Task Initiation Support for Adults with ADHD: A Wearable and UI-Based Assistive Prototype

Jiayang Xu *

Department of EDI, National University of Singapore, Singapore

* Corresponding Author Email: e1553357@u.nus.edu

Abstract. Attention Deficit Hyperactivity Disorder (ADHD) often persists in adulthood, where difficulties in task initiation significantly impact daily life and work. Current interventions mainly target children and lack practical tools for adults. This study proposes an assistive system integrating a wearable device with an ADHD-friendly user interface, designed on behavioral therapy principles. The software supports task customization and monitoring, while the hardware provides vibration and pressure-based tactile reminders via Bluetooth. A six-page prototype interface was developed to reduce cognitive load and support personalized task management. The wearable device delivers immediate cues, records responses, and forms a closed loop of "task setting-reminder-execution-feedback-summarization." Results suggest that the system creates a structured, low-burden workflow to enhance task initiation. Despite prototype limitations, the design offers a novel approach to supporting adults with ADHD in digital health contexts. Future research can extend this work by conducting longitudinal usability studies and integrating adaptive algorithms to further personalize task initiation support.

Keywords: ADHD, task initiation, wearable, UI Design.

1. Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a common neurodevelopmental condition disorder characterized by patterns of inattention, hyperactivity and impulsivity. While ADHD is most frequently diagnosed in childhood, research indicates that a substantial proportion of individuals continue to experience symptoms in adulthood. According to Faraone et al. [1], approximately 2.5% of the global adult population is affected by ADHD, even in cases where the condition was not identified during their childhood.

In adults, ADHD symptoms often manifest as difficulty sustaining attention, racing thoughts, impaired time perception, and challenges in task initiation. Among all of these, difficulties in initiating tasks represent one of the most significant problems that affect daily life, study and work.

Nowadays, the neurological underpinnings of ADHD have been extensively examined and documented in clinical literature. And the current treatment approaches focus primarily on pharmacological interventions, behavioral therapy, and psychological counseling. However, most interventions are designed for children and emphasize educational or behavioral settings. Although numerous attention-training games and programs have been developed, these designs rarely align with the complex, real-world contexts that adults with ADHD operate. Consequently, practical solutions for adult ADHD remain limited and insufficient to meet the needs of this population. Kooij et al. outlined a comprehensive framework for the treatment of adult ADHD [2], yet the majority of research remains centered on clinical outcomes rather than the development of supportive, everyday assistive tools. Similarly, Pan et al. noted that ADHD-related products are predominantly focused on education and training for children [3], with minimal attention given to the living and working environments of adults, particularly in relation to task initiation. Furthermore, adults with ADHD often occupy diverse social roles and may face persistent societal stigma. This stigma can discourage individuals from seeking medical treatment or engaging with formal therapeutic interventions [4].

In light of these challenges, there is a pressing and significant need for assistive designs tailored specifically to adults with ADHD, particularly those that address task initiation. This study proposes a design based on behavioral therapy principles into a wearable device coupled with an ADHD-

friendly user interface. This system aims to deliver personalized tactile reminders, support time management, and provide targeted attention-training functions. By doing so, it seeks to mitigate the effects of stigma, assist adults with ADHD in overcoming difficulties encountered in daily life and work, and ultimately enhance both quality of life and work efficiency.

2. Method

2.1. Framework

The methodological framework of this study consists of two major components: a software system and a hardware system, which are interconnected via Bluetooth Low Energy (BLE) to form a closed-loop assistive system for task initiation. The overall framework is illustrated in Fig. 1.

The software system serves as the core logic and interaction platform, divided into two modules: the user-defined module and the system monitoring and feedback module. The former emphasizes personalization, allowing users to set tasks and reminders based on their individual needs. The latter records task initiation or completion, provides immediate feedback, and generates periodic summaries, thus establishing a monitoring and feedback mechanism [2].

The hardware system functions as the carrier of reminders and feedback. By employing wearable tactile feedback mechanisms such as vibration and pressure, it transforms the software's signals into intuitive and physical cues, thereby lowering the threshold of task initiation [5].

Together, the two systems form a continuous loop of "task setting - reminder - execution - recording - feedback - summarization." This loop aims to address the executive dysfunction related to task initiation commonly found in adults with ADHD [6].

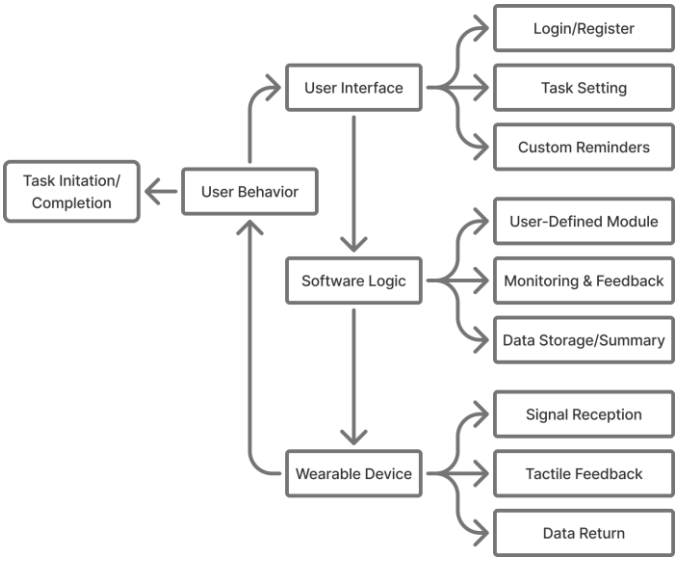

Fig 1. Framework of the proposed system (Picture credit: Original).

2.2. Software Architecture

The software architecture is composed of two core modules:

(1) User-Defined Module

This module allows users to define and customize their task settings according to personal needs. The customization features of the system are designed to accommodate the diverse needs of adult users with ADHD. Specifically, users can configure the reminder frequency, choosing either fixed intervals or countdown-based notifications to suit their preferred working rhythm. They may also adjust the feedback intensity, ranging from mild vibration to stronger vibration or pressure-based cues, thereby tailoring the tactile response to their individual sensitivity levels. In addition, tasks can be assigned priority levels—high, medium, or low—so that users are able to distinguish urgent responsibilities from less critical ones. Together, these customizable settings enhance the flexibility

of the system, promote a stronger sense of user autonomy, and support personalized strategies for task initiation and time management.

The emphasis on personalization is designed to increase the sense of autonomy and engagement among users. Previous research has suggested that autonomy and self-determination are critical in enhancing adherence to behavioral interventions among individuals with ADHD [7].

(2) System Monitoring and Feedback Module

The second module manages background monitoring and feedback generation. It follows three primary steps:

The monitoring and feedback system operates through three interconnected functions. First, it performs real-time monitoring, automatically recording each task initiation or completion event with a timestamp to ensure accurate data tracking. Second, it provides immediate feedback through short tactile signals, such as vibration, once the user has initiated a task, thereby reinforcing the action and supporting task engagement. Finally, it generates a periodic summary, compiling daily or weekly reports that include key indicators such as completion rate, average initiation latency, and sustained attention duration. These reports enable users to review their performance patterns and gradually improve task initiation efficiency [3].

(3) Workflow of the Software

The software operates through the following workflow:

The software workflow begins with login and registration, during which new users create an account and establish a personal database to enable cross-device synchronization. Once registered, users proceed to the task setting stage, where they can define task content, schedules, and reminder modes through the user-defined module. During the execution and recording phase, the wearable device delivers tactile reminders, and user responses are captured in real time to ensure accurate tracking of task-related behaviors. Following this, the feedback and loop stage provides users with feedback upon task completion, while the software simultaneously updates the database and generates summary reports. This cyclical process of "capture–feedback–reinforce" is designed to gradually strengthen task initiation behaviors and enhance user engagement [8].

2.3. Hardware Architecture

The hardware system is designed as an ADHD-friendly wearable device to be worn on the wrist or palm, maintaining partial contact with the fingers to enhance tactile feedback. Its design and functions include:

(1) Signal reception unit: Receives task reminder instructions from the software via BLE.

(2) Tactile feedback module: Equipped with a micro vibration motor and flexible pressure elements to deliver diverse tactile cues (e.g., short/long vibration, light/heavy pressure), which have been shown to help users maintain attention in multitasking environments [9].

(3) Low-power energy system: Ensures sufficient daily usage with wireless or magnetic charging for convenience.

(4) Ergonomic design: Soft, lightweight materials are adopted to avoid the appearance of medical devices, thereby reducing potential stigma associated with mental health–related wearables [4].

The interactive loop between hardware and software operates as follows:

(1) The software generates a task reminder, which is then transmitted to the wearable device; the device subsequently provides tactile feedback to the user in the form of vibration or pressure.

(2) After receiving this reminder, the user responds and confirms task initiation or completion through either the device input or the user interface; the hardware then transmits the corresponding data back to the software for recording and processing.

(3) The software records the outcome, updates performance reports, and continues the cycle.

This closed-loop interaction of "reminder–execution–feedback–summarization" is intended to alleviate the task initiation difficulties frequently experienced by adults with ADHD [5].

3. Results and Discussion

3.1. Interface Design Results

On the software side, this study developed a user interface prototype tailored for adults with ADHD, emphasizing simplicity, low cognitive load, and intuitive interaction. The final design comprises six primary pages, illustrated in Fig. 2(a-f).

(a) (b) (c)

(d) (e) (f)

Fig 2. Prototype user interface for the assistive system (Picture credit: Original).

The login and registration page (a) provides account management and data synchronization functions to ensure consistent use across devices. The task overview page (b) presents daily tasks and their completion status in a card-based format, highlighting key information while reducing cognitive

effort. The task setting page (c) allows users to customize task content, reminder methods, vibration intensity, and priority levels, thereby accommodating individual differences. The execution and feedback page (d) contains only essential buttons, such as “Start Task” and “End Task” and simultaneously displays the hardware feedback status to help users focus on a single task during execution. The data summary page (e) generates periodic visual reports, including indicators such as task completion rate, average initiation latency, and weekly performance summaries, enabling reflection and behavioral adjustment. Finally, the settings and device management page (f) provides options for Bluetooth connection, privacy settings, and notification frequency, allowing users to control the system at a global level.

This interface architecture establishes a continuous workflow from task creation to execution feedback, thereby offering adults with ADHD a clear and structured user experience. Prior research has indicated that simplified, stepwise digital environments can effectively reduce executive load and improve task adherence in neurodiverse populations [10].

3.2. Wearable Device Structure Results

The hardware design focuses on the immediacy of tactile feedback and long-term comfort. The device is worn on the wrist or palm, maintaining partial contact with the fingers to ensure that feedback signals are intuitively perceived. Its structure includes several core components: a Bluetooth communication module for low-power real-time connectivity with the software; a tactile feedback module with a micro vibration motor and flexible pressure sensors capable of delivering diverse signals such as short or long vibrations and light or heavy pressure; a power supply system that supports daily usage with the convenience of magnetic wireless charging; and an ergonomic exterior design employing lightweight and flexible materials to avoid the medicalized appearance that often contributes to stigma.

The device works in close cooperation with the software: once a task reminder is generated on the software side, the wearable immediately delivers tactile cues. The user then confirms task initiation or completion via the device or the interface, after which the hardware transmits the corresponding status data back to the software, where it is incorporated into periodic reports. This closed-loop interaction ensures the completion of the “reminder - execution - feedback - summarization” process, which has been recognized as critical in supporting task initiation for adults with ADHD [5].

3.3. Discussion

The results demonstrate that the integration of software and hardware creates a coherent assistive loop that effectively addresses the core challenge of task initiation in adults with ADHD. Compared with existing interventions, which are primarily designed for children and focus on educational settings, this system is more suitable for adult work and daily life contexts. The inclusion of periodic summaries and visualized task reports offers new tools for self-monitoring and behavioral adjustment, thereby reinforcing users’ sense of self-efficacy.

Nevertheless, several limitations remain. First, the system is currently limited to the design and prototyping stage, and its practical effectiveness has not yet been validated through large-scale user testing. Second, tactile feedback is restricted to vibration and pressure, leaving room for future exploration of multimodal signals such as thermal or optical feedback. Third, although the design deliberately avoids clinical appearance to mitigate stigma, further research is required to examine the long-term acceptance of wearable devices among adults with ADHD. These limitations highlight important directions for future development, including more diverse sensory feedback and systematic user studies [3, 6].

4. Conclusion

This study addressed the task initiation difficulties of adults with ADHD by proposing an assistive design system that combines a software user interface with a wearable hardware device.

Methodologically, the system was developed on the principles of behavioral therapy and established an interactive process that includes task setting, personalized reminders, immediate tactile feedback, and periodic data summaries. The results presented six interface pages and a wearable device prototype, demonstrating the system's potential advantages in intuitive interaction and task execution support. The discussion highlighted the limitations of the current design, including its prototype stage and the limited range of feedback modalities, while also pointing toward future improvements such as multimodal feedback and large-scale user testing. Overall, the study not only provides a new design perspective for assisting adults with ADHD but also contributes practical insights into the application of digital health design in the field of mental health support.

References

[1] Faraone SV, Biederman J, Mick E. The age-dependent decline of attention deficit hyperactivity disorder. Psychological Medicine. 2015;36(2):159–65.

[2] Kooij JJS, Bejerot S, Blackwell A, Caci H, Casas-Brugué M, Carpentier PJ, et al. European consensus statement on diagnosis and treatment of adult ADHD. BMC Psychiatry. 2010; 10:67.

[3] Pan W, Zhao N, Jiang Y. A bibliometric analysis of research on adult ADHD (in Chinese). Modern Special Education. 2020;(2):43–9.

[4] Yu S. The patient role construction of undiagnosed adult women with ADHD (in Chinese). Master's thesis. Huazhong University of Science and Technology; 2024.

[5] Piguet C, Ehrensperger M, Bischof GN, Barfuss A, Wälchli C, Fornari E, et al. Wearable devices in ADHD: A systematic review. Sensors. 2021;21(6):1956.

[6] Li Y, Zhang L. Progress in the application of wearable devices in mental health intervention (in Chinese). Chinese Journal of Health Psychology. 2021;29(2):304–8.

[7] Deci EL, Ryan RM. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist. 2000;55(1):68–78.

[8] Abroms LC, Whittaker R, Free C, Van Alstyne JM, Schindler-Ruwisch JM. Developing and pretesting a text messaging program for health behavior change. JMIR mHealth and uHealth. 2019;7(5): e12139.

[9] Wang W, Zhang J. The application of wearable devices in cognitive and attention research (in Chinese). Advances in Psychological Science. 2019;27(5):817–27.

[10] Seeman L, Cooper M, Kirkpatrick A. Cognitive accessibility design patterns. W3C Working Group Note. 2017.