph for this function:



Here is the caller graph for this function:



6.7.3.8 def obstacle.PolyObstacle.getPoint (*self, p*)

Gets the closest point from the polygon to p.

Parameters

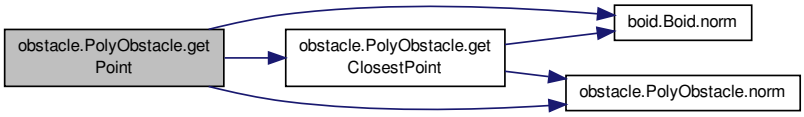
p	The point to be checked

Returns

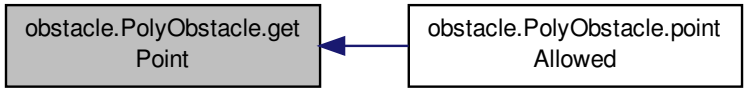
The closest point that lies on the polygon exterior to p

Definition at line 323 of file obstacle.py.

Here is the call graph for this function:



Here is the caller graph for this function:



6.7.3.9 def obstacle.PolyObstacle.getRadius (*self*)

Gets the 'radius' of the checking point.

Only used for conformity with circle obstacles that have not been included in this repository

Returns

1

Definition at line 352 of file obstacle.py.

6.7.3.10 def obstacle.PolyObstacle.norm (*self, p1, p2*)

Gets the Eulidean distance between p1 and p2.

Parameters

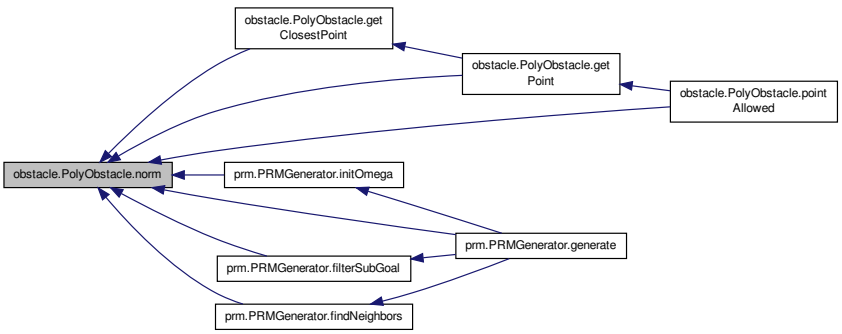
p1,p2	Points in space

Returns

The distance between p1 and p2

Definition at line 73 of file obstacle.py.

Here is the caller graph for this function:



6.7.3.11 def obstacle.PolyObstacle.pointAllowed (*self, b, p*)

Checks if a point is allowed, meaning no collisions occur.

Parameters

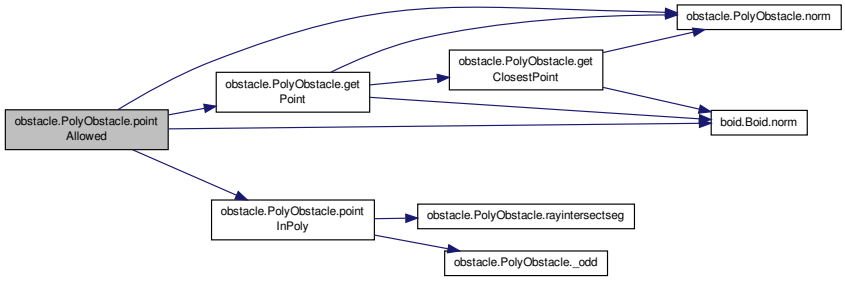
b	The boid object that will be checked
p	The point that will be checked

Returns

True if allowed, false otherwise

Definition at line 303 of file obstacle.py.

Here is the call graph for this function:



6.7.3.12 def obstacle.PolyObstacle.pointInPoly (*self, p*)

Determines if a point p is inside the polygon represented by this PolyObstacle object.

It does this by checking the number ray intersections that occur is odd or even. If the number is odd, the point is inside the polygon, otherwise it is not.

Parameters

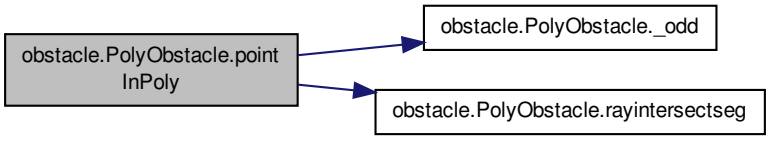
p	The point to be checked

Returns

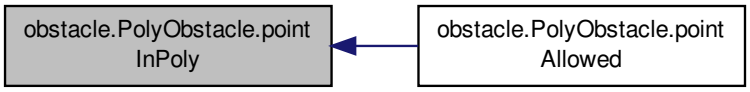
True if the point is in the polygon and false otherwise

Definition at line 286 of file obstacle.py.

Here is the call graph for this function:



Here is the caller graph for this function:



6.7.3.13 def obstacle.PolyObstacle.rayintersectseg (*self, p, edge*)

Determines if a ray from point p intersects with an edge, edge.

```
Used to determine if a point p in inside the polygon
```

Parameters

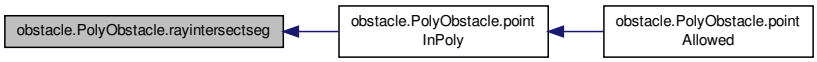
p	The point to be checked
edge	The edge that will be checked

Returns

True if a ray from point p intersects with edge and false otherwise

Definition at line 239 of file obstacle.py.

Here is the caller graph for this function:



6.7.3.14 def obstacle.PolyObstacle.removeSelfFromObstacleList (*self*)

Removes self from obstacle list.

Definition at line 62 of file obstacle.py.

6.7.3.15 def obstacle.PolyObstacle.translate (*self*)

Translate obstacle.

Definition at line 372 of file obstacle.py.

Here is the call graph for this function:

Here is the caller graph for this function:

6.7.4 Member Data Documentation

6.7.4.1 obstacle.PolyObstacle.avgPoint

The average point in the polygon.

Represents the center of the enclosing circle

Definition at line 85 of file obstacle.py.

6.7.4.2 obstacle.PolyObstacle.boundary

Bondaries of the simualation.

Definition at line 39 of file obstacle.py.

6.7.4.3 obstacle.PolyObstacle.colors

A dictionary of colors defined in pygame.

Definition at line 33 of file obstacle.py.

6.7.4.4 obstacle.PolyObstacle.displacement

The displacement of the obstacle.

Definition at line 48 of file obstacle.py.

6.7.4.5 obstacle.PolyObstacle.dynamic

Defines wether the obstacle is dynamic or not.

Definition at line 42 of file obstacle.py.

6.7.4.6 obstacle.PolyObstacle.max_displacement

Max displacement allowed.

Definition at line 51 of file obstacle.py.

6.7.4.7 obstacle.PolyObstacle.maxDist

The maximum distance from any vertex and the average point.

Definition at line 97 of file obstacle.py.

6.7.4.8 obstacle.PolyObstacle.nodes

A list of nodes used to represent the vertices.

Definition at line 30 of file obstacle.py.

6.7.4.9 obstacle.PolyObstacle.obstacles

List of static obstacles.

Definition at line 54 of file obstacle.py.

6.7.4.10 obstacle.PolyObstacle.screen

The PyGame screen that is used to draw the obstacle.

Definition at line 36 of file obstacle.py.

6.7.4.11 obstacle.PolyObstacle.velocity

Velocity of the obstacle.

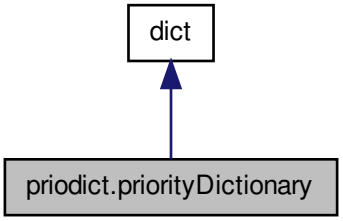
Definition at line 45 of file obstacle.py.

The documentation for this class was generated from the following file:

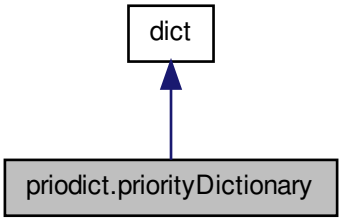
- code/obstacle.py

6.8 priodict.priorityDictionary Class Reference

Inheritance diagram for priodict.priorityDictionary:



Collaboration diagram for priodict.priorityDictionary:



Public Member Functions

- def __init__

Initialize priorityDictionary by creating binary heap of pairs (value,key).

- def smallest

  Find smallest item after removing deleted items from heap.

- def __iter__

  Create destructive sorted iterator of priorityDictionary.

- def __setitem__

  Change value stored in dictionary and add corresponding pair to heap.

- def setdefault

  *Reimplement setdefault to call our customized **setitem**.*

6.8.1 Detailed Description

Definition at line 6 of file priodict.py.

6.8.2 Constructor & Destructor Documentation

6.8.2.1 def priodict.priorityDictionary.__init__ (*self*)

Initialize priorityDictionary by creating binary heap of pairs (value,key).

Note that changing or removing a dict entry will not remove the old pair from the heap until it is found by smallest() or until the heap is rebuilt.

Definition at line 12 of file priodict.py.

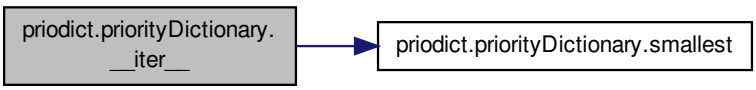
6.8.3 Member Function Documentation

6.8.3.1 def priodict.priorityDictionary.__iter__ (*self*)

Create destructive sorted iterator of priorityDictionary.

Definition at line 39 of file priodict.py.

Here is the call graph for this function:



6.8.3.2 def priodict.priorityDictionary.__setitem__ (*self, key, val*)

Change value stored in dictionary and add corresponding pair to heap.

Rebuilds the heap if the number of deleted items grows too large, to avoid memory leakage.

Definition at line 51 of file priodict.py.

6.8.3.3 def priodict.priorityDictionary.setdefault (*self, key, val*)

Reimplement setdefault to call our customized **setitem**.

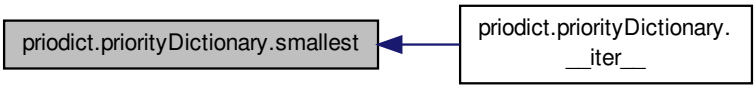
Definition at line 69 of file priodict.py.

6.8.3.4 def priodict.priorityDictionary.smallest (*self*)

Find smallest item after removing deleted items from heap.

Definition at line 18 of file priodict.py.

Here is the caller graph for this function:



The documentation for this class was generated from the following file:

- code/priodict.py

6.9 prm.PRMGenerator Class Reference

Class used to hold methods and variables that are important for the global path planning problem.

Public Member Functions

- def __init__
  Creates a new instance of the PRMGenerator.
- def norm
  Gets the distance between p1 and p2.
- def generatePositionList
  Generates the random positions for the sample points.
- def initOmega
  Initiates the omega function which holds the node weights.
- def filterSubGoal
  Filters out sample points that are inside of obstacles or otherwise inadequate.
- def findNeighbors
  Finds suitable neighbours for a sample point.
- def getRandom
  Gets a random number and cathes the ValueError if the two numbers are the same.
- def generate
  Generates a series of random points that will become the roadmap and connects them and weights them into a graph.
- def getShortestPath
- def draw
  Draws the graph.
- def drawPath
  Draws the selected shortest path.

Public Attributes

- obstacleList

  List of obstacles.
- startPos

  Position of the first goal.
- endPos

  Position of the last goal.
- screen

  PyGame screen that is will be drawn on.
- xSize

  Horizontal size of the PyGame screen.
- ySize

  Vertical size of the PyGame screen.
- adjacentThresh

  Distance that the PRM is willing to check when connecting sample points.
- numNext

  Maximum number of sample points that can be connected.
- subGoalNumber

  Number of initial sample points.
- subGoalPositionList

  Initial positions of the sample points.
- roadmap

  The global roadmap.
- gPosList

  Holds the positions of the intermediate goals that were selected by the global path planner.
- goalNodes

  Indexes of the goal positions.
- omegaDict

  Dictionary (for easy access) that holds the weights for the nodes.
- dontDraw

6.9.1 Detailed Description

Class used to hold methods and variables that are important for the global path planning problem.

This class generates the roadmap and finds the shortest path to the the goals by determining intermediate goals for the boids to be attracted to

Definition at line 16 of file prm.py.

6.9.2 Constructor & Destructor Documentation

6.9.2.1 def prm.PRMGenerator.__init__ (*self, _startPos, _endPos, _obstacleList, _xSize, _ySize, _subGoalNumber, _screen*)

Creates a new instance of the PRMGenerator.

Intializes key variables used in the generation of the global planner.

Parameters

_startPos	The starting position of the boids
_endPos	The final goal position of the boids
_obstacleList	The list of obstacles that the global planner needs to avoid
_xSize	The size of the x component of the screen
_ySize	The size of the y component of the screen
_subGoal-Number	The initial number of sample points for the global planner
_screen	The PyGame screen that the PRMGenerator will draw to

Definition at line 38 of file prm.py.

6.9.3 Member Function Documentation

6.9.3.1 def prm.PRMGenerator.draw (*self*)

Draws the graph.

Definition at line 306 of file prm.py.

6.9.3.2 def prm.PRMGenerator.drawPath (*self*)

Draws the selected shortest path.

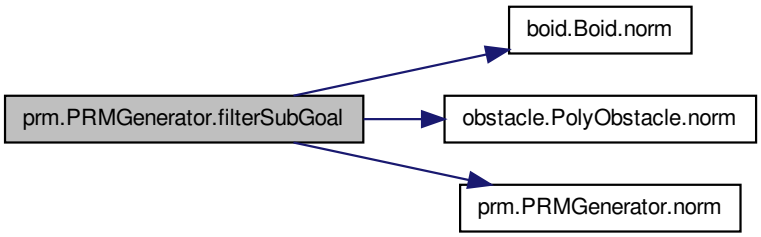
Definition at line 330 of file prm.py.

6.9.3.3 def prm.PRMGenerator.filterSubGoal (*self*)

Filters out sample points that are inside of obstacles or otherwise inadequate.

Definition at line 135 of file prm.py.

Here is the call graph for this function:

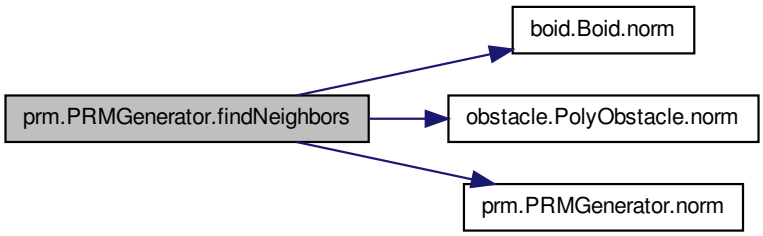


6.9.3.4 def prm.PRMGenerator.findNeighbors (*self, point*)

Finds suitable neighbours for a sample point.

Definition at line 158 of file prm.py.

Here is the call graph for this function:



6.9.3.5 def prm.PRMGenerator.generate (*self, subGoalRadius*)

Generates a series of random points that will become the roadmap and connects them and weights them into a graph.

```
If the goal and the starting point are not connected, more
points are added. The roadmap is then searched for the shortest
weighted distance which become the intermediate goals.
```

Parameters

subGoalRadius	The radius of the intermediate goals

Returns

A list of sub goals from the roadmap connecting the starting point and the end goal

Definition at line 223 of file prm.py.

6.9.3.6 def prm.PRMGenerator.generatePositionList (*self, num*)

Generates the random positions for the sample points.

Parameters

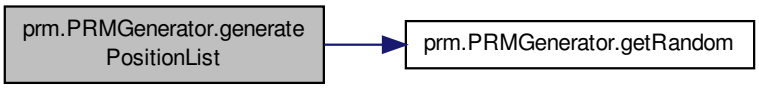
num	The number of points to generate

Returns

A list of random subgoals (sample points)

Definition at line 105 of file prm.py.

Here is the call graph for this function:



6.9.3.7 def prm.PRMGenerator.getRandom (*self, p, q*)

Gets a random number and cathes the ValueError if the two numbers are the same.

Parameters

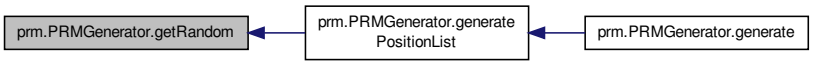
p	Lower bound for the random number
q	upper bound for the random number

Returns

A random number

Definition at line 206 of file prm.py.

Here is the caller graph for this function:



6.9.3.8 def prm.PRMGenerator.getShortestPath (*self, roadmap, fromNode, toNode*)

Definition at line 295 of file prm.py.

Here is the call graph for this function:

6.9.3.9 def prm.PRMGenerator.initOmega (*self, posList*)

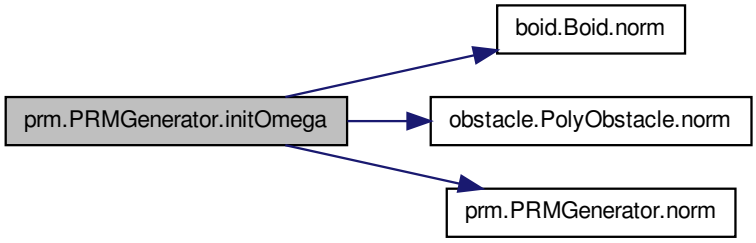
Initiates the omega function which holds the node weights.

Parameters

posList	The list of positions for the sample points

Definition at line 118 of file prm.py.

Here is the call graph for this function:



6.9.3.10 def prm.PRMGenerator.norm (*self, p1, p2*)

Gets the distance between p1 and p2.

Parameters

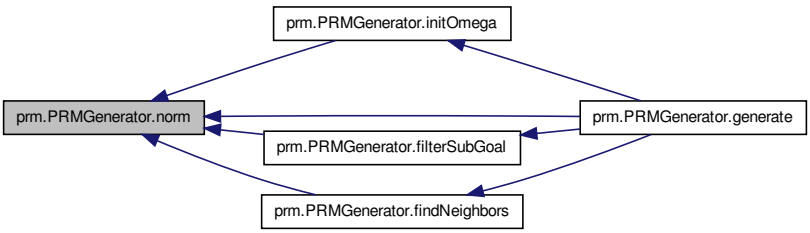
p1	The first point
p2	The second point

Returns

The Eulidean distance from p1 to p2

Definition at line 96 of file prm.py.

Here is the caller graph for this function:



6.9.4 Member Data Documentation

6.9.4.1 prm.PRMGenerator.adjacentThresh

Distance that the PRM is willing to check when connecting sample points.

Definition at line 60 of file prm.py.

6.9.4.2 prm.PRMGenerator.dontDraw

Definition at line 226 of file prm.py.

6.9.4.3 prm.PRMGenerator.endPos

Position of the last goal.

Definition at line 47 of file prm.py.

6.9.4.4 prm.PRMGenerator.goalNodes

Indexes of the goal positions.

Definition at line 82 of file prm.py.

6.9.4.5 prm.PRMGenerator.gPosList

Holds the positions of the intermediate goals that were selected by the global path planner.

Definition at line 79 of file prm.py.

6.9.4.6 prm.PRMGenerator.numNext

Maximum number of sample points that can be connected.

Definition at line 63 of file prm.py.

6.9.4.7 prm.PRMGenerator.obstacleList

List of obstacles.

Definition at line 41 of file prm.py.

6.9.4.8 prm.PRMGenerator.omegaDict

Dictionary (for easy access) that holds the weights for the nodes.

Definition at line 84 of file prm.py.

6.9.4.9 prm.PRMGenerator.roadmap

The global roadmap.

It will be a graph represented as a dictionary

Definition at line 75 of file prm.py.

6.9.4.10 prm.PRMGenerator.screen

PyGame screen that is will be drawn on.

Definition at line 50 of file prm.py.

6.9.4.11 prm.PRMGenerator.startPos

Position of the first goal.

Definition at line 44 of file prm.py.

6.9.4.12 prm.PRMGenerator.subGoalNumber

Number of initial sample points.

Definition at line 66 of file prm.py.

6.9.4.13 prm.PRMGenerator.subGoalPositionList

Initial positions of the sample points.

Definition at line 69 of file prm.py.

6.9.4.14 prm.PRMGenerator.xSize

Horizontal size of the PyGame screen.

Definition at line 53 of file prm.py.

6.9.4.15 prm.PRMGenerator.ySize

Vertical size of the PyGame screen.

Definition at line 56 of file prm.py.

The documentation for this class was generated from the following file:

- code/prm.py

Chapter 7

File Documentation

7.1 code/boid.py File Reference

Classes

- class boid.Boid

  Class which represents one boid.

Namespaces

- boid

Constant Groups

- boid

Functions

- def boid.guassianFunc

  Gamma function used to give a probability distribution of the flock in order to choose an appropriate neighbour.

Variables

- string boid.__author__ = "Alex Wallar <aw204@st-andrews.ac.uk>"

7.2 code/boidsimulation.py File Reference

Classes

- class boidsimulation.FlockSim

  Main class for that is used for the simulation and display of the flock.

Namespaces

- boidsimulation

Constant Groups

- boidsimulation

Variables

- string boidsimulation.__author__ = "Alex Wallar <aw204@st-andrews.ac.uk>"

7.3 code/configuration.py File Reference

Classes

- class configuration.Configuration

  Static class that holds important global variables.
- class configuration.PolyFileConfiguration

  Extends the Configuration class.

Namespaces

- configuration

Constant Groups

- configuration

7.4 code/dijkstra.py File Reference

Namespaces

- dijkstra

Constant Groups

- dijkstra

Functions

- def dijkstra.Dijkstra

  Find shortest paths from the start vertex to all vertices nearer than or equal to the end.
- def dijkstra.shortestPath

  Find a single shortest path from the given start vertex to the given end vertex.

7.5 code/gatherstats.py File Reference

Namespaces

- gatherstats

Constant Groups

- gatherstats

Functions

- def gatherstats.generateStats

  Generates the statistics and saves them in a well known location.

Variables

- list gatherstats.mapList

  A list of dictionaries used to store the map files, starting and ending points of the boids.
- gatherstats.testList = mapList

7.6 code/goal.py File Reference

Classes

- class goal.CircleGoal

  Object that holds data about a goal modelled as circular configuration space.

Namespaces

- goal

Constant Groups

- goal

Variables

- string goal.__author__ = "Alex Wallar <aw204@st-andrews.ac.uk>"

7.7 code/mapparser.py File Reference

Namespaces

- mapparser

Constant Groups

- mapparser

Functions

- def mapparser.mapVal

  Maps a value that is between in_min and in_max to a value between out_min and out_max.
- def mapparser.mparse

  Parses a map file into a list of obstacles.

7.8 code/obstacle.py File Reference

Classes

- class obstacle.PolyObstacle

  Object that represents the an obstacle represented by a series of points (in the node list) which make up a set of lines.

Namespaces

- obstacle

Constant Groups

- obstacle

Variables

- string obstacle.__author__ = "Alex Wallar <aw204@st-andrews.ac.uk>"

7.9 code/priodict.py File Reference

Classes

- class priodict.priorityDictionary

Namespaces

- priodict

Constant Groups

- priodict

7.10 code/prm.py File Reference

Classes

- class prm.PRMGenerator

  Class used to hold methods and variables that are important for the global path planning problem.

Namespaces

- prm

Constant Groups

- prm

7.11 code/test_sim.py File Reference

Namespaces

- test_sim

Constant Groups

- test_sim

Variables

- dictionary test_sim.mapDict

  Main module to run for testing purposes.
- tuple test_sim.flockSize = int(sys.argv[2])
- list test_sim.startPoint = mapDict[sys.argv[1]]
- list test_sim.endPoint = mapDict[sys.argv[1]]
- list test_sim.mapFilePath = sys.argv[1]
- test_sim.obstacleFilePath = None
- test_sim.dynamicObstacleAutoGenerate = False
- int test_sim.generateTarget = 0
- list test_sim.arg = sys.argv[3]
- tuple test_sim.fs

Index