Product Requirements Document (PRD)

# 🎯 Objective

To build a visually immersive and emotionally resonant personal portfolio website that uses React Three Fiber (R3F), Tailwind CSS, GSAP, Framer Motion, and realistic natural effects (like flowing oceans, sunrise/sunset transitions, clouds, rain, and animated beach characters) as a seamless 3D background. The primary goal is to elevate user engagement through storytelling visuals, while preserving content clarity, accessibility, and responsive usability.

# 🧩 Core Features & Functional Scope

## 1. 3D Background Effects (Three.js Layer)

* a. Landing Page: Ocean + Sunrise
* - Flowing animated ocean surface under portfolio name
* - Rising sun with light-intensity increase and atmospheric warmth
* - Gradient lighting simulates sunrise over the horizon
* b. Scroll Transitions (GSAP ScrollTrigger)
* - Scroll from hero → Education: fades sunrise, introduces soft clouds
* - Scroll into mid-section (Projects, Skills): adds realistic rain effect
* - Scroll into end-section: removes rain, transitions to a vibrant sunset
* c. Final Section: Sunset with Animated Friends
* - Sun lowers into sunset, hues shift from yellow → deep red/purple
* - Animated GLTF characters sitting/standing near ocean, subtly interacting
* - Scene symbolizes peaceful closure to the user’s journey through the portfolio

## 2. 3D Asset Integration

|  |  |  |
| --- | --- | --- |
| Asset | Type | Purpose |
| Water mesh | Shader (R3F) | Ocean ripples during landing |
| DirectionalLight | Lighting | Simulate sunrise/sunset brightness and warmth |
| Cloud layer | Particle or Shader Plane | Drifting cloud backdrop for transition |
| Rain particles | Particle System | Natural rain effect, layered over content |
| GLTF Friends | GLTF 3D Models | Character silhouettes at beach during sunset |

## 3. Website Structure Compatibility

- The 3D canvas (`<Canvas />`) will be mounted behind all content using Tailwind (`z-10`, `pointer-events-none`)

- HTML/CSS structure remains untouched for accessibility and SEO

- Site maintains responsive design across all device breakpoints

# ⚙️ Technical Requirements

## Tech Stack Overview

|  |  |
| --- | --- |
| Stack Component | Technology / Library |
| 3D Engine | Three.js (via React Three Fiber) |
| React Integration | React Three Fiber + Drei |
| Styling Framework | Tailwind CSS |
| Animation Engine | GSAP + ScrollTrigger |
| UI Animations | Framer Motion |
| 3D Models | GLTF format |
| Postprocessing | @react-three/postprocessing |
| Shader Effects | Custom GLSL (rain/clouds/sunset) |

## Canvas Mounting (React + Tailwind)

<Canvas className="fixed top-0 left-0 w-full h-full -z-10 pointer-events-none">...</Canvas>  
- This ensures canvas stays behind all content.  
- Tailwind handles full-size scaling and layering.

# 🎨 Design Principles

* - Subtlety over distraction: effects support, not overwhelm content.
* - Emotional progression: from dawn to dusk with storytelling cues.
* - Minimal interference: text and content remain readable and interactive.
* - Mobile responsiveness: effects adapt to screen size gracefully.
* - Optimized performance: lazy loading, shader efficiency, GPU-aware design.

# 📄 Page-by-Page Breakdown

|  |  |  |
| --- | --- | --- |
| Section | Visual Effect | Trigger |
| Hero (Intro/Name) | Ocean + Sunrise animation | Page load |
| Education/Projects | Transition to clouds, fade light | Scroll to section |
| Projects/Skills | Rain overlays, cooler lighting | Scroll midpoint |
| Final Leadership Page | Sunset colors + animated beach characters | Final scroll area |

# 📦 Dependencies (NPM Modules)

* - three
* - @react-three/fiber
* - @react-three/drei
* - @react-three/postprocessing
* - gsap
* - framer-motion
* - leva (optional UI controls)
* - spectorjs (debugging)

# 🧪 Testing & Optimization

Performance Tools:

- MCP tools / Chrome DevTools / Three.js Inspector

- Stats.js for FPS tracking

- SpectorJS for WebGL inspection

Optimization Guidelines:

- Use `.glb` binary models, compressed for loading speed

- Keep texture sizes <= 512px unless high detail is required

- Only apply postprocessing effects to visible regions

- Use `drei/Suspense` for lazy loading models and shaders

# 📆 Milestones & Timeline

|  |  |
| --- | --- |
| Milestone | ETA |
| Setup Tailwind + R3F base layout | Day 1 |
| Canvas + Ocean + Sunrise Scene | Day 2 |
| Clouds + Rain + Scroll Sync | Day 3 |
| Sunset Scene + GLTF Models | Day 4 |
| Performance Audit + Responsive Fixes | Day 5 |
| Final QA + Deployment | Day 6–7 |

# 📌 Out of Scope

* - Backend logic or form processing
* - Rewriting existing page content structure
* - Adding audio or ambient sound effects (future option)

# ✅ Success Criteria

* - Users experience immersive sunrise and ocean effect at load.
* - Scrolling introduces clouds and realistic rain transitions.
* - Final scene creates emotional payoff with sunset + character interaction.
* - 3D effects load seamlessly behind HTML content.
* - No layout shifts or performance issues across devices.