Interactive Solutions for Advancing Attention Deficit Hyperactivity Disorder Diagnosis and Management in Children

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Abstract: Attention Deficit Hyperactivity Disorder (ADHD) is a complex neurodevelopmental condition that influences a person's thinking patterns and behavior. Early diagnosis and intervention for ADHD are crucial for improving outcomes, as they can significantly enhance the overall development and well-being of those affected. However, many families encounter various challenges that can lead to delays in treating this disorder. To address these issues, this paper presents an innovative and interactive gaming-based platform designed to enhance the assessment and therapy of ADHD in children. By leveraging engaging gameplay mechanics and user-friendly mobile technology, the proposed solution aims to provide a dynamic platform for evaluating ADHD symptoms while delivering therapy treatment. In particular, our platform incorporates cognitive, behavioral and emotional therapeutic exercises, capable of offering significant support to children with ADHD by enhancing self-control, managing impulse and building organizational skills. These exercises are carefully selected by healthcare professionals. Clinical insights and feedback from child psychologists were integral in developing the games' mechanics, which not only assess attention but also reinforce coping strategies and behavioral skills. This study underscores the potential of mobile gaming as a transformative tool in pediatric mental health care, paving the way for future research and application in this critical area.

1 INTRODUCTION

1.1 Context

Attention Deficit Hyperactivity Disorder (ADHD) is a prevalent neurodevelopmental disorder affecting millions of children worldwide. The World Health Organization (WHO) estimates that globally, the prevalence of this disorder among children is approximately 5% (WHO, 2021). ADHD affects populations worldwide, spanning multiple countries with diverse cultural, social, and economic contexts. Prevalence rates may vary significantly between different countries due to region-specific factors (Al-Wardat et al., 2024). According to the centers for disease control and prevention, approximately seven million children in the U.S. have been diagnosed with ADHD in 2022, which is about 11.4% of children aged 3 to 17 years (Melissa et al., 2024). Tunisia also faces the issue of ADHD. In fact, the study of Khemakhem et al. further emphasizes the prevalence of ADHD in Tunisian school children (Khemakhem et al., 2012). The American psychiatric association's diagnostic and statistical manual of mental disorders (DSM-5) describes the diagnostic criteria for this disorder (American Psychiatric Association, 2013). Characterized by symptoms of inattention, hyperactivity, and impulsivity, ADHD can significantly impact a child's academic performance, social interactions, and overall quality of life. Traditional methods of diagnosis and management often involve clin-

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ical assessments and behavioral interventions, which can be resource-intensive and may not fully engage young patients. In addition, ADHD symptoms can vary widely among individuals and may overlap with other conditions. This can complicate the diagnostic process, as clinicians may need more time to differentiate ADHD from other disorders.

Despite the importance of early evaluation for ADHD, many families encounter various challenges that can lead to delays in identifying and managing the disorder. These challenges can include the lack of parents' awareness. In fact, many parents may not recognize the symptoms of ADHD or may attribute them to typical childhood behavior, leading to underreporting of concerns to healthcare providers. Moreover, the process of diagnosing ADHD often involves comprehensive assessments, including interviews, behavioral evaluations, and input from parents and teachers. This multi-step process can be time-consuming and may require multiple appointments. Besides the complex ADHD evaluation process, families may struggle to effectively communicate their observations about their child's behavior to healthcare professionals, leading to misunderstandings or misinterpretations.

All these factors collectively contribute to delays in obtaining a proper evaluation for this neurodevelopmental disorder, which can impact the timely implementation of effective interventions and support for children with ADHD. Addressing these challenges is essential to ensure that families receive the help they need as early as possible.

1.2 Contributions

In recent years, the integration of technology into healthcare has opened new avenues for enhancing the diagnosis and management of diseases and disorders. In particular, gamification can play a crucial role in ADHD evaluation and therapy. More precisely, interactive solutions, particularly those leveraging mobile and gaming technologies, offer innovative approaches to engage children in their own care. This work explores the potential of interactive solutions in the context of ADHD. Especially, we propose an interactive gaming-based mobile application in order to advance ADHD diagnosis and management in children. The proposed solution can provide real-time feedback, personalized therapeutic exercises, and engaging assessments that not only make the process more enjoyable for children, but also yield valuable data for clinicians. By examining the effectiveness of gamified applications and mobile platforms in the context of child psychiatry, we aim to highlight how

these technologies can improve patient engagement, enhance therapeutic outcomes, and support healthcare providers in delivering more effective interventions. Ultimately, this innovative approach seeks to transform the way ADHD is diagnosed and managed, providing a more comprehensive and accessible framework for supporting children and their families.

In this work, we explore innovative strategies to overcome the limitations of traditional ADHD diagnostic methods. Our main contributions towards developing an innovative platform for children with ADHD can be summarized as follows:

- **Game-Based Assessment Tool:** The platform involves specially designed games that measure attention, memory, impulsivity, and reaction times. These assessments can be aligned with established ADHD diagnostic criteria, providing valuable data to clinicians. Especially, we develop an interactive game based on the Conners CPT3 test (Conners et al., 2003), designed to capture children's attention while collecting valuable data for the overall diagnostic evaluation.

- **Behavioral Tracking Algorithms:** Through play-wise principle, the system tracks behavioral patterns such as attention span, response accuracy, task-switching abilities, and time spent on each task. Consequently, doctors can analyze these behaviors to identify potential ADHD symptoms.

- **Cognitive, Behavioral and Emotional Therapeutic Activities:** the platform introduces cognitive, behavioral and emotional exercises of therapy designed for children with ADHD. Especially, interactive tasks requiring patience and thoughtful responses are developed to help children practice controlling impulsive behavior. In addition, we design executive function activities that develop planning and decision-making skills, which are often areas of difficulty for children with ADHD.

- **Comprehensive Healthcare Professionals' Dashboard:** Detailed progress reports are displayed for healthcare professionals in the web part of the proposed platform, allowing them to access gameplay data and the assessment reports about the child's performance in terms of attention and behavior, as well as child's emotion. Such a dashboard can supplement traditional ADHD diagnostic methods and monitor the child's ongoing management.

- **Gamified Reward System:** the platform involves a reward system that encourages children to achieve goals, complete tasks, and improve their scores over time. In fact, rewards and incentives are provided to promote improvements of

the child's performance, teaching him the value of patience, persistence, and focus.

- **Empowering Arabic-Speaking Children with ADHD:** our innovative platform represents a significant advancement in providing accessible and effective support for children with ADHD in the Arabic-speaking community. By using Arabic language in the mobile interfaces dedicated for children, we ensure that our solution resonates with the local population, fostering a sense of familiarity and connection.

The remainder of the study is organized as follows: Section 2 outlines relevant related works by discussing existing tools for ADHD evaluation and management. Section 3 focuses on details of the proposed interactive platform for ADHD assessment and therapy, particularly the developed games and therapeutic activities, emphasizing the mobile and web interfaces as well as the assessment reports. Section 4 presents the system components and the data flow within the proposed solution. Finally, Section 5 concludes the manuscript with insights from the study and outlines emerging areas for future research.

2 RELATED WORK

ADHD is a common and significant neurodevelopmental disorder affecting children. The assessment and treatment of ADHD have been subjects of extensive research, focusing on various methodologies, tools, and therapeutic approaches. One of the most widely used tools for assessing ADHD is behavioral rating scales, such as the Conners rating scales (Conners et al., 2003). These instruments provide quantitative data regarding a child's behavior across different settings. Cognitive tests that evaluate attention, memory, and executive functioning are also interesting. Instruments like the Continuous Performance Test (CPT) measure attention-related capabilities and are often used in conjunction with behavioral assessments (Booth, 2010).

In the context of ADHD therapy, behavioral interventions focus on modifying specific behaviors through reinforcement strategies. Parent training programs, school-based interventions, and cognitive-behavioral therapy (CBT) are effective in improving behavior and coping strategies (Pelham, 2005). Recently, different advancements include the use of digital tools for ADHD assessment and therapy (Peñuelas-Calvo et al., 2022). Recent research studies have increasingly focused on the potential of gaming-based assessment and therapy as an innovative approach to address the challenges faced by children

with ADHD. These studies explore how interactive digital games can be designed to improve attention, impulse control, and emotional regulation in a fun and engaging manner.

Different interactive applications have been developed to engage children in the diagnostic and therapy process while providing valuable data for clinicians. For instance, in (Wu, 2024), Wu et al. explored the use of multimodal interaction and proposed a new approach to ADHD therapy through the integration of a jigsaw game combined with eye-tracking technology. This proposition aims to improve attention, focus, and cognitive features in ADHD patients by engaging them in therapeutic tasks that utilize both language and visual stimuli. Cerezo et al. explored how the collaborative design and creation of physical, interactive tabletop games can support the development of soft skills in children with ADHD (Cerezo et al., 2024). In (Song et al., 2023; Doulou and Drigas, 2022), the authors share a common focus on leveraging advanced digital technologies, like virtual reality and remote sensing, to assess and understand ADHD symptoms in children.

The assessment and management of ADHD have evolved significantly, with a range of methods and systems available for clinicians. Continued research into innovative tools and therapies holds promise for improving outcomes for children with ADHD, making early and effective intervention more accessible.

3 PROPOSED PLATFORM FOR ADHD ASSESSMENT AND THERAPY IN CHILDREN

In this work, we propose an innovative platform that leverages interactive games and activities for children to assist in the early diagnosis and ongoing management of the neurodevelopmental ADHD disorder. The proposed platform involves an interactive Conners CPT3-based gaming tool and various therapeutic activities. Our solution includes mobile and web parts. Designed for children, the mobile application provides a user-friendly, fun, and engaging environment to evaluate behaviors and implement therapeutic cognitive, comportmental and emotional exercises for children with ADHD.

The web application designed for healthcare professionals serves as analytics tools that streamlines patient management and enhances clinical decision-making.

3.1 Interactive Conners Cpt3-Based Gaming Tool for ADHD Assessment

This section examines a creative approach that tackles the shortcomings of conventional ADHD diagnostic methods. We present the incorporation of mobile game-based assessment and the strategic application of the Conners CPT3 (Continuous Performance Test 3rd edition), highlighting the advancements aimed at achieving more accurate and thorough ADHD diagnoses.

3.1.1 Gameplay Mechanism

In accordance with the principles of the Conners Continuous Performance Test 3rd edition (CPT3), we have developed a mobile game that accommodates both Latin and Arabic scripts. This innovative tool functions as an interactive means to evaluate attention-related aspects in children with ADHD, facilitating data collection and analysis. The game is specifically designed to reflect the features of the Conners CPT3, allowing for a thorough assessment that adheres to established diagnostic criteria.

The mobile game, designed to evaluate attention-related aspects in children, incorporates a straightforward yet effective algorithm. The algorithm mirrors the principles of the Conners CPT3, aiming to provide a smooth and unobtrusive experience for young users. Built on the Flutter framework, the game guarantees an engaging interface while effectively gathering crucial data for ADHD assessment. At the commencement of the game, users are greeted with clear and straightforward instructions, as shown in Figure 1. These instructions are tailored to be easily understood by children, promoting engagement and comprehension. The objective is to foster a supportive atmosphere that aids the child's grasp of game mechanics.

After tapping the start button, the instructions disappear, and the child begins the 360-trial assessment. Random letters appear on the screen, as illustrated in Figure 2, and the child must quickly tap any letter, except the non-target letter "X" for the English language for example. The game's user interface is deliberately designed to be simple and unobtrusive, reducing potential distractions during the assessment. By prioritizing a clean and intuitive layout, the mobile game enables children to interact with it easily. This mobile design choice ensures that the data collected accurately represents the child's true attention-related responses. This algorithm aims to create an engaging, reliable, and comprehensible tool that aligns with the Conners CPT3 and considers the needs of child participants.
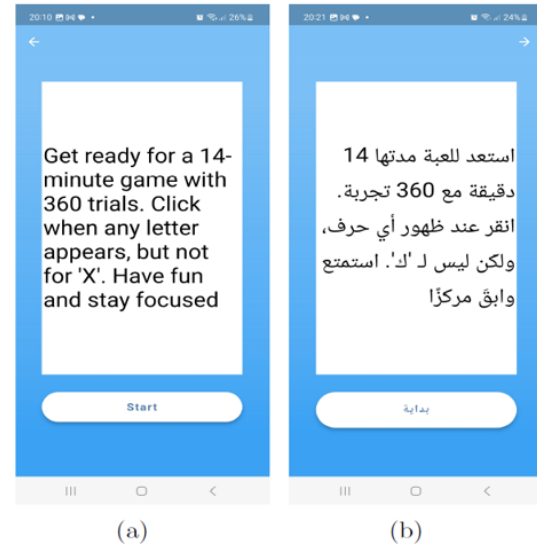

Figure 1: User interfaces for the mobile game guidelines in English (a) and Arabic (b) languages.

3.1.2 Core CPT3 Metrics and Features

Conners CPT3 principle focuses on measuring attention and impulsivity-related issues in ADHD individuals by relying on four main dimensions which are:

- Inattentiveness: indicating the person's capacity to sustain focused attention.
- Impulsivity: assessing the person's ability for inhibiting impulsive reactions.
- Sustained Attention: evaluating the individual's capacity to sustain attention over time.
- Vigilance: involving paying close attention when changing levels of stimulus frequency and being ready to respond.

These dimensions offer a holistic view of a person's attentional behaviors and cognitive functions, aiding in a detailed assessment of ADHD and related problems. Each dimension is characterized by specific features extracted during gameplay, as depicted in Figure 3. In Table 1, we clearly define these features that collectively assess ADHD related issues. By combining these elements, the mobile gaming tool offers a thorough framework for analyzing attention-related behaviors and cognitive functions, enabling a more nuanced evaluation of ADHD.

3.1.3 Assessment Report

Following gameplay and data collection, a detailed assessment report is generated for the clinician, including raw data as well as visual representations of each attentional dimension. This output provides clear and interpretable information for an in-depth
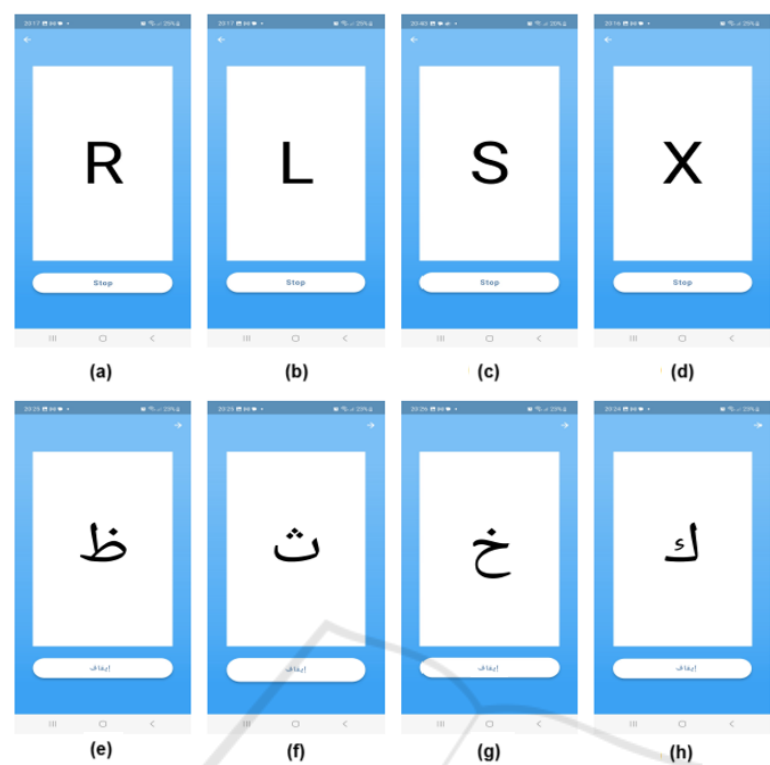
Figure 2: The proposed mobile game-play interfaces in English (first row) and Arabic (second row). Child must quickly tap any letter, except the non-target letter "X" for the English language (except the non-target letter "ك" for the Arabic language, respectively).
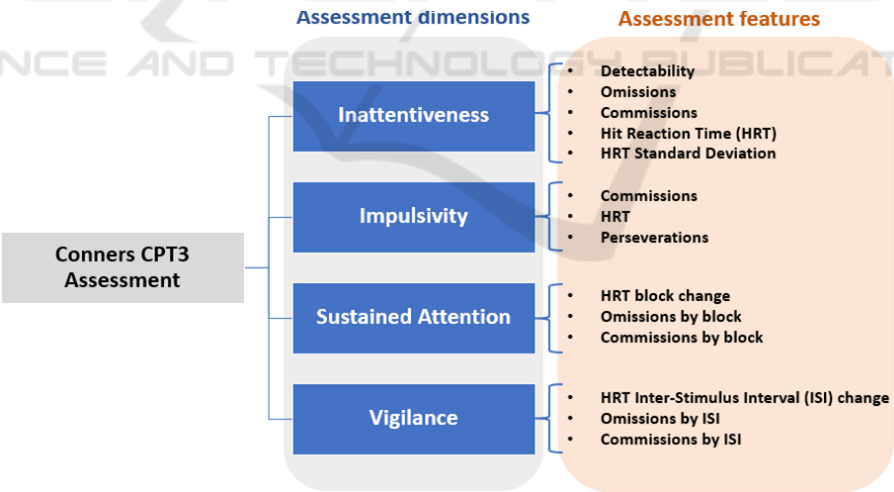

Figure 3: Conners CPT3 dimensions and features used for the assessment of ADHD.

examination of the child's performance, offering insights into traits such as reaction time, impulsive behavior, changes in sustained attention, and vigilance performance. In particular, graphs visually summarize these characteristics, providing a quick understanding of a child's behaviors. An extract of this output report is given in Figures 4 and 5.

3.2 Therapeutic Activities

In response to the unique challenges faced by children with ADHD, we propose a comprehensive tool designed to facilitate therapeutic activities tailored to their specific needs. This innovative platform combines engaging, interactive exercises with evidence-

Table 1: Detailed description of the CPT3 features.

Feature	Description
Detectability (d')	It assesses the child's ability to accurately differentiate between target stimuli (non-"X", respectively non-"ك" for the Arabic) and non-target stimuli ("X", respectively "ك" for the Arabic). Significant values correlate with increased discriminatory potential.
Omissions	Omissions define missed target stimuli, which are indicative of reduced attention.
Commissions	Incorrect answers to non-target stimuli are indicated by commissions.
Hit Reaction Time (HRT)	HRT refers to the response speed which is the time it takes for a user to respond to a stimulus.
HRT Standard Deviation (SD)	It reflects the response speed consistency. A high SD in HRT suggests that there is a wide range of response times for answers. This could indicate inconsistency in response speed, potentially due to fluctuating attention levels. A low SD indicates that most of responses have similar reaction times, suggesting a more consistent engagement with the task.
Perseverations	Perseverations are defined as random or anticipatory responses (i.e. HRT<100ms)
HRT block change	It refers to the change in response speed across blocks of trials. Since the CPT3 test is divided into blocks of trials, HRT block change looks at whether a user's response time becomes faster or slower as the assessment progresses.
Omissions and commissions by block	Omissions by block define missed target stimuli by block. Commissions by block refer to incorrect answers to non-target stimuli by block. These two rates monitor performance across each section of the test. Increasing rates in later blocks may signal a decrease in sustained attention and engagement.
HRT Inter-Stimulus Interval change	HRT Inter-Stimulus Interval (ISI) change assesses how reaction times vary with different ISIs (i.e. 1, 2, and 4 seconds). Variations in response speed across ISIs can indicate difficulties in maintaining vigilance and adjusting to changing tasks.
Omissions and commissions by ISI	Omissions and commissions by ISI assess performance across different ISI trials. Increased errors in longer ISIs indicate diminished attention and vigilance.

Figure 4: Illustration of raw data collected following a sample of gameplay and presented in the dashboard which is dedicated to the healthcare professional and involved in the proposed web application.

based therapeutic strategies to promote skill development in areas such as attention, impulse control, and emotional regulation. The proposed mobile application includes a variety of activities that are both enjoyable and beneficial, making therapy more accessible and effective for children. Each activity is designed to be adaptable, allowing caregivers and therapists to customize the experience based on the child's individual preferences and developmental stage. By incorporating gamification elements, the tool aims to enhance motivation and participation, creating a supportive environment where children can thrive.

This proposed tool not only serves as a resource for therapy, but also empowers parents and educators to engage with children in meaningful ways. Through structured activities that encourage focus and self-regulation, we aim to foster lasting improvements in the daily lives of children with ADHD, supporting their overall growth and well-being. In the following subsections, we present the different proposed cognitive, behavioral, and emotional therapeutic exercises.

3.2.1 Cognitive Exercises

Cognitive therapeutic activities play an essential role in supporting children with ADHD by targeting the core challenges they face, such as difficulties with attention, impulse control, and emotional regulation
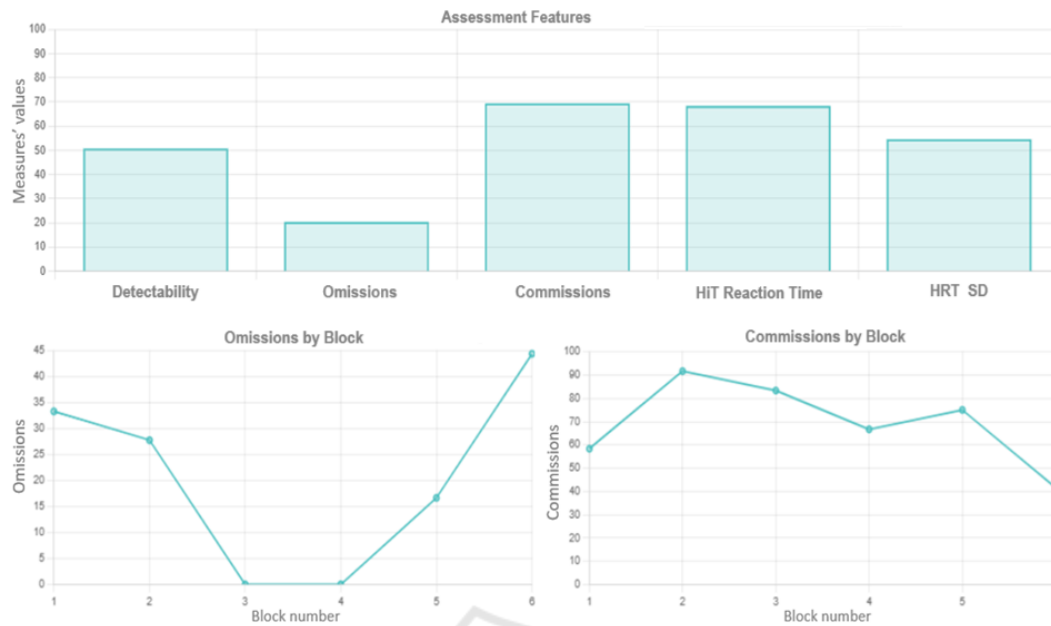
Figure 5: Illustration of some samples of assessment features within the assessment report.

(Barkley, 2015). The proposed cognitive exercises are designed not only to engage children in meaningful ways, but also to foster essential cognitive skills that can significantly enhance their daily functioning and quality of life. Figure 6 illustrates examples of interfaces designed for cognitive activities. For instance, the principle of the therapeutic exercise shown in Figure 6(a) involves encouraging the child to utilize this tool whenever they face a problem. They are instructed to take notes that connect the triggering context of the situation with their thoughts, emotions, physical sensations, behaviors, and the consequences that follow. This reflective process aims to help the child gain insight into their experiences and develop healthier coping strategies.

The objective of the exercise illustrated in Figure 6(b) is to facilitate the daily completion of small tasks for children, thereby boosting their self-esteem. By following the given instructions, the child is encouraged to categorize their tasks into three groups: tasks they always complete, tasks they sometimes complete, and tasks they do not complete. This structured approach helps children recognize their achievements and areas for improvement, fostering a sense of accomplishment and confidence.

The exercise presented in Figure 6(c) is a concentration game with the following objective: the child is tasked to select the correct image from a list of options featuring objects or colors. The game provides various difficulty levels and tracks the child's score, helping to enhance focus and attention skills in a fun

and engaging way.

The significance of these cognitive therapeutic activities lies in their ability to provide structured, interactive experiences that promote active learning and skill development. By focusing on cognitive processes, such as problem-solving (like the activity presented in Figure 6(a)), attention management (like the activity presented in Figure 6(b)), and memory (like the activity presented in Figure 6(c)), these exercises help children build resilience and improve their ability to navigate various situations both at home and in school. By incorporating cognitive therapeutic activities into children's routine, their motivation and engagement can be enhanced, making therapy feel like an enjoyable part of their days. This positive approach can lead to increased participation and, ultimately, better therapeutic outcomes.

3.2.2 Behavioral Exercises

Behavioral therapeutic activities are crucial for supporting children with the neurodevelopmental ADHD disorder by providing practical strategies to manage their symptoms and improve their overall functioning (Daley et al., 2014). The proposed behavioral exercises, which are illustrated in Figure 7, focus on reinforcing positive behaviors, enhancing self-regulation, and developing coping mechanisms that can significantly benefit children in various aspects of their lives. These therapeutic activities are effective tools to support children's behavioral development. Specifically, the proposed exercise presented in Figure 7(a) focuses
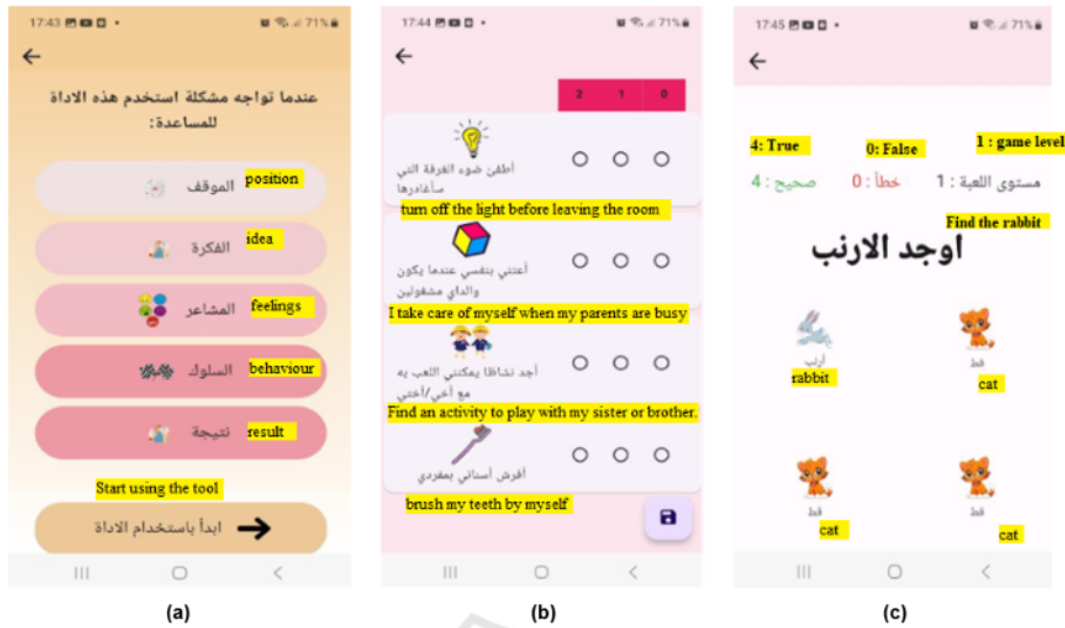
Figure 6: Some interfaces with English annotations of cognitive activities within the proposed mobile application.

on activity transition management. For example, if a child finds it difficult to finish a fun activity and it is time to start his homework, here's a fun tip. He uses the Bingo wheel to decide how he wants to smoothly wrap up his current activity. Parents can give it a spin and let it choose which activity will be his last before transitioning to his homework. This method can make the transition more enjoyable and motivate the child to complete his tasks positively.

The objective of the therapeutic exercise illustrated in Figure 7(b) focuses on establishing daily routines. More precisely, this exercise helps the child create consistent routines for daily activities such as homework, chores, or preparing school supplies. Fixed and predictable schedules foster the development of planning and organizational skills, making it easier for the child to manage their responsibilities and transitions throughout the day.

The reward activity depicted in Figure 7(c) relies on a token economy system for reinforcement. The idea is for a kid with ADHD to earn tokens each time he successfully manages his anger, for example. These earned tokens can later be exchanged for a reward that he enjoys. This system encourages positive behavior and helps children learn to regulate their emotions by providing tangible incentives for their efforts.

The significance of these proposed therapeutic activities in the context of ADHD management lies in their ability to create structured environments where the child can practice and internalize desired behaviors. By engaging in activities that encourage self-monitoring and goal-setting, the child learns to nav-

igate challenges more effectively. This proactive approach not only helps children with ADHD gain control over their impulses but also fosters greater independence and responsibility.

In summary, the proposed behavioral therapeutic activities play a vital role in helping children with ADHD develop essential skills for managing their symptoms, building self-esteem, and achieving success in their daily lives. By focusing on behavioral improvement in a structured and enjoyable manner, we can lay the foundation for lasting positive change.

3.2.3 Emotional Exercises

Emotional therapeutic activities play an important role in supporting children with ADHD by helping them develop essential emotional regulation skills (Musser and Nigg, 2019). In fact, children with ADHD often face challenges in managing their emotions, which can lead to heightened frustration, anxiety, and social difficulties. The main objective of the proposed emotional exercises, which are introduced in the proposed platform and shown in Figure 8, aim to provide structured, engaging ways for children to understand and express their feelings more effectively. For instance, the exercise illustrated in Figure 8(a) focuses on the awareness of emotions. More precisely, the child is encouraged to identify and express his emotion for each event he experiences. This practice helps him develop emotional awareness and understand the significance of their feelings, fostering better emotional regulation and communication skills.
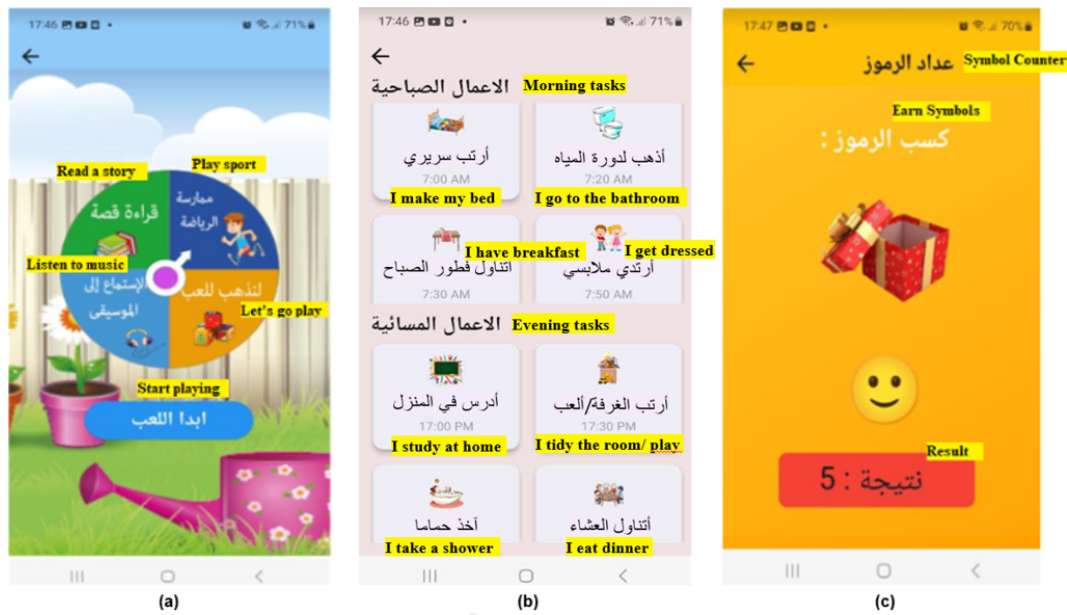
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Figure 7: Some interfaces with English annotations of behavioral activities within the proposed mobile application.

As illustrated in Figure 8(b), we integrate also in the proposed mobile application a therapeutic activity which is based on a guided deep breathing method using the hand. Specifically, the kid is guided to practice deep breathing by tracing his fingers or using his hand as a visual aid. As the child having ADHD inhales and exhales, this exercise promotes relaxation and helps him manage anxiety or overwhelming emotions, fostering greater emotional regulation and calmness.

In addition, the implemented therapeutic activity presented in Figure 8(c) focuses on the principle of emotions' wave. In this exercise, and by following the given instructions, the kid with ADHD is encouraged to visualize his emotions as a wave, illustrating how feelings can rise and fall over time. He can express and discuss his emotions related to different experiences, helping him understand that emotions are natural and can be managed. Besides promoting emotional awareness and management, this exercise encourages children with ADHD to reflect on their feelings in a constructive way.

The significance of these activities lies in their ability to foster emotional awareness and management. By participating in guided practical therapeutic exercises that encourage self-reflection, kids with ADHD learn to identify their emotions and the triggers behind them. This understanding is crucial for developing coping strategies that can help mitigate impulsive reactions and improve their interactions with family members, relatives, as well as peers.

3.2.4 Assessment Report

This section provides an overview of the generated assessment report conducted to evaluate the presence and impact of the neurodevelopmental ADHD disorder in the children. The assessment report includes a combination of cognitive, behavioral and emotional observations about each child (as presented in Figure 9). This approach is designed to gather detailed information about the patient's attention, impulsivity, and hyperactivity across different settings. The generated report also captures the child's verbal and non-verbal responses during the activities, highlighting their engagement level and insight into their experiences. Documenting therapeutic exercises can reveal patterns in the ADHD child's responses, helping to identify which activities are most effective and which may need modification.

A history of activities, including date and time, is presented in the generated assessment report in order to ensure consistent engagement in the developed therapeutic activities. Keeping a record helps track the progress of the child with ADHD over time, allowing healthcare professionals to assess improvements and adjust interventions accordingly. In addition, it is important to understand the kid's history, allowing for more tailored therapeutic approaches and ensuring that activities align with his interests and needs. Moreover, a detailed record facilitates better communication between parents and therapists, providing a common reference point for discussions about the development of the child with ADHD.

By analyzing this data, we aim to understand the

Figure 8: Some interfaces with English annotations of emotional activities within the proposed mobile application.

severity of symptoms, their influence on daily functioning, and any coexisting conditions that may be present. This thorough evaluation is very important for healthcare professionals in order to help them develop an accurate diagnosis and formulate an effective treatment plan tailored to the ADHD child's needs. In conclusion, such a report synthesizes cognitive, behavioral, and emotional observations to provide a holistic view of the ADHD child's functioning. The collected insights will inform recommendations for interventions, support strategies, and further assessments as needed, ensuring that the children with ADHD receive the comprehensive care necessary for their development.

4 IMPLEMENTATION AND DATA FLOW

4.1 Proposed Development Architecture

The proposed platform is built around three key components: the mobile application implemented using the Flutter framework, the backend server built using the Django framework, and the web server developed with the Angular framework. Together, these elements create a user-friendly experience for children and parents, offer an effective diagnostic tool for healthcare professionals, and ensure secure data storage. An overview about the proposed platform architecture is presented in Figure 10.

4.2 Data Flow and Key Technologies

The proposed mobile application enables parents to create accounts, register their children through a registration form, and complete interactive activities to assess ADHD features and manage ADHD-related issues. The data generated by these various activities is securely transmitted to the backend server, where it is processed and stored within the Firestore database. Alternatively, healthcare professionals are able to access the proposed platform via the web application developed using the Angular framework. This web application allows doctors to view a list of patients, where they can also check parent and child profiles, form responses, game data, and diagnostic reports. The web server interacts with the Firestore database to fetch and update patient data.

The selected technologies for each component enhance the system's overall efficiency and reliability. Specifically, Flutter facilitates a seamless and responsive user interface on different mobile devices. Django serves as a dependable and scalable backend solution, while Angular creates a dynamic and engaging web application. Additionally, Firestore, which is a NoSQL cloud database, ensures secure storage and data synchronization. The system is designed to ensure efficient and precise data exchange. From participant inputs in the mobile application to diagnostic data stored in Firestore, the architecture facilitates seamless and secure data transfer. HTTPS encryption is employed to protect sensitive and confidential information during transmission, ensuring privacy and security.

Figure 9: Example of an assessment report presented in the dashboard of the healthcare professional through the proposed web application.
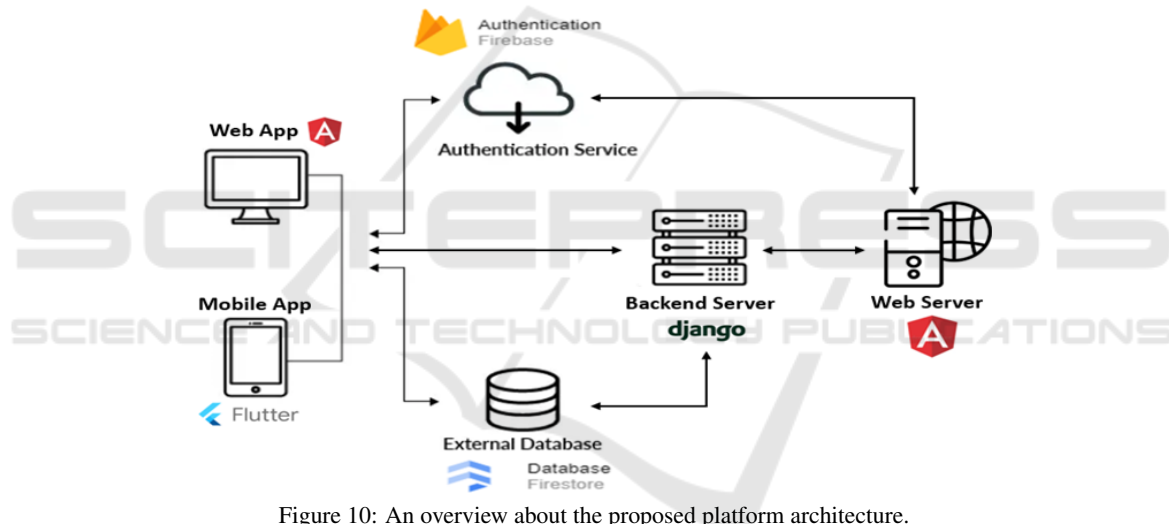

Figure 10: An overview about the proposed platform architecture.

Through the proposed platform, we mention that we will be able to collect a database covering cognitive, behavioral and emotional patterns. The collected data could serve as a foundation for building machine learning models that can assist in early detection, treatment planning, and ongoing monitoring of children with ADHD. Machine learning algorithms, such as those studied in (Harizi et al., 2022) (Walha et al., 2015), could leverage this data to detect subtle patterns that might not be immediately apparent to clinicians, enabling more accurate and timely diagnosis.

5 CONCLUSION

In conclusion, this research work underscores the significant potential of interactive solutions in enhancing the assessment and therapy of ADHD in children. By integrating engaging, game-based tools, and interactive therapeutic exercises with established assessment frameworks, the proposed platform can create an environment that not only motivates children but also improves their attention and behavioral regulation. In addition to individual benefits, the developed activities empower parents and healthcare professionals by equipping them with effective tools to support children in managing their ADHD symptoms. Moreover, by fostering a collaborative online environment

through the proposed platform, they can track the child's progress without frequent clinic visits, making it convenient for ongoing ADHD management. Overall, the proposed interactive gaming-based tool and therapeutic activities represent a vital component in the comprehensive care of children with ADHD, laying the groundwork for lasting improvements in their cognitive and emotional well-being. As we look to the future of research on interactive solutions for advancing ADHD assessment and therapy in children, several key perspectives emerge. First, it is crucial to continue exploring and validating these innovative solutions in real case studies, ensuring they are accessible and effective for diverse populations. In Particular, we will continue collaborating with medical institutions to validate the proposed platform's effectiveness through clinical trials, ensuring it adheres to best practices in ADHD diagnosis and management. Second, incorporating advancements like computer vision and machine learning could provide personalized feedback and adaptive learning experiences, further enhancing the efficacy of these interactive solutions.

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