Simulador de Tráfego em Malha Viária

65DSD

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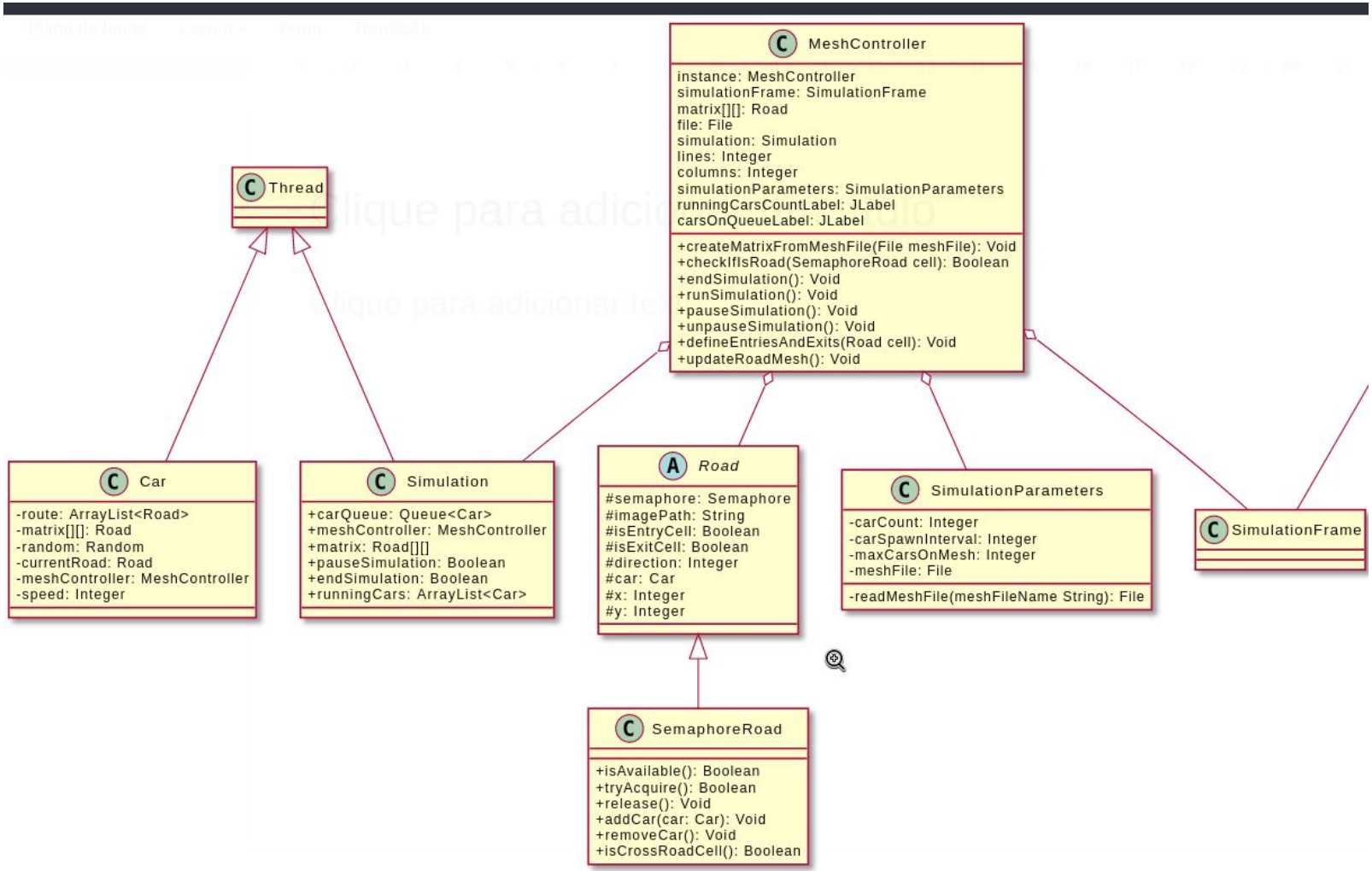
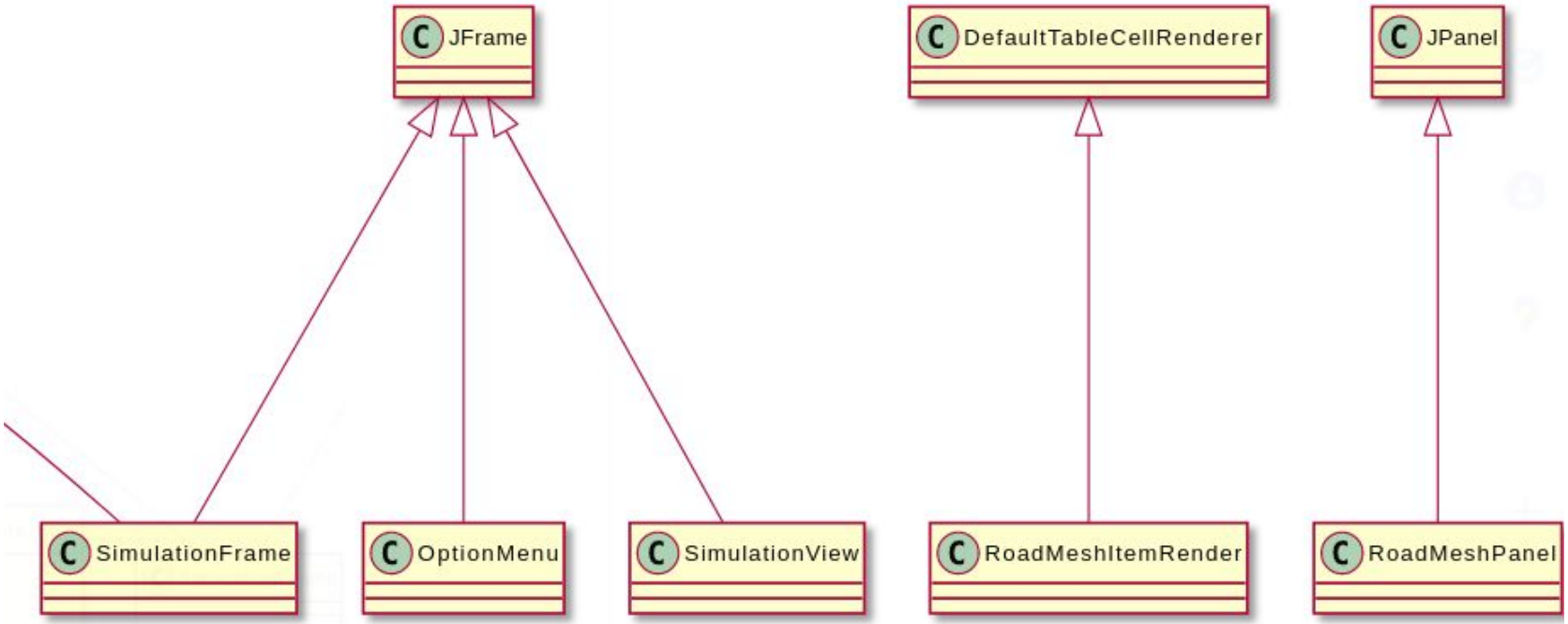
Tópicos

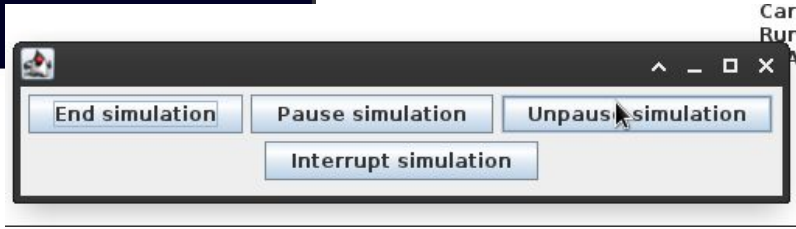
1. Leitura do arquivo da malha
2. Iniciar simulação
3. Gerar carros
4. Definir rotas
5. Iniciar threads dos carros (mover)


MeshController
instance: MeshController
simulationFrame: SimulationFrame
matrix[][]: Road
file: File
simulation: Simulation
lines: Integer
columns: Integer
simulationParameters: SimulationParameters
runningCarsCountLabel: JLabel
carsOnQueueLabel: JLabel
+createMatrixFromMeshFile(File meshFile): Void
+checkIfIsRoad(SemaphoreRoad cell): Boolean
+endSimulation(): Void
+runSimulation(): Void
+pauseSimulation(): Void
+unpauseSimulation(): Void
+defineEntriesAndExits(Road cell): Void
+updateRoadMesh(): Void
Thread
Car
-route: ArrayList<Road>
-matrix[][]: Road
-random: Random
-currentRoad: Road
-meshController: MeshController
-speed: Integer
Simulation
+carQueue: Queue<Car>
+meshController: MeshController
+matrix: Road[][]
+pauseSimulation: Boolean
+endSimulation: Boolean
+runningCars: ArrayList<Car>
Road
#semaphore: Semaphore
#imagePath: String
#isEntryCell: Boolean
#isExitCell: Boolean
#direction: Integer
#car: Car
#x: Integer
#y: Integer
SimulationParameters
-carCount: Integer
-carSpawnInterval: Integer
-maxCarsOnMesh: Integer
-meshFile: File
-readMeshFile(meshFileName String): File
SimulationFrame
SemaphoreRoad
+isAvailable(): Boolean
+tryAcquire(): Boolean
+release(): Void
+addCar(car: Car): Void
+removeCar(): Void
+isCrossRoadCell(): Boolean


JFrame
DefaultTableCellRenderer
JPanel
SimulationFrame
OptionMenu
SimulationView
RoadMeshItemRender
RoadMeshPanel


OptionMenu
Car count
100
Spawn rate (seconds)
1
Maximum cars on mesh at the same time
5
mesh 1
mesh 2
mesh 3
Start simulation


SimulationFrame
Cars on queue: 57
Running cars: 5
PLAYING...


End simulation
Pause simulation
Unpause simulation
Interrupt simulation

```java
1 usage  Lucas Dolsan
public void createMatrixFromMeshFile(File meshFile) {
    Scanner meshScanner = null;
    try {

        meshScanner = new Scanner(meshFile);

        while (meshScanner.hasNextInt()) {
            this.lines = meshScanner.nextInt();
            this.columns = meshScanner.nextInt();

            this.matrix = new Road[this.columns][this.lines];

            for (int y = 0; y < this.lines; y++) {
                for (int x = 0; x < this.columns; x++) {
                    int direction = meshScanner.nextInt();
                    SemaphoreRoad cell = new SemaphoreRoad(x, y, direction);
                    if (this.checkIfIsRoad(cell)) {
                        this.defineEntriesAndExits(cell);
                    }
                    this.matrix[x][y] = cell;
                }
            }
        }

    } catch (FileNotFoundException e) {
        e.printStackTrace();
    } finally {
        meshScanner.close();
    }
}
```

MeshController.java

```
10
16
0   0   0   0   0   0   0   3   1   0   0   0   0   0   0   0
0   0   0   0   0   0   0   3   1   0   0   0   0   0   0   0
0   0   0   0   0   0   0   3   1   0   0   0   0   0   0   0
0   0   0   0   0   0   0   3   1   0   0   0   0   0   0   0
4   4   4   4   4   4   4   12  10  4   4   4   4   4   4   4
2   2   2   2   2   2   2   11  9   2   2   2   2   2   2   2
0   0   0   0   0   0   0   3   1   0   0   0   0   0   0   0
0   0   0   0   0   0   0   3   1   0   0   0   0   0   0   0
0   0   0   0   0   0   0   3   1   0   0   0   0   0   0   0
0   0   0   0   0   0   0   3   1   0   0   0   0   0   0   0
```

Simulation.java

```
Lucas Dolsan
public void run() {
    this.carQueue = this.loadCars();

    this.meshController.getCarsOnQueueLabel().setText("Cars on queue: " + this.carQueue.size());

    this.matrix = this.meshController.getMatrix();

    this.meshController.updateRoadMesh();

    SimulationParameters params = this.meshController.getSimulationParameters();

    while(!carQueue.isEmpty()) {
        for (int y = 0; y < this.meshController.getLines(); y++) {
            for (int x = 0; x < this.meshController.getColumns(); x++) {

                Road startingRoad = matrix[x][y];

                Boolean canAddCarsToSimulation = (
                    startingRoad.isEntryCell() &&
                    startingRoad.isAvailable() &&
                    !carQueue.isEmpty() &&
                    !this.pauseSimulation &&
                    !this.endSimulation &&
                    this.runningCars.size() < params.getMaxCarsOnMesh()
                );

                if (canAddCarsToSimulation) {...}
            }
        }
    }
}
```

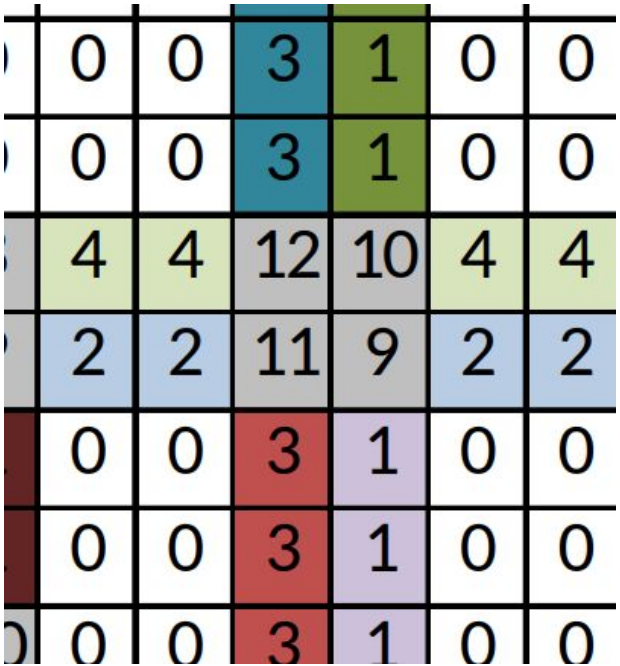
Simulation.java

```
if (canAddCarsToSimulation) {
    try {
        sleep( millis: params.getCarSpawnInterval() * 1000);

        Car car = carQueue.remove();

        this.meshController.getCarsOnQueueLabel().setText("Cars on queue: " + this.carQueue.size());

        car.defineRoute(startingRoad);
        car.start();

        car.setSimulation(this);

        this.addRunningCar(car);
        this.meshController.getRunningCarsCountLabel().setText("Running cars: " + this.runningCars.size());

    } catch (Exception e) {
        throw new RuntimeException(e);
    }
}
```

Car.java defineRoute()

```
1 usage  Lucas Dolsan
public void defineRoute(Road startingRoad) throws Exception {
    // defineRoute will append road cells to the route list until the last one is an exit
    boolean foundExit = false;

    Road nextRoadOnRoute = startingRoad;

    route.add(nextRoadOnRoute);

    // this variable counts the amount of crossroad cells immediately on route, to prevent driving in circles
    // inside the crossroad
    int amountOfCrossroadsCellsOnCurrentCrossroad = 0;

    while (!foundExit) {...}
}
```

Car.java




```java
while (!foundExit) {
    int direction = nextRoadOnRoute.getDirection();
    int currentRouteX = nextRoadOnRoute.getX();
    int currentRouteY = nextRoadOnRoute.getY();

    boolean isRoad = direction <= 4;

    if (isRoad) {
        nextRoadOnRoute = this.chooseRoad(direction, currentRouteX, currentRouteY);
    } else {
        nextRoadOnRoute = this.chooseCrossroad(
                direction,
                currentRouteX,
                currentRouteY,
                amountOfCrossroadsCellsOnCurrentCrossroad
        );
        if (nextRoadOnRoute.isCrossRoadCell()) {
            amountOfCrossroadsCellsOnCurrentCrossroad++;
        } else {
            amountOfCrossroadsCellsOnCurrentCrossroad = 0;
        }
    }

    route.add(nextRoadOnRoute);

    foundExit = nextRoadOnRoute.isExitCell();
}
}
```

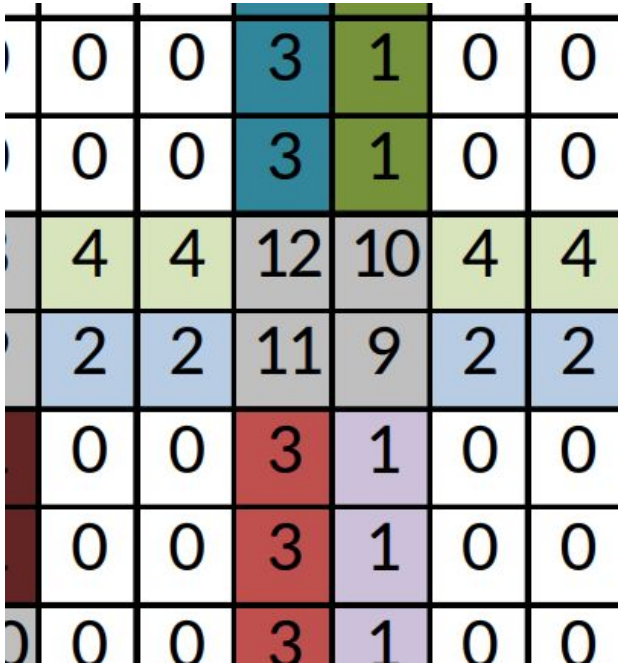
Car.java run()

```
Lucas Dolsan
@Override
public void run() {
    while (!route.isEmpty()) {
        int nextRoadIndex = 0;

        if (route.get(nextRoadIndex).isCrossRoadCell()) {
            handleCrossroads();
        } else {
            Road road = this.route.remove(nextRoadIndex);

            this.move(road, needsAcquire: true);
        }
    }
    this.getCurrentRoad().removeCar();
    this.getCurrentRoad().release();
    this.simulation.removeRunningCar(this);
    this.meshController.updateRoadMesh();
}
```

Car.java

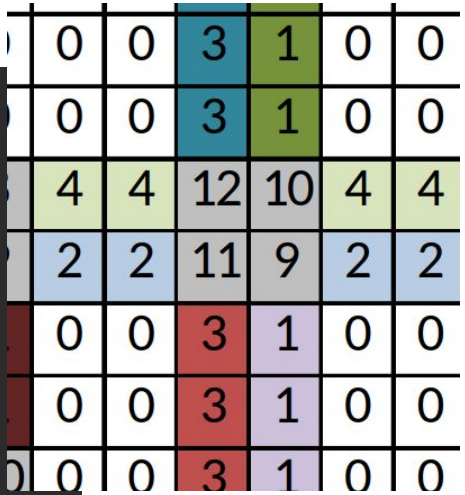
handleCrossroads()

```
1 usage   Lucas Dolsan
private void handleCrossroads() {
    try {
        sleep(this.speed);
    } catch (InterruptedException e) {
        throw new RuntimeException(e);
    }

    ArrayList<Road> crossroadsToAcquire = new ArrayList<>();
    ArrayList<Road> acquiredCrossroads = new ArrayList<>();


    for (int i = 0; i < this.route.size(); i++) {
        Road road = this.route.get(i);

        // take into consideration the next road cell right outside the crossroads
        crossroadsToAcquire.add(road);

        if (!road.isCrossRoadCell()) {
            break;
        }
    }
```



Car.java

handleCrossroads()




```
    for (Road crossroadToAcquire : crossroadsToAcquire) {
        if (crossroadToAcquire.tryAcquire()) {
            acquiredCrossroads.add(crossroadToAcquire);
        } else {
            // failed to acquire all the crossroads + the road right outside the crossroad
            for (Road acquiredRoad : acquiredCrossroads) {
                acquiredRoad.release();
            }
            break;
        }
    }

    boolean acquiredAllNecessaryCrossroads = acquiredCrossroads.size() == crossroadsToAcquire.size();

    if (acquiredAllNecessaryCrossroads) {
        for (Road acquiredCrossroad : acquiredCrossroads) {
            this.route.remove(acquiredCrossroad);
            this.move(acquiredCrossroad, needsAcquire: false);
        }
    }
}
```