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**MotivFit: Leveraging Generative AI in a User-Centered Approach for Personalized Exercise Motivation**

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**Abstract:** This study presents the development of MotivFit, an innovative exercise motivation service, rooted in the principles of intrinsic and extrinsic motivation and the Self-Determination Theory (SDT). Addressing the challenge of insufficient physical activity, MotivFit is designed to encourage regular exercise engagement through a user-centered approach. The service design was informed by a comprehensive literature review, followed by targeted surveys (*n = 118*) and in-depth interviews (*n = 6*) with potential users. These efforts were crucial in understanding the motivational needs, preferences, and challenges faced by individuals in maintaining regular exercise routines. Employing generative AI, MotivFit provides personalized motivational messages tailored to users' specific needs at various stages of their exercise journey. This unique approach allows for context-specific and adaptive encouragement, enhancing the user experience. The service notably features DZM, a mascot designed to resonate with users and facilitate engagement through a friendly and motivating persona. User validation played a pivotal role in refining our service. Feedback from surveys and interviews led to significant enhancements in the service, particularly in voice selection, pace, and content of motivational messages, ensuring alignment with user expectations and preferences. The study emphasizes the importance of a user-centered design process in developing health-related services. MotivFit demonstrates the potential of applying large language models in personalized wellness solutions, highlighting the effectiveness of combining psychological insights with technological innovation. The findings suggest the necessity for ongoing user engagement and the potential for broader applications of LLM technology in various motivational contexts.

**Keywords:** exercise motivation, self-determination theory, large language model, generative AI, AI design, user-centered design

**Ⅰ. Introduction**

Contemporary societal challenges feature the pervasive issue of insufficient physical activity. While the health benefits of exercise are widely recognized, consistently translating this awareness into action remains a daunting task. Physical inactivity is increasingly identified as a significant contributor to chronic diseases, elevating risks for conditions like cardiovascular disease, diabetes, obesity, osteoporosis, and depression (1). The lack of sufficient daily exercise is a barrier to maintaining a healthy lifestyle. Research underscores the beneficial effects of exercise on physiological responses, overall mortality rates, disease and disability management, functional capabilities, mental health, and quality of life (2). Studies indicate that even moderate daily physical activity can offer substantial health advantages. These findings collectively highlight the critical importance of regular exercise in promoting health and well-being. Inspired by these results, we are interested in to motivate individuals to incorporate exercise into their daily routines. The role of motivation is especially crucial, as evidenced in the realm of sports, where it is a pivotal factor in athletes' success (3), underscoring its importance in the context of physical activity.

**ⅠI. Related Work**

Previous research has explored various motivational strategies to encourage physical activity and weight loss (4). One approach involves using rewards and competition to stimulate physical activity (5–7). In these studies, participants set weekly goals and receive rewards like ribbons and trophies for achieving them. They also share their progress with friends, creating a competitive environment that leverages diverse motivational tactics to enhance physical activity (5). Another research showcased the 'UbitFit Garden' service, a platform that incentivizes fitness achievements by awarding virtual rewards like flowers and butterflies upon reaching specific fitness milestones (8). This service tracks activity through sensors to further boost motivation. The STOP (Stop Obesity Platform) project represents another initiative, focusing on obesity prevention and healthy weight maintenance through tailored feedback (9). It utilizes chatbots like Replika (10) and Woebot (11) for service delivery. Similarly, the WeightMentor chatbot has been developed to motivate and assist users in achieving and maintaining weight loss (12).

While these studies span various domains and employ different methods to motivate users, they predominantly rely on straightforward rewards or encourage sharing to prompt engagement, rather than fostering deeper user interaction. Some methods may not appeal to those who are not motivated by competition or virtual rewards (13). Furthermore, existing chatbot interactions often lack support and encouragement when users fail to meet their goals or lose enthusiasm (14). Additionally, there is a lack of nuanced motivational services that consider the diverse exercise contexts and situations of individual users. Recognizing these gaps, we propose the exploration of innovative methods, integrating analysis with user-centered design and development, to offer a novel approach to motivation that has not yet been attempted.

**III. Methods**

In our quest to design and develop an innovative exercise motivation service, we conducted on a comprehensive literature review to enhance our grasp of motivational theories and practices. This included examining existing exercise motivation models and technological interventions in this domain. Building on this foundation, we conducted targeted surveys and in-depth interviews to gather insights into the specific motivations, preferences, and challenges faced by individuals in maintaining regular exercise routines. These user-centric findings, coupled with the theoretical knowledge, informed our service design. In the conceptualization phase, we designed our service, focusing on features that effectively harness motivational psychology and user-friendly technology. We aimed to create a service that not only motivates users through innovative means but also addresses the diverse needs and contexts of various user groups. The technical specification phase involved a selection of advanced technologies. This included the integration of generative AI for personalized motivation strategies. Following this, we entered the service development phase, where our conceptualized design was transformed into a functional service. This involved iterative development and testing to ensure usability and effectiveness. Finally, to evaluate the impact of our service and refine it further, we conducted a comprehensive user evaluation study. This assessment aimed to gather user feedback on various aspects of the service, such as its motivational effectiveness, user experience, and technological robustness, thereby identifying areas for continuous improvement and refinement.

**Fig 1.** Design and develop process for an innovative exercise motivation service.

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**1. Literature review**

Motivation is broadly divided into two categories: intrinsic and extrinsic motivation (15). Extrinsic motivation arises from external factors, driving individuals to engage in activities as a means to an end, rather than for the activity itself. It is characterized by behavior influenced by external rewards or stimuli. In contrast, intrinsic motivation is driven by internal factors, where individuals engage in an activity for the sheer enjoyment and satisfaction it brings, valuing the activity for its own sake (16,17).

Within this context, the self-determination theory (SDT) emerges as a pivotal framework (18). SDT seeks to explore the roots of human intrinsic motivation and behavioral regulation. Central to this theory is the concept that human motivation is not solely dependent on external rewards or regulations, but significantly influenced by internal motivators and values. These internal factors are deemed essential for personal growth, development, and well-being (19). SDT also introduces the concept of internalization, which describes the process of transforming external motivators into internal ones. This process is critical for fostering autonomy and self-determination (20). Experimental research supports these ideas, showing that external motivators like the threat of punishment (21), imposition of deadlines (22), and surveillance (23) can diminish intrinsic motivation. Conversely, positive performance feedback is known to enhance intrinsic motivation (24).

Applying these insights, our approach to motivating consistent exercise behavior focuses on stimulating intrinsic motivation. Specifically, we employ the extrinsic motivator of encouragement in a manner that nurtures and sustains intrinsic motivation for regular exercise.

**2. Survey and Interviews**

We conducted a survey with 118 participants in their twenties, comprising six key questions (refer to Table 1). The objective was to understand the underlying reasons for the lack of motivation in exercising regularly. Our findings revealed that a significant portion (51.7%) of participants, who either exercised regularly or occasionally, reported a decline in motivation for physical activities. The most cited reason for this decline was attributed to feelings of laziness (83.2%). Additionally, a substantial number of respondents (72.9%) indicated the use of electronic devices, like cell phones and smartwatches, during their workouts, suggesting a high likelihood of them receiving notifications while exercising.

Interestingly, when presented with multiple options for exercise motivation, the majority identified self-satisfaction (72%) as a key motivator. This suggests that while individuals recognize the importance of self-satisfaction in motivating exercise, there might be a gap in understanding how to effectively achieve it. This lack of clarity on attaining self-satisfaction could be contributing to the perceived burden and laziness towards exercise, as reflected in the reluctance to engage in regular physical activity.

Furthermore, a notable 77.1% of participants expressed that receiving motivational words during exercise would aid in maintaining a consistent workout routine. These insights led us to the idea of leveraging technology to fill this motivational gap. Therefore, we propose using notifications as a tool to deliver encouraging messages, aiming to enhance motivation for exercise among users. This strategy is designed to bridge the gap between understanding the value of self-satisfaction in exercise and practically achieving it, thereby addressing the identified lack of motivation.

**Table 1.** Questionnaire items.

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| --- |
| 1. The number of times exercising. |
| 2. The level of reluctance to exercise. |
| 3. The reason why participants don't want to go to the gym. |
| 4. Whether to use electronic devices during a exercise. |
| 5. The most effective in exercise motivation. |
| 6. Whether listening to encouraging words helps with consistent exercise. |

We additionally conducted interviews with six individuals who actively engage in regular exercise routines. These interviews provided valuable insights into the type of motivation that individuals find most effective. A common theme emerged: the desire for motivation that is both timely and contextually appropriate.

For instance, Interviewee #5 shared that immediate positive feedback, such as an enthusiastic “Wow! That’s incredible!” after achieving a goal, significantly boosts their sense of accomplishment. Contrastingly, Interviewee #6 noted a skepticism towards compliments, particularly when they feel their workout was subpar, perceiving such praise as insincere.

Interviewee #2 highlighted the value of recognition for their consistency in exercising, suggesting that acknowledgment from others could be a powerful motivator. Similarly, Interviewee #4 expressed that recognizing the achievement of surpassing personal past performance would serve as a strong motivational factor.

These diverse perspectives underscore the complexity of exercise motivation and the importance of personalized and authentic encouragement in enhancing the exercise experience.

**3. Conceptualization**

Our comprehensive review of literature, surveys, and interviews revealed the significant impact of encouragement and positive feedback in motivating individuals to exercise. Recognizing the need for contextually relevant and timely motivation, we categorized user scenarios into three phases: pre-exercise, during exercise, and post-exercise.

To deliver a broad range of context-specific motivational responses, we opted to integrate generative AI using a Large Language Model (LLM) (25), like ChatGPT. The advantage of LLMs lies in their training on expansive datasets, which equips them to provide a multitude of unique responses. This capability is crucial for ensuring that users consistently receive novel and contextually appropriate encouragement. Our service interfaces with the LLM through an API, enabling the generation of customized motivational comments for users.

Additionally, considering survey data that many users engage with electronic devices during workouts, we incorporated a Text-to-Speech (TTS) feature. This allows users to receive motivational messages audibly, a crucial functionality especially when their visual attention is occupied during exercises. The emotional conveyance of voice in TTS is leveraged to enhance motivation, as voice can transmit emotions more effectively than text (26,27).

In our service, the choice of voice in TTS is a key component. Based on further interviews and survey feedback, we selected voices characterized as 'friendly and encouraging,' 'trustworthy,' and 'energetic' to optimize motivational impact (28). Additionally, our service features a mascot named 'DZM' (as shown in Fig.2), designed to embody a youthful and motivating persona, further facilitating user engagement.

**Fig 2**. The mascot ‘DZM’.

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Our fitness motivation service, MotivFit utilizes the DZM mascot, which employs the ChatGPT API and TTS technology for delivering encouragement. For users lacking exercise records or feeling hesitant to start, MotivFit provides prompts such as, "Just start with something small, like a five-minute warm-up or stretch. Taking the first step can be the most challenging part" (see Fig.3).

**Fig 3**. MotivFit -- before exercise.

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During exercise, upon pressing the 'Start' button, DZM delivers supportive messages such as, "You got this! Keep pushing towards your goals and remember your motivation!" (see Fig.4). Post-workout, users interact with DZM in a chatbot format for feedback and workout information, aiding in managing their exercise schedules effectively.

**Fig 4**. MotivFit -- during exercise.

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Through these features, MotivFit aims to provide a holistic and emotionally resonant experience, supporting users in their fitness journeys with contextually appropriate and varied motivational messages.

**4. Technical specifications**

Our technological framework consists of three primary components. The first is an LLM module for providing encouragement and interactive conversations. The second component is a TTS system for converting text into audible speech. Lastly, we have an application server that underpins these functionalities.

Delving into the LLM module, we employed the ChatGPT API module, a cutting-edge AI chatbot developed by OpenAI. ChatGPT utilizes Reinforced Learning From Human Feedback (RLHF) techniques (29), which enhance the performance of LLMs. This approach offers significant improvements over traditional rule-based dialogue systems, enabling the chatbot to deliver more diverse and contextually relevant motivational messages. The ChatGPT model is capable of understanding and retaining conversation context, thus generating responses that are both human-like and intricately detailed. Through strategic prompt engineering, we fine-tuned the chatbot's responses to optimize motivation and relevance.

The TTS technology component has evolved significantly due to advances in machine learning and neural networks, allowing for more natural-sounding speech synthesis. This technology intricately converts text into speech, taking into account grammatical nuances, stress patterns, and intonation. We tested various TTS programs, such as Google Text-to-Speech (30), Amazon Polly (31), IBM Watson Text to Speech (32), Naver CLOVA (30), and KT Voice Studio. Our final choice was Amazon Polly , selected for its voice tone and pace that align with our mascot's image and effectively resonate with users.

For our application server, we chose the Django web framework in Python, facilitating the use of Python-based APIs. Django, known for its robustness in rapid web application development, is based on the Model-View-Controller (MVC) architecture, which promotes code modularity and reusability, simplifying maintenance and scalability. To enable real-time client-server communication, we integrated the Channels library, utilizing WebSocket-based asynchronous channels for bidirectional communication. This setup was crucial for implementing the chat functionality of our application.

In summary, the combination of Django and Channels allowed us to achieve asynchronous communication between the application and its users, facilitating real-time updates and interactions. Our API, developed with Django, ensures smooth server-client communication, effectively harnessing Python's capabilities and Django's efficiency to create a robust server infrastructure.

**IV. User Validation and Improvement**

We sought feedback from potential users to refine our service. We conducted a seven-item survey (refer to Table 2) with ten interviewees interested in exercise and willing to try our service.

**Table 2**. Items of questionnaire

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| 1. Appropriateness of DZM’s voice |
| 1. Length of encouragement phrases |
| 1. Content of encouraging phrases |
| 1. Pace of encouraging phrases |
| 1. Appropriateness of Chatbot Responses |
| 1. Diversity of Chatbot responses |
| 1. Appropriateness of design |

The majority highlighted a discrepancy between DZM's voice and its visual persona. For instance, Interviewee #1 felt the voice was too mature for DZM's adorable appearance, while Interviewee #6 noted a mismatch between the mascot's cuteness and its voice. However, two interviewees found the voice inconsequential. Concerning the length of motivational phrases, feedback suggested a preference for brevity. Interviewees #2 and #6 found the longer sentences awkward and less impactful, though Interviewees #3 and #7 appreciated the detail and heart in the longer messages.

The content of the motivational messages received universally positive feedback. Interviewees #4 and #6 found them situationally appropriate and suitably familiar. Regarding the pace of encouragement delivery, five interviewees felt it was too fast and lacked resonance, as noted by Interviewees #3 and #1. In contrast, three others believed the faster pace suited exercise. Feedback on the chatbot's post-exercise responses was uniformly positive. Interviewees #5 and #8 praised the appropriateness and personalization of the responses. Additionally, all interviewees were pleased with the diversity of the chatbot's responses, finding them varied and engaging.

Finally, regarding the screen layout of MotivFit, the feedback was largely favorable. Interviewee #4 appreciated the intuitive and simple design, and Interviewee #5 enjoyed the presence of the DZM mascot. However, Interviewee #2 felt the layout somewhat sparse, suggesting room for improvement.

Overall, this user evaluation provided valuable insights for enhancing our service, highlighting areas for fine-tuning to better align with user expectations and preferences.

In response to the user evaluation feedback, we acknowledged the mismatch between DZM's persona and its voice. To rectify this, we undertook several modifications using Text-to-Speech (TTS) technology. Our primary change involved switching from Amazon Polly to Google Text-to-Speech, aiming to find a voice more congruent with DZM's character. Furthermore, we addressed the issue of the voice pace being too rapid. By applying prompt engineering techniques, we adjusted the speech rate to a slower tempo, aligning it better with user preferences.

Additionally, we recognized the need to address concerns about the length of the voice content. User feedback pointed out that the responses were often overly long. In light of this, we revised the script, shortening the length of DZM's messages to make them more concise and thus, more effectively resonant with users. These adjustments are a testament to our commitment to continuously refine our service based on user insights.

**V. Discussion & Conclusion**

Our study, anchored in the foundational principles of intrinsic and extrinsic motivation (33) and the Self-Determination Theory (SDT) (34), has illuminated the critical significance of autonomy in enhancing individual motivation. By harnessing the concept within SDT that external motivators can be internalized, we developed MotivFit, a service aimed at supporting users in achieving consistent exercise routines. MotivFit stands out in the digital wellness landscape through its innovative use of Large Language Model (LLM) technology. This empowers us to deliver highly personalized motivational messages, meticulously tailored to the specific conditions of users at different stages of their exercise journey – pre-exercise, during exercise, and post-exercise. The utilization of LLMs ensures a dynamic and rich diversity in the motivational content, adapting to the unique context of each user. This approach represents a significant shift from generic, one-size-fits-all motivational strategies, moving towards a more empathetic, user-centric model.

In the future, our intent to evolve MotivFit into a more multifaceted platform. We plan to introduce a wider array of features, aiming to offer a more engaging and immersive motivational experience to users. These proposed enhancements will incorporate a spectrum of motivational techniques, drawing from behavioral psychology (5), gamification (6), and user feedback. This expansion will enable us to offer a service that is not only more comprehensive but also deeply personalized to meet the diverse needs and preferences of our users.

Furthermore, the application of LLM technology in MotivFit demonstrates a model with far-reaching potential, extending well beyond exercise motivation. Its adaptability to various domains, such as educational achievement (7) and weight management (8), highlights the versatility of LLMs in addressing a range of motivational challenges across different facets of life. This versatility opens up avenues for future research and application in numerous fields where motivation is a key driver for success.

However, we acknowledge that our study's scope, particularly in user evaluation, was limited. Conducting our evaluation with a small, targeted group of interviewees provided initial insights but also revealed the necessity for broader user engagement. Future research will benefit from a more extensive user evaluation process, encompassing a diverse demographic to capture a comprehensive spectrum of user experiences and preferences. Such inclusive feedback will be instrumental in refining MotivFit and exploring the development of a diverse array of motivational approaches and tools, thereby enhancing the service's effectiveness and appeal to a broader audience.

In conclusion, MotivFit represents a significant step forward in the application of AI technology for personal wellness. By combining insights from motivational psychology with advanced technological solutions, we have created a platform that not only motivates but also resonates with users on a personal level. As we continue to refine and expand MotivFit, we remain committed to exploring the full potential of LLMs in creating transformative experiences that positively impact users' lives.