**Game Design Document (GDD)**

**Project Title:** AR Auto Showroom  
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**Course:** DMVR606 – Virtual and Augmented Reality Development  
**Semester:** Spring 2025

**1. Project Overview**

The AR Auto Showroom is a mobile application that leverages Augmented Reality (AR) to let users explore, customize, and interact with realistic 3D car models in their physical environment. Built using Unity3D and AR Foundation, it supports both markerless and marker-based AR experiences. The system is designed for intuitive interaction, immersive vehicle inspection, and responsive performance.

**2. Objectives**

* Implement **markerless plane detection** for real-world car placement.
* Enable **marker-based image tracking** to spawn specific car models using printed markers.
* Provide a **UI panel** for vehicle configuration:
  + Switch car model
  + Change body color
  + Start/stop engine with audio
  + Open and close doors with animation

**3. Target Platform**

* **Android** devices supporting ARCore
* Tested on Android via Unity Remote and APK builds

**4. Core Features**

**4.1 Markerless AR Placement**

* Uses ARRaycastManager and ARPlaneManager to detect flat surfaces.
* On user tap, a car prefab is instantiated at the detected pose.

**4.2 Marker-Based Image Tracking**

* Uses ARTrackedImageManager with a Reference Image Library.
* When a marker is recognized, the corresponding car prefab appears at the tracked image's position.

**4.3 Car Model Switching**

* Users can switch between two cars using the UI.
* Only one car is active at a time using an index-based controller script.

**4.4 Vehicle Customization**

* **Color Change:** Cycle through multiple color presets using a button.
* **Engine Toggle:** Plays/stops looping engine audio.
* **Door Animation:** Triggers Animator to open or close doors using triggers.

**4.5 UI Design**

* Bottom-anchored control panel with buttons for each function.
* Responsive layout to support multiple screen sizes.

**5. Technical Architecture**

* **Engine:** Unity3D (2022.3 LTS)
* **AR SDK:** AR Foundation + ARCore XR Plugin
* **Programming Language:** C#
* **Animation:** Animator with trigger-based transitions
* **Audio:** AudioSource with play/stop toggle logic
* **Scene Management:** Two separate scenes (Markerless + Marker-based)

**6. Assets**

* 3D Models: Chevrolet and Dodge (low-poly, realistic scale)
* Materials: Multiple materials used for body color switching
* Audio: Engine sound loop, voiceover (planned)
* UI: Unity built-in UI toolkit with anchors and layout groups

**7. Scripts Overview**

* CarColorChanger.cs — Cycles material color from a color array.
* EngineToggle.cs — Plays or stops engine audio on tap.
* CarSwitcher.cs — Toggles between car prefabs using index.
* DoorAnimator.cs — Controls opening/closing door animations with triggers.

**8. Development Challenges**

* Identifying the correct mesh to change material color.
* Aligning AR objects to detected surfaces.
* Ensuring animations play correctly through script control.
* Optimizing UI interaction for AR overlays.

**9. Future Improvements**

* Add voiceover playback near cars (20s TTS clip).
* Add snapshot/photo mode.
* Save user customization settings between sessions.
* Introduce tooltip panels and guided tour feature.

**10. GitHub Repository**

<https://github.com/mariamahmed04/Final-Car-Showroom>

**11. APK and Demo Video**

* APK: [FinalBuild.apk] (link to be attached)
* Video Demo: [Final\_AR\_Showroom\_Demo.mp4] (link to be attached)

**End of Game Design Document**