STUDENT SESSION

DIGITAL WELL-BEING MODULAR MOBILE PLATFORM FOR COGNITIVE MINI-GAMES

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Abstract:

Excessive screen time and dopamine-driven digital applications have been linked to reduced attention spans and diminished cognitive well-being. This paper presents GAMS, a mobile application designed as a collection of logic-based mini-games, aimed at promoting mindful and purposeful engagement. Unlike conventional mobile games that rely on addictive mechanics, GAMS incorporates limited gameplay sessions and achievement-based progression to foster a sense of accomplishment without encouraging prolonged use. Developed using Kotlin and a modular software architecture, the platform ensures scalability, maintainability, and ease of integration for additional games. This research explores the intersection of ethical software engineering, digital well-being, and cognitive stimulation, demonstrating how thoughtfully designed applications can contribute to healthier technology habits while maintaining user engagement.

Keywords:

Digital Well-Being, Mobile Application Development, Cognitive Mini-Games, Screen Time Reduction, Human-Centred Computing.

INTRODUCTION

The rapid increase of mobile technologies has significantly increased global screen time, raising concerns about its impact on cognitive health, productivity, and overall well-being. Many contemporary digital applications are designed to maximize user engagement through dopamine-driven reward systems, often contributing to reduced attention spans and excessive device usage. In response to these challenges, this paper presents the design and development of GAMS, a modular mobile application that integrates logic-based mini-games aimed at fostering mindful interaction, cognitive stimulation, and healthier digital habits. GAMS features a curated collection of definite, achievement-oriented games. The games in question are logic puzzles games such as word search, sudoku, memory, designed to provide users with a clear sense of completion and intellectual satisfaction. Unlike infinite-scroll or reward-based applications, the platform emphasizes limited gameplay sessions and structured challenges to discourage compulsive use while promoting concentration, problem-solving skills, and mental agility. By prioritizing purposeful engagement over addictive mechanics, the application aligns with emerging principles of ethical and human-centred software design.

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From a software engineering perspective, the system is developed using Kotlin within the Android Studio environment and follows a modular and scalable architecture. Each mini game is implemented as an independent component, ensuring maintainability, extensibility, and efficient integration of new features. The platform leverages reusable user interface elements, standardized navigation patterns, and optimized resource management to deliver consistent performance and a seamless user experience. This architectural approach supports long-term scalability while adhering to best practices in modern mobile application development [1]. Furthermore, this research explores the intersection of digital well-being and responsible game design, highlighting how technology can be engineered to alleviate the adverse effects of excessive screen time. By combining cognitive psychology principles with ethical development strategies, GAMS demonstrates how thoughtfully designed applications can enhance attention, encourage balanced technology use, and provide meaningful digital experiences.

The findings of this study contribute to the broader discourse on humane technology and ethical software engineering, offering a practical framework for developing mobile applications that prioritize user well-being without compromising functionality or engagement. As such, GAMS serves as a model for future innovations in educational and cognitive gaming platforms.

2. TYPES OF CONTENT

The impact of screen time on attention, cognitive performance, and overall well-being has been widely explored in recent research. Several studies highlight that excessive and unstructured screen exposure is associated with negative cognitive and behavioral outcomes. For example, a longitudinal study by Scientific Reports found that increased screen time is significantly associated with higher levels of impulsivity and attention-related difficulties, particularly in adolescents. Similarly, large-scale data from the ABCD study indicates that higher screen use is linked to behavioral and mental health challenges, reinforcing concerns about prolonged and passive digital consumption. However, more recent research suggests that the type of screen interaction plays a crucial role, rather than screen time alone. A scoping review on screen use and cognition reports that active and goal-oriented digital activities are often associated with improved cognitive outcomes, including attention and memory, while passive consumption is linked to poorer performance. This distinction is particularly important, as it shifts the focus from reducing screen time entirely to redesigning how users interact with digital content.

In the context of digital games, several studies demonstrate that not all games negatively affect attention. Research on video game genres shows that certain types of games can improve visual attention and cognitive processing abilities. In addition, a review of serious games for cognitive enhancement found that structured and purpose-driven games can positively impact attention, especially when designed with clear objectives and feedback mechanisms. These findings support the idea that well-designed games can serve as tools for cognitive improvement rather than sources of distraction.

At the same time, other studies emphasize the risks of poorly designed or excessive gameplay. Research examining video game addiction highlights that uncontrolled or highly stimulating game environments may negatively affect attention and learning-related cognitive skills. This suggests that game design itself—including reward systems, duration, and structure is a key factor in determining whether digital experiences are beneficial or harmful. Existing applications reflect these different design approaches. Many modern mobile apps rely on continuous engagement strategies such as infinite scrolling and variable rewards, which can contribute to prolonged usage and reduced attention. In contrast, puzzle-based and daily-limit games (such as word and memory games) emphasize finite interaction [2], encouraging users to complete a task and disengage. These applications often provide a clear sense of completion and intrinsic satisfaction, which aligns with behavior change principles identified in prior research.

Building on these findings, the GAMS application adopts a design approach that prioritizes structured, limited, and cognitively engaging gameplay. By incorporating mini-games [3] such as Wordle-style puzzles, memory games, and word search challenges, the platform focuses on active participation rather than passive consumption. Each game session is finite and goal-oriented, reducing the likelihood of excessive use while supporting attention and problem-solving skills. In its current implementation, the application includes basic interface customization, allowing users to adjust visual elements such as colour themes. While simple, this level of personalization can improve user comfort and reduce visual fatigue, contributing to a more pleasant and sustainable interaction experience [4].

Future extensions of the system may include more advanced personalization features, such as adaptive difficulty settings and a companion-style avatar that provides encouraging feedback. Such additions could further support user motivation and engagement, while maintaining the application's core principle of con-

trolled and non-addictive interaction. By combining insights from research on screen time, cognitive performance, and serious game design, GAMS positions itself as a practical example of how mobile applications can be engineered to promote healthier digital habits and improved attention.

3. IMPLEMENTATION

The GAMS application is developed as a native Android application using Kotlin, with the goal of providing a collection of structured and cognitively engaging mini games [5]. The system is designed with a modular architecture, allowing each mini game to function as an independent component while maintaining a consistent overall structure.

3.1. SYSTEM OVERVIEW

The application's main interface provides centralized access to all mini-games and features through a bottom navigation bar. This navigation system allows users to switch between different game modules in a simple and consistent manner. Each mini game is implemented as an independent activity, enabling modularity and separation of functionality within the application. The overall system follows a Model–View–Controller (MVC) architectural pattern. The View layer consists of XML-based user interface layouts, while the Controller is implemented through Kotlin activities that manage user interactions and game logic.

The Model component is responsible for storing and managing game-related data such as scores and progress. The user interface is designed with simplicity and usability in mind, ensuring that users can easily navigate between different cognitive challenges. Figure 1 illustrates the main interface of the application, including the navigation structure and access to individual mini games.

3.2. MINI GAME IMPLEMENTATION

The application consists of multiple independent mini games designed as separate Android activities. This structure ensures modularity, where each game operates as an isolated component with its own logic, user interface, and lifecycle management. As a result, each mini game can be developed, tested, and modified independently without affecting the overall system. All games are designed around the principle of finite interaction, meaning that each session has a clear start and end. This approach avoids continuous or infinite gameplay loops and encourages users to engage in short, focused cognitive activities. Each mini game is intentionally designed with a specific cognitive focus, targeting different aspects of mental performance such as memory, attention, and language processing. The games also include built-in constraints such as time limits or limited attempts, which further reinforce structured interaction and prevent prolonged, unregulated usage.

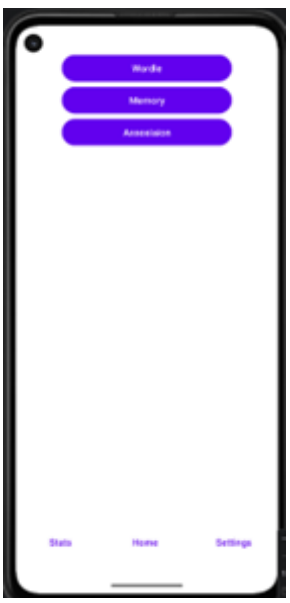

Figure 1. Home page

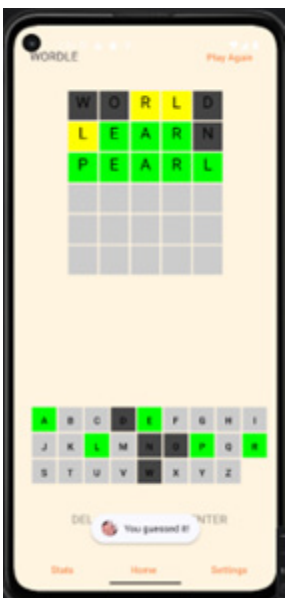

Figure 2. Word game

The first implemented game is a word-based puzzle game inspired by popular word-guessing mechanics. In this game, the user is required to guess a hidden five-letter word within a limited number of attempts. After each guess, feedback is provided in the form of colour indicators that guide the user toward the correct solution. This game primarily targets language processing, pattern recognition, and logical deduction. Figure 2 shows the interface of the word-based puzzle game during gameplay.

The second mini-game is a memory matching game in which users are presented with a set of face-down cards and must find matching pairs. The cards are briefly revealed at the beginning of the session before being hidden, requiring the user to rely on short-term memory and recall ability. This game is designed to improve concentration, visual memory, and attention to detail. Figure 3 illustrates the memory game interface during an active session.

The third mini-game is a timed word-generation challenge where users are required to input as many valid words as possible within a fixed time limit of 46 seconds. This game emphasizes rapid thinking, lexical retrieval, and cognitive flexibility under time pressure. By introducing a strict time constraint, the game encourages focused engagement while preventing extended play sessions. Figure 4 presents the interface of the timed word-generation game.

Overall, each mini-game contributes to a different aspect of cognitive training while maintaining a consistent design philosophy focused on finite, goal-oriented interaction. This ensures that gameplay remains structured, engaging, and aligned with the application's objective of promoting mindful digital use.

3.3. CUSTOMIZATION FEATURES

The game includes basic customization features that allow users to adjust the visual appearance of the interface according to their preferences. As of this time, this functionality is primarily focused on colour theme selection, enabling users to switch between different predefined colour schemes within the application. Although simple in scope, this feature contributes to a more personalized and comfortable user experience. Figure 5 shows the available color customization options within the application interface. The layout is designed to be minimal and intuitive, ensuring that users can easily select and apply their preferred theme without interrupting their navigation or gameplay experience. Overall, the customization system, although lightweight, contributes to improved user satisfaction and reinforces the application's focus on user-centered design principles.

3.4. PROGRESS TRACKING AND STATISTICS

Statistics feature records basic interaction data such as the number of game sessions completed, frequency of gameplay, and total time spent within the application. The collected data is stored locally on the device, ensuring that user information remains private and is not transmitted to external servers.

The purpose of this module is not to promote extended usage, but rather to encourage self-awareness regarding digital habits. By presenting users with clear and simple feedback about their interaction patterns, the application supports reflective use and helps users better understand how often and for how long they engage

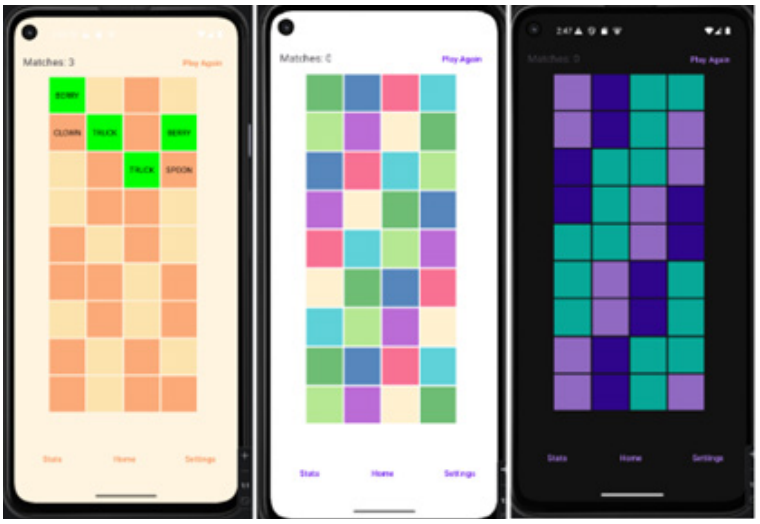

Figure 3. Memory through different settings

with the mini games. This aligns with the broader goal of promoting mindful and controlled technology usage. Figure 6 illustrates the statistics interface, where users can view their gameplay data in a structured format. The interface is designed to be minimal and easy to interpret, allowing users to quickly access relevant information without unnecessary complexity.

3.5. DESIGN RATIONAL

The design is guided by principles of digital well-being, cognitive engagement, and ethical software design. Each design decision is intentionally aligned with research findings on screen time, attention, and user interaction with digital systems. A key design choice is the use of finite and clearly defined gameplay sessions. Unlike applications that rely on infinite scrolling or continuous reward loops, GAMS ensures that each mini game has a clear beginning and end. This structure reduces the risk of compulsive usage and encourages users to engage in short, focused interactions rather than prolonged passive consumption.

Furthermore, the inclusion of logic-based mini-games supports active cognitive engagement. Tasks such as word puzzles, memory matching, and timed word generation require attention, problem-solving, and recall, which contrasts with passive content consumption commonly found in many mobile applications. This design choice is based on research suggesting that active digital interaction can have more positive cognitive effects than passive screen exposure. In addition, the application avoids complex or highly stimulating reward systems that are often associated with addictive behaviour patterns. Instead, it focuses on simple achievement-based progression, where users complete tasks and receive immediate feedback without prolonged incentive loops.

Overall, the design of GAMS reflects an intentional shift away from attention-maximizing application models toward a more balanced and user-centred approach. By integrating structured gameplay, cognitive challenges, and limited interaction sessions, the application demonstrates how mobile software can be designed to support healthier digital habits while maintaining user engagement.

4. FUTURE WORK

The Future improvements of the application will focus on expanding both its educational and engagement capabilities. One key direction is the introduction of difficulty levels, within existing games. This would allow better adaptation to different users' cognitive abilities and enable more structured attention training progression over time.

In addition, the application can be enhanced through the integration of multimedia systems, including customizable avatars, animations, and improved visual design elements. These additions would increase user engagement and motivation, making the experience more immersive and interactive.

Another important improvement is the development of new mini games, designed to target different aspects of attention and cognitive performance. Expanding the variety of games would help prevent monotony and support more comprehensive cognitive training.

Figure 4. Association

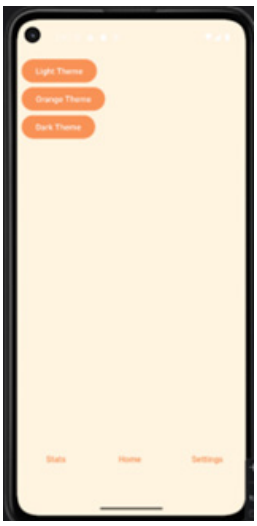

Figure 5. Settings

Figure 6. Statistics

Finally, future versions could further improve the statistics and tracking system, allowing deeper analysis of user progress over time, which could provide more meaningful insights into attention span development and the effects of repeated gameplay.

5. CONCLUSION

This paper examined how digital games can influence attention span and cognitive performance through structured and interactive gameplay. The developed application shows that combining mini-games, customization, and progress tracking can turn screen time into a more active and engaging experience.

Findings and related research suggest that well-designed digital tools may support attention training, although they should not be seen as a complete solution. Future improvements such as adaptive difficulty and richer multimedia features could further enhance effectiveness.

Overall, the project highlights the potential of game-based approaches in supporting attention and cognitive engagement in digital environments.

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