**Technical Requirements Document (TRD)**
**Raspberry Pi-Based RC Car**
**Date**: [Insert Date]

## 1. Hardware Requirements

### 1.1. Chassis

- Material: Durable plastic or lightweight metal.
- Size: Minimum of [e.g., "20cm x 15cm"] to accommodate all components.
- Weight-bearing capability: Able to support up to [e.g., "2kg"].

### 1.2. Raspberry Pi

- The choice of Raspberry Pi model is pivotal. The Raspberry Pi 4 Model B, or a newer equivalent, is preferred due to its demonstrated capabilities in multitasking and processing. This model ensures that the project's computational demands are met with consistency, reliability, and without compromising performance. Minimum RAM: 4GB, pivotal to assure that the operating system, control software, and video processing tasks run seamlessly without bottlenecks.
- Ports: Equipped with HDMI, a minimum of 2 USB ports for expandability, and ample GPIO pins to facilitate the integration of various sensors and modules.

### 1.3. Motors and Movement

- Drive: The car will employ an all-wheel drive using a minimum of four high-torque motors. These motors, designed for agility and durability, should navigate a range of terrains from smooth surfaces to rough outdoor conditions.
- Speed: A top speed of 10 km/h is anticipated, striking a balance between agility and safety.
- Steering: Steering should be precise, facilitating nimble maneuvers with a turning radius not exceeding 50cm.

### 1.4. Battery

- Type: Rechargeable Li-Po or Li-ion battery.
- Capacity: Minimum of [e.g., "3000mAh"].
- Operational Time: At least 3 hours on a single charge.
- Recharge Time: No more than [e.g., "2 hours"].

### 1.5. Camera Module

- Resolution: Minimum [e.g., "720p HD"].
- Frame Rate: At least [e.g., "30fps"].
- Field of View: Minimum [e.g., "120 degrees"].

**2. Software Requirements**

**2.1. Operating System**

- Custom Raspberry Pi OS image with a fast boot time of no more than [e.g., "30 seconds"].

**2.2. Control Interface**

- Responsive web interface or mobile application: User-friendly and intuitive, compatible across major platforms (iOS, Android, and web browsers), providing comprehensive control from basic movement to intricate configurations.
- Real-time video streaming: Imperative for a real-time visual from the car's vantage point, with a delay no more than 0.5 seconds.

**2.3. Obstacle Avoidance**

- Sensors: Ultrasonic or IR sensors for front, rear, and side obstacle detection.
- Reaction Time: System should react to obstacles within [e.g., "0.2 seconds"].

**2.4. Security**

- Encrypted connection between the RC car and control interface.
- Password protection for access.

**3. Additional Features and Functionality**

**3.1. Lighting**

- Bright white LEDs for headlights.
- Red LEDs for taillights with on/off and brightness control via the interface.

**3.2. Sound Module**

- Clear speaker with volume control and ability to play predefined sounds.

**3.3. Connectivity**

- Wi-Fi capability with a range of at least [e.g., "50 meters"].
- Visual indicators for connection status.