

Fitness for Elderly (FFE)

Sushmita Dahal - 1340853
Frankfurt University of Applied Sciences
Frankfurt am Main, Germany
sushmytadahal@gmail.com

Syed Ahmed Zaki - 1322363
Frankfurt University of Applied Sciences
Frankfurt am Main, Germany
zaki.cse.daffodil@gmail.com

Huzaifa Bin Zahoor - 1366659*
Frankfurt University of Applied Sciences
Frankfurt am Main, Germany
huzaifazahoor4@gmail.com

Abid Latif - 1358900
Frankfurt University of Applied Sciences
Frankfurt am Main, Germany
imabidlatif@gmail.com

ABSTRACT

This paper presents an application for the fitness of elderly people ranging 50 and above to guide them for staying healthy and active with the help of daily and weekly exercise plans. Fitness industries are mostly aiming for the growth of young age group for their structural and functional modules of fitness equipment and applications. With the help of practical cases, this paper discusses in-depth analysis of design status and existing problems, and purpose a system that have new design patterns and strategies according to the usage and interaction of elder people with application. This research introduces a system where users will be assisted through active support system, digital exercises, voice assistance for motivation and will suggest healthy meal plans. The intent of this application is to help elder people manage and promote their health and mitigate the effect of aging, boredom, depression, and muscle strength.

KEYWORDS

Fitness elderly, exercise, active support system, meal plans, trainer, voice assistance

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1 INTRODUCTION

It is estimated that in 2050, number of world's elderly population over 60 years old will reach 2.1 billion. However, the statistics of Germany (2020) conducted by worldometer shows that life expectancy for genders (life expectancy at birth, genders combined) is 81.9

*All authors contributed equally to this research.

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years. At present, one in five Germans is over the age of 65.[1] A study commissioned by the Bertelsmann Foundation found that nearly two-third of Germans believe there are more risks than opportunities associated with country's aging population. The most feared outcomes are rising poverty among the elderly and an increase in the retirement age which leads to less activities, more boredom that results in fitness problems.[2] To end this, the Federal Ministry of Family Affairs, Senior Citizens, Women and Youth have developed a comprehensive approach in cooperation with the Federal Ministry of Health, civil society, the Länder (states), welfare service associations and research institutions. The aims are to help elder people who want to remain fit physically, mentally by taking part in society. Multi-generational centers are just one way to provide meeting places for people of all generations and for them to engage in a wide range of activities.[3] We are going to overcome this problem by designing a system which will be actively monitoring, calculating and suggesting the best possible solutions regarding their health. A simple questioner will take data from user, then based on which age group the person falls in, digital exercises will be provided in which the trainer will most likely be of the same age group. Some general guidelines will be explained by the trainer beforehand to ensure the safety of users. An active support system will be available all the time to answers the queries asked by people for assistance. The application will assist elder people to perform exercises with low effort and more strength building training's. Users will be able to appoint a trainer for any specific training's, health, exercise, meals or dysfunction of muscles. Voice assistance will play a motivational role in reaching users to their weekly or daily goals.

2 RELATED WORK

There are many works that show the importance of fitness for older adults. In [4], the authors discuss about how crucial physical activities and exercises are for the well-being of the elderly citizens. There are studies that suggest various ways to use technology in order to promote the physical activities of the elderly. In [5], the authors found that the health care professionals and senior citizens agreed that physical activities would be more enjoyable with the use of digital technology, but it should be aided with social interaction. Our fitness application for elderly people provides a trainer to monitor and facilitate the elders in fitness related activities. The authors in [6] discuss about the several barriers faced by elderly people that restrict them from maintaining good health and suggest some

ways in which technology could be used to enhance their well being. They suggest that activity monitoring, activity partner search, finding daily flexibility are some of the things that technology can help to reduce the barriers faced by elderly citizens. Bhardwaj et al. [7] have shared in their paper how the IoT-like things have been used in their applications and problem solutions. Both for exercise and finding the algorithms usability while doing activity stuff. Some drawbacks of algorithms also have been described.

The findings in [8] show that the use of mobile for having an active support system for generating self-awareness towards senior citizens regarding their health. Our application will maintain updates alongside physical activity suggestion system to make sure that the elderly people maintain good health. Likewise, the discussions in [9] also show that fitness applications such as Nike+ and Run Keeper applications did not comply with the fitness standard that is required for the elderly population. The main issues discussed here were that the applications were not very user friendly to the elderly population and violated the standards set by the paper in areas such as Visual Design, Content, Dexterity. Digital technology can be used to improve the nutrition level of the elderly citizens [10].

2.1 Method

Due to increase number of health issues happening there is much benefit of fitness. Older aged people love to make fitness and make it in a best way while using app. In order to understand one's physical activities we have used PHYSICAL ACTIVITY SCALE FOR THE ELDERLY (PASE) model [11]. PASE model covers physical activities ranging from walking outside of home to slightly increasing the physical endurance of the respondent. Like light sports activities, moderate sports activities, strenuous sports or recreational activity and muscle strength activities like playing tennis, aerobics etc., then it leads to further ascertaining different domestic chores from light housework to heavy work, home repairs to lawn mowing and outdoor gardening to caring someone. Then it considers if someone is working in any form. Work for pay or volunteering services that too requires physical exercises. Based on the all-aforesaid type of physical exercises there is a corresponding physical work frequency that is determined using the activities per day conversion table mentioned below.

2.2 Procedure

We have used google forms to get the responses from the user. From the response we got, there are a number of activities in the PASE model that were required to be individually calculated. A specified conversion table is used to assign values to the activities frequency of the user. Hence, the calculation was performed on the major activities like walking, light sports, moderate and strenuous activities. Based on the activity frequency, a complete PASE model for a single response was calculated.

Our application provides users with 3 different options to sign in. They can login using their Facebook or Google account or use our application as a guest. Once the user has signed in, our application queries them about their basic details, experiences related to fitness and preferences in exercise time, nutrition consumption and so on. The data collected will be used to create personalized fitness plans

ACTIVITY TIME TO HOURS PER DAY CONVERSION TABLE		
Days of Activity	Hours Per day of Activity	Hours Per day
0. Never		0
1. Seldom	1. Less than 1 hour	.11
	2. 1-2 hours	.32
	3. 2-4 hours	.64
	4. More than 4 hours	1.07
2. Sometimes	1. Less than 1 hour	.25
	2. 1-2 hours	.75
	3. 2-4 hours	1.50
	4. More than 4 hours	2.50
3. Often	1. Less than 1 hour	.43
	2. 1-2 hours	1.29
	3. 2-4 hours	2.57
	4. More than 4 hours	4.29

Figure 1: Conversion Table

and daily goals that compliments with the user's preferences. Our application also provides voice assistance to aid the elderly users in the exercise process. Moreover, the application gives an option to hire a personal trainer or contact us about any of their queries. Likewise, our application also suggests several different meal plans based on the data provided by the user.

2.3 Stimuli

Our study emphasizes on providing best possible fitness plans for elderly based on their age group, preferences and body condition. In order to understand our elderly user better, we used the following factors.

- Age Group
- Previous Training Experience
- Favourite Exercise
- Preferred food type
- Body Disability

Our application provides services to elderly citizens (above the age of 50). We have created different age groups with 10 years gap (50-60 and on-wards) to learn which age group the user lies in. Similarly, we also collect how frequently the user takes trainer assistance for their exercises and asks them to select some of their favorite exercises (Yoga, Deep Breathing, Chair Squats are some of the options). Moreover, our application queries the users regarding any sort of disabilities (Joint Pain, Muscle Cramps, Broken Cramps, Respiratory Care) they have. Using these data, the application suggests exercises that are compatible with the user. For instance, for a user with joint pain, our application would suggest low-impact aerobic exercises such as walking. Likewise, when the user wants to hire a trainer, we use the age group and physical disabilities to suggest trainers suitable for that situation. In case, the user wants to share more details about their requirements and plans, we provide the Contact Us feature whether they can explain more about their situation. Using this data, we help the user to find personalized trainer and set personalized daily goals to improve their fitness levels. In order to incentivize the users to exercise regularly, our application also aims to include their favorite exercises in the routine created. Moreover, the food details collected by our application is

used to suggest different meal plans that maintain calories as well as provide adequate nutrition to the user based on their age group.

2.4 Participants

We have used google form for getting the data in which 49 responses were recorded using the google form. The consent form has also been added inside the google form for the survey participants. It was a 4-week long process to get responses recorded. This is the google form for our survey based on PASE activity, herein each question the German translation is also available which is needful for our targeted German user.

Application played a considerable part in defining the results. Further data being generated by the application will help improve processes to understand and evaluate. It's an ongoing process that needs to be carefully monitored and accordingly evolved.

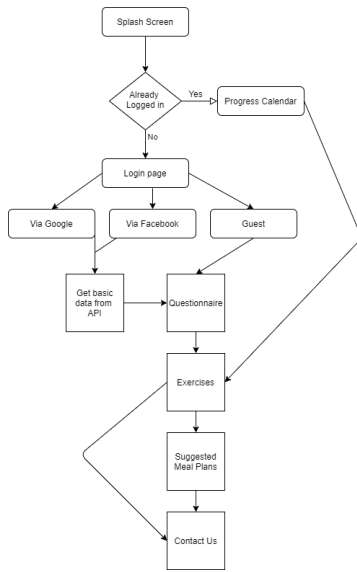


Figure 2: Flowchart

3 RESULTS

Based on the responses that we got from the surveys and from the continuous use of our applications by the end users. Our data is helping to further train the models more specifically for the applications continues recommendation system of different exercises and help the user to achieve maximum healthy routine. Most of the studies are focusing on the meal plan but our system is recommending meal plan as well as physical exercise types so that the user can consume well and maintain themselves.

Survey responses received by the user are very important as it will give data that particular user have done this activity in past 7 days. If the user has not done specific activity, then it is marked 0 and if the user has performed the certain activity, then it led to the next phase of question that what was the frequency of the user in the past 7 days on average. Based on the users' inputs there are corresponding figures that can be used to get the relevant score of the user activities. Survey responses provided the necessary



Figure 3: Activity 1

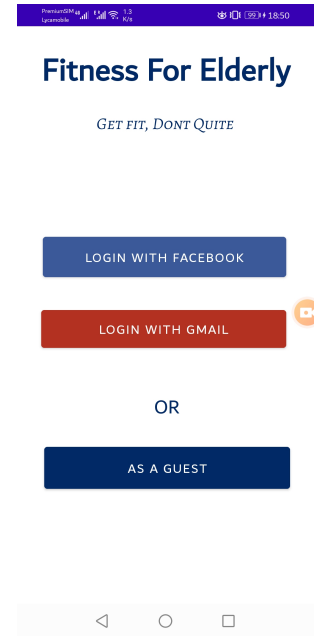


Figure 4: Activity 2

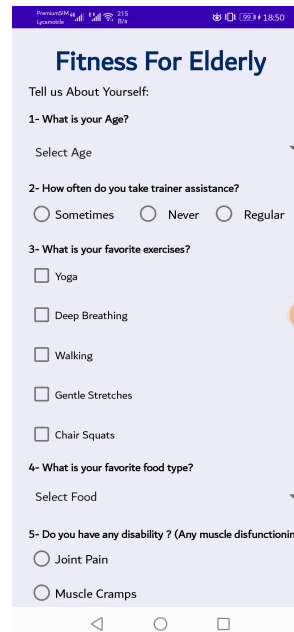


Figure 5: Activity 3

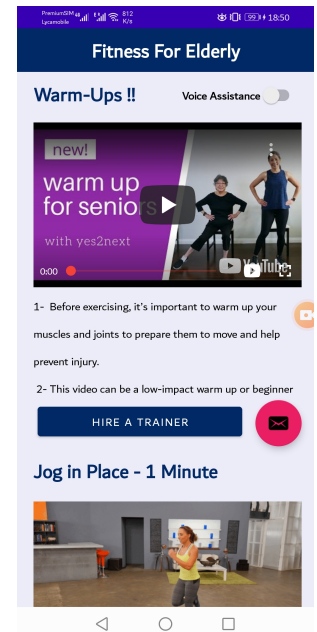


Figure 6: Activity 4

data to populate the users' data into the PASE scoring table to get information about the user's physical activity level.

In the Figure 1, corresponding values are evaluated based on the users' inputs. If the user has not performed any activity, then it is marked 0 in the past 7 days. Then no further calculation is performed. Whereas if the user has performed the activity, then these particular activities weight is multiplied with the activity

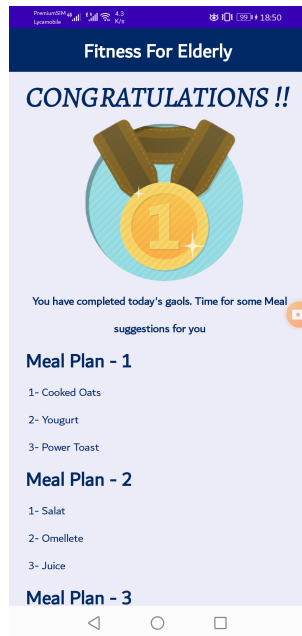


Figure 7: Activity 5

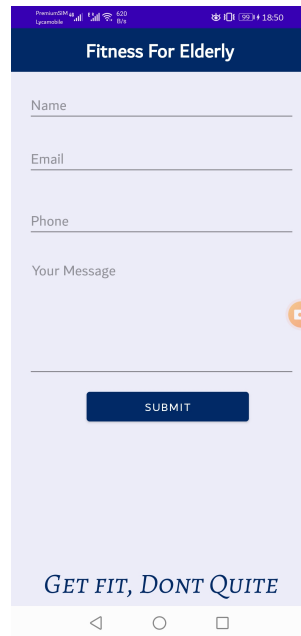


Figure 8: Activity 6

PASE Scoring				
PASE Score	Type of Activity	Activity Weight	Activity Frequency	Weight times Frequency
2	Walk outside home	20	0.75	15
3	Light sport / recreational activities	21	0.64	13.44
4	Moderate sport / recreational activities	23	0.75	17.25
5	Strenuous sport / recreational activities	23	0	0
6	Muscle strength / endurance exercises	30	0	0
7	Light housework	25	1	25
8	Heavy housework or chores	25	0	0
9a	Home repairs	30	0	0
0b	Lawn work or yard care	36	1	36
9c	Outdoor gardening	20	0	0
9d	Caring for another person	35	0	0
10	Work for pay or as volunteer	21	2.86	60.06
PASE SCORE:				166.75

Figure 9: PASE Table

frequency which is obtained from the conversion table. Then Activity weight and Activity Frequency is multiplied to get Weighted times Frequency. After getting the all activities score final score is calculated using Sum function to get the final score of the particular user. There are different variations possible in the scores as if the user is more active and performs more physical activities then his corresponding score will be higher then the other user that was not that much physically active in the past 7 days. These scores are calculated for every user on the back-end projections and recommendation system.

In our survey different genders participated that can be seen in the below bar chart.

This study was not on a larger scale owing to the prevailing Covid Pandemic situation and due to its limitation in time and

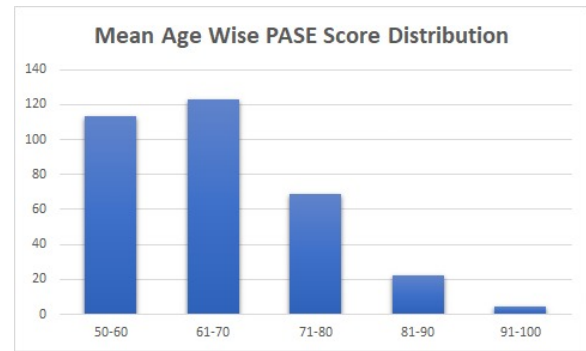


Figure 10: Bar Chat

resources. As the application will continue to operate more data of different age groups will be available with the passage of time. System will more improve in terms of effectiveness and efficiency in helping the user to serve their purpose more and more.

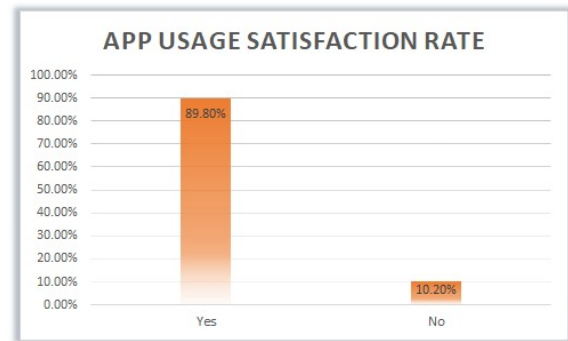


Figure 11: Bar Chart

The respondent data shows that more than 89 percent of the respondents were satisfied with the application. We have been using PASE model to ascertain the user's physical activity level below mentioned graphs shows range of different users' genders and their physical activity level.

According to the data of the respondents of our survey that ranges from 0 to 364. Means score was 97.55, standard deviation is 74.15 and median of the data was 96.55. After calculating the mean and standard deviation for different gender groups, Above chart shows the figure of different age groups. This can be concluded that as the age increases the activity level of the users started to decrease. Based on the PASE score and exercise types that fits the individual needs, system will project what sort of exercise and meal one has to take to stay health.

4 FUTURE WORK

We are currently doing a mobile app-based solution. We want to expand our technology to other devices also. For example Digital smartwatches, VR and AR technology, and other high-end exercise devices for experiencing most digital interaction and community-based contribution. We have a plan to use the next generation of

technology and want to make it works with different types of monitoring parameters and accuracy. For example, Monitoring heart rate, respiratory data, psychological data from wearable devices, etc will be collected in future versions. Currently, our app is only available for Android phones, later we will make it for iPhone too. We have made a plan for any futuristic work and problematic situation, For example, our app can also help for assisting the situation like in covid 19, isolation and quarantine cases, or any other health-related issues for elder people. We will make leader boards as a community-based motivation. Another option will be a location-based service that will find nearby friends to join together. It will help them to recover from boredom as well as to find the best fitness buddy.

Tracking the progress of body fat percentage, taking photos, and share in social media. Especially before and after pictures will keep elderly people motivated if they need to. We have those options too in futures. Now the online fitness has grown interests from home in this pandemic. Recorded video, one-to-one coaching, online zoom workout classes, etc. will be available. A freelance fitness trainer can join here and make teaching subscriptions for elderly people to train live. Nutritionists can also join and share the Recipe guide, meal plans, etc. All this will be available in our future versions of the app. We have also a plan to keep progress reports of ECG, breathing training, blood sugar monitoring, tension, and stress management through our app. These technologies are much related to modern exercise, it can also give notification after a desired time when need to do fitness. Some more options like sleep tracking for the elderly. Connect with a coach in an emergency while doing sports alone and getting an answer from the coach immediately, consult with a doctor is another plan. Not only that notifying the user about taking medicine, notifying for routine activities to hit a milestone, or reminding them for eating healthy, alongside some fitness puzzle games for well being management will be available soon in the future app.

5 CONCLUSION

Our application is an excellent companion for the elderly in keeping a healthy lifestyle. We made it convenient by suggesting numerous types of exercises. It provides improved health measures. This will help them feel better, more productive, and mentally calm. We have focused on the happiness and well-being of older ages people.

The primary goal of our innovation was to make it the most user-friendly app for the elderly. Different options also made it more realistic to use. Our motto for the app is “get fit, don’t quit” is so much perfect here. So with our app elder people can enjoy their fitness journey as much as possible.

5.1 Project Link

- (1) Code for application developed
https://github.com/HuzaifaBinZahoor/Fitness_for_Elderly
- (2) Google form
<http://shorturl.at/evAL0>

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