

Motiv Fit : An Innovative Exercise Motivation Service

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Abstract

1. Introduction

One pressing social issue nowadays is lack of exercise. While many are aware of the beneficial effects of exercise on our health, putting this awareness into practice often proves challenging. In fact, physical inactivity is being emphasized as a major contributor to chronic diseases. It elevates the risk of conditions like cardiovascular diseases, diabetes, obesity, osteoporosis, and depression. Inadequate daily physical activity can make it difficult to maintain a healthy lifestyle(1). Research also has demonstrated that exercise has positive effects on physiological responses, overall mortality rates, various diseases and disabilities, overall functional abilities, mental health, and quality of life. Moreover, study suggest that even moderate daily physical activity can yield significant health benefits(2). These findings collectively underscore the importance of regular exercise in promoting overall health and well-being. From these results, we have decided on a mission to motivate people to incorporate exercise into their lives. Indeed, motivation plays a pivotal role in the success of sports players(3), highlighting its significance in the realm of physical activity. Consequently, motivation is a important role in the context of exercise.

2. Related Work

In previous studies, research aimed at motivating users, such as promoting physical activity or encouraging weight loss, has been ongoing through various motivational methods. Firstly, research using motivational strategies like rewards and competition has been conducted to stimulate user physical activity. Users set weekly goals and are provided with rewards such as ribbons and trophies upon achieving these goals. They also share their data with friends, fostering competition, and employing diverse motivational approaches to promote user physical activity(4). Additionally, a similar study demonstrated the effectiveness of motivating user physical activity through a service called 'UbitFit Garden,' which provides virtual rewards like flowers and butterflies when users achieve their goals. This service also tracks user activity through sensors, further enhancing motivation(5).

In another study, the STOP (Stop Obesity Platform) project was proposed with the aim of providing tailored feedback for obesity prevention and healthy weight maintenance. This project utilizes chatbots such as **Replika(*)** and **Woebot(*)** to deliver its services(6). Similarly, in a related study, a chatbot called WeightMentor has been developed to provide motivation and assistance to users in achieving and maintaining weight loss(7).

Such research continues in various domains, utilizing diverse methods to motivate users. However, these approaches often provide motivation through simple rewards based on outcomes or by encouraging sharing rather than fostering engagement through interaction with the user. Moreover, these methods may not motivate individuals who dislike competition, and expecting motivation through virtual rewards can be challenging. Furthermore, in interactions between users and chatbots aimed at providing motivation, there is a scarcity of encouragement

or support when users fail to achieve their goals or when they lack enthusiasm. Additionally, while each users' exercise situations and contexts vary, there is no meticulous motivation service that takes into account the subtle differences in such situations. Therefore, we believe that with careful consideration and in collaboration with thoughtful design and development, a new method that no one has attempted before could be explored.

3. Method

To create our new method, we followed a structured approach. Firstly, we conducted a thorough literature review to gain a detailed understanding of motivation. Secondly, we conducted surveys and interviews to investigate what real people desire based on the knowledge acquired from the literature review. Thirdly, during the conceptualization phase, we designed the service we aimed to develop. Subsequently, in the Technical Specification phase, we determined the technologies through which we would implement our design. In the Service Development phase, we actualized the service. Finally, to gauge user perceptions and identify areas for improvement, we conducted user evaluation on the service we developed.

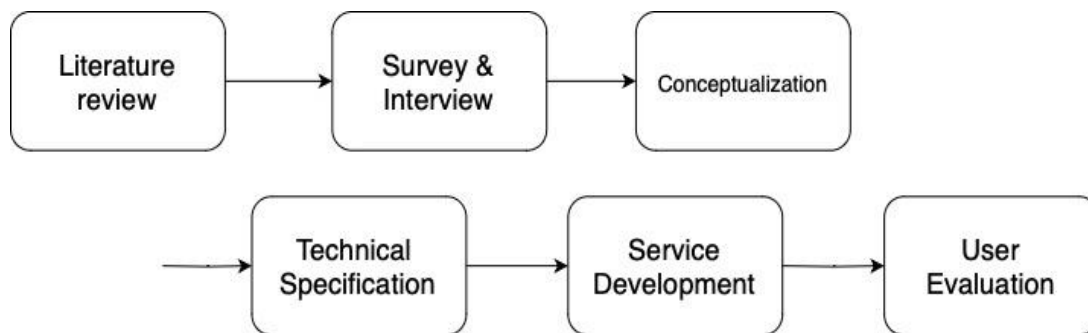


Fig 1. Design and Development Process

3.1. Literature Review

Motivation can be categorized into two main types: intrinsic motivation and extrinsic motivation. Extrinsic motivation is associated with engaging in various activities as a means to an end rather than pursuing the activity itself. It involves engaging in behaviors driven by external stimuli or rewards. In contrast, intrinsic motivation involves pursuing an activity for its own sake, driven by the inherent enjoyment and satisfaction derived from engaging in the activity for its own purposes(8,9).

Based on these concepts, the self-determination theory(SDT) has been formulated. SDT is a theory that aims to understand human intrinsic motivation and behavioral regulation. It emphasizes that humans are not driven by external rewards or regulations, but rather by internal motivation and values. These internal factors play a crucial role in human growth, development, and well-being. In this theory, internalization is defined as the process of transforming external regulations or rewards into internal regulations or rewards, and it is emphasized that this process plays a crucial role in enhancing autonomy and self-determination.(10). Furthermore, experimental findings indicate that motivators such as the threat of punishment(11), deadlines(12), and surveillance(13) decrease intrinsic motivation, whereas positive performance feedback enhances intrinsic motivation(14).

Based on these findings, we provide motivation to encourage users' consistent exercise behavior. Specifically, we stimulate intrinsic motivation through one of the extrinsic motivators, "encouragement," in order to foster a sustained exercise routine.

3.2. Survey & Interviews

In this study, we conducted a survey consisting of six items(see Table 1) with 20s 118 participants. The findings indicated that a majority of individuals who used to exercise regularly or those who exercised once a week expressed a lack of motivation to engage in physical activities (51.7%). The predominant reason for this inclination was attributed to just laziness(83.2%). Furthermore, a considerable number of individuals reported using electronic devices (e.g., cell phone, smartwatch) during exercise(72.9%), This implies that many individuals can receive notifications during workouts. Moreover, when multiple options to choose methods for exercise motivation were provided, participants reported self-satisfaction(72%) emerged as the most frequently. This indicates that individuals have an understanding of effective motivational strategies; nevertheless, they may lack a concrete grasp of how to attain self-satisfaction. As a result, this lack of knowledge regarding how to achieve self-satisfaction could lead to insufficient motivation, resulting in individuals thinking exercise cumbersome and lazy, as observed in their recurring reluctance to engage in physical activity. Even, a majority of participants(77.1%) responded that receiving words of encouragement during exercise would be helpful for consistent workout routines. In light of these findings, we propose utilizing notifications to provide encouragement and enhance exercise motivation to users.

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.

Table 1. Items of questionnaire

We also conducted interviews with six individuals who are interested in exercise and maintain regular workout routines. Through these interviews, we came to understand that people desire motivation that is timely and appropriate to the context. For instance, interviewee #5 responded “When I accomplish my goal and someone exclaims, ‘Wow! That’s incredible!’ appears to enhance my sense of fulfillment.”, interviewee #6 answered “Even when I’m not satisfied with the exercise I’ve done, If someone offer compliments, I feel it might be a hollow reaction.” Also interviewee #2 said “If someone else acknowledges my consistency in exercising, it would likely be more effective in motivating me.” and interviewee #4 responded “Acknowledging the achievement of surpassing a greater goal than my past self would serve as motivation.”

3.3. Conceptualization

Through a comprehensive literature review, survey and interviews, we uncovered the potential to motivate individuals for exercise through encouragement and positive feedback. We also recognized people’s desire for timely and relevant encouragement and feedback, so we divide the user's situation into before, during, and after exercise. We utilized the ChatGPT API from the LLM model to provide a variety of responses, not always the same, and offer context-specific and timely motivation tailored to the user's situation.

Furthermore, based on survey responses indicating that many users use electronic devices, we enable users to listen to motivation without needing to look at the screen using Text-to-Speech (TTS) when they are either before or during exercise. The voice used in the TTS is a crucial factor in providing motivation. Through other interviews and survey, we discovered that voices characterized as 'friendly and encouraging,' 'trustworthy,' and 'energetic' are beneficial for motivation. Moreover, we have selected a voice that aligns with the concept

of our service's mascot 'DZM'(see fig.2). DZM is a mascot created for our service to facilitate a more friendly interaction with users and provide motivation. It is a persona with a pure teenage concept designed to effectively motivate users.

With these technologies, we have developed a fitness motivation service called 'Motiv Fit.' Before starting their workout, users are motivated by Motiv Fit's mascot, 'DZM', who utilizes ChatGPT API(*) and TTS technology to provide encouragement, especially for users who have no exercise records.

For instance, if our users have set exercise goals but feel reluctant to begin, they receive notifications that offer encouragement such as, "Just get started by doing one small thing, like a five-minute warm-up or stretch, and see how you feel. Sometimes taking the first step is the hardest part." These messages serve as motivation, prompting them to start their workout routine. (see fig.3). Furthermore, when users press the "Start" button before beginning their workout, after a certain duration, DZM offers encouragement with messages like, "You got this! Don't give up, keep pushing yourself to reach your goals and remember why you started in the first place!" This support from DZM is designed to assist users in staying motivated and working towards their fitness goals(see fig.4). Finally, after completing their exercise session and pressing the finish button, users can receive feedback and various information about their workout for the day in a Chatbot format with DZM through prompt engineering. Additionally, since exercise times and dates are recorded, users can also manage their exercise schedules effectively.



Fig 2. Mascot 'DZM'

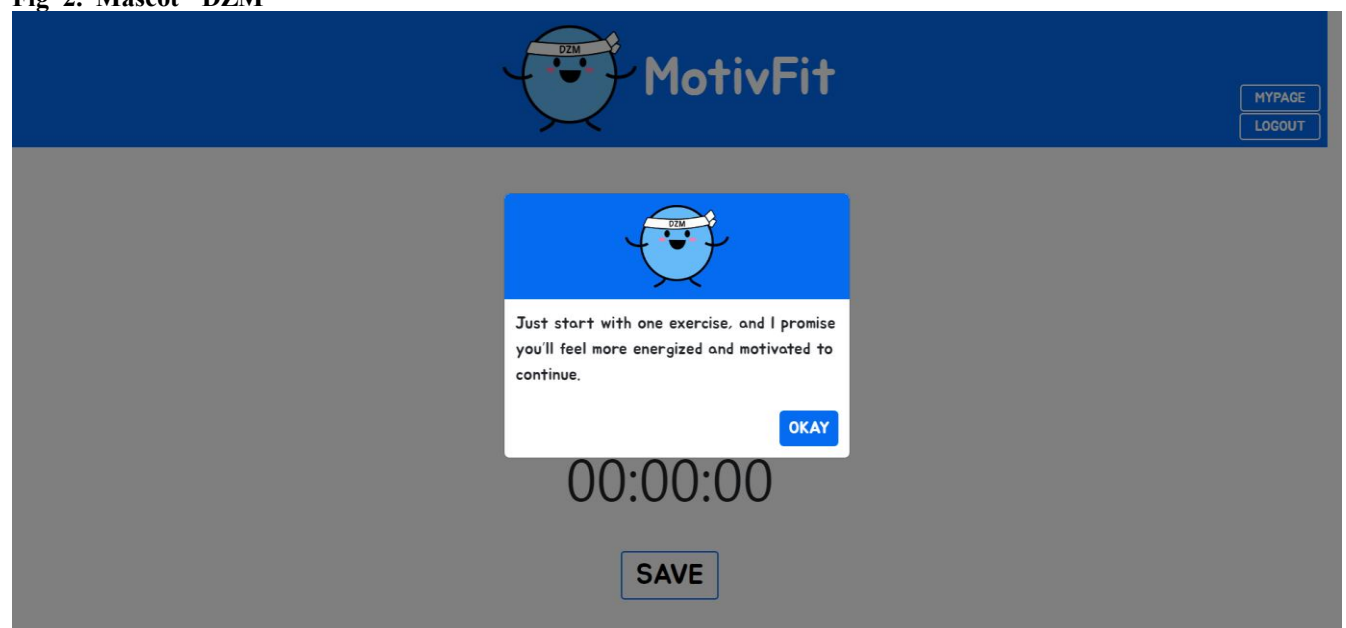


Fig 3. 'MotivFit' – before exercise

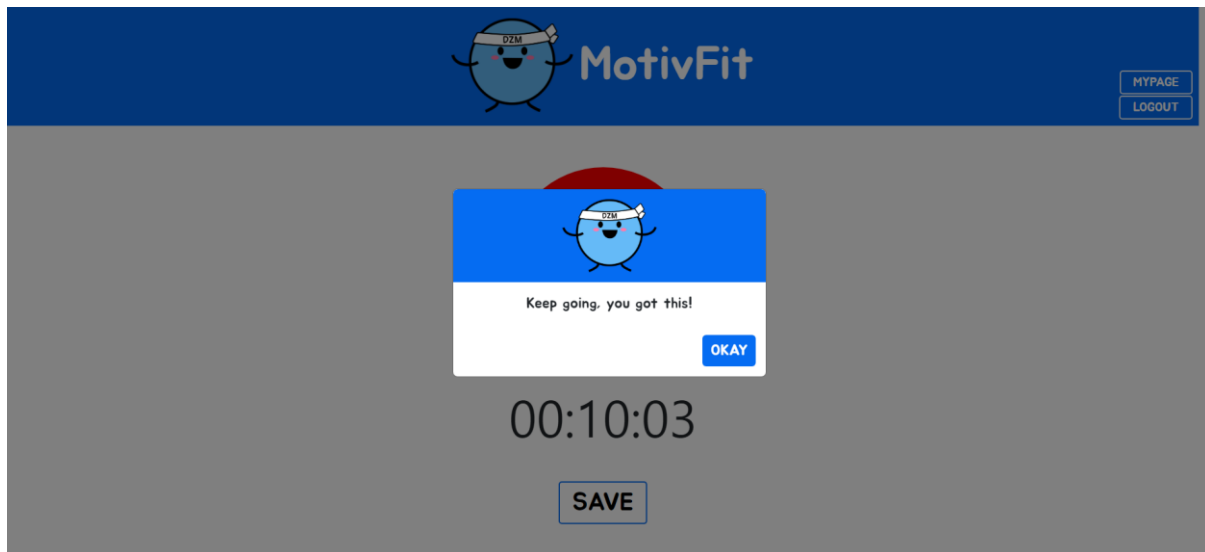


Fig 4. ‘MotivFit’ – during exercise

+ fig 5. After exercise

3.4. Technical Specification

Our technology can be categorized into three main components. Firstly, an LLM module that provides encouragement and conversational interactions. Secondly, a Text-To-Speech(TTS) system that transforms text into speech. Lastly, an application server to facilitate these functionalities.

Taking a closer look at the LLM module, we implemented using the chatGPT API module. This prototype interactive AI chatbot, developed by OpenAI, leverages the RLHF (Reinforce Learning From Human Feedback) technique(15,16), which effectively utilizes Large Language Models (LLM) for enhanced performance(17,18). Thus, it offers advantages over rule-based dialogue models by providing greater diversity and suitability for delivering timely and relevant motivation. The chatbot, thus realized, possesses the ability to comprehend and remember the context and content of conversations, enabling it to generate human-like and detailed text. Furthermore, by employing prompt engineering techniques to elicit the most fitting responses from the language model, we have enhanced our ability to provide motivation and improve the appropriateness of chatbot responses.

Secondly the Text-to-Speech (TTS) technology has benefited from advancements in machine learning and neural network algorithms, enabling more sophisticated speech synthesis. This technology places a strong emphasis on converting given text into natural-sounding speech by considering aspects such as grammar, stress, and intonation. Various programs make use of this technology, including **Google Text-to-Speech(*)**, **Amazon Polly(*)**, **IBM Watson Text to Speech(*)**, **Naver CLOVA(*)**, and **KT Voice Studio(*)**. After experimenting with different programs, we ultimately opted for Amazon Polly preliminary, selecting a voice tone and pace that align with our mascot's image and resonate with users, providing motivational value.

Lastly, for the implementation of the application's server, we selected the **Django(*)** web framework in Python to facilitate the seamless utilization of Python-based APIs. Django is a robust tool for rapid development and management of web applications, founded on the Model-View-Controller (MVC) architecture. This architecture enhances modularity and reusability of code, facilitating easy maintenance and expansion even within intricate projects. To realize real-time communication between the application and clients, we employed the **Channels library(*)**. Leveraging WebSocket-based asynchronous channels, this library supports bidirectional communication through web socket connections. Through this, we

implemented a core feature of the application, namely, chat functionality.

In essence, by integrating Django and Channels, we accomplished asynchronous communication between the application and clients, enabling real-time updates and interactions. Moreover, our API, developed using Django, supports smooth communication between the server and clients, effectively combining the potent capabilities of the Python language with the convenience of the Django framework to establish an efficient server system.

3.5. User Evaluation

To enhance the user experience, we conducted an evaluation among potential users. The seven items survey(see Table 2) was conducted with a sample of 10 interviewees who expressed an interest in exercise and indicated their willingness to use our service.

Firstly, the majority of interviewees responded that DZM's voice, used for user encouragement both before and during exercise, did not align with DZM's persona. For instance, interviewee #1 commented, "Your voice seems too mature for your adorable appearance," and interviewee #6 remarked, "Your mascots look cute, but your voice doesn't convey a sense of cuteness." However, it's worth noting that two interviewees mentioned that the voice wasn't significant to them..

Furthermore, when asked about the appropriateness of the length of encouragement phrases for motivation, the feedback indicated that the sentences were perceived as lengthy. Specifically, interviewee #2 mentioned, "It would be better if the sentences were more concise," and interviewee #6 stated, "When the sentences are too long, it feels awkward and doesn't resonate." In contrast, interviewee #3 and #7 evaluated the longer sentences positively, suggesting that they conveyed a more detailed and heartfelt message.

Another important factor to consider is the content of encouragement, and all interviewees provided positive evaluations in this regard. For instance, interviewee #4 mentioned, "The motivational content seems appropriately tailored to the situation," while interviewee #6 stated, "Although the motivational content may be familiar, I believe it is suitable."

Next, we conducted a survey on the pace of delivering encouragement, and five interviewees assessed that the pace was too fast and didn't resonate. Interviewee #3 commented, "The pace is too fast, making it feel awkward," and interviewee #1 mentioned, "The speaking pace is too rapid, and it doesn't convey sincerity." However, three other interviewees expressed that the faster pace was more conducive to exercising.

Another aspect we considered was the appropriateness of the chatbot's responses for post-exercise conversations, and all interviewees evaluated the responses as appropriate. For instance, interviewee #5 mentioned, "DZM provides appropriate responses as a supportive friend," and interviewee #8 stated, "The responses feel entirely tailored to me, and it feels great." Furthermore, when asked about the diversity of chatbot responses, all interviewees responded positively, indicating that the responses were varied and diverse.

Lastly, when asked about the screen layout of the 'Motiv Fit' service, all seven interviewees expressed satisfaction. Interviewee #4 commented, "The screen layout is intuitive and simple, making it convenient to use." Interviewee #5 mentioned, "DZM mascot is placed throughout the screen, adding a cute touch, and it includes all the essential elements." However, interviewee #2 did mention, "It feels somewhat empty," providing a slightly less favorable evaluation.

1. Appropriateness of DZM's voice
2. Length of encouragement phrases
3. Content of encouraging phrases

4. Pace of encouraging phrases
5. Appropriateness of Chatbot Responses
6. Diversity of Chatbot responses
7. Appropriateness of design

Table 2. Items of questionnaire

4. Results

Through user evaluation, we acknowledged feedback indicating that DZM's persona and voice did not align well. To address this concern, we made several modifications using Text-to-Speech (TTS) technology. Specifically, in our quest to find a voice that better suited DZM's character, we transitioned from Amazon Polly to Google Text-to-Speech. Additionally, we adjusted the speech rate based on feedback that the voice was too fast, employing prompt engineering to slow it down.

Recognizing that voice content length also posed a challenge, we heeded user feedback regarding excessively lengthy responses. As a result, we made adjustments to the script length to ensure that DZM's messages were more concise and better received by users.

5. Conclusion & Discussion

Relying on the foundational concepts of intrinsic and extrinsic motivation rooted in psychology and drawing from the Self-Determination Theory (SDT), we have come to recognize the critical importance of autonomy in enhancing individual motivation. Furthermore, by harnessing a pivotal aspect within SDT, namely the concept of external motivation influencing internalization, we have conceived "Motiv Fit" to aid users in sustaining consistent exercise regimens.

What sets Motiv Fit apart from similar motivation services is its utilization of LLM (Large Language Model) technology to deliver personalized motivation tailored to users' specific pre, during, and post-exercise circumstances, with a more nuanced consideration of their situations. Moreover, it capitalizes on the strengths of LLM, offering a plethora of diverse encouragements during each interaction.

Furthermore, moving forward, we plan to develop a wider range of features to offer users a more diverse and engaging motivational experience. These features will incorporate various motivation techniques, allowing us to provide users with a more comprehensive and personalized motivational service.

This application of LLM's model extends beyond exercise and can be adapted to various domains, such as studying and weight management. However, given the limited number of interviewees in the user evaluation, conducting additional interviews could allow us to incorporate a broader spectrum of perspectives, potentially leading to the development of a more extensive array of motivational approaches.

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