**Diagram

Description automatically generated**

**Domain Model Documentation**

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| **Element Name** | | **Description** |
| Brake-by-Wire Actuator | | The Brake-by-Wire Actuator responds to deceleration requests by interrupting the steady state velocity control and then applying brake torque via electro-mechanical actuators at all four wheels of the vehicle. |
| Attributes |  |  |
|  | decelAccuracy: double | for our modeling purposes, the Brake-by-Wire Actuator is able to apply a specified deceleration value within an accuracy of +/- 2% |
|  | decelTime: double | it takes 200 ms to reach a requested deceleration value |
|  | releaseTime: double | it takes 100 ms to get back to the acceleration to steady state value |
| Operations |  |  |
|  | SlowDown() | adjusts the vehicle’s acceleration to slow it down |
|  | ReturnToSteady() | adjusts the vehicle’s acceleration to return it to it’s steady state velocity |
| Relationships | A Vehicle has a Brake-by-Wire Actuator. The Brake-by-Wire Actuator receives requests from the Pedestrian Collision Avoidance System. | |
| UML Extensions | N/A | |

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| **Element Name** | | **Description** |
| Pedestrian | | a person walking along a road. |
| Attributes |  |  |
|  | X: double | x coordinate position |
|  | Y: double | y coordinate position |
|  | Diameter: double | a pedestrian is modeled as being a circle with a diameter of .5 m. |
|  | Velocity: double | the speed and direction at which the pedestrian moves along the y-axis |
|  | Acceleration: double | the rate at which a pedestrian’s speed is changing |
| Operations |  |  |
|  | Move() | this function is used to model a pedestrian moving. It updates the pedestrian’s position based on the amount of time that has passed. |
| Relationships | A Vehicle has a Brake-by-Wire Actuator. The Brake-by-Wire Actuator receives requests from the Pedestrian Collision Avoidance System. | |
| UML Extensions | N/A | |

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| **Element Name** | | **Description** |
| Pedestrian Collision Avoidance System | | The Pedestrian Collision Avoidance System is an algorithm that is responsible for enacting avoidance maneuvers in the event of a potential collision with a pedestrian. |
| Attributes |  |  |
|  | minDistance: double | the closest distance that the algorithm will allow the vehicle to get near a pedestrian |
|  | maxDecel: double | the maximum deceleration of the vehicle is 0.7 g |
| Operations |  |  |
|  | CheckCollision() | this function is the meat and potatoes of the Pedestrian Collision Avoidance System. It will take in the information about a pedestrian sent from the Pedestrian Detection Sensor and determine if avoidance action needs to be taken. If action does need to be taken, the function will issue an ApplyBrakes() request. |
|  | IsMalfunction() | function that is responsible for disabling the Pedestrian Collision Avoidance System in the event that the Pedestrian Detection Sensor malfunctions, the Brake-by-Wire Actuator malfunctions, or the data sent by the Pedestrian Detection Sensor is determine to be corrupt. |
|  | ApplyBrakes() | this function sends a request to the Brake-by-Wire Actuator to apply a given deceleration value. |
|  | ReleaseBrakes() | this function sends a request to the Brake-by-Wire Actuator to return to steady state velocity. |
| Relationships | The Pedestrian Collision Avoidance System is part of the Safety Controller of a Vehicle. | |
| UML Extensions | N/A | |

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| **Element Name** | | **Description** |
| Pedestrian Detection Sensor | | The Pedestrian Detection Sensor is a stereo camera that has pedestrian recognition and tracking capabilities. |
| Attributes |  |  |
|  | locationAccuracy: double | the sensor can give a pedestrian’s (x,y) location relative to the car with an accuracy of +/- .5 m. |
|  | speedAccuracy: double | the sensor can give a pedestrian’s speed with an accuracy of +/- .2m/s |
|  | directionAccuracy: double | the sensor can give a pedestrian’s direction with an accuracy of +/- 5 degrees |
| Operations |  |  |
|  | SendData() | this function sends a detected pedestrian’s relative location to the vehicle as well as their velocity to the Pedestrian Collision Avoidance Algorithm. |
| Relationships | The Pedestrian Detection Sensor detects a pedestrian and sends the data about that pedestrian to the Pedestrian Collision Avoidance System. | |
| UML Extensions | N/A | |

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| **Element Name** | | **Description** |
| Safety Controller | | The Safety Controller is a large system within the vehicle that is responsible for the vehicle’s safety operations. |
| Attributes |  |  |
| Operations |  |  |
| Relationships | The Safety Controller is part of the Vehicle. | |
| UML Extensions | N/A | |

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| **Element Name** | | **Description** |
| Vehicle | | a road vehicle with 4 wheels powered by an internal combustion engine or electric motor and able to carry a small number of people |
| Attributes |  |  |
|  | steadySpeed: double | for our modeling purposes, a vehicle has a normal steady state speed of 50 kph (13.9 m/s). |
|  | width: double | for our modeling purposes, a vehicle has a width of 2 m, which marks its collision zone |
|  | x: double | x coordinate position |
|  | y: double | y coordinate position |
|  | Acceleration: double | the rate at which a vehicle’s speed is changing. For our modeling purposes a vehicle can have a maximum acceleration of .25 g and a maximum deceleration of 0.7g (1 g = 9.81 m/s^2) |
|  | Velocity: double | the speed and direction at which the vehicle moves along the x-axis |
|  | failSafe: bool | a vehicle has a fail safe mode in which the response time to reach a requested deceleration value is increased. This flag indicates whether a vehicle is in fail safe mode. |
| Operations |  |  |
|  | Move() | this function is used to model a vehicle moving. It updates the vehicle’s position based on the amount of time that has passed. |
| Relationships | A vehicle has a Pedestrian Detection Sensor, Safety Controller, and Brake-by-Wire Actuator. | |
| UML Extensions | N/A | |