

# AdTech Mastery Quiz - Project Report

Project Title: AdTech Mastery Quiz

Version: 1.0.0

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## 1. Executive Summary

The **AdTech Mastery Quiz** is a premium, gamified educational platform designed to help professionals and students master the complex ecosystem of Digital Advertising Technology. Unlike standard quiz applications, it offers a high-fidelity, immersive user experience ("Glassmorphism" aesthetic) combined with advanced learning tools like scenario-based reasoning ("Mastermind Mode") and persistent performance analytics ("Pro Stats Dashboard").

## 2. Key Features

### 2.1 Pro Stats Dashboard

- **Visual Analytics:** Users can track their progress through a "Spider Chart" (Radar Chart) visualizing 5 key attributes: Knowledge, Speed, Experience, Tenacity, and Focus.
- **Persistent History:** Utilizes a custom LocalStorage service to save every quiz attempt, allowing users to review past scores and improvement over time.
- **Detailed Metrics:** Displays Average Score, Best Streak, and Total Time Spent.

### 2.2 Mastermind Mode (Insight Engine 2.0)

- **Scenario-Based Learning:** A flagship feature that presents complex, real-world AdTech scenarios rather than simple multiple-choice questions.
- **Deep Reasoning:** Users must apply multi-step logic to solve problems (e.g., debugging a waterfall setup or optimizing a bid strategy).
- **Instant Feedback:** Provides detailed, context-aware explanations for every decision.

### 2.3 Comprehensive Content Library

- **Scale:** Over 250+ questions covering 11 distinct chapters.
- **Topics:** Ranges from "Basics" and "Programmatic" to advanced "Identity Resolution", "Attribution Models", and "Privacy Sandbox".
- **Randomization:** Smart shuffling algorithms ensure no two sessions are identical.

## 3. Technical Architecture

### 3.1 Core Stack

- **Framework:** React 19 - Utilizing the latest Concurrent features and hooks for optimized rendering.
- **Build Tool:** Vite 7.2 - Ensures lightning-fast HMR (Hot Module Replacement) and optimized production builds.
- **Language:** TypeScript - Enforcing strict type safety across the application to prevent runtime errors.

### 3.2 Styling & Design System

- **Tailwind CSS 3.4:** A utility-first CSS framework enabling rapid UI development.
- **Tailwind Merge (twMerge):** Utility for efficiently resolving Tailwind class conflicts, essential for dynamic component styling.
- **Lucide React:** A modern, lightweight icon library providing consistent visual language.
- **Glassmorphism:** A core design philosophy using backdrop filters (backdrop-blur-xl), semi-transparent gradients, and subtle borders to create depth and hierarchy.

### 3.3 State Management & Animation

- **Framer Motion 12:** Powering complex animations, including:
  - Page transitions (AnimatePresence)
  - Hover effects (Scale, Glow)
  - Statistical charts (Animated SVG paths for the Radar Chart)
- **React Hooks:** Extensive use of useState, useEffect, and custom hooks for game logic state.
- **LocalStorage Service:** A focused service layer (src/services/storage.ts) handling data persistence, ensuring user progress survives page reloads.

### 3.4 Project Structure

```
src/
  ├── components/      # Reusable UI components (QuizCard, StatsDashboard, etc.)
  ├── data/            # Static JSON data (questions.json, insight-loops.json)
  ├── services/        # Business logic & external communication (storage.ts, api.ts)
  ├── App.tsx          # Main application controller & router
  └── index.css        # Global styles & Tailwind directives
```

## 4. Design Techniques

### 4.1 Immersive UI

The application moves away from "flat" design towards a rich, layered interface.

- **Dynamic Backgrounds:** Uses MouseParallax to create a subtle depth effect that responds to cursor movement.
- **Interactive Gradients:** Buttons and cards feature "moving" gradients on hover to signal interactivity.
- **Sonic Feedback:** Integrated sound effects (via use-sound pattern) for clicks, success, and error states (placeholder architecture ready).

### 4.2 Responsive & Accessible

- **Mobile-First:** All layouts, including the complex Stats Dashboard, are fully responsive, stacking vertically on mobile devices utilizing Tailwind's responsive prefixes (md:, lg:).

- **Semantic HTML:** Uses proper button and heading tags to ensure basic screen reader compatibility.

## 5. Future Roadmap

- **Backend Integration:** Migrating from LocalStorage to a real database (PostgreSQL/NestJS) for global leaderboards.
- **Mobile App:** Wrapping the web app into a native container (React Native or Capacitor).
- **AI Tutor:** Expanding Mastermind Mode with a real-time LLM chat interface for deeper explanations.

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