Development of an Android Fitness App

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SCHOOL OF SCIENCE & TECHNOLOGY

A thesis submitted for the degree of

Master of Science (MSc) in Mobile and Web Computing

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THESSALONIKI – GREECE

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Abstract

The surge in "smartphone ownership" has fashioned a foundation for fitness apps that can assist individuals in improving their health and stamina, by increasing motivation for physical exercise using gamification principles and wearables. However, the retention rate of such apps is low in comparison with other types of apps. In this dissertation, a review of most popular fitness mobile apps was conducted and a comparison of different gamification techniques was made. The findings showed that most fitness apps are complex to use, have too many features and do not provide enough motivation. To address some of the above shortcomings a fitness application was developed, which is simple, connects to a wearable and uses levels and avatars to increase motivation. The application was evaluated by a group of volunteers with quite positive results. The results showed that the developed application can be further improved in the future.

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Contents

1 Introduction

In the past decade, mobiles phones have experienced a rapid growth in terms of features and capabilities. Nowadays, smartphones can be found everywhere and are constantly improving and enriched with new features, while their cost is dropping. The new capabilities of the smartphones, such as the immediate accessibility to the network and fast and instantaneous communication with other people, have rendered them ubiquitous in our lives [1]. Mobile usage is constantly growing and 80% of Internet users own a smartphone. It is an interesting fact that, in addition to smartphones, other smart devices such as smart watches and smart TVs, also gain popularity. Figure 1 shows the exact usage of smart devices in the Internet [2].
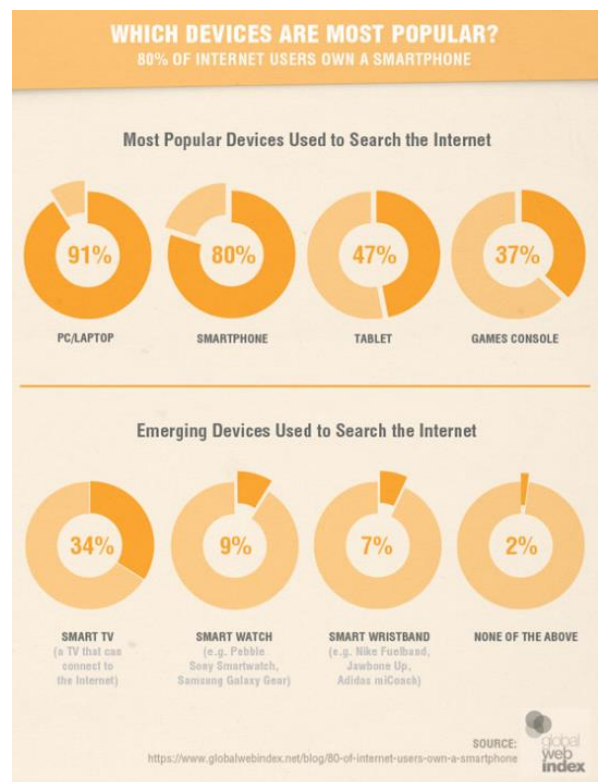

Figure 1. Smart device usage in the Internet

These numbers depict the situation in the year 2015. By the year 2018 over 36% of population is estimated to own a smartphone [3]. Users use the smartphones to perform various activities, in addition to phones calls, such as social networking, checking emails or managing their finance [1]. In general, smartphone owners desire to have access to

information. According to a study conducted by Pew Research Center [4], this information pertains to important life events, such as looking for a job, searching for medical information, or do online banking. The interesting part of the study is the fact that 62% of the users look up information about their health. So, we have users that seek help about their health in smartphones. Because of this, mobile health has been experiencing a growth in the last few years.

1.1 Mobile Health

Mobile health or mHealth, according to the Global Observatory for eHealth (GOe), is defined as the "medical and public health practice supported by mobile devices". It promises a better and healthier lifestyle and a great potential to enhance healthcare quality, by providing the users with ways to be in charge of their own data [5]. Mobile Health is mainly divided into two big categories: 1) disease and treatment management and 2) wellness management (Figure 2).
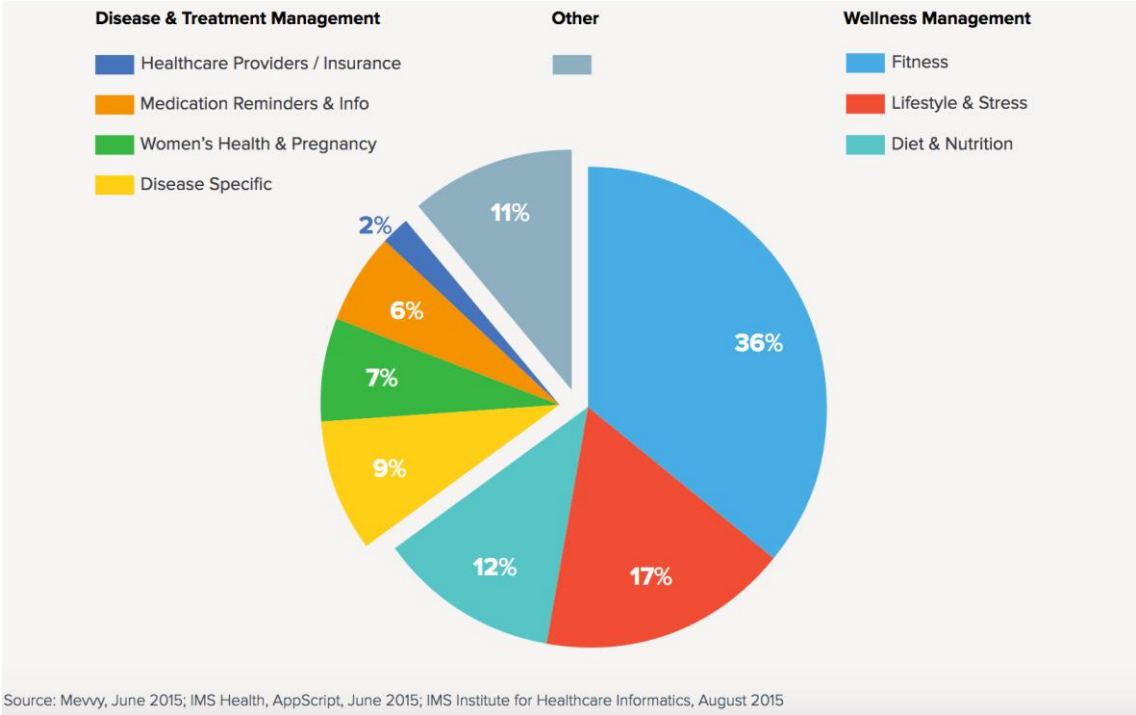

Figure 2. Mobile Health categories.

65% of mobile apps target wellness management. This includes fitness, lifestyle and diet. Disease and treatment management apps are not that popular and comprise a lower percentage of 24% [7]. This happens, because it is more difficult to develop an app to treat or even cure diseases due to the high level of required medical knowledge. In order

for a team to develop a mobile app, it should first contact medical staff and gain information about this field. This seems rather difficult, for it is quite difficult to find knowledgeable people, who are willing to spent time on such a project. On the other hand, the development of a fitness app appears to be challenging, too, but more feasible. The main challenge in fitness apps is the fact that they have a low retention rate (see Section 1.2.3).

1.2 Fitness Apps

Since our health is our main concern, we can pose the following question "Why don't we use smartphones to improve our health condition, stamina and nutrition?". Studies have shown that 28% of people exercise rarely or not at all. Most people engage in physical activities because they want to improve their health, while others exercise for the joy of physical activity [8]. Surveys show that 58% of smartphone users have downloaded a fitness app at least once in their lifetime. According to Flurry Analytics, between December 2013 and June 2014, health and fitness apps have gained popularity reaching 62% usage, contrary to other apps that grew only by 33%. It is noted that most people continued to use the app even when they set a goal and they couldn't accomplish it. Because of this, users fixated on fitness apps and a group "Fitness Fanatics" were created [10]. Regardless of one's motivation, it is clear that fitness apps address one of the biggest challenges in our busy lives, namely the struggle of keeping fit.

1.2.1 Advantages

Studies have shown that fitness apps successfully motivate a person to exercise and bring many advantages to one's life. First of all, users can track their progress through a fitness app. Otherwise, they will never know whether they successfully completed a specific goal. As mentioned, goals provide incentives to people regardless of whether they eventually succeed or not. If one succeeds, they know that their effort is paying off and even if they don't, they decide to try more persistently in order to achieve the goal. Also, recent studies have shown that visualization of the data influences our way of thinking. In a fitness app, progress is usually presented through graphs and other visual techniques. For example, if one wants to lose weight and the graph shows a descent line then the person will be delighted and satisfied. This will encourage them to continue. Another advantage of fitness apps is the motivation booster. This is achieved, apart from setting goals, through the rewarding system of fitness apps. Yet another motivation booster is the

challenges that someone can set among friends. The user can connect with other people and get valuable advice from them or even influence them in many ways to exercise more. The option to share results is proved to be even more motivating because everybody would want to show their achievements and be proud of them. Moreover, a person is able to do physical activities even if they don't go to gym. Most fitness apps (see Chapter 2) show the steps walked and someone may find walking to be just the right physical activity for them. But even if someone didn't walk the necessary steps to be fit, there are plenty of recommended exercises in fitness apps, which the user could follow. Many apps, also, give instructions through images or animations, so that one's exercise is not wasteful [11]. Hence, such apps can help someone to exercise efficiently and, by tracking their progress, people can be encouraged to continue and reach their goals. Also, there are health implications from physical activity, which is recommended by the doctors, as well. Some of them are: brain and mood booster, stress reduction, strengthening of the immune system, heart conditioning, weight loss and fit body [12].

1.2.2 Categories

Fitness apps can be divided into three categories: workout apps, nutrition and diet apps, and activity apps. We next provide more specific details about these categories.

1. *Workout app category* consists of different types: personal trainer apps, logbook apps, and workout tracking apps, which connect with a wearable device [13].

a. Logbook apps: Such apps are mainly related to logging the different activities and exercises performed in a day. There is an option for planning daily activities.

b. Personal trainer apps: These apps have taken the logbook apps a step further, since the app acts as a personal trainer. There are pre-arranged exercise routines that are provided in various formats, such as animations, videos or 3D models. There is, also, an option to select the difficulty or the level of a physical activity. Such apps may be divided into subcategories according to the type of training they offer, such as CrossFit apps or Yoga apps.

c. Workout tracking apps: These apps resemble logbook apps, except that they are combined with a wearable device. The wearable device does most of the work, because it tracks physical activity and then, when the smartphone is connected to the wearable device, the activity is logged automatically.

2. Activity app category refers to apps which count steps or track more specific activities, such as mountain climbing. Most of them track sleep and calories burned, as well. Many of them do not need any wearable device to count steps, because they use the smartphone's sensors and free APIs, such as Google Fit API. Surely, there is an option to connect a wearable device, which extend the app's capabilities [13].

Nutrition and diet app category may belong to fitness and activity app category with an additional function, namely tracking the nutritional habits. Their purpose is to help users acquire healthy eating habits, or lose or gain weight. However, just sending notifications when a user achieves a goal is sufficient, as the app should encourage the users to work out, as well. Unfortunately, these apps are not as automated as fitness and activity apps or workout tracking apps, because one must manually log the meals they consumed [13].

1.2.3   Abandonment and what should be done

Even though fitness apps have become so popular, their retention rate is 34% and their current usage is low in comparison to other types of apps, such as Social Networking apps or Gaming apps. Hence, this indicates that more effort to ensure continuous usage among users is needed [1]. According to an online survey by NYU Langone Medical Center, 58% of respondents had downloaded at least one health app from the store. 65% of them responded that the app helped them, while 46% reported that they don't use it anymore. The reasons cited for not using the app were concern about app fees, privacy and loss of interest [14]. Specifically, the reasons of fitness apps abandonment are related to app's functionality or software problems (known also as bugs and personal reasons. With respect to the first one, more specific reasons were battery drain, phone incompatibility, lack of trust in the developer, undesirable features and difficulty to use the app. If an app was difficult to use, then it was replaced by others or simply deleted [16]. Personal reasons involve the abandonment after achieving a goal and thus lack of interest, or vice versa when the goal is uncompleted. Unfortunately, studies have shown that this is the main reason why most users abandon fitness apps. In many cases the motivations of the app are not enough to overcome the obstacles [15]. However, this behavior may be the result of the users' initial motives. Many users learn about fitness apps from family members or friends and not from professionals. This make us question the users' motives, because it seems that they don't consider it important and family members or friends are more likely to have little knowledge on this topic [15]. Next, there is Paul Krebs, assistant professor in the NYU Langone Medical Center's department of population health, whose belief is

that developers are responsible for the high rate of abandonment. He explains that most developers want to create a fitness app and quickly finish it, without first consulting a specialist in health field. However, the study by NYU Medical Center, found out that the abandonment depends on the physical condition of the participant. This is a logical outcome, because an obese person is more likely to need a fitness app than a fit person. Another factor that led to uninstalling the fitness app, is the in-app payments [14] or the cost to purchase the app. Many apps come as a trial and then one must purchase them to continue using them. Users find this unnecessary because there are many free fitness apps in the market [16]. But the cost may not be the only reason, as advertisements in an app may be annoying too. Lastly, apart from the abandonment of fitness apps, the potential of users to become preoccupied with the app or even addicted should be studied. Since the app is used on a daily basis, so it may have a negative impact, because many users may develop a habit which can become eventually an addiction [16].

2 Literature Review

In this chapter, a survey of existing fitness applications will be conducted. Since we are researching about fitness mobile applications, we have to be aware about the most popular mobile operating systems. According to www.theverge.com, 99.6% of users use either Android or iOS. More specifically, the percentage of Android use is 81.7 % and iOS 17.9 % [17].

The next step was to search for such applications in each operating system's store, App Store and Google Play, which belong to iOS and Android respectively. Apart from the above popular stores, we consulted other sources in order to confirm our findings [24] [25] [26] [27]. It should be noted that there are many fitness apps in the market which promise that the user will lose weight or get fit.

2.1 Existing mobile applications

2.1.1 Fitbit

Fitbit is a fitness app which tracks, measures and saves data such as steps walked, heart rate, sleep, weight, water intake, exercise and nutrition. It is available on Google Play, App Store and Windows Store. The Fitbit Inc., also, is known about its products (such as activity trackers and wireless wearable devices) to measure steps, heart rate or quality of sleep. Specifically, their trackers do not just count steps but track one's activity in general and their movements in three-dimensional space. So, the tracker is able to tell if the person has been running or if they have been sitting in a couch. As for the quality of sleep, if a person wears the tracker while asleep, it can detect when they are awake or if they are in deep sleep, providing data about one's sleep. The tracker is connected with the Fitbit application wirelessly and sends data to it, so that the user can have an overview of their fitness situation for a period of time. Also, Fitbit users can log their weight and add their meals in order to track their diet habits. Goals can be set to each of the above measurements in order for a user to keep updated about their physical and nutritional condition. Moreover, the users can interact with other users and add them as friends. The app gives the opportunity to a user to set a challenge and then watch if the challenge is

successfully accomplished. This can motivate them to exercise more and stay fit, because it can boost their confidence. Lastly, another feature of the app is the guidance it provides about workout exercises [19].

When Fitbit Inc. was founded, there were very few Fitbit trackers available in the market and there wasn't any mobile app (only a desktop one) but now after 10 years there are many activity trackers available and a big range from which one can choose to meet their requirements [18].

The rating in App Store is 3.5/5 and in Google Play 4/5. The comments are generally favorable but there are some negative comments, mainly about weight log and nutrition log. Regarding weight, the users cannot have a good review about their progress, because there is a confusion with the visual graph indications weight they log and the ultimate weight goal. Concerning the nutrition, most of the comments pointed out that the predefined meals to log are few [20].
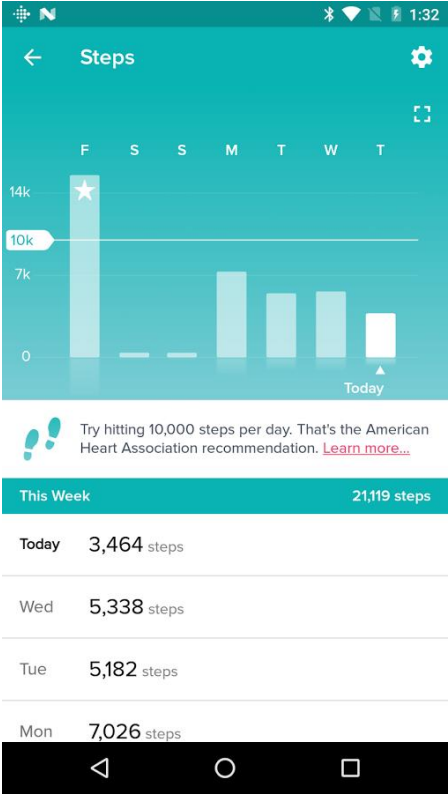

Figure 3. Fitbit screenshot.

2.1.2 Calorie Counter - MyFitnessPal

MyFitnessPal is a fitness app, which mainly counts one's calories, both burned and consumed in order to help one to lose or gain weight or stay in their weight. It is available on Google Play and App Store. Users can log their food and water intake and set goals

about the calories they want to consume daily. MyFitnessPal uses one of the biggest food databases with more than 6 million foods in many languages. Users just add their meals and the app automatically computes the calories in their foods. Of course, it provides information about the nutrition value of each food. One unique feature of the app is the barcode scanner which can detect the barcode of a food and automatically add the calories consumed. This is also offered in a "restaurant edition", meaning that a user can add meals from their favorite restaurants, provided they are in the database. Users don't have to worry if a meal is not in the app's database because they can create their own recipes. The above features refer to the food logging and calories consumed. MyFitnessPal also counts the calories burned. This is achieved by the numerous features it offers. First, it can connect with activity trackers and devices wirelessly. If there is no activity tracker, users can log their exercise manually or create their own exercises. Other than the connection with activity trackers, the app can connect with other apps and import data from them. Other significant features of the app are about one's progress and their motivation. In regards with the progress, charts are provided, so that the user can review the weekly progress of their weight. A useful feature is that the user can add a photo of their body so that it is possible to see the difference in time. In order to keep the user motivated, the app gives the ability to users to add friends and share their progress.

The app's ratings are 4.2 and 4.6 in App Store and Google Play respectively. It is a better rating that Fitbit's and it seems that users are more satisfied with this app. However, there are some negative comments mainly about the food database and the numerous features previously mentioned. It seems that at the end of the day users do not have the need to choose among the variety of foods, because they get confused. Basically, the users want the automation, but in this case, it cannot be achieved. Maybe this is achieved only with the barcode scanner, but not all foods have barcodes. Moreover, it offers many exclusive features regarding the calories consumption, which in fact may not be needed by a user and can eventually be confusing [21].
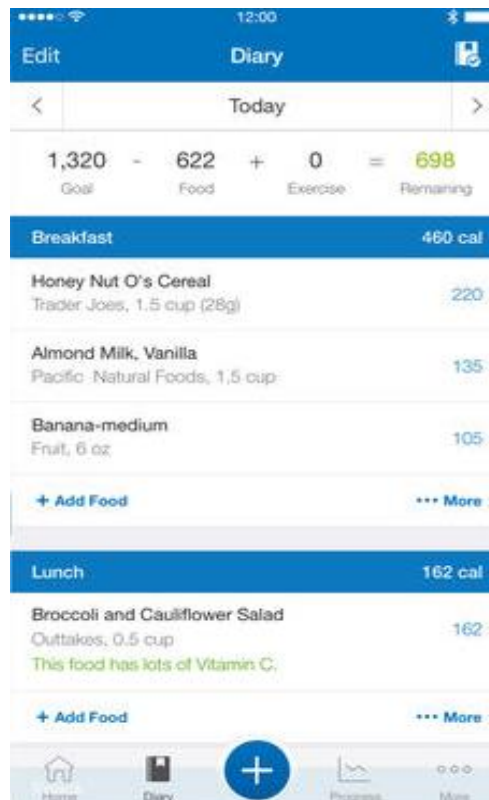
Figure 4. MyFitnessPal screenshot.

2.1.3   Runtastic

Runtastic is another popular fitness app, which focuses on steps count and exercise. It is available on Google Play and App Store. The app can track the activity of a user and then store the duration, the distance walked, the calories burned and also save the route of the user on a map (if the GPS is enabled). The activity tracked is not restricted to walking or steps count, but it has a variety of activities, such as aerobics, basketball or even CrossFit. Also, users can manually add an activity entry and they can choose among the variety of activities. The duration is set by the user and then the app calculates the distance and the calories burned. Runtastic keeps a history about all the activities the user has performed and it gives the user the ability to see some statistics about all the activities in a period. Although, Runtastic is a free app, not all of its features are free. One must pay to unlock all its features. An interesting feature about Runtastic are the training plans, which is a paid feature. Users can have their own training plans and follow them to get fit. The training plans involve physical activities, such as running or walking and even a marathon training. Moreover, users set yearly goals and when they achieve a goal, they get an award; however, this is a paid feature. Runtastic uses the competition among friends as a motivation for users' goals. A user can add friends and make groups, so that a friendly

competition can take place. A leaderboard allows the users to see who has won the competition. Lastly, Runtastic, like most fitness apps, is able to connect with wearable devices wirelessly. It, also, supports the connection and synchronization with other fitness apps, such as Google Fit, MyFitnessPal etc. The Runtastic app is owned by Adidas and the devices are exclusively produced by Adidas.

The rating of the app on App Store is 4.6 and on Play Store 4.5. The rating overall is a high rating, but the main disadvantage of Runtastic is that its primary features are locked and can be used only in the pro version, which is paid. Also, the free version has a lot of advertisements. Another drawback of the app, according to users' opinions, is that it only tracks physical exercise and not nutrition. For example, if somebody wants to lose weight, then they should keep track for both exercise and nutrition. So, Runtastic in such occasions should be combined with another nutrition app, such as MyFitnessPal. Last but not least, some users had problems with the route saved on the map, which proved to be a big confusion for the users because it showed a wrong route. Nevertheless, it seems that this feature is not important, because many people run or exercise in the gym [22].
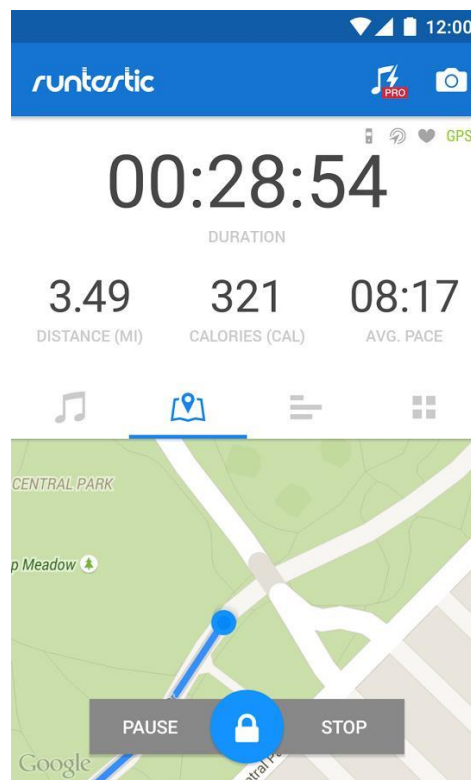

Figure 5. Runtastic screenshot.

2.1.4　Pact

Pact is a very interesting app in the fitness apps category. It is a unique app and there isn't any other similar app in the Web. The main idea of Pact is to earn money by exercising and by eating healthy. It is available on App Store and Google Play. More specifically, users make "pacts" by setting goals and by choosing an amount of money, which they will lose if they don't meet their objective. Not only are pacts about exercise, but for nutrition, too. Users prove that they have achieved their goals by taking photos of their meals or logging their meals for nutrition goals and by tracking their activity with Pact's activity tracker using smartphone's GPS and sensors for exercise goals. Goals are set in a weekly basis. With regards to exercise, users set the number of days they are going to work out, whereas nutrition is "charged" on a daily basis. If they fail to meet their goals, users are charged the penalty they set, but they get paid if they complete them. It works just like all the bets, where one bets their money on something and they may win or lose. The winner earns the money from those who lost it. Thus, in Pact the winners take the money from those who failed to meet the goals. Basically, Pact is an app which focuses on motivation and the motive is money. Pact can be combined with all popular fitness apps, such as Fitbit and MyFitnessPal, since it can be connected with them. Because money is involved, Pact is a very popular app, which promises real results and help. Pact's team claims that 95% of users achieve their goals and the value gained by users is not only about their fitness, but, also, the money.

Although the idea is very promising and the incentive is high, it doesn't seem to work. The ratings are 2.5 and 2.8 in App Store and Google Play respectively. The ratings are very low. This means that the users are not satisfied by the app. The main drawback of the app is that it involves money. Although money is a good incentive, when money is lost, users start to lose their patience and they do not follow their goals. In fact, it has the opposite results from what the creators had in mind. Committing to eat healthy and to exercise or pay the consequences may add stress to users' everyday life. It is very absolute and strict as an idea, because it has the concept of penalties, whereas fitness is about wellness [23].
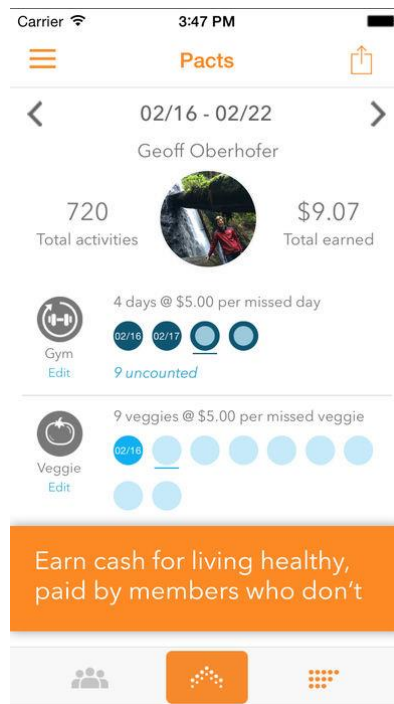
Figure 6. Pact screenshot.

2.1.5　Carrot Fit

Carrot Fit is another interesting fitness app, which promises results and does not look like any other app. It is available only for iOS in App Store and it is not free. Carrot Fit is based on the 7-minute workout idea, except that it is reinforced with humor and sarcasm. So, there is a trainer, which is called Al Carrot and he will train a user with 7-minute exercises that the user should complete successfully. There is a variety of exercises, which are not that easy, but there are also levels for amateurs. The exercises have hilarious titles such as "Celebrity Face Punching" or "Dragon Mating Dances" to keep the user motivated. The app measures the calories burned and keeps a history about the exercises. To encourage the users more, Carrot Fit gives rewards when the exercises are completed and the users level up. Users log their calories and if they have eaten too much then there is a punishment, i.e. their cute avatar gets an electric shock. Furthermore, the app tracks one's steps and shows charts, as well as charts about weight to keep the users updated about their weight progress. Carrot Fit is equipped with humor and sarcasm and this acts as the motivation of the users. Also, they use methods such as gamification (level up) and punishment to engage the user to workout. Of course, the punishment has nothing to do with the punishment of Pact; even this has a sense of humor, which is the main idea of the app. It can connect with wearable devices such as Apple watch and it connects with Apple's Health app, as well.

Carrot Fit has a high rating of 4.8 on App Store. This means that the idea of humor is a successful one. The main drawback of Carrot Fit is the fact that it is not free and it doesn't support the most popular platform, Android. One cannot download it even as a trial to test it and most people wouldn't bother to pay to try it, even though the price is low.
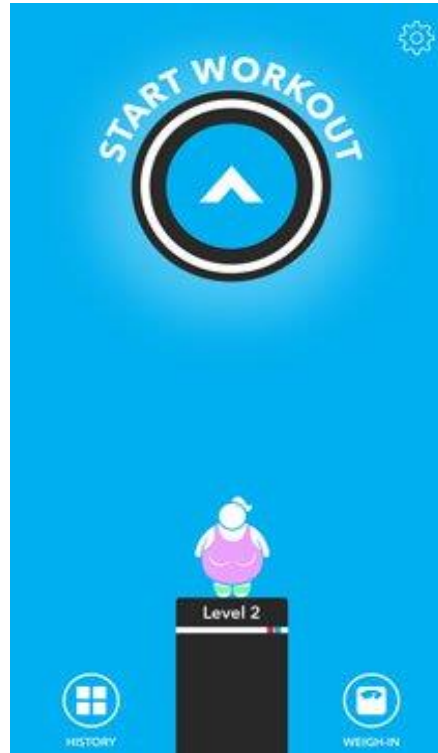

Figure 7. Carrot Fit screenshot.

2.1.6   Samsung Health

Samsung health (previously known as sHealth) is another fitness app, which provides many features to keep the user fit. It is developed by Samsung Electronics Co., Ltd and it is available on Play Store. Unlike other apps, which focus on a particular sub – category of fitness (examples), Samsung Health promises the whole package. Firstly, not only does it count steps, it also tracks whether someone is running, bicycling, hiking or performing other physical activities. It doesn't require a wearable, since it uses the smartphone's sensors. However, a wearable can be connected and synchronized with the app. Secondly, daily meals can be logged, as well as weight in order to have a healthy lifestyle. Other helpful trackers are the sleep and stress tracker. Sleep and stress trackers are important to maintain the healthy lifestyle. Moreover, options for water and coffee intake are provided. Users manually add the above values, except for the activities and weight which can be synchronized with a Bluetooth weight scale. Other interesting features of the app are the measurements of heart rate, blood pressure and blood glucose levels. To use them, the

smartphone should be equipped with the proper sensors otherwise the user should measure the vital signs with third party devices and then synchronize with Samsung Health. In order for the users to keep track of their progress, Samsung Health offers weekly reports and charts. The app uses challenges and marathons, as well as ranking, with friends in order to urge the users to use the app. A new feature of Samsung Health is the ability to check daily news by health professionals per user's preferences. Lastly, it can be connected and synchronize data with other fitness apps [28].

Samsung Health's rating on Google Play is 4.2. This is a good score overall. Most of the users are pleased with it and consider it helpful, but nonetheless many of them have written a bad review. Many comments were about the app's many features creating a complexity to use. The complexity is shown in Figure 8 below, where too much information is presented, which can mislead the user. There are many exercises which are useless, because seldom would someone do them and many of them are automatically tracked and one cannot make changes. For example, someone should time their activity, but many users first work out and then write down their time of exercise. Furthermore, Samsung Health sends many notifications in daily and weekly basis which are considered annoying by the users [28].
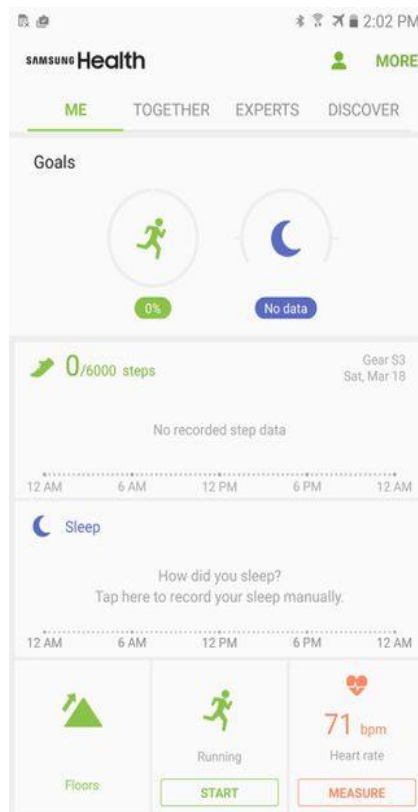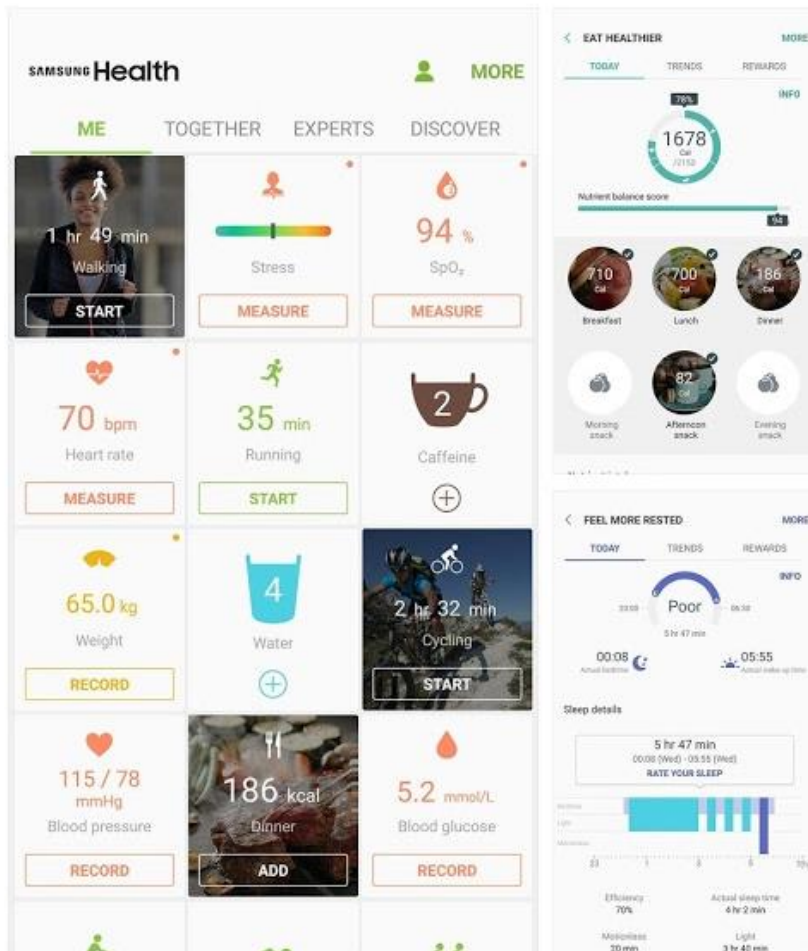

Figure 8. Samsung Health screenshot.

Figure 9. Multiple features of Samsung Health.

Table 1. Comparison of fitness apps' categories and engagement methods

App	Fitness Category	Engagement method
Fitbit	Logbook, Workout Tracking, Activity	Goals, Challenges – Interaction with friends, Awards
MyFitnessPal	Nutrition and Diet	Goals, Interaction with friends
Runtastic	Activity app	Yearly goals, Awards (pro version), Leaderboard
Pact	Logbook, Nutrition and Diet	Goals, Punishments, Monetary

Carrot Fit	Logbook, Personal Trainer	Awards, Levels, Punishments, Humor
Samsung Health	Logbook, Workout Tracking, Activity	Goals, Challenges – Interaction with friends, Awards

2.2 Comparison of user engagement methods and gamification

Gamification is defined as "an informal umbrella term for the use of video game elements in non-gaming systems to improve user experience and user engagement" (Deterding, O'Hara, Sicart, Dixon, & Nacke, 2011). In order for the users to be motivated to achieve their goals, gamification methods (basically, game concepts) are used such as lives, leaderboards, competition among friends, and awards.

1. *Goals:* Much of the apps use goals to keep the retention rate high. These goals are quite specific, e.g. walk 6000 steps. Reference [29] about personalized goals has indicated that users who use apps that emphasize personalized goals tend to be more active physically and for a longer period of time (see Figure 10). The term "personalized goal" does not refer to the goal set for an individual measurement (e.g. weight) but is a more generic term. Let's say, for example, that there is an obese person. The goal for them would be to lose weight initially, and then check all the individual goals (steps, activity, weight, calories burned/consumed) that will affect the more generic goal (i.e. to lose weight).
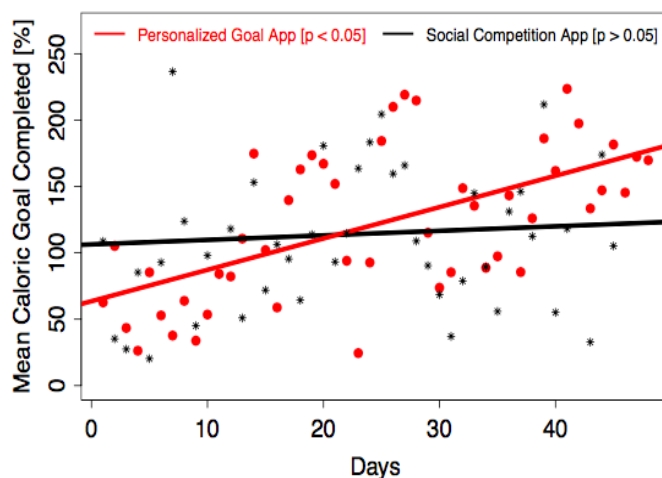
Figure 10. Goals completion using a personalized goal app vs a social competition app.

2. *Leaderboards:* Since the early times, human have always been competitive towards each other. Leaderboards on fitness apps indicate this competition among the users of a fitness app and show the rank of the users. However, here lies the question of whether leaderboards have a negative or positive effect on the users' motivation. Several studies [30] have indicated that leaderboards influence the desire to exercise, although most of them combined leaderboard with another gamification method, the rewards. Rewards were presented in many forms: points, badges or medals. The researchers observed increased physical activity and less stress. Nevertheless, there were several other researchers and studies, which indeed observed increased physical activity, but only for a short period of time, which was not extended [30].

3. *Challenges:* This way of gamification resembles leaderboard, except it may concern only the user or a group of users. The similarity with the leaderboard is referred to the challenge among a group of users. Since there is a winner of the challenge, users compete and this motivates them more to continue. It is certain that challenges are a good way to motivate the users to keep on exercising, but there is no evidence whether this refers to a shorter or a longer period [33].

4. *Social Interaction:* Applications that have a social interaction or sharing with friends tend to have a higher retention rate. Social networks, nowadays, are very popular and almost everyone has a social media account in order to interact with others. Specifically, it is believed that the social component and the feedback that users receive from their friends is enough to motivate them to continue to use the app and thus exercise more [30]. This was proved on a research. It was found that users didn't stop posting on social media, since their friends were expecting them to post [32]. Nevertheless, there is another work of research on college students, which provides different results. Half of the respondents replied that they would not combine social media and their fitness app. The rest replied that they would but they didn't. Many of them expressed negative feelings about sharing fitness data on social media. Thus, this study concludes that social media should not be used on fitness apps [16]. In any case, social interaction as a motivation method is used by the majority of the apps [31]. However, it isn't yet known whether it is a good practice or not, as opinions are very much divided on this issue.

5. *Rewards:* Rewards may be found in many forms, including: scoring system, points, badges, medals and digital rewards, in general. Rewards is one of the most common

methods (along with social interaction) to engage users to increase their physical activity or achieve their goals [30] [31]. Preliminary studies have shown that apps with reward systems have a high retention rate, because the users have another goal to achieve, namely to obtain the reward [32]. However, other studies have shown that rewards perform well and engage the user but they have no-long terms effects. Specifically, the research by Zuckerman and Gal-Oz (2014) found that there was no difference between gamified (rewards and leaderboards) and non-gamified apps [30].

6. *Levels:* In this gamification technique, the user should achieve goals or tasks in order to level up. According to the study mentioned in Social Interaction, the combination of social media and levels provides a good user experience and achieves a high retention rate [32]. The "Levels" method is not common among fitness apps [30] [31]. One remarkable observation about this technique is that it resembles a game more than other methods. We currently don't have much data to compare it with other methods, but it sounds a good way to keep users motivated, just like games do. When a gamer achieves a new level then they want to succeed in the higher level and so on.

7. *Avatar:* Avatars are more common in fitness apps than levels, but not as popular as goals, rewards and social interaction [30]. They are typically used to represent the user's image in the app. Many studies associate avatars with a high retention rate and increased motivation. Another study, which used virtual characters, found out that avatars reduced stress and anxiety, while another study with children found out that combined with rewards and levels, children started to eat healthier. Despite these facts, in another research the participants tended to be more susceptible to the gamification part rather than the fitness part of the app [30].

8. *Real World Prizes:* Real world prizes are rarely used on fitness apps [31]. The real-world prizes could vary from money to gift cards or coupons. Specifically, there is an iOS app, which applies this technique. The user collects points and then the rewards are earned via a lottery system [34]. Although it is really motivating to earn real world prizes, it doesn't seem to function. Usually the really valuable prizes are difficult to be gained and the users get frustrated and abandon the app [35]. A classic example is the app Pact, which offers money in exchange for achieving the goals, but has bad reviews.

2.3 Wearables

Wearables and devices are used daily by users. Their purpose is to automate the process of data collection [7]. Some apps do not use such devices as they use the embedded sensors of the smartphone to collect data [37]. Most of the wearables are designed for use on the wrist. Next follow some wearables that are designed to be worn around the chest. Figure 11 below shows the exact percentage of each kind of wearable that exist.
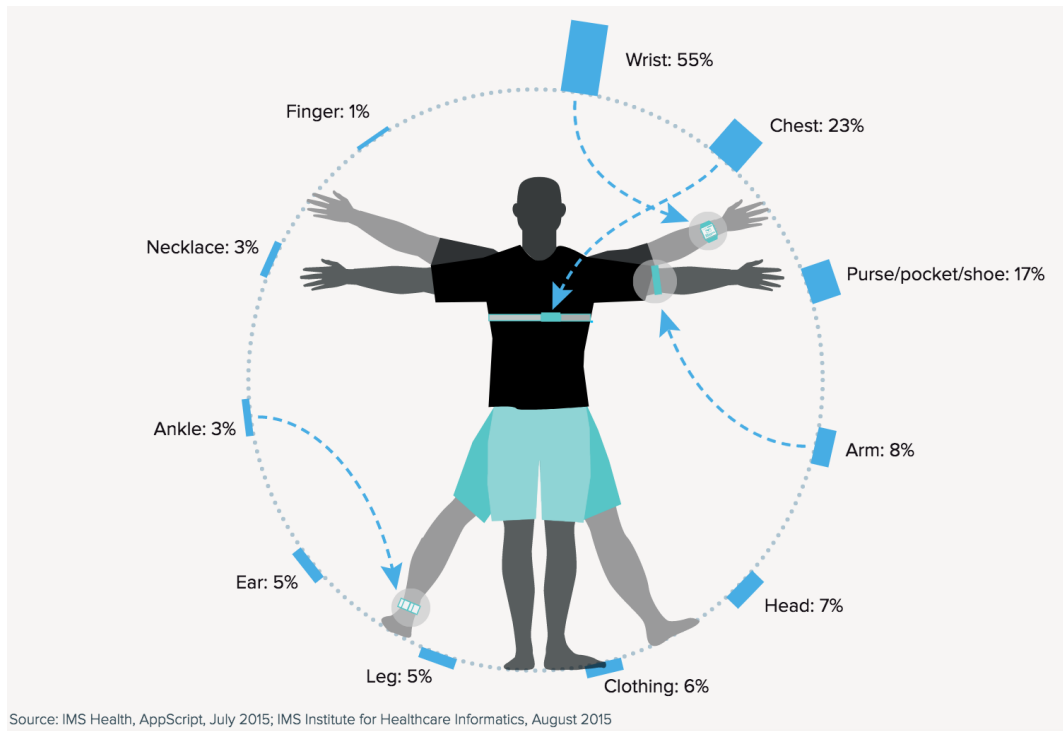

Figure 11. Body parts where wearables are used.

90% of the devices are able to connect and synchronize wirelessly with smartphones to provide data reports. Also, there are currently under development wearables that attach to the ear or a body part in order to collect data automatically in real-time, such as heart rate, blood pressure, oxygen or even blood sugar levels [7].

However, wearables still have some issues to solve. Some of them are [37]:

Accuracy: According to a 2014 of Iowa State University, where some devices were used to track calories, all the measurements from the devices were inaccurate. Definitely, the percentage of inaccuracy varied depending on the device brand, but nonetheless it cannot be neglected when we are talking about health data.

Security: Wearables and activity trackers can be hacked easily, as the majority of them transmit the data wirelessly. In fact, it is easy to connect with some of them and read the data while others have neither password nor data encryption. Another security issue is

related to location vulnerability especially on the devices that use Bluetooth LE. A threat could easily find the location of the user in case the device is hacked.

Motivation: Wearables by themselves are unable to motivate the user to follow a healthy lifestyle. Thus, the best option is combine them with an application that provides the motivation for the user in order to follow a plan and become healthier.

All in all, there are many fitness apps in the market, which all offer features to improve the lifestyle of the users. However, most apps have many features that confuse the user, especially if they are middle-aged. Hence, there is the need for a fitness app, which will have a simple uncluttered interface, connect to a wearable device and organize the user's weekly schedule with a plan. We decided to develop a fitness app that will implement these principles. Our fitness app will belong to the following fitness app categories (based on Table 1): Logbook, Nutrition and Diet. In the next chapter, the technologies and tools used for the development of this app are described.

3 Methodology

The platform that the application runs on is Android. It was selected from the beginning since the application would be able to communicate with a wearable via Bluetooth LE and the Android platform has a rich documentation with respect to BLE. Of course, to avoid compatibility issues, the app was developed in a native programming language (Java). Although developing in native programming language is more challenging, it also ensures high performance and ultimate user experience [38].

3.1 Android

Android is an open source mobile operating system developed by Google [39]. Android OS is based on Linux kernel, currently at version 3.18 [40]. The latest version of Android is the 8.0 (Oreo). Android's version names are given different names of sweets related to the versions' initials [41]. Currently, the most commonly used Android version is 6.0 Marshmallow (32% usage) and then 5.0-5.1 Lollipop follows with a 27.7% (the numbers are found on developer.android.com/about/dashboards and the data is collected during a 7-day period ending on October 2, 2017) [42].

Our app's minimum SDK version is 5.0 Lollipop. The BLE cannot be used on versions prior to 4.4 Kitkat, but ultimately 5.1 Lollipop was decided to be the minimum supported version because not all the support's library UI components and animations are supported on previous versions. Given the data usage from "Android Developers" [42], most devices are supported.

The app was developed using Android Studio, which is the official IDE, based on JetBrains' IntelliJ IDEA, designed for Android development [43]. The latest version of Android Studio is the 3.0 version, which was released on October 25 2017 [44]. Two of the Android Studio's important features, which are included in all versions, are the Gradle build support and the emulator to run and debug the applications. Gradle is a build automation system to deploy and integrate the software easily [45]. The development language used is Java, which is used by the majority of developers for Android applications. All Java 7 features are supported as well as a subset of Java 8 features, which

vary by platform version. The developers could use Java 7, but Java 8 is still needed for compilation [46]. In our project Java 8 is used, although not all features are supported. Java 8 has a lot of benefits over Java 7, including [47]:

1. Java 7 is no longer supported by Oracle.

2. It is faster in terms of performance, garbage collector and fork/join improvements.

3. Fewer lines of code.

4. Lambda expressions simplify the code and make it more readable.

5. New methods on collections.

6. Streams to easily query and manipulate data.

7. Optional types to minimize Null Pointer Exceptions.

The last three features are supported only on platforms 7.0 Nougat and above and are not used in this project, but we can still benefit from the other ones.

3.2 Architecture

Every project should use an architecture so that the code can be organized better. The choice of an architecture is not specific and depends on the application's requirements. The benefits of working with an architecture pattern are [48]:

Simplicity: The debugging is easier, because the role of each component is specific. So, each class does not contain a big number of functions that are difficult to keep track of.

Testability: Unit tests are easier to write because the logic is simpler.

Maintenance: As we mentioned it is easier to keep track of the functions. Thus, the easier to keep track, the easier to maintain and add new features to the application.

Currently, the most popular architectures in the Web for Android are MVC (Model – View – Controller), MVP (Model – View – Presenter) and MVVM (Model – View – ViewModel) [48].

3.2.1   MVC

In *MVC* pattern data model is separated from the view and they communicate via the controller. To be more specific, the model is responsible for handling the business logic and the data. The view is responsible for visualizing the data from the model. Last, the controller contains the functions and the logic to update the view when an action is triggered (Figure 12) [49].
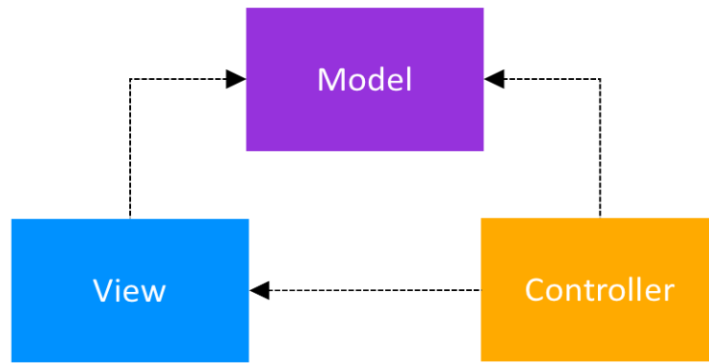
Figure 12. MVC architecture.

Figure 13. MVC Example in our application.

In Figure 13, an example is presented. In this example, there is the view, which notifies the controller when an event happens (e.g. a button is pressed), then the controller interacts with the model to retrieve and next setup and refresh the view.

MVC separates successfully the view from the model, however the controller has some disadvantages such as flexibity and maintenance issues. Controllers are tightly coupled to the views, which makes them less flexible in changes. This means that if the view changes then the controller must change, as well. As for the maintenance, over time more and more code is written in the controller, which makes it difficult to keep track. The solution to the above issues is to use another architecture pattern such as MVP or MVVM [50].

3.2.2   MVP

MVP is essentially similar to MVC although it uses a presenter instead of a controller. Let's take a look again at our previous example. In case MVP was used, the DashboardFragment would be a view component and the presenter replaces the controller with a DashboardPresenter class, which contains all the functions and the logic to update

the view. The model does not change. However, it doesn't differentiate much from MVC so the problem of maintenance still exists, because the Presenter class over time may be a huge class [50].

3.2.3   MVVM

In *MVVM*, there is no controller or presenter, but a ViewModel class. This class implements all of the functions needed and the difference from the other two patterns is that the data binding happens in xml using ViewModel class. The data from model are saved in "Observable" objects. In this way, the testing is much easier because there is no dependency on the view. All one has to do is to verify that the observable objects have changed when the model changes. However, the problem of maintenance still exists, because extra logic is added on xml files, which can make them bloated [50].

3.2.4   Conclusion

It seems that MVP and MVVM have fewer disadvantages than MVC, but they add more complexity to the app. They may, theoretically, solve the problem of flexibility but the problem of maintenance still exists. In any case the difference in flexibility is the degree of the coupling between the view and controller (MVC), the view and presenter (MVP) and the view and ViewModel (MVVM), namely the coupling in MVC is tighter than in MVVM, but it still exists. Our point is that the developer still would make changes in the controller/presenter/viewmodel, if a change in view is needed. Therefore, there is not really a difference between these patterns; the logic is the same. We chose for our application the MVC pattern, because the other ones add more complexity.

3.3 Bluetooth Low Energy

Bluetooth is a wireless connectivity technology used to transfer data between devices. There are two types of Bluetooth: Basic Rate/Enhanced Data Rate (BR/EDR) and Low Energy (LE) [36].

Bluetooth BR/EDR is designed for continuous wireless connections between one-to-one devices, using point-to-point topology. This makes it ideal for streaming data applications [36]. The "classic" Bluetooth is applicable in wireless headsets or hands-free devices, wireless keyboards and printers or wireless speakers [51].

Bluetooth Low Energy (BLE) is designed to transfer small amounts of data, connecting wirelessly for a short period of time. It uses point-to-point (one-to-one connection), broadcast (one-to-many) or mesh (many-to-many) topologies [36]. The main difference between the BR/EDR is the low power consumption, as the name of BLE indicates, and this makes it the perfect candidate for many-to-many devices connections, which will transfer data periodically. It is applicable on Health care (e.g. blood pressure monitors, blood glucose monitors, heart rate monitors), on Fitness (running/cycling speed, pedometer, location), on Industrial monitoring or Proximity sensing (sensors, iBeacon) and Public transportation apps [51] [52].

Currently the following mobile operating systems are supported:

1. iOS 5 or later [53]

2. Windows Phone 8.1 [54]

3. Android 4.3 or later [52]

4. BlackBerry 10 [55]

3.3.1 Concepts and Implementation

Characteristic: Characteristics are types analogous to a class, which contain a single value. For example, the Heart Rate Control Point's characteristic is the value "0x2A39" [52] [56].

Descriptor: Descriptors are attributes that describe a characteristic value [56]. Specifically, it may be a description or an acceptable range value or a unit for a characteristic [52].

Service: A service is a collection of characteristics [52]. For example, the Heart Rate Control Point characteristic is included in Heart Rate service [57].

Attribute Protocol (ATT): It is a protocol that defines the concept of attributes. All attributes are specific and are identified uniquely by a UUID, which is described by a 128-bit format string. Attributes are formatted as characteristics and services.

Generic Attribute Profile (GATT): It is a specification for sending and receiving data "attributes" over a BLE link. There are many profiles for BLE devices. A profile describes a use case based on a functionality and they contain services [58]. For example, a device could have a profile with two services, a heart rate monitor and a battery level detector [52].

Example based on our implementation:

The Xiaomi mi band has a profile with service "Heart Rate".

"Heart Rate" *service* has an attribute: 0000-1000-8000-00805f9b34fb (this uuid is the same for other services, too) and a value: 0x180d. UUID: 0000180d-0000-1000-8000-00805f9b34fb.

This service contains a *characteristic* which is called "Heart Rate Control Point". This characteristic has, also, an attribute: 0000-1000-8000-00805f9b34fb (same with the service) and a value: 0x2A39. UUID: 00002A39-0000-1000-8000-00805f9b34fb.

The service's *descriptor* is the "Client Characteristic Configuration", whose attribute is: 0000-1000-8000-00805f9b34fb and value: 00002902. UUID: 00002902-0000-1000-8000-00805f9b34fb

So, in order for our application to connect and retrieve data from the Mi Band device it should have the knowledge of the above "concepts". Specifically, the steps that should be followed are [52]:

The first step is to connect to the BLE device by connecting to the GATT server on the device. In order to connect to the device, we use the *connectGatt(Context context, boolean autoConnect, BluetoothGattCallback callback)* method available on the *BluetoothDevice* class, which is obtained after Bluetooth scan and pair. This method connects to the GATT server and returns a *BluetoothGatt* instance, which is used to communicate with the device. The *BluetoothGattCallback* is used to deliver the results to our application. This means that the Android app has connected to a GATT server and discovered services, and now it can read and write attributes.

Next, the developer can get the service (*BluetoothGattService*) from the *BluetoothGatt* instance using its uuid and can then write or read a characteristic (*BluetoothGattCharacteristic*) to the service using again the uuid of the characteristic. Depending on the type of characteristic the action should be read or write. The results are delivered to the BluetoothGattCallback.

Example of writing:

```
BluetoothGattCharacteristic characteristic =
        bluetoothGatt.getService(serviceUUID).getCharacteristic(characteristicUUID);
characteristic.setValue(value);
```

```
bluetoothGatt.writeCharacteristic(characteristic);
```

Example of reading:

```
BluetoothGattCharacteristic characteristic =
      bluetoothGatt.getService(serviceUUID).getCharacteristic(characteristicUUID);
bluetoothGatt.readCharacteristic(characteristic);
```

3.4 Other Libraries

For the development of the application, the Support Library of Android and other third party libraries were used, which are popular to the development community as discussed in Stack Overflow, an online community for developers to ask questions, learn and share knowledge [60]. Of course, all of them are open source.

3.4.1 Android Support Library

The Support Library provides a wide range of classes from fundamental app components, to user interface widgets, media handling, TV app components etc [65]. The library also handles the backwards compatibility among the multiple API versions (OS versions) of Android, when new features are added or older features are improved. Initially, the support library was a single library, but it gradually evolved into a suite of libraries, which are fundamental for the development of the application [66], especially if the developer wants to follow the Google's guidelines of Material Design.

In this project the following libraries of Support Library were used:

1. *App Components:*

'com.android.support:support-v4:25.3.1'

'com.android.support:appcompat-v7:25.3.1'

These libraries are used in all Android projects, as they provide backwards compatibility for core platform classes and features, such as Activities and Fragments (support) and Toolbar (appcompat) [65].

2. *Material Design:*

'com.android.support:design:25.3.1'

They provide components for implementing the Material Design guidelines [65].

3. *Graphics:*

'com.android.support:support-vector-drawable:25.3.1'

They provide support for vector drawables implementation in the application. The benefit of vector drawables is that multiple PNG images can be replaced with a single vector drawable defined in xml [65].

4. *ConstraintLayout:*

'com.android.support.constraint:constraint-layout:1.0.2'

This library provides the ConstraintLayout UI component, which allows the development of a responsive layout in an Android application [67].

5. *CardView:*

'com.android.support:cardview-v7:25.3.1'

This library enables the support of the CardView component, a rectangle view, which can be customized easily with a set of properties, such as rounded corners, shadow etc [68]. Before the integration of this library, the developers had to develop by themselves all these features.

3.4.2 Snappy DB

Snappy DB is a key value database library for Android. It's an alternative to SQLite. Primitive types, Serializable objects and arrays can be stored on Snappy DB. It is based on leveldb, developed by Google Inc. and it uses kryo library, by EsotericSoftware, to store the values. Also, it uses the Snappy compression algorithm in order to achieve a good compression rate. In this way the data stored would occupy less space. Last, for better performance it uses native code [59].

In this project, Snappy DB was used to store user preferences and user data, such as weight, steps, fitness plan's details etc. As mentioned, it is very easy to develop a persistence app with Snappy DB, because it can store an object as it is, in contrast to SQLite, where someone should create tables and foreign keys. Even the process of retrieving the objects in SQLite is challenging. Another advantage over SQLite is the fact that Snappy DB uses compression and in this way the app won't occupy much space on the smartphone. The most significant advantage of Snappy DB is that it outperforms SQLite in read/write operations. Figure 14 shows the big difference [59].
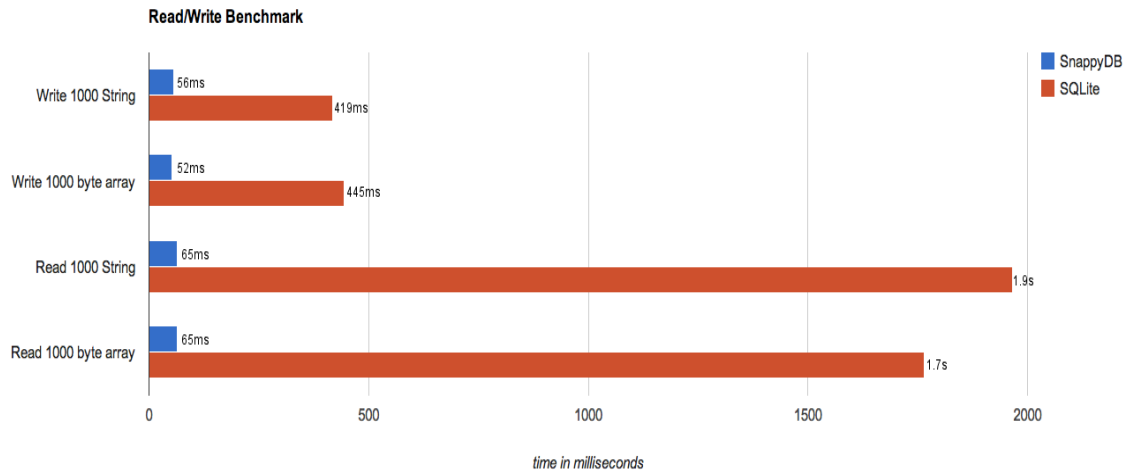
Figure 14. Speed advantages of Snappy DB over SQLite.

3.4.3 MP Android Chart

MP Android Chart is an Android chart library and it is chosen in this project for the representation of the charts such as steps, weight, nutrition etc. It supports 8 different types of graphs, as well as combined charts such as line and bar chart combined, the type that was used in this project [61]. The library provides many features for customization, making it the ideal candidate for the project. Other libraries were used, as well. Specifically, GraphView and AndroidPlot were used, but they were not as customizable as MP Android Chart, which has more features. After some research, most developers in Stack Overflow mentioned MP Android Chart to be the best of them. Hence, MP Android Chart was chosen. The library is developed by Philipp Jahoda and it is constantly improving and being enriched with more features.

3.4.4 Apache Commons Lang

Apache Commons Lang is a library that provides utility classes for Java projects. The standard Java classes do not provide enough utility methods to develop basic functionalities and the use of a library is needed. The library provides helper classes for String manipulation, numerical functions, object reflection, concurrency, creation and serialization, System properties, as well as Date helper utility classes [62]. In this project this library was used, because utility methods for String and Date manipulation were needed. There are, also, other utility libraries (e.g. Collection manipulation, Math functions, file functions etc.) under the Apache Software Foundation license.

3.4.5　Joda Time

Joda Time is another library used in this project. It provides date and time utility methods, since the standard date and time classes prior to Java 8 are poor and although the project is in Java 8, not all features of Java 8 can be used in Android [63]. Joda Time's most noteworthy features are [63]:

1. Easy to use and simple.

2. Easy to extend.

3. Up-to-date.

4. Performance.

5. Good test coverage.

6. Documentation.

7. Maturity, because it has been developed since 2002.

8. Open Source (under Apache License) [64].

Nevertheless, a library could not have all the desired features, as expected, so some functions for Date comparison from Apache Commons Lang were used.

3.4.6　Pixlr

Pixlr is a free browser photo editor and it is used as a free alternative of Photoshop. In this dissertation, Pixlr was used to edit icons and images for the fitness application.

In addition, the app icons were downloaded from www.flaticon.com, which provides free and paid icons. We used for our application free icons.

All the above were the tools and methods used in the implementation of our application. In the next chapter, the features of this application are going to be explained.

4 Implementation
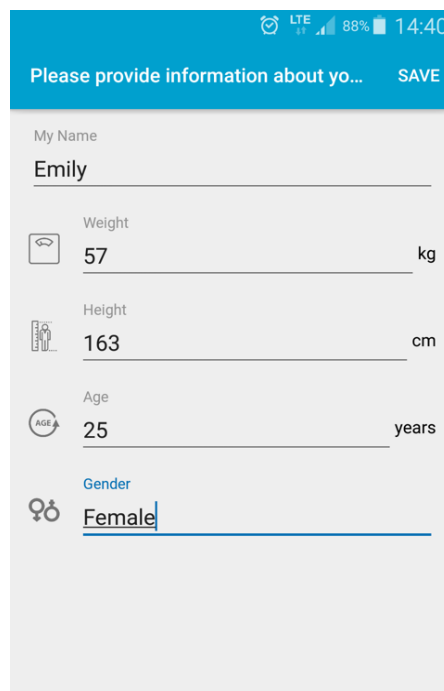
4.1 Features

We developed an application which aims to help people stay fit and monitor their progress through graphs and charts. The app uses various techniques to engage its users, such as setting goals, which have proved to be efficient [29]. In general, the app can help someone to organize their daily activity and meals, as well as monitor their sleep and water intake. More details are going to be presented in this chapter.

First of all, the name that we chose for our application is MyFitnessPlan. There were two reasons why this name was chosen. Firstly, because the main idea of the app is that each user creates a "Fitness Plan", which helps them to stay fit. Secondly, the name is similar to a popular fitness app, MyFitnessPal, so it is easier to memorize. In Figure 15, the app icon is also presented. The app icon, clearly, shows that the app is about health and fitness.

Figure 15. The MyFitnessPlan logo.

Figure 16. Personal user information.

When a user uses the app for the first time, a new profile screen is shown, which prompts the user to fill in some information about themselves (Figure 16). This information is needed, so that the app can do some calculations, such as calories burned etc. The calculations will be explained in subsequent sections.

After the information is provided, the Dashboard screen is shown to the user. The Dashboard screen is our home screen and a visual overview of the user's activities and progress for the current day.

4.1.1 The idea of Fitness Plan

Now let's review better the idea of a fitness plan. As mentioned, this idea helps the user to set goals and monitor if the goals are achieved. A fitness plan consists of the measurements the user should take, a date which indicates the period of the fitness plan and a name. The "measurements" are daily steps, weight, daily calories consumption, daily sleep hours, daily water consumption. Also, the user can set the weekly number days, they wish to exercise. The name of the fitness plan is not related to the measurements; it is only an additional identification information to help the user. The user sets goals for each of the aforementioned measurements.
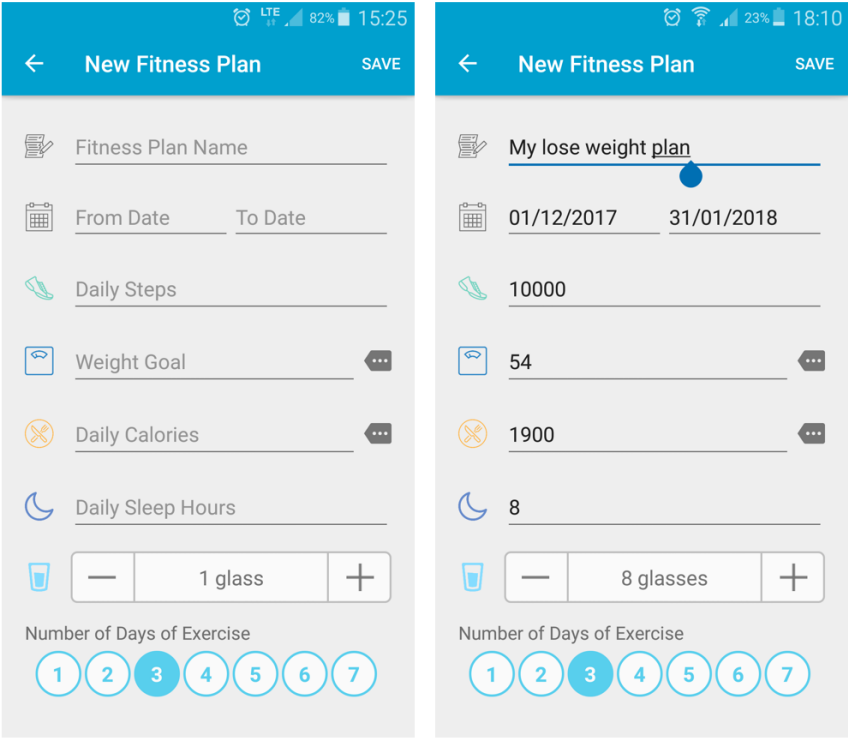
Figure 17. Creation of a new fitness plan.

After researching the existing mobile applications (Chapter 2), we chose to combine different measurements used in existing fitness apps. According to a study [15] about mobile health apps, the most popular types of mobile health apps are those logging physical activity (pedometer and workout), food, hydration and sleep logging.

Figure 17 shows the creation of a new fitness plan. Next to weight and daily calories, there are two buttons. The functionality of these buttons has to do with the user's ideal weight and daily calories consumption. This functionality was added, because most people do not know their ideal weight or ideal daily calories consumption. So, it would be very helpful for someone. In Figure 18, we can see the result if those two buttons are selected.
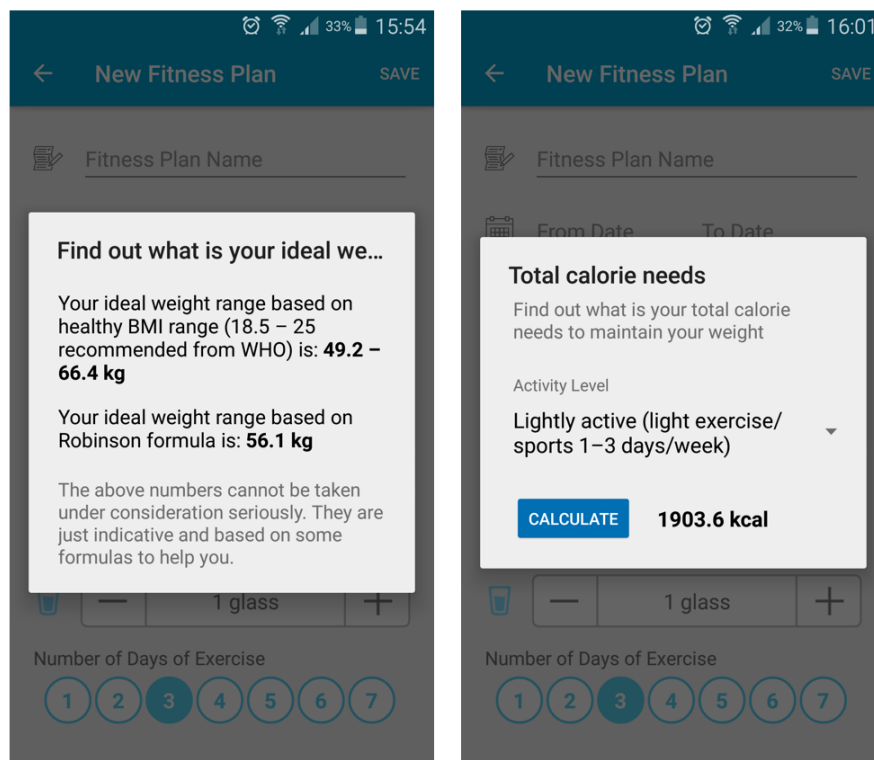
Figure 18. Ideal weight and calorie intake.

First, for ideal weight calculation, we decided to use the BMI (Body Mass Index). BMI is the body mass index, it is recommended from WHO and it is used worldwide to determine a person's nutritional status, for example if someone is obese. It is defined as a person's weight in kilograms divided by the square of the person's height in meters (kg/m2) [69]. The healthy BMI range, according to WHO [69] is 18.5 – 24.9. What we did was to take this range and calculate the ideal weight provided we have the user's height (in user's profile). So, the formula for ideal weight is defined as the healthy range BMI divided by the person's height in meters. Therefore, a weight range is shown in the

screen of our app. Next, we investigated whether the weight range would confuse some users, because it doesn't provide a specific value but only a range. So, a research was performed based on formulas that calculate ideal weight. Based on [70], the most popular ideal weight formulas are the Devine (1974), Robinson et al. (1983) and Miller et al. (1983). In Table 2, the equations of the aforementioned formulas are presented. In our app, we used the Robinson formula, because it has the lowest percentage error [70].

Table 2. Formulas for ideal weight.

Devine	men: 50 kg + 2.3 kg per inch over 5 feet
	women: 45.5 kg + 2.3 kg per inch over 5 feet
Robinson et al.	men: 52 kg + 1.9 kg per inch over 5 feet
	women: 49 kg + 1.7 kg per inch over 5 feet
Miller et all.	men: 56.2 kg + 1.41 kg per inch over 5 feet
	women: 53.1 kg + 1.36 kg per inch over 5 feet

For the calculation of daily calories consumption or total needs consumption, the Harris benedict equation was used. It is defined as the BMR (Basal Metabolic Rate) multiplied by an activity factor (Table 3) [72] [73].

Table 3. Activity factor used in determining calorie consumption.

Activity	Factor
Sedentary (little or no exercise)	1.2
Lightly active (light exercise/sports 1–3 days/week)	1.375
Moderately active (moderate exercise/sports 3–5 days/week)	1.55
Very active (hard exercise/sports 6–7 days a week)	1.725
Extra active (very hard exercise/sports twice a day)	1.9

The BMR estimation formula is different between men and women and is defined as [74]:

For males: 66.47 + (13.75 * weight) + (5 * height in cm) - (6.76 * age) **(1)**

For females: 655.09 + (9.56 * weight) + (1.85 * height in cm) - (4.68 * age) **(2)**

After the successful creation of a fitness plan, the user can check the values they set in the same tab (Figure 19). Last, the user can delete their fitness plan and create a new one.
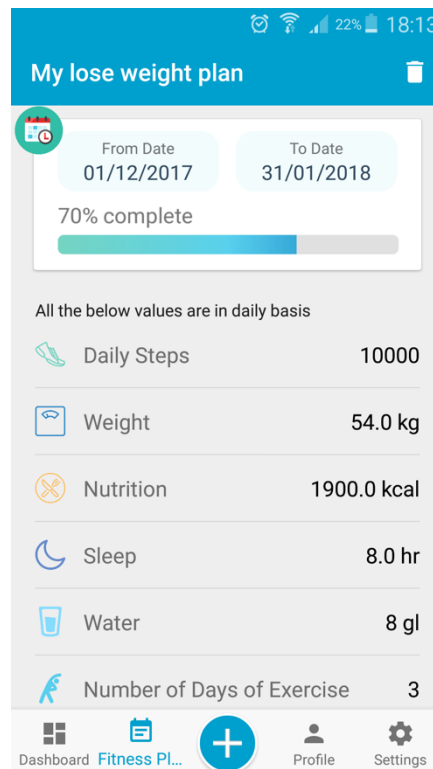
Figure 19. A finalized fitness plan.

4.1.2   Dashboard Screen

Having explained the idea of a fitness plan, we continue to the Dashboard screen. It is the main screen of the app and provides valuable information for a user. If the user has not created a fitness plan, then the app notifies them to create one (Figure 20).
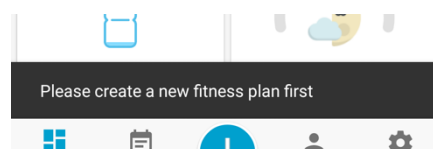
Figure 20. The app notifies the user to create a new fitness plan.

The Dashboard screen provides information about the daily progress of the user's measurements (Figure 21). This information is presented in cards as it is more visually pleasing and the content is more organized [75]. Weight, calories, water intake and sleep

have only the today value, but steps and exercise have some extra information. The "Steps" card shows information about distance walked and calories burned and "Exercise" card shows how many days the user exercises and information about the duration of exercise and calories burned.
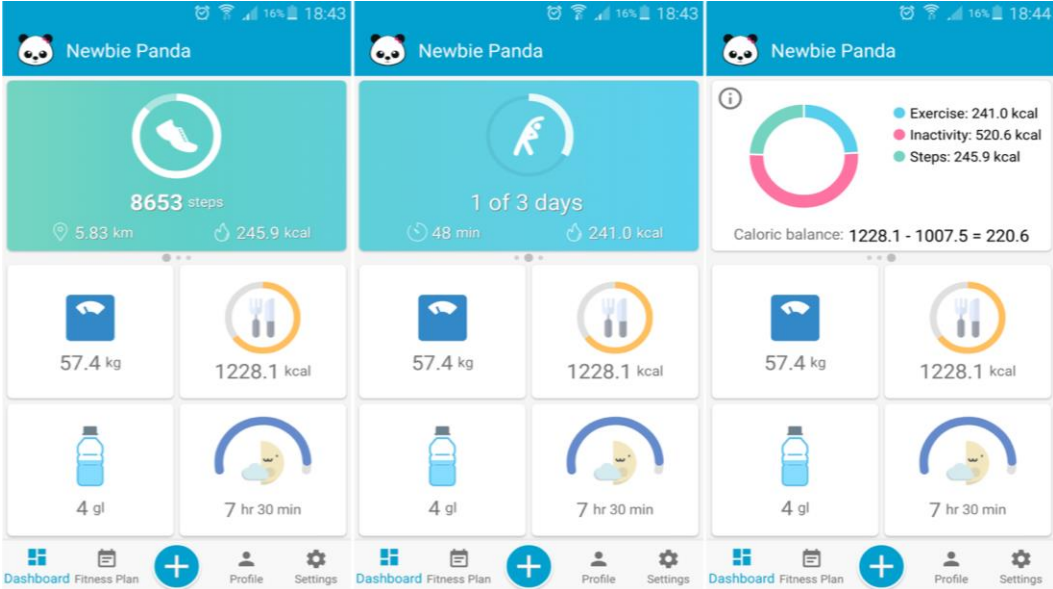
Figure 21. Dashboard screen cards.

Figure 22. Caloric balance information.

There is another card, which shows the calories burned in total regarding all the activities the user has completed today. The important part is that it shows the total calorie balance, which helps users to control their weight. The total caloric balance is defined as (calorie

intake − calorie burned). The info button ⓘ in the top left corner in caloric balance card (Figure 21) shows information about caloric balance (Figure 22). The navigation through these cards (steps, exercise days and total calories) is done by swiping left and right.

4.1.3   Explanation of "Measurements"

Next, we continue explaining further the "measurements" of the fitness plan. The user should daily log the steps, the exercise, the weight, the food, the water intake and sleep. Although, it is not automated enough, the user is not obliged to log these values every day. However, it is recommended practice for the better control of their fitness status. The user can log a value by selecting the plus (+) button in the middle of the bottom menu (Figure 21).
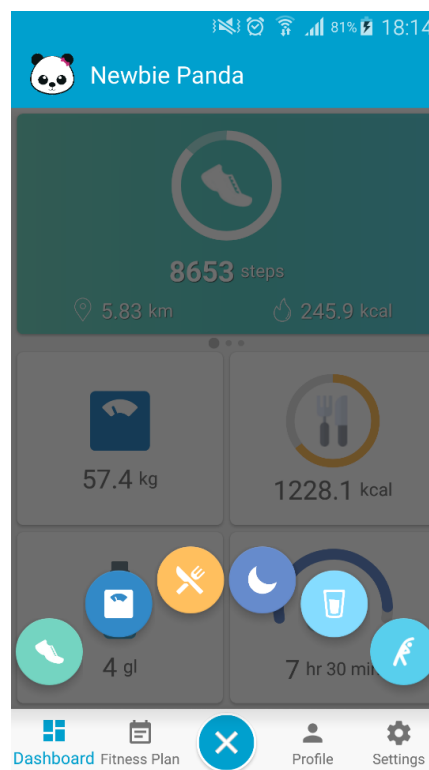
Figure 23. Select a measurement to log a value.

The user can select a button among, steps, weight, food, sleep, water and activity (exercise or activity or inactivity) to log a value (Figure 23). By selecting a card (e.g. steps card) on Dashboard, charts are available for each measurement so that the user can monitor their progress. The user can select to see the progress of the week, the month or three months by selecting the calendar icon on the top right corner (Figure 24.). There is a red line that indicates the user's goal, which was set in fitness plan. Below the chart, a list with the dates and the respective values is displayed. The values are grouped by weeks.

In Figure 24, the chart for steps is shown. In addition, each measurement has a specific color. For example, the color of steps is the color displayed in Figure 24. Same applies to all measurements. The colors can be found also in Figure 23.

Figure 24. Steps chart.

More specific information is detailed below about all the measurements:

1. *Weight*: The current weight is displayed on the Dashboard (Figure 21) and on the user's profile, as well. The user can log their weight in the "Log Weight" screen (after selecting the respective button in Figure 21) and then select the date of weight. The default date is today. A weight chart is provided to monitor the progress.

2. *Food*: The today's calories consumption is displayed on the Dashboard (Figure 21). The user can log their food, in "Log Food" screen (after selecting the respective button in Figure 21). For food log, the user should select the food, they ate and the food weight and then a date. The default date is today. The app, then calculates the calories consumption for the selected food. In order to see an overview for the week, month or three months, a chart is available. Lastly, it should be noted, that for the foods and calories consumption a free food database was used, called FSANZ. FSANZ stands for Food Standards Australia New Zealand and it is, also, a part of Australian Government's Health Portfolio [82]. This database was the best choice, because it provides a wide range of foods as

structured data, whereas others provided HTML tables or they lack of foods (e.g. Hellenic Health Foundation).

3. *Sleep*: Dashboard displays the total sleep hours for last night. The user can log their sleep hours in "Log Sleep" screen (after selecting the respective button in Figure 23). The user selects the bed time, namely the time that they went to sleep and then selects the wake-up time and a date. By default, the date of sleep is today and it refers to the bed time date. Then the app calculates the total sleep hours. Users can see their daily sleep hours in a chart.

4. *Water*: Water is also displayed in Dashboard. More specifically, a bottle of water is displayed and if the user accomplishes the goal of fitness plan, the bottle fills. Users can log their water intake, in "Log Water" screen (after selecting the respective button in Figure 23). With the help of a number picker, the user can quickly and easily log the daily glasses of water. By default, the date is today, unless the user wants to log for past dates. The everyday water intake is, also, displayed in a chart.

5. *Activity*: By the term activity, we mean the exercise or inactivity (e.g. watching television) or other activities (e.g. wash dishes) that the user does through the day. In Dashboard there is a car which displays the total days of exercise, meaning the goal set in fitness plan and the days that the user has exercised (e.g. 1 of 3 days). The duration and calories burned for today's exercise are displayed in the same card (Figure 21). But why do we mention the other activities and include the exercise in there, too? That is because, exercise is an activity and all activities result in burnt calories. As mentioned, we calculate the total caloric balance in a day. A person does not burn calories only by exercising. However, the exercise is visually separated from other activities, because it burns more calories and it helps people stay fit. The visualization of this better motivates the user to continue exercise. As for other activities, we need only the information of calories burned, which is displayed in the calories card (Figure 21). Nevertheless, an activity is logged in the "Log Activity" screen, where two tabs are displayed, namely "Exercise" and "Other". As mentioned, the other tab concerns other activities and inactivity. To log an activity, the user selects the activity category, then the specific activity and then the duration in hours or minutes. The app calculates the calories burned. This applies to all cases.

The calories for each activity are calculated differently for men and women. The formula to calculate how many calories were burned is [77]:

Calorie burn $=$ (BMR/24) * MET * duration **(3)** where:

BMR = Basal Metabolic Rate (already explained in equations 1 and 2),

MET = Metabolic Equivalent for the selected activity. It is a level factor, which indicates the energy cost of an activity. METs are standardized by The Compendium of Physical Activities [78],
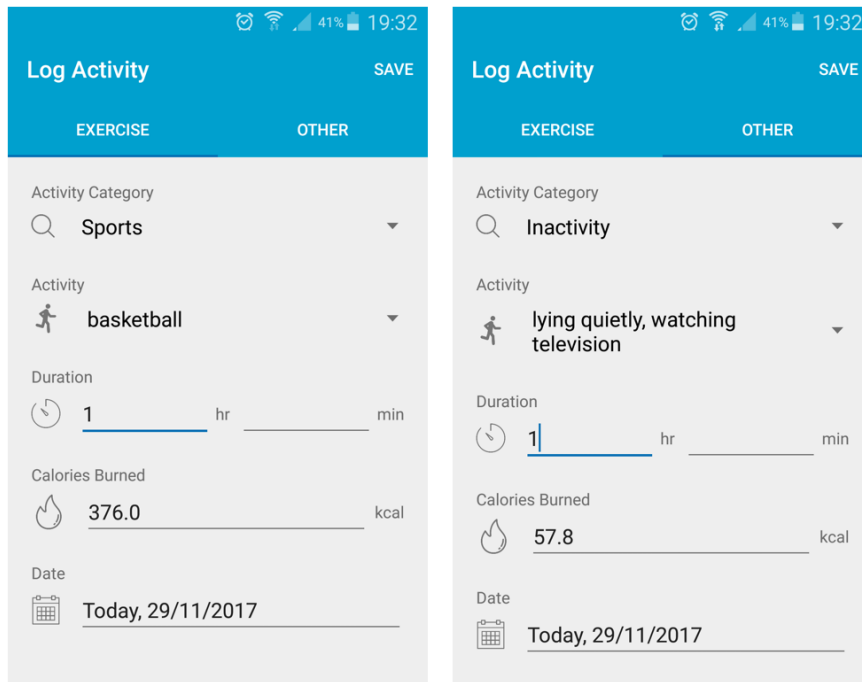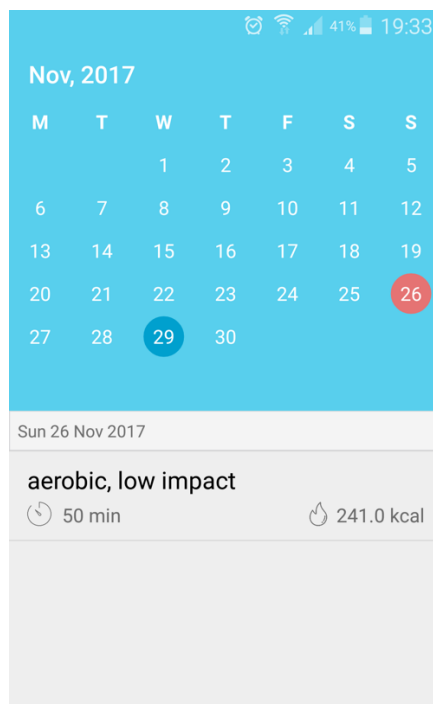
Duration in hours.

Figure 25. Activity Logging.

Figure 26. Display of past activities.

So, the calories burned number, except for activity level and duration, is related to weight, height, age and gender.

Contrary to other measurements (weight, water etc.), where a chart is displayed for details, in exercises, the app displays a calendar. The user selects a date and the app displays a list of exercises for the selected date (Figure 26).

6. *Steps*: Steps taken daily are displayed in Dashboard. It is, also, displayed the distance walked and calories burned information for the user. The distance walked is calculated from the stride length multiplied by the number of total steps. The stride length for the user is calculated by multiplying the user's height by 0.413 [79]. The same formula that was used in exercises was also used for calculating the calories burned in steps. However, the problem in steps is that we don't have the duration and the walking speed, which will give us the MET value to calculate the calories burned. As for the duration the solution was simple. There is the basic physics formula speed = distance/time and we could find the time using this formula. So, if we found the speed, then we could calculate the calories burned for walking. Still, we couldn't find the walking speed of the user, but we could use the preferred walking speed in general. So, our solution was to use the preferred walking speed as default and add a feature, where the user could change their average walking speed. Based on [80] [81], we discovered that the preferred or average walking speed is 5.0 km/h. The Compendium of Physical Activities provides a MET value for 4.8 km/h walking speed, so this speed is used by default.

As a result, we calculate the duration (average) from the formula:

time = distance/speed where,

distance is the calculated distance from stride and speed is the preferred walking speed.

Then, we calculate the calories burned from the calories burned formula (equation 3).

The logging of steps can be done manually or automatically. The manual way is the same as the other measurements: a "Log Steps" screen appears, where the user can log the number of steps walked. The automatic way is done by the Xiaomi's Mi Band 1S (activity tracker). The app provides a feature to the user, where they can connect their Mi Bands and synchronize their steps with the app. The Mi Band feature is explained in the next section.

4.1.4   Mi Band Integration

Users who own a Mi Band 1S can connect it with the app and then synchronize their steps (Figure 27). Mi Band 1S is an activity tracker by Xiaomi, which measures somebody's steps [83]. It is connected via BLE (Chapter 2) with a smartphone and it transfers data, in our case the user's steps.

Figure 27. Mi Band.

The user can pair their Mi Band in the Setting of the app. Then the app asks permission to turn on the device's Bluetooth in order to search for available Mi Bands. If the user turns on the Bluetooth, then a list of available Mi Bands is displayed. Then the user selects their Mi Band from the list. Next, Mi Band should pair with the smartphone and the user should be authorized in order to retrieve the data. The app displays a screen to show the pairing process. At the same time Mi Band device will flash and vibrate indicating that needs pairing. The user should tap the Band a few times in order to authorize the pairing with their smartphone (Figure 28). After this procedure the device is paired with the user's smartphone.
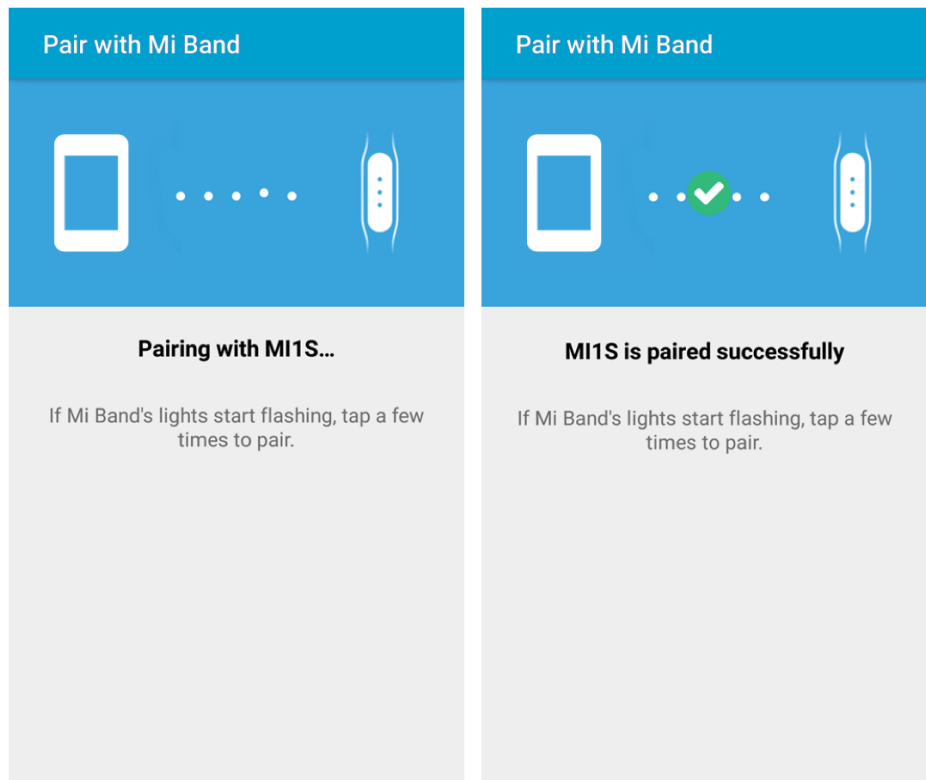
Figure 28. Connecting the app to the Mi band.

After the successful pairing, if the user goes to Settings screen and selects Mi Band, details about the Mi Band will be displayed, such as battery, MAC Address and an option to unpair the Mi Band.

Next, the user can synchronize their steps with the app. This option is available in the Steps screen. When the user selects the "Mi Band" button on the top right corner, next to calendar button (), a dialog shows and starts to synchronize with the device showing the progress percent. Undoubtedly, if the Mi Band is not close to the smartphone, then it can't connect with it. After the successful synchronization, the steps are saved to user's smartphone and the chart it updated with new values.

4.1.5   User Profile

We first explain that when a user starts the app for the first time, a new profile screen appears (Figure 17). The user should complete the fields and save their profile. Then, the profile screen is accessible via the bottom menu. The profile of a user appears in Figure 29.
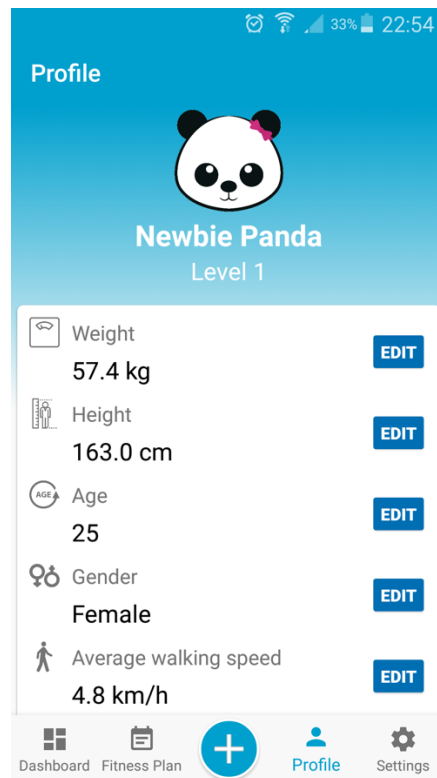
Figure 29. User profile information.

The user profile contains information such as weight, height, age, gender and average walking speed, which are needed by the app to do calculations about the measurements, such as calculate calories burned or calculate ideal weight (all functions described above). In addition, the user's level and avatar shows in profile screen.

4.1.6　Levels and Avatars

The motivation of the user is an important feature for a fitness app. There are various techniques that can be used (mentioned and compared in Chapter 2), which help the user stay motivated to continue using the app. For our application, we chose levels and avatars, as well as, goals.

First of all, creating an everyday plan and setting goals helps a user to organize better their fitness activities. In our app, the user creates a fitness plan and sets goals. This will organize their program and help them to start exercising. Definitely, it is better for an amateur user not to set high goals and overestimate their powers, because they may be disappointed (high chances not to succeed) and lose interest in the app.

Moreover, we chose to include levels as an engagement technique for two reasons. Firstly, because it is clearly a gamification technique and it is known that games with levels can be very addictive. So, in this case the user would want to level up and discover what the next level of MyFitnessPlan is. Secondly, we chose levels, because not many apps use it, making our app unique in a way. Each level is given a unique name. If a user completes the fitness plan successfully, then they level up, otherwise they level down. For the purpose of this dissertation 2 negative and 4 positive levels were created. A new user starts at Level 1 (Table 4).

In combination with levels, the app uses avatars to achieve a higher retention rate. As mentioned in Chapter 2, levels and avatars are a good combination to motivate the users. Many fitness apps use avatars as photo profiles of the user. In these apps, users can change their avatar whenever they want to. The difference in our app is that avatars are connected with levels. So, every time a user levels up or levels down the avatar changes too. Also, the names of levels are related to avatars and this means that levels become visualized. Visualization makes anything more comprehensive and more familiar. The more familiar something is, the more someone wants to be occupied with it.

The user's avatar and level name is visible in Dashboard screen (Figure 21), which is the home screen of the app and visible in Profile screen (Figure 29), too.

The initial thought for level names was to have names that are humorous and users would find them humorous. But, then we had the problem of finding humorous avatars online that would match the level names. The only solution was to make our own custom avatars. The problem with custom avatars is that they are difficult to create and they additional software, such as Adobe Illustrator, which is not free. After searching online in various websites (www.iconfinder.com, www.flaticon.com, www.freepik.com) that provide free images, we decided that the best approach would be to include avatars and names related to animals. So, we discovered some funny panda avatars in www.freepik.com. The level names were based on the panda avatars. However, for fun purposes, men's and women's avatars should not be the same. Therefore, there is a slight difference between men's and women's avatars. Avatars and level names of the app are shown in Table 4.

Table 4. User levels for gamification purposes.

Level number	Level Name	Man's Avatar	Woman's Avatar

-1	Crying Panda		
0	Embarrassed Panda		
1	Newbie Panda		
2	Happy Panda		
3	Delighted Panda		
4	Very Excited Panda		

When a fitness plan ends (based on end date), the app calculates if it is successful or not. Firstly, the app checks if a 2/3 percentage of the values for all measurements are set by the user and then it checks if the goals for 2/3 of the values are achieved. Only the 2/3 of the values are checked in order not to be too harsh with the user, since the user may otherwise get disappointed.

In case the fitness plan is successfully completed, the app shows a screen to congratulate the user for their success. The new level is also displayed. The user can share their success with friends in social media, selecting the share button or they can continue without sharing (Figure 30). If they choose to continue, a new fitness plan screen is shown, so that the user can create a new fitness plan with new goals.
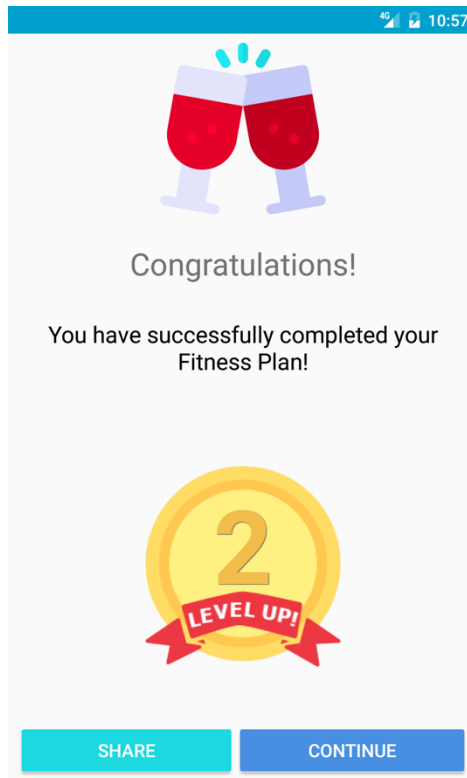
Figure 30. Successful level completion.

In case the fitness plan is unsuccessfully completed, the app shows a screen to display the failure of the user. The user levels down and the new level is displayed (Figure 31). In this case the user must share their failure in social media. This is a kind of a punishment for the user. Then, the user can select continue and they can create and start a new fitness from the beginning.
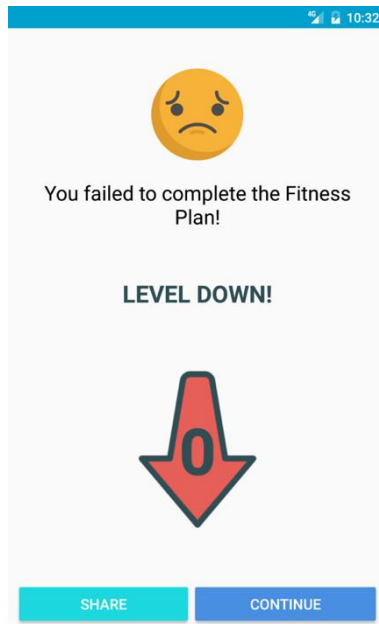
Figure 31. Failure to pass the level.

The aforementioned were the features of the application we developed in detail. Next, we provide some main use cases of the app.

4.2 Why our app is better

As has already been discussed, the main purpose is to improve people's lifestyle and physical condition by stimulating them to monitor some basic "measurements", such as steps, weight, water intake, calories consumption and daily activity. It is important for the application to really provide benefits to users so that it can be successful. The success of a fitness app depends on motivating and persuading individuals to be physically active [1]. Our application tries to accomplish continuous use by users, using some persuasive principles, such as goals setting/daily plan, motivation with gamification techniques, simple and user-friendly design, self-monitoring, free to user and suggestions.

1. *Goals Setting/Daily plan*

Goals can fulfil someone's fitness needs, due to the daily fitness plan. A daily plan can urge someone to follow a schedule. The daily fitness plan may engage the user to follow a specific behavior, which may eventually become a habit. This has a high potential to happen, because smartphones are currently a habit and apps are a part of smartphones. Habit can make a user continue using the fitness app [85]. Besides, goals help to sustain motivation, even without a fitness plan [15] and eventually app goals can lead a person

to achieve their personal goals, which will be a success for the user and the app [1]. These two factors make a good combination for a fitness app.

2. *Gamification techniques*

It is known that fun and enjoyment is a strong factor to keep the users engaged with a technology [86]. Therefore, as mentioned, our application uses a gamification technique as engagement method, by using levels and avatars. Although, it is difficult to combine fitness app with funny aspects, we managed to include this feature in our app, making it more appealing for the user. Few apps use levels and avatars combined with humor [30] [31]. This approach is positively associated with continues usage of a fitness app.

3. *Simple and user-friendly Design*

Simplicity is a major factor for someone to keep using an application, because it boosts their self-confidence by enabling them to feel that they can achieve their goals [1]. The more effort needed to perform some tasks, the lower the retention rate [86] and, since users do not read manuals, all the tasks should be simple. We managed to accomplish the simplicity and user-friendly design principle in our application, as users performing simple steps can log their everyday activities and measurements. The simplicity of the application is visible in the Dashboard Screen, where the user can see the information on an aggregate basis. Although most fitness apps are well designed, many features that are useless are included. This makes them complex and confusing. In addition, the mi band feature simplifies the steps logging, as with just "one-click" synchronizes steps data.

4. *Self-Monitoring*

Self-Monitoring in fitness apps is defined as the principle that allows the user to track their own performance [1]. Our application implements this feature by providing to the user weekly and monthly charts, showing at the same time the user goals. In this way, users are able to understand their capacity and set achievable fitness goals based on their performance. Users feel that they can control their fitness status, which increases the intention of continued use.

5. *Free*

Currently there are three types of apps, regarding price, in market: free, paid and freemium. Free apps are free, paid apps should be bought before downloading and freemium usually provide a free feature and if the user wants to use additional features they have to pay (e.g. MyFitnessPal, Runtastic) [85]. Users value apps which provide

useful features. If the app is paid, they expect a high quality and useful services otherwise they may be frustrated and write a bad review. Even if the app is free, they expect to benefit from it. Most successful fitness apps are freemium, namely they are free but they have paid features [84]. Other fitness apps, which are free, may include ads. Our application is free, has no ads and provides valuable services.

6. *Suggestions*

Most users are ignorant with respect to fitness. Our application makes suggestions for the user's ideal weight and calories consumption. In addition, it provides information about the caloric balance, which is important for losing weight (see Section 4.1.1). Few fitness apps have these features and usually they provide information about the ideal weight based on BMI (e.g. Samsung Health).

4.3 Main Use Cases

Use Case ID:	**1**
Use Case Name:	**Create Fitness Plan**
Description:	A user creates a fitness plan in order to start following a schedule by monitoring and logging steps, weight, exercise etc.
Primary Actor:	User.
Precondition:	User has not created yet a fitness plan.
Trigger:	Save button.
Basic Flow:	1. User selects from menu the option "Fitness Plan".
	2. The app displays an info screen and an option for user to start a new fitness plan.
	3. User selects "Start a new Fitness plan".
	4. The app displays a form with some fields needed for a fitness plan that the user should fill in.
	5. The user fills in the fields.
	6. The user selects the "Save" button in order to save the fitness plan.
	7. The app saves successfully the fitness plan.

Alternative Flow:	7. The app does not save successfully the fitness plan, because the user has left some values blank.

Use Case ID:	**2**
Use Case Name:	**Log a measurement value**
Description:	After successfully creating the fitness plan, the user should log the values of the measurements.
Primary Actor:	User.
Precondition:	User should have created a fitness plan.
Trigger:	Add button in bottom menu.
Basic Flow:	1. User selects from menu the option "+".
	2. The app displays six buttons which correspond to: log steps, log weight, log nutrition, log sleep, log water and log exercise.
	3. User selects the button "Log Steps".
	4. The app displays a screen, where the user can log their daily steps.
	5. The user fills in the steps number (the default date is today).
	6. The user selects the "Save" button in order to save the value.
	7. The app successfully saves the value.
Alternative Flow 1:	7. The app does not successfully save the fitness plan, because the user has left the steps number blank.
Alternative Flow 2:	5. The user fills in the steps number and selects a date.
	6. The user selects the "Save" button in order to save the value.
	7. The app successfully saves the value.

Use Case ID:	**3**
Use Case Name:	**Watch progress**
Description:	After logging some values, the user can watch and monitor their progress from charts the app provides.
Primary Actor:	User.
Precondition:	User should have logged values.
Trigger:	Select a measurement in Dashboard Screen.

Basic Flow:	1. User selects steps in Dashboard Screen.
	2. The app displays a chart showing the steps of the week. A list with the steps and corresponding dates below the chart is displayed.
	3. User watches the chart and scrolls the list.
Alternative Flow 1:	3. User watches the chart and scrolls the list.
	4. User selects from menu to see the monthly steps.
	5. The app displays a chart showing the monthly steps. A list with the steps and corresponding dates below the chart is displayed.

Use Case ID:	**4**
Use Case Name:	**Sync steps with Mi Band**
Description:	User can connect their Mi Band with the app, to synchronize the daily steps.
Primary Actor:	User.
Precondition:	User should have paired the Mi band in settings.
Trigger:	Select the "Mi Band" button in Steps Screen.
Basic Flow:	1. User selects the "Mi Band" button in Steps Screen.
	2. The app displays a progress dialog, trying to connect with Mi Band.
	3. The app connects with Mi Band.
	4. The app retrieves the steps data and displays the progress simultaneously.
	5. The data are successfully retrieved.
	6. The app displays the values in the Screen.
Alternative Flow 1:	3. The app cannot connect with Mi Band, because it is not close enough.
	4. The process of synchronization is canceled.
	5. The data are not successfully retrieved.

4.4 Evaluation

The application was given to 14 volunteers in order to use it and then answer a questionnaire to evaluate it. The participants have been using the application for 1 month. The questionnaire given to the users is presented next:

1. Select gender.

Male	Female

2. Select age group.

18-39	40-59	60+

3. How easy was it for you to use the mobile app?

Very difficult	Difficult	Neutral	Easy	Very easy

4. Approximately how much time did you spend per day interacting with the mobile app?

Less than 10 minutes/day	10-30 minutes/day	30-60 minutes/day	1-2 hours/day	>2 hours/day

5. Please provide an overall rating of the mobile app, considering ONLY the currently offered functionality.

Very poor	Somewhat poor	Neutral	Somewhat good	Very good

6. How likely would it be for you to recommend the mobile app?

Very unlikely	Somewhat unlikely	Neutral	Somewhat likely	Very likely

7. How likely would it be for you to keep using the mobile app?

Very unlikely	Somewhat unlikely	Neutral	Somewhat likely	Very likely

8. Which is the most useful feature of the mobile app?

9. Which feature is currently missing and you would like to be implemented?

The questions were selected in order to mainly evaluate the usability, the overall features of the application and the satisfaction of users.

4.4.1   Results

As mentioned, 14 people participated in the application evaluation. More specifically, 7 men and 7 women (Figure 32). It was decided the users to be divided in 3 age groups: 18-39, 40-59, 60+ (Figure 33). The age groups were selected based on the users' level of experience with smartphones. For example, the age 18-39 have a better understanding in using a smartphone that the other two groups. Especially, the group 60+ have very little experience with smartphones.
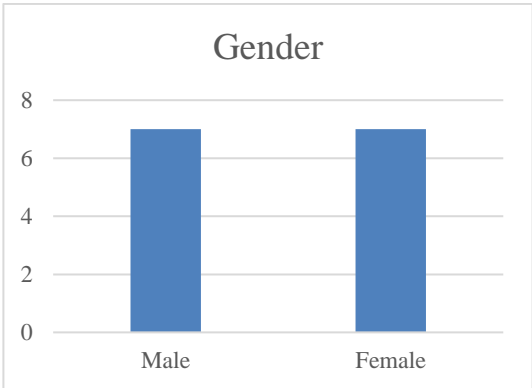
Figure 32. Application evaluators by gender.
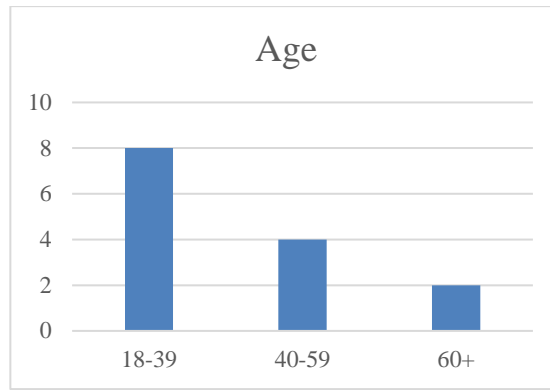
Figure 33. Age of evaluators.

The results from questionnaires were written on Microsoft Excel and are presented in Figure 34 and Figure 35.

Select Gender	Select Age Group	How easy was it for you to	Approximately how much tim	Please provide an overall rating of the mob	How likely would it be for you to rec
Male	40-59	Easy	10-30 minutes/day	Somewhat good	Very likely
Female	40-59	Very Easy	Less than 10 minutes/day	Very good	Very likely
Female	60+	Easy	Less than 10 minutes/day	Very good	Very likely
Male	18-39	Easy	>2 hours/day	Somewhat good	Very likely
Female	18-39	Very Easy	30-60 minutes /day	Somewhat good	Very likely
Male	18-39	Very Easy	10-30 minutes/day	Very good	Very likely
Male	40-59	Easy	30-60 minutes /day	Very good	Somewhat likely
Female	18-39	Neutral	1-2 hours/day	Very good	Very likely
Female	18-39	Easy	Less than 10 minutes/day	Somewhat good	Very likely
Male	60+	Difficult	1-2 hours/day	Somewhat good	Somewhat likely
Male	18-39	Very Easy	1-2 hours/day	Very good	Very likely
Female	18-39	Easy	>2 hours/day	Very good	Very likely
Male	18-39	Easy	10-30 minutes/day	Very good	Somewhat likely
Female	40-59	Neutral	30-60 minutes /day	Somewhat good	Very likely

Figure 34. Results in Excel (part 1)

How likely would it be for you to keep u	Which is the most useful feature of the mobile app	Which feature is currently missing and you would like to be implemented?
Very likely	Steps logging	Glucose measurement
Very likely	Activity logging and caloric balance	Heart rate measurment
Very likely	Food logging	Nothing
Neutral	Easy navigation, plus icon for logging	Connection with more bands, e.g. Mi Band 2
Somewhat likely	Easy navigation and simple	Easier food logging
Very likely	The creation of your own fitness plan	More medical features like blood pressure logging
Somewhat likely	The connection with Mi Band	Supported meals from nutritionists
Neutral	Activity logging	Connection with more activity trackers
Neutral	Easy navigation	Cloud backup
Somewhat likely	Steps logging	Nothing
Neutral	Fitness plan, activity and food logging	Connection with other users and statistics about them
Somewhat likely	Caloric balance, activity and food logging	Supported gym exercises per level
Somewhat likely	Fitness plan, avatars with pandas	Different themes, e.g. dark
Neutral	Steps and weight logging	Easier food logging

Figure 35. Results in Excel (part 2)

Most of the participants found the application to be easy to use (Figure 36). Two of the users were neutral and one found it difficult. It should be noted that the one who found it

difficult is in the age group 60+, namely users that don't have very much experience with smartphones. However, another user who is in the same age group found the app easy.
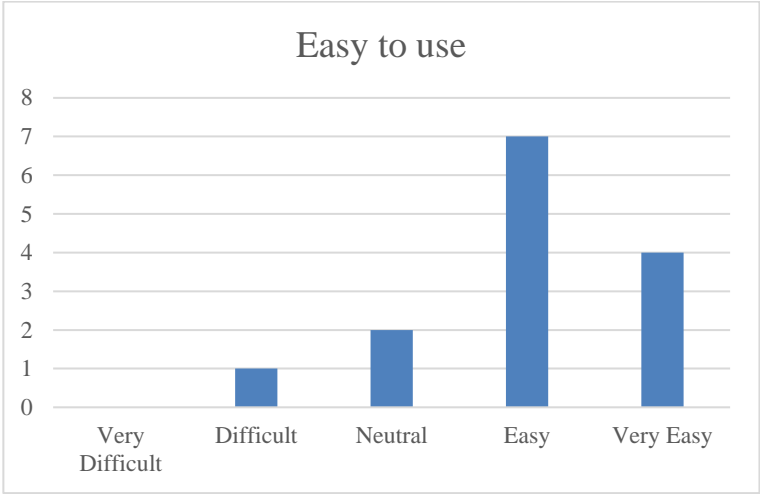

Figure 36. Evaluation of ease of use.

The results from time usage of the application were confusing, because they were quite varied (Figure 37). This shows that each individual person needs different time to spend using an application.
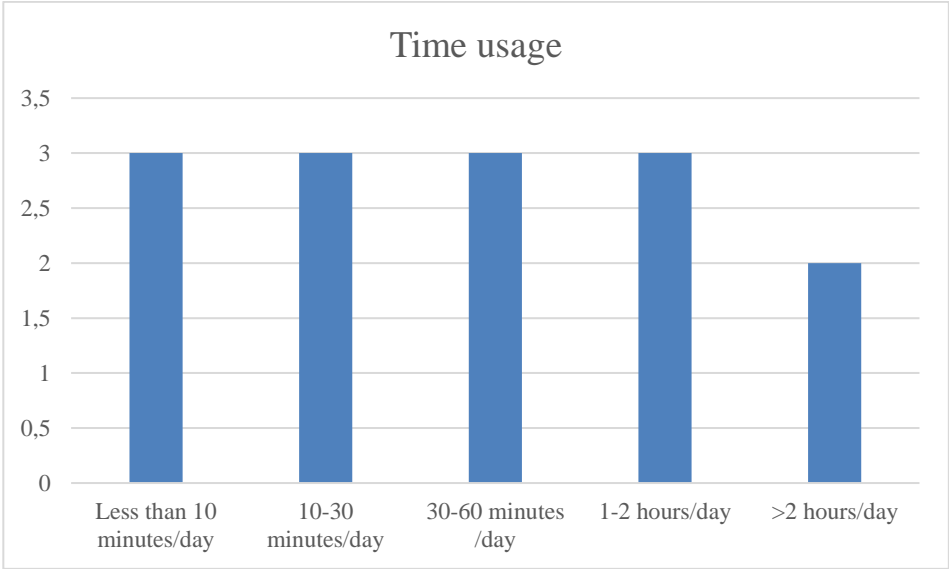

Figure 37. Time spend of each user with the application

The overall rating of the application was very good and good (Figure 38). This is an indicator that our application has managed to fulfill a user's needs mostly. Even if it doesn't have, these results show that it is close to fulfill a user's needs.
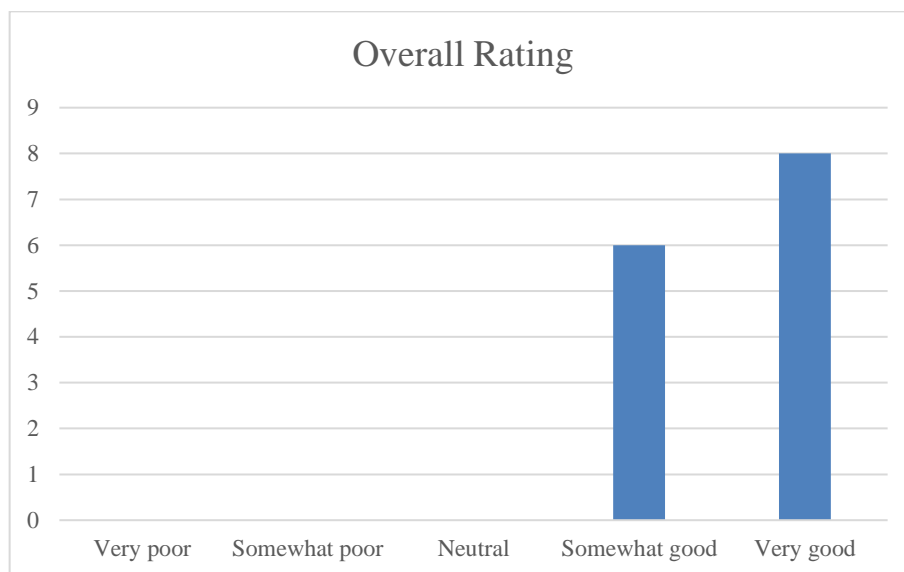
Figure 38. Overall app rating from evaluators.

Most users responded that they would very likely recommend "MyFitnessPlan" to other users (Figure 39). Therefore, this means that the app leaves a good impression to users.
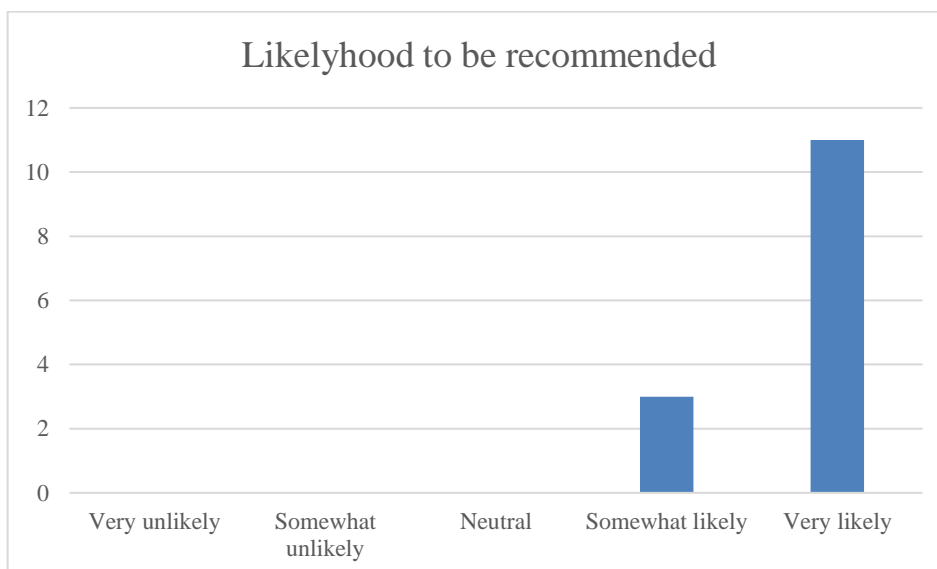
Figure 39. How likely the evaluators were to recommend app to other people.

Moreover, Figure 40 is related to the retention rate of a fitness app. Overall the answers were positive, which means that users would want to keep using our application. This means that our approach motivates the users.
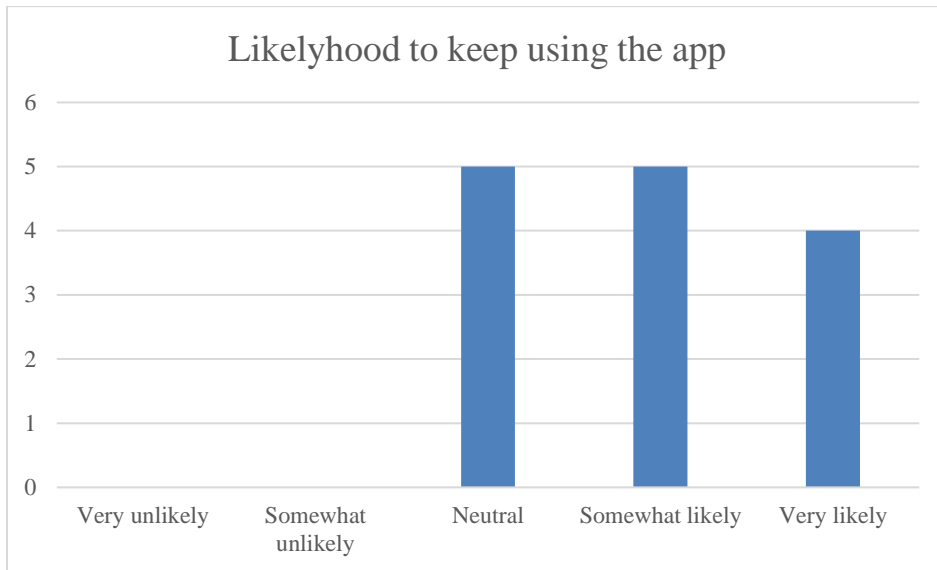
Figure 40. Retention rate of the app.

Next, the features considered most useful by the users are presented (Figure 41). The most useful features according to our participants is the Activity logging, followed by Steps and Food logging, Fitness plan concept and easy navigation.
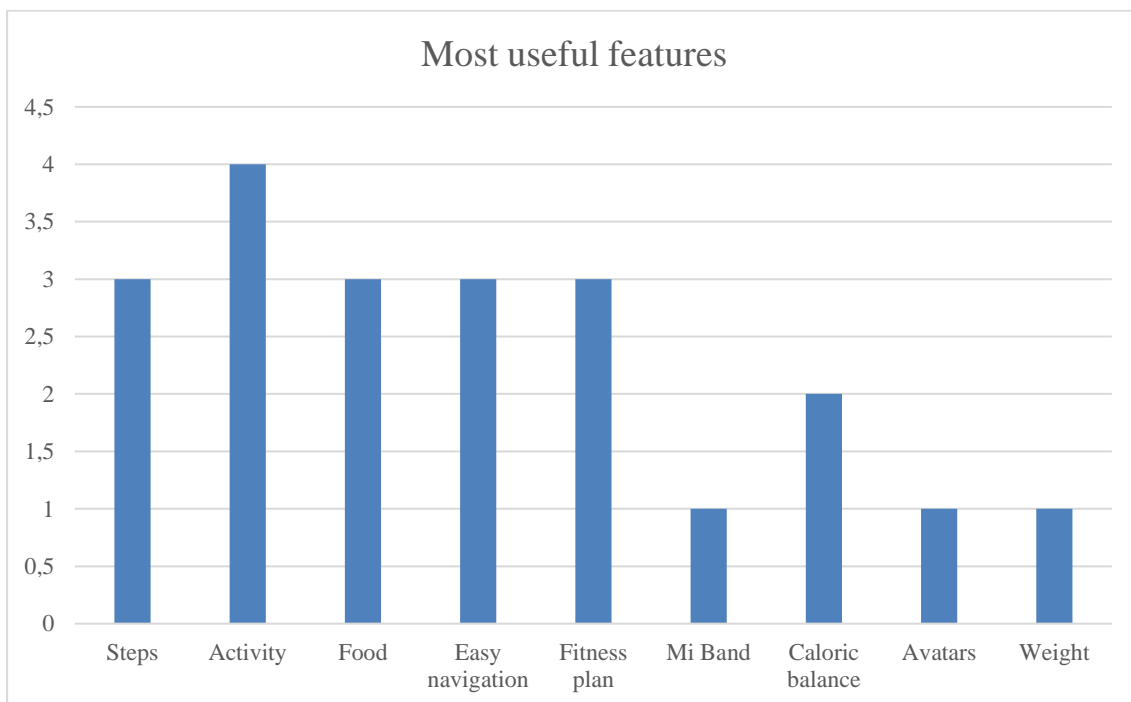
Figure 41. Most useful app features.

The answers in the last question were very interesting, because almost all users had something to propose. Only two users responded that no extra feature is needed and interestingly these users are in the age group 60+.
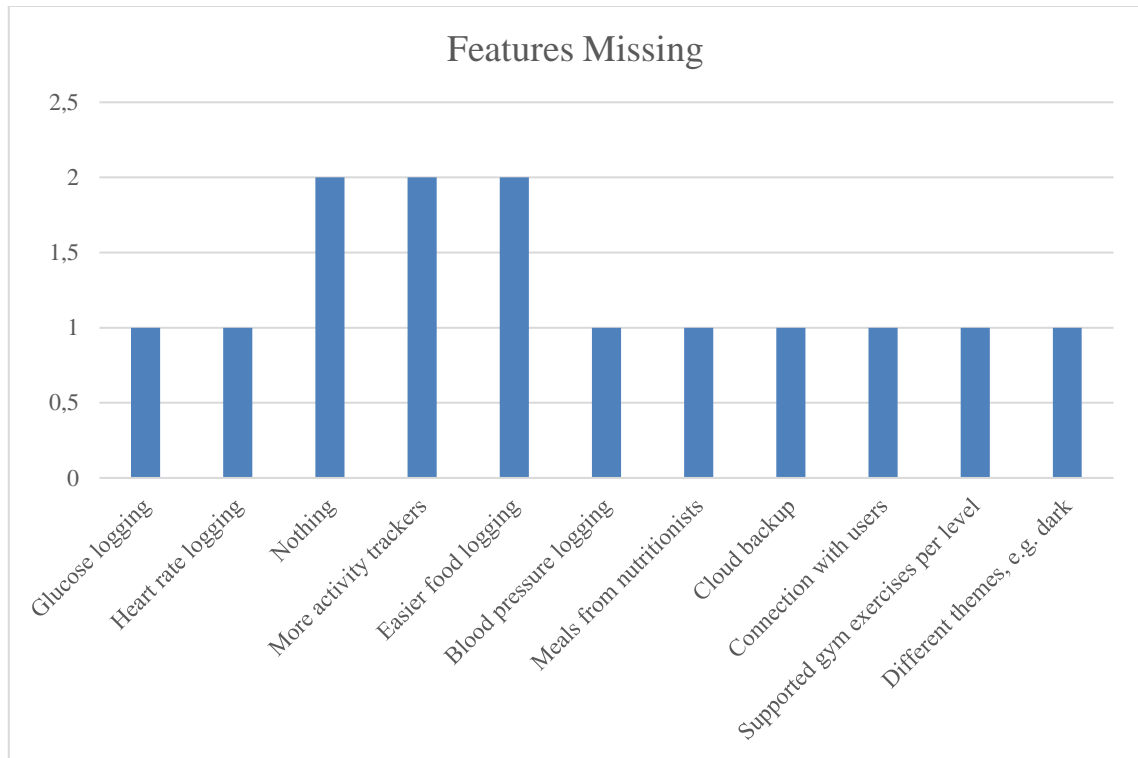
Figure 42. Suggestion for additional features.

Two of the users also proposed easier food logging, which means that food logging was not implemented very successfully and should be improved. For example, "MyFitnessPal" implements some features of easy food logging like bar code scanner. Two other users missed the connection with more activity trackers. This was anticipated, because, usually, people don't have the same activity tracker. However, this is difficult to be implemented, because BLE technology is difficult to be implemented and understood as it is low level. Support of other activity trackers is feasible only if the manufacturer provides an API or a documentation for the BLE connection. The additional missing features are shown in Figure 42

All in all, the results were quite positive. This first version of the application manages to achieve the goal, to make the users occupied with their health. However, it lacks some features, which users believe they are important and would help them to continue using "MyFitnessPlan".

4.4.2   Limitations

There are some limitation regarding our application's evaluation. The sample size was small (14 people) and thus, we cannot determine whether the results are accurate enough. In addition, the users have used the app for a short period of time, one month, and we cannot be aware of the users' behavior for a longer period. Lastly, most of our users were in the age group 18-49, which affects our results, because younger participants are more keen on using smartphones and it effects the usability of the application, meaning it is sensible to believe that the application is easy to use.

5 Conclusion

In this dissertation the topic of fitness apps was studied and was followed by the implementation of our own fitness application. Fitness apps are a part of Mobile Health (mHealth) field, which combines medical practices with the use of smartphones to help people. First, an introduction to mHealth and its subcategories was presented. Fitness apps belong to Wellness and Management category of Mobile Health. The advantages, categories and their retention rate was discussed. Next, popular applications from Google Play store and App store were presented and reviewed, along with fitness apps' categories and motivation techniques and the use of wearables. Then we concluded, based on user reviews from market stores, that fitness apps need more work and study to be more effective and motivated.

Since there are many existing fitness apps in the market, designing and developing a fitness app was a challenge. Not only because there are many fitness apps and the users could easily compare them with our application, but also, because of the nature of the app. More specifically, fitness apps are related to a person's health so we had to study a lot of documentation apart from developing the app, in order to find out more about health and mHealth. The evaluation indicated that our fitness application needs some enhancements, but overall is easy to use, made the users health-conscious and they would recommend it to other users. Hence, we believe that this version of the application achieves the goals we set. Nevertheless, in the future the existing implementation could be improved and enriched with more features. Some potential improvements are listed below (most of them were mentioned by the users, as well):

1. More logging measurements, such as heart rate or blood pressure.

2. Support more activity trackers or fitness applications.

3. Easier food and exercise logging.

4. Support meals from nutritionists.

5. Enhancement in gamification method.

6. Connection with other users – friends.

7. Data stored in the cloud.

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