RocketRobot

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Contents

Chapter 1

Summary

1.1 Overview

RocketRobot is a multi-featured robot simulator. It simulates robots, targets, and obstacles in an environment, with the goal of robots seeking and finding their targets. When a robot finds its target, both disappear from the simulation. In addtion, stimuli or light sources can be placed in the environment. There are several types of robots. Simple robots have sensors that only seek the target, and ignore obstacles. Complex robots have sensors for lights, robots, obstacles, and the target. Note that obstacle sensors include the wall as an 'obstacle', straight ahead of the sensor. For both robot types, the wheels speeds are controlled directly by the sensor readings. Complex robots can have each type of sensor scaled or connected in any pattern, this is controllable from the 'New complex robot settings' tab in the interface. Neural network robots use a feed-forward neural network for control. The network takes the target, robot, and obstacle settings as inputs, and outputs the wheel speeds. The network is loaded from a file, specified in the 'New neural network robot settings' tab in the interface.

1.1.1 Installation

You can execute the 'gorobot' executable directly from the src or bin folder, but it is easier to directly install it. This allows you to run it as 'rocketrobot <optional filename>="">' from any folder. To install on a Linux computer, simply run the install script from the main folder. This soft-links a script to your ∼/bin folder. This requires that you have a ∼/bin folder on your path, if not you can create one and add it to your .bashrc or .cshrc. To uninstall, you can simply run the uninstall script.

1.1.2 User Interface

The RocketRobot user interface is fairly simple. The control panel allows you to start, stop, pause, resume, and quit the simulation. The reset button reverts to the previous time it was started if the simulation was opened from a file, or randomly generates a new simulation if the current simulation is random. The 'Refresh settings' button reloads the configuration files (described later). The open/save tab also lets you open or save the current state. You can also provide a file to open as the command-line argument. There are several examples simulations for this in the examples folder.

The user inteface is fairly straightforward for adding and removing objects. There are several control tabs from which the number of obstacles, robots, and lights can be controlled. Objects are added and removed in a FILO manner from the interface. Targets are always created with a robot, but not all robots need to have a target. Decreasing the number of robots through the control panel deletes the target paired with the removed robot.

For more information about an object (location, speed, orientation, radius), you can click on an object. You can also drag and drop objects to move them, or drag them off the screen to delete them. The radius off the selected object can be changed with the up and down arrow keys, the orientation with the left and right keys, and the speed with the + and - keys. You can also middle-click to paste a copy of the selected object. Note that copying a robot creates a new robot with the same target (if any.) You cannot copy targets.

1.2 Neural network optimization

A major portion of the project is the neural network-driven robot, and the associated optimization algorithims. To optimize the neural network robot, a seperate simulation class, OptimizeSimulation, was created. Optimization employs a genetic algorthim, in which a pool of possible networks is maintained, along with their performance. The performances are calculated by performing a large number of runs of (consistant) random simulations, and summing the total time for all robots to find all targets. In addition, several spesfic test cases are run for each network to test some interesting cases (e.g. navigating a simple maze, etc.) Pairs of networks are randomly selected from the pool (with one network from a better subset of the pool.) These are combined by taking half the weights from each and merging them into a new network, then making more random tweaks. This is then tested and added to the pool if it is better than the worst performance in the pool. The best performance in the pool is the optimal network.

To run the optimization, run ./optimize from the scripts folder. The temporary and intermediate files get saved to runtime/neuralnetwork. This includes the optimization log, pool performances, optimial network, pool networks, and several others.

1.3 Implementation

The various objects are all subclasses of PhysicalObject, which handles basic behaviors and attributes. This class is virtual, so that spesific bevhaviors for collisions, etc are handled individually, and can optionally call back to the default handlers in PhysicalObject. Each type of robot is a subclass of Robot, which is also virtual, as it has virtual functions to get new wheel speeds given the sensor readings. Everything else, including reading from sensors and collision behavior, is handled directly by the robot class.

There is also an environment namespace with which all objects regester, and are automaticly removed when they are destructed. An iterator over all objects can be requested from the environment, and they can also be accessed by id. The environment also contains functions for detecting collisions between walls and objects. A util namespace provides an easy way of adding and removing objects, managing stacks so that objects are added and removed in FILO order. It also contains functionality to open and save the current state to and from files.

The Simulation class handles the user interface, providing a wrapper for the functions in util. It also acts as a driver, requesting updates and redraws from all objects.

1.3.1 Object motion

Object movement is handled by PhysicalObject. It has an updateMembers function which advances all objects by a distance caluclated from the speed, after calling the virtual update function. The robot class update sets the position and speed from the calculated wheel speeds. The updateMembers function is called for each object from advance in util, which in turn is called from advance in Simulation which is triggered by a glut timer function.

1.3.2 Graphics

A graphical display of the simulation is rendered by OpenGL. Most of the graphics functionallity is in the artist namespace, which has simple functions for drawing circles and lines, which are used by more complex functions for different kinds of objects. There is a virtual function in PhysicalObject to render each object as a circle, and this is overridden by Robot and LightSource. These are called by simulation similarly to updatePosition.

1.3.3 Configuration system

Most settings are loaded through the configuration system, see configuration.h for more details. This allows settings to be stored externally, and avoids needing to recompile often when making small changes. Configuration values can also be set from the command line.

1.4 Licence

Chapter 2

Namespace Index

2.1 Namespace List

Here is a list of all namespaces with brief descriptions:

Chapter 3

Hierarchical Index

3.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Chapter 4

Class Index

4.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 5

File Index

5.1 File List

Here is a list of all files with brief descriptions:

Chapter 6

Namespace Documentation

6.1 artist Namespace Reference

graphical commands

Functions

- void drawObject (Location loc, int radius, Color color)
- void debugArrow (Location loc, int orientation)
- void drawLight (Location loc, int radius, Color color)
- void drawObstacle (Location loc, int radius)
- void drawSensor (Location loc, int orientation, int angle, float intensity)
- void drawRobot (Location loc, int radius, int orientation, Color color, Color lineColor)

6.1.1 Detailed Description

graphical commands

Author

Carl artist functions provide a contained way to display graphics without putting OpenGL graphics in each file

6.1.2 Function Documentation

6.1.2.1 void artist::debugArrow (Location *loc*, int *orientation*)

6.1.2.2 void artist::drawLight (Location *loc*, int *radius*, Color *color*)

Draws a LightSource

Parameters

loc	absolute Location to draw center of light
radius	radius of 'bulb' of light

6.1.2.3 void artist::drawObject (Location *loc*, int *radius*, Color *color*)

Author

Lucas Kramer Draws the default Object, which is a circle

Parameters

loc	absolute Location to draw center of circle
radius	radius of circle
color	the color of the circle

6.1.2.4 void artist::drawObstacle (Location *loc,* int *radius*)

Draws an obstacle

Parameters

loc	absolute Location to draw center of Obstacle
radius	radius of Obstacle

6.1.2.5 void artist::drawRobot (Location *loc,* int *radius,* int *orientation,* Color *color,* Color *lineColor*)

Draws a Robot

Parameters

loc	absolute Location of center of robot
orientation	absolute direction for robot to face
color	the color of the robot's body
lineColor	the color of the robot's direction line

6.1.2.6 void artist::drawSensor (Location *loc,* int *orientation,* int *angle,* float *intensity*)

Draws a sensor

Parameters

loc	absolute Location to draw center of Sensor
orientation	absolute direction of sensor
angle	number of degrees that sensor senses in, with orientation in center
intensity	redness of sensor as value between 0 and 1, meant to indicate amount of light detected

6.2 environment Namespace Reference

environment namespace, handles all the objects as a group. Also manages object ids and collision detection

Typedefs

- typedef ObjectIterator objectIterator

Functions

- int addObject (PhysicalObject ∗object)

  Adds an object to the environment.

- void removeObject (int id)

    Removes an object from the environment.
- void clear ()

    Removes all objects from the environment and resets the id counter.
- unsigned getNumObjects ()

    Gets the number of objects in environment.
- PhysicalObject ∗ getObject (int id)

    Finds an object from the environment.
- objectIterator getObjectsBegin ()

    Gets an iterator to the beginning of the objects.
- objectIterator getObjectsEnd ()

    Gets an iterator to the end of the objects.
- bool isTouchingWall (Location l, int r)
- bool isTouchingWall (int id)
- bool isTouchingObject (Location l, int r, int id)
- bool isTouchingHitableObject (Location l, int r, int id)
- bool isTouchingObject (Location l, int r)
- bool isTouchingHitableObject (Location l, int r)
- bool isTouchingObject (int id)
- bool isTouchingHitableObject (int id)
- bool isColliding (Location l, int r)
- bool isColliding (int id)
- bool isCollidingWithHitable (Location l, int r)
- bool isCollidingWithHitable (int id)
- int getCollisionId (Location l, int r, int id)
- int getHitableCollisionId (Location l, int r, int id)
- int getCollisionId (Location l, int r)
- int getHitableCollisionId (Location l, int r)
- int getCollisionId (int id)
- int getHitableCollisionId (int id)

6.2.1 Detailed Description

environment namespace, handles all the objects as a group. Also manages object ids and collision detection

6.2.2 Typedef Documentation

6.2.2.1 typedef **ObjectIterator environment::objectIterator**

An object iterator

6.2.3 Function Documentation

6.2.3.1 int environment::addObject (**PhysicalObject** ∗ ***object***)

Adds an object to the environment.

Parameters

object	The object to add

Returns

The assigned id of the object

6.2.3.2 void environment::clear ( )

Removes all objects from the environment and resets the id counter.

6.2.3.3 int environment::getCollisionId (Location *l*, int *r*, int *id*)

Determines what object is being hit by another object

Parameters

l	The Location of the object
r	The radius of the object
id	The id of the object to exclude

Returns

The id of one object that is being hit, or -1 if it is hiting nothing or a wall

See Also

isColliding

6.2.3.4 int environment::getCollisionId (Location *l*, int *r*)

Determines what object is being hit by another object

Parameters

l	The Location of the object
r	The radius of the object

Returns

The id of one object that is being hit, or -1 if it is hiting nothing or a wall

See Also

isColliding

6.2.3.5 int environment::getCollisionId (int *id*)

Determines what object is being hit by another object

Parameters

id	The id of the object

Returns

The id of one object that is being hit, or -1 if it is hiting nothing or a wall

See Also

isColliding

6.2.3.6 int environment::getHitableCollisionId (Location *l*, int *r*, int *id*)

Determines what hitable object is being hit by another object

Parameters

l	The Location of the object
r	The radius of the object
id	The id of the object to exclude

Returns

The id of one hitable object that is being hit, or -1 if it is hiting nothing or a wall

See Also

isColliding

6.2.3.7 int environment::getHitableCollisionId (Location *l*, int *r*)

Determines what hitable object is being hit by another object

Parameters

l	The Location of the object
r	The radius of the object

Returns

The id of one hitable object that is being hit, or -1 if it is hiting nothing or a wall

See Also

isColliding

6.2.3.8 int environment::getHitableCollisionId (int *id*)

Determines what hitable object is being hit by another object

Parameters

id	The id of the object

Returns

The id of one hitable object that is being hit, or -1 if it is hiting nothing or a wall

See Also

isColliding

6.2.3.9 unsigned environment::getNumObjects ( )

Gets the number of objects in environment.

Returns

The number of objects

6.2.3.10 PhysicalObject ∗ environment::getObject (int *id*)

Finds an object from the environment.

Parameters

id	The id of the object to find

Returns

The object that was looked iup

6.2.3.11 objectIterator environment::getObjectsBegin ( )

Gets an iterator to the beginning of the objects.

Returns

The iterator

6.2.3.12 objectIterator environment::getObjectsEnd ( )

Gets an iterator to the end of the objects.

Returns

The iterator

6.2.3.13 bool environment::isColliding (Location *l*, int *r*)

Checks if the object specified by the given Location and radius is touching a wall or any other objects

Parameters

l	The Location of the object
r	The radius of the object

Returns

true when the object is touching a wall or any other object

See Also

isTouchingWall, isTouchingObject

6.2.3.14 bool environment::isColliding (int *id*)

Checks if the object specified by the given id is touching a wall or any other objects

Parameters

id	The id of the object

Returns

true when the object is touching a wall or any other object

See Also

isTouchingWall, isTouchingObject

6.2.3.15 bool environment::isCollidingWithHitable (Location *l*, int *r*)

Checks if the object specified by the given Location and radius is touching a wall or any other hitable objects

Parameters

l	The Location of the object
r	The radius of the object

Returns

true when the object is touching a wall or any other hitable object

See Also

isTouchingWall, isTouchingObject

6.2.3.16 bool environment::isCollidingWithHitable (int *id*)

Checks if the object specified by the given id is touching a wall or any other hitable objects

Parameters

id	The id of the object

Returns

true when the object is touching a wall or any other hitable object

See Also

isTouchingWall, isTouchingObject

6.2.3.17 bool environment::isTouchingHitableObject (Location *l*, int *r*, int *id*)

Same as isTouchingObject(Location l, int r), but ignores the object with the given id and non-hitable objects.

Parameters

l	The Location of the object
r	The radius of the object
id	The id of the object to ignore

6.2.3.18 bool environment::isTouchingHitableObject (Location *l*, int *r*)

Checks if the object specified by the given Location and radius is touching any other hitable objects

Parameters

l	The Location of the object
r	The radius of the object

Returns

true when the object is touching any other hitable object

6.2.3.19 bool environment::isTouchingHitableObject (int *id*)

Checks if the object specified by the given id is touching any other hitable objects

Parameters

id	The id of the object

Returns

true when the object is touching any other hitable object

6.2.3.20 bool environment::isTouchingObject (Location *l*, int *r*, int *id*)

Same as isTouchingObject(Location l, int r), but ignores the object with the given id.

Parameters

l	The Location of the object
r	The radius of the object
id	The id of the object to ignore

6.2.3.21 bool environment::isTouchingObject (Location *l*, int *r*)

Checks if the object specified by the given Location and radius is touching any other objects

Parameters

l	The Location of the object
r	The radius of the object

Returns

true when the object is touching any other object

6.2.3.22 bool environment::isTouchingObject (int *id*)

Checks if the object specified by the given id is touching any other objects

Parameters

id	The id of the object

Returns

true when the object is touching any other object

6.2.3.23 bool environment::isTouchingWall (Location *l*, int *r*)

Checks if an object is in the designated window

It returns true whenever the following conditions are met:

x position - radius <= 0

y position - radius <= 0

x position + radius >= width

y position + radius >= height

Parameters

l	The Location of the object
r	The radius of the object

Returns

true when the object is touching a wall

6.2.3.24 bool environment::isTouchingWall (int *id*)

Checks if an object is in the designated window

It reads in the width, height, x and y position of the object, and then returns true whenever the following conditions are met:

x position - radius <= 0

y position - radius <= 0

x position + radius >= width

y position + radius >= height

Parameters

id	The id of the object

Returns

true when the object is touching a wall

6.2.3.25 void environment::removeObject (int *id*)

Removes an object from the environment.

Parameters

id	The id of the object to remove

6.3 util Namespace Reference

util namespace, contains helper functions to add and remove robots

Functions

- void reset ()

  Removes all objects and resets to the initial state.
- void display ()

  Function to render all the objects. This function is called repeatedly from the simulation, and iterates through the objects and calls their respective display functions.
- void advance ()

  Function to update the positions of all objects. This function is called repeatedly from the simulation, and iterates through the objects and calls their respective updatePosition functions.
- Color newColor ()

  Gets a new, unused color.
- int getNumRobotsTargets ()

  Gets the number of robots/target pairs.
- int getNumLights ()

  Gets the number of lights.
- int getNumObstacles ()

  Gets the number of obstacles.
- bool addRobotTarget (int robotType, int lightSensorConnectionPattern, int robotSensorConnectionPattern, int obstacleSensorConnectionPattern, int targetSensorConnectionPattern, float lightSensorScale, float robotSensorScale, float obstacleSensorScale, float targetSensorScale, int initialSpeed, std::string neuralNetworkFile)

  Adds a robot and paired target to the simulation.

- bool addRobot (int robotType, int lightSensorConnectionPattern, int robotSensorConnectionPattern, int obstacleSensorConnectionPattern, int targetSensorConnectionPattern, float lightSensorScale, float robotSensorScale, float obstacleSensorScale, float targetSensorScale, int initialSpeed, std::string neuralNetworkFile)

  Adds a robot to the simulation.
- bool addNeuralNetworkRobotTarget (const NeuralNetwork &network)

  Adds a neural network robot and a paired target to the simulation.
- bool addStationaryLightSource ()

  Adds a light to the simulation.
- bool addMovingLightSource ()

  Adds a light to the simulation.
- bool addObstacle ()

  Adds a obstacle to the simulation.
- bool copy (int id, Location loc)

  Copies an object to a new Location.
- bool removeRobotTarget ()

  Removes a robot from the simulation.
- bool removeLightSource ()

  Removes a light from the simulation.
- bool removeObstacle ()

  Removes a obstacle from the simulation.
- void removeAllRobotTarget ()

  Removes all robots.
- void removeAllLightSource ()

  Removes all lights.
- void removeAllObstacle ()

  Removes all obstacles.
- bool open (std::string filename)

  Loads a simulation from a file.
- bool save (std::string filename)

  Saves the current state to a file.

6.3.1 Detailed Description

util namespace, contains helper functions to add and remove robots

6.3.2 Function Documentation

6.3.2.1 bool util::addMovingLightSource ( )

Adds a light to the simulation.

Returns

true if successful

6.3.2.2 bool util::addNeuralNetworkRobotTarget (const NeuralNetwork & *network*)

Adds a neural network robot and a paired target to the simulation.

Parameters

network	the network to control the robot

Returns

true if successful

6.3.2.3 bool util::addObstacle ( )

Adds a obstacle to the simulation.

Returns

true if successful

6.3.2.4 bool util::addRobot (int *robotType,* int *lightSensorConnectionPattern,* int *robotSensorConnectionPattern,* int *obstacleSensorConnectionPattern,* int *targetSensorConnectionPattern,* float *lightSensorScale,* float *robotSensorScale,* float *obstacleSensorScale,* float *targetSensorScale,* int *initialSpeed,* std::string *neuralNetworkFile*)

Adds a robot to the simulation.

Parameters

robotType	The type of robot to add. 0 is SimpleRobot, 1 is ComplexRobot, and 2 is NeuralNetworkRobot
lightSensor-Connection-Pattern	Settings for ComplexRobot light sensor
robotSensor-Connection-Pattern	Settings for ComplexRobot robot sensor
obstacleSensor-Connection-Pattern	Settings for ComplexRobot obstacle sensor
targetSensor-Connection-Pattern	Settings for ComplexRobot target sensor
lightSensorScale	Settings for ComplexRobot light sensor
robotSensor-Scale	Settings for ComplexRobot robot sensor
obstacleSensor-Scale	Settings for ComplexRobot obstacle sensor
targetSensor-Scale	Settings for ComplexRobot target sensor
initalSpeed	Default speed for ComplexRobot
neuralNetwork-File	File in which neural network is stored

Returns

true if successful

6.3.2.5 bool util::addRobotTarget (int *robotType,* int *lightSensorConnectionPattern,* int *robotSensorConnectionPattern,* int *obstacleSensorConnectionPattern,* int *targetSensorConnectionPattern,* float *lightSensorScale,* float *robotSensorScale,* float *obstacleSensorScale,* float *targetSensorScale,* int *initialSpeed,* std::string *neuralNetworkFile*)

Adds a robot and paired target to the simulation.

Parameters

robotType	The type of robot to add. 0 is SimpleRobot, 1 is ComplexRobot, and 2 is NeuralNetworkRobot
lightSensor-Connection-Pattern	Settings for ComplexRobot light sensor
robotSensor-Connection-Pattern	Settings for ComplexRobot robot sensor
obstacleSensor-Connection-Pattern	Settings for ComplexRobot obstacle sensor
targetSensor-Connection-Pattern	Settings for ComplexRobot target sensor
lightSensorScale	Settings for ComplexRobot light sensor
robotSensor-Scale	Settings for ComplexRobot robot sensor
obstacleSensor-Scale	Settings for ComplexRobot obstacle sensor
targetSensor-Scale	Settings for ComplexRobot target sensor
initalSpeed	Default speed for ComplexRobot
neuralNetwork-File	File in which neural network is stored

Returns

true if successful

6.3.2.6 bool util::addStationaryLightSource ( )

Adds a light to the simulation.

Returns

true if successful

6.3.2.7 void util::advance ( )

Function to update the positions of all objects. This function is called repeatedly from the simulation, and iterates through the objects and calls their respective updatePosition functions.

6.3.2.8 bool util::copy (int *id*, Location *loc*)

Copies an object to a new Location.

Parameters

id	the id of the object to copy
loc	the destination

Returns

true if successful

6.3.2.9 void util::display ( )

Function to render all the objects. This function is called repeatedly from the simulation, and iterates through the objects and calls their respective display functions.

6.3.2.10 int util::getNumLights ( )

Gets the number of lights.

Returns

The number of lights

6.3.2.11 int util::getNumObstacles ( )

Gets the number of obstacles.

Returns

The number of obstacles

6.3.2.12 int util::getNumRobotsTargets ( )

Gets the number of robots/target pairs.

Returns

The number of robots/target pairs

6.3.2.13 Color util::newColor ( )

Gets a new, unused color.

Returns

The new color

6.3.2.14 bool util::open (std::string *filename*)

Loads a simulation from a file.

6.3.2.15 void util::removeAllLightSource ( )

Removes all lights.

6.3.2.16 void util::removeAllObstacle ( )

Removes all obstacles.

6.3.2.17 void util::removeAllRobotTarget ( )

Removes all robots.

6.3.2.18 bool util::removeLightSource ( )

Removes a light from the simulation.

Returns

true if successful

6.3.2.19 bool util::removeObstacle ( )

Removes a obstacle from the simulation.

Returns

true if successful

6.3.2.20 bool util::removeRobotTarget ( )

Removes a robot from the simulation.

Returns

true if successful

6.3.2.21 void util::reset ( )

Removes all objects and resets to the initial state.

6.3.2.22 bool util::save (std::string *filename*)

Saves the current state to a file.

Chapter 7

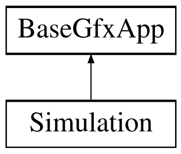
Class Documentation

7.1 BaseGfxApp Class Reference

Graphics driver class.

`#include <BaseGfxApp.h>`

Inheritance diagram for BaseGfxApp:



Public Member Functions

- BaseGfxApp (int argc, char *argv[], int width, int height, int x, int y, int glutFlags, bool createGLUIWin, int gluiWinX, int gluiWinY)
- virtual ∼BaseGfxApp ()
- void setCaption (const std::string &caption)
- void runMainLoop ()
- virtual void display ()
- virtual void advance ()
- virtual void mouseMoved (int x, int y)
- virtual void mouseDragged (int x, int y)
- virtual void leftMouseDown (int x, int y)
- virtual void leftMouseUp (int x, int y)
- virtual void rightMouseDown (int x, int y)
- virtual void rightMouseUp (int x, int y)
- virtual void middleMouseDown (int x, int y)
- virtual void middleMouseUp (int x, int y)
- virtual void keyboard (unsigned char c, int x, int y)
- virtual void keyboardSpecial (int key, int x, int y)
- virtual void keyboardUp (unsigned char c, int x, int y)
- virtual void keyboardSpecialUp (int key, int x, int y)
- virtual void reshape (int width, int height)
- virtual void gluiControl (int controlID)
- int width () const
- int height () const
- int handle ()
- GLUI * glui ()

Static Public Member Functions

- static void graphicsBegin (int v, int delay)

Static Protected Member Functions

- static void graphicsTimer (int v)
- static void s_reshape (int width, int height)
- static void s_keyboard (unsigned char c, int x, int y)
- static void s_keyboardspecial (int key, int x, int y)
- static void s_keyboardup (unsigned char c, int x, int y)
- static void s_keyboardspecialup (int key, int x, int y)
- static void s_mousemotion (int x, int y)
- static void s_mousebtn (int b, int s, int x, int y)
- static void s_draw ()
- static void s_gluicallback (int controlID)

Protected Attributes

- int m_glutWindowHandle
- GLUI ∗ m_glui
- bool m_drag
- int m_width
- int m_height

Static Protected Attributes

- static BaseGfxApp ∗ s_currentApp = NULL
- static bool s_glutInitialized = false

7.1.1 Detailed Description

Graphics driver class.

7.1.2 Constructor & Destructor Documentation

7.1.2.1 BaseGfxApp::BaseGfxApp (int *argc,* char ∗ *argv[ ],* int *width,* int *height,* int *x,* int *y,* int *glutFlags,* bool *createGLUIWin,* int *gluiWinX,* int *gluiWinY*)

7.1.2.2 BaseGfxApp::∼BaseGfxApp ( ) `[virtual]`

7.1.3 Member Function Documentation

7.1.3.1 virtual void BaseGfxApp::advance ( ) `[inline]`, `[virtual]`

Reimplemented in Simulation.

7.1.3.2 virtual void BaseGfxApp::display ( ) `[inline]`, `[virtual]`

Reimplemented in Simulation.

7.1.3.3 GLUI∗ BaseGfxApp::glui ( ) [inline]

7.1.3.4 virtual void BaseGfxApp::gluiControl (int *controlID*) [inline], [virtual]

Reimplemented in Simulation.

7.1.3.5 void BaseGfxApp::graphicsBegin (int *v*, int *delay*) [static]

This function starts the graphics after a delay.

7.1.3.6 void BaseGfxApp::graphicsTimer (int *v*) [static], [protected]

This function calls itself using glutTimerFunc once per frame.

7.1.3.7 int BaseGfxApp::handle ( ) [inline]

7.1.3.8 int BaseGfxApp::height ( ) const

7.1.3.9 virtual void BaseGfxApp::keyboard (unsigned char *c*, int *x*, int *y*) [inline], [virtual]

Reimplemented in Simulation.

7.1.3.10 virtual void BaseGfxApp::keyboardSpecial (int *key*, int *x*, int *y*) [inline], [virtual]

Reimplemented in Simulation.

7.1.3.11 virtual void BaseGfxApp::keyboardSpecialUp (int *key*, int *x*, int *y*) [inline], [virtual]

7.1.3.12 virtual void BaseGfxApp::keyboardUp (unsigned char *c*, int *x*, int *y*) [inline], [virtual]

7.1.3.13 virtual void BaseGfxApp::leftMouseDown (int *x*, int *y*) [inline], [virtual]

Reimplemented in Simulation.

7.1.3.14 virtual void BaseGfxApp::leftMouseUp (int *x*, int *y*) [inline], [virtual]

Reimplemented in Simulation.

7.1.3.15 virtual void BaseGfxApp::middleMouseDown (int *x*, int *y*) [inline], [virtual]

Reimplemented in Simulation.

7.1.3.16 virtual void BaseGfxApp::middleMouseUp (int *x*, int *y*) [inline], [virtual]

7.1.3.17 virtual void BaseGfxApp::mouseDragged (int *x*, int *y*) [inline], [virtual]

Reimplemented in Simulation.

7.1.3.18 virtual void BaseGfxApp::mouseMoved (int *x*, int *y*) [inline], [virtual]

7.1.3.19 void BaseGfxApp::reshape (int *width*, int *height*) [virtual]

7.1.3.20 virtual void BaseGfxApp::rightMouseDown (int *x*, int *y*) [inline], [virtual]

7.1.3.21 virtual void BaseGfxApp::rightMouseUp (int *x*, int *y*) [inline], [virtual]

7.1.3.22 void BaseGfxApp::runMainLoop ( )

7.1.3.23 void BaseGfxApp::s_draw ( ) [static], [protected]

7.1.3.24 void BaseGfxApp::s_gluicallback (int *controlID*) [static], [protected]

7.1.3.25 void BaseGfxApp::s_keyboard (unsigned char *c*, int *x*, int *y*) [static], [protected]

7.1.3.26 void BaseGfxApp::s_keyboardspecial (int *key*, int *x*, int *y*) [static], [protected]

7.1.3.27 void BaseGfxApp::s_keyboardspecialup (int *key*, int *x*, int *y*) [static], [protected]

7.1.3.28 void BaseGfxApp::s_keyboardup (unsigned char *c*, int *x*, int *y*) [static], [protected]

7.1.3.29 void BaseGfxApp::s_mousebtn (int *b*, int *s*, int *x*, int *y*) [static], [protected]

7.1.3.30 void BaseGfxApp::s_mousemotion (int *x*, int *y*) [static], [protected]

7.1.3.31 void BaseGfxApp::s_reshape (int *width*, int *height*) [static], [protected]

7.1.3.32 void BaseGfxApp::setCaption (const std::string & *caption*)

7.1.3.33 int BaseGfxApp::width ( ) const

7.1.4 Member Data Documentation

7.1.4.1 bool BaseGfxApp::m_drag [protected]

7.1.4.2 GLUI∗ BaseGfxApp::m_glui [protected]

7.1.4.3 int BaseGfxApp::m_glutWindowHandle [protected]

Underlying glut window handle

7.1.4.4 int BaseGfxApp::m_height [protected]

7.1.4.5 int BaseGfxApp::m_width [protected]

7.1.4.6 BaseGfxApp ∗ BaseGfxApp::s_currentApp = NULL [static], [protected]

GLUT and GLUI event callbacks are sent to the current window/app. Right now, there is only one window anyway (not counting the GLUI UI window.. in the future could be extended to support more windows. In any case, some structure like this is always needed when using glut with C++, since the glut callbacks must be either global or static functions.

7.1.4.7 bool BaseGfxApp::s_glutInitialized = false [static], [protected]

Has glutInit been called? (only allowed once per program)

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

- BaseGfxApp.h
- BaseGfxApp.cpp

7.2 Color Struct Reference

This struct holds the representation of a color.

`#include <Color.h>`

Public Member Functions

- Color ()
- Color (float r, float g, float b)
- Color (char c)

  Creates a RGB color from its char color name The following is the list of allowed colors:
- Color (int c)

  Creates an RGB color from a hex value The color is stored as the last 3 bytes, as 0x<unused (set to 0)><red><green><blue>
  Each byte is interpreted as an integer holding an RGB value from 0-255. These are then converted to floats between 0 and 1 by dividing by 255. Note that this requires at least 3 byte integers.
- bool isSimilar (Color c1)

  Checks if two colors are similar.
- std::ostream & operator<< (std::ostream &out)
- bool operator== (Color c1)

  Checks if two colors are equal.
- bool operator!= (Color c1)

  Checks if two colors are not equal.

Public Attributes

- float red
- float green
- float blue

7.2.1 Detailed Description

This struct holds the representation of a color.

Each field is a float value that shoult be between 0 and 1. This allows a direct translation from hex colors, with each field being the hex RGB value / 255.

7.2.2 Constructor & Destructor Documentation

7.2.2.1 Color::Color ( ) [inline]

7.2.2.2 Color::Color (float *r*, float *g*, float *b*) [inline]

7.2.2.3 Color::Color (char *c*)

Creates a RGB color from its char color name The following is the list of allowed colors:

Author

Lucas Kramer

Color char	Color name	RGB floating-point value
'R'	Red	(1, 0, 0)
'O'	Orange	(1, 0.4, 0)
'Y'	Yellow	(1, 1, 0)
'G'	Green	(0, 1, 0)
'B'	Blue	(0, 0, 1)
'V'	Violet	(0.5, 0, 0.5)
'W'	White	(1, 1, 1)
default	Black	(0, 0, 0)

7.2.2.4 Color::Color (int *c*)

Creates an RGB color from a hex value The color is stored as the last 3 bytes, as 0x<unused (set to 0)><red><green><blue>

Each byte is interpreted as an integer holding an RGB value from 0-255. These are then converted to floats between 0 and 1 by dividing by 255. Note that this requires at least 3 byte integers.

Author

Carl Bahn Lucas Kramer

7.2.3 Member Function Documentation

7.2.3.1 bool Color::isSimilar (Color *c1*)

Checks if two colors are similar.

Author

Lucas Kramer

Parameters

c1	the color to compare

Returns

true if the colors are similar

7.2.3.2 bool Color::operator!= (Color *c1*)

Checks if two colors are not equal.

Author

Lucas Kramer

Parameters

c1	the color to check

Returns

true if the colors are not equal

7.2.3.3 std::ostream& Color::operator<< (std::ostream & *out*) [inline]

7.2.3.4 bool Color::operator== (Color *c1*)

Checks if two colors are equal.

Author

Lucas Kramer

Parameters

c1	the color to check

Returns

true if the colors are equal

7.2.4 Member Data Documentation

7.2.4.1 float Color::blue

7.2.4.2 float Color::green

7.2.4.3 float Color::red

The documentation for this struct was generated from the following files:

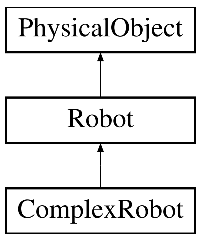
- Color.h
- Color.cpp

7.3 ComplexRobot Class Reference

A complex robot with configurable feedback from all sensors.

`#include <ComplexRobot.h>`

Inheritance diagram for ComplexRobot:



Public Member Functions

- ComplexRobot ()
- ComplexRobot (int radius, Color color, Color lineColor, bool enableLightSensors, bool enableRobotSensors, bool enableObstacleSensors, bool enableTargetSensors, bool lightSensorsCrossed, bool robotSensorsCrossed, bool obstacleSensorsCrossed, bool targetSensorsCrossed, float lightSensorScale, float robotSensorScale, float obstacleSensorScale, float targetSensorScale, int defaultSpeed, int targetId=-1)
- ComplexRobot (int radius, Location loc, Color color, Color lineColor, bool enableLightSensors, bool enableRobotSensors, bool enableObstacleSensors, bool enableTargetSensors, bool lightSensorsCrossed, bool robotSensorsCrossed, bool obstacleSensorsCrossed, bool targetSensorsCrossed, float lightSensorScale, float robotSensorScale, float obstacleSensorScale, float targetSensorScale, int defaultSpeed, int targetId=-1)
- ∼ComplexRobot ()
- float getLeftSpeed (float leftLightSensorVal, float rightLightSensorVal, float leftRobotSensorVal, float rightRobotSensorVal, float leftObstacleSensorVal, float rightObstacleSensorVal, float leftTargetSensorVal, float rightTargetSensorVal)
- float getRightSpeed (float leftLightSensorVal, float rightLightSensorVal, float leftRobotSensorVal, float rightRobotSensorVal, float leftObstacleSensorVal, float rightObstacleSensorVal, float leftTargetSensorVal, float rightTargetSensorVal)

Public Attributes

- const bool enableLightSensors
- const bool enableRobotSensors
- const bool enableObstacleSensors
- const bool enableTargetSensors
- const bool lightSensorsCrossed
- const bool robotSensorsCrossed
- const bool obstacleSensorsCrossed
- const bool targetSensorsCrossed
- const float lightSensorScale
- const float robotSensorScale
- const float obstacleSensorScale
- const float targetSensorScale
- const int defaultSpeed

Additional Inherited Members

7.3.1 Detailed Description

A complex robot with configurable feedback from all sensors.

7.3.2 Constructor & Destructor Documentation

7.3.2.1 ComplexRobot::ComplexRobot ( )

7.3.2.2 ComplexRobot::ComplexRobot (int *radius,* Color *color,* Color *lineColor,* bool *enableLightSensors,* bool *enableRobotSensors,* bool *enableObstacleSensors,* bool *enableTargetSensors,* bool *lightSensorsCrossed,* bool *robotSensorsCrossed,* bool *obstacleSensorsCrossed,* bool *targetSensorsCrossed,* float *lightSensorScale,* float *robotSensorScale,* float *obstacleSensorScale,* float *targetSensorScale,* int *defaultSpeed,* int *targetId* = `-1`)

7.3.2.3 ComplexRobot::ComplexRobot (int *radius,* Location *loc,* Color *color,* Color *lineColor,* bool *enableLightSensors,* bool *enableRobotSensors,* bool *enableObstacleSensors,* bool *enableTargetSensors,* bool *lightSensorsCrossed,* bool *robotSensorsCrossed,* bool *obstacleSensorsCrossed,* bool *targetSensorsCrossed,* float *lightSensorScale,* float *robotSensorScale,* float *obstacleSensorScale,* float *targetSensorScale,* int *defaultSpeed,* int *targetId* = `-1`)

7.3.2.4 ComplexRobot::∼ComplexRobot ( )

7.3.3 Member Function Documentation

7.3.3.1 float ComplexRobot::getLeftSpeed (float *leftLightSensorVal,* float *rightLightSensorVal,* float *leftRobotSensorVal,* float *rightRobotSensorVal,* float *leftObstacleSensorVal,* float *rightObstacleSensorVal,* float *leftTargetSensorVal,* float *rightTargetSensorVal*) `[virtual]`

Implements Robot.

7.3.3.2 float ComplexRobot::getRightSpeed (float *leftLightSensorVal,* float *rightLightSensorVal,* float *leftRobotSensorVal,* float *rightRobotSensorVal,* float *leftObstacleSensorVal,* float *rightObstacleSensorVal,* float *leftTargetSensorVal,* float *rightTargetSensorVal*) `[virtual]`

Implements Robot.

7.3.4 Member Data Documentation

7.3.4.1 const int ComplexRobot::defaultSpeed

7.3.4.2 const bool ComplexRobot::enableLightSensors

7.3.4.3 const bool ComplexRobot::enableObstacleSensors

7.3.4.4 const bool ComplexRobot::enableRobotSensors

7.3.4.5 const bool ComplexRobot::enableTargetSensors

7.3.4.6 const float ComplexRobot::lightSensorScale

7.3.4.7 const bool ComplexRobot::lightSensorsCrossed

7.3.4.8 const float ComplexRobot::obstacleSensorScale

7.3.4.9 const bool ComplexRobot::obstacleSensorsCrossed

7.3.4.10 const float ComplexRobot::robotSensorScale

7.3.4.11 const bool ComplexRobot::robotSensorsCrossed

7.3.4.12 const float ComplexRobot::targetSensorScale

7.3.4.13 const bool ComplexRobot::targetSensorsCrossed

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

- ComplexRobot.h
- ComplexRobot.cpp

7.4 Configuration Class Reference

```
#include <configuration.h>
```

Public Member Functions

- int getIntConfig (const std::string &name)

    Looks up an int.
- float getFloatConfig (const std::string &name)

    Looks up a float.
- bool getBoolConfig (const std::string &name)

    Looks up a boolean.
- char getCharConfig (const std::string &name)

    Looks up a character.
- std::string getStringConfig (const std::string &name)

    Looks up a string.

Static Public Member Functions

- static void initConfig (const std::string &filename)
- static void initConfig (int argc, char ∗argv[ ], const std::string &defaultFilename)
- static Configuration ∗ get ()
- static void refresh ()

7.4.1 Member Function Documentation

7.4.1.1 Configuration ∗ Configuration::get ( ) `[static]`

7.4.1.2 bool Configuration::getBoolConfig (const std::string & *name*)

Looks up a boolean.

Parameters

table	The table from which to look up the value
name	The name of the value

Returns

The value

7.4.1.3 char Configuration::getCharConfig (const std::string & *name*)

Looks up a character.

Parameters

table	The table from which to look up the value
name	The name of the value

Returns

The value

7.4.1.4 float Configuration::getFloatConfig (const std::string & *name*)

Looks up a float.

Parameters

table	The table from which to look up the value
name	The name of the value

Returns

The value

7.4.1.5 int Configuration::getIntConfig (const std::string & *name*)

Looks up an int.

Parameters

table	The table from which to look up the value
name	The name of the value

Returns

The value

7.4.1.6 string Configuration::getStringConfig (const std::string & *name*)

Looks up a string.

Parameters

table	The table from which to look up the value
name	The name of the value

Returns

The value

7.4.1.7 static void Configuration::initConfig (const std::string & *filename*) `[static]`

7.4.1.8 static void Configuration::initConfig (int *argc,* char ∗ *argv[ ],* const std::string & *defaultFilename*) `[static]`

7.4.1.9 void Configuration::refresh ( ) `[static]`

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

- configuration.h
- configuration.cpp

7.5 configValue Struct Reference

This struct holds a configuration value of any legal type.

```
#include <configuration.h>
```

Public Attributes

- std::string type
- union {
  int intVal
  float floatVal
  char charVal
  bool boolVal
  const char ∗ stringVal
  };

7.5.1 Detailed Description

This struct holds a configuration value of any legal type.

Note that stringVal is stored as a const char ∗ in the union due to restrictions in C++ not allowing complex types in unions. The string is converted to a char ∗ after it is parsed, and is converted back in getStringVal.

7.5.2 Member Data Documentation

7.5.2.1 union { ... }

An anonymous union of all possible types that can be stored.

7.5.2.2 bool configValue::boolVal

7.5.2.3 char configValue::charVal

7.5.2.4 float configValue::floatVal

7.5.2.5 int configValue::intVal

7.5.2.6 const char∗ configValue::stringVal

7.5.2.7 std::string configValue::type

The name of the type that is stored ("int", "float", "char", "bool", or "string") or an error code from parsing ("invalid type name" or "invalid syntax").

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

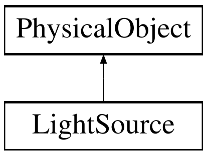
- configuration.h

7.6 LightSource Class Reference

LightSource for the robot to seek.

```
#include <LightSource.h>
```

Inheritance diagram for LightSource:



Public Member Functions

- LightSource (int radius, Color color)
- LightSource (int maxRadius, int minRadius, Color color)
- LightSource (int radius, Location loc, Color color)
- bool handleCollision (int otherId, bool wasHit)
- ∼LightSource ()
- void display ()

Additional Inherited Members

7.6.1 Detailed Description

LightSource for the robot to seek.

7.6.2 Constructor & Destructor Documentation

7.6.2.1 LightSource::LightSource (int *radius,* Color *color*)

This constructor requires two parameters: radius and color)

Parameters

radius	the radius in pixels
color	a struct of float value 0 to 1 representing a hexedecimal color

Initialization

LightSource is initialized with the following values:

Orientation: random

Speed: 0

Position: (loc.x, loc.y)

7.6.2.2 LightSource::LightSource (int *maxRadius,* int *minRadius,* Color *color*)

This constructor creates a light with a random radius

Parameters

minRadius	the minimum possible radius in pixels
maxRadius	the maximum possible radius in pixels
color	a struct representing color

Initialization

LightSource is initialized with the following values:

Orientation: random

Speed: 0

Position: (loc.x, loc.y)

7.6.2.3 LightSource::LightSource (int *radius*, Location *loc*, Color *color*)

This constructor requires four parameters: radius, color, start Location and ConfigTable value)

Parameters

radius	the radius in pixels
color	a struct of float value 0 to 1 representing a hexedecimal color
loc	a struct of the x,y start Location in pixels
config	a configuration table

Initialization

LightSource is initialized with the following values:

Orientation: 0

Speed: 0

Position: (loc.x, loc.y)

7.6.2.4 LightSource::∼LightSource ( )

This is the class destructor.

7.6.3 Member Function Documentation

7.6.3.1 void LightSource::display ( ) [virtual]

This function displays the LightSource in the graphics.

Reimplemented from PhysicalObject.

7.6.3.2 bool LightSource::handleCollision (int *otherId*, bool *wasHit*) [virtual]

Author

Lucas Kramer This function gives LightSource an appropriate reaction when a collision occurs.

Parameters

otherId	id of the object that it collides with
wasHit	tells if the object was hit previously

Implements PhysicalObject.

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

- LightSource.h
- LightSource.cpp

7.7 Location Struct Reference

an xy position on the screen, approximately in pixels x is horizontal from the left and y is vertical from the bottom

```
#include <Location.h>
```

Public Member Functions

- Location ()
- Location (float x, float y)
- bool operator== (Location other)

Public Attributes

- float x
- float y

7.7.1 Detailed Description

an xy position on the screen, approximately in pixels x is horizontal from the left and y is vertical from the bottom

7.7.2 Constructor & Destructor Documentation

7.7.2.1 Location::Location ( ) `[inline]`

7.7.2.2 Location::Location (float *x*, float *y*) `[inline]`

7.7.3 Member Function Documentation

7.7.3.1 bool Location::operator== (Location *other*) `[inline]`

7.7.4 Member Data Documentation

7.7.4.1 float Location::x

7.7.4.2 float Location::y

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

- Location.h

7.8 NeuralNetwork Class Reference

A representation of a neural network.

```
#include <NeuralNetwork.h>
```

Public Member Functions

- NeuralNetwork (const NeuralNetwork &other)
- NeuralNetwork (const std::string &filename)
- std::vector< float > compute (const std::vector< float > &inputs)

- NeuralNetwork mutate (int numChanged, float amount)
- NeuralNetwork combine (const NeuralNetwork &other)
- void write (const std::string &filename)

Static Public Member Functions

- static NeuralNetwork load (const std::string &filename)

7.8.1 Detailed Description

A representation of a neural network.

7.8.2 Constructor & Destructor Documentation

7.8.2.1 NeuralNetwork::NeuralNetwork (const **NeuralNetwork** & *other*)

The copy constructor

Parameters

other	the network to copy

7.8.2.2 NeuralNetwork::NeuralNetwork (const std::string & *filename*)

Constructs a network from a file description

Parameters

filename	the description filename

7.8.3 Member Function Documentation

7.8.3.1 **NeuralNetwork** NeuralNetwork::combine (const **NeuralNetwork** & *other*)

Combines the network with another network by constructing a new network with half the connection strengths from each. Throws an exception if the networks have incompatible structures

Returns

the new network

7.8.3.2 vector< float > NeuralNetwork::compute (const std::vector< float > & *inputs*)

Computes the output values of a network for a vector of inputs. Throws an exception if an incorrect number of inputs is provided

Parameters

inputs	a vector containing the inputs

Returns

a vector containing the outputs

7.8.3.3 NeuralNetwork NeuralNetwork::load (const std::string & *filename*) `[static]`

Loads a network from a file

Parameters

filename	the filename to load

Returns

the new network

7.8.3.4 NeuralNetwork NeuralNetwork::mutate (int *numChanged,* float *amount*)

Mutates the network by changing numChanged connection strengths by a random number between -amount and amount

Parameters

numChanged	the number of connections to mutate
amount	the maximum amount to change the connections

Returns

the new network

7.8.3.5 void NeuralNetwork::write (const std::string & *filename*)

Writes the network to a file

Parameters

filename	the file to write

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

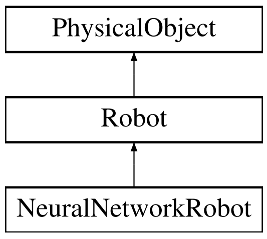
- NeuralNetwork.h
- NeuralNetwork.cpp

7.9 NeuralNetworkRobot Class Reference

A robot controlled by a neural network with inputs from the sensors.

`#include <NeuralNetworkRobot.h>`

Inheritance diagram for NeuralNetworkRobot:



Public Member Functions

- NeuralNetworkRobot (int radius, Color color, Color lineColor, NeuralNetwork network, int targetId=-1, std::string filename=GET_STRING("DEFAULT_NEURAL_NETWORK_FILE"))

- NeuralNetworkRobot (int radius, Location loc, Color color, Color lineColor, NeuralNetwork network, int targetId=-1, std::string filename=GET_STRING("DEFAULT_NEURAL_NETWORK_FILE"))
- ∼NeuralNetworkRobot ()
- float getLeftSpeed (float leftLightSensorVal, float rightLightSensorVal, float leftRobotSensorVal, float rightRobotSensorVal, float leftObstacleSensorVal, float rightObstacleSensorVal, float leftTargetSensorVal, float rightTargetSensorVal)
- float getRightSpeed (float leftLightSensorVal, float rightLightSensorVal, float leftRobotSensorVal, float rightRobotSensorVal, float leftObstacleSensorVal, float rightObstacleSensorVal, float leftTargetSensorVal, float rightTargetSensorVal)

Public Attributes

- const std::string filename

Additional Inherited Members

7.9.1 Detailed Description

A robot controlled by a neural network with inputs from the sensors.

7.9.2 Constructor & Destructor Documentation

7.9.2.1 NeuralNetworkRobot::NeuralNetworkRobot (int *radius,* Color *color,* Color *lineColor,* NeuralNetwork *network,* int *targetId* = −1, std::string *filename* = GET_STRING ("DEFAULT_NEURAL_NETWORK_FILE"))

7.9.2.2 NeuralNetworkRobot::NeuralNetworkRobot (int *radius,* Location *loc,* Color *color,* Color *lineColor,* NeuralNetwork *network,* int *targetId* = −1, std::string *filename* = GET_STRING ("DEFAULT_NEURAL_NETWORK_FILE"))

7.9.2.3 NeuralNetworkRobot::∼NeuralNetworkRobot ( )

7.9.3 Member Function Documentation

7.9.3.1 float NeuralNetworkRobot::getLeftSpeed (float *leftLightSensorVal,* float *rightLightSensorVal,* float *leftRobotSensorVal,* float *rightRobotSensorVal,* float *leftObstacleSensorVal,* float *rightObstacleSensorVal,* float *leftTargetSensorVal,* float *rightTargetSensorVal*) [virtual]

Implements Robot.

7.9.3.2 float NeuralNetworkRobot::getRightSpeed (float *leftLightSensorVal,* float *rightLightSensorVal,* float *leftRobotSensorVal,* float *rightRobotSensorVal,* float *leftObstacleSensorVal,* float *rightObstacleSensorVal,* float *leftTargetSensorVal,* float *rightTargetSensorVal*) [virtual]

Implements Robot.

7.9.4 Member Data Documentation

7.9.4.1 const std::string NeuralNetworkRobot::filename

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

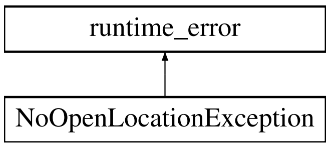
- NeuralNetworkRobot.h
- NeuralNetworkRobot.cpp

7.10 NoOpenLocationException Class Reference

An exception to be thrown when an open Location cannot be found.

```
#include <environment.h>
```

Inheritance diagram for NoOpenLocationException:



Public Member Functions

- NoOpenLocationException ()

7.10.1 Detailed Description

An exception to be thrown when an open Location cannot be found.

7.10.2 Constructor & Destructor Documentation

7.10.2.1 NoOpenLocationException::NoOpenLocationException ( ) [inline]

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

- environment.h

7.11 ObjectIterator Class Reference

ObjectIterator class, a simple iterator for the object in environment.

```
#include <environment.h>
```

Public Member Functions

- ObjectIterator ()

  The default constructor, the iterated objects are allways the iterObjects vector in environment.
- ObjectIterator (const ObjectIterator &other)

  The copy constructor, the iterated objects are allways the iterObjects vector in environment.
- ∼ObjectIterator ()

  The destructor, does nothing.
- void operator++ ()
- void operator++ (int)
- PhysicalObject ∗ operator∗ ()
- bool operator> (const ObjectIterator &other)
- bool operator< (const ObjectIterator &other)
- bool operator== (const ObjectIterator &other)
- bool operator!= (const ObjectIterator &other)

Friends

- environment::objectIterator environment::getObjectsBegin ()
- environment::objectIterator environment::getObjectsEnd ()

7.11.1 Detailed Description

ObjectIterator class, a simple iterator for the object in environment.

7.11.2 Constructor & Destructor Documentation

7.11.2.1 ObjectIterator::ObjectIterator ( )

The default constructor, the iterated objects are allways the iterObjects vector in environment.

7.11.2.2 ObjectIterator::ObjectIterator (const **ObjectIterator** & *other*)

The copy constructor, the iterated objects are allways the iterObjects vector in environment.

Parameters

other	The ObjectIterator to copy

7.11.2.3 ObjectIterator::∼ObjectIterator ( )

The destructor, does nothing.

7.11.3 Member Function Documentation

7.11.3.1 bool ObjectIterator::operator!= (const **ObjectIterator** & *other*)

7.11.3.2 **PhysicalObject** ∗ ObjectIterator::operator∗ ( )

7.11.3.3 void ObjectIterator::operator++ ( )

7.11.3.4 void ObjectIterator::operator++ (int)

7.11.3.5 bool ObjectIterator::operator< (const **ObjectIterator** & *other*)

7.11.3.6 bool ObjectIterator::operator== (const **ObjectIterator** & *other*)

7.11.3.7 bool ObjectIterator::operator> (const **ObjectIterator** & *other*)

7.11.4 Friends And Related Function Documentation

7.11.4.1 **environment::objectIterator environment::getObjectsBegin** ( ) `[friend]`

7.11.4.2 **environment::objectIterator environment::getObjectsEnd** ( ) `[friend]`

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

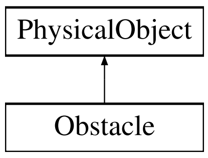
- environment.h
- environment.cpp

7.12 Obstacle Class Reference

Obstacle for the robot to hit/avoid.

`#include <Obstacle.h>`

Inheritance diagram for Obstacle:



Public Member Functions

- Obstacle (int radius, Color color)
- Obstacle (int maxRadius, int minRadius, Color color)
- Obstacle (int radius, Location loc, Color color)
- bool handleCollision (int otherId, bool wasHit)
- ∼Obstacle ()

Additional Inherited Members

7.12.1 Detailed Description

Obstacle for the robot to hit/avoid.

7.12.2 Constructor & Destructor Documentation

7.12.2.1 Obstacle::Obstacle (int *radius*, Color *color*)

Parameters

radius	the radius in pixels
color	a struct of float value 0 to 1 representing a hexedecimal color
config	a configuration table

Initialization

Obstacle is initialized with the following values:

Radius: DEFAULT_RADIUS as specified in ../config/default

Orientation: random

Speed: 0

Position: (loc.x, loc.y)

7.12.2.2 Obstacle::Obstacle (int *maxRadius*, int *minRadius*, Color *color*)

Parameters

minRadius	the minimum radius in pixels
maxRadius	the maximum radius in pixels
color	a struct of float value 0 to 1 representing a hexedecimal color

Initialization

Obstacle is initialized with the following values:

Orientation: random

Speed: 0

Position: (loc.x, loc.y)

7.12.2.3 Obstacle::Obstacle (int *radius*, Location *loc*, Color *color*)

Parameters

radius	the radius in pixels
color	a struct of float value 0 to 1 representing a hexedecimal color
loc	a struct of the x,y start Location in pixels

Initialization

Obstacle is initialized with the following values:

Orientation: 0

Speed: 0

Position: (loc.x, loc.y)

7.12.2.4 Obstacle::∼Obstacle ( )

This is the class destructor.

7.12.3 Member Function Documentation

7.12.3.1 bool Obstacle::handleCollision (int *otherId*, bool *wasHit*) `[virtual]`

Author

Lucas Kramer This function gives Obstacle an appropriate reaction when a collision occurs. Does nothing for now

Parameters

otherId	id of the object that it collides with
wasHit	tells if the object was hit previously

Implements PhysicalObject.

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

- Obstacle.h
- Obstacle.cpp

7.13 OptimizeSimulation Class Reference

OptimizeSimulation class, sets up environments and robots.

`#include <OptimizeSimulation.h>`

Public Member Functions

- OptimizeSimulation (int argc, char ∗argv[])

  The constructor for the Simulation class.
- virtual ∼OptimizeSimulation ()
- void runMainLoop ()
- int getPerformance (const NeuralNetwork &network)
- int getPerformanceRandomRepeated (const NeuralNetwork &network)
- int getPerformanceMaze (const NeuralNetwork &network)
- int getPerformanceObstacles (const NeuralNetwork &network)

7.13.1 Detailed Description

OptimizeSimulation class, sets up environments and robots.

7.13.2 Constructor & Destructor Documentation

7.13.2.1 OptimizeSimulation::OptimizeSimulation (int *argc,* char ∗ *argv[]*)

The constructor for the Simulation class.

Parameters

argc	The number of command-line arguments
argv	The command-line arguments

7.13.2.2 OptimizeSimulation::∼OptimizeSimulation ( ) `[virtual]`

7.13.3 Member Function Documentation

7.13.3.1 int OptimizeSimulation::getPerformance (const **NeuralNetwork** & *network*)

7.13.3.2 int OptimizeSimulation::getPerformanceMaze (const **NeuralNetwork** & *network*)

7.13.3.3 int OptimizeSimulation::getPerformanceObstacles (const **NeuralNetwork** & *network*)

7.13.3.4 int OptimizeSimulation::getPerformanceRandomRepeated (const **NeuralNetwork** & *network*)

7.13.3.5 void OptimizeSimulation::runMainLoop ( )

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

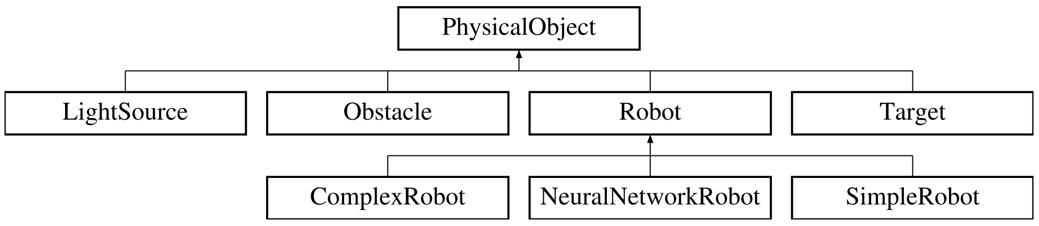
- OptimizeSimulation.h
- OptimizeSimulation.cpp

7.14 PhysicalObject Class Reference

This is a common superclass for all objects.

```
#include <PhysicalObject.h>
```

Inheritance diagram for PhysicalObject:



Public Member Functions

- PhysicalObject (ObjectType objectType, int radius=GET_INT("DEFAULT_RADIUS"), Color color=Color('?'), bool isHitable=true)
- PhysicalObject (ObjectType objectType, int maxRadius, int minRadius, Color color=Color('?'), bool isHitable=true)
- PhysicalObject (ObjectType objectType, int radius, Location loc, Color color=Color('?'), bool isHitable=true)
- virtual ∼PhysicalObject ()
- int getId () const
- void setPosition (float x, float y)
- void forceSetPosition (float x, float y)
- void setLocation (Location loc)
- void reorient (int angle, float distance)
- bool translate (float distance)
- void forceTranslate (float distance)
- void setOrientation (int degrees)
- void setSpeed (int pps)
- void setRadius (int radius)
- void setColor (Color color)
- float getXPosition () const
- float getYPosition () const
- Location getLocation () const
- int getOrientation () const
- int getSpeed () const
- int getRadius () const
- Color getColor () const
- void pointTo (const PhysicalObject &other)
- void rotate (int degrees)
- bool hasEqualPosition (const PhysicalObject &other) const
- bool updatePosition ()
- virtual void update ()
- virtual void updateMembers ()
- virtual void display ()
- virtual bool handleCollision (int otherId, bool wasHit)=0

Public Attributes

- const ObjectType objectType
- const bool isHitable

Static Protected Member Functions

- static Location findOpenLocation (int radius)

7.14.1 Detailed Description

This is a common superclass for all objects.

7.14.2 Constructor & Destructor Documentation

7.14.2.1 PhysicalObject::PhysicalObject (ObjectType *objectType*, int *radius* = GET_INT ("DEFAULT_RADIUS"), Color *color* = Color ('?'), bool *isHitable* = true)

7.14.2.2 PhysicalObject::PhysicalObject (ObjectType *objectType*, int *maxRadius*, int *minRadius*, Color *color* = Color ('?'), bool *isHitable* = true)

7.14.2.3 PhysicalObject::PhysicalObject (ObjectType *objectType*, int *radius*, Location *loc*, Color *color* = Color ('?'), bool *isHitable* = true)

7.14.2.4 PhysicalObject::∼PhysicalObject ( ) [virtual]

This is the class destructor, it is implemented by all subclasses.

7.14.3 Member Function Documentation

7.14.3.1 void PhysicalObject::display ( ) [virtual]

This is implemented by each class, normally just calls displayAsCircle.

See Also

displayAsCircle()

Reimplemented in Robot, and LightSource.

7.14.3.2 Location PhysicalObject::findOpenLocation (int *radius*) [static], [protected]

This function finds an open Location to place the object

Parameters

radius	The radius of the object

7.14.3.3 void PhysicalObject::forceSetPosition (float *x*, float *y*)

Sets the position for the object. It does not throw an exception on invalid input.

Parameters

x	position in pixels
y	position in pixels

7.14.3.4 void PhysicalObject::forceTranslate (float *distance*)

Translates without calling handleCollision. This may cause objects to overlap

Parameters

distance	Distance to move in pixels

7.14.3.5 Color PhysicalObject::getColor ( ) const

Returns the color of the object

Returns

color

7.14.3.6 int PhysicalObject::getId ( ) const

Getter function for the object's id.

Returns

The object's id

7.14.3.7 Location PhysicalObject::getLocation ( ) const

Returns the x and y Location of the object in pixels in a struct

See Also

Location

7.14.3.8 int PhysicalObject::getOrientation ( ) const

Returns the orientation of the object in degrees

Returns

orientation in degrees

7.14.3.9 int PhysicalObject::getRadius ( ) const

Returns the radius of the object

Returns

radius

7.14.3.10 int PhysicalObject::getSpeed ( ) const

Returns the speed of the object

Returns

speed in pixels per second

7.14.3.11 float PhysicalObject::getXPosition ( ) const

Returns the x position in pixels of the object

Returns

x position, horizontal from left

7.14.3.12 float PhysicalObject::getYPosition ( ) const

Returns the y position in pixels of the object

Returns

y position, vertical from bottom

7.14.3.13 virtual bool PhysicalObject::handleCollision (int *otherId,* bool *wasHit*) `[pure virtual]`

This is implemented by each class. It controls the objects behavior on collision during translate, normally just calls reorient.

Parameters

otherId	The id of the object it hit, or -1 for a wall
wasHit	true if the object hit somthing, false if hit by somthing (see translate)

Returns

true if objects were added or removed

See Also

reorient()

Implemented in Robot, LightSource, Obstacle, and Target.

7.14.3.14 bool PhysicalObject::hasEqualPosition (const **PhysicalObject** & *other*) const

This member function checks when two objects are at the same Location, it has one parameter

Parameters

other	The object to compare

Returns

A boolean value that is true when objects are overlapping

7.14.3.15 void PhysicalObject::pointTo (const **PhysicalObject** & *other*)

Calculates the direction of the object is facing towards the target object based on position of the two objects using the math function atan2

Parameters

other	A PhysicalObject class pointer

7.14.3.16 void PhysicalObject::reorient (int *angle,* float *distance*)

This function can be called by subclasses when handleing a collision. This causes the robot to rotate by the specified amount, and then translate if that is enabled in the configuration. Since translating could cause another collision, this could call back to reorient, causing infinite recusion in some cases. To prevent this, the function ommits the translate if it is more than MAX_REORIENT_RETRIES deep in recursive calls, set in the configuration

Parameters

angle	Angle to rotate in degrees
distance	Distance to move in pixels

7.14.3.17 void PhysicalObject::rotate (int *degrees*)

This function increments the object's orientation

Parameters

degrees	Angle to be incremented clockwise.

Exceptions

Input	must be within (-360,360)

7.14.3.18 void PhysicalObject::setColor (Color *color*)

Set a new color for the object.

Parameters

color	

See Also

Color

7.14.3.19 void PhysicalObject::setLocation (Location *loc*)

Sets the position for the object for the object

Parameters

loc	A struct of the x,y Location in pixels

See Also

setPosition

7.14.3.20 void PhysicalObject::setOrientation (int *degrees*)

Sets the absolute orientation for an object

Parameters

degrees	New angle for the object in degrees clockwise of North.

7.14.3.21 void PhysicalObject::setPosition (float *x*, float *y*)

Sets the position for the object

Parameters

x	x position in pixels
y	y position in pixels

7.14.3.22 void PhysicalObject::setRadius (int *radius*)

Set the radius of the object

Parameters

radius	the new radius in pixels

7.14.3.23 void PhysicalObject::setSpeed (int *pps*)

Sets the speed of an object

Parameters

pps	The new speed in pixels per second

7.14.3.24 bool PhysicalObject::translate (float *distance*)

Translates in the current direction, and calls handleCollision where needed

Parameters

distance	Distance to move in pixels

Returns

true if objects were added or removed when any collisions were handled. This is to allow the position update function to break out of the loop when objects are removed, to prevent trying to update objects that no longer exist

7.14.3.25 void PhysicalObject::update ( ) `[virtual]`

This is implemented by each class, and performs random updates, e.g. point toward target

Reimplemented in Robot.

7.14.3.26 void PhysicalObject::updateMembers ( ) `[virtual]`

This is implemented by each class, and perfoms updates such as setting the position of sub-objects

Reimplemented in Robot.

7.14.3.27 bool PhysicalObject::updatePosition ( )

This member function uses the speed and time to update the Location

Returns

true if objects were added or removed

7.14.4 Member Data Documentation

7.14.4.1 const bool PhysicalObject::isHitable

7.14.4.2 const ObjectType PhysicalObject::objectType

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

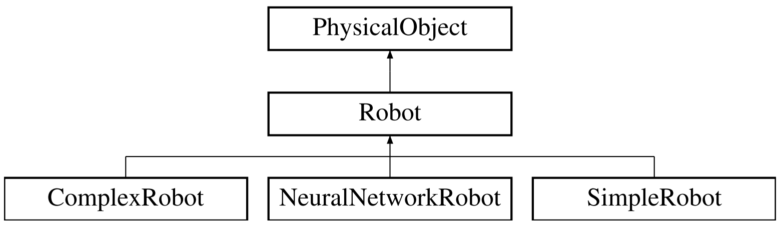
- PhysicalObject.h
- PhysicalObject.cpp

7.15 Robot Class Reference

Robot that moves around the window and bumps into obstacles.

```
#include <Robot.h>
```

Inheritance diagram for Robot:



Public Member Functions

- Robot (RobotType robotType, int radius, Color color, Color lineColor, int targetId=-1)
- Robot (RobotType robotType, int radius, Location loc, Color color, Color lineColor, int targetId=-1)
- ∼Robot ()
- int getTarget () const
- void setTarget (int id)
- bool handleCollision (int otherId, bool wasHit)
- void update ()
- void updateMembers ()
- void display ()
- void setLineColor (Color lineColor)
- Color getLineColor ()

Public Attributes

- const RobotType robotType

Protected Member Functions

- virtual float getLeftSpeed (float leftLightSensorVal, float rightLightSensorVal, float leftRobotSensorVal, float rightRobotSensorVal, float leftObstacleSensorVal, float rightObstacleSensorVal, float leftTargetSensorVal, float rightTargetSensorVal)=0
- virtual float getRightSpeed (float leftLightSensorVal, float rightLightSensorVal, float leftRobotSensorVal, float rightRobotSensorVal, float leftObstacleSensorVal, float rightObstacleSensorVal, float leftTargetSensorVal, float rightTargetSensorVal)=0

Additional Inherited Members

7.15.1 Detailed Description

Robot that moves around the window and bumps into obstacles.

7.15.2 Constructor & Destructor Documentation

7.15.2.1 Robot::Robot (**RobotType** *robotType,* int *radius,* **Color** *color,* **Color** *lineColor,* int *targetId* = `-1`)

Parameters

robotType	the robot type
radius	the radius in pixels
color	color of the robot itself, a struct of float value 0 to 1 representing a hexedecimal color
lineColor	color of the line, a struct of float value 0 to 1 representing a hexedecimal color

Initialization

Robot is initialized with the following values:

Orientation: 0

Speed: 0

Position: (loc.x, loc.y)

7.15.2.2 Robot::Robot (**RobotType** *robotType,* int *radius,* **Location** *loc,* **Color** *color,* **Color** *lineColor,* int *targetId* = `-1`)

Parameters

robotType	the robot type
radius	the radius in pixels
color	a struct of float value 0 to 1 representing a hexedecimal color
linecolor	color of the line, a struct of float value 0 to 1 representing a hexedecimal color
loc	start Location of the robot

Initialization

Robot is initialized with the following values:

Orientation: random

Speed: 0

Position: (loc.x, loc.y)

7.15.2.3 Robot::∼Robot ( )

This is the class destructor.

7.15.3 Member Function Documentation

7.15.3.1 void Robot::display ( ) [virtual]

Author

Lucas Kramer This function displays the Robot in the graphics

Reimplemented from PhysicalObject.

7.15.3.2 virtual float Robot::getLeftSpeed (float *leftLightSensorVal*, float *rightLightSensorVal*, float *leftRobotSensorVal*, float *rightRobotSensorVal*, float *leftObstacleSensorVal*, float *rightObstacleSensorVal*, float *leftTargetSensorVal*, float *rightTargetSensorVal*) [protected], [pure virtual]

Implemented in ComplexRobot, NeuralNetworkRobot, and SimpleRobot.

7.15.3.3 Color Robot::getLineColor ( )

7.15.3.4 virtual float Robot::getRightSpeed (float *leftLightSensorVal*, float *rightLightSensorVal*, float *leftRobotSensorVal*, float *rightRobotSensorVal*, float *leftObstacleSensorVal*, float *rightObstacleSensorVal*, float *leftTargetSensorVal*, float *rightTargetSensorVal*) [protected], [pure virtual]

Implemented in ComplexRobot, NeuralNetworkRobot, and SimpleRobot.

7.15.3.5 int Robot::getTarget ( ) const

Author

Lucas Kramer This function gets the id of the target for the robot to seek.

Parameters

id	the id of the target

7.15.3.6 bool Robot::handleCollision (int *otherId*, bool *wasHit*) [virtual]

Author

Lucas Kramer This function gives Robot an appropriate reaction when a collision occurs

Parameters

otherId	id of the object that it collides with
wasHit	tells if the object was hit previously

Implements PhysicalObject.

7.15.3.7 void Robot::setLineColor (Color *lineColor*)

Author

Lucas Kramer This function sets a new color for the robot's direction line.

Parameters

lineColor	color of the line, a struct of float value 0 to 1 representing a hexedecimal color

7.15.3.8 void Robot::setTarget (int *id*)

Author

Lucas Kramer This function sets the id of the target for the robot to seek.

Returns

the target id

7.15.3.9 void Robot::update ( ) `[virtual]`

Author

Lucas Kramer This function updates the Robot's wheel speeds from the sensors

Reimplemented from PhysicalObject.

7.15.3.10 void Robot::updateMembers ( ) `[virtual]`

Author

Lucas Kramer This function updates the position of the robot's sub-objects

Reimplemented from PhysicalObject.

7.15.4 Member Data Documentation

7.15.4.1 const RobotType Robot::robotType

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

- Robot.h
- Robot.cpp

7.16 Sensor Class Reference

```
#include <Sensor.h>
```

Public Member Functions

- Sensor (Location loc, int orientation, ObjectType typeDetected)
- Sensor (Location loc, int orientation, int viewAngle, ObjectType typeDetected)
- void setPosition (float x, float y)
- void setPosition (Location loc)
- Location getPosition ()
- float getXPosition ()
- float getYPosition ()

- void setOrientation (int orientation)
- int getOrientation ()
- void setViewAngle (int degrees)
- int getViewAngle ()
- void setTypeDetected (ObjectType type)
- ObjectType getTypeDetected ()
- void updatePosition (Location robotLoc, int robotAngle)
- void display ()
- float sense ()

7.16.1 Constructor & Destructor Documentation

7.16.1.1 Sensor::Sensor (**Location** *loc*, int *orientation*, **ObjectType** *typeDetected*)

Sensor constructor with default angle

Parameters

loc	Location of the sensor in x and y
orientation	orientation of the sensor
typeDetected	type that sensor will detect

7.16.1.2 Sensor::Sensor (**Location** *loc*, int *orientation*, int *viewAngle*, **ObjectType** *typeDetected*)

Sensor constructor

Parameters

loc	Location of the sensor in x and y
orientation	orientation of the sensor
viewAngle	view angle of the sensor in degrees
typeDetected	type that sensor will detect

7.16.2 Member Function Documentation

7.16.2.1 void Sensor::display ( )

Displays the sensor

Author

Carl

7.16.2.2 int Sensor::getOrientation ( )

Returns the orientation of the sensor

Returns

orientation in degrees

7.16.2.3 Location Sensor::getPosition ( )

Returns a Location struct of x and y position in pixels of the sensor

Returns

A Location struct of x and y position

7.16.2.4 ObjectType Sensor::getTypeDetected ( )

Returns the type that sensor detects

Author

Himawan

Returns

type the sensor detects

7.16.2.5 int Sensor::getViewAngle ( )

Returns the view angle of the sensor

Returns

view angle in degrees

7.16.2.6 float Sensor::getXPosition ( )

Returns the x position in pixels of the sensor

Returns

x position

7.16.2.7 float Sensor::getYPosition ( )

Returns the y position in pixels of the sensor

Returns

y position

7.16.2.8 float Sensor::sense ( )

Returns some strength by sensing the environment

Author

Carl & Himawan

Returns

the strength of sensor reading of [0..1]

7.16.2.9 void Sensor::setOrientation (int *orientation*)

Sets the orientation for the sensor

Parameters

orientation	The orientation of the object in degrees

7.16.2.10 void Sensor::setPosition (float *x*, float *y*)

Sets the position for the sensor

Parameters

x	x position in pixels
y	y position in pixels

7.16.2.11 void Sensor::setPosition (Location *loc*)

Sets the position for the sensor

Parameters

loc	A struct of the x and y Location in pixels

7.16.2.12 void Sensor::setTypeDetected (ObjectType *type*)

Sets the object type that the sensor detects

Author

Himawan

Parameters

type	object type to detect

7.16.2.13 void Sensor::setViewAngle (int *degrees*)

Sets the view angle of the sensor

Parameters

degrees	The view angle of the sensor in degrees

7.16.2.14 void Sensor::updatePosition (Location *robotLoc*, int *robotAngle*)

Called to update the position of the sensor match the updated position of the robot

Author

Carl

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

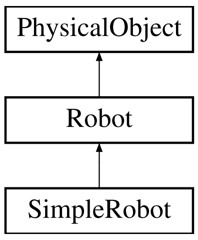
- Sensor.h
- Sensor.cpp

7.17 SimpleRobot Class Reference

A simple robot with uncrossed feedback.

`#include <SimpleRobot.h>`

Inheritance diagram for SimpleRobot:



Public Member Functions

- SimpleRobot (int radius, Color color, Color lineColor, int targetId=-1)
- SimpleRobot (int radius, Location loc, Color color, Color lineColor, int targetId=-1)
- ∼SimpleRobot ()
- float getLeftSpeed (float leftLightSensorVal, float rightLightSensorVal, float leftRobotSensorVal, float right-RobotSensorVal, float leftObstacleSensorVal, float rightObstacleSensorVal, float leftTargetSensorVal, float rightTargetSensorVal)
- float getRightSpeed (float leftLightSensorVal, float rightLightSensorVal, float leftRobotSensorVal, float right-RobotSensorVal, float leftObstacleSensorVal, float rightObstacleSensorVal, float leftTargetSensorVal, float rightTargetSensorVal)

Additional Inherited Members

7.17.1 Detailed Description

A simple robot with uncrossed feedback.

7.17.2 Constructor & Destructor Documentation

7.17.2.1 SimpleRobot::SimpleRobot (int *radius,* Color *color,* Color *lineColor,* int *targetId* = `-1`)

7.17.2.2 SimpleRobot::SimpleRobot (int *radius,* Location *loc,* Color *color,* Color *lineColor,* int *targetId* = `-1`)

7.17.2.3 SimpleRobot::∼SimpleRobot ( )

7.17.3 Member Function Documentation

7.17.3.1 float SimpleRobot::getLeftSpeed (float *leftLightSensorVal,* float *rightLightSensorVal,* float *leftRobotSensorVal,* float *rightRobotSensorVal,* float *leftObstacleSensorVal,* float *rightObstacleSensorVal,* float *leftTargetSensorVal,* float *rightTargetSensorVal*) `[virtual]`

Implements Robot.

7.17.3.2 float SimpleRobot::getRightSpeed (float *leftLightSensorVal,* float *rightLightSensorVal,* float *leftRobotSensorVal,* float *rightRobotSensorVal,* float *leftObstacleSensorVal,* float *rightObstacleSensorVal,* float *leftTargetSensorVal,* float *rightTargetSensorVal*) `[virtual]`

Implements Robot.

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

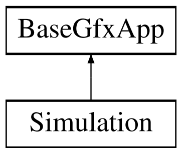
- SimpleRobot.h
- SimpleRobot.cpp

7.18 Simulation Class Reference

Simulation class, sets up the GUI and the drawing environment.

`#include <Simulation.h>`

Inheritance diagram for Simulation:



Public Types

- enum UIControlType {
UI_QUIT = 0, UI_START = 1, UI_PAUSE = 2, UI_RESUME = 3,
UI_RESET = 4, UI_ADD_RT = 5, UI_REMOVE_RT = 6, UI_REMOVE_ALL_RT = 7,
UI_ADD_O = 8, UI_REMOVE_O = 9, UI_REMOVE_ALL_O = 10, UI_REFRESH_SETTINGS_O = 11 }

Public Member Functions

- Simulation (int argc, char ∗argv[])

  The constructor for the Simulation class.
- virtual ∼Simulation ()
- void initObjects ()

  Adds objects according to configuration.
- void tryAddRobotTarget ()

  Adds a robot and target to the simulation, or raises an error on failure.
- void tryAddRobot ()

  Adds a robot to the simulation, or raises an error on failure.
- void tryAddStationaryLightSource ()

  Adds a stationary light to the simulation, or raises an error on failure.
- void tryAddMovingLightSource ()

  Adds a moving light to the simulation, or raises an error on failure.
- void tryAddObstacle ()

  Adds a obstacle to the simulation, or raises an error on failure.
- void tryRemoveRobotTarget ()

  Removes a robot and target from the simulation, or raises an error on failure.
- void tryRemoveLightSource ()

  Removes a light from the simulation, or raises an error on failure.

- void tryRemoveObstacle ()

  Removes a obstacle from the simulation, or raises an error on failure.
- void tryOpen ()

  Loads a simulation, or raises an error on failure.
- void trySave ()

  Saves a simulation, or raises an error on failure.
- void display ()

  Call-back function to render all the objects. This function is called repeatedly from glut, and iterates through the objects and calls their respective display functions.
- void advance ()

  Call-back function to update the positions of all objects. This function is called repeatedly from glut, and iterates through the objects and calls their respective updatePosition functions.
- void gluiControl (int controlID)

  Call-back function for user input.
- void leftMouseDown (int x, int y)

  Call-back function for mouse click.
- void leftMouseUp (int x, int y)

  Call-back function for mouse click.
- void middleMouseDown (int x, int y)

  Call-back function for mouse click.
- void mouseDragged (int x, int y)

  Call-back function for mouse drag.
- void keyboard (unsigned char key, int x, int y)

  Call-back function keyboard press.
- void keyboardSpecial (int key, int x, int y)

  Call-back function for special keyboard press.
- void start (int)
- void pause (int)
- void resume (int)
- void reinit (int)

Static Public Member Functions

- static void s_start (int)
- static void s_pause (int)
- static void s_resume (int)
- static void s_reinit (int)
- static void s_addRobotTarget (int)
- static void s_addRobot (int)
- static void s_addStationaryLightSource (int)
- static void s_addMovingLightSource (int)
- static void s_addObstacle (int)
- static void s_removeRobotTarget (int)
- static void s_removeLightSource (int)
- static void s_removeObstacle (int)
- static void s_removeAllRobotTarget (int)
- static void s_removeAllLightSource (int)
- static void s_removeAllObstacle (int)
- static void s_refreshConfiguration (int)
- static void s_open (int)
- static void s_save (int)
- static void s_neuralNetworkFileChanged (int)

Additional Inherited Members

7.18.1 Detailed Description

Simulation class, sets up the GUI and the drawing environment.

7.18.2 Member Enumeration Documentation

7.18.2.1 enum Simulation::UIControlType

Enumerator

- ***UI_QUIT***
- ***UI_START***
- ***UI_PAUSE***
- ***UI_RESUME***
- ***UI_RESET***
- ***UI_ADD_RT***
- ***UI_REMOVE_RT***
- ***UI_REMOVE_ALL_RT***
- ***UI_ADD_O***
- ***UI_REMOVE_O***
- ***UI_REMOVE_ALL_O***
- ***UI_REFRESH_SETTINGS_O***

7.18.3 Constructor & Destructor Documentation

7.18.3.1 Simulation::Simulation (int *argc*, char ∗ *argv[]*)

The constructor for the Simulation class.

Parameters

argc	The number of command-line arguments
argv	The command-line arguments

7.18.3.2 Simulation::∼Simulation ( ) `[virtual]`

7.18.4 Member Function Documentation

7.18.4.1 void Simulation::advance ( ) `[virtual]`

Call-back function to update the positions of all objects. This function is called repeatedly from glut, and iterates through the objects and calls their respective updatePosition functions.

Reimplemented from BaseGfxApp.

7.18.4.2 void Simulation::display ( ) `[virtual]`

Call-back function to render all the objects. This function is called repeatedly from glut, and iterates through the objects and calls their respective display functions.

Reimplemented from BaseGfxApp.

7.18.4.3 void Simulation::gluiControl (int *controlID*) [virtual]

Call-back function for user input.

Reimplemented from BaseGfxApp.

7.18.4.4 void Simulation::initObjects ( )

Adds objects according to configuration.

7.18.4.5 void Simulation::keyboard (unsigned char *key*, int *x*, int *y*) [virtual]

Call-back function keyboard press.

Reimplemented from BaseGfxApp.

7.18.4.6 void Simulation::keyboardSpecial (int *key*, int *x*, int *y*) [virtual]

Call-back function for special keyboard press.

Reimplemented from BaseGfxApp.

7.18.4.7 void Simulation::leftMouseDown (int *x*, int *y*) [virtual]

Call-back function for mouse click.

Reimplemented from BaseGfxApp.

7.18.4.8 void Simulation::leftMouseUp (int *x*, int *y*) [virtual]

Call-back function for mouse click.

Reimplemented from BaseGfxApp.

7.18.4.9 void Simulation::middleMouseDown (int *x*, int *y*) [virtual]

Call-back function for mouse click.

Reimplemented from BaseGfxApp.

7.18.4.10 void Simulation::mouseDragged (int *x*, int *y*) [virtual]

Call-back function for mouse drag.

Reimplemented from BaseGfxApp.

7.18.4.11 void Simulation::pause (int)

7.18.4.12 void Simulation::reinit (int)

7.18.4.13 void Simulation::resume (int)

7.18.4.14 void Simulation::s_addMovingLightSource (int *a*) [static]

7.18.4.15 void Simulation::s_addObstacle (int *a*) [static]

7.18.4.16 void Simulation::s_addRobot (int *a*) [static]

7.18.4.17 void Simulation::s_addRobotTarget (int *a*) [static]

7.18.4.18 void Simulation::s_addStationaryLightSource (int *a*) [static]

7.18.4.19 void Simulation::s_neuralNetworkFileChanged (int *a*) [static]

7.18.4.20 void Simulation::s_open (int *a*) [static]

7.18.4.21 void Simulation::s_pause (int *a*) [static]

7.18.4.22 void Simulation::s_refreshConfiguration (int *a*) [static]

7.18.4.23 void Simulation::s_reinit (int *a*) [static]

7.18.4.24 void Simulation::s_removeAllLightSource (int *a*) [static]

7.18.4.25 void Simulation::s_removeAllObstacle (int *a*) [static]

7.18.4.26 void Simulation::s_removeAllRobotTarget (int *a*) [static]

7.18.4.27 void Simulation::s_removeLightSource (int *a*) [static]

7.18.4.28 void Simulation::s_removeObstacle (int *a*) [static]

7.18.4.29 void Simulation::s_removeRobotTarget (int *a*) [static]

7.18.4.30 void Simulation::s_resume (int *a*) [static]

7.18.4.31 void Simulation::s_save (int *a*) [static]

7.18.4.32 void Simulation::s_start (int *a*) [static]

7.18.4.33 void Simulation::start (int)

7.18.4.34 void Simulation::tryAddMovingLightSource ( )

Adds a moving light to the simulation, or raises an error on failure.

7.18.4.35 void Simulation::tryAddObstacle ( )

Adds a obstacle to the simulation, or raises an error on failure.

7.18.4.36 void Simulation::tryAddRobot ( )

Adds a robot to the simulation, or raises an error on failure.

7.18.4.37 void Simulation::tryAddRobotTarget ( )

Adds a robot and target to the simulation, or raises an error on failure.

7.18.4.38 void Simulation::tryAddStationaryLightSource ( )

Adds a stationary light to the simulation, or raises an error on failure.

7.18.4.39 void Simulation::tryOpen ( )

Loads a simulation, or raises an error on failure.

7.18.4.40 void Simulation::tryRemoveLightSource ( )

Removes a light from the simulation, or raises an error on failure.

7.18.4.41 void Simulation::tryRemoveObstacle ( )

Removes a obstacle from the simulation, or raises an error on failure.

7.18.4.42 void Simulation::tryRemoveRobotTarget ( )

Removes a robot and target from the simulation, or raises an error on failure.

7.18.4.43 void Simulation::trySave ( )

Saves a simulation, or raises an error on failure.

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

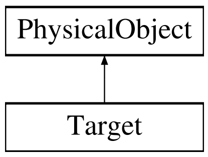
- Simulation.h
- Simulation.cpp

7.19 Target Class Reference

Target for the robot to seek.

`#include <Target.h>`

Inheritance diagram for Target:



Public Member Functions

- Target ()
- Target (int radius, Color color, int targetNum=TARGET)
- Target (int maxRadius, int minRadius, Color color, int targetNum=TARGET)
- Target (int radius, Location loc, Color color, int targetNum=TARGET)
- bool handleCollision (int otherId, bool wasHit)
- ∼Target ()

Additional Inherited Members

7.19.1 Detailed Description

Target for the robot to seek.

7.19.2 Constructor & Destructor Documentation

7.19.2.1 Target::Target ( )

7.19.2.2 Target::Target (int *radius*, Color *color*, int *targetNum* = TARGET)

7.19.2.3 Target::Target (int *maxRadius*, int *minRadius*, Color *color*, int *targetNum* = TARGET)

7.19.2.4 Target::Target (int *radius*, Location *loc*, Color *color*, int *targetNum* = TARGET)

7.19.2.5 Target::∼Target ( )

This is the class destructor.

7.19.3 Member Function Documentation

7.19.3.1 bool Target::handleCollision (int *otherId*, bool *wasHit*) `[virtual]`

Author

Lucas Kramer This function gives Target an appropriate reaction when a collision occurs.

Parameters

otherId	id of the object that it collides with
wasHit	tells if the object was hit previously

Implements PhysicalObject.

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

- Target.h
- Target.cpp

Chapter 8

File Documentation

8.1 artist.cpp File Reference

```
#include "Color.h"
#include "artist.h"
#include "configuration.h"
#include <GL/glut.h>
#include <GL/glu.h>
#include <math.h>
```

Namespaces

- artist

  graphical commands

Macros

- #define _USE_MATH_DEFINES

Functions

- void artist::drawObject (Location loc, int radius, Color color)
- void artist::debugArrow (Location loc, int orientation)
- void artist::drawLight (Location loc, int radius, Color color)
- void artist::drawObstacle (Location loc, int radius)
- void artist::drawSensor (Location loc, int orientation, int angle, float intensity)
- void artist::drawRobot (Location loc, int radius, int orientation, Color color, Color lineColor)

8.1.1 Macro Definition Documentation

8.1.1.1 #define _USE_MATH_DEFINES

8.2 artist.h File Reference

A namespace for OpenGL graphical functions.

```
#include "Color.h"
#include "Location.h"
```

Namespaces

- artist

  graphical commands

Functions

- void artist::debugArrow (Location loc, int orientation)
- void artist::drawObject (Location loc, int radius, Color color)
- void artist::drawLight (Location loc, int radius, Color color)
- void artist::drawObstacle (Location loc, int radius)
- void artist::drawSensor (Location loc, int orientation, int angle, float intensity)
- void artist::drawRobot (Location loc, int radius, int orientation, Color color, Color lineColor)

8.2.1 Detailed Description

A namespace for OpenGL graphical functions.

Author

Carl Bahn Lucas Kramer

8.3 BaseGfxApp.cpp File Reference

Implementation of BaseGfxApp.

```
#include "BaseGfxApp.h"
```

8.3.1 Detailed Description

Implementation of BaseGfxApp.

Author

CSci3081 Guru Carl Bahn, Lucas Kramer

8.4 BaseGfxApp.h File Reference

The basic application class for CSci-3081 project. Uses GLUT and GLUI and wraps them in a nice C++ interface.

```
#include <string>
#include <iostream>
#include <assert.h>
#include <GL/glui.h>
```

Classes

- class BaseGfxApp

  Graphics driver class.

8.4.1 Detailed Description

The basic application class for CSci-3081 project. Uses GLUT and GLUI and wraps them in a nice C++ interface.

Author

CSci3081 Guru Carl Bahn, Lucas Kramer

8.5 Color.cpp File Reference

Utility functions for handling color.

```
#include "Color.h"
#include "configuration.h"
#include <iostream>
#include <cstdlib>
#include <math.h>
```

8.5.1 Detailed Description

Utility functions for handling color.

Author

Carl Bahn Lucas Kramer

8.6 Color.h File Reference

Definintions for representing any hexedecimal color.

```
#include <iostream>
```

Classes

- struct Color

  This struct holds the representation of a color.

Macros

- #define GET_COLOR(COLOR_VAR)

Typedefs

- typedef struct Color Color

  This struct holds the representation of a color.

8.6.1 Detailed Description

Definintions for representing any hexedecimal color.

Author

Lucas Kramer

8.6.2 Macro Definition Documentation

8.6.2.1 #define GET_COLOR(*COLOR_VAR*)

Value:

```
(GET_BOOL("USE_HEX_COLORS")?                                    \
   Color(GET_INT(COLOR_VAR "_HEX")) :                             \
   Color(GET_CHAR(COLOR_VAR)))
```

8.6.3 Typedef Documentation

8.6.3.1 typedef struct Color Color

This struct holds the representation of a color.

Each field is a float value that shoult be between 0 and 1. This allows a direct translation from hex colors, with each field being the hex RGB value / 255.

8.7 ComplexRobot.cpp File Reference

The representation of a robot within the simulation.

```
#include <GL/glu.h>
#include <GL/glut.h>
#include <stdexcept>
#include "environment.h"
#include "Robot.h"
#include "ComplexRobot.h"
#include "configuration.h"
```

8.7.1 Detailed Description

The representation of a robot within the simulation.

Author

Lucas Kramer

8.8 ComplexRobot.h File Reference

The representation of a robot within the simulation.

```
#include "PhysicalObject.h"
#include "Robot.h"
#include "Sensor.h"
#include "configuration.h"
```

Classes

- class ComplexRobot

  A complex robot with configurable feedback from all sensors.

8.8.1 Detailed Description

The representation of a robot within the simulation.

Author

Lucas Kramer

8.9 configuration.cpp File Reference

Implementation for configuration file loader.

```
#include <vector>
#include <iostream>
#include <fstream>
#include <sstream>
#include <string>
#include <string.h>
#include <boost/regex.hpp>
#include <boost/algorithm/string.hpp>
#include <boost/algorithm/string/regex.hpp>
#include "configuration.h"
```

Typedefs

- typedef unordered_map< string,
  configValue > ConfigTable

  A type alias for an unordered map containing strings mapped to configValues.

Functions

- bool isAllWhitespace (const string &line)

  A helper function for loadConfig that tests if the line is valid input.
- configValue parseValue (const string &type, const string &valueText)
- ConfigTable mergeConfigTables (ConfigTable c1, ConfigTable c2)
- ConfigTable loadConfig (const string &filename)
- string expandVar (const smatch &match)

8.9.1 Detailed Description

Implementation for configuration file loader.

Author

Lucas Kramer Carl Bahn

See config.h for more information.

8.9.2 Typedef Documentation

8.9.2.1 typedef unordered_map<string, configValue> ConfigTable

A type alias for an unordered map containing strings mapped to configValues.

8.9.3 Function Documentation

8.9.3.1 string expandVar (const smatch & *match*)

8.9.3.2 bool isAllWhitespace (const string & *line*)

A helper function for loadConfig that tests if the line is valid input.

8.9.3.3 ConfigTable loadConfig (const string & *filename*)

8.9.3.4 ConfigTable mergeConfigTables (ConfigTable *c1,* ConfigTable *c2*)

8.9.3.5 configValue parseValue (const string & *type,* const string & *valueText*)

8.10 configuration.h File Reference

Interface definitions for configuration file loader.

```
#include <string>
#include <unordered_map>
```

Classes

- struct configValue

  This struct holds a configuration value of any legal type.
- class Configuration

Macros

- #define GET_INT(NAME) Configuration::get()->getIntConfig(NAME)
- #define GET_FLOAT(NAME) Configuration::get()->getFloatConfig(NAME)
- #define GET_BOOL(NAME) Configuration::get()->getBoolConfig(NAME)
- #define GET_CHAR(NAME) Configuration::get()->getCharConfig(NAME)
- #define GET_STRING(NAME) Configuration::get()->getStringConfig(NAME)

8.10.1 Detailed Description

Interface definitions for configuration file loader.

Author

Lucas Kramer

The format of the config file is a series of lines with the format

<type> <name> = <value>

Blank lines are allowed, and comments # can occur at the end of a line.

Valid types are int, hex, octal, float, bool/boolean, char, and string. Note that int, hex, and octal all create a variable with type int, and only affect how the value is parsed.

Names can be [A-Za-z][A-Za-z0-9_-]∗, but the recommended usage is all upper case, seperated by underscores.

The following is a list of valid value formats:

Type name	Format	Examples	Notes
int	[0-9]+	42	
hex	(0x)?[0-9A-Fa-f]+	0x3AF4, 0x3af4, 3AF4	It is recommended to use the 0x prefix and upper case A-F
hex	[0-7]+	0123, 123	It is recommended to use the 0 prefix
float	[0-9]+(.[0-9]+)?	3, 3.14	
bool/boolean	true|false	true, false	It is recommended to use the bool type name
string	"[^"\n]∗"	"Hello, World! ", "", "$OTHER"	$ followed by a variable is expanded to that variable. An actual $ must be escaped
char	'([^\n\r\t]|\\n|\\r|\\t)'	'a', 'A', '4', '\n', '\t'	

In addition to variable settings, it is possible to load other configuration files. This has the syntax:

use <filename>

where filename is a string. The path to <filename> is with respect to the directory containing the current file - absolute paths are not permitted. When an included file contains a variable with the same name as a value that is already defined, the current behavior is to overwrite the old value. Any value re-definition causes a warning.

8.10.2 Macro Definition Documentation

8.10.2.1 #define GET_BOOL(*NAME*) Configuration::get()->getBoolConfig(NAME)

8.10.2.2 #define GET_CHAR(*NAME*) Configuration::get()->getCharConfig(NAME)

8.10.2.3 #define GET_FLOAT(*NAME*) Configuration::get()->getFloatConfig(NAME)

8.10.2.4 #define GET_INT(*NAME*) Configuration::get()->getIntConfig(NAME)

8.10.2.5 #define GET_STRING(*NAME*) Configuration::get()->getStringConfig(NAME)

8.11 environment.cpp File Reference

```
#include "PhysicalObject.h"
#include "environment.h"
#include "configuration.h"
#include <iostream>
#include <math.h>
```

Functions

- bool isTouching (Location l1, int r1, Location l2, int r2)

8.11.1 Function Documentation

8.11.1.1 bool isTouching (Location *l1,* int *r1,* Location *l2,* int *r2*)

Checks if two objects specified by their Locations and radii

Returns

a boolean value that is true when objects are overlapping

8.12 environment.h File Reference

```
#include "Location.h"
#include "configuration.h"
#include <unordered_map>
#include <vector>
#include <mutex>
#include <stdexcept>
```

Classes

- class ObjectIterator

  ObjectIterator class, a simple iterator for the object in environment.
- class NoOpenLocationException

  An exception to be thrown when an open Location cannot be found.

Namespaces

- environment

  environment namespace, handles all the objects as a group. Also manages object ids and collision detection

Typedefs

- typedef ObjectIterator environment::objectIterator

Functions

- int environment::addObject (PhysicalObject ∗object)

  Adds an object to the environment.
- void environment::removeObject (int id)

  Removes an object from the environment.
- void environment::clear ()

  Removes all objects from the environment and resets the id counter.
- unsigned environment::getNumObjects ()

  Gets the number of objects in environment.
- PhysicalObject ∗ environment::getObject (int id)

  Finds an object from the environment.
- objectIterator environment::getObjectsBegin ()

  Gets an iterator to the beginning of the objects.
- objectIterator environment::getObjectsEnd ()

  Gets an iterator to the end of the objects.
- bool environment::isTouchingWall (Location l, int r)
- bool environment::isTouchingWall (int id)
- bool environment::isTouchingObject (Location l, int r, int id)
- bool environment::isTouchingHitableObject (Location l, int r, int id)
- bool environment::isTouchingObject (Location l, int r)
- bool environment::isTouchingHitableObject (Location l, int r)
- bool environment::isTouchingObject (int id)
- bool environment::isTouchingHitableObject (int id)
- bool environment::isColliding (Location l, int r)
- bool environment::isColliding (int id)
- bool environment::isCollidingWithHitable (Location l, int r)
- bool environment::isCollidingWithHitable (int id)
- int environment::getCollisionId (Location l, int r, int id)
- int environment::getHitableCollisionId (Location l, int r, int id)
- int environment::getCollisionId (Location l, int r)
- int environment::getHitableCollisionId (Location l, int r)
- int environment::getCollisionId (int id)
- int environment::getHitableCollisionId (int id)

8.13 LightSource.cpp File Reference

The representation of a target in the simulation.

```
#include <stdlib.h>
#include <math.h>
#include "artist.h"
#include "environment.h"
#include "LightSource.h"
#include "configuration.h"
```

8.13.1 Detailed Description

The representation of a target in the simulation.

Author

Himawan Go Lucas Kramer

8.14 LightSource.h File Reference

The representation of an obstacle in the simulation.

```
#include "PhysicalObject.h"
#include "configuration.h"
```

Classes

- class LightSource

  LightSource for the robot to seek.

8.14.1 Detailed Description

The representation of an obstacle in the simulation.

Author

Himawan Go Lucas Kramer

8.15 Location.h File Reference

Classes

- struct Location

  an xy position on the screen, approximately in pixels x is horizontal from the left and y is vertical from the bottom

Typedefs

- typedef struct Location Location

  an xy position on the screen, approximately in pixels x is horizontal from the left and y is vertical from the bottom

8.15.1 Typedef Documentation

8.15.1.1 typedef struct Location Location

an xy position on the screen, approximately in pixels x is horizontal from the left and y is vertical from the bottom

8.16 main.cpp File Reference

The main function to execute the simulation program.

```
#include <stdlib.h>
#include <time.h>
#include "OptimizeSimulation.h"
#include "Simulation.h"
#include "configuration.h"
```

Macros

- #define DEFAULT_CONFIG "../config/default"

Functions

- int main (int argc, char ∗argv[])

8.16.1 Detailed Description

The main function to execute the simulation program.

Author

Lucas Kramer
Carl Bahn
Himawan Go

8.16.2 Macro Definition Documentation

8.16.2.1 #define DEFAULT_CONFIG "../config/default"

8.16.3 Function Documentation

8.16.3.1 int main (int *argc,* char ∗ *argv[]*)

Main function to execute the simulation

8.17 mainpage.h File Reference

8.18 NeuralNetwork.cpp File Reference

A feed-forward neural network class.

```
#include <stdlib.h>
#include <iostream>
#include <vector>
#include <mutex>
#include <fstream>
#include <sstream>
#include <string>
#include <string.h>
#include <boost/regex.hpp>
#include <boost/algorithm/string.hpp>
#include <boost/algorithm/string/regex.hpp>
#include "NeuralNetwork.h"
```

8.18.1 Detailed Description

A feed-forward neural network class.

Author

Lucas Kramer

8.19 NeuralNetwork.h File Reference

A feed-forward neural network class.

```
#include <vector>
#include <mutex>
```

Classes

- class NeuralNetwork

  A representation of a neural network.

8.19.1 Detailed Description

A feed-forward neural network class.

Author

Lucas Kramer

8.20 NeuralNetworkRobot.cpp File Reference

The representation of a neural network robot within the simulation.

```
#include <GL/glu.h>
#include <GL/glut.h>
#include <stdexcept>
#include "environment.h"
#include "Robot.h"
#include "NeuralNetworkRobot.h"
#include "NeuralNetwork.h"
#include "configuration.h"
```

8.20.1 Detailed Description

The representation of a neural network robot within the simulation.

Author

Lucas Kramer

8.21 NeuralNetworkRobot.h File Reference

The representation of a neural network robot.

```
#include "PhysicalObject.h"
#include "Robot.h"
#include "Sensor.h"
#include "NeuralNetwork.h"
#include "configuration.h"
```

Classes

- class NeuralNetworkRobot

  A robot controlled by a neural network with inputs from the sensors.

8.21.1 Detailed Description

The representation of a neural network robot.

Author

Lucas Kramer

8.22 Obstacle.cpp File Reference

The representation of an obstacle in the simulation.

```
#include <stdlib.h>
#include <math.h>
#include "environment.h"
#include "Obstacle.h"
#include "configuration.h"
#include "artist.h"
```

8.22.1 Detailed Description

The representation of an obstacle in the simulation.

Author

Himawan Go Lucas Kramer

8.23 Obstacle.h File Reference

The representation of an obstacle in the simulation.

```
#include "PhysicalObject.h"
#include "configuration.h"
```

Classes

- class Obstacle

  Obstacle for the robot to hit/avoid.

8.23.1 Detailed Description

The representation of an obstacle in the simulation.

Author

Himawan Go Lucas Kramer

8.24 OptimizeSimulation.cpp File Reference

```
#include <unistd.h>
#include <stdlib.h>
#include <signal.h>
#include <algorithm>
#include <vector>
#include <mutex>
#include <stdexcept>
#include <sstream>
#include <fstream>
#include <iostream>
#include <climits>
#include <sys/stat.h>
#include <boost/interprocess/sync/named_upgradable_mutex.hpp>
#include "Robot.h"
#include "SimpleRobot.h"
#include "ComplexRobot.h"
#include "NeuralNetworkRobot.h"
#include "NeuralNetwork.h"
#include "Target.h"
#include "Obstacle.h"
#include "LightSource.h"
#include "Location.h"
#include "configuration.h"
#include "environment.h"
#include "util.h"
#include "OptimizeSimulation.h"
```

8.25 OptimizeSimulation.h File Reference

Robot simultaion for optimizing the NeuralNetworkRobot.

```
#include <vector>
#include <boost/interprocess/sync/named_upgradable_mutex.hpp>
#include "Color.h"
#include "Location.h"
#include "configuration.h"
#include "environment.h"
#include "util.h"
#include "PhysicalObject.h"
#include "NeuralNetwork.h"
```

Classes

- class OptimizeSimulation

OptimizeSimulation class, sets up environments and robots.

8.25.1 Detailed Description

Robot simultaion for optimizing the NeuralNetworkRobot.

Author

Lucas Kramer

8.26 PhysicalObject.cpp File Reference

The representation of any object within the simulation.

```
#include <stdlib.h>
#include <iostream>
#include <math.h>
#include <assert.h>
#include <unistd.h>
#include <stdexcept>
#include "artist.h"
#include "PhysicalObject.h"
#include "environment.h"
#include "configuration.h"
```

Macros

- #define _USE_MATH_DEFINES

8.26.1 Detailed Description

The representation of any object within the simulation.

Author

Lucas Kramer Himawan Go, Carl Bahn

8.26.2 Macro Definition Documentation

8.26.2.1 #define _USE_MATH_DEFINES

8.27 PhysicalObject.h File Reference

The representation of any object within the simulation.

```
#include "Color.h"
#include "configuration.h"
#include "Location.h"
```

Classes

- class PhysicalObject

  This is a common superclass for all objects.

Enumerations

- enum ObjectType {
  ROBOT, TARGET, OBSTACLE, LIGHT,
  LAST =LIGHT }

8.27.1 Detailed Description

The representation of any object within the simulation.

Author

Lucas Kramer Himawan Go, Carl Bahn

8.27.2 Enumeration Type Documentation

8.27.2.1 enum ObjectType

Enumerator

ROBOT

TARGET

OBSTACLE

LIGHT

LAST

8.28 Robot.cpp File Reference

The representation of robot within the simulation.

```
#include <stdexcept>
#include <math.h>
#include "artist.h"
#include "environment.h"
#include "Robot.h"
#include "configuration.h"
```

8.28.1 Detailed Description

The representation of robot within the simulation.

Author

Lucas Kramer Himawan Go, Carl Bahn

8.29 Robot.h File Reference

The representation of robot within the simulation.

```
#include "PhysicalObject.h"
#include "Sensor.h"
#include "configuration.h"
```

Classes

- class Robot

  Robot that moves around the window and bumps into obstacles.

Enumerations

- enum RobotType { SIMPLE, COMPLEX, NEURAL_NETWORK }

8.29.1 Detailed Description

The representation of robot within the simulation.

Author

Himawan Go Lucas Kramer

8.29.2 Enumeration Type Documentation

8.29.2.1 enum RobotType

Enumerator

SIMPLE

COMPLEX

NEURAL_NETWORK

8.30 Sensor.cpp File Reference

A sensor that detects certain objects in the environment.

```
#include "artist.h"
#include "Sensor.h"
#include "environment.h"
#include "configuration.h"
#include "PhysicalObject.h"
#include <iostream>
#include <math.h>
#include <stdexcept>
```

Macros

- #define _USE_MATH_DEFINES

8.30.1 Detailed Description

A sensor that detects certain objects in the environment.

Author

Himawan Go Carl Bahn Lucas Kramer

8.30.2 Macro Definition Documentation

8.30.2.1 #define _USE_MATH_DEFINES

8.31 Sensor.h File Reference

A sensor that detects certain objects in the environment.

```
#include "Color.h"
#include "Location.h"
#include "configuration.h"
#include "PhysicalObject.h"
```

Classes

- class Sensor

8.31.1 Detailed Description

A sensor that detects certain objects in the environment.

Author

Himawan Go
Carl Bahn

8.32 SimpleRobot.cpp File Reference

The representation of robot within the simulation.

```
#include <GL/glu.h>
#include <GL/glut.h>
#include <stdexcept>
#include "environment.h"
#include "Robot.h"
#include "SimpleRobot.h"
#include "configuration.h"
```

8.32.1 Detailed Description

The representation of robot within the simulation.

Author

Lucas Kramer

8.33 SimpleRobot.h File Reference

The representation of a simple robot.

```
#include "PhysicalObject.h"
#include "Robot.h"
#include "Sensor.h"
#include "configuration.h"
```

Classes

- class SimpleRobot

  A simple robot with uncrossed feedback.

8.33.1 Detailed Description

The representation of a simple robot.

Author

Lucas Kramer

8.34 Simulation.cpp File Reference

Implementation for the main application class of the robot simulation.

```
#include <unistd.h>
#include <limits.h>
#include <deque>
#include <mutex>
#include <stdexcept>
#include <sstream>
#include <iostream>
#include <fstream>
#include <dirent.h>
#include <sys/stat.h>
#include "PhysicalObject.h"
#include "Robot.h"
#include "SimpleRobot.h"
#include "ComplexRobot.h"
#include "NeuralNetworkRobot.h"
#include "Target.h"
#include "Obstacle.h"
#include "LightSource.h"
#include "Location.h"
#include "configuration.h"
#include "environment.h"
#include "util.h"
#include "Simulation.h"
```

Functions

- string ftos (float f)

8.34.1 Detailed Description

Implementation for the main application class of the robot simulation.

Author

Lucas Kramer
Lucas Kramer Xi Zhang, Carl Bahn

8.34.2 Function Documentation

8.34.2.1 string ftos (float *f*)

8.35 Simulation.h File Reference

Main application class for the robot simulation.

```
#include "Color.h"
#include "Location.h"
#include "configuration.h"
#include "environment.h"
#include "util.h"
#include "BaseGfxApp.h"
#include "PhysicalObject.h"
```

Classes

- class Simulation

  Simulation class, sets up the GUI and the drawing environment.

8.35.1 Detailed Description

Main application class for the robot simulation.

Author

Lucas Kramer Xi Zhang, Carl Bahn

8.36 Target.cpp File Reference

The representation of a target in the simulation.

```
#include <stdlib.h>
#include <math.h>
#include "environment.h"
#include "Target.h"
#include "configuration.h"
```

8.36.1 Detailed Description

The representation of a target in the simulation.

Author

Himawan Go Lucas Kramer

8.37 Target.h File Reference

The representation of an obstacle in the simulation.

```
#include "PhysicalObject.h"
```

Classes

- class Target

  Target for the robot to seek.

8.37.1 Detailed Description

The representation of an obstacle in the simulation.

Author

Himawan Go Lucas Kramer

8.38 util.cpp File Reference

Implmentation of functions for the simulation.

```
#include <unistd.h>
#include <stack>
#include <queue>
#include <mutex>
#include <stdexcept>
#include <sstream>
#include <iostream>
#include <fstream>
#include <GL/glui.h>
#include <assert.h>
#include "Robot.h"
#include "SimpleRobot.h"
#include "ComplexRobot.h"
#include "NeuralNetwork.h"
#include "NeuralNetworkRobot.h"
#include "Target.h"
#include "Obstacle.h"
#include "LightSource.h"
#include "Location.h"
#include "configuration.h"
#include "environment.h"
#include "util.h"
```

Variables

- std::mutex objectsMutex

- stack< int > robots
- stack< int > targets
- stack< int > lights
- stack< int > obstacles
- int colorNum = 0

8.38.1 Detailed Description

Implmentation of functions for the simulation.

Author

Lucas Kramer

8.38.2 Variable Documentation

8.38.2.1 int colorNum = 0

8.38.2.2 stack<int> lights

8.38.2.3 std::mutex objectsMutex

8.38.2.4 stack<int> obstacles

8.38.2.5 stack<int> robots

8.38.2.6 stack<int> targets

8.39 util.h File Reference

Helper functions for the simulation.

```
#include "NeuralNetwork.h"
```

Namespaces

- util

  util namespace, contains helper functions to add and remove robots

Functions

- void util::reset ()

  Removes all objects and resets to the initial state.
- void util::display ()

  Function to render all the objects. This function is called repeatedly from the simulation, and iterates through the objects and calls their respective display functions.
- void util::advance ()

  Function to update the positions of all objects. This function is called repeatedly from the simulation, and iterates through the objects and calls their respective updatePosition functions.
- Color util::newColor ()

  Gets a new, unused color.
- int util::getNumRobotsTargets ()

Gets the number of robots/target pairs.

- int util::getNumLights ()

  Gets the number of lights.
- int util::getNumObstacles ()

  Gets the number of obstacles.
- bool util::addRobotTarget (int robotType, int lightSensorConnectionPattern, int robotSensorConnectionPattern, int obstacleSensorConnectionPattern, int targetSensorConnectionPattern, float lightSensorScale, float robotSensorScale, float obstacleSensorScale, float targetSensorScale, int initialSpeed, std::string neuralNetworkFile)

  Adds a robot and paired target to the simulation.
- bool util::addRobot (int robotType, int lightSensorConnectionPattern, int robotSensorConnectionPattern, int obstacleSensorConnectionPattern, int targetSensorConnectionPattern, float lightSensorScale, float robotSensorScale, float obstacleSensorScale, float targetSensorScale, int initialSpeed, std::string neuralNetworkFile)

  Adds a robot to the simulation.
- bool util::addNeuralNetworkRobotTarget (const NeuralNetwork &network)

  Adds a neural network robot and a paired target to the simulation.
- bool util::addStationaryLightSource ()

  Adds a light to the simulation.
- bool util::addMovingLightSource ()

  Adds a light to the simulation.
- bool util::addObstacle ()

  Adds a obstacle to the simulation.
- bool util::copy (int id, Location loc)

  Copies an object to a new Location.
- bool util::removeRobotTarget ()

  Removes a robot from the simulation.
- bool util::removeLightSource ()

  Removes a light from the simulation.
- bool util::removeObstacle ()

  Removes a obstacle from the simulation.
- void util::removeAllRobotTarget ()

  Removes all robots.
- void util::removeAllLightSource ()

  Removes all lights.
- void util::removeAllObstacle ()

  Removes all obstacles.
- bool util::open (std::string filename)

  Loads a simulation from a file.
- bool util::save (std::string filename)

  Saves the current state to a file.

8.39.1 Detailed Description

Helper functions for the simulation.

Author

Lucas Kramer

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