



@FXML -busPane: Pane  
@FXML -truckPane: Pane  
@FXML -bikePane: Pane  
@FXML -logLabel: Label  
@FXML -zoomInButton: Button  
@FXML -zoomOutButton: Button  
@FXML -resetViewButton: Button  
@FXML -toggle3DButton: ToggleButton  
@FXML -bottomLogArea: TitledPane  
-simManager: SimulationManager  
-renderer: Renderer  
-converter: CoordinateConverter  
-uiLoop: AnimationTimer  
-threadPool: ExecutorService  
-NUMBER\_OF\_THREADS: int  
-isSimulationRunning: boolean  
-vehicleVisuals: Map<String, Shape>  
-mapContentGroup: Group  
-mapInteractionHandler: MapInteractionHandler  
-PADDING: double

+MainController()  
+main(args: String[]): void  
@FXML +initialize(): void  
@FXML -startSimulation(): void  
-startUiLoop(): void  
-updateView(): void  
-log(message: String): void  
+stopSimulation(): void  
@FXML -pauseSimulation(): void  
@FXML -stepSimulation(): void  
@FXML -injectVehicle(): void  
@FXML -startSumoGUI(): void  
@FXML -insertSumoConfigFile(): void  
@FXML -applyFilter(): void  
@FXML -clearFilter(): void  
@FXML -runStressTest(): void

-sumoPath: String  
-sumoConfigFileName:  
-sumoConfigFilePath:  
-stepLength: String  
-sumoConnection: Su  
-stateLock: Object  
-activeVehicles: volati  
-activeTrafficlights: vo  
-statisticsManager: St  
-reportManager: Repr  
-sumoMap: MapMang  
-vehicleManager: Veh  
-trafficlightManager: T  
-currentStep: volatile i  
-isRunning: volatile bc

+SimulationManager(  
+startConnection(): bc  
-setupPaths(): boolea  
+runSimulationLoop()  
+step(): void  
+stopSimulation(): voi  
+getActiveVehicles():  
+getStatisticsManage  
+getReportManager()  
+getCurrentStep(): int  
+getConnection(): Sui  
+getSumoMap(): Map

StatisticsManager

-averageSpeed: double  
-totalVehicles: int

+StatisticsManager()  
+updateStatistics(currentAw

ReportManager

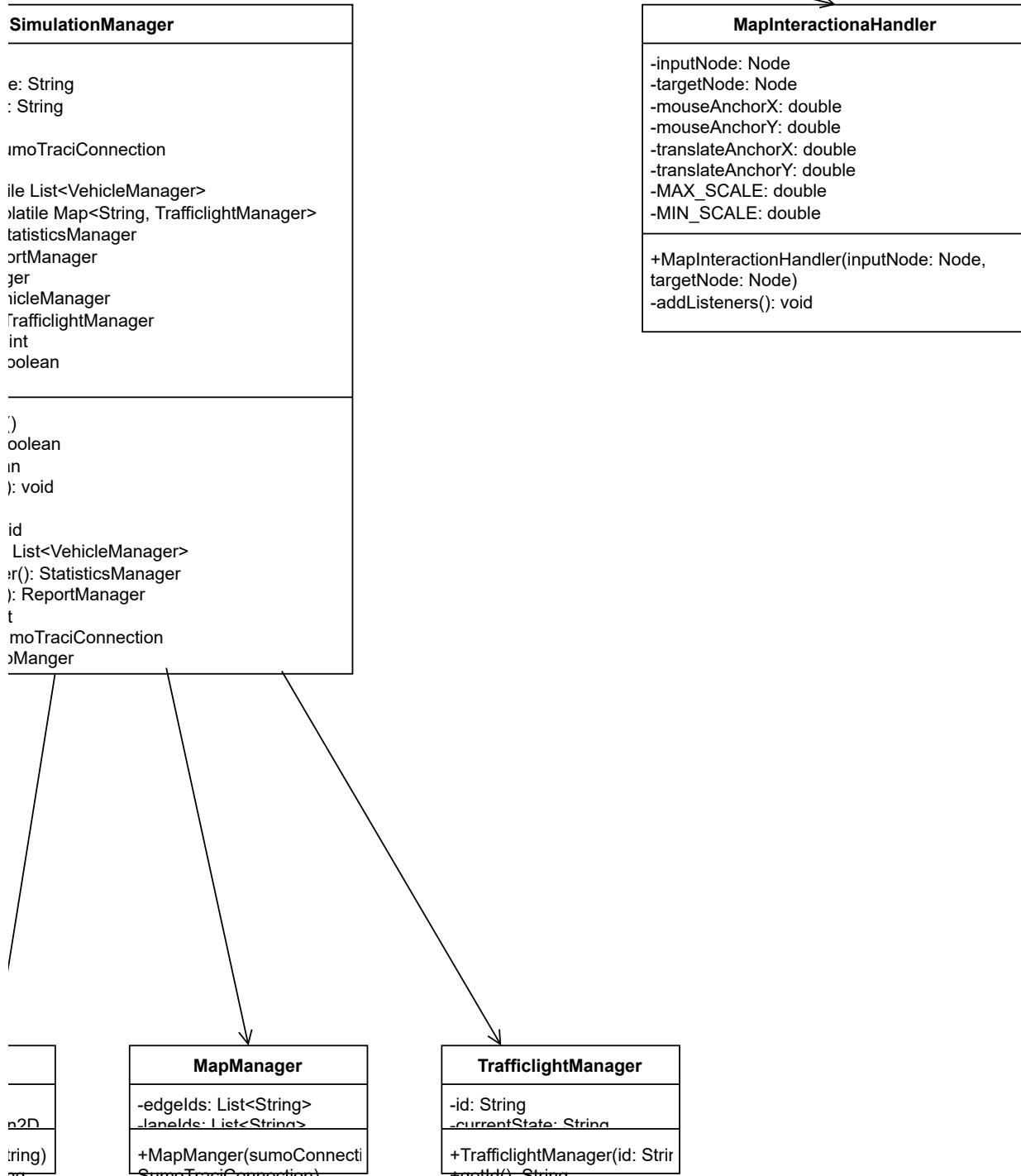
+ field: type

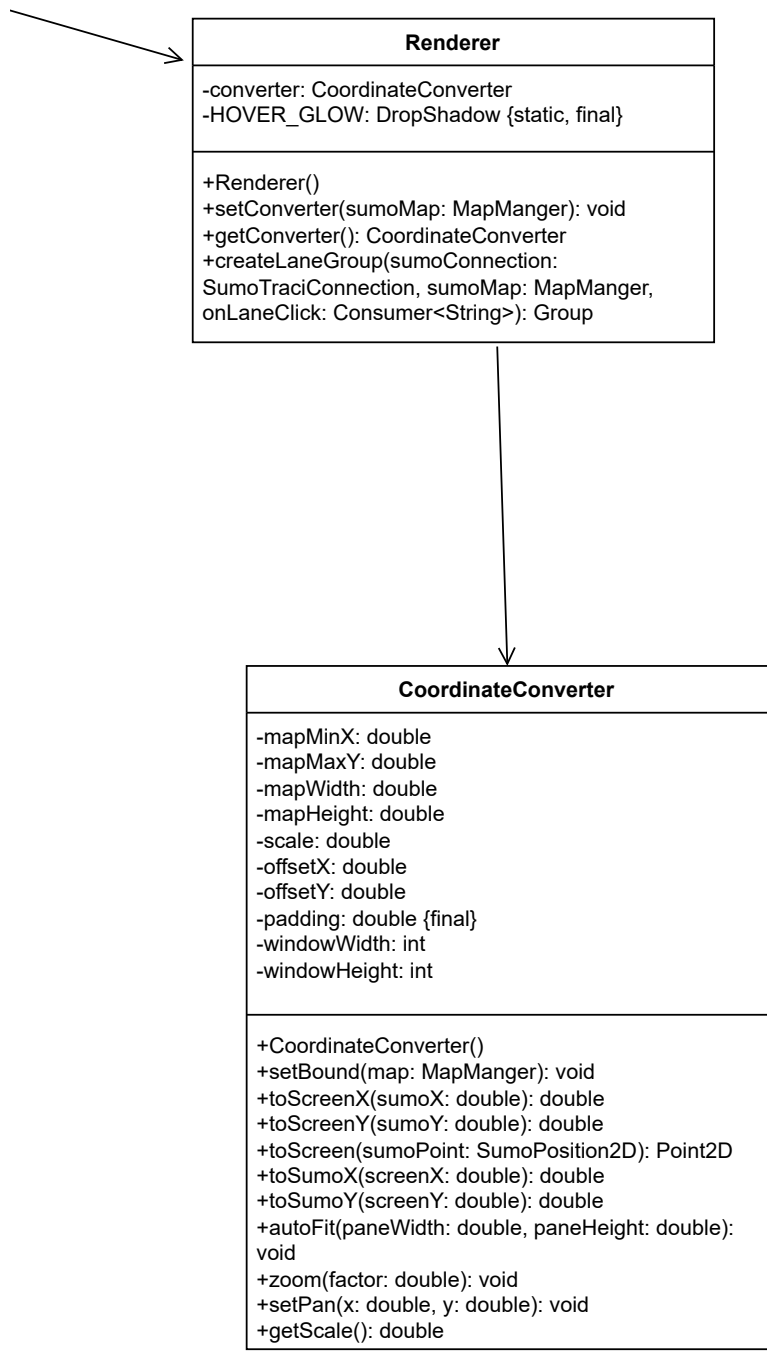
+exportToCSV(stat:  
StatisticsManager filePath

VehicleManager

#id: String  
#position: SumoPosition

+VehicleManager(id: St  
+setVehicleTypeA: Str





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// --- FXML UI Elements: Map & Log ---
[FXML] - leftControlPanel: ScrollPane
[FXML] - mapScrollPane: ScrollPane
[FXML] - mapPane: Pane
[FXML] - logLabel: Label
[FXML] - mapControlsContainer: StackPane
[FXML] - mapControlsVBox: VBox
[FXML] - zoomInButton: Button
[FXML] - zoomOutButton: Button
[FXML] - resetViewButton: Button
[FXML] - toggle3DButton: ToggleButton
// --- FXML UI Elements: Sim Control ---
[FXML] - startButton: Button
[FXML] - pauseButton: Button
[FXML] - stepButton: Button
// --- FXML UI Elements: Vehicle Actions ---
[FXML] - vehicleIdField: TextField
[FXML] - routeIdField: TextField
[FXML] - injectVehicleButton: Button
[FXML] - setVehicleSpeedButton: Button
[FXML] - vehicleSpeedField: TextField
[FXML] - setVehicleColorButton: Button
[FXML] - vehicleColorField: TextField
// --- FXML UI Elements: Traffic Light Actions ---
[FXML] - trafficLightIdField: TextField
[FXML] - setRedPhaseButton: Button
[FXML] - setGreenPhaseButton: Button
[FXML] - resumeAutoButton: Button
[FXML] - setPhaseDurationButton: Button
[FXML] - phaseDurationField: TextField
[FXML] - adaptiveTrafficCheck: CheckBox
// --- FXML UI Elements: Vehicle Filtering ---
[FXML] - filterColorField: TextField
[FXML] - filterSpeedField: TextField
[FXML] - filterEdgeField: TextField
[FXML] - applyFilterButton: Button
[FXML] - clearFilterButton: Button
// --- FXML UI Elements: Stress Testing ---
[FXML] - stressEdgeField: TextField
[FXML] - stressCountField: TextField
[FXML] - stressTestButton: Button
// --- FXML UI Elements: Statistics ---
[FXML] - simStepLabel: Label
[FXML] - vehicleCountLabel: Label
[FXML] - avgSpeedLabel: Label
[FXML] - avgTravelTimeLabel: Label
[FXML] - congestionLabel: Label
[FXML] - showChartsButton: Button
// --- FXML UI Elements: Data Export ---
[FXML] - exportFilterCheck: CheckBox
[FXML] - exportCsvButton: Button
[FXML] - exportPdfButton: Button

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