universität ulm

Softwareprojekt

Institut für Softwaretechnik und Programmiersprachen | WiSe 2023/24
Prof. Dr. Thomas Thüm, Sabrina Böhm, Valentin Kolb, Lukas Ostheimer

Pflichtenheft - Marius Cart

1 Einleitung

Der Zweck dieses Dokuments ist es, eine detaillierte Beschreibung der Anforderungen, sowie der Benutzerschnittstelle für die Anwendung *Marius Cart* bereitzustellen. Es wird abgegrenzt, welche Anforderungen erfüllt werden müssen, damit die entwickelte Anwendung vom Kunden akzeptiert wird.

Das Spiel *Marius Cart* ist eine Unity Anwendung, die es dem Benutzer ermöglicht, ein 3D Spiel zu spielen. Im Folgenden wird auf die Systemfunktionalität und die Systemeinschränkungen, sowie Annahmen über das Produkt eingegangen. Zuletzt werden detaillierte Anforderungsspezifikation bereitgestellt.

2 Allgemeine Beschreibung

Marius Cart ist ein Einzelspielerspiel aus dem Genre der Autorennspiele. Es nimmt genau ein(e) Spieler*in an einer Spielpartie teil. Ziel des Spiels ist es, das Fahrzeug über die Rennstrecke mit einer gewisse Anzahl an Runden ins Ziel zu bringen.

2.1 Ansichten

Die Anwendung besteht aus mehreren Ansichten, sogenannten *Scenes*, über welche der Benutzer mit dem Programm interagieren kann.

Scenes	**Beschreibung**
Startbildschirm	Nach dem Start der Anwendung befindet sich der Spieler / die Spielerin im Startscreen. Von hier aus kann er / sie ein neues Spiel starten.
Spielbildschirm	Auf dieser View wird das eigentliche Spiel dargestellt. Während der Platzierungs- und der Kampfphase interagiert der Spieler / die Spielerin hier mit dem Spiel.
Car Screen	The Car Screen view shows a list of available cars along with a preview picture, the driver's information, and speed parameters for each.
End Screen	The End Screen view displays the player's car, how long the race took, and how many coins were gathered.

2.2 Systemeinschränkungen und Abhängigkeiten

Die Anwendung wird durch die Prozessor- und/oder Grafikleistung des Systems begrenzt, auf dem es läuft. Um die Anwendung zu entwickeln, wird Sprache C# verwendet und in der Version C#11 benötigt. Später soll die Anwendung

als Binary für Windows ausgeliefert werden.

3 Spezifische Anforderungen

Dieser Abschnitt enthält alle spezifischen Anforderungen an das System. Er bietet eine detaillierte Beschreibung des Systems und seiner Funktionen.

3.1 Funktionale Anforderungen

Dieser Abschnitt enthält alle Anforderungen, die die grundlegenden Aktionen des Softwaresystems spezifizieren.

ID	**FA1**
TITEL:	Spielbildschirm
BESCHREIBUNG:	Der Spieler / die Spielerin bekommt auf dem Spielbildschirm den aktuellen Spielzustand angezeigt. Hier führt der Spieler / die Spielerin das Spiel aus.
BEGRÜNDUNG:	Um das Spiel spielen zu können muss es einen Bildschirm geben, auf welchem der aktuelle Spielzustand angezeigt wird.
ABHÄNGIGKEITEN:	FA2, FA6, FA8

ID	**FA2**
TITEL:	Rennstrecke anzeigen
BESCHREIBUNG:	Die Rennstrecke des Spiels ist eine runde graue Bahn, die in Mitte des Spielbildschirms angezeigt wird. Sie muss mindestens 3 Fahrzeuggrößen breit sein.
BEGRÜNDUNG:	Es muss eine für den Spieler / die Spielerin sichtbare Rennstrecke angezeigt werden, auf der das Fahrzeug fahren soll, da sonst nicht erkenntlich ist, wo die Strecke für das Fahrzeug verläuft und das Spielziel nicht erkenntlich ist.
ABHÄNGIGKEITEN:	FA1, FA14 ,FA15, FA16, FA17, FA18

ID	**FA3**
TITEL:	Fahrer*innen
BESCHREIBUNG:	Der Spieler / die Spielerin kann aus drei verschiedenen Fahrer*innen wählen mit der er / sie das Rennspiel bezwingen will. Jede(r) Fahrer*in hat ein eigenes Fahrzeug. Es kann aus folgenden Fahrer*innen gewählt werden: Mario, Luis und Browser
BEGRÜNDUNG:	Der Spieler / die Spielerin braucht eine(n) Fahrer*in, der die spielende Person im Spiel verkörpert, um für den Spieler / die Spielerin ein Spielcharakter im Spielbildschirm darstellen zu können.
ABHÄNGIGKEITEN:	FA1, FA2, FA4

ID	**FA4**
TITEL:	Vehicles
BESCHREIBUNG:	Three different vehicles can be chosen from in the game. Following vehicles can be chosen from: Marius in a sports car, Luis in the line2 and Browser on a motorcyle. Each vehicle has a speed property that will be shown when a player tries to choose a vehicle to play the game with.
BEGRÜNDUNG:	The Vehicles are integral part of the game because with it, a player can navigate the racecourse and engage with the game world.
ABHÄNGIGKEITEN:	FA3, FA6

ID	FA5
TITEL:	Start line
BESCHREIBUNG:	The start line marks the beginning of the very first lap and the beginning of each subsequent lap in the game. The start line is situated on the race course. Since the race course is cyclic in nature, the start line also serves as the finish line. Crossing the finish line in the last lap marks the end of the game round.
BEGRÜNDUNG:	As a player navigates the racecourse, the start line/ finish line encourages overtaking manoeuvres and keeping track of each lap progress. This also enhances the sense of competition and achievement, reinforcing the continuous and cyclical nature of the racing challenge
ABHÄNGIGKEITEN:	FA1, FA2

ID	FA6
TITEL:	Car Screen
BESCHREIBUNG:	Via the Car Screen a vehicle can be chosen. The list of available cars is displayed alongside a preview picture of the car, the driver's depiction as well as the speed property of the car on the car screen. When a car is selected, the game goes to the Race Screen.
BEGRÜNDUNG:	One key element that will improve a player's interaction with the game is the car screen. By enabling players to select a vehicle that best suits their tastes and playstlye, this feature aims to improve entire gaming experience and provide a more engaging and joyful gameplay experience
ABHÄNGIGKEITEN:	FA3, FA4, FA7

ID	FA7
TITEL:	Start Screen
BESCHREIBUNG:	When the game is launched, the first interface that will appear is the start screen. The Start Screen has buttons that make it easy to navigate between loading a configuration file, beginning the game and ending the game. The visually pleasing graphics on the screen are intended to draw in and hold a player's attention.
BEGRÜNDUNG:	The Start Screen's implementation achieves important goals that are essential for a fun gaming experience. The navigation buttons on the Start Screen allow a player to quickly access necessary features such as initiating a game or changing settings. The goal of including eye-catching visuals is to entice players into the game's world from the outset. Furthermore, the Start Screen provide a clear overview of the game's mechanics and theme, piquing players' interest from the inset. This feature is essential to laying the groundwork for a fun gaming session
ABHÄNGIGKEITEN:	FA6

ID	FA8
TITEL:	End Screen
BESCHREIBUNG:	Upon completion of the last lap in a gaming session, the End Screen is shown. On the End Screen, important details such as the player's car, amount of time that has passed ans the number of coins that have been collected are shown. The End Screen also gives the player the option to go back to the Start Screen.
BEGRÜNDUNG:	An essential component of bringing the gaming experience to end is the End Screen. Through the display of the selected vehicle, the overall time of the race and the coins earned, the End Screen provides a thorough overview of the player's progress during the course of the race. Players can evaluate their progress and achievements in the game as well as feel a state of accomplishment from this summary. The ability to go back to the Start Screen guarantees a smooth transition, allowing a player to explore with other features or start a new game session without any interruptions. The End Screen advances the game's story by bringing the racing experience to an end as well as providing an intuitive interface for additional interactions with the game world.
ABHÄNGIGKEITEN:	FA1, FA2, FA3, FA4, FA7, FA10, FA18

ID	**FA9**
TITEL:	Countdown and Start Signal
BESCHREIBUNG:	When the Start button is pressed, a countdown begins, decresing from 3 to 0. A Start Signal is when the Countdown is complete. The Start Signal can either be audible or visual, for example, displaying the text 'Start'.
BEGRÜNDUNG:	The Countdown and Start Signal build excitement and anticipation for the first lap of a gaming session. Players can prepare for the impending challenge by using the Countdown as a prelude. Any kind of Start Signal, whether visual or auditory indicates to players that the should be actively participating in the game. If the game is being played by more than one player, the Countdown and Start signal combo guarantees that every player starts at the same time. It gives the beginning of the first lap a lively and captivating element, which enhances the overall gaming experience of the player.
ABHÄNGIGKEITEN:	FA1, FA3, FA4

ID	**FA10**
TITEL:	Stopwatch for Race Duration Measurement
BESCHREIBUNG:	The instant the Start Signal is triggered, a stopwatch starts to run and keeps track of the total amount of time required for the entire race.
BEGRÜNDUNG:	A Stopwatch is an essential feature for measuring and documenting the total time of the race. Players can compare race time, evaluate their own performance and compete by trying to complete laps faster. The race duration data that has been recorded can be used for a number of in-game functions, including setting high scores, evaluating progress over repeated tries and improving the competitive experience in general. If the game is being played by more than one player, the Stopwatch feature complements the racing theme by simulating actual races where exact timing is crucial for identifying the winners and assessing performance.
ABHÄNGIGKEITEN:	FA1, FA2, FA3, FA4, FA10

ID	**FA11**
TITEL:	Pause Game Feature
BESCHREIBUNG:	The Pause Game feature lets players halt the ongoing race(temporarily). This Pause Game feature is realised either through a dedicated screen or a popup. On the dedicated pause screen, players can either choose to resume the game, quit the game or restart the current game session.
BEGRÜNDUNG:	The Pause Game feature allow players to be more flexible and is convenient while playing the game. Furthermore, it also lets users to pause the race for a short while so they can take a break without losing their progress, Including a dedicated screen for pausing so that players can quickly access and make use of other features while playing makes the game even more user-friendly.
ABHÄNGIGKEITEN:	FA1

ID	**FA12**
TITEL:	Configuring Game Parameters
BESCHREIBUNG:	The Start Screen reads a JSON file at the beginning of the game, which acts as a centralised file for defining properties that are essential to the gameplay. The configuration file includes a number of parameters such as number of rounds, the speed enhancement criteria through coin collection, the coin loss event penalty, the amount of oil spills in the game and the amount of time the vehicle runs at 10% of its initial speed.
BEGRÜNDUNG:	The Configuring Game Parameters feature offer an adaptable gaming experience. With this feature, the game can adjust to varying player preferences and difficulty level by enabling Parameter adjustments via a Configuration file. The Configuring Game Parameters feature guarantees that obstacles and rewards of the game are in line with the intended design and are easily adjustable without modifying the main game code
ABHÄNGIGKEITEN:	FA1, FA2, FA3, FA4

ID	**FA13**
TITEL:	Vehicle Steering and Movement
BESCHREIBUNG:	Controlling the car, players can move around the racecourse using the W, A, S and D keys or the arrow keys as control. It is possible to move the vehicle sideways, backwards or forewards. Pressing the forward key accelerates the vehicle to its top speed. The acceleration is determined by the Speed property, which is between 1 and 10. This means that vehicles with higher speed values accelerate more quickly, The foreward key must be released in other to decrease the speed. Furthermore, using the backward key decelerates the vehicle more quickly by acting as a brake. Pressing the backward key will cause the vehicle to move backward while it is still.
BEGRÜNDUNG:	The purpose of implementing the Vehicle Steering and Movement feature is to improve the overall gaming experience by giving players responsive and intuitive control over their vehicles. The Controls are handeled with responsiveness, which enhances player engagement and skill-based gameplay by enabling players to move through the race course and react quickly to challenges that arise during the gameplay
ABHÄNGIGKEITEN:	FA1, FA2, FA3, FA4

ID	**FA14**
TITEL:	Objects on the Racecourse
BESCHREIBUNG:	A variety of objects such as coins, eggplants and oil puddles are placed on the racecourse. In each game round, the server determines how many coins and eggplants to give out. Every round, these objects are replaced with new ones that are placed randomly on the track, replacing the ones that were there the previous round. The configuration file at the start of the game specifies the number of oil puddles which are only placed once per game and no more
BEGRÜNDUNG:	The Objects on the Racecourse feature makes the gameplay more lively and gives the player a more different environment to play in. Coins and eggplants are examples of objects that provide strategic advantages and penalties, affecting the player's decision-making throughout the race. The unpredictable nature of the object placement forces players to modify their tactics with every round. These elements add to the overall excitement and skill-based aspect of the race, making for an exciting and unpredictable gaming experience.
ABHÄNGIGKEITEN:	FA1, FA2, FA12

ID	**FA15**
TITEL:	Coin Collection and Speed Enhancement
BESCHREIBUNG:	The player's car can gather the coins that are scattered throughout the racecourse. When the coins are collected, they vanish from the track. The car's speed rises by a preset percentage as soon as the player collects a certain amount of coins. The amount of coins needed to increase speed is specified in the configuration file. Every round, used coins disappear and a certain number of fresh coins are placed on the track in strategic locations. It's made sure the player can never have too few coins
BEGRÜNDUNG:	The Coin Collection and Speed Enhancement feature introduces a coin-based currency system that has an immediate effect on gameplay. Players can increase their speed, which is a tangible benefit, by collecting coins. By incorporating this feature, players are encouraged to actively interact with the racecourse in order to obtain the speed boost, which gives the game more depth and strategy.
ABHÄNGIGKEITEN:	FA1, FA2, FA3, FA4, FA12, FA13

ID	FA16
TITEL:	Eggplant Interaction
BESCHREIBUNG:	During every round, eggplants appear on the racecourse from time to time. The speed of the player's vehicle drastically decreases when it collides with an egg plant; it slows down to 10% of its current speed for a set amount of time. A coin penalty is also applied to the player, who forfeits a set amount of coins for each egg plant collision. The configuration file contains values that specify the precise coin loss.
BEGRÜNDUNG:	The addition of eggplants to the game adds a level of difficulty and strategy. Players have to manoeuvre carefully around the racetrack to avoid running into eggplants, since every time they do, their speed is severely reduced and they lose coins.
ABHÄNGIGKEITEN:	FA1, FA2, FA3, FA4, FA12, FA13

ID	FA17
TITEL:	Oil Puddle Interaction
BESCHREIBUNG:	When a player hits oil puddles, two things happen. First, as stated in the configuration file, the player loses a fixed quantity of coins as a result of a coin penalty. Second, for a predetermined period of time, the vehicle's speed is drastically reduced and is set at 10% of its current speed. This slowdown mimics the obstacle of having to navigate through an oil puddle.
BEGRÜNDUNG:	The addition of oil puddles to the game adds a new level of difficulty and danger. Players have to be extremely cautious when navigating the racecourse to avoid running into oil puddles, as doing so will cost them money in the form of lost coins and cause their speed to temporarily decrease.
ABHÄNGIGKEITEN:	FA1, FA2, FA3, FA4, FA12, FA13

ID	FA18
TITEL:	Lap Timer
BESCHREIBUNG:	A lap timer is incorporated into the game to track how long it takes the player to finish each lap of racing. The lap timer continuously logs the amount of time that has passed for the current lap while you are driving. Throughout the race, the player receives real-time feedback on their lap time.
BEGRÜNDUNG:	By incorporating Lap Timer into the game. Players receive real-time feedback on their lap times during the race, which helps them understand how they are pacing and modify their strategy accordingly. The competitive element of the game is enhanced by this real-time information, which encourages players to improve their racing strategies and aim for faster lap times
ABHÄNGIGKEITEN:	FA1, FA2, FA3, FA4

ID	FA19
TITEL:	Off-Track Environment Interaction
BESCHREIBUNG:	Grass will make up the off-track area around the racecourse in Marius Cart. The player's car will travel at half the speed it did on the racecourse when it leaves the officially marked racecourse and hits the grass. There will be a variety of stationary items in the grassy area, like trees, plants, and stones. These grass-covered items will function as barriers; the player's vehicle cannot drive through them or collect them. Instead, the vehicle will be hindered and prevented from moving forward if it collides with these off-track objects
BEGRÜNDUNG:	Incorporating an off-track environment with slower speed and obstacles enhances gameplay realism and presents strategic challenges. This feature, which imposes penalties for straying into off-track areas, encourages players to remain on the assigned racecourse
ABHÄNGIGKEITEN:	FA1 FA2

3.2 Nicht-funktionale Anforderungen

Dieser Abschnitt spezifiziert die nicht-funktionalen Anforderungen an das Softwaresystem.

ID	NFA1
TITEL:	Robustheit
BESCHREIBUNG:	Die Anwendung darf nicht abstürzen. Bei 100 Spielen darf maximal 1 Spiel aufgrund eines Fehlers abgebrochen werden.
BEGRÜNDUNG:	Dies soll dem Spieler / der Spielerin ein gutes Spielerlebnis offenbaren.

ID	NFA2
TITEL:	Error Handling
BESCHREIBUNG:	In the event that a request is unsuccessful, the server replies with the relevant error codes (400 for unauthorised requests, 500 for internal server errors). Requests that are successful are acknowledged with a 200 response code.
BEGRÜNDUNG:	The ability of the game to recognise and address problems with communication with the server is dependent on effective error handling. Clear error codes make troubleshooting easier and contribute to a seamless gaming experience by giving helpful feedback when there are communication issues.

ID	NFA3
TITEL:	Server Communication and Response
BESCHREIBUNG:	The Websocket protocol is used by the game to communicate with the server and request the quantity of coins and eggplants to be placed on the track. The requested data is returned by the server. Each round begins with a communication with the server.
BEGRÜNDUNG:	Effective communication with the server guarantees that the game gets up-to-date and precise object placement information giving players the information they need to successfully navigate the racecourse.

ID	NFA4
TITEL:	Scalability
BESCHREIBUNG:	Scalability is the ability of the game's source code and structure to accommodate new features. There should be no trade off between Scalability and the game's speed.
BEGRÜNDUNG:	During the development of the game, there will be a need to consistently add new features. Scalability ensures that new features can be accomodated without interfering with the pre existing ones.

ID	NFA5
TITEL:	User Interface
BESCHREIBUNG:	The game's UI has to be aesthetically pleasing, with a visually appealing design that makes for a better overall gaming experience. Furthermore, players should be able to interact with the UI in an intuitive and responsive manner.
BEGRÜNDUNG:	A smooth gaming experience, positive first impressions, and exploration are all enhanced by a well-designed user interface. It significantly enhances player immersion and raises the level of enjoyment from the game as a whole.

ID	NFA6
TITEL:	Game Performance
BESCHREIBUNG:	The game should respond to user input quickly and without any discernible lag
BEGRÜNDUNG:	A smooth and immersive player experience depends on optimal performance, which also helps to keep players engaged. Smooth gameplay is facilitated by a lag-free environment and quick reaction times.

ID	NFA7
TITEL:	Technology Stack and Programming Language
BESCHREIBUNG:	The Unity game engine and the C# programming language will be used to create the Marius Cart game
BEGRÜNDUNG:	Unity and are C# chosen because they complement each other well and provide a flexible and strong game development environment.

ID	NFA8
TITEL:	Version Control System
BESCHREIBUNG:	GitLab will be used by Marius Cart's game development as the version control system.
BEGRÜNDUNG:	Effective collaboration, code synchronisation, and version tracking are ensured throughout the development life cycle of the Marius Cart game by selecting GitLab as the version control system. This choice is in line with contemporary software development best practises, which encourage openness, cooperation, and effective version control.

ID	NFA9
TITEL:	Continuous Testing
BESCHREIBUNG:	The Marius Cart game development process will incorporate continuous testing as a fundamental component. Several testing techniques will be used during the game's development lifecycle to guarantee its dependability, functionality, and performance.
BEGRÜNDUNG:	To find and fix possible problems early in the development process and improve the game's overall quality, continuous testing is necessary. Frequent testing iterations help write stable, reliable code that makes sure new features and updates keep the intended functionality.

4 Documentation of State Machine Diagrams and Transitions

The state machine diagrams and transitions in the game are thoroughly examined in this section. Every diagram provides a thorough summary of the user's journey through the game by illustrating how the various states of the game flow and the corresponding transitions.

4.1 Game State

The game state diagram can also be seen as the super state or composite state diagram that encapsulates the major sub-states in the game. It shows the transition from one screen to another screen which represents the overall state of the game in each screen.

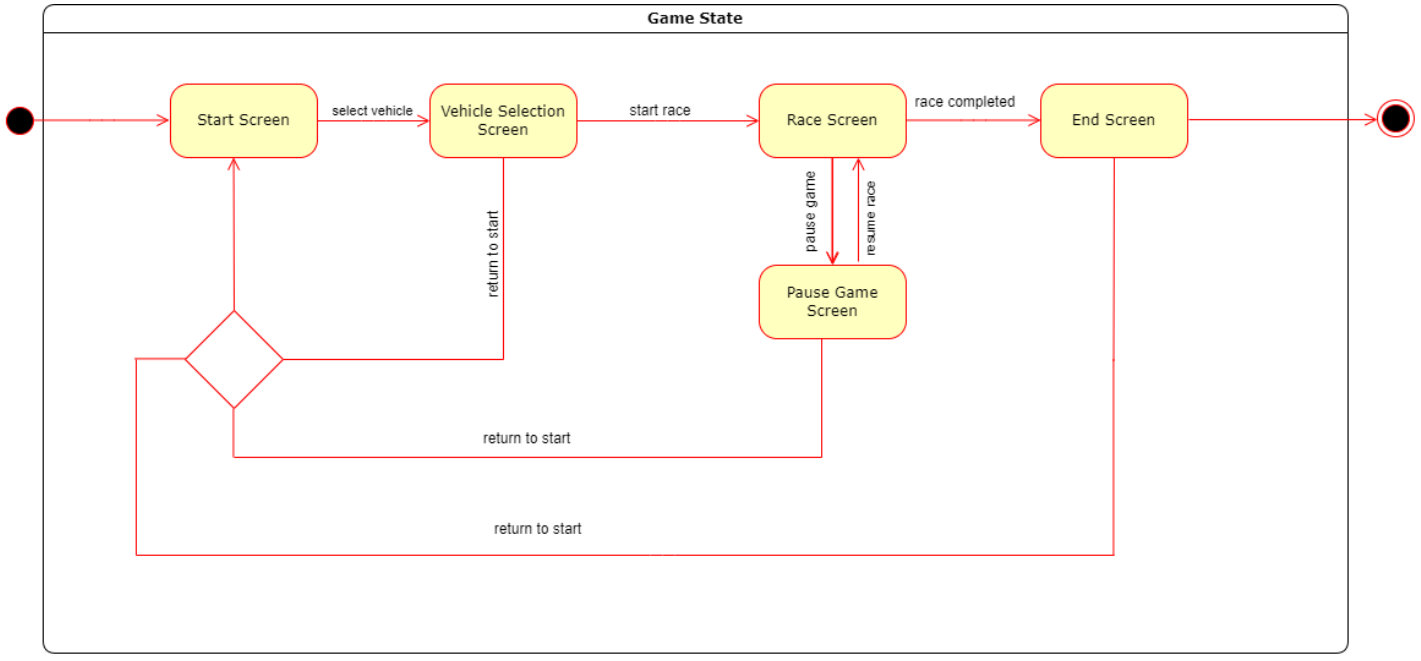

Abbildung 1: Game state diagram

1. **Start Screen**:Initial state from where the player interacts with the game.

- **Transitions**:
- **select vehicle:** This transition occur when the user presses the select vehicle button, this transition leads to the vehicle selection screen.

2. **Vehicle selection Screen:** This is the state in which players can choose their preferred vehicle for the race.
   - **Transitions**:
   - **start race:** This transition occurs when the player confirms their vehicle selection and decides to begin the race.This transition leads to the Race Screen.
   - **return to start:** This transition is triggered if the player chooses to return to the Start Screen.
3. **Race Screen:**The primary gameplay state in which the race takes place.
   - **Transitions**:
   - **pause game:** if the player decides to halt the game, this transition leads to the Pause Game Screen
   - **race completed:** When the race is over, this transition takes the player to the End Screen.
4. **Pause Game Screen:**A state in which the game is temporarily paused.
   - **Transitions**:
   - **resume race:** If the player chooses to continue playing the game after halting it, this transition leads to the Race Screen.
   - **return to start:** If the player wishes to start afresh, this transition leads back to the Start Screen

5. **End Screen:** This is the end state of the overall gameplay and it's reached when the player completes all the rounds in the game
    - **Transitions**:
    - **return to start:** If the player chooses to begin a new game, this transition leads back to the Start Screen.

4.2 Start Screen

The Start Screen state diagram captures in essence what happens upon opening the game application or navigating to the start screen from the End Screen

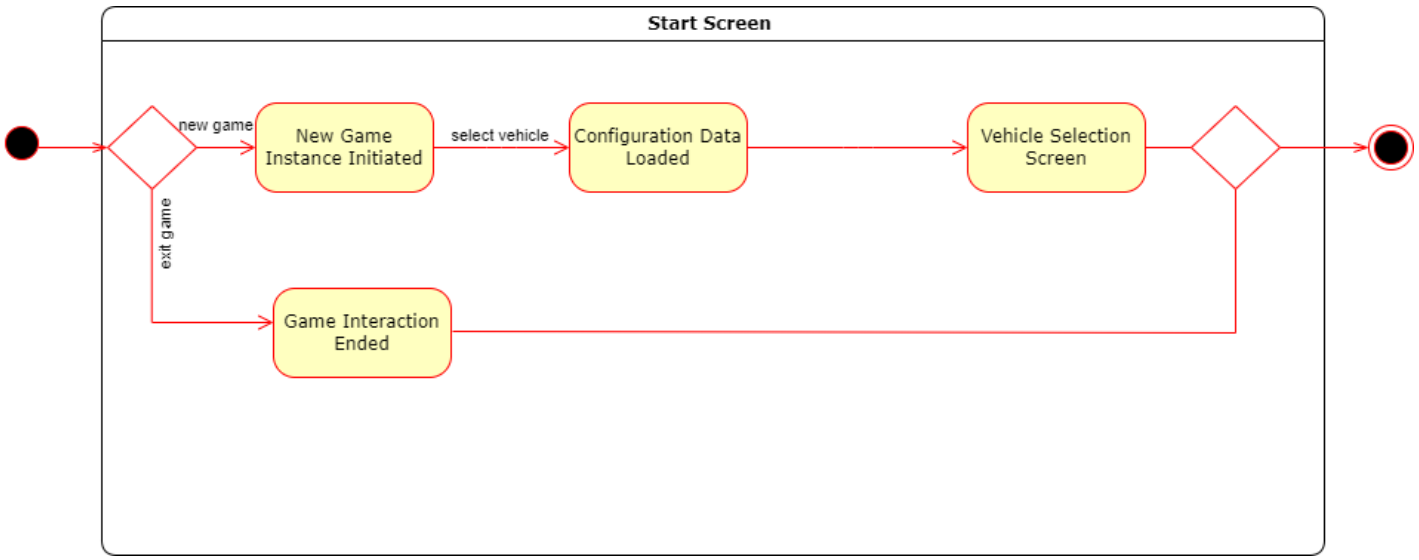

Abbildung 2: Start screen state diagram

1. **New Game Instance Initiated:** If the player clicks the "New Game" button on the Start Screen, a new game instance is automatically instantiated.
    - **Transitions**:
    - **select vehicle:** If the player chooses the "select vehicle" option on the screen, it triggers the game to load the configuration data.
    - **exit game:** If the player wishes to close the game application, this transition leads to the Game Interaction Ended State
2. **Configuration Data Loaded:** This is an essential state before entering Vehicle Selection State because loading configuration data is required for configuring game parameters needed for the game. This state is not visible to the user.
3. **Vehicle Selection Screen:** This state subsequently ends the Start Screen state. At this point, the game has entered an entirely new state.
4. **Game Interaction Ended:**This state also ends the Start Screen state by terminating the game application process. After this state, no new game state is triggered because in this state, the player returns to whatever environment they were using to play the game.

4.3 Vehicle Selection Screen

After the Start Screen, the next game sub-state the user encounters is the vehicle selection screen.

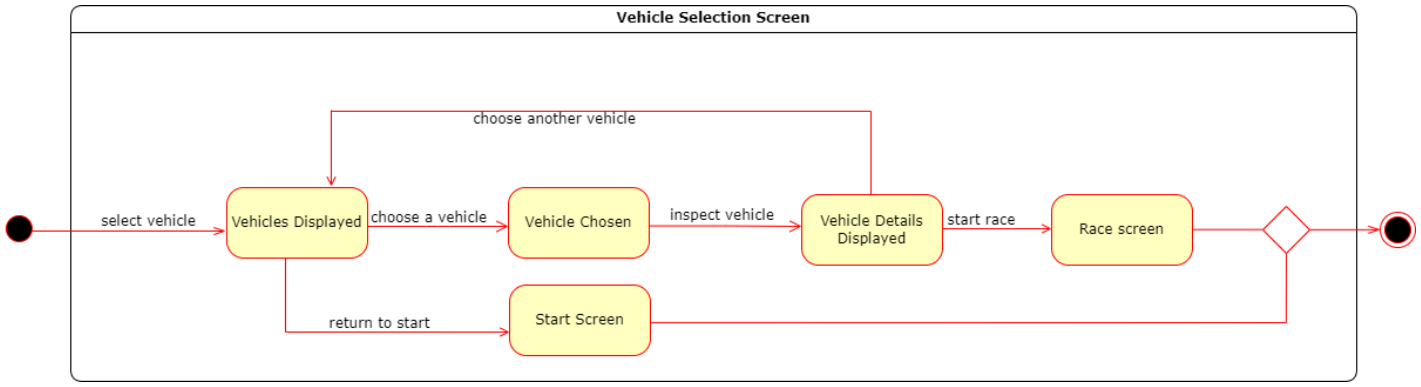

Abbildung 3: Vehicle selection Screen state diagram

1. **Vehicle Displayed:** If the player clicks the "select vehicle" button on the Vehicle Screen, this state captures what happens after that, a list of vehicles that be used for the race is displayed to the player
   - **Transitions**:
   - **choose a vehicle:** This transition is essential for going into the state where a vehicle choice has been made by the player.
   - **return the start:** If the player wishes to navigate back to the Start Screen from the Vehicle Selection Screen, this transition is essentially does that.
2. **Vehicle Chosen:** This is the state the game goes into when the player makes their choice of a vehicle to use during the race.
3. **Vehicle Selection Screen:** This state subsequently ends the Start Screen state. At this point, the game has entered an entirely new state.
   - **Transitions**:
   - **inspect vehicle:** After choosing a vehicle, there has to be a way to view its details, this transition enables that, it triggers the Vehicle Details Displayed state.
4. **Vehicle Details Displayed:**This is the state where the player sees the details of the vehicle they have chosen. An example of such a detail is the speed of the vehicle.
   - **Transitions**:
   - **start race:** This transition is essential for going into the Race Screen after a choice of a vehicle has been made.
   - **choose a vehicle:** If the player wishes to race with another vehicle instead and wants to make a different choice, this transition leads them back to the Vehicles Displayed state.
5. **Race Screen:** This state subsequently ends the Vehicle Selection Screen. Once the player is in the Race Screen, the game is no longer in the Vehicle Selection Screen state.
6. **Start Screen:** This state also ends the Vehicle Selection Screen, if the player makes the choice to navigate back to the Start Screen. Once, in the start screen, the Vehicle Selection Screen ends.

4.4 Race screen

This is the state where the actual gameplay takes place, it encapsulates other sub-states that take place while the player is playing the game.

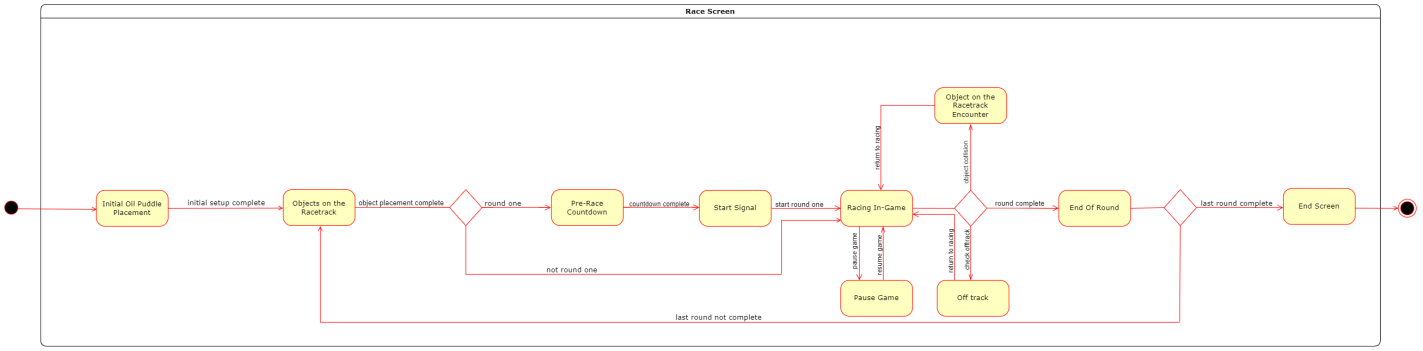

Abbildung 4: Race screen state diagram

1. **Initial Oil Puddle Placement:** This state captures the moment when the player navigates to the race screen for the first time, that is, before the first round of the race. An oil puddle is randomly placed in either of the game rounds and is done by querying a server. This state is not visible to the user
   - **Transitions**:
   - **initial setup complete:**There has to be a way to signify that the Initial Oil Puddle Placement state was achieved, this transition realises that and triggers the the Object on the Racetrack state.
2. **Object On the Racetrack:** This is the state where other objects such as eggplants and coins are randomly placed on the racetrack. This state happens before every round and is done by querying a server.
   - **Transitions**:
   - **object placement complete:** After randomly placing objects on the race track, this transition essentially shows the actual race track to the user.
     - **Transitions**:
     - **round one:** In case it's the player's first round of the race, this transition is essential for going into the Pre-Race Countdown state.
     - **not round one:** In case, it's not the player's first round, pre-race countdown should be skipped and this transition achieves that by triggering the Racing-In-Game state.
3. **Pre-Race Countdown:** This is the state where the countdown is actively going on prior to the first round of the race.
   - **Transitions**:
   - **countdown complete:** After the countdown, a Signal in form of a sound or a text should be triggered. This transition essentially achieves that by triggering the Start Signal state.
4. **Racing In-Game:** While the Start Signal is triggered, the game briefly goes into this state.
   - **Transitions**:
   - **start round one:** This transition is essential for beginning the actual gameplay for the player and triggers the Racing In-Game state.
5. **Racing In-Game:** The state in which the player is actively racing on the race course.
   - **Transitions**:
   - **round complete:** This transition is essential for triggering the end of each round of a race which is detected just briefly as the player approaches the finish line which also doubles as the start line.

- **object collision:** In case the player encounters an object on the race track, this transition handles that and triggers the Object on the Racetrack Encounter state.
- **check offtrack:** In case the player finds themselves on the off-track, this transition handles that and triggers the Off track state.
- **pause game:** This transition is essential for briefly halting the game during the gameplay. It triggers the Pause Game state.

6. **End Of Round:** In this state, each round has just ended, the game has to briefly determine if this is the last round or are there remaining rounds/round. While the game does that, it goes into this state.
   - **Transitions**:
   - **last round:** If it's the last round then this transition helps the player to navigate to the End Screen
   - **last round not complete** As the name implies, this transition triggers the Object on the Racetrack state so as to begin a new round after the former one
7. **Off track:** In this state, the game has to deal with the player's vehicle being on the off-track.
   - **Transitions**:
   - **return to racing:** After dealing with the off-track scenario, the game has to return to its previous Racing In-Game state.
8. **Object on the Racetrack Encounter:** In this state, the game has to deal with the player's vehicle collision with an object on the racetrack.
   - **Transitions**:
   - **return to racing:** After dealing with the player's vehicle colliding with an object on the race track scenario, the game has to return to its previous Racing In-Game state.
9. **Pause Game:** In this state, the game has been halted by the user.
   - **Transitions**:
   - **resume game:** When the player wishes to continue racing, this transition is essential in continuing when they stopped and it triggers the Racing-In-Game state
10. **End Screen:** The last state that ends the overall End Screen state and is only when the player finishes the 3rd and last round.

4.4.1 Object on the Racetrack Encounter

A sub-state in the Race Screen state that the game goes into when a player runs into an object on the track. The objects can be coins, eggplants or oil puddles.

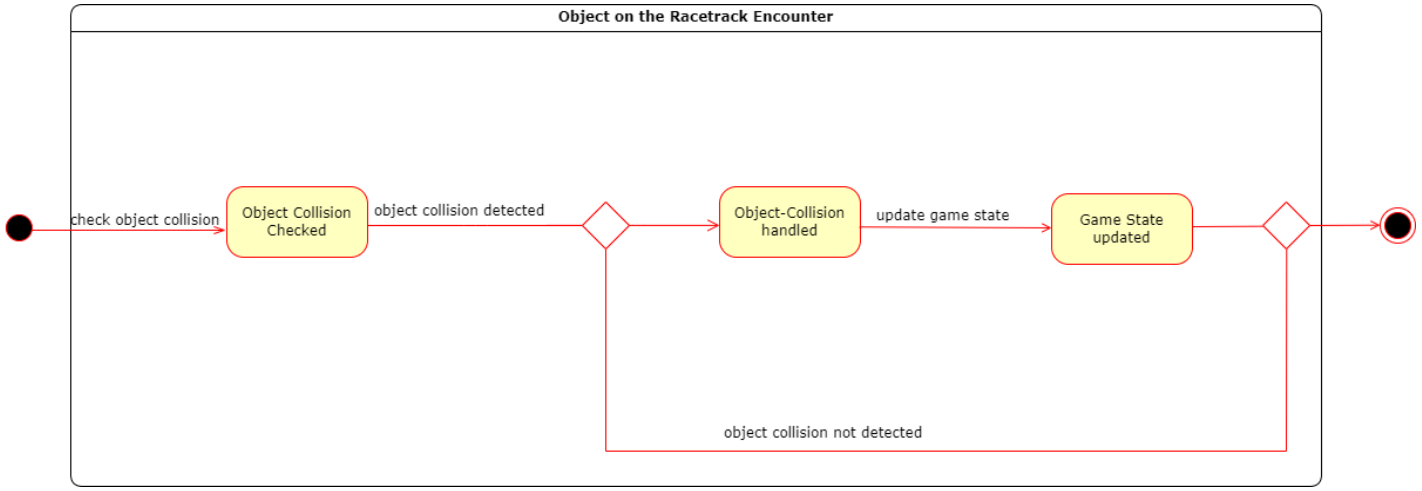

Abbildung 5: Objects on the racetrack state diagram

1. **Object Collision Checked:** This is the state triggered during the course of the race to check if the player's vehicle collides with objects such as coins, eggplants and oil puddles. This state is triggered by the check object collision transition.
   - **Transitions**:
   - **object collision detected:** When the player's vehicle collides with an object on the race track, it's essential to handle this collision because there are consequences depending on which object is collided with.
   - **object collision not detected:** If the player's vehicle does not collide with a vehicle, this transition subsequently ends the the Object on the Racetrack Encounter state.
2. **Object Collision handled:** After handling the object collision by temporarily decreasing the vehicle's speed or increasing the vehicle's speed, this state essentially represents the how the object collision was handled.
   - **Transitions**:
   - **update game state:** After handling the the collision of the player's vehicle with an object, this transition is essential in adjusting the game state.
3. **Game State Updated:**This state also ends the Object on the Racetrack Encounter state and is triggered by the update game state transition. This state captures the state of the game after the collision and handling it.

4.4.2 Off-track

A sub-state in the Race Screen state that the game goes into when a player runs into an object on the track. The objects can be coins, eggplants or oil puddles.

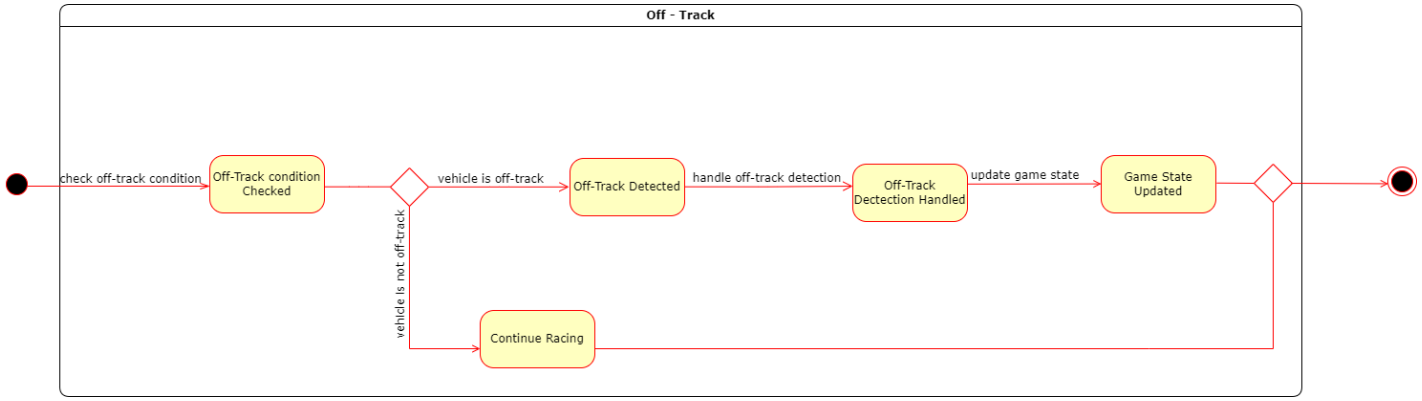

Abbildung 6: Off-track state diagram

1. **Off-Track Condition Checked:** This is the state triggered during the course of the race to check if the player's vehicle is on the off-track which is mostly made up of trees and grasses. This state is triggered by the check off track condition transition.
    - **Transitions**:
    - **vehicle is off-track:** When the player's vehicle is on the off-track, it's important to handle this scenario cause the player to race normally if they are not on the race track. This transition triggers the Off-Track Detected state.
    - **vehicle is not off-track:** If the player's vehicle is not on the off-track then this transition in essential in handling that and it triggers the Continue Racing state.
2. **Off-Track Detected:** When the player's vehicle is off-track, this state is essential in handling that moment because being on the off-track has a consequence.
    - **Transitions**:
    - **handle off-track detection:** This transition is essential for going into the state where being on the off-track can be handled.
3. **Off-Track Detection Handled:**After handling the off-track detection by not allowing the player to drive through the off-track and temporarily decreasing the vehicle's speed until the vehicle is on the racetrack, this state captures when the speed of the vehicle has been temporarily reduced as a consequence of being on the off-track.
    - **Transitions**:
    - **update game state:** This transition is essential for going into the state where the vehicles normal speed is restored after being back on the track.
4. **Continue Racing:** This state ends the Off-track state and is essential in case the game does not detect the player being on the off-track.
5. **Game State Updated:**This state also ends the Off-track state and is triggered by the update game state transition. This state captures the state of the game after the player is back on the race track after being temporarily on the off-track.

4.5 End Screen

The End Screen state diagram describes what happens when the player is done with a game session.

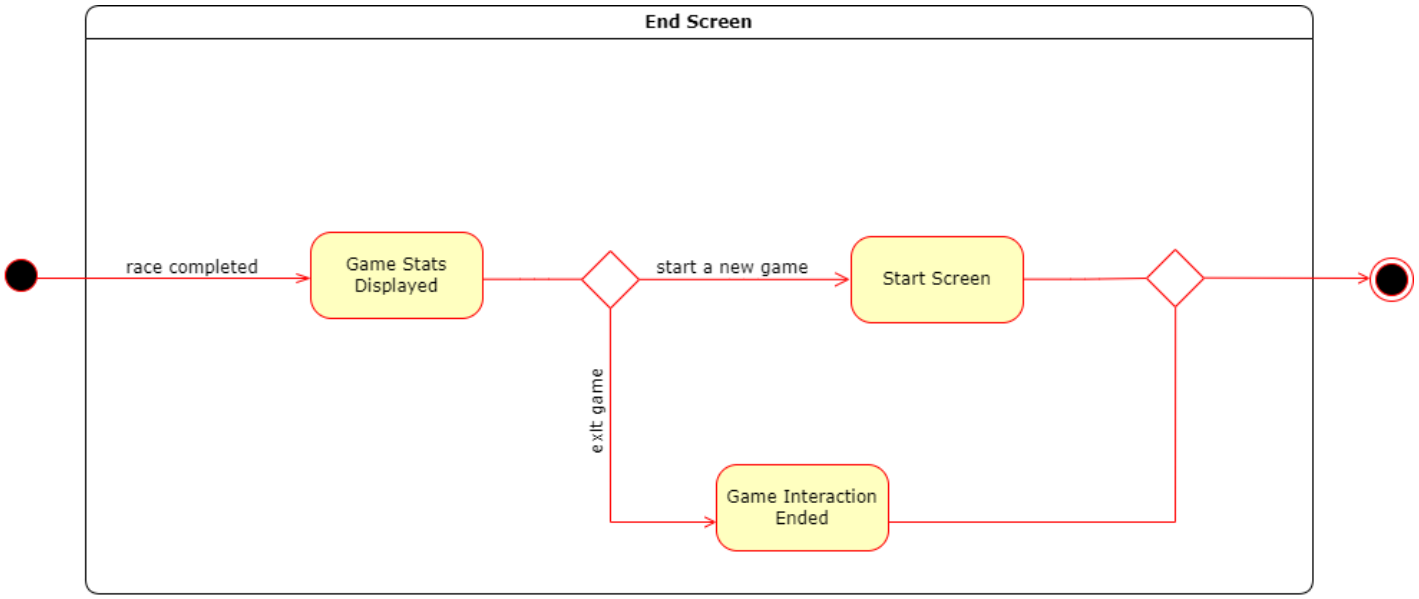

Abbildung 7: End Screen state diagram

1. **Game Stats Displayed:** This is an essential state for showing the player how well they played during the race
   - **Transitions**:
   - **start a new game:** If the player chooses the "New Game" option on the screen, it triggers the game to navigate to the start screen subsequently ending the End Screen State as a whole
   - **exit game:** If the player wishes to close the game application, this transition leads to the Game Interaction Ended State
2. **Game Interaction Ended:**This state also ends the End Screen state by terminating the game application process. After this state, no new game state is triggered because in this state, the player returns to whatever environment they were using to play the game.

5 Class Diagrams

This section essentially describes the view of the whole system using class diagrams.

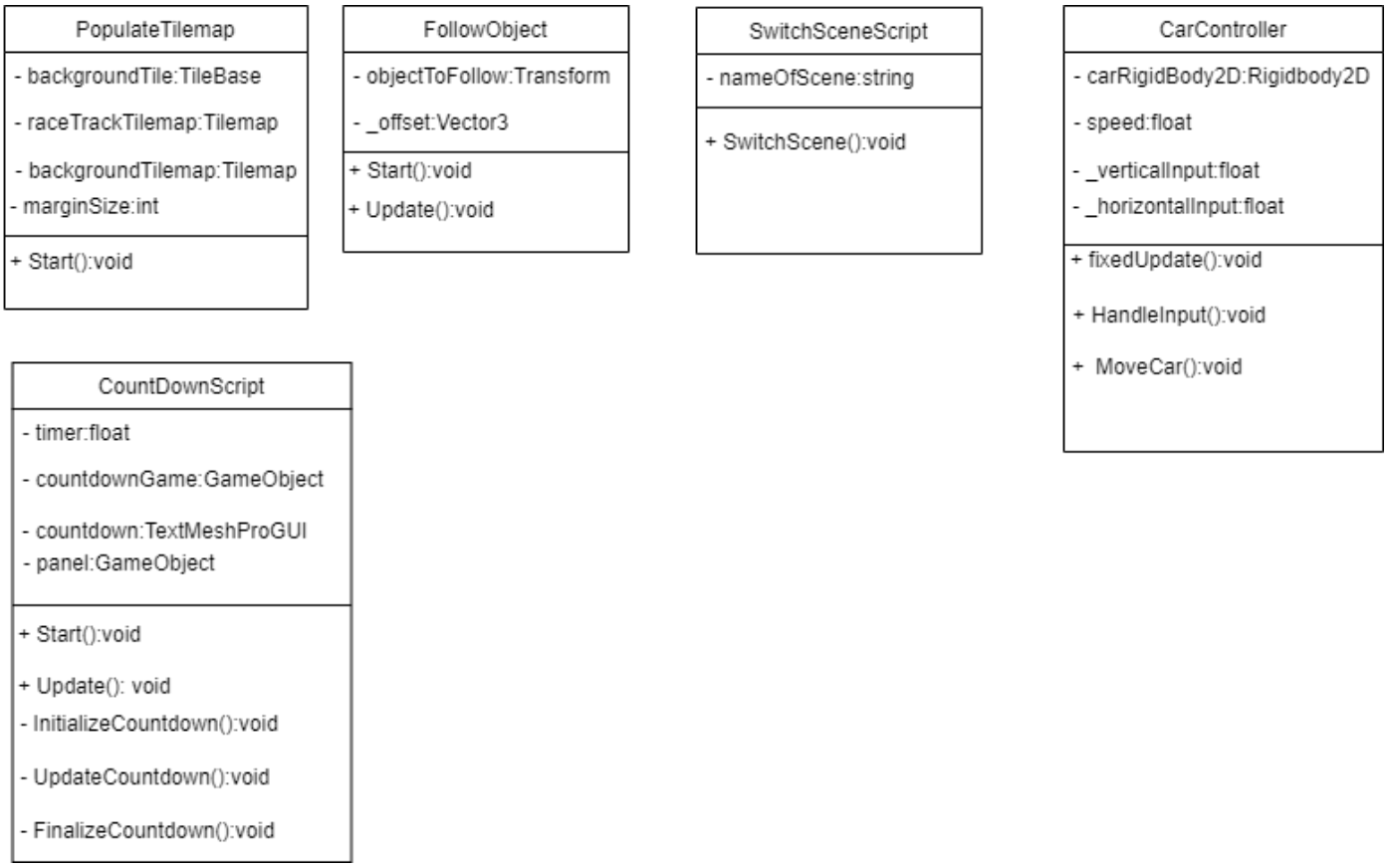

Abbildung 8: class diagram