**Functional Requirements Document**  
**Car Racing Game Prototype**

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## ****1. Introduction****

### ****1.1 Purpose****

This document defines the functional requirements for the Car Racing Game Prototype. The game is designed to simulate a car race with dynamic elements affecting gameplay. The main objectives include:

* Enabling cars to move between multiple stops on the track.
* Calculating total race time for each car while introducing randomness for realism.
* Visually displaying the race process and determining the winner.

### ****1.2 Scope****

This document outlines the primary functional aspects of the game but does not cover technical implementation details, such as programming languages or system architecture.

### ****1.3 Document Structure****

The document is structured as follows:

* Section 2 defines key functional requirements.
* Section 3 lists non-functional requirements.
* Section 4 provides a conclusion summarizing the document’s scope.

## ****2. Key Functional Requirements****

### ****2.1 Cars Move Along the Track and Determine the Winner****

#### **Description**

* Multiple cars participate in the race, moving from one stop to another until they reach the finish line.
* The track consists of multiple stops, and each car follows a unique path.
* The system calculates the total completion time for each car, with the fastest car winning the race.

#### **System Behavior**

* Once the race starts, cars follow their designated paths from start to finish.
* The system records the time taken for each movement and calculates total completion time.
* Speed is affected by track conditions, weather, and obstacles.

### ****2.2 Car Speed Influenced by Multiple Factors****

#### **Description**

Car speed is dynamic and influenced by several factors:

1. **Engine (Engine):** Affects maximum speed.
2. **Tires (Tire):** Different types (Soft, Hard, Wet) impact grip and durability.
3. **Fuel (Fuel):** Affects car weight, influencing acceleration and speed.
4. Wheels (Wheel): Affects aerodynamics and steering control, impacting speed and stability.

- Carbon Fiber Wheel: Reduces weight, improving acceleration and handling.

- Alloy Wheel: Increases durability, providing better resistance to wear and tear.

1. **Driver (Driver):** Driving styles (Aggressive, Cautious, Balanced) alter race strategy and speed.

#### **System Behavior**

* The system continuously updates car speed based on these attributes.
* Speed dynamically changes during the race (e.g., tire wear reduces speed).
* The system records real-time speed changes.

### ****2.3 Obstacles Affect Race Dynamics****

#### **Description**

Obstacles appear randomly on the track, affecting car performance:

* **Oil Spill:** Reduces grip, increasing skidding risk.
* **Debris:** May damage tires, slowing the car.
* **Pothole:** Affects stability and handling.
* **Water Puddle:** Temporarily slows down the car.
* **Speed Bump:** Requires braking or causes suspension damage.
* **Barrier:** Forces braking or detouring.

#### **System Behavior**

* Obstacles are randomly placed on the track.
* When a car encounters an obstacle, speed and tire condition are affected.
* The TrackManager dynamically adjusts track conditions, such as adding or removing obstacles and changing surface conditions like wetness, which impacts car performance.

### ****2.4 Pit Stop for Refueling and Maintenance****

#### **Description**

Cars may enter a **Pit Stop** for:

* **Refueling:** To avoid running out of fuel.
* **Tire Change:** To replace worn-out tires.
* **Repairs:** To fix damage from obstacles.

#### **System Behavior**

* The **CarManager** monitors car status and schedules pit stops.
* The **PitStop** provides refueling, tire changes, and repairs.
* After servicing, cars wait a set time before re-entering the race.

### ****2.5 Race Management and Results Calculation****

#### **Description**

The **RaceManager** oversees the race, handling:

1. **Start Race:** Signals cars to begin racing.
2. **Monitor Race:** Tracks progress, speed, and obstacles.
3. **Coordinate Pit Stops:** Determines optimal pit stop timing.
4. **Calculate Results:** Records total race time for each car.
5. **Announce Winner:** Declares the fastest car as the winner.

#### **System Behavior**

* The **RaceManager** initiates the race and controls game flow.
* The **TrackManager** updates track conditions.
* At race end, the **RaceManager** calculates results and displays the winner.
* The system should record race data, including each car’s speed variations, pit stop times, and final rankings, allowing users to review past races and analyze performance trends.

## ****3. Non-Functional Requirements****

### ****3.1 Visual Representation****

* The game must include graphical or animated visuals of the race.

### ****3.2 Randomized Data****

* The system must generate random values for track conditions, car speeds, and obstacle locations.

### ****3.3 Scalability****

* The design should allow future expansion, such as new car types and weather effects.

### ****3.4 Performance****

* The race should run efficiently, avoiding excessive delays or infinite loops.

## ****4. Conclusion****

This document outlines the core functionalities of the Car Racing Game Prototype, covering car movement, path calculation, random elements, pit stops, and race management. The game is designed to provide a dynamic and strategic racing experience, ensuring unpredictability and engagement for players. Future expansions can build upon this foundation to introduce additional complexities and enhancements.

**End of Document**