

Empowering Elderly Fitness by Gamifying Walking: A Design Thinking Approach [†]

Shriya Maind, Pranita Ranade  and Indresh Kumar Verma 

Symbiosis Institute of Design, Symbiosis International (Deemed University), Pune 411014, India; shriyaamaind@gmail.com (S.M.); pranitaranade@gmail.com (P.R.)

* Correspondence: indresh.verma@gmail.com

[†] Presented at the 5th International Conference on Innovative Product Design and Intelligent Manufacturing Systems (IPDIMS 2023), Rourkela, India, 6–7 December 2023.

Abstract: In today's fast-paced and continuously evolving fitness industry, it can be difficult for the elderly to keep up with industry and technological trends. Furthermore, a sedentary lifestyle, lack of motivation, and limited access to age-appropriate exercise materials make it difficult for the elderly to engage in fitness activities regularly. They also sometimes struggle to begin and eventually maintain a regular fitness regimen. Hence, this study proposes a technology-driven design intervention to serve the requirements of the elderly and make fitness training simple, enjoyable, and accessible. A systematic design thinking approach was followed, which began with conducting a literature review, then continued with conducting interviews, conceptualizing ideas, prototyping the solution, and usability testing. Combining the gamification technique of personal walking plans with virtual trip experiences increases motivation and makes it more engaging for the elderly. In conclusion, the proposed solution would help the elderly live a much healthier and happier life by making the everyday fitness activity of walking enjoyable and engaging.

Keywords: elderly fitness; gamification; design thinking; virtual travel; elderly healthcare



Citation: Maind, S.; Ranade, P.; Verma, I.K. Empowering Elderly Fitness by Gamifying Walking: A Design Thinking Approach. *Eng. Proc.* **2024**, *66*, 16. <https://doi.org/10.3390/engproc2024066016>

Academic Editors: B. B. V. L. Deepak, M. V. A. Raju Bahubalendruni, Dayal Parhi, P. C. Jena, Gujjala Raghavendra and Aezeden Mohamed

Published: 8 July 2024



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1. Introduction

Today's fitness industry is evolving and changing dynamically as people become more aware of fitness and well-being, influenced by advanced technology and societal norms. Individuals of all ages are bombarded with an overwhelming array of fitness-related terminologies, trends, and various strategies for accomplishing different objectives. In the fitness sector, the elderly are frequently underrepresented in advertising and marketing materials. The fitness industry ignores the needs and interests of older adults, which can lead to a lack of adequate exercise programs and facilities for older people. It also reinforces negative perceptions about aging and physical activity. Barriers to involvement among older adults may include chronic health concerns, mobility issues, and social isolation [1]. Older adults' motivation when pursuing physical activity should not rely on performance or capacity but rather on the happiness generated through physical activity and maintaining physical function. Engaging in physical activities promotes social participation and prevents the formation of psychological barriers, loneliness, and overall well-being [2]. A market gap has been identified because of these multiple issues. The goal of the study is to propose a user-centric, easy-to-access solution for the elderly, in order to bridge this gap and raise awareness. The paper also investigates the current technological solutions in the market for the problem. This research paper proposes a technology-driven design intervention to address the pain points of the elderly after using a well-organized design thinking process. This approach will make physical activity more engaging and pleasurable by simplifying fitness activity, increasing motivation, and making physical activity more accessible and fun. The proposed solution would fulfill physical activity requirements and improve cognitive

well-being. The study aims to apply the design thinking process to designing a solution that ensures older adults maintain regular fitness engagement.

2. Literature Review

To understand fitness in the elderly and their need for inclusion in the fitness sector, several relevant articles were researched. The keywords used include elderly fitness, senior wellness, elderly health, and gamification for older digital fitness solutions. The information was gathered from the ScienceDirect, Hindawi, IEEE, and PubMed databases. A total of 1094 articles surfaced around the keywords, of which 17 were found to be relevant and up to date.

2.1. Physical Health of the Elderly

One in every five older adults in India suffers from chronic diseases. Chronic diseases like diabetes and cardiovascular diseases are increasing rapidly in India, due to the rising proportion of aging adults in the population and obesity. Factors such as tobacco consumption, unhealthy food, and lack of physical activity contribute to these chronic diseases. Policymakers are concerned about these trends. It is critical for India to keep the elderly economically active and encourage them to live an active lifestyle, in order to delay the onset of and combat chronic disease [3]. A test regimen that displays the capacity for users to engage in activities safely and without becoming exhausted can be used to assess physical fitness. However, individuals' physical fitness tends to deteriorate as they age, resulting in differing degrees of flexibility, endurance, and agility over time [4].

2.2. Walking as a Physical Activity

Walking is a form of exercise that older individuals can easily engage in. It helps maintain cognitive independence by preventing health issues. Regular walking prevents weight gain, hypertension, muscle loss, stiffness, joints, and deterioration of posture. Additionally, it impacts anxiety and stress by reducing cortisol levels. The best part about walking is its simplicity and convenience—you can perform this exercise anywhere. It is a type of exercise for people of all ages. You can also choose your walking pace, distance, and frequency [5].

2.3. Existing Technology-Based Solutions

Mobile fitness technology encourages older adults to engage in physical activity, exercise, and live a healthy lifestyle. It tracks physical activity and health issues and sends reminders to the elderly to check their activities, create objectives, and share their data with others, assisting them in maintaining their health [6]. To encourage physical activity in older individuals, several technologies such as the Nintendo, balance board, and Kinects are used. These technologies are popular because they are generally inexpensive, easy to install and use, and provide a positive motivator for physical exercise. Customized connective systems are more effective than center-based programs in improving physical activity. They largely aid in the enhancement of functionalities such as strength, balance, and endurance. Promoting such a technological system can assist the elderly in maintaining their independence and engaging in physical activity in a comfortable manner [7]. Saksham et al. discuss an exergaming solution for promoting frequent physical activity in the elderly. Their report continues by stating that the planned solution will have a long-term positive impact on older adults' physical and mental health [8].

2.4. Mental Health of the Elderly

Depression among the elderly in India is intensified by a lack of social or familial support, isolation, reliance, loneliness, a lack of family care, and the perceived inadequacy of time spent with children. People must develop hobbies, participate in regular physical exercise, refrain from drugs, and maintain a good diet to keep themselves engaged because bad health raises everyone's risk of depression [8,9].

2.5. Role of Gamification

Gamification is an evolving strategy to promote user motivation, engagement, and enjoyment in computer-based environments that are not intended for gaming purposes. There is evidence suggesting that gamification can have positive effects in certain situations. Although the term is still used inconsistently, gamification is gaining recognition. A common definition of gamification is emerging, along with frameworks based on theories like self-determination [10].

2.6. Motivational Affordance in Gamification

The many components investigated in empirical research as motivational affordances include points, leaderboards, and badges. Most psychological results concentrate on elements like enjoyment, attitude, and motivation, and are based on core psychological principles like self-determination [11]. In many contexts, such as marketing, education, health and wellness, and crowdsourcing, motivational affordances or gamification components have been utilized to boost engagement and motivation. Researchers have also shown the benefits of gamification in motivating youngsters to conduct mindful usage of social media [12]. Studies have also discovered that older adults could generate intrinsic motivation for physical activity (PA) by utilizing motivational affordances through gamified technology [13].

2.7. Facilitation of Physical Activity through Gamification

The motivation and goal-setting skills of older individuals in terms of their PA have not received much attention. The use of persuasive games and interpersonal communications in digital gaming for older adults has demonstrated its effectiveness in influencing and encouraging positive health behavior to engage in more PA. Gamified applications promote motivation, improve goal monitoring and tracking, and let users engage with others in a community [14].

2.8. Gamification for the Elderly

An increasing segment of the population comprises older adults, with the number of those in this age group predicted to quadruple by 2050. They are contributing significantly to the gamification research field since they live better lifestyles and have longer life expectancies and higher levels of education. Technology users' unique requirements and difficulties are expanding, creating new potential for technical solutions that meet this group's needs. Achievable objectives, tasks that reflect talent, challenges that pique interest, social support, intangible incentives, tangible rewards, visual representations of growth, onboarding, and education are all important [13]. Technology is utilized in therapies to enhance cognitive performance in older people, including mobile phones, activity monitors, and tablet gadgets. Older people are more motivated by the concrete information provided by activity trackers and smartphones than by more abstract gamified feedback, which is why these devices provide more varied gamification options [15]. Gamification can enhance intervention design and extend health programs to elderly populations. Even if there are obstacles to digital inclusion, regional initiatives to improve capability and skills raise the possibility that more individuals will utilize these technologies successfully as time goes on [16].

2.9. Traveling as a Motivation for the Elderly

Traveling can be a non-pharmacological therapy for people suffering from chronic illnesses. The elderly also have more free time, making them significant as tourists who are rapidly rising in number. Exploring is typically associated with positivity and can contribute to an excellent quality of life. The elderly are motivated to travel for a variety of reasons, including socialization, physical activity, learning, self-fulfillment, and accomplishment. Spiritual impulses tend to grow increasingly dominant, and the need for

self-fulfillment has been identified as the primary motivation for older people to travel to spiritual destinations [17,18].

3. Methodology

In this study, a systematic design thinking process was utilized to develop and propose a solution. The study started with a systematic literature review to explore the subject and understand users, followed by the collection of the latest data, affinity mapping, contextual models, and competitor analysis. An in-depth interview with people aged 55 to 75 was performed in Pune, India. Information and ideas about the fitness requirements and preferences of the elderly were gained through interviews. Usability testing was carried out to put the proposed design solution (a mobile application) to the test. The brief, which included the concept, pain points, and task to be completed, was specified to the users. The system usability scale (SUS) [19] was used to evaluate the usability of the proposed solution.

3.1. User Interview

The target user group of this study is elderly people in the age range of 55–75 years; hence, in-person user interviews were conducted with 15 adults between 55 and 75 years old to understand the target group and their fundamental requirements. The interviews were conducted in locations such as joggers' parks and temples. The interviews were helpful for understanding the perspectives of and difficulties experienced by the elderly. The interview comprised 10 open-ended questions that included areas such as acquiring information on current health status, interest in travel, issues with fitness, technology literacy, the purpose of fitness, and preferred physical activity.

3.2. Competitors Research

Competitor benchmarking analysis (shown in Table 1) was carried out to collect and examine the data from various direct and indirect competitors in the market [20]. The analysis assisted in identifying the scope and areas covered, market inefficiencies, and potential growth prospects. Apps or design systems that contribute to the overall experience for all age groups are considered indirect competitors.

Table 1. Benchmarking for the specifications of competitors.

Features	Healthify Me	Home Workouts	Fit India Mobile App	Step Bet
Tracking	✓	✓	✓	✓
Goal Setting	✓	×	✓	×
Gamified Experience	×	×	×	✓
Social Features	✓	×	×	×
Elderly Friendly	✓	×	×	✓
Custom Plans	✓	✓	×	×
Wearables Integration	✓	×	✓	×
Community Support	✓	×	✓	×
Collaborative Targets	×	×	×	×
Virtual Travel	×	×	×	×
User Friendly UI	✓	×	×	✓
Total features	8	2	4	4

3.3. Contextual Inquiry

Using a cultural model framework, a contextual inquiry was carried out. Thus, a comprehensive picture of the user was gathered through observation and in-depth information. The cultural model aids in comprehending the target user's mental model and pattern behavior in relation to many factors and experiences in the problem area. The various contributing elements for the targeted user group are shown in the cultural

models in Figure 1. This makes it easier to fully comprehend the situation that led to the problem area.

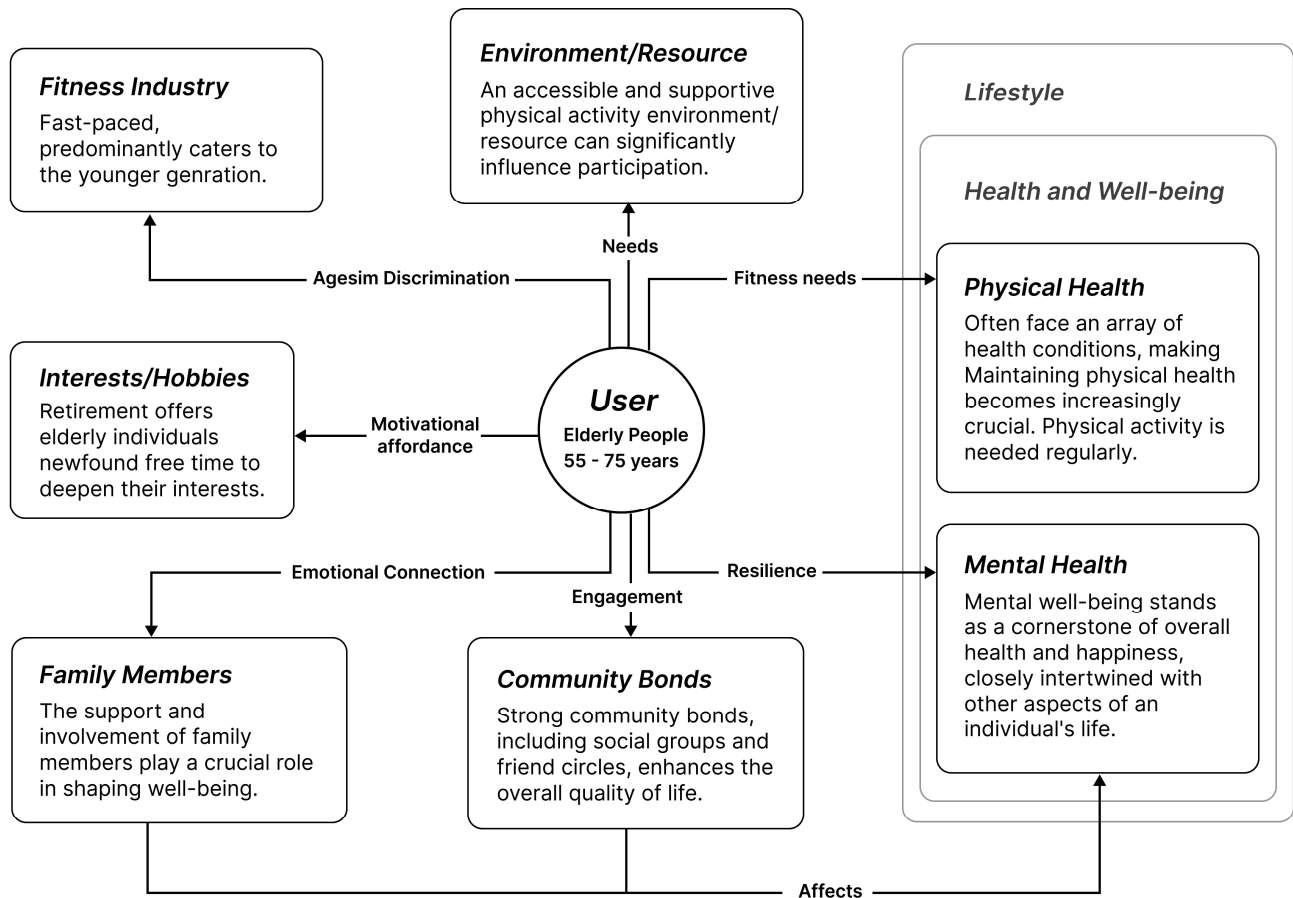


Figure 1. The cultural model of the target user and their influencing factors (author-made).

3.4. Ideation and Conceptualization

In this phase, various solutions were ideated, and a list of features was made after identifying the issue, the target user, their needs, and the contextual elements. To better understand the navigation system, a task flow and an information architecture diagram were created, before open card sorting and prioritizing activities were carried out.

4. Results

4.1. Insights from User Interviews

The fast-paced fitness industry, which is constantly changing and establishing high standards, was found to have a substantial level of ignorance regarding the elderly age group after performing both secondary and primary research. It was observed that about 80% of the individuals surveyed had numerous chronic illnesses and health problems, the majority of which were diabetes, high blood pressure, and arthritis. Additionally, it was observed that only 20% of those surveyed exercised regularly, and most individuals worked out for 20 to 25 minutes daily. Most of them also expressed worry about walking alone because of their balance problems. Research has also helped to ascertain that this age group uses smartphones for family video calling, WhatsApp messaging, and other entertainment services. When questioned about their travel places of interest, it was found that there was a mix of religious and non-religious locations. Additionally, the group knew about gamification and had a basic understanding of how it works. It was also found that there is an absence of suitable fitness resources for the elderly that are simpler to use, enjoyable, and easily accessible. A fitness walking application that uses virtual travel gamification was proposed to address this issue.

4.2. Workings of the Proposed Solution

Walking is one of the most enjoyable forms of exercise, and gamification will motivate users by providing the necessary motivational affordance. The user must customize the walking plans, based on their own needs and preferences. The application will then suggest various virtual travel destinations based on the user's personal interests (religious, historical, or scenic). A target is set once the user enrolls for a virtual trip to the destination that he/she wishes to visit and explore. The notification is sent to the user at the usual time chosen by the user. The user will have a daily goal of reaching a milestone in the journey, and once reached, the user will be able to witness an engaging experience regarding the milestone or the destination in audio-video form. This will allow users to travel to new places, learn about diverse cultures, and be active while staying within their comfort zone. This design solution would provide the user with a sense of fulfillment. Figure 2 illustrates a sequential model of the working of the proposed solution. The user must sign up and customize their walking plans, after which they can book a virtual trip destination and achieve daily milestones, eventually reaching their destination and earning location-specific rewards and incentives. Figures 3 and 4 show a low-fidelity paper prototype (hand-drawn sketches) and high-fidelity visual designs of the application, respectively.

Salient features of the application:

- Personalized Walking Plans: Goals are set based on personal capability;
- Diverse Destinations: A range of locations is available (religious, historical, scenic, etc.);
- Value Walks: Engaging audio-video destination-specific content;
- Rewards and Incentives: Incentives for reaching a milestone/destination;
- Socialize: Create a team and challenge friends/family.

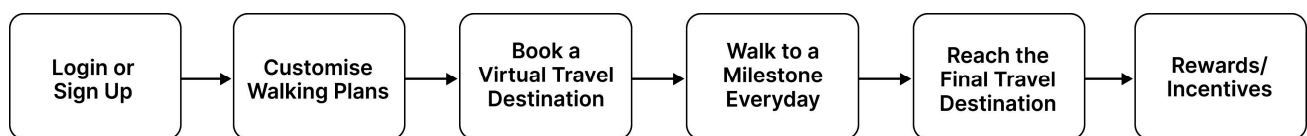


Figure 2. Sequence model of the proposed solution (author-made).

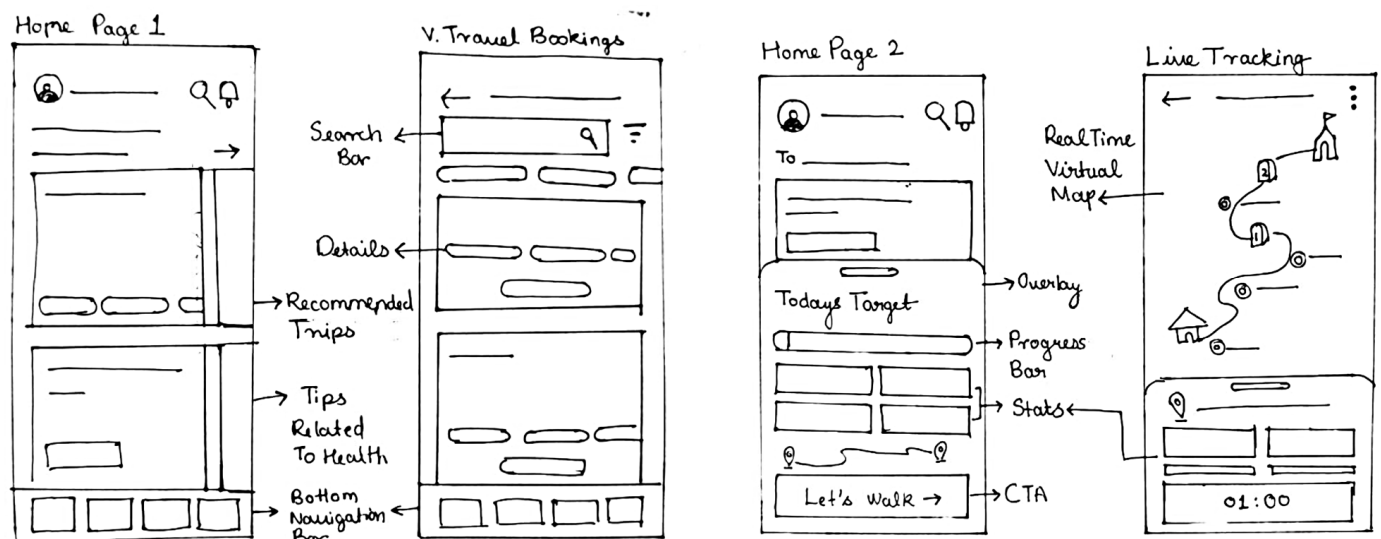


Figure 3. Low-fidelity paper prototype of the application screens (author-made).

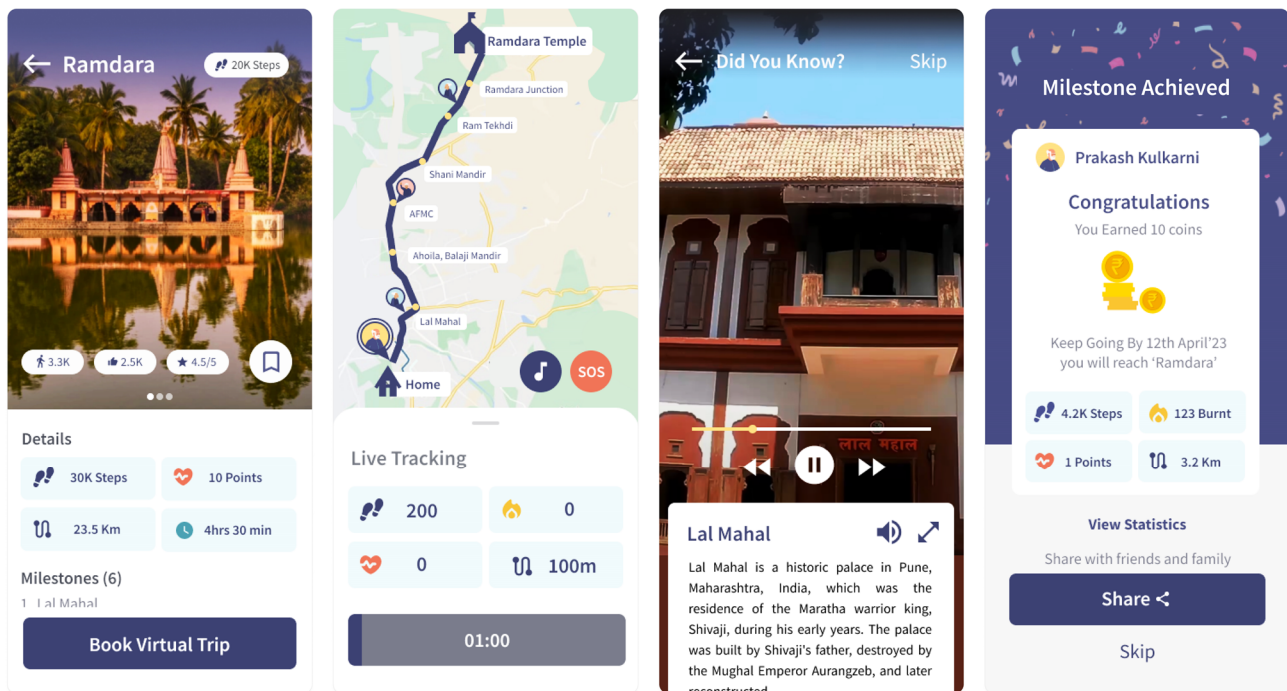


Figure 4. High-fidelity prototype of the application (author-made).

4.3. User Testing

Six participants conducted usability testing, using system usability scale (SUS) ratings to determine the proposed mobile application's perceived usability. The aim was to complete the entire user flow process, from selecting a virtual trip destination to achieving a milestone, finally reaching a destination, and receiving incentives. The SUS ratings with respect to the different criteria are shown in Table 2. The calculated average SUS score was 83.42, indicating that the system is user-friendly and meets user needs. The application is not complex, according to 50% of participants. Also, 50% of respondents strongly agreed that the application is easy to use. Finally, 66.67% of participants strongly agreed that the application is highly functional, and 33.33% said that they were highly confident in utilizing the application.

Table 2. System usability scale ratings for the proposed design.

System Usability Scale (Questions)	Ratings, n (%), n = 6				
	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
I would like to frequently use this application	0	0	2 (33.33)	2 (33.33)	2 (33.33)
The application is unnecessarily complex	2 (33.33)	3 (50)	1 (16.67)	0	0
The application was easy to use	0	0	1 (16.67)	2 (33.33)	3 (50)
I would require technical support to use this application	1 (16.67)	4 (66.67)	1 (16.67)	0	0
Various functions of this application were well integrated	0	0	0	2 (33.33)	4 (66.67)
The application had too much inconsistency	3 (50)	2 (33.33)	1 (16.67)	0	0
This application is very quick to learn	0	0	1 (16.67)	3 (50)	2 (33.33)
The application is very cumbersome in use	2 (33.33)	4 (66.67)	0	0	0
I felt very confident using the application	0	0	2 (33.33)	2 (33.33)	2 (33.33)
A lot of things need to be learned before using this application	2 (33.33)	3 (50)	1 (16.67)	0	0

5. Discussion

The above literature review provided insights into the health status of the elderly, current developments in geriatric fitness, and the use of gamification. In the field of fitness, it was observed that there is no specifically age-appropriate customized solution that is easy to use, accessible, and enjoyable for older adults. After conducting interviews, it became clear that 20% of the participants interviewed worked hard and dedicated time to their physical activity routine. Another issue was a lack of stable motivation and a fear of getting hurt while participating in physical activities. As a result, it has been determined that there is the potential to develop a smartphone application that will motivate users by allowing them to virtually journey to their preferred destination using the most accessible type of physical activity, walking. The proposed solution is designed to have a significant influence on physical health as well as mental well-being by creating a sense of fulfillment by allowing users to visit their dream destinations. The cultural model helped us to understand users, their relationships with other stakeholders, and the elements surrounding them. It also examined additional causes and triggers of frustration. The proposed solution received a 'Good' adjective rating since the system usability scale (SUS) score was above 80 [21]. This signifies that the solution was validated and was considered to be user-friendly. This implies that the design solution is effective in terms of feasibility, navigation [22], and usefulness. The design thinking approach aids in understanding users and their problem points; it also aids in conceptualizing a design solution and developing a mobile application prototype.

Limitations and Future Scope

There may be some possible limitations to the study. The lifestyle, background, technological literacy, and medical conditions of the participants were based on a sample collected from the metropolitan area of India, and the results may not be universally applicable. Due to self-reporting bias, participants may provide desirable responses before expressing their genuine feelings. The suggested mobile application is not a substitute for medical advice or treatment. Usability testing was conducted on a small sample size of older adults, with no medical experts present. Iterative improvement is required to suit the evolving needs of the user. Additional user testing and requirement gathering are required. Some future research possibilities include merging the app-based solution with wearable technology and health-monitoring devices. The application's future may involve adding virtual reality (VR) or augmented reality (AR) features to improve the immersive experience and give users a more dynamic and interesting way to explore. Additionally, the present research and solution primarily focused on the Indian cultural context; however, going forward, the intervention can be modified and implemented in diverse cultural contexts, making it relevant and comprehensible to a wider geographical user group. In the future, the solution could be investigated for other age groups and can be customized to fit their unique interests and fitness objectives. It is critical to collaborate with healthcare experts to guarantee that the app adheres to geriatric best practice. Localization and community participation elements of the application can be explored further.

6. Conclusions

A systematic design thinking approach was employed in devising a fitness solution for older adults. The proposed solution was deemed easy to use, engaging, and convenient for providing physical activity to the elderly. Elements of gamification were instrumental in motivating the elderly to walk to any of the desired locations virtually. The proposed solution is expected to help older adults in their personal growth by exposing them to different cultures and experiences. Hence, the proposed mobile application is expected to enhance the physical and emotional health of the elderly, contributing to their overall well-being.

Author Contributions: Conceptualization, S.M. and P.R.; methodology, I.K.V.; software, S.M.; formal analysis, S.M.; investigation, S.M.; resources, P.R. and I.K.V.; data curation, S.M.; writing—original

draft preparation, S.M.; writing—review and editing, I.K.V.; visualization, S.M.; supervision, P.R.; project administration, P.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data are contained within this article.

Conflicts of Interest: The authors declare no conflicts of interest.

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