

Digital Therapeutic Mobile Application for Supporting Children with Attention Deficit Hyperactivity Disorder

Lismariya Shaji¹, Melbin Dominic Jose², Alphonsa Prince³, Pavithra Sony⁴ and Sreedaya M⁵

¹⁻⁵Department of Computer Science and Engineering, Vimal Jyothi Engineering College, Chemperi, Kannur, Kerala, India
Email: lismariya16@gmail.com, melbindominicjose1.1@gmail.com, alphonsaprince666@gmail.com,
pavithrasony25@gmail.com, sreedayam@vjec.ac.in

Abstract— Children with attention deficit hyperactivity disorder (ADHD) may have problems with sustained attention, impulsive behavior, and following regular schooling requirements. Given the widespread nature of the problems, the nature of the assistance must also be continuous and well-structured, as opposed to being intermittent. This paper considers the conceptualization and creation of a mobile-based digital therapeutic application that integrates support mechanisms into a single platform. This application provides a focus timer, utilising the ‘Pomodoro Technique’ that lets children use their study time properly and has features that detect their faces to ensure they are not distracted during use. To improve their mental faculties, there is a module that offers cognitive games geared towards enhancing their attention and concentration powers. To ensure children are emotionally stable, there is a meditation module that lets children relax and boosts their self-control abilities. The app is also equipped with a parent dashboard that shows the child’s progress during the course of the app usage. Primary tests show proper working of the app’s functionalities, as well as the recording of user activity. Despite the initial limitations in the evaluation, the testing reveals that the application has the potential to improve the child’s sustained attention and active engagement. Overall, this project aims to offer a simple, child-friendly digital therapeutic solution that supports positive behavioral development in children with ADHD.

Index Terms— ADHD, Digital Therapeutics, Focus Timer, Cognitive Games, Meditation.

I. INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is a well-recognised neurodevelopmental disorder in children, characterised by persistent difficulties in sustaining attention, regulating impulsive behaviours, managing emotions, and maintaining structured learning habits in daily activities [1, 2]. These challenges can significantly affect a child’s academic performance, social interactions, and overall quality of life, often necessitating continuous support beyond conventional clinical interventions. While pharmacological treatment and behavioural therapy remain widely adopted approaches [2], limitations related to accessibility, long-term adherence, and the availability of supportive resources continue to pose challenges for affected children and their caregivers [1].

In recent years, there has been increasing interest in digital and mobile-based therapeutic solutions designed to support children with ADHD. Ref. [3] explores a mobile device-based game prototype aimed at improving attention through interactive engagement, while Ref. [4] reports the positive impact of digital therapeutic interventions on attention and working memory through controlled clinical evaluation.

Personalised and adaptive game-based approaches have further demonstrated the potential to enhance engagement and performance by tailoring content to individual needs [5, 6]. Additionally, structured digital tools that promote consistent learning routines and behavioural monitoring have shown promise in supporting academic and cognitive development [10]. Despite these advances, many existing applications focus on isolated features such as attention games, focus timers, or relaxation exercises, without providing a comprehensive framework for sustained behavioural development [3, 5]. Moreover, limited emphasis is placed on systematic tracking and longitudinal analysis of user behaviour, reducing caregivers' ability to monitor progress over time [7]. Ref. [7] highlights the importance of usability-driven design and structured evaluation in educational applications for children with special needs, while Ref. [8] emphasises caregiver acceptance and engagement as key factors influencing the effectiveness of digital therapeutic tools. Beyond ADHD-focused interventions, digital platforms developed for related neurodevelopmental and neurodiverse populations have demonstrated the value of integrated therapeutic support and home-based intervention models. Ref. [9] presents an autism-focused therapeutic platform that combines structured activities with caregiver accessibility, and Ref. [11] reports real-world user experiences with psycho-educational smartphone applications, underscoring the importance of practical usability and continuous engagement.

To address the identified limitations, this study proposes a mobile-based digital therapeutic application that integrates multiple supportive components within a unified interface. The proposed system incorporates a focus timer based on the Pomodoro technique combined with real-time face detection to encourage sustained study engagement, cognitive mini-games to strengthen attention capabilities, and guided meditation modules aimed at emotional regulation. In alignment with prior findings that stress caregiver involvement and feedback-driven intervention design [7, 8], a dedicated caregiver dashboard is included to provide analytical insights into study performance, meditation activity, and behavioural trends over time. Through this integrated approach, the proposed solution aims to serve as an accessible and comprehensive digital support tool that enhances focus, emotional balance, and caregiver understanding of a child's developmental progress.

II. SYSTEM ARCHITECTURE

The proposed system is realised with a modular client-server architecture to support the different therapeutic features intended for children with ADHD. As highlighted in Figure 1, the mobile application comprises four major modules: Cognitive Games, Focus Session, Guided Meditation, and a Parent Dashboard. Each module contributes independently on the client-side, while all components share information through a common interface connected to a centralised backend service.

The Game module consists of simple cognitive training activities and logs data regarding gameplay; this data is regularly synchronised with the server. The Focus Timer is based on the Pomodoro approach to studying, with a lightweight face detection model that confirms the child's presence during active study sessions. Events related to session creation and teardown, pauses, face detection interruptions, and session completion are logged in a structured manner. The Guided Meditation module conducts structured relaxation exercises and logs data such as session length and completion status. Aggregated data, such as the total focus time, meditation usage, and game activity of children, is accessed by the Parent Dashboard through secured application programming interfaces, enabling caregivers to track daily patterns of usage and behavioural trends. Communication between the mobile application and the backend goes both ways: the client sends session logs and behavioural metrics to the server, where data is processed to create progress summaries in a form suitable for visualisation. This display is shown only in a pseudonymized or aggregated manner in the parent interface for privacy and responsible handling of data of minors. The architecture supports reliable activity tracking, modular expandability in any direction in the future, and smooth synchronisation across all therapeutic components.

The new system has four core modules, each of which is developed to cater to areas in which children with ADHD are in need, such as attention, memory issues, emotional management, and parent or caregiver management. Each of these modules is incorporated in one app and uses the same communication layer in order not to disrupt any experience during synchronisation with the new system offered as a backend service.

A. Game Module

The Game Module comprises cognitive games in short and easy-to-understand formats, geared at keeping children occupied as it refines essential executive and attention skills in them. The games are designed in such a way as not to cause any overload in the cognitive abilities of children, and at the same time, keep their

motivation level high. Performance measures such as accuracy, time, and rate of errors are recorded in this module in order to track the desired long-term outcomes.

Noise Ninjas: This assigns the child the task of focusing their attention on a target sound while filtering out all background noise, as a way of enhancing selective auditory attention as well as filtering skills.

Memory Match: It is a classic card game that requires visual memory and focused attention by challenging the child to retain the position of the cards that are revealed.

Track the Ball: Within this activity, multiple identical balls move at once, and the child needs to track their designated target through visual observation.

Jigsaw Puzzle: This game involves completing puzzles correctly, which enhances problem-solving skills.

Catch the Right One: Objects would fall from the top of the screen, and the child is supposed to pick only the correct ones and not be distracted by the wrong ones.

Hit the Monster: This game has rabbits appearing randomly from different burrows, with a monster occasionally appearing among them. The task for the child is to tap only the monster, avoiding the rabbits.

This game trains the child in the concept of inhibition when they have to suppress acting on their impulse.

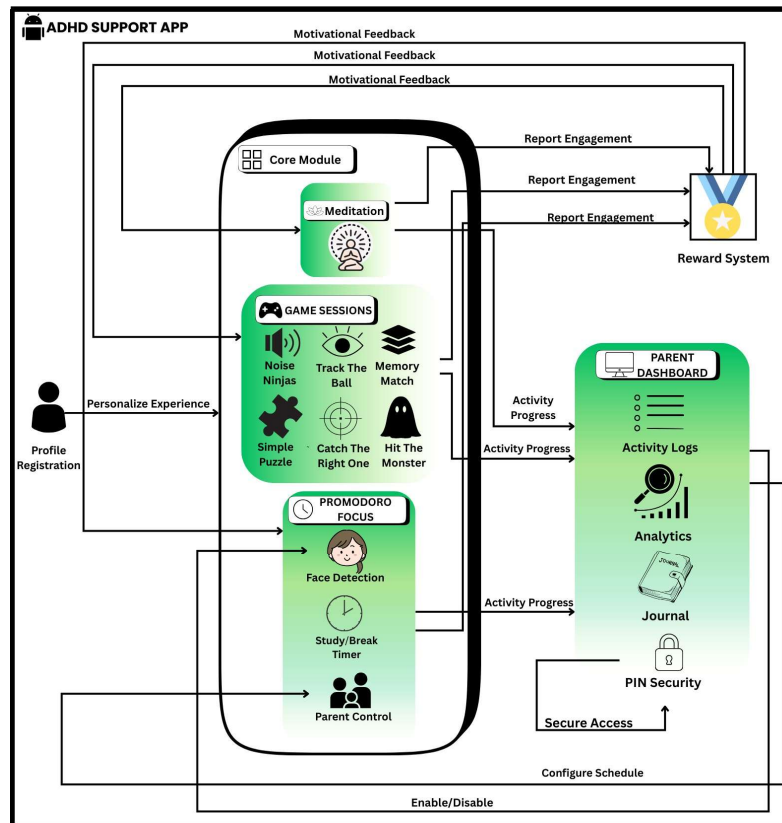


Fig. 1. Overview of the app showing interaction between the user, core app functions, rewards, and parental monitoring

B. Focus Timer with Face Detection

The Focus Timer module is designed on a Pomodoro-based structure, with the time interspersed between periods of focus and breaks. During active focus sessions, a lightweight face detection mechanism monitors for the child's presence. Prolonged absence or distraction is logged as an interruption. Metrics such as effective focus time and frequency of interruptions are tracked to support the development over time of consistent, healthy study habits.

C. Meditation Module

This module is designed with short, guided meditation and breathing exercises meant specifically for children. The session employs calm, child-friendly audio that supports emotional regulation, reduces restlessness, and creates relaxation. Session duration and completion status are tracked to show consistency and engagement.

D. Parent Dashboard

The Parent Dashboard introduces the caregiver to a synthesised version of the child's activities across all modules. These visual summaries reflect information on study duration, Pomodoro session completion, trends in game performances, and meditation usage. This helps caregivers detect progress and areas needing further support, thus motivating them to be involved with the child's daily routines.

III. IMPLEMENTATION

The therapeutic application is implemented as a modular, cross-platform mobile system designed to ensure seamless execution and minimal computational cost on Android phones. The frontend is built using JavaScript/TypeScript with Next.js (React), which supports component development and optimised state management. The UI is designed using Tailwind CSS with additional components from shadcn/ui and Radix UI that share common design systems for a more accessible UI experience throughout the app. Each significant functional component, such as the Game module, Focus Timer, Meditation module, and Parent Dashboard, has been developed as a standalone component in React. This helps in making it easily maintainable, scalable, and amenable to future upgrades. User input handling has been done by React Hook Form efficiently. Lucide React Icons have been incorporated to enable child-friendly visual referrals throughout this application. Communication between the client app and backend services is done by means of RESTful APIs, allowing functionalities such as user login, managing user sessions, synchronising data, and getting progress summaries. Usage data for focus activities, meditations, and gaming performance is stored on the backend securely, offering caregivers access to this data using the Parent Dashboard. The Parent Dashboard utilises Recharts to provide minimalist, responsive, and understandable representations of trends and usage data. The entire set of data is controlled by means of authentication tokens for guaranteed secure usage.

The Focus Timer module is coupled with face-api.js for real-time face detection to track user presence and interaction. To maintain user privacy, it is ensured that all processing related to face detection is conducted within the device itself, and no image or video data is transferred or stored, but only event data that is not user-sensitive, such as completion status, is sent to the backend. The app was built to be compatible with an Android smartphone that has a camera, which is needed for the face detection functionality. It is preferable to mount the device in a fixed position for the accurate detection of the face during focus activities. The user interface has been made easy and intuitive by making use of soft colour schemes and clean layouts. Touch functionality in the Game Module, visual indicators in the Focus Session, and guided instruction capabilities in the Meditation Module make the app easy for children to operate, while the Parent Dashboard offers meaningful insights for parents in a concise manner.

IV. RESULTS AND PLANNED EVALUATION

As large-scale user testing has not yet taken place, the following is a description of the method of evaluation, in terms of looking at the usability and possible effectiveness of the app. The app will be assessed on the basis of engagement, improvements in attentional behaviours, and usability in both children and their caregivers. The said evaluation shall be done on the basis of app usage, observation, and parental feedback registered on the Parent Dashboard. Overall, the first study aims to target a small cohort of children aged 7-12 years, formally diagnosed with ADHD. The children will utilise the app as an activity within their daily regime for about two to four weeks by participating in focus activities, cognitive fun tasks, and short meditation. Meanwhile, their guardians will follow their activities within the Parent Dashboard. Outcomes related to attention will be evaluated through the data produced by the Focus Timer, which may include the number of Pomodoro cycles completed, the actual focus time, and the rate of detected interruptions by the facial recognition system. Cognitive function will be evaluated through the data produced by the Game Module, which may include accuracy of responses, reaction times, and game progression. Data from the Meditation Module, which may include the rate of meditation and the length of each session, will be used as indicators of emotional regulation. Usability testing will be conducted using a survey designed for caregivers and focusing on digital applications for children. An assumption will be made that if the digital product has good usability, this will have a positive effect on child behaviour outcomes. In addition to usability testing, qualitative feedback will request observations regarding child behaviour post-use of the app. The larger aim of this assessment would be to understand a possible synergy for attention management, emotional regulation, and routine establishment for children with ADHD by integrating focus training, cognition games, meditation guidance, and caregiver participation into one app facility. This assessment will help future modifications and offer a means to assess its

utility as a potential effective digital tool for therapy. Based on the design of this digital health solution's testing process, this system has been capable of deriving relevant data regarding attention levels. Finally, combining focus sessions in a Pomodoro manner with facial recognition may help to maximise focus as well as improve time management. One of the key strengths of this proposed system is its multifaceted nature. Rather than focusing solely on one element of ADHD treatment, this app addresses multiple aspects of it. While the mental games aim to develop executive skills of attentional control and impulse regulation, the guided meditation exercises allow kids to easily cope with their hyperactivity or mood swings. Moreover, it increases caregiver understanding of the usage patterns of their kids through its Parent Dashboard feature, which increases their engagement levels.

However, several limitations should be conceded. While the face detection mechanism ensures the child's physical presence during the focus-enhancing sessions, it does not directly measure cognitive engagement or depth of attention. For cognitive games to take effect, there has to be regular and consistent usage, which can vary depending on factors related to motivation, daily routines, and caregiver support. In addition, since large-scale user testing has yet to be conducted, the expected results remain exploratory and need validation through structured assessments in real-world settings. With these limitations considered, the application still holds immense promise as an adjunct support tool for children with ADHD. Its modular design will enable further upgrades: more comprehensive reporting, therapist-facing interfaces, and integration of new therapeutic elements. Further refinement and controlled assessment may enable its evolution into a widely usable and accessible digital therapeutic device, a viable adjunct to traditional behavioural and clinical methods.

V. DISCUSSION

The proposed digital therapeutic application presents an integrated framework for supporting children with ADHD by combining focus training, cognitive stimulation, emotional regulation, and caregiver monitoring within a single platform. This multi-component structure recognises that ADHD management often requires consistent reinforcement across behavioural, cognitive, and environmental domains rather than reliance on a single intervention method. A key strength of the system lies in its emphasis on routine formation and accountability. The Focus Timer encourages structured study habits, while the Parent Dashboard creates transparency for caregivers, enabling them to monitor patterns and provide timely support. Such shared involvement may enhance consistency and reinforce positive behavioural changes over time. Although it does not directly measure cognitive engagement, it may support habit development and task persistence, particularly during early stages of behavioural training. Additionally, the modular design ensures flexibility and scalability. Future improvements such as adaptive difficulty levels, AI-based personalisation, or therapist-oriented reporting tools could be incorporated without redesigning the entire system. While further empirical validation is necessary, the proposed framework demonstrates the feasibility of a structured, home-based digital therapeutic approach that can complement traditional behavioural and clinical strategies for ADHD management.

VI. CONCLUSION

This work presented a mobile-based digital therapeutic application designed to support children with ADHD through an integrated set of modules combining cognitive games, focus training with face detection, guided meditation, and caregiver monitoring. The system aims to improve attention, emotional regulation, and routine-building by offering structured and child-friendly activities that can be incorporated into daily home environments. The modular design allows consistent tracking of behavioural patterns and facilitates meaningful caregiver involvement through the Parent Dashboard. Although real-world evaluation has not yet been completed, the proposed metrics indicate the system's potential to deliver measurable improvements in focus, cognitive performance, and emotional stability. Current limitations include the need for adaptive personalisation, deeper behavioural engagement analysis, and validation through testing with clinical populations. Future work will involve conducting controlled user studies, refining therapeutic content, and exploring AI-driven personalisation to enhance long-term effectiveness. Overall, the application represents a promising and accessible digital tool for supplementing behavioural interventions for children with ADHD.

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