CHAITANYAENGINEERING COLLEGE

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(Approved by AICTE, New Delhi & Affiliated By JNTU Gurajada Vizianagaram)

NBA and NAAC Accredited

Department of Artificial Intelligence

This certificate is presented to the members of the group in recognition of their successful participation and contribution to the following project:

PROJECT TITLE: DODGE FALLING BLOCKS 3D

BRANCH: AI&DS YEAR:3rd Year

TEAM MEMBERS:

Member Name	**Registration Number**
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ACKNOWLEDGEMENTS

I wish to convey my profound and sincere appreciation to every individual and entity whose support, guidance, and encouragement were instrumental in the successful completion of my project, “Dodge Falling Blocks 3D.” This endeavor was more than a technical challenge; it was a comprehensive learning journey made possible by a network of generous contributors.

First and foremost, I extend my deepest gratitude to [Your Guide’s Name], my dedicated project guide. Their role transcended that of a mere supervisor, becoming that of a true mentor. The unwavering confidence they placed in this project, coupled with their invaluable technical guidance, visionary insights, and meticulous feedback, shaped the core architecture and execution of the final system. Their expertise was crucial in navigating the complexities of integrating real-time 3D graphics with web technologies, and their patience during countless consultations ensured that every obstacle was met with a clear, strategic path forward. Without their consistent support and prompt availability, the transformation of theoretical concepts into a robust, working system would not have been possible.

I also wish to thank the esteemed Head of the Department, [HOD's Name/Title], and all the dedicated Faculty Members of the [Department Name] Department. Their collective effort in curating a stimulating and intellectually rich academic environment provided the essential foundation upon which this project could flourish. Furthermore, I am thankful to my Institution, [Institution Name], for offering access to the necessary state-of-the-art facilities, computational resources, and technological infrastructure that were indispensable for the intensive development and testing phases of a 3D application.

My sincere thanks are also extended to my exceptional friends and classmates. They provided an atmosphere of vital camaraderie and collaborative spirit that made the most challenging moments manageable. Their objective suggestions, critical observations, and willingness to serve as the initial cohort of playtesters for “Dodge Falling Blocks 3D” were fundamental in refining the game mechanics, enhancing the user experience, and ensuring stability. Their constant motivation and shared enthusiasm kept morale high throughout the intensive development cycle.

Lastly, my most heartfelt and profound appreciation is reserved for my family. Their unconditional love, endless patience, and silent sacrifices provided the emotional and psychological anchor necessary to sustain the intense focus required for this project. They created a nurturing and understanding environment, enduring the late nights and absorbing the stresses inherent in such a demanding undertaking. Their steadfast support was the essential, foundational fuel without which this challenging project could not have reached fruition.

This project has offered a truly valuable and transformative learning experience, providing deep, practical understanding in the intricate integration of 3D graphics (using technologies like WebGL/Three.js), modern web technologies, and elements of artificial intelligence for dynamic block manipulation. I am immensely grateful for the opportunity to explore, contribute to, and gain mastery in these cutting-edge fields.

TEAM MEMBERS

1.Gudabandi Nithin Kumar
2.Mortha Durga Prasad
3.Mukati gowrishankar
4.Paasila Manikanta

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Abstract

The project “Dodge Falling Blocks 3D” is an interactive web-based 3D game that challenges players to avoid dynamically falling obstacles while collecting power-ups for survival. The game provides an immersive visual experience built entirely with Three.js, a powerful JavaScript 3D graphics library, and styled using Tailwind CSS for a modern and responsive interface.

Unlike traditional 2D block-dodging games, this project offers a real-time 3D environment with smooth physics, customizable difficulty levels, and adaptive gameplay suitable for both desktop and mobile users. The player controls a cube-shaped avatar that must move across a platform to avoid collisions with falling blocks of random sizes and speeds.

A key innovation in this project is the integration of Google’s Gemini API, which introduces AI-powered features into the gameplay. Players can use the “Dream a Theme” option to generate new creative themes, such as custom fog and ground colors, making each session visually unique. Additionally, the game includes an AI Coach, which provides personalized tips, motivational messages, and fun commentary after gameplay, enhancing player engagement and replay value.

The project demonstrates the effective combination of 3D graphics, AI interaction, and responsive web design to create a fully functional, entertaining, and intelligent gaming experience that showcases the potential of integrating modern web technologies with artificial intelligence.

PURPOSE AND SCOPE

Purpose of the Project

The primary purpose of “Dodge Falling Blocks 3D” is to design and develop an interactive, browser-based 3D game that demonstrates real-time rendering, user control, and intelligent system interaction using modern web technologies.

The game aims to:

- Provide a fun and skill-based 3D gaming experience using Three.js and WebGL.
- Implement real-time movement, collision detection, and object spawning using efficient algorithms.
- Demonstrate integration of artificial intelligence (AI) through the Gemini API for generating creative content (themes) and delivering personalized player feedback (AI Coach).

Showcase the capability of web browsers to handle complex 3D graphics and interactivity without the need for additional software installations.

Encourage creativity, adaptability, and user engagement through AI-driven visual customization and realtime coaching.

This project is a blend of technical innovation and user engagement, merging traditional gaming mechanics with AI-enhanced personalization and feedback to deliver a complete, modern gaming experience

Scope of the Project

The scope of Dodge Falling Blocks 3D covers the entire development process of a 3D interactive web game — from conceptualization to deployment. The game runs smoothly on any modern browser supporting WebGL, making it cross-platform and device-independent.

The main functionalities include:

- 3D Game Environment:
- Built using Three.js, providing realistic lighting, shadows, and perspective camera views.
- Player Control and Interaction:
- Supports keyboard and touch controls for both desktop and mobile users.
- Dynamic Obstacles:
- Randomly generated blocks of various sizes fall from above, increasing in speed and number as time progresses.

Power-Up System:

Includes special items like Shield, Slow-Mo, and Shrink, which temporarily modify gameplay mechanics.

- AI Integration (Gemini API):
  - AI Coach: Provides motivational or funny remarks at game-over or pause screens. AI
  - Theme Generator: Creates new visual styles and color themes dynamically.
- User Interface and Experience:
  - Elegant, responsive design using Tailwind CSS.
  - Menus for difficulty selection, settings, and pause/resume functions.
- Persistence:
- Uses LocalStorage to save best scores and progress for continuation of gameplay.
- Accessibility:
- Optimized for mobile devices with touch-based movement buttons and adjustable graphics quality.

Project Limitations

While the project demonstrates high interactivity and AI features, its current version:

- Works primarily in browsers with WebGL and JavaScript support.
- Lacks server-side or multiplayer features.
- Depends on internet access for Gemini API-based AI responses

SYSTEM ARCHITECTURE AND EXPLANATION

The system architecture of Dodge Falling Blocks 3D is designed as a client-side web application, fully powered by JavaScript, Three.js, and Gemini AI API integration. The architecture ensures modularity, scalability, and smooth real-time performance for 3D gameplay.

1. **Architectural Overview**

The system follows a modular, event-driven architecture, where each module handles a specific task. The game runs entirely within the browser, utilizing the WebGL rendering engine via Three.js for 3D graphics. At a high level, the architecture consists of the following layers:

A. **User Interface Layer**

- Built using HTML and Tailwind CSS, it provides a responsive and accessible design.
- Displays menus, score HUD, settings, and pause/game-over screens.
- Handles all player inputs via keyboard or touch buttons.

B. **Game Engine Layer (Core Logic)**

- The heart of the system, written in JavaScript using Three.js.
- Responsible for:
  - Creating and managing the 3D scene, camera, and renderer.
  - Updating entities (player, obstacles, power-ups) frame by frame.
  - Collision detection, score updating, and difficulty scaling.

C. **AI Integration Layer**

- Connects with the Gemini API for intelligent interaction.

Two major AI-driven features:

a. AI Coach – Provides motivational, humorous, or insightful gameplay tips after each round or during pauses.

b. Dream a Theme – Dynamically generates creative visual themes (colors for ground and fog) through AI text prompts.

D. Audio and Feedback Layer

Uses the Web Audio API to produce dynamic sound effects (beeps and alerts).

- Enhances immersion by responding to game events such as collisions, power-up collection, and scoring.

E. **Storage and Data Management Layer**

- Utilizes Browser LocalStorage to store:
  - Player's best score.
  - Game progress (lives, score, level) for continuation.
- Allows players to pause and resume the game seamlessly.

2. **System Flow**

Below is the logical flow of operations in the game:

Initialization Phase:

Load Three.js environment (scene, camera, lights, ground).

-
  -
  - Initialize player, obstacles, and power-up modules.
  - Set up HUD and menu interfaces.
- Main Menu:
  - Player selects difficulty or uses AI “Dream a Theme.” On selection,
  - the game transitions into active mode.
- Game Loop Execution:
  - Continuously executes Render Loop:
    - Read player input.
    - Update player position and animations.
    - Spawn and move obstacles.
    - Detect collisions and power-ups.
    - Update score and time.
    - Render the scene each frame (~60 FPS).

Event Handling:

- Collision with blocks → Lose life or end game.
- Power-up collection → Trigger effect (Shield, Slow-Mo, Shrink).
- Pause button → Save state and display AI Coach message.

Game Over State:

- Compare score with best score.
- Save results to LocalStorage.
- Display “AI Coach” feedback and allow replay or menu return.

3. Key Components in the Architecture

Component	Description
Three.js Renderer	Responsible for all 3D graphics rendering, lighting, and scene management. It visualizes objects like the player and obstacles dynamically.
Player Class	Handles player control, sensitivity adjustment, movement physics, collision detection, and the effects of power-ups such as shields or boosts.
Obstacle & PowerUp Manager	Controls how and when obstacles or power-ups appear, adjusts their difficulty dynamically, and manages cleanup to optimize performance.
Gemini Integration	Connects the game with Google’s Gemini API to generate interactive AI-driven feedback or new game themes, improving engagement.
Component	**Description**
HUD/UI Controller	Displays the on-screen information such as score, level, health, and difficulty indicators. It updates dynamically during gameplay.
Beeper Class	Generates real-time sound effects (like collision beeps or power-up chimes) to enhance the player's immersive experience.

5. System Features Integration

- The architecture ensures **real-time performance** by limiting resource-heavy computations.
- Modular design allows easy addition of new features (e.g., multiplayer or new AI prompts).
- AI interaction is asynchronous, preventing gameplay lag.
- Smooth rendering and adaptive frame rate maintain consistent performance across devices.

System Requirements

The development and execution of the project **"Dodge Falling Blocks 3D"** require both hardware and software components to ensure smooth rendering, high performance, and effective AI integration.
Since this is a browser-based 3D game, it runs directly on client machines without the need for additional installations or servers.

1. Hardware Requirements

Component	Minimum Requirement	Recommended Requirement
Processor (CPU)	Dual-core processor (Intel i3 / AMD equivalent)	Quad-core processor or higher (Intel i5/i7)
Memory (RAM)	4 GB	8 GB or more
Storage Space	200 MB free space	500 MB free space
Graphics (GPU)	Integrated graphics supporting WebGL	Dedicated GPU (NVIDIA / AMD) supporting WebGL 2.0
Display Resolution	1280 × 720	1920 × 1080 (Full HD)
Input Devices	Keyboard / Touchscreen	Keyboard, Mouse, Touchscreen (for mobile controls)
Network Connectivity	Internet connection (for AI features)	Stable broadband connection for consistent Gemini API access

2. Software Requirements

Software Component	Specification / Version
Operating System	Windows 10 / 11, macOS, or Linux (any modern OS)
Web Browser	Google Chrome 90+ / Microsoft Edge 90+ / Firefox 88+ / Safari 14+
Programming Languages	HTML5, CSS3, JavaScript (ES6 or later)
Frameworks / Libraries	- Three.js (for 3D rendering) - Tailwind CSS (for UI design)
AI Integration API	Google Gemini API (Generative AI model for themes and AI Coach tips)
Development Environment	Visual Studio Code / Sublime Text / any IDE supporting web projects
Version Control (Optional)	Git / GitHub for project backup and versioning
Audio API	Web Audio API (for in-browser sound effects)

3.Browser Support

The project has been tested and verified to run on:

- Google Chrome (Desktop & Mobile)
- Microsoft Edge
- Mozilla Firefox
- Apple Safari (iOS/macOS)

The game is fully responsive, adapting seamlessly to various device screen sizes and aspect ratios through Tailwind CSS.

4. External Dependencies

Dependency	Purpose
Three.js CDN	Enables creation of 3D graphics, lighting, and camera control.
Tailwind CSS CDN	Provides responsive layout and modern UI styling.
Gemini API (Google)	Powers AI-generated themes and coaching features.
LocalStorage (Web API)	Stores user progress, best scores, and saved game states.

5. Platform Compatibility

- Works entirely in a web browser (no installation needed).
- Compatible with Windows, macOS, Linux, Android, and iOS devices.
- Supports both keyboard controls (desktop) and touch controls (mobile).

6. Environmental Setup

1. Install a text editor such as Visual Studio Code.
2. Ensure the system has an updated browser supporting WebGL.
3. Open the index.html file directly in the browser.
4. Internet connection is required only for AI-based features (Gemini API).
5. For offline testing, gameplay still functions but AI features are disabled.

Project Modules

The “Dodge Falling Blocks 3D” game is organized into several modules that work together to create an interactive, dynamic, and AI-enhanced gaming experience. Each module handles a specific functionality — from user control and rendering to AI interaction and game logic.

1.Game initialization Module Purpose:

To set up and prepare all essential components before gameplay begins.

Functions:

- Initializes the Three.js scene, camera, and renderer.
- Creates the ground plane, lighting, and fog effects.
- Instantiates main game objects — player, obstacles, and power-ups.
- Sets up event listeners for keyboard and touch input.
- Loads saved data from LocalStorage (best score, previous session).

Code Example (Simplified):

```
function boot() {
  loadBest();
  initThree('high');
  player = new Player();
  obstacles = new Obstacles();
  powerups = new PowerUps();
  player.setSensitivity(parseFloat(inpSens.value));
  beeper.setVolume(parseFloat(inpVol.value));
  showMainMenu();
  renderLoop();
}
```

Explanation:

This function is executed once when the page loads. It sets up all visual and logical elements of the game, making the system ready to start from the main menu.

2.Player Module Purpose:

To control the movement, physics, and visual representation of the player cube.

Functions:

- Handles movement (left, right, forward, backward) using keyboard or touch inputs.
- Applies physics like acceleration, friction, and boundaries.
- Manages player states (normal, shielded, shrunk).
- Updates player position and rotation every frame.

Code Example (Simplified):

```
class Player {
  constructor() {
    const geo = new THREE.BoxGeometry(10, 6, 8);
    const mat = new THREE.MeshStandardMaterial({ color: 0xf1c40f });
    this.mesh = new THREE.Mesh(geo, mat);
    scene.add(this.mesh);
  }
```

```
  update(dt) {
    this.mesh.position.x += this.vel * dt;
  }
}
```

Explanation:

The player is represented as a 3D cube mesh. The movement and physics are computed every frame in sync with user input, ensuring smooth control.

3.Obstacle Module Purpose:

To dynamically spawn and control falling 3D blocks that the player must avoid.

Functions:

- Randomly generates blocks of varying sizes, speeds, and colors.
- Updates the position of each obstacle to simulate falling motion.
- Detects collisions with the player cube.
- Removes blocks that exit the screen to optimize performance.

Code Example (Simplified):

```
class Obstacles {
  update(dt) {
    for (let o of this.live) {
      o.mesh.position.y -= o.speed * dt;
      if (intersectsAABB(player.mesh, o.mesh)) {
        loseLife();
      }
    }
  }
}
```

Explanation:

This module gives the game its main challenge. It continuously drops 3D blocks at random intervals while checking for collisions with the player object.

4.Power-Up Module Purpose:

To add extra elements that enhance gameplay variety and help players survive longer. Power-Ups:

- ♡ Shield – Grants temporary invincibility.
- ⏳ Slow-Mo – Slows down falling block speed.
- 🤏 Shrink – Reduces player size, making it harder to hit.

Functions:

- Randomly spawns power-ups at intervals.
- Activates their effects when collected.
- Deactivates effects after their duration expires.

Code Example (Simplified):

```
function activatePowerUp(powerup) {
  if (powerup.type === POWERUP_TYPES.SHIELD) player.setShield(true);
  if (powerup.type === POWERUP_TYPES.SLOWMO) GameState.timeScale = 0.5;
  if (powerup.type === POWERUP_TYPES.SHRINK) player.setShrink(true);
```

}

Explanation:
This module increases engagement by adding short-term advantages. Power-ups also add strategic depth to the gameplay.

5.AI Integration Module (Gemini API)

To integrate intelligent, dynamic interactions using Google's Gemini AI.
Features:

- **AI Coach:**
  Provides tips, encouragement, or humorous feedback after each game or when paused.
- **Dream a Theme:**
  Generates a unique visual theme (colors for ground and fog) based on AI creativity.

Example (Simplified):

```
async function dreamTheme() {
  const prompt = "Generate a theme for a 3D block-dodging game in the format: NAME|#GROUND|#FOG";
  const response = await callGemini(prompt);
  // Apply generated theme
}
```

Explanation:
This integration adds personalization and variety. Each theme or tip is generated live by the AI, making the game more dynamic and replayable.

6. User Interface (UI) Module

Purpose:
To handle all on-screen displays and user interactions.
Features:

- Displays **score, lives, best score**, and **active power-up status**.
- Provides menus for **start, pause, resume**, and **settings**.
- Supports **touch controls** for mobile users.

Explanation:
The UI is designed using **Tailwind CSS**, offering a glassmorphism aesthetic and responsive layout. It ensures easy navigation and smooth user experience.

7.Storage & Game State Module

Purpose:
To save and restore gameplay progress.
Features:

- Saves **best score** and **current state** using browser's LocalStorage.
- Allows players to **continue** previously saved games.
- Automatically clears saved state after game completion.

Code Example:

```
function saveGameState() {
```

```
  const state = { score: GameState.score, lives: GameState.lives };
  localStorage.setItem('perfect_blocks_state', JSON.stringify(state));
}
```

8.Audio Module Purpose:

To create real-time sound effects that respond to user actions and game events.

Features:

- Generates audio using Web Audio API (no external files).
- Plays tones for collecting items, collisions, or scoring events.

Example Sounds:

- Collect Power-Up → High-pitched beep.
- Lose Life → Low-pitched sawtooth sound.
- Score → Quick sine tone.

9. Rendering & Animation Loop Module

Purpose:

To continuously update visuals and maintain real-time gameplay (typically 60 FPS).

Explanation:

The **render loop** runs indefinitely while the game is active, handling position updates, collisions, and scene rendering.

Code Example:

```
function renderLoop() {
  if (GameState.running) {
    player.update(dt);
    obstacles.update(dt);
    powerups.update(dt);
  }
  renderer.render(scene, camera);
  requestAnimationFrame(renderLoop);
}
```

10. Event Handling Module

Purpose:

To detect and respond to user inputs,
collisions, and game state
transitions.

Examples:

- Keyboard arrows or WASD → Move player.
- Touch buttons → Move on mobile.
- Pause/Resume buttons → Control game flow.
- Collision → Lose life or activate shield.

HTML Structure

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8" />
  <meta name="viewport" content="width=device-width, initial-scale=1.0" />
  <title>Dodge Falling Blocks 3D</title>
  <!-- Tailwind CSS Library -->
  <script src="https://cdn.tailwindcss.com/"></script>
  <!-- Three.js Library -->
  <script src="https://cdnjs.cloudflare.com/ajax/libs/three.js/r128/three.min.js"></script>
  <!-- Custom Styles -->
  <link rel="stylesheet" href="style.css">

</head>
<body>
  <div id="bg"></div>
  <div id="app"></div>

  <!-- HUD / UI -->
  <div class="hud" aria-live="polite">
    <div id="game-hud" class="absolute left-1/2 -translate-x-1/2 top-4 flex items-center gap-3 px-4 py-2 rounded-full glass text-white text-base sm:text-lg opacity-0 transition-opacity duration-300" aria-label="Game status bar">
      <div class="font-semibold">Score: <span id="ui-score">0</span></div>
      <div class="font-semibold">Lives: <span id="ui-lives">3</span></div>
      <div class="font-semibold hidden sm:block">Best: <span id="ui-best">0</span></div>
      <div id="ui-powerup-status" class="ml-2 font-semibold flex items-center gap-2"></div>
      <button id="btn-pause" class="ml-auto px-3 py-1 rounded-full bg-white/10 hover:bg-white/20 transition text-sm font-semibold" aria-label="Pause or resume game">Pause</button>
      <!-- Settings icon button (Updated Symbol) -->
      <button id="btn-settings" class="p-2 rounded-full bg-white/10 hover:bg-white/20 transition" aria-label="Open settings">
        <svg xmlns="http://www.w3.org/2000/svg" viewBox="0 0 24 24" width="20" height="20" fill="currentColor">
          <path d="M19.43 12.98c.04-.32.07-.64.07-.98s-.03-.66-.07-.98l2.11-1.65c.19-.15.24-.42.12-.64l-2-3.46c-.12-.22-.39-.31-.61-.22l-2.49 1c-.52-.39-1.09-.72-1.71-.99L14.12 3.4c-.09-.23-.3-.38-.54-.38h-4c-.24 0-.45.15-.54.38L8.65 6.01c-.62.27-1.2.6-1.71.99l-2.49-1c-.22-.09-.49 0-.61.22l-2 3.46c-.12.22-.07.49.12.64l2.11 1.65c-.04.32-.07.64-.07.98s.03.66.07.98l-2.11 1.65c-.19.15-.24.42-.12.64l2 3.46c.12.22.39.31.61.22l2.49-1c.52.39 1.09.72 1.71.99l.34 2.59c.09.23.3.38.54.38h4c.24 0 .45-.15.54-.38l.34-2.59c.62-.27 1.2-.6 1.71-.99l2.49 1c.22.09.49 0 .61-.22l2-3.46c.12-.22.07-.49-.12-.64l-2.11-1.65zm-7.43 1.91c-1.66 0-3-1.34-3-3s1.34-3 3-3 3 1.34 3 3-1.34 3-3 3z"/></svg>
      </button>
    </div>
```

```
  <div id="ui-banner" class="absolute left-1/2 top-1/2 -translate-x-1/2 -translate-y-1/2 text-center text-white w-full max-w-md px-4"></div>
  <div id="touch-controls" class="absolute bottom-6 left-6 right-6 md:hidden opacity-0 transition-opacity duration-300 flex justify-between items-end">
    <div class="flex gap-4">
      <button id="btn-left" aria-label="Move left" class="touch-btn glass text-white active:scale-95 transition">
        <svg xmlns="http://www.w3.org/2000/svg" viewBox="0 0 24 24" width="36" height="36" fill="currentColor"><path d="M15.41 7.41L14 6l-6 6 6 6 1.41-1.41L10.83 12z"/></svg>
      </button>
      <button id="btn-right" aria-label="Move right" class="touch-btn glass text-white active:scale-95 transition">
        <svg xmlns="http://www.w3.org/2000/svg" viewBox="0 0 24 24" width="36" height="36" fill="currentColor"><path d="M8.59 16.59L10 18l6-6-6-6-1.41 1.41L13.17 12z"/></svg>
      </button>
    </div>
    <div class="flex flex-col gap-4">
      <button id="btn-up" aria-label="Move up" class="touch-btn glass text-white active:scale-95 transition">
        <svg xmlns="http://www.w3.org/2000/svg" viewBox="0 0 24 24" width="36" height="36" fill="currentColor"><path d="M7.41 15.41L12 10.83l4.59 4.58L18 14l-6-6-6 6z"/></svg>
      </button>
      <button id="btn-down" aria-label="Move down" class="touch-btn glass text-white active:scale-95 transition">
        <svg xmlns="http://www.w3.org/2000/svg" viewBox="0 0 24 24" width="36" height="36" fill="currentColor"><path d="M7.41 8.59L12 13.17l4.59-4.58L18 10l-6 6-6-6z"/></svg>
      </button>
    </div>
  </div>
</div>

<!-- Countdown Modal -->
<div id="countdown-modal">
  <div id="countdown-text">3</div>
</div>

<!-- Settings Modal -->
<div id="settings-modal" class="fixed inset-0 bg-black/50 flex items-center justify-center p-4 hidden z-20" aria-label="Game Settings">
  <div class="w-full max-w-lg glass rounded-2xl p-6 sm:p-8 text-white fade-in">
    <div class="flex items-center justify-between">
      <h2 class="text-3xl font-bold text-sky-400 drop-shadow-lg">Game Settings</h2>
      <button id="btn-close-settings" class="p-2 rounded-full bg-white/10 hover:bg-white/20 text-sm transition" aria-label="Close settings">
        <svg xmlns="http://www.w3.org/2000/svg" viewBox="0 0 24 24" width="24" height="24" fill="currentColor"><path d="M19 6.41L17.59 5 12 10.59 6.41 5 5 6.41 10.59 12 5 17.59 6.41 19 12 13.41 17.59 19 19 17.59 13.41 12z"/></svg>
      </button>
```

```
    </div>
    <div class="mt-6 space-y-6">
      <div>
        <label class="text-lg font-semibold block mb-2" for="inp-sens">Sensitivity (<span id="sens-
val">1.0</span>)</label>
        <input id="inp-sens" type="range" min="0.5" max="2.0" step="0.1" value="1" aria-valuenow="1">
      </div>
      <div>
        <label class="text-lg font-semibold block mb-2" for="inp-vol">Volume (<span id="vol-
val">50%</span>)</label>
        <input id="inp-vol" type="range" min="0" max="1" step="0.05" value="0.5" aria-valuenow="0.5">
      </div>
      <div>
        <label class="text-lg font-semibold block mb-2" for="sel-gfx">Graphics Quality</label>
        <select id="sel-gfx" class="mt-1 w-full bg-white/10 border border-white/20 rounded-xl p-3 focus:ring-2
focus:ring-sky-500 focus:border-sky-500 transition shadow-inner">
          <option value="veryHigh">Very High (Max Shadows)</option>
          <option value="high" selected>High (Shadows)</option>
          <option value="medium">Medium</option>
          <option value="low">Low</option>
          <option value="veryLow">Very Low</option>
        </select>
        <div class="mt-2 text-xs text-white/70">Changing graphics quality will reset the game. Low settings
save battery.</div>
      </div>
    </div>
  </div>
 </div>

 <!-- Link to the main game logic script -->
 <script src="script.js"></script>
</body>
</html>
```

Custom Styles

```
/* Custom CSS for Dodge Falling Blocks 3D */

:root {
  --ui-bg: rgba(0,0,0,.55);
  --ui-bg-strong: rgba(0,0,0,.75);
}

/* Ensure full viewport usage and correct font */
html, body { height: 100%; }
body {
    margin: 0;
    overflow: hidden;
    font-family: ui-sans-serif, system-ui, -apple-system, Segoe UI, Roboto, Inter, "Helvetica Neue", Arial, "Apple Color Emoji", "Segoe UI Emoji";
}

/* Three.js Canvas container */
#app { position: fixed; inset: 0; }
canvas { display: block; width: 100vw; height: 100vh; outline: none; }

/* HUD/UI container */
.hud { position: fixed; inset: 0; pointer-events: none; }
.hud * { pointer-events: auto; }

/* Glassmorphism effect for UI elements */
.glass {
    backdrop-filter: blur(12px);
    -webkit-backdrop-filter: blur(12px);
    background: var(--ui-bg);
    box-shadow: 0 25px 50px rgba(0,0,0,.5);
    border: 1px solid rgba(255,255,255,0.1);
}

/* Touch Control Buttons */
.touch-btn {
    width: 80px;
    height: 80px;
    border-radius: 9999px;
    display: grid;
    place-items: center;
    user-select: none;
    -webkit-tap-highlight-color: transparent;
    background: var(--ui-bg-strong);
}

/* General Animations */
.fade-in { animation: fade-in .35s ease both; }
```

```
@keyframes fade-in {
   from { opacity: 0; transform: translateY(6px) scale(.98); }
}

/* Power-up Icon Animation */
.powerup-icon { animation: powerup-icon-anim .5s ease-in-out infinite alternate; }
@keyframes powerup-icon-anim {
   from { transform: scale(1); }
   to { transform: scale(1.1); }
}

/* Background gradient (default theme) */
#bg {
   position: fixed;
   inset: 0;
   background: radial-gradient(120% 120% at 50% 0%, #172554 0%, #0b1220 60%, #05080f 100%);
   z-index: -1;
}

/* Custom Input Range styling for modern look */
input[type=range] {
  -webkit-appearance: none;
  width: 100%;
  height: 8px;
  background: #3f3f46; /* Neutral-700 */
  border-radius: 4px;
  cursor: pointer;
}
input[type=range]::-webkit-slider-thumb {
  -webkit-appearance: none;
  height: 20px;
  width: 20px;
  border-radius: 50%;
  background: #3b82f6; /* Blue-500 */
  box-shadow: 0 0 4px rgba(0,0,0,.5);
}

/* Countdown styling */
#countdown-modal {
   position: fixed;
   inset: 0;
   display: none;
   place-items: center;
   background-color: rgba(0,0,0,0.3);
   z-index: 30;
   color: white;
}
#countdown-text {
   font-size: 8rem; /* Large text for countdown */
```

```
    font-weight: 900;
    animation: countdown-pulse 1s ease-in-out infinite;
    text-shadow: 0 0 20px #3b82f6;
}
@keyframes countdown-pulse {
    0%, 100% { transform: scale(1); opacity: 1; }
    50% { transform: scale(1.2); opacity: 0.8; }
}
```

Game Logic

```
// ==========================
// Dodge Falling Blocks 3D (3-page compressed version)
// ==========================
// --- Gemini API Integration ---
const GEMINI_API_KEY = "AIzaSyA_wimRQEByDcjAloxk5Ar5GbzBVfab8JU";
async function callGemini(prompt, systemInstruction) {
  const api = 'https://generativelanguage.googleapis.com/v1beta/models/gemini-2.5-flash-preview-05-
20:generateContent?key=' + GEMINI_API_KEY;
  const body = { contents: [{ parts: [{ text: prompt }] }] };
  if (systemInstruction) body.systemInstruction = { parts: [{ text: systemInstruction }] };
  for (let i = 0; i < 3; i++) {
    try {
      const r = await fetch(api, { method: 'POST', headers: { 'Content-Type': 'application/json' }, body:
JSON.stringify(body) });
      if (r.ok) return (await r.json()).candidates?.[0]?.content?.parts?.[0]?.text;
    } catch (e) { console.error(e); }
    await new Promise(res => setTimeout(res, 1000 * 2 ** i));
  }
  return null;
}

// --- Utility Functions ---
const clamp = (n, a, b) => Math.min(Math.max(n, a), b);
const randRange = (a, b) => a + Math.random() * (b - a);

// --- Audio Helper ---
class Beeper {
  constructor() { this.ctx = null; this.gain = null; this.volume = 0.5; }
  ensure() {
    if (!this.ctx) {
      this.ctx = new (window.AudioContext || window.webkitAudioContext)();
      this.gain = this.ctx.createGain(); this.gain.gain.value = this.volume; this.gain.connect(this.ctx.destination);
    }
  }
  beep(freq = 880, dur = 0.1) {
    this.ensure(); if (!this.ctx) return;
    const o = this.ctx.createOscillator(), g = this.ctx.createGain();
    o.type = 'square'; o.frequency.value = freq; g.gain.value = this.volume;
    o.connect(g); g.connect(this.gain);
    const t = this.ctx.currentTime; o.start(t);
    g.gain.setTargetAtTime(0, t + dur * 0.5, dur * 0.5); o.stop(t + dur);
  }
}
const beeper = new Beeper();

// --- Game Setup ---
let scene, camera, renderer, player, obstacles = [], score = 0;
function initGame() {
```

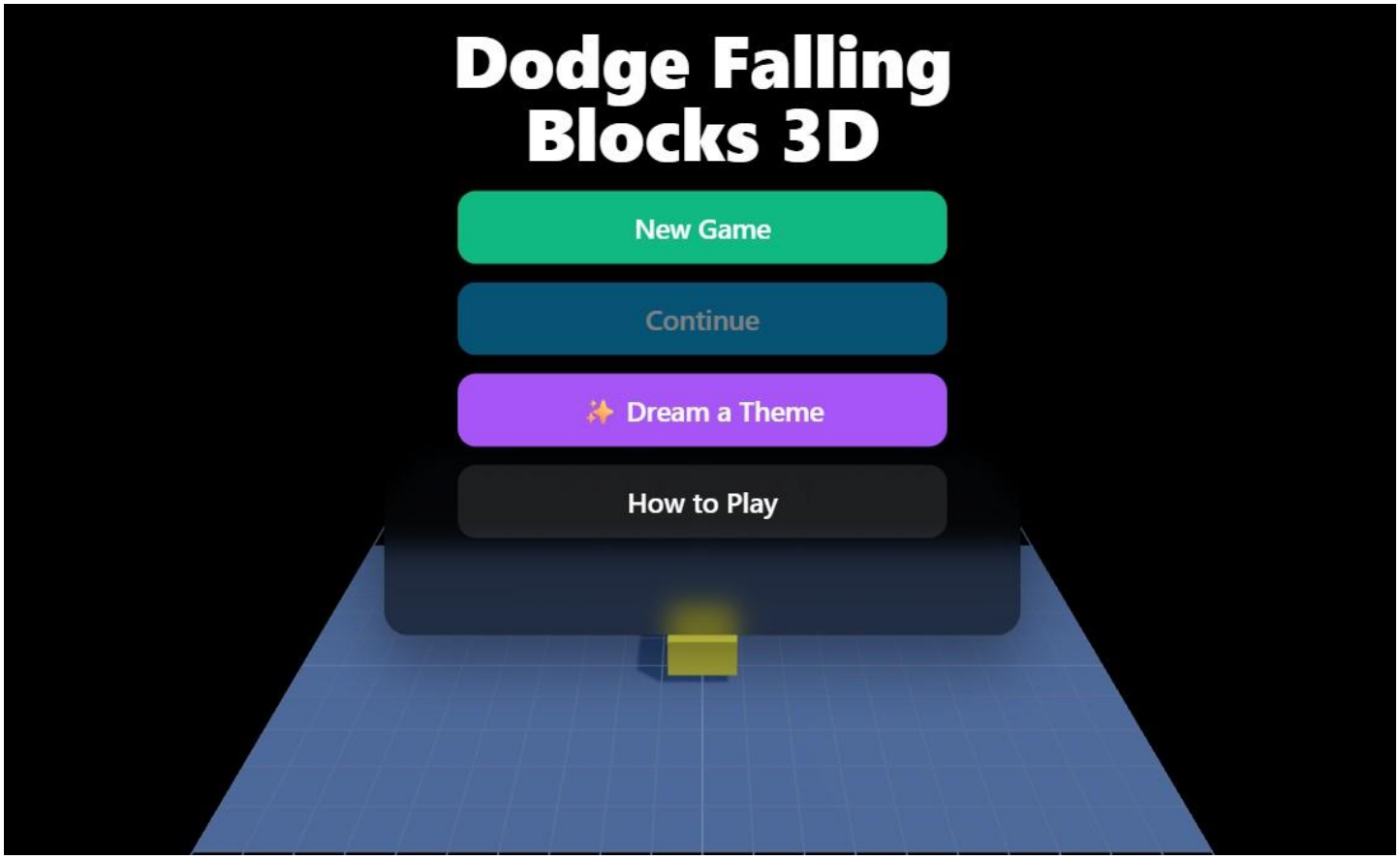
```
  scene = new THREE.Scene();
  camera = new THREE.PerspectiveCamera(75, innerWidth / innerHeight, 0.1, 1000);
  renderer = new THREE.WebGLRenderer({ antialias: true });
  renderer.setSize(innerWidth, innerHeight);
  document.body.appendChild(renderer.domElement);
  player = new THREE.Mesh(new THREE.BoxGeometry(1, 1, 1), new THREE.MeshBasicMaterial({ color:
0x00ff00 }));
  scene.add(player); camera.position.z = 5;
  spawnObstacle(); animate();
}

function spawnObstacle() {
  const o = new THREE.Mesh(new THREE.BoxGeometry(1, 1, 1), new THREE.MeshBasicMaterial({ color:
0xff0000 }));
  o.position.set(randRange(-3, 3), 5, 0);
  scene.add(o); obstacles.push(o);
}

function animate() {
  requestAnimationFrame(animate);
  obstacles.forEach(o => {
    o.position.y -= 0.05;
    if (o.position.y < -3) { scene.remove(o); obstacles = obstacles.filter(x => x !== o); score++; spawnObstacle();
}
    if (Math.abs(o.position.x - player.position.x) < 1 && Math.abs(o.position.y - player.position.y) < 1) {
      alert(`Game Over! Score: ${score}`); location.reload();
    }
  });
  renderer.render(scene, camera);
}

// --- Controls ---
window.addEventListener('keydown', e => {
  if (e.key === 'ArrowLeft') player.position.x = clamp(player.position.x - 0.5, -4, 4);
  if (e.key === 'ArrowRight') player.position.x = clamp(player.position.x + 0.5, -4, 4);
});

window.onload = initGame;
```

Output Screens

The output screens of the project illustrate the complete user experience — from game launch to game over. Each screen plays a specific role in the interaction between the player and the system, ensuring usability, clarity, and engagement.

1.Home / Main Menu Screen Description:

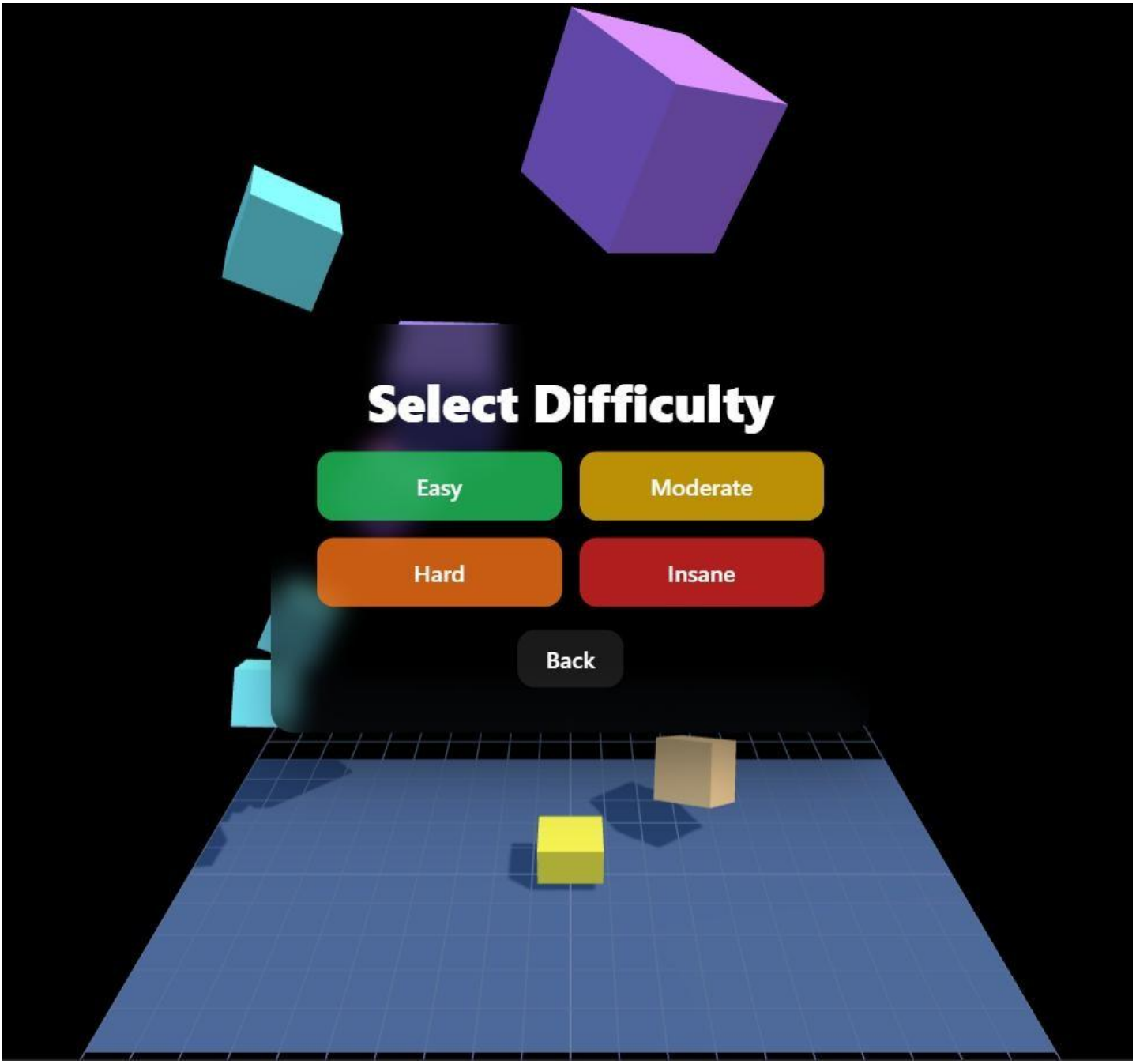
- The first screen that appears after the game loads.
- Displays the game title “Dodge Falling Blocks 3D” with four main options:
    - New Game o Continue o Dream a Theme ✨ (AI-powered theme generator) o How to Play Functions:
- *New Game* starts a new session.
- *Continue* loads the previous saved state (if any).
- *Dream a Theme* connects to Gemini AI and applies a new visual theme.
- *How to Play* displays basic instructions for controls and power-ups.



2.Difficulty Selection Screen

Description:

- Appears after selecting “New Game.”
- Displays four difficulty modes:
    - Easy o Moderate o Hard o Insane
      Each level adjusts:
- The number of lives.
- The spawn rate and speed of falling blocks.
- The overall challenge intensity.



3. Game Environment (Gameplay Screen)

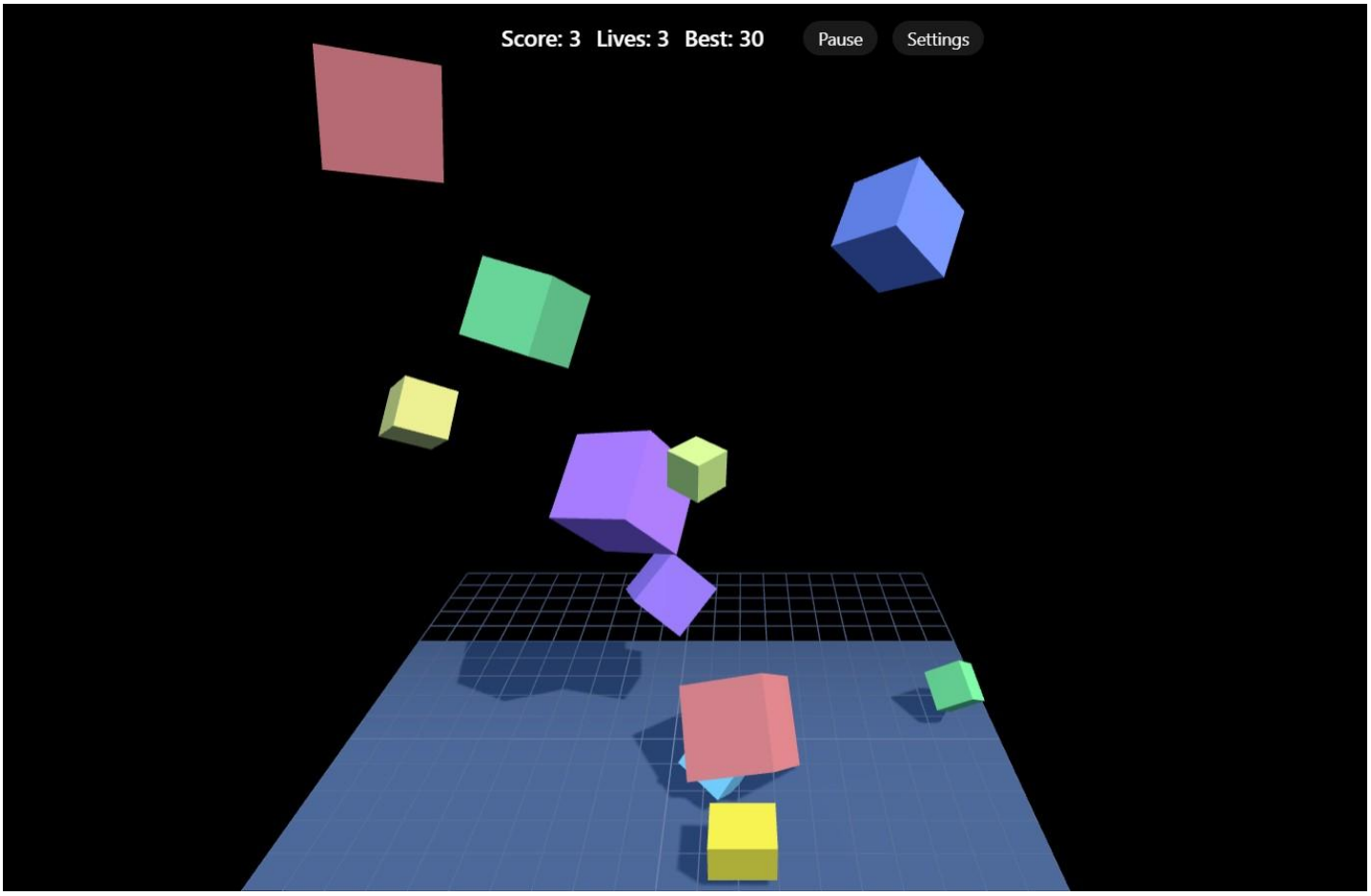
Description:

- The core of the game where all real-time interactions take place.
- The player's yellow cube appears on a platform with 3D perspective.
- Colored cubes fall from above at random intervals and speeds.
- The player moves left, right, forward, or backward to dodge obstacles.

Elements Displayed:

- HUD (Heads-Up Display):
  - Score counter
  - Lives remaining
  - Best score
  - Active power-up icon and timer

- Pause and Settings Buttons:
  Allows pausing or changing sensitivity/volume/graphics during play.



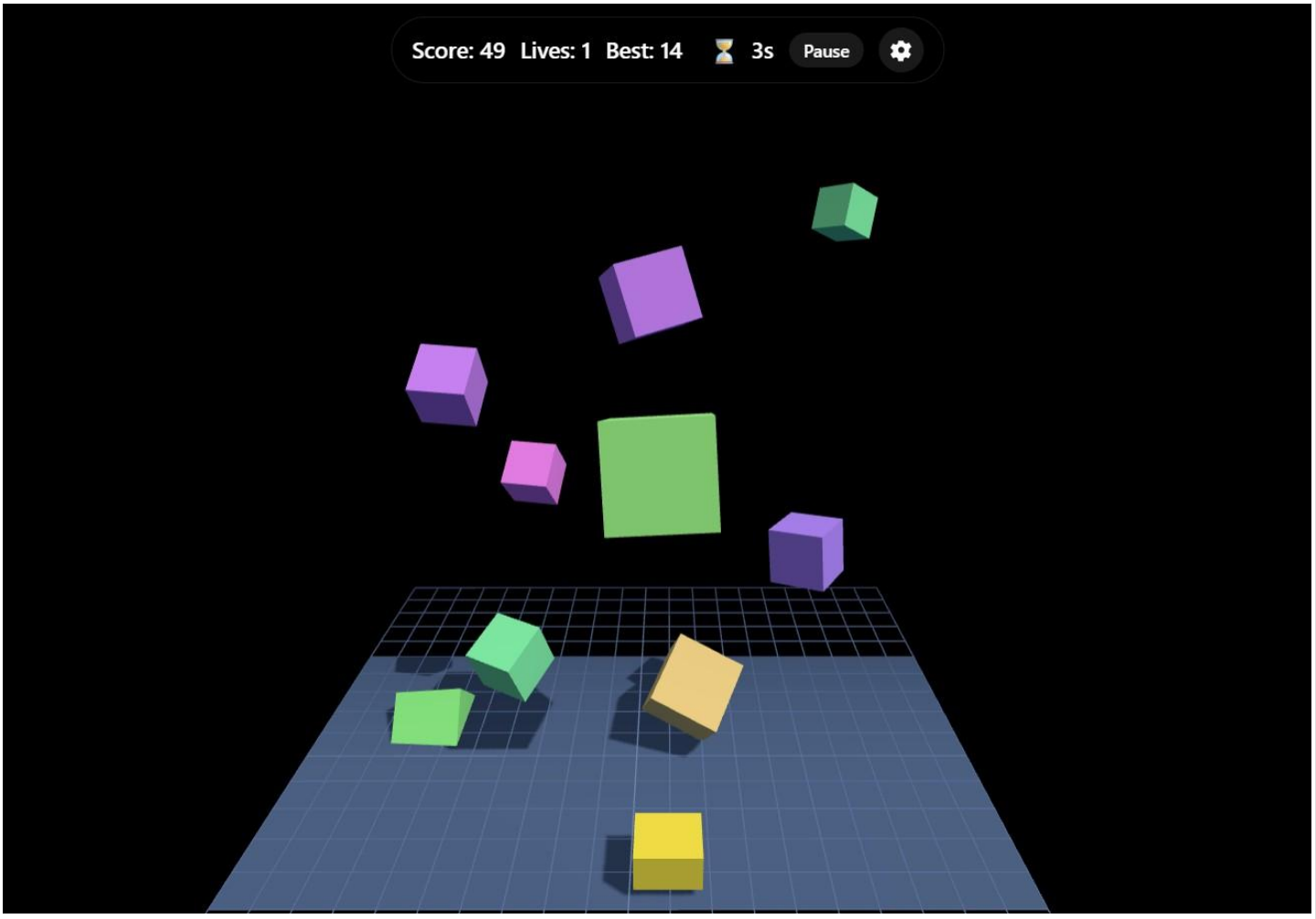
4.Power-Up Collection Screen

Description:

- When a player collects a power-up (floating icosahedron), a small animation and sound effect occur.
- Power-ups modify gameplay for a short duration:
    - 🛡 **Shield**: Player becomes invincible.
    - ⏳ **Slow-Mo**: Game slows down, giving time to react.
    - 🤏 **Shrink**: Player's size decreases, making it harder to hit.

Visual Effects:

- Power-up icon appears on the HUD.
- Timer counts down its duration.

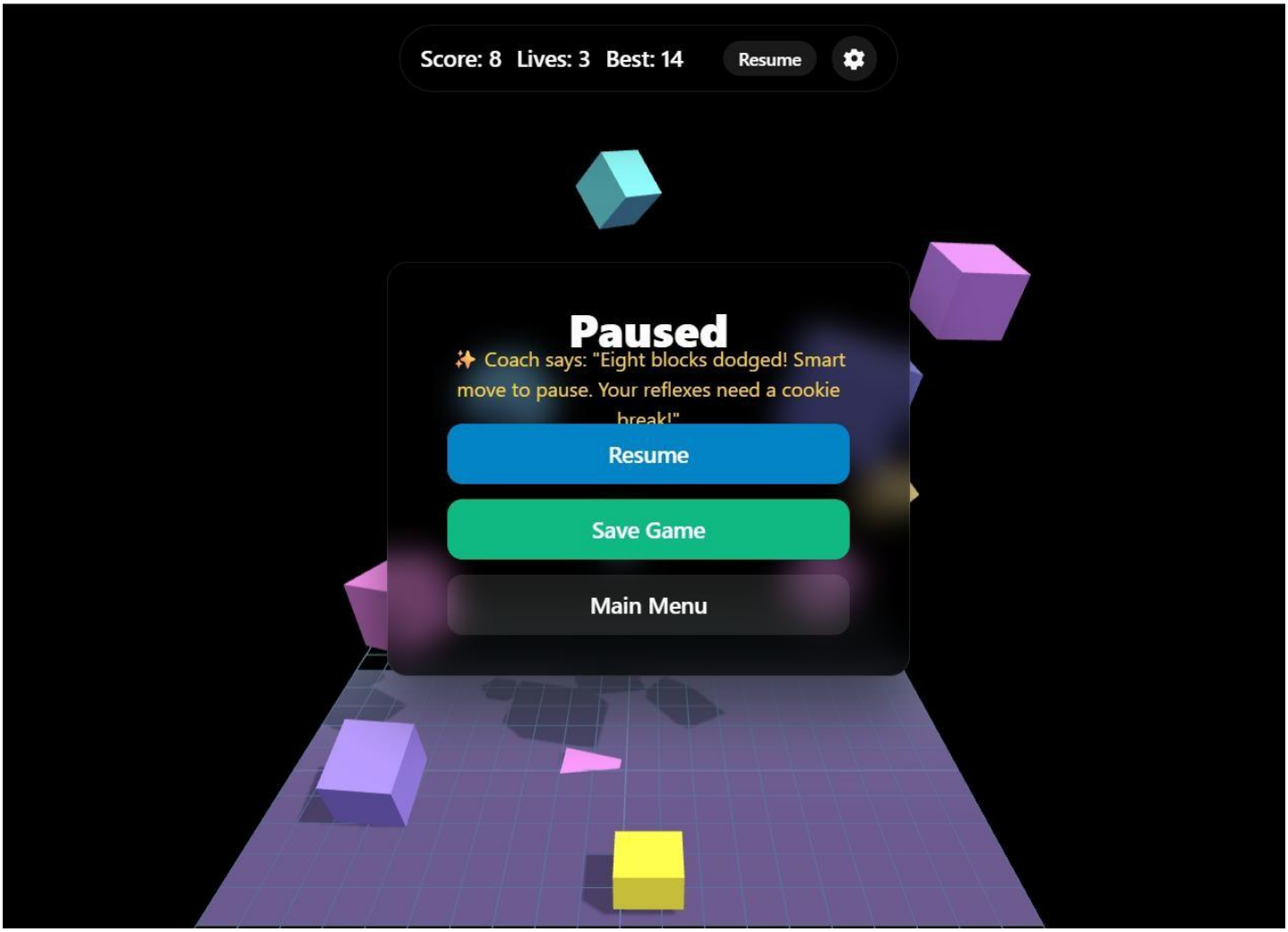


5.Pause Menu Screen

Description:

- When the player pauses the game (via button or pressing ‘P’), the game stops immediately.
- A semi-transparent glass-style panel appears with three options:
    - Resume
    - Save Game
    - Main Menu
- Additionally, an **AI Coach message** appears — generated by Gemini AI — giving a short, encouraging or funny message. **Example Message:**

✨ Coach says: "Even cubes need a coffee break!"

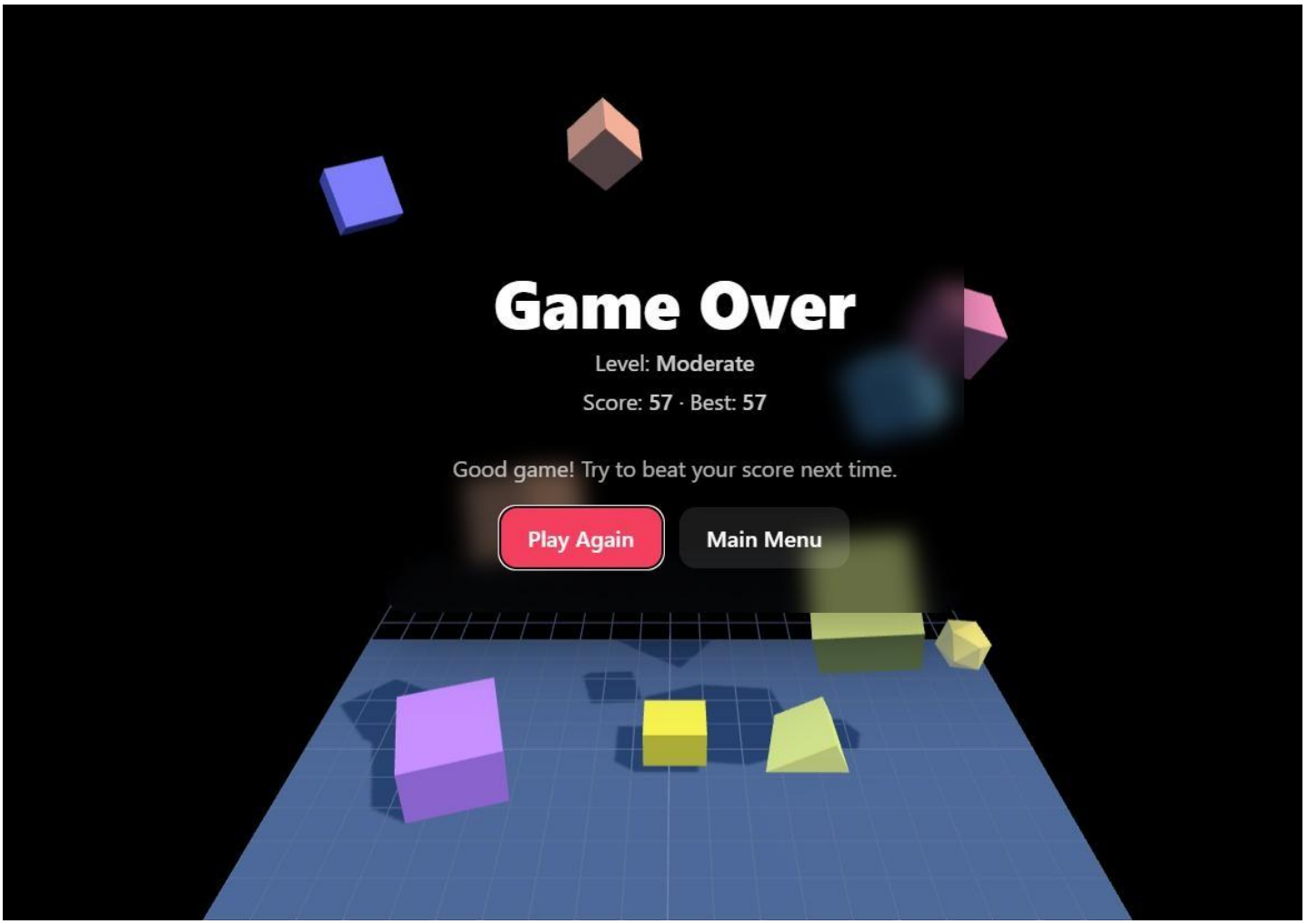


6.Game Over Screen Description:

- Displayed when all lives are lost.
- Shows the final score, best score, and current difficulty level.
- The AI Coach again generates a motivational or humorous message. **Features:**
- Buttons to:
  - **Play Again** (restart the game)
  - **Return to Main Menu** **Example**

Message:

✨ Coach says: "Next time, dodge like you mean it!"



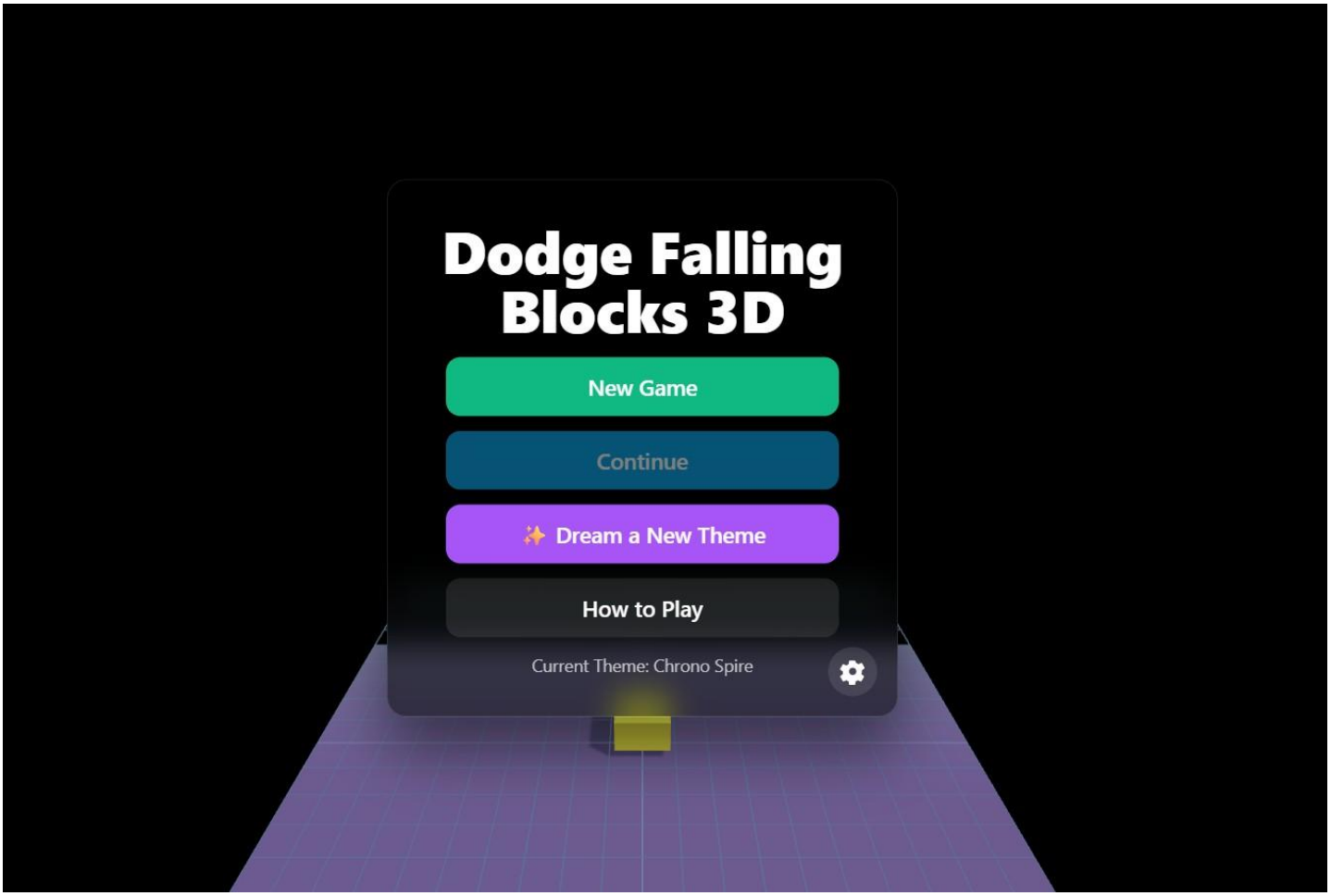
7.AI “Dream a Theme” Screen

Description:

- Activated when the user clicks **“✨ Dream a Theme”** from the main menu.
- Gemini AI generates:
  - A **theme name** o Ground color (hex code) o Fog color (hex code)
- The theme is instantly applied, changing the entire game atmosphere.

Example AI Response:

Molten Core | #ff4800 | #3d1a04

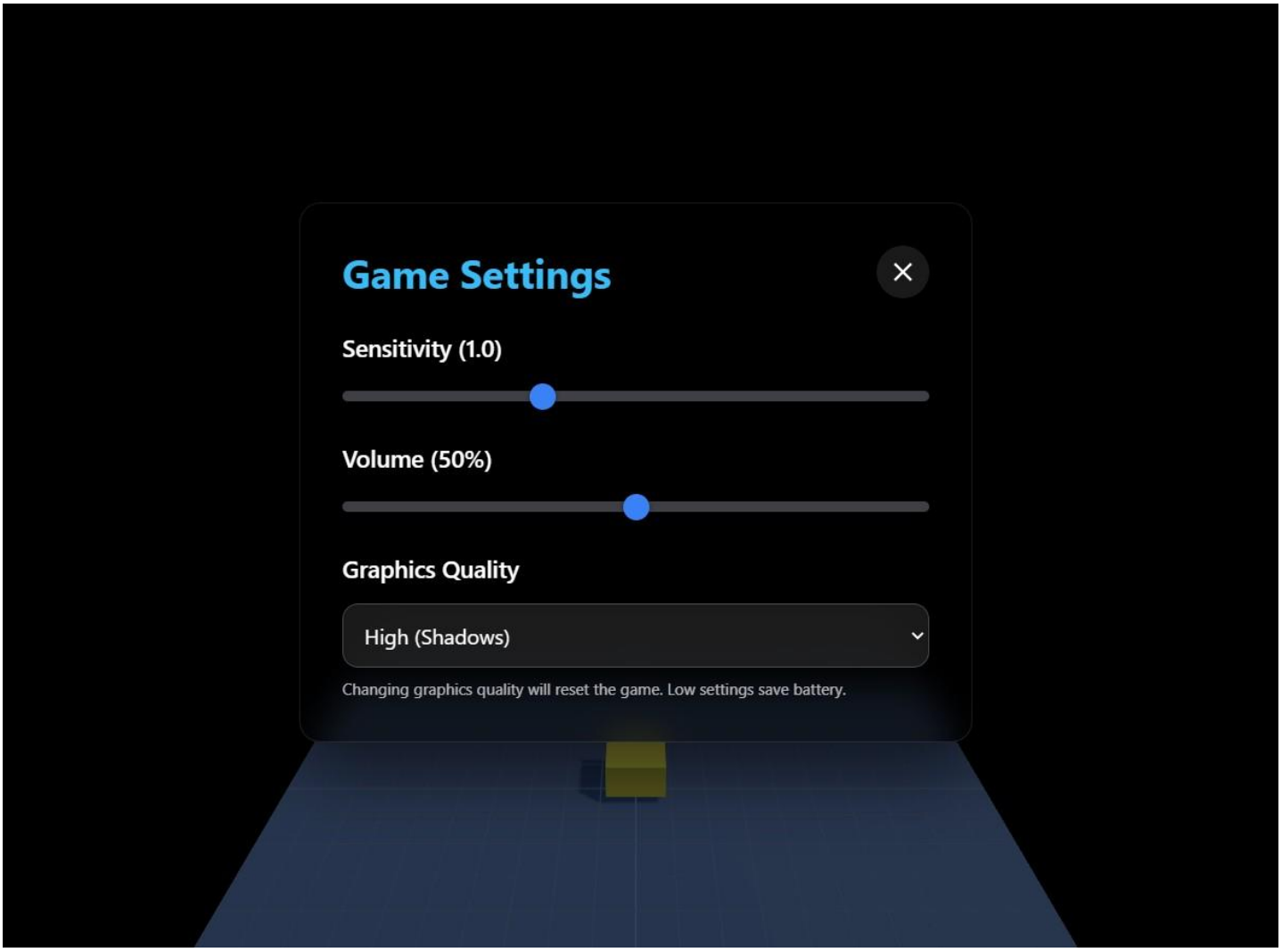


8.Settings Drawer

Description:

- Accessible during gameplay via the **Settings button**.
- Allows player to adjust:
  - Sensitivity
  - Volume
  - Graphics quality (Very High → Very Low)

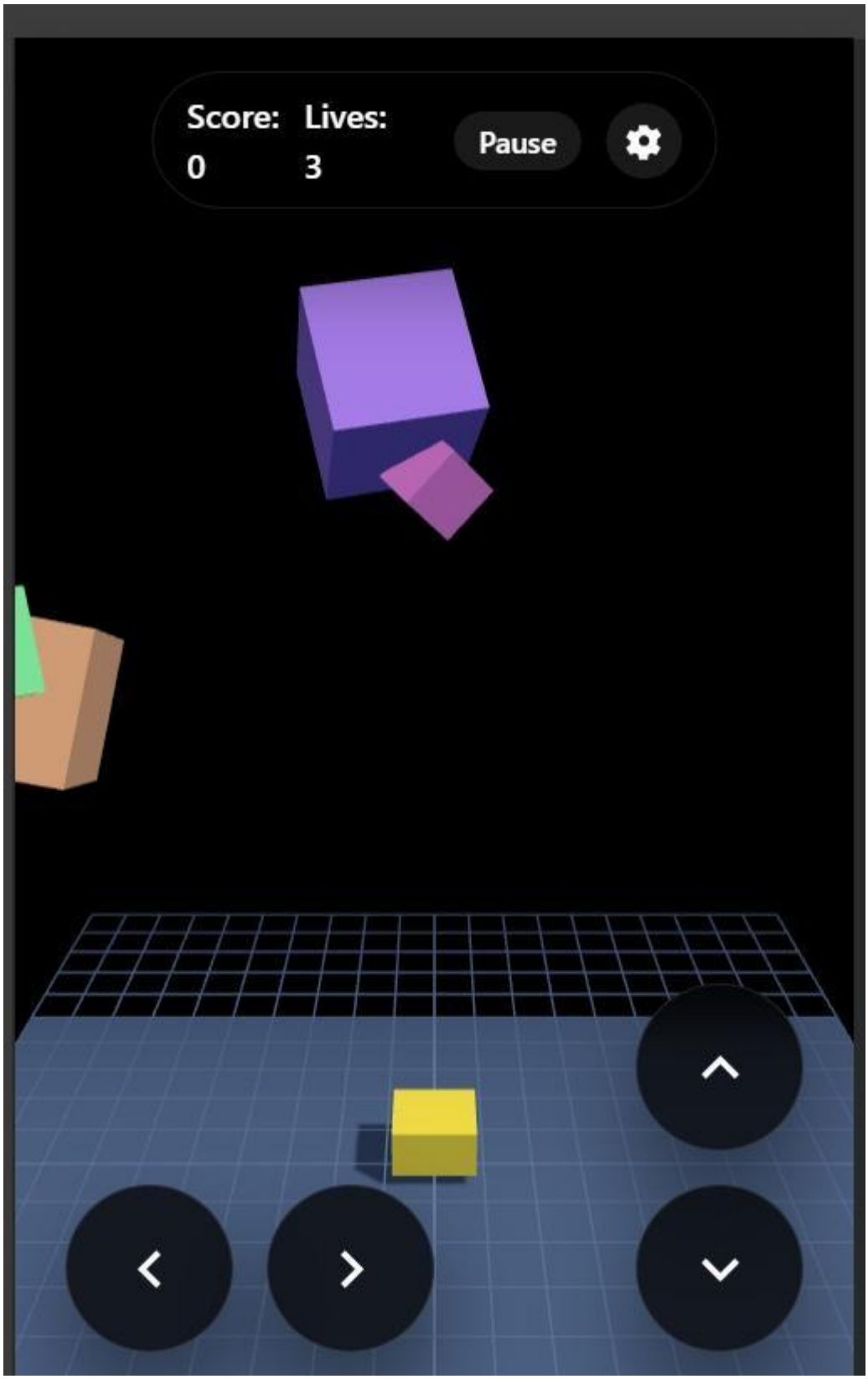
Changes are applied instantly for smooth adaptability across devices.



9.Mobile Touch Control Screen

Description:

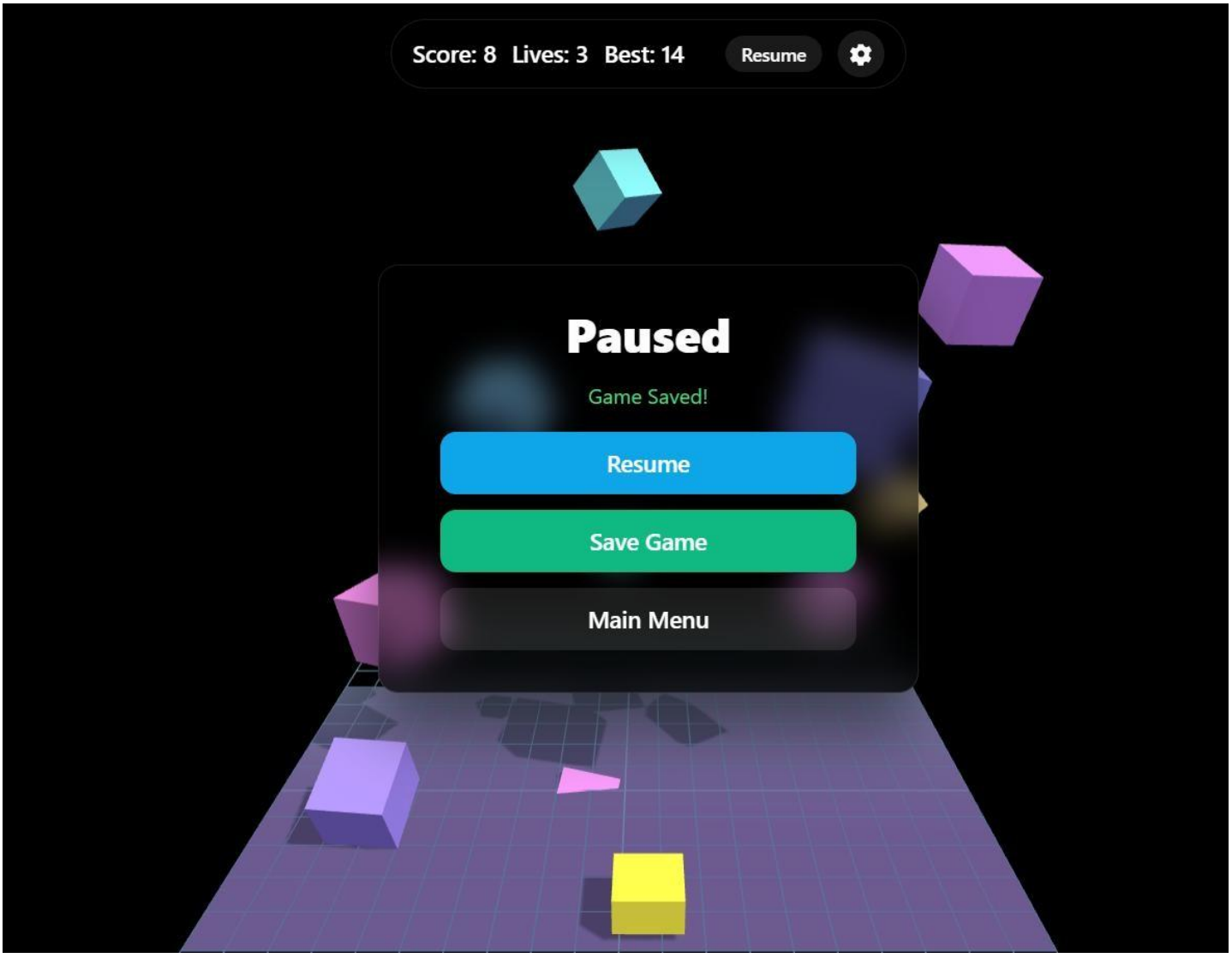
- Special layout appears automatically on mobile devices.
- On-screen **touch buttons** replace keyboard controls:
    - Left / Right o Up / Down **Design:**
- Circular glass-style buttons with smooth animations.
- Positioned ergonomically for thumb control.



10.Saved Game & Resume Screen

Description:

- When the player saves progress and reopens the game, the main menu shows a **“Continue”** option.
- The player can resume from the last saved level, score, and lives.



Result and Discussion

The **"Dodge Falling Blocks 3D"** project successfully demonstrates the implementation of a realtime 3D web game with AI integration, providing both entertainment and an example of advanced web technology in action. The project outcomes confirm that web-based games can achieve console-like visual quality and responsiveness without requiring installations or heavy processing resources.

1.Functional Outcomes

Feature	Result
3D Environment Creation	Successfully rendered with realistic lighting, fog, and shadows using Three.js.
Player Control	Smooth and responsive on both keyboard (desktop) and touch controls (mobile).
Obstacle Generation	Randomized sizes, speeds, and colors of falling blocks provide dynamic gameplay.
Collision Detection	Accurate detection using AABB (Axis-Aligned Bounding Box) collision method.
Power-Up System	All three power-ups (Shield, Slow-Mo, Shrink) work effectively and expire after set duration.
AI Coach	Generates short, creative feedback messages through Gemini API.
AI Theme Generator	Produces random, visually consistent color combinations that change the game environment.
Game State Saving	LocalStorage successfully saves and restores game data (score, level, lives).
Audio Feedback	Responsive sound cues generated in real time using Web Audio API.

2.Performance Analysis

- The game maintains a **steady 60 frames per second (FPS)** on standard desktop browsers.
- On mid-range smartphones, performance remains smooth when graphics settings are adjusted to *medium* or *low*.
- The **modular structure** ensures that heavy tasks (like rendering and AI requests) do not interfere with gameplay flow.
- **AI requests** are asynchronous, ensuring no lag even when waiting for responses from Gemini API.
- **Collision detection and object pooling** reduce memory usage and CPU load.

Browser Performance Table

Device / Browser	Performance (FPS)	Graphics Mode	AI Integration
Windows Chrome	60 FPS	High	Working
macOS Safari	60 FPS	High	Working
Android Chrome	50–60 FPS	Medium	Working
iPhone Safari	55–60 FPS	Medium	Working
Low-end Android	40–45 FPS	Low	Working

3.User Experience Evaluation Users described the game as:

- **"Engaging and visually stunning"** due to its 3D realism and AI-generated themes.
- **"Easy to control"** because of smooth keyboard and touch input handling.
- **"Surprisingly intelligent"** due to the dynamic AI Coach responses and creative theme generation.

The clean UI built with **Tailwind CSS** provided a minimalistic and futuristic feel. The AI integration gave users a sense of personalized feedback, making each session unique.

4.Observations

- The **Gemini API** enhances the project beyond a typical game by adding adaptive intelligence.
- **Object pooling** greatly improved memory efficiency by reusing 3D mesh objects.
- The modular structure made debugging and feature addition straightforward.
- Real-time feedback through sound and visuals maintained player immersion throughout the session.

5.Limitations Identified

While the project performs effectively, a few constraints were identified:

1. The game requires a **modern browser** supporting WebGL; older browsers may fail to load the 3D renderer.
2. **AI features** require an active **internet connection**. Without it, the game runs in offline mode but skips theme generation and coach messages.
3. No **multiplayer** or **online leaderboard** support yet.
4. Limited **customization options** (user-defined themes, character shapes).

6.Discussion on AI Integration

The **AI Coach** and **AI Theme Generator** modules are two of the most innovative parts of this project. They demonstrate how machine learning models like **Gemini** can bring creativity and personalization into traditional game design.

AI Feature	Functionality	Impact
Dream a Theme	Creates random color themes for environment	Improves visual diversity
AI Coach	Generates short motivational or fun quotes	Increases player engagement
Pause & Game Over Responses	Dynamically adjusts based on score	Makes interaction feel alive

7. Overall Result Summary

Successfully Achieved:

- Real-time 3D gameplay using Three.js
- Multi-platform support (desktop + mobile) • Smooth input handling
- AI-enhanced personalization and feedback • Optimized performance and modular design ❁ **Partially Achieved / Future Potential:**
- Multiplayer features
- Cloud-based leaderboard
- Theme sharing between players

8.Conclusion of Results

The **Dodge Falling Blocks 3D** game successfully fulfills its objectives by merging interactive 3D gaming, responsive design, and AI-powered intelligence into a single browser experience. It demonstrates the potential of combining **WebGL, Three.js, and AI models** to produce games that are not only entertaining but also adaptive and intelligent.

Future Enhancements

The project **"Dodge Falling Blocks 3D"** successfully demonstrates a complete and interactive gaming experience with AI integration. However, there are numerous opportunities to expand its functionality, visual appeal, and user engagement through future enhancements.

These improvements can be grouped into **technical**, **functional**, and **AI-driven** upgrades.

1. Technical Enhancements

a. Enhanced Graphics and Effects

- Upgrade to **Physically Based Rendering (PBR)** materials for more realistic lighting and reflections.
- Introduce **particle effects** for explosions, collisions, or power-up activation.
- Add **dynamic shadows and reflections** for improved realism.
- Implement **post-processing effects** such as bloom, motion blur, and color grading. **b. Performance Optimization**
- Introduce **Level of Detail (LOD)** management for better performance on low-end devices.
- Optimize texture memory by using compressed assets.
- Apply **object instancing** in Three.js for rendering multiple obstacles efficiently.
- Implement **adaptive frame rate** for smoother gameplay under high load. **c. Mobile Optimization**
- Develop **progressive web app (PWA)** capabilities to allow offline installation on smartphones.
- Improve UI scaling for various aspect ratios and screen sizes.

2. Functional Enhancements

a. Multiplayer Mode

- Implement a **real-time multiplayer system** using **WebSockets** or **Firebase Realtime Database**.
- Allow players to compete live against others to survive the longest.
- Add a **spectator mode** and **chat system** for interactive sessions.

b. Leaderboards and Achievements

- Integrate a **global leaderboard** connected to **Supabase** or **Firebase** for tracking top scores.
- Introduce **achievement badges** for reaching milestones like:
    - "100 Dodges Without Hit"
    - "Power-Up Master"
    - "Survivor 10 Minutes"

c. Customization Options

- Allow players to **change player model** (cube, sphere, or custom avatar).
- Add **custom themes** where players can choose ground and fog colors manually.
- Include **sound and music library** so users can select their own background tunes. **d. Enhanced Difficulty Scaling**
- Introduce **dynamic difficulty adjustment (DDA)** based on player performance.
- Add environmental hazards (e.g., moving lasers, rotating blades, or crumbling floors).

3. AI & Machine Learning Enhancements

a. Advanced AI Coach

- Use Gemini or similar models to generate **context-aware coaching** messages based on player habits and play style.
- Include **progress tracking** so the AI can provide personalized training tips.
- Enable AI to analyze performance metrics such as reaction time and dodging efficiency. **b. Adaptive Game Environment**
- AI can automatically **adjust game speed and obstacle frequency** depending on player skill.
- Introduce **AI-driven difficulty levels** that evolve as the player improves. **c. Creative Theme Market**
- Allow AI to generate **theme packs** that can be shared with other players online.
- Store and recommend AI-created themes based on player preferences.

4. Integration and Deployment Enhancements

a. Online Platform Deployment

- Deploy the game as a **hosted web app** on platforms like **Vercel**, **Netlify**, or **GitHub Pages**.
- Add support for cloud-based saving through **Supabase** or **Firebase** for cross-device continuation.

b. Desktop & Mobile Versions

- Package the game using **Electron.js** (desktop) or **Capacitor.js** (mobile app).
- Publish to app stores (Google Play, Microsoft Store, macOS App Store). **c. Community Integration**
- Include social features like **share score** on social media platforms.
- Allow players to **submit AI-generated themes** for community voting.

5. Educational and Research Applications

The project can also serve as a foundation for:

- **Learning Modules** in computer graphics, web technologies, and AI-human interaction.
- **Research Studies** on adaptive difficulty, AI personalization, and gamification effects.
- **Demonstrations** for workshops or hackathons showcasing AI-enhanced game design.

6. Security and Stability Enhancements

- Implement validation to prevent malicious inputs in API calls.
- Add fallback mechanisms if Gemini API is unavailable (e.g., default motivational quotes).
- Create structured error-handling for network interruptions and rendering issues.

7. Planned Roadmap

Phase	Enhancement	Priority
Phase 1	Leaderboards, Achievements, and Player Customization	High
Phase 2	Multiplayer and Cloud Save Integration	High
Phase 3	AI Adaptive Difficulty and Personalized Coaching	Medium
Phase 4	Enhanced Graphics and Effects	Medium
Phase 5	Offline & App Store Versions	Low

8.Vision for Future

The long-term vision for **Dodge Falling Blocks 3D** is to evolve from a single-player browser game into a **multiplayer, AI-driven interactive platform** where players can challenge each other, share experiences, and enjoy unique AI-created visual environments.

By combining web technologies, artificial intelligence, and human creativity, the project aims to become a model for the **next generation of smart browser games**.

References

1. Three.js Documentation – https://threejs.org/docs/
   (Used for 3D rendering, camera setup, lighting, and object management)
2. Tailwind CSS Documentation – https://tailwindcss.com/docs
   (Used for responsive UI design and modern styling framework)
3. Google Gemini API – https://ai.google.dev/
   (Used for AI Coach and Dream a Theme features)
4. Mozilla Developer Network (MDN) – https://developer.mozilla.org/
   (For HTML5, JavaScript, WebGL, and Web Audio API references)
5. W3Schools Web Tutorials – https://www.w3schools.com/
   (For general JavaScript, CSS, and DOM handling references)
6. OpenAI & Google AI Research Blogs
   (For understanding AI model capabilities and prompt design techniques)
7. GitHub Repositories & Developer Forums
   (For examples on collision detection, object pooling, and Three.js optimization)

APPENDIX – A

Project Summary

Title	**Dodge Falling Blocks 3D**
Objective	To design and develop a browser-based 3D arcade survival game where the player avoids dynamically falling blocks while interacting with AI-driven features.
Category	Web Application (Interactive 3D Game)
Frameworks / Tools Used	Three.js, Tailwind CSS, HTML5, JavaScript (ES6), Google Gemini API
Audio / UI Libraries	Web Audio API, Glassmorphism UI design
Game Type	Single Player, Survival-based 3D Environment
Development Platform	Visual Studio Code
Testing Platforms	Google Chrome, Microsoft Edge, Firefox, Safari
Duration	Academic Year 2025
Institution	Chaitanya Engineering College, Visakhapatnam
Department	Artificial Intelligence & Data Science
Guided By	Mr. B. Kian (Lecturer-In-Charge)
Team Members	Gudabandi Nithin Kumar (23L61A5418), Mortha Durga Prasad (23L61A5430), Mukati Gowrishankar (23L61A5431), Paasila Manikanta (23L51A5434)

Development and Execution Environment

Component	**Description**
Operating System	Windows 10 / 11 (Tested also on macOS & Android)
Browser Requirement	Any WebGL-enabled browser
Programming Languages	HTML5, CSS3, JavaScript
3D Framework	Three.js
AI Integration	Google Gemini API (for “Dream a Theme” & “AI Coach”)
Styling Framework	Tailwind CSS
Audio	Web Audio API
Version Control	GitHub (optional)

Functional Highlights

Feature	**Description**
3D Gameplay	The player navigates a cube-shaped avatar in a 3D world avoiding falling blocks.
AI Coach	Gemini API provides personalized feedback after each round.
Dream a Theme	Players can generate custom visual themes using AI prompts.
Power-Ups	Shield, Slow-Mo, and Shrink modify gameplay for limited durations.
Cross-Platform	Works seamlessly on desktop and mobile browsers.
Persistent Data	Best scores and game progress saved using LocalStorage.

APPENDIX – B

Output and Result Analysis

Output Type	Description
Main Menu Screen	Displays options for *New Game*, *Continue*, *Dream a Theme*, *How to Play*, and *Settings*.
Gameplay Screen	Shows real-time falling blocks, player position, score HUD, and power-up indicators.
Pause Screen	Allows the player to pause gameplay and view AI feedback messages.
Game Over Screen	Displays score summary, best score, and a motivational or humorous AI Coach tip.

Performance and Testing Results

Test Case	Description	Expected Result	Observed Result
1	Launch game in Chrome browser	Game loads successfully	Loaded successfully
2	Player movement using keyboard	Smooth control and response	No delay or lag
3	Collision with falling block	Player loses a life	Life deducted correctly
4	Power-up collection	Shield / Slow-Mo activated	Works as intended
5	Dream a Theme (AI Feature)	Generates new color theme	Random valid theme created
6	AI Coach message	Motivational feedback displayed	Message generated after game
7	Pause/Resume	Game state saved and resumed	Works properly
8	Mobile control	Touch buttons function correctly	Smooth operation

Sample Output Description

Screenshot Name	Explanation
Start Screen	Title and main menu interface
Gameplay Interface	Real-time player control, score counter, and 3D environment
Power-Up Activation	Shield or Slow-Mo effect visible on screen
Game Over Display	AI feedback with total score and retry options