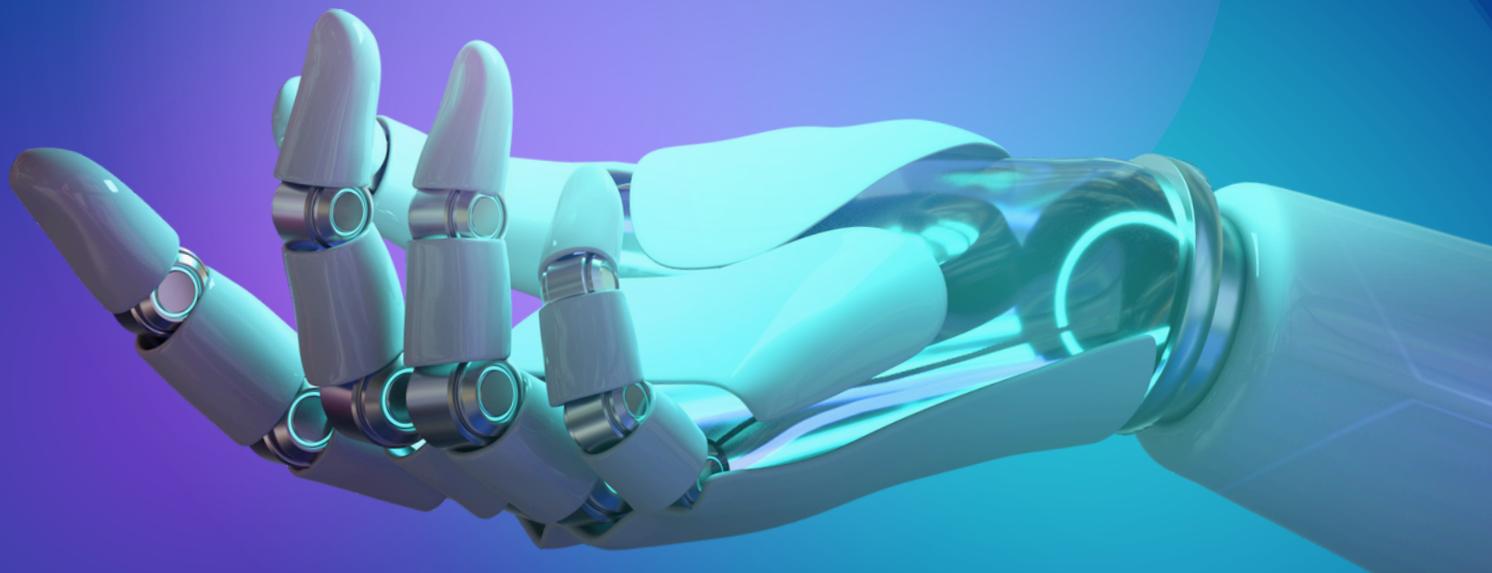


PROGRAMMING 3D

P.O.E PART 1

PLANNING & DESIGN



PROG7314

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P.O.E PART 1

PLANNING AND DESIGN

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Introduction

This planning and design document builds directly on the findings of the research analysis to provide a structured blueprint for the development of Memory Match Madness, a mobile cognitive training game. Drawing on the strengths and weaknesses of existing applications, the document outlines the technical requirements, user interface designs, and system architecture that will guide implementation. Four core innovations identified through research: Dynamic Difficulty Adaptation, Multi-Categorical Educational Content, Enhanced Social Multiplayer Integration, and Dual Game Mode Frameworks, form the foundation of the design. The document specifies minimum requirements such as secure Google SSO and biometric login, RESTful API integration, offline functionality with synchronization, real-time notifications, and multi-language support including South African languages. User interface mockups created in Figma illustrate intuitive navigation, accessibility features, and personalization options designed to enhance engagement. Technical diagrams detail the client-server structure, API endpoints, and UML class models that support scalable and reliable development. Data capture requirements cover authentication, gameplay tracking, social interaction, and analytics to ensure both entertainment and therapeutic applications are supported. A project timeline with resource allocation provides a practical roadmap for implementation. This introduction sets the stage for translating research-driven insights into a functional, user-centred design.

Overview of app

Memory Match Madness is a cognitive training mobile game that reimagines the classic memory card match into a structured brain-training experience. The app is designed with a vibrant, playful interface that appeals to all age groups, making memory improvement fun and engaging. It features multiple game modes: Adventure Mode for progressive challenges and Arcade Mode for spontaneous, randomized sessions. Players can choose from diverse themed categories including Animals, Pokémon, Fruits, Flags, F1 Logos, and Harry Potter. A personal dashboard tracks completion times, accuracy, win streaks, and overall progress through detailed performance analytics. Gamification elements such as experience points, badges, and milestone rewards encourage consistent practice. The Smart Daily Streak System introduces themed daily challenges and adaptive goals to keep users motivated. Competitive features include customizable grid sizes and multiplayer battles for social engagement. The app supports offline play with cloud synchronization, biometric authentication, and real-time notifications. With multi-language support and accessible design, Memory Match Madness becomes a universal platform for memory training.

App Name: Memory Match Madness.

Initial icon design:



Innovative Features

1. **Dynamic Difficulty Adaptation System:** This feature automatically adjusts card grid size, complexity, and time limits based on player performance (for example: accuracy, speed, and mistakes). It prevents frustration from excessive difficulty and boredom from overly simple levels, keeping players motivated. By creating personalized difficulty curves, it ensures steady improvement for different learning styles and abilities. This makes the game engaging for casual players while still offering measurable cognitive training benefits (Branded Brothers, 2021; Dreamy Dingo, 2016; Monkey Games Studios, 2024).

2. **Multi-Categorical Educational Content Library:** This feature introduces diverse content categories such as Animals, Fruit, Pokémon, Flags, F1 Logos, and Harry Potter, turning simple matching into themed educational experiences. Each theme promotes different learning outcomes, from geography and biology to cultural awareness and memory of popular icons. The interface allows players to select categories aligned with their interests, ensuring personalization and reducing monotony. Teachers, parents, and therapists can use these categories for targeted learning, therapy, or family engagement. The variety of content appeals to multiple age groups and learning styles, making the game versatile in both entertainment and education. By combining fun with academic enrichment, the library sustains engagement while supporting cross-curricular learning (Branded Brothers, 2021).
3. **Enhanced Social Multiplayer Integration Framework:** This system supports local and online multiplayer modes, from family challenges to classroom tournaments. Features like leaderboards, replays, and community events make the game more interactive and socially engaging. By encouraging friendly competition and collaboration, it enhances motivation and keeps players returning. This addresses the solitary nature of traditional memory games, proving that social interaction significantly boosts both learning outcomes and user retention (Branded Brothers, 2021; Dreamy Dingo, 2016).
4. **Dual Game Mode Framework:** This feature offers two distinct modes: Adventure Mode for structured progression and Arcade Mode for casual, endless play. Adventure Mode gradually increases difficulty, building cognitive skills through planned challenges and achievement recognition. Arcade Mode provides spontaneous sessions with randomized levels, suitable for quick training or casual relaxation. Together, the modes balance formal skill development with flexible play, appealing to both serious users and casual gamers. This design accommodates therapeutic programs, educational use, and personal entertainment alike. By offering structured and unstructured options, the game avoids routine fatigue and supports long-term use. The dual framework makes the app adaptable to different goals, time commitments, and user preferences (Branded Brothers, 2021; Digitag Studio, 2018).

App Requirements

Minimum Requirements

1. **User Registration & Authentication:** The app must support secure account creation and login through Google Single Sign-On (SSO), managed via Firebase Authentication. Biometric login (fingerprint recognition) will be provided after the initial sign-in to ensure both convenience and strong security. Users must also be able to log out at any time, maintaining full control over their session and privacy.'
2. **REST API & Data Management:** A custom REST API must manage authentication validation, progress synchronization, leaderboards, achievements, and cross-device consistency. The API must be cloud-hosted for reliability and scalability, ensuring secure and efficient data handling.
3. **Offline Mode with Synchronization:** All game modes and progress tracking must be fully functional offline using RoomDB. Upon reconnection, the system must sync progress with the cloud database, merging offline and online achievements seamlessly.
4. **Real-Time Notifications:** Push notifications, powered by Firebase Cloud Messaging, must deliver personalized reminders for daily play, milestone celebrations, seasonal challenges, and multiplayer invitations. Users must have the ability to configure frequency and notification types.
5. **Multi-Language Support:** The app must provide full support for at least **two South African languages** (in addition to English). This includes translations for all menus, gameplay instructions, notifications, and system messages to ensure accessibility for a diverse user base.
6. **Settings Management:** Users must be able to change and save key preferences within the app, including language selection, notification preferences, and biometric login toggle. These settings must persist across sessions and devices.
7. **Game Mode Management:** The app must provide multiple distinct modes to support different play styles and cognitive goals:
 - Adventure Mode – structured level progression with increasing difficulty.
 - Arcade Mode – casual randomized gameplay.
 - Multiplayer Mode – competitive local and online matches.

All progress and mode data will be stored in RoomDB for persistence.

8. **Adaptive Difficulty & Progress Tracking:** The game must automatically adjust difficulty parameters (for example: grid size, time limits) based on player performance. Detailed statistics, performance trends, and achievement badges will provide feedback and motivation, ensuring long-term engagement and measurable cognitive improvement.
9. **Theme Selection:** The app must include a diverse set of themed card categories (Animals, Food & Drinks, Vehicles, Flags, Musical Instruments, Pokémon and Harry Potter). Categories will be available offline and can be unlocked through achievements or progression, with premium categories offered as optional content.
10. **Personalization & Accessibility:** Users must have access to a comprehensive settings screen to adjust:
 - Profile details (username, avatar, theme preference).
 - Gameplay settings (sounds, animations, reveal timing).
 - Difficulty (grid sizes from 3x2 to 8x12).
 - Accessibility (high contrast mode, scalable card sizes).
11. **Social & Competitive Features:** The app must include multiplayer functionality (local and online), leaderboards, and achievement sharing. These features will transform gameplay from a solitary activity into a social and competitive experience that encourages engagement and repeat play.

Innovative Requirements

1. **Comprehensive Personal Dashboard System:** This feature provides players with a personalized profile that tracks statistics such as games won, streaks, completion times, and cumulative scores. It uses experience points and achievements to show progression, giving clear evidence of cognitive improvement. Milestone badges like “First Win,” “Speed Demon,” and “Memory Guru” gamify the experience and encourage motivation. By recording historical performance data, players can see long-term growth and celebrate personal milestones. This transforms the game into structured cognitive training rather than casual play, offering both entertainment and measurable skill development. The dashboard creates a sense of achievement while reinforcing consistent engagement, making cognitive improvement both rewarding and trackable. (Branded Brothers, 2021).
2. **Personalize User Profile Picture:** The app will allow for a more personalized user experience; users will have the option to upload a custom display picture (profile picture) or select from a pre-provided collection of images. This feature allows users to express their individuality within the app, making the experience feel more personal. The ability to choose a display picture can make users feel more connected to the app, encouraging frequent use and engagement (Piluta, 2021).
3. **Smart Daily Streak System:** The app will have a habit-forming cognitive training tool by motivating consistent play through themed daily challenges (for example: Animal Monday, Food Tuesday). A visual streak counter with fire animations and milestone rewards (3-day, 5-day, 10-day, 30-day) provides both short- and long-term motivation. Personalized daily goals adjust dynamically based on past performance, encouraging gradual improvement. A weekly recap dashboard shows progress metrics like accuracy and completion time, transforming gameplay into measurable brain training. Notifications to deliver personalized reminders at optimal times, ensuring consistent engagement. This feature addresses weaknesses in existing apps by adding structured progression, motivation, and accountability while remaining technically simple to implement (Dreamy Dingo, 2016).

User interface design

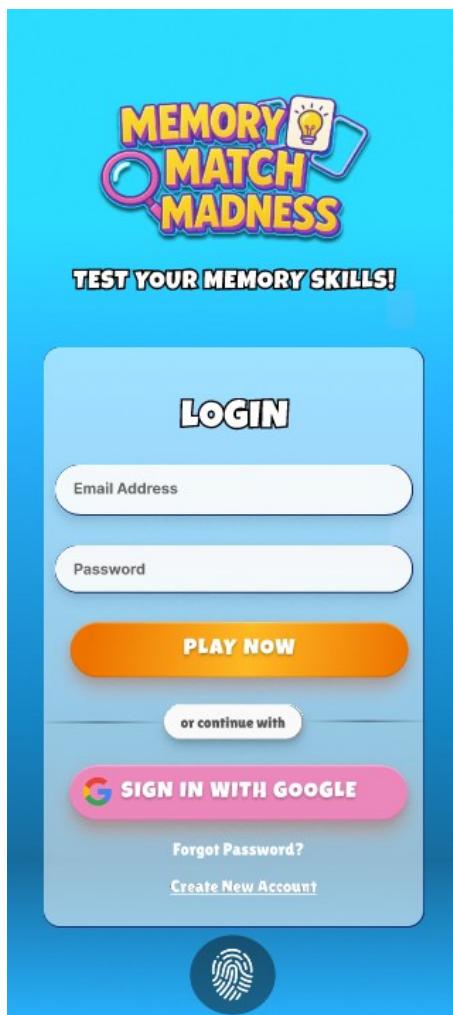
Using Figma: <https://www.figma.com/design/HtvjTyZPRCiPF3m25KIkR7/MEMORY-MATCH-MADNESS?node-id=0-1&t=DWkElQVJRK2v1Pii-1>

Loading Screen



The loading screen is the first interface users encounter when opening Memory Match Madness. It displays the app's branding with vibrant blue background featuring scattered card outlines, establishing the memory game theme immediately. The prominent logo “MEMORY MATCH MADNESS” with lightbulb and magnifying glass icons communicates the app's focus on cognitive training and discovery. A loading progress bar at the bottom provides visual feedback during app initialization, ensuring users understand the system is preparing their gaming experience.

Login Screen

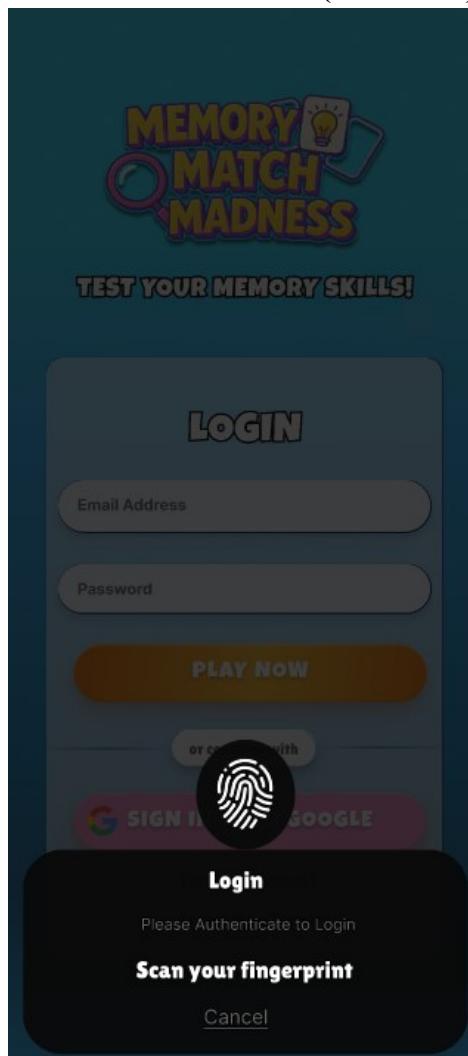


The login screen allows existing users to access their Memory Match Madness accounts securely. Users can enter their email and password credentials, with the prominent orange “PLAY NOW” button providing clear next-step guidance. The screen includes Google Single Sign-On integration via the pink “SIGN IN WITH GOOGLE” button, streamlining the authentication process. A fingerprint icon at the bottom indicates biometric authentication support, while “Forgot Password?” and “Create New Account” links provide comprehensive account management options.

Features satisfied:

- **POE requirement:** User registration and authentication with SSO support.
- **POE requirement:** Biometric Authentication (fingerprint recognition indicated).

Authentication Screen (Biometric)

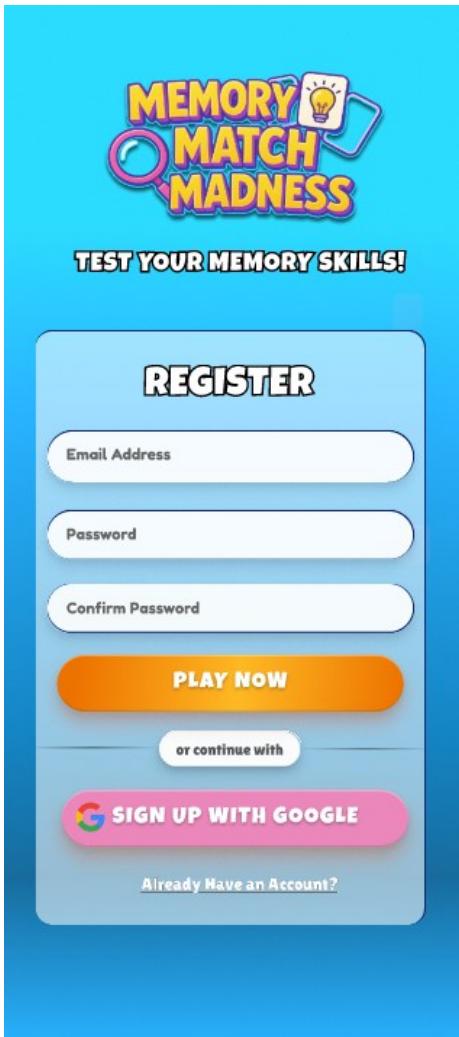


The biometric authentication screen provides secure, convenient access through fingerprint recognition. The dark overlay with fingerprint scanner interface creates focus on the authentication process, while “Please authenticate to login” messaging guides users clearly. The “Scan your fingerprint” prompt with cancel option ensures user control over the authentication method. This screen demonstrates the app's commitment to modern security practices while maintaining user-friendly access.

Features satisfied:

- **POE requirement:** Biometric Authentication (facial recognition).

Register Screen



The registration screen enables new users to create Memory Match Madness accounts with comprehensive account setup options. Fields for email address, password, and password confirmation ensure secure account creation, while the orange “PLAY NOW” button maintains consistent visual design. Google SSO option via “SIGN UP WITH GOOGLE” provides alternative registration methods. The “Already Have an Account?” link facilitates easy navigation between login and registration, supporting user flow optimization.

Features satisfied:

- **POE requirement:** User registration and authentication.
- **POE requirement:** Single sign-on (SSO) implementation.

Main Menu Screen



The main menu serves as the central navigation hub, providing access to all primary game modes and app features. Users can select from Arcade Mode, Adventure Mode, Multiplayer, Statistics, and Settings through clearly labelled, color-coded buttons. The interface includes user profile indicators in the top-left corner, notification badges, and a connectivity status indicator in the top-right corner showing offline/online status. When offline (no Wi-Fi symbol displayed), all single-player modes remain fully functional using local RoomDB storage, while multiplayer options may show limited availability. The design uses vibrant colours and intuitive iconography to create an engaging and easily navigable experience for users of all technical skill levels. Upon reconnection, the app seamlessly syncs offline progress with cloud databases.

Features satisfied:

- **POE requirement:** Offline mode with Sync - All game modes and progress tracking fully functional offline, with seamless cloud synchronization upon reconnection.
- **Memory Match Madness Innovative requirement/feature:** Dual Game Mode Framework providing structured Adventure Mode and casual Arcade Mode options.
- **Memory Match Madness Innovative requirement/feature:** Enhanced Social Multiplayer Integration Framework access point.

Choose Grid Size Screen



This screen implements the adaptive difficulty system by allowing users to select their preferred challenge level. Grid options are organized by difficulty: Beginner (3×2 , 4×3), Intermediate (5×4 , 6×5), and Expert (8×7 , 9×8), with card counts clearly displayed. The color-coded difficulty levels (green, orange, red) provide intuitive visual guidance for users to select appropriate challenges. This systematic progression supports cognitive training effectiveness across different skill levels.

Features satisfied:

- **POE requirement:** Customizable difficulty settings and game configuration.
- **Memory Match Madness Innovative requirement/feature:** Dynamic Difficulty Adaptation System.
- **Memory Match Madness Innovative requirement/feature:** Multi-level progression supporting cognitive training.

Settings Screen

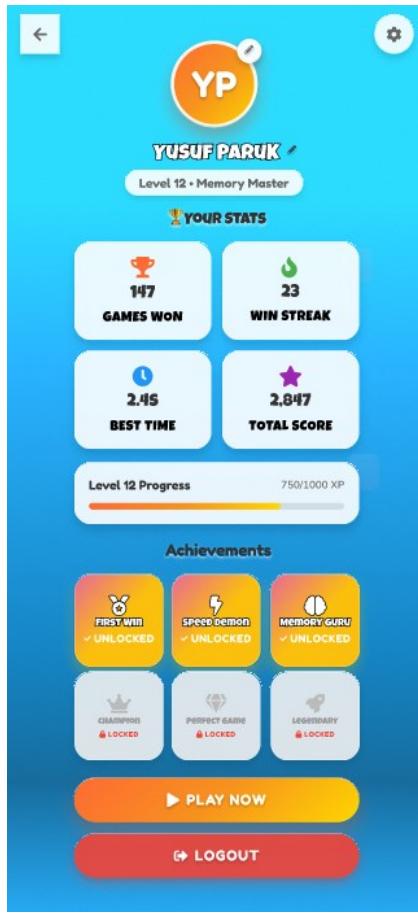


The comprehensive settings screen provides extensive personalization options divided into logical sections: Appearance, Language, Notifications, Account, and Support. Card background customization enables visual personalization, while language selection supports accessibility across diverse user groups. Notification toggles give users control over their engagement preferences, and account management options (Edit Profile, Password & Login, Delete Account) provide complete account control. The organized layout ensures easy navigation through various customization options.

Features satisfied:

- **POE requirement:** User settings management and personalization.
- **POE requirement:** Multi-language support preparation.

Profile/Personal Dashboard Screen

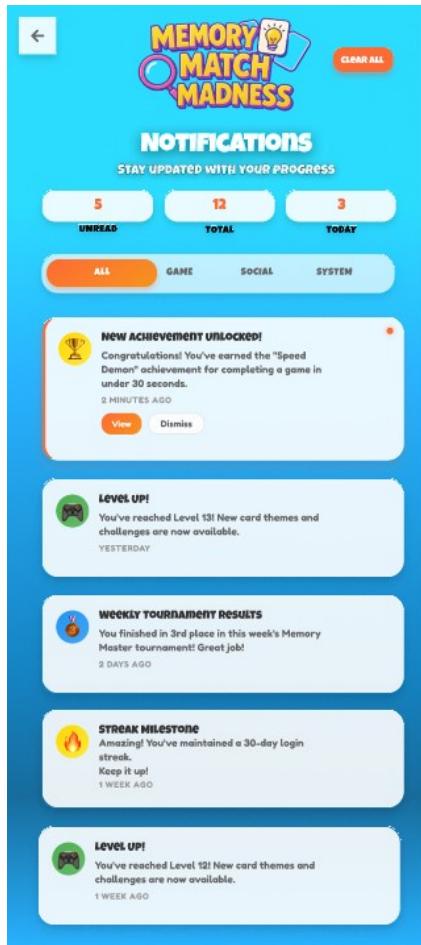


The personal dashboard showcases the comprehensive tracking system with user avatar, level progression (Level 12: Memory Master), and detailed statistics display. Key metrics include games won (147), win streak (23), best time (2:45), and total score (567), providing measurable cognitive improvement indicators. The achievement system shows unlocked badges (First Win, Speed Demon, Memory Guru) with locked achievements creating motivation for continued play. The progress bar and “PLAY NOW” button encourage ongoing engagement while the logout option provides account control.

Features satisfied:

- **Memory Match Madness Innovative requirement/feature:** Comprehensive Personal Dashboard System.
- **Memory Match Madness Innovative requirement/feature:** Achievement and gamification framework.

Notifications Screen

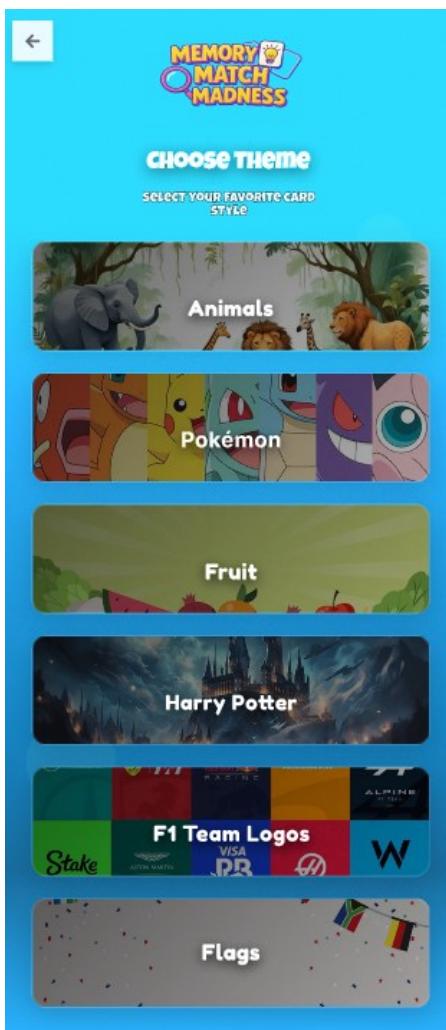


The notifications center keeps users engaged through comprehensive communication management. Organized into categories (All, Game, Social, System), it displays achievement unlocks, level progression, tournament results, and streak milestones. The “**NEW ACHIEVEMENT UNLOCKED**” notification with trophy icon celebrates user accomplishments, while level-up notifications provide progression feedback. Social notifications about tournaments create community engagement, and streak milestone alerts support the daily engagement system.

Features satisfied:

- **POE requirement:** Real-time notifications and user engagement.
- **Memory Match Madness Innovative requirement/feature:** Smart Daily Streak System (streak notifications).
- **Memory Match Madness Innovative requirement/feature:** Enhanced Social Multiplayer Integration Framework (tournament notifications).

Theme Selection Screen



The theme selection screen demonstrates the multi-categorical content library through diverse themed collections. Options include Animals (safari scene), Pokémon (character artwork), Fruit (fresh produce), Harry Potter (magical elements), F1 Team Logos (racing brands), and Flags (international symbols). Each theme features distinctive visual representation that aids memory formation through familiar imagery. This variety ensures sustained engagement across different user interests and learning preferences.

Features satisfied:

- **Memory Match Madness Innovative requirement/feature:** Multi-Categorical Educational Content Library.

Level Selection Screen



The level selection screen displays structured progression through numbered levels with star rating systems and completion status indicators. Users can see their progress through Adventure Mode with clear visual indicators of completed, current, and locked levels. The interface shows performance ratings (stars earned) for each completed level and provides easy navigation between different level sets. Progress tracking at the bottom shows overall advancement through the level system.

Features satisfied:

- **Memory Match Madness Innovative requirement/feature:** Structured progressive learning system with measurable goals and achievement recognition.
- **Memory Match Madness Innovative requirement/feature:** Adventure Mode implementation with planned challenges and difficulty scaling.

Solo Player Gameplay Screen – Adventure Mode



The Adventure Mode gameplay interface displays structured level progression with increasing difficulty through the core memory matching mechanics. The UI header shows specific level information, remaining moves, timer countdown, and current score, providing real-time performance feedback that tracks cognitive improvement over time. The grid layout features themed cards where some cards are revealed during matching attempts while others remain face-down with distinctive blue backing. This mode emphasizes systematic skill development through planned challenges and measurable progression milestones. The clean design focuses attention on cognitive training while maintaining accessibility across age groups.

Features satisfied:

- **Memory Match Madness Innovative requirement/feature:** Multi-Categorical Educational Content Library implementation through themed card imagery.
- **Memory Match Madness Innovative requirement/feature:** Real-time progress tracking during gameplay with detailed performance metrics.

Solo Player Gameplay Screen – Arcade Mode



The Arcade Mode gameplay interface provides casual randomized gameplay with flexible, endless play sessions suitable for spontaneous cognitive training. Unlike Adventure Mode's structured progression, Arcade Mode presents randomized level configurations with varied grid sizes and unpredictable themed content categories. The UI header displays session-based metrics (points, time, moves) rather than level-specific progression, encouraging relaxed play without pressure for systematic advancement. The interface maintains the same core memory matching mechanics with themed cards (Pokémon characters shown) but emphasizes immediate enjoyment over long-term skill building. This mode serves users seeking quick mental exercise sessions or casual entertainment without commitment to structured learning paths.

Features satisfied:

- **POE requirement:** Offline mode support with RoomDB storing session statistics and preferences
- **Memory Match Madness Innovative requirement/feature:** Dual Game Mode Framework providing casual, endless play complementing structured Adventure Mode

Multiplayer Competition Screen

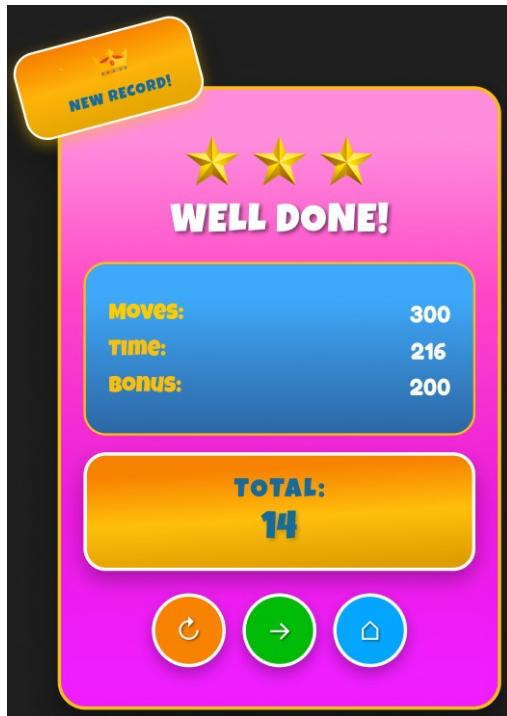


The multiplayer interface creates competitive cognitive training through split-screen design showing Red vs Blue player competition. Real-time score tracking (Red: 0, Blue: 2) creates immediate competitive feedback, while shared card grid ensures fair play conditions. The competitive timer and scoring system transform individual memory training into social engagement, encouraging family and peer participation. This design maintains cognitive training benefits while adding motivational social elements.

Features satisfied:

- **Memory Match Madness Innovative requirement/feature:** Enhanced Social Multiplayer Integration Framework.

Level Completion Screen

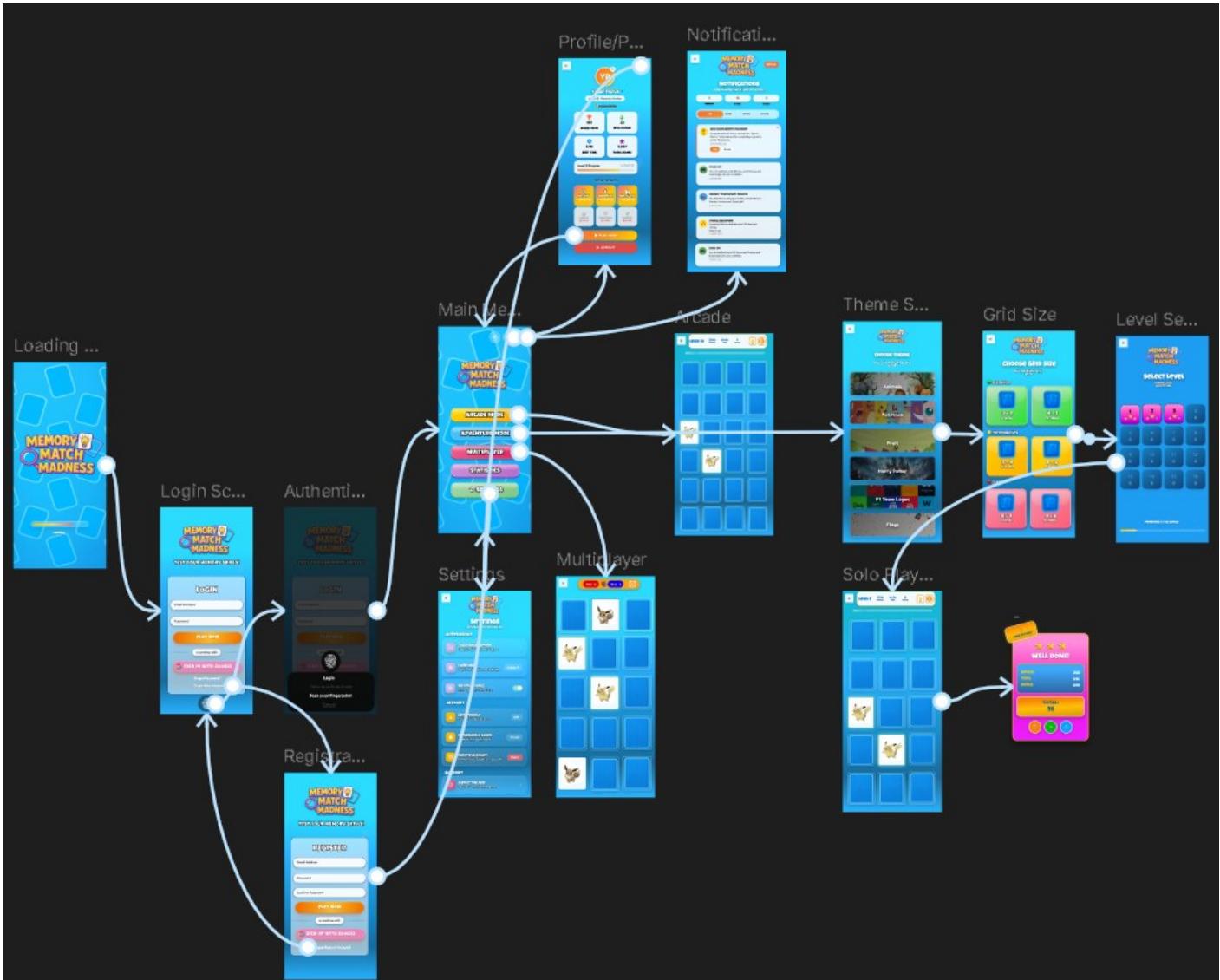


The completion screen provides comprehensive performance feedback through detailed metrics display. The “WELL DONE!” celebration with three-star rating system gamifies achievement, while performance breakdown (Moves: 300, Time: 216, Bonus: 200) enables detailed progress tracking. The “NEW RECORD!” banner adds motivational elements, and the final score (Total: 14) provides quantifiable cognitive improvement measurement. Action buttons (replay, continue, home) give users clear navigation options.

Features satisfied:

- **Memory Match Madness Innovative requirement/feature:** Comprehensive Personal Dashboard System (performance metrics).
- **Memory Match Madness Innovative requirement/feature:** Achievement recognition and motivation system.

Navigation Diagram:



API and UML diagram

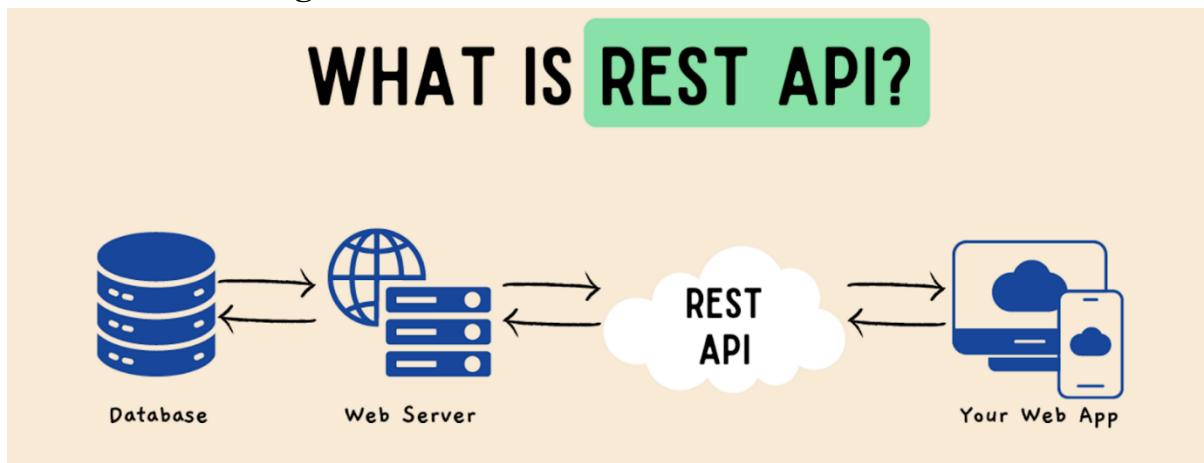


Figure 1: What is Restful API? (GeeksforGeeks, 2023)

What is a RESTful API and How Will It Be Used in Memory Match Madness?

A RESTful API (Representational State Transfer) is a web service architecture that enables different software applications to communicate over the internet using standard HTTP methods such as GET, POST, PUT, and DELETE. REST APIs follow a stateless, client-server communication model where data is exchanged in JSON format, making them platform-independent and scalable. In the Memory Match Madness application, as illustrated in the Client Server Architecture Diagram, the RESTful API layer serves as the crucial communication bridge between the Android client application and the backend services. The API handles essential operations including user authentication through Google SSO, game result submissions, leaderboard data retrieval, and theme content management. Specifically, the diagram shows endpoints like /api/auth/login for authentication, /api/games/result for submitting player scores, and /api/themes for downloading card themes such as Pokémons, Fruits, and Animals. This RESTful approach ensures that the Memory Match Madness app can seamlessly synchronize local gameplay data with cloud services while maintaining offline functionality through the local RoomDB storage system (GeeksforGeeks, 2023).

Architecture Overview

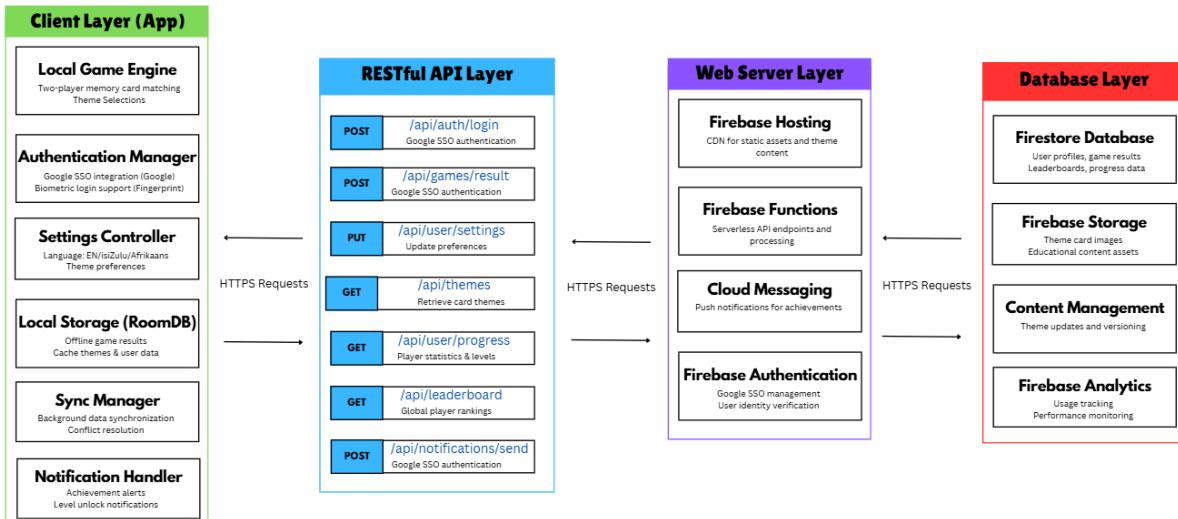


Figure 2: Client Service (GeeksforGeeks, 2019)

How This Architecture Works in Relation to Memory Match Madness

The Client Server Architecture Diagram demonstrates a four-layer system specifically designed to support Memory Match Madness's unique requirements for local multiplayer gameplay with cloud synchronization capabilities. The Client Layer contains the Android application with components like the Local Game Engine for two-player card matching, Authentication Manager for Google SSO and biometric login, and Local Storage using RoomDB for offline game results. When players complete matches, the Sync Manager component communicates with the RESTful API Layer through HTTPS requests to endpoints such as /api/user/progress and /api/leaderboard for updating global rankings. The Web Server Layer, powered by Firebase Functions, processes these requests and manages serverless API endpoints while Firebase Hosting delivers static theme content through a CDN. The Database Layer stores all persistent data in Firestore Database for user profiles and game statistics, while Firebase Storage houses the themed card images and educational content assets. This architecture ensures that Memory Match Madness can operate offline during local multiplayer sessions while automatically synchronizing progress when internet connectivity is restored, perfectly supporting the POE requirements for both offline functionality and cloud-based features like real-time notifications and multi-language support (GeeksforGeeks, 2019).

API Functionality, Data Exchange, and Implementation Strategy

The Memory Match Madness API, as depicted in the Client Server Architecture Diagram, will handle comprehensive data management for user authentication, game mechanics, and content delivery. The API will receive data including user credentials through Google SSO, game completion results with timing and accuracy metrics, language preference settings for isiZulu and Afrikaans support, and biometric authentication tokens for secure login. In return, the API will send themed card data for different collections, updated leaderboard rankings,

achievement notifications, and synchronized user progress across devices. The RESTful endpoints shown in the diagram, such as /api/user/settings for preference updates and /api/notifications/send for push messaging, will facilitate real-time communication between the client and server layers. The API implementation will utilize Firebase Functions for serverless computing, providing automatic scaling and cost-effective hosting without requiring traditional server management. Firebase Hosting will serve as the primary hosting platform, offering global CDN capabilities for fast content delivery and seamless integration with other Firebase services like Firestore Database and Cloud Messaging. This cloud-first approach aligns with modern mobile development practices and ensures that Memory Match Madness can handle varying user loads while maintaining consistent performance for features like dynamic difficulty adjustment and real-time multiplayer notifications (GeeksforGeeks, 2019).

UML DIAGRAM

https://docs.google.com/document/d/1E9bgSwU0MZEGU9-pLLIs0dNFWYxmty-OXb8m_K2z5XY/edit?usp=sharing

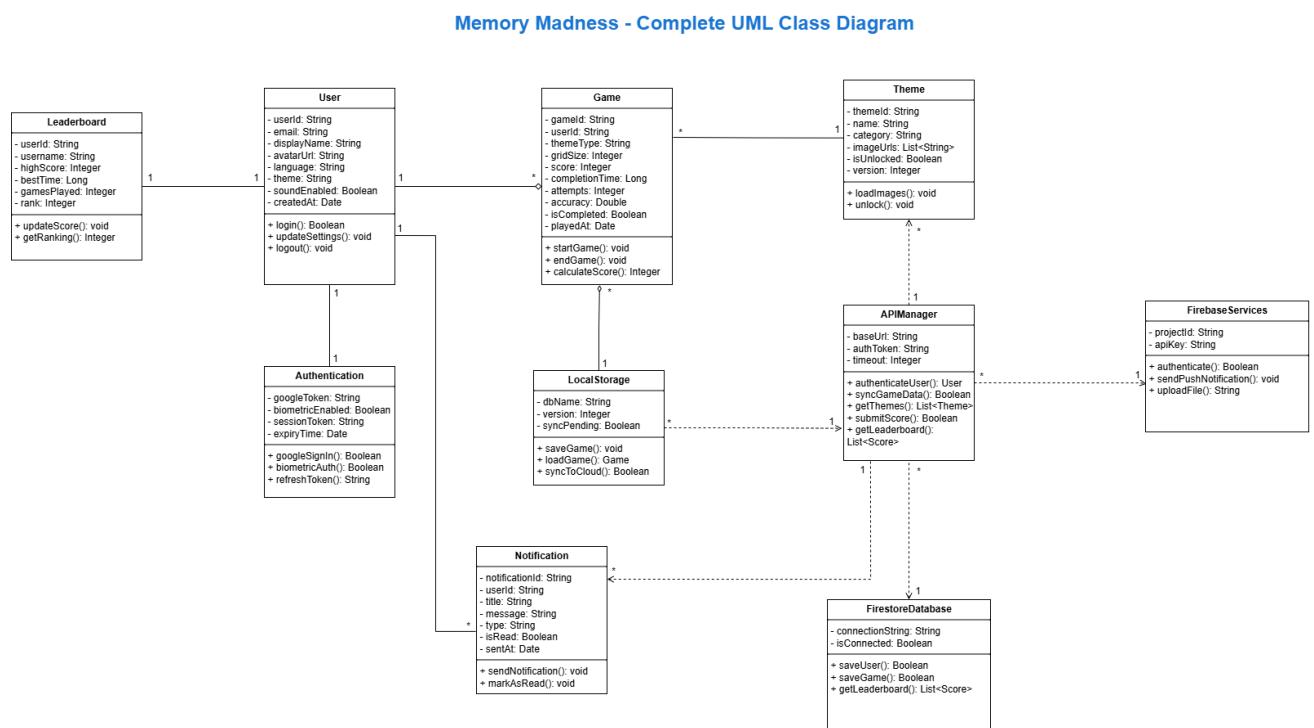


Figure 3: Memory Match Madness UML Diagram (Diagrams.net, 2015)

UML Diagram Explanation

The UML Class Diagram for Memory Match Madness demonstrates a comprehensive object-oriented architecture that facilitates the card matching game's core functionality through ten strategically designed classes representing distinct system components. The User class serves as the central entity, maintaining player profiles with attributes such as userId (String), language preferences for isiZulu and Afrikaans support, and theme selections, while establishing one-to-many relationships with the Game class to track multiple gameplay

sessions including completion times, accuracy rates, and themed content selections (Pokémon, Fruits, Animals). The APIManager class functions as the critical intermediary layer, implementing RESTful endpoints through methods like syncGameData() and getLeaderboard() to facilitate communication between the Android client and Firebase backend services, ensuring seamless data exchange for user authentication, score submissions, and theme downloads. The diagram's association arrows illustrate how LocalStorage provides offline functionality by temporarily caching game results in RoomDB until APIManager can synchronize with FirebaseDatabase, while the Authentication class manages Google SSO integration and biometric login capabilities through specialized methods like googleSignIn() and biometricAuth(). This architectural design specifically addresses Memory Match Madness's requirement for local multiplayer gameplay with cloud synchronization, where the Theme class manages different card sets through imageUrl (List<String>) attributes, and the Notification class handles real-time push messaging for achievements and game invites, creating a robust system that supports both offline and online gaming experiences essential for the POE requirements (GeeksforGeeks, 2019).

User Data to Capture and Store

1) User Account & Authentication

- **UserID (Primary Key, UUID, or String):** A unique number that can be used to identify each person.
- **Username (String, 50 chars max):** Chosen display name.
- **Email (String, 100 characters):** Is used for Google SSO and to log in.
- **PasswordHash (String, 255 characters):** Data is saved safely (only if not only using OAuth).
- **GoogleSSOToken (String, nullable):** For authentication via Google.
- **BIOmetricEnabled (Boolean):** This tells you if fingerprint or biometric login is enabled.
- **DateCreated (DateTime):** The date the account was made.
- **LastLogin (DateTime):** The time of the last sign-in.

2) User Profile & Personalization

- **AvatarURL / ProfilePicture (String / Blob):** Either an image you posted or one from a list that was already there.
- **ThemePreference (Enum: Light, Dark, HighContrast):** The scheme the user has picked for the interface.
- **LanguagePreference (Enum: English, Afrikaans, ...):** Chosen app language.
- **AccessibilitySettings (JSON / String):** This setting lets you change or toggle the animations, card size, and colour mode.

3) Gameplay & Progress Tracking

- **TotalGamesPlayed:** Integer.
- **GamesWon:** Integer.
- **StreakCount (Integer):** For keeping track of daily streaks.
- **CurrentLevel (Integer):** Adventure mode progression.
- **UnlockedCategories (Array of Strings / JSON):** for example: “Animals” or “Flags”.
- **AchievementsUnlocked (Array of Strings / JSON):** for example: “Memory Guru” or “Speed Demon”.
- **AverageCompletionTime:** Float, seconds.
- **AccuracyRate (Float, %):** Number of correct matches / Sum of tries.
- **DifficultyHistory (JSON):** A list of grid sizes and game times.
- **BadgesEarned (Array of Strings / JSON):** Gamified milestones.

4) Multiplayer & Social Features

- **FriendsList:** Array of UserIDs / JSON.
- **LeaderboardsRank (Integer):** The current global or local ranking.
- **MatchesPlayedOnline:** Integer.
- **WinsOnline:** Integer.
- **ReplaysSaved (Array / JSON):** Links to replay data that has been saved.

5) Notifications & Engagement

- **NotificationPreferences (JSON):** How often and what kinds of notifications (daily streaks, goals, and multiplayer invites) you want.
- **LastNotificationSent:** DateTime.
- **DailyChallengesCompleted:** Integer.
- **FireStreakVisual (Boolean):** Whether fire animation is activated.

6) Analytics & Cognitive Assessment

- **WeeklyReportData (JSON):** Metrics for memory, focus, and response time.
- **MonthlyReportData (JSON):** Progress trends.
- **CognitiveScores (Float / JSON):** for example: memory = 85, attention = 72.

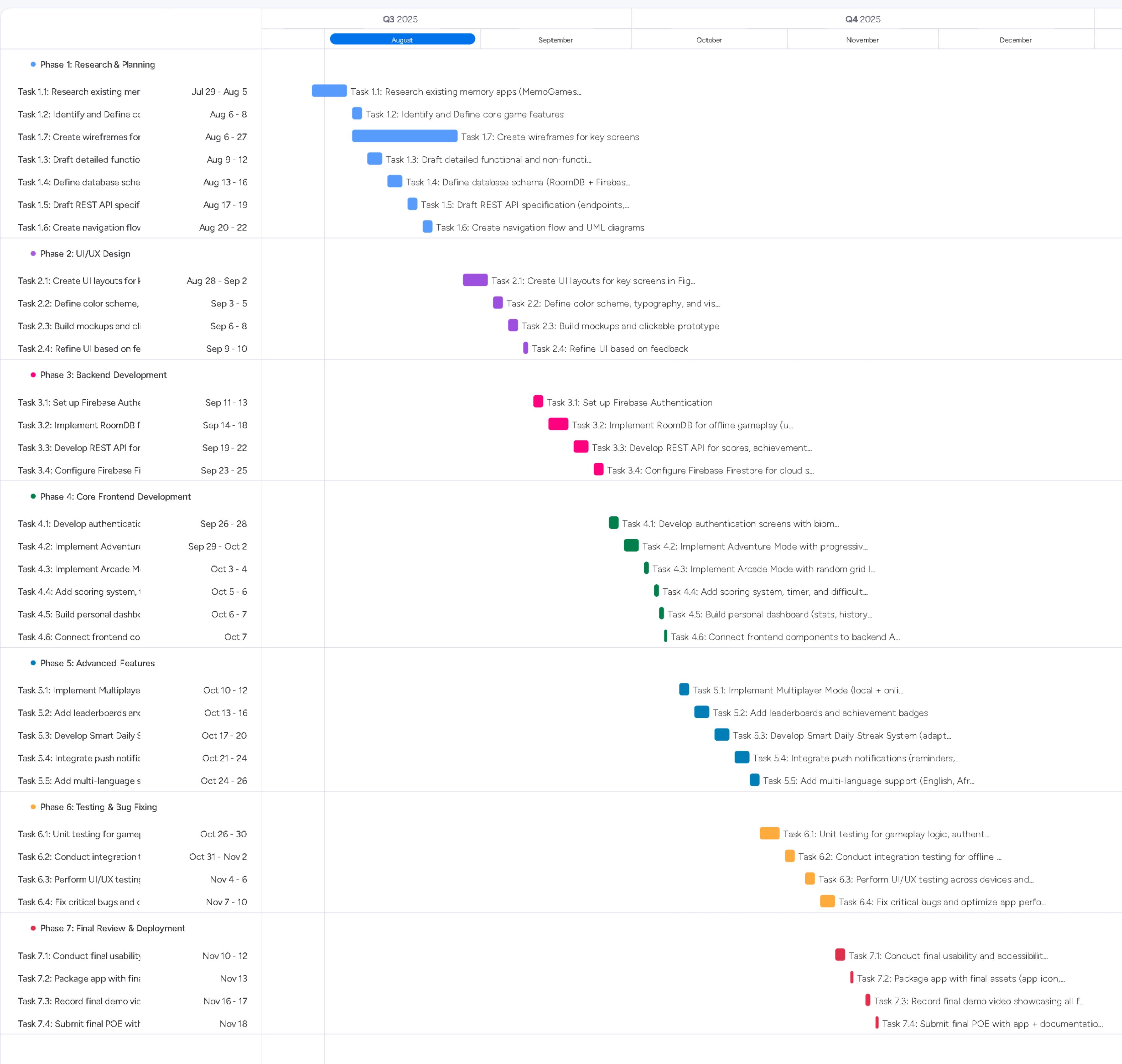
7) Monetization & Premium Content

- **SubscriptionStatus:** (Enum: Free, Premium, Trial)
- **PremiumCategoriesUnlocked:** (Array of Strings / JSON)
- **PurchasesHistory (Array / JSON):** List of in-app purchases.
- AdFreeStatus: Boolean.

(Choudhury, 2022; pankaj, 2022)

Project Plan

(attached below)



Memory Match Madness Project Plan

Phase 1: Research & Planning

Name	Timeline - Start	Timeline - End
Task 1.1: Research existing memory apps (MemoGames, Memory Food, Match) and analyze features	2025-07-29	2025-08-05
Task 1.2: Identify and Define core game features	2025-08-06	2025-08-08
Task 1.3: Draft detailed functional and non-functional requirements	2025-08-09	2025-08-12
Task 1.4: Define database schema (RoomDB + Firebase) and REST API endpoints	2025-08-13	2025-08-16
Task 1.5: Draft REST API specification (endpoints, payloads, hosting plan)	2025-08-17	2025-08-19
Task 1.6: Create navigation flow and UML diagrams	2025-08-20	2025-08-22
Task 1.7: Create wireframes for key screens	2025-08-06	2025-08-27
	2025-07-29	2025-08-27

Phase 2: UI/UX Design

Name	Timeline - Start	Timeline - End
Task 2.1: Create UI layouts for key screens in Figma	2025-08-28	2025-09-02
Task 2.2: Define color scheme, typography, and visual assets (cards, icons, badges)	2025-09-03	2025-09-05
Task 2.3: Build mockups and clickable prototype	2025-09-06	2025-09-08
Task 2.4: Refine UI based on feedback	2025-09-09	2025-09-10
	2025-08-28	2025-09-10

Phase 3: Backend Development

Name	Timeline - Start	Timeline - End
Task 3.1: Set up Firebase Authentication	2025-09-11	2025-09-13
Task 3.2: Implement RoomDB for offline gameplay (user progress, stats, categories)	2025-09-14	2025-09-18
Task 3.3: Develop REST API for scores, achievements, and multiplayer data	2025-09-19	2025-09-22
Task 3.4: Configure Firebase Firestore for cloud sync	2025-09-23	2025-09-25
	2025-09-11	2025-09-25

Phase 4: Core Frontend Development

Name	Timeline - Start	Timeline - End
Task 4.1: Develop authentication screens with biometric login	2025-09-26	2025-09-28
Task 4.2: Implement Adventure Mode with progressive levels	2025-09-29	2025-10-02
Task 4.3: Implement Arcade Mode with random grid layouts	2025-10-03	2025-10-04
Task 4.4: Add scoring system, timer, and difficulty scaling	2025-10-05	2025-10-06
Task 4.5: Build personal dashboard (stats, history, streaks)	2025-10-06	2025-10-07
Task 4.6: Connect frontend components to backend API	2025-10-07	2025-10-07
	2025-09-26	2025-10-07

Phase 5: Advanced Features

Name	Timeline - Start	Timeline - End
Task 5.1: Implement Multiplayer Mode (local + online)	2025-10-10	2025-10-12
Task 5.2: Add leaderboards and achievement badges	2025-10-13	2025-10-16
Task 5.3: Develop Smart Daily Streak System (adaptive challenges)	2025-10-17	2025-10-20
Task 5.4: Integrate push notifications (reminders, challenges, rewards)	2025-10-21	2025-10-24
Task 5.5: Add multi-language support (English, Afrikaans)	2025-10-24	2025-10-26
	2025-10-10	2025-10-26

	Phase 6: Testing & Bug Fixing	Timeline - Start	Timeline - End
43	Name		
44	Task 6.1: Unit testing for gameplay logic, authentication, and API calls	2025-10-26	2025-10-30
45	Task 6.2: Conduct integration testing for offline + online sync	2025-10-31	2025-11-02
46	Task 6.3: Perform UI/UX testing across devices and screen sizes	2025-11-04	2025-11-06
47	Task 6.4: Fix critical bugs and optimize app performance	2025-11-07	2025-11-10
48		2025-10-26	2025-11-10
49			
50	Phase 7: Final Review & Deployment		
51	Name	Timeline - Start	Timeline - End
52	Task 7.1: Conduct final usability and accessibility review	2025-11-10	2025-11-12
53	Task 7.2: Package app with final assets (app icon, splash screen, animations)	2025-11-13	2025-11-13
54	Task 7.3: Record final demo video showcasing all features	2025-11-16	2025-11-17
55	Task 7.4: Submit final POE with app + documentation	2025-11-18	2025-11-18
56		2025-11-10	2025-11-18

Conclusion

This planning and design document provides a clear and practical framework for developing Memory Match Madness, directly informed by the research phase. The proposed features address market gaps by combining adaptive difficulty, multiplayer interaction, diverse content, and flexible game modes to create engaging and effective cognitive training. The user interface designs demonstrate how evidence-based principles can be applied to produce intuitive, accessible, and customizable experiences for a wide range of users. Technical specifications, including RESTful API integration, Firebase services, and native Android development, ensure stability, scalability, and high performance. Data capture strategies and synchronization features support progress tracking and learning personalization, resolving limitations identified in existing applications. Inclusive elements such as multi-language support and accessibility tools highlight the project's commitment to broad usability. The development plan, with timelines and architectural models, provides a structured pathway for implementation. By linking research findings with design specifications, this document establishes a strong foundation for building a cognitive training application that is both effective and enjoyable.

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Annexure: Disclosure of AI Usage in my Assessment

1. Section(s) within the assessment in which generative AI was used

- Section(s) within the assessment in which generative AI was used, PoE PART 1 – Planning and Design

2. Name of AI tool(s) used

- QuillBot Paraphrasing Tool

3. Purpose/intention behind use

- Paraphrasing, correcting grammar and spelling;

4. Date(s) in which generative AI was used

- From 29 July 2025 – 25 August 2025.

5. Link QuilBot paraphrasing tool

- <https://quillbot.com/paraphrasing-tool>