Comparison of Various Wearable Activity Trackers

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Abstract. With the various activity trackers available in the market, customers often find themselves confused between choosing one amongst them all. Due to the advancements in technology there are several specifications and features to choose from but the main challenge is that there is not one activity tracker that has it all, hence the need of comparison between the several activity trackers and their specifications. Existing research focuses mostly on giving the specifications of all the activity trackers out there, and not comparing different activity trackers to help the customer make the correct choice. This research paper has outlined the need, challenges and comparison of the specification between the different activity trackers available in the market.

Keywords: Comparison · Fitness trackers · Physical activity trackers · Specifications · Wearable activity trackers

1 Introduction

There are primarily two types of wearable activity trackers available in the market.

- Smart watches: Smart watches are basically dumbed down smart phones. They have almost all functions of a smartphone including a touchscreen display, apps, notifications, camera etc. Hence, they also have the adequate processor and memory to handle such smartphone-like functions [1].
- Fitness trackers: Fitness trackers are devices used for apprehending fitness related metrics which include heart rate monitoring, distance covered, calorie consumption, GPS and quality of sleep. These mostly have only fitness related functions, unlike smartphones, and hence usually have physical buttons and little or no internal storage space.

The wearable activity trackers this research paper focuses on are fitness trackers.

A common issue for all fitness enthusiasts and fitness aspirants is that of maintaining their daily diet and exercise plan which requires the need of keeping track of their daily activities. Motivation also plays a huge role as consistently keeping an eye

on workout goals and daily nutrition is challenging. Due to this reason, companies have tried to capitalize on the growing wearable activity trackers market by selling fitness trackers.

These versatile wearable activity trackers can be taken anywhere by the user and by just wearing them on their wrists these devices track fitness related activities such as how much fat has the user burned (calorie burn), how many steps has the user walked (accelerometer), how much distance has the user physically covered (GPS), a user's heart rate and even sleep.

Existing research only focuses on explaining the idea of a wearable activity tracker (e.g. [2]) and its adoption and usability challenges. In this paper, we aim to provide a comparison between the specifications of different types of activity trackers available in the market, exhibit their pros and cons, provide solutions for the cons and an explanation for the same.

2   List of Various Wearable Fitness Trackers

2.1   Fitbit Charge 2

A fitness tracker that provides all Fitbit functionalities and is one of the affordable trackers having promising features like heart rate monitor, water resistance etc.

2.2   Garmin Vivoactive 3

One of the best fitness trackers from the Garmin range that not only provides all functionalities of a fitness tracker but also has additional features like automatic sleep tracking and built-in GPS.

2.3   Fitbit Versa

This particular activity tracker is a notch above the aforementioned Fitbit Charge 2 as it has all its functionality in addition to a highly accurate heart rate monitor and high water resistance.

2.4   Samsung Gear Sport

The Samsung Gear Sport was for a long while, the only fitness tracker from Samsung which provided a highly sharp and impressive display but wasn't as successful as a fitness trackers as it's competitors.

2.5   Garmin Forerunner 35

The Garmin Forerunner 35 provided built in GPS however isn't as impressive a fitness tracker as the others in the Garmin range (Table 1).

Table 1. Analysis of different parameters of various wearable fitness trackers.

	Fitbit Charge 2	Garmin Vivoactive 3	Fitbit Versa	Samsung Gear Sport	Garmin Forerunner 35
Display type	–OLED [3] –Hard to see when outdoors [3] –Has one tap display [3] –1.5-in. screen size [3]	–Colour LCD [7] –Bright enough to read when outdoors [7] –1.2-in. screen size [7]	–Colour LCD [8] –Bright display [8] –Easy to read in sunlight [8] –1.32-in. screen display [9]	–AMOLED full colour display [12] –Gorilla Glass3 [12] –Scratch and breakproof display [12] –1.2-in. screen size [9]	–Monochrome LCD [16] –Not a super sharp display [16] –Not touchscreen [16] –0.9 in. screen size [7]
Compatibility	–Android –Windows –iOS	–Android –iOS –Mac	–Android –Windows –iOS	–Android –iOS	–Android –Windows –iOS
Heart rate monitor	–Consists of Fitbit heart rate zones [3] –Suggest breathing pattern based on heart rate [3] –Low HR (heart rate) accuracy [3]	–Frequent heart rate monitoring at 1 s rate [7] –Shows heart rate stats monitor [7] –Allows stress tracking [7]	–Consists of Fitbit heart rate zones [10] –Suggest breathing pattern based on heart rate [10] –High HR (heart rate) accuracy [10]	–High heart rate accuracy [10]	–Uses Optical heart rate monitoring Technology [16] –No continuous Monitoring. Displays graph of heart rate every 4 h [16] –Gives erratic heart rate readings many a times [16]

(*continued*)

Table 1. (*continued*)

	Fitbit Charge 2	Garmin Vivoactive 3	Fitbit Versa	Samsung Gear Sport	Garmin Forerunner 35
Sleep tracker	–Gives sleep stages [4] –Accurate Measurement of REM sleep [4]	–Automatic night sleep tracking [7] –Doesn't track naps [7] –Accurate start and end time of sleep [7]	–Gives sleep stages [11] –Gives personalized tips for better sleep [11] –Doesn't allow to share health tips to other apps [11]	–Measures deep sleep [13] –Doesn't allow sharing of data to Google Health or Apple Fit [13]	–Gives total hours of sleep [16] –Gives sleep levels [16] –Gives sleep movements [16] –Sleep statistics available on Garmin App. [16]
Battery life	5 days [3]	7 days [7]	4+ days [8]	7 days [13]	9 days [16]
GPS	–No built-in GPS sensor [5] –Consists of "connected GPS" which connects to nearby phone to track GPS data [5]	–Has built-in GPS [7] –Both GPS and non-GPS workouts are stored on the online to be viewed by user later [7]	–No built-in GPS sensor [5] –Consists of "connected GPS" which connects to nearby phone to track GPS data [5]	–Has built-in GPS [14] –Erratic GPS performance [14]	–Has built-in GPS [18] –No GLONASS support [18] –GPS Accuracy is high [18]
Water resistance	–Up to 10 m [6] –Hence, not swim-proof [6] –However, splash, rain and sweat resistant [6]	–Up to 50 m for swimming [7] –Also splash, rain and sweat resistant [7]	–Up to 50 m for swimming [6] –Also splash, rain and sweat resistant [6]	–Up to 50 m for swimming [15] –Has swim tracking app, SpeedO [15] –Cannot be used for high water pressure activities like water diving etc. [15]	–Up to 50 m for swimming [18] –Also splash, rain and sweat resistant [18]

3 Analysis of Various Wearable Fitness Trackers

3.1 Justifications for Analysis

The pros and cons of the considered wearable fitness trackers are as follows:

- The pros of the Fitbit Charge 2 are that it has the Fitbit heart zones and that the heart rate monitor suggests suitable breathing pattern based on the heart rate zones. It is compatible with Android, iOS as well as Windows. The sleep tracker in the Fitbit Charge 2 is also impressive as it provides sleep stages and gives accurate measurement of REM sleep.
- The cons are that the Fitbit Charge 2 has an OLED display which makes outdoor reading difficult. It is also said that the heart rate accuracy of the Fitbit Charge 2 is low because, in reference to [20], experiments prove that the Fitbit Charge 2 gives different readings when placed at improper positioning. And ideally, activity trackers should do so from any positioning on the wrist because displacing of a tracker while exercising/sleeping or doing any other activity while wearing it is bound to happen. The Fitbit Charge 2 does not have a built-in GPS and uses connected GPS instead and the water resistance is also not impressive as it is only up to 10 m making it splash proof.
- The pros of the Garmin Vivoactive 3 are that it has a Colour LCD display which is bright enough for outdoor usage. It is also compatible with Android, iOS and Mac. The heart rate monitor in Garmin Vivoactive 3 provides continuous heart rate monitoring and also tracks stress levels of a user. The sleep tracker in this device has the pro of accurate and automatic night sleep tracking. The major pro of the Garmin Vivoactive 3 is that it has built-in GPS feature and all workouts, GPS or non-GPS, are stored online to be viewed according to user's discretion. Lastly, the Garmin Vivoactive provides a good water resistance of up to 50 m.
- The cons of the Garmin Vivoactive 3 are that it doesn't track naps, which also includes it not using the automatic sleep tracking feature for a user's nap sessions. The water resistance of the Garmin Vivoactive 3 doesn't make it suitable for high water pressure activities like diving.
- The pros of the Fitbit Versa are that it has a Colour LCD display, it is compatible with Android and iOS, has the Fitbit heart zones and that the heart rate monitor suggests suitable breathing pattern based on the heart rate zones. The heart rate accuracy is also high in the Fitbit Versa as opposed to that of the Fitbit Charge 2. The sleep tracker in the Fitbit Versa gives sleep stages and also provides personalized tips for better sleep. It also tries to covers up for not having a built-in GPS, by having a connected GPS like in the Fitbit Charge 2. It also has better water resistance that Fitbit Charge 2.
- The major cons of the Fitbit Versa are that the sleep tracking doesn't allow data sharing to other apps, it has no built-in sensor and the water resistance is not suitable for extreme water sports.
- The pros of the Samsung Gear Sport are that it has an AMOLED full colour display, which as discussed is the best display type amongst all the fitness trackers considered. It also has a Gorilla Glass3 which makes the display scratch proof and

break proof. Other than that, the Samsung Gear Sport provides high heart rate accuracy, measures deep sleep, has a built-in GPS and water resistance of up to 50 m for swimming.

- The cons of the Samsung Gear Sport are that it is not compatible with windows, it doesn't allow sharing of sleep tracking data to other apps like Google Health or Apple Fit, the GPS accuracy is erratic and the water resistance is not at all suitable for high water pressure activities.
- The pros of the Garmin Forerunner 35 are that it is compatible with Android, iOS as well as Windows, the sleep tracker gives total hours of sleep, sleep levels and movements and provides all sleep statistics on the Garmin App. It also has a built-in GPS which is highly accurate [18], and the water resistance of up to 50 m is good enough too.
- The cons of the Garmin Forerunner 35 are that it has a weak Monochrome LCD display which is not touchscreen, it does not have continuous heart rate monitoring, there is no GLONASS support to the built-in GPS.

The solutions we would like to provide are that Fitbit Charge 2 should work on its HR accuracy, the Garmin Vivoactive 3 should allow sharing it's health statistics to other apps like Google Health and Apple Fit, like its mentioned in the table, the Samsung Gear Sport fails at its weight which is too heavy for it sleep or exercise with, and lastly the Garmin Forerunner 35 should work on making it's display sharp, and making it touchscreen rather than just manually operating through buttons. It should also enable the continuous heart monitoring feature.

4   Conclusion

To exhibit the best and worst wearable fitness tracker from the five that are covered in this study, evidence in the form of pros and cons is as aforementioned. The best fitness tracker from the above will be the Garmin Vivoactive 3 and the Fitbit Versa and the worst activity tracker will be the Garmin Forerunner 35.

With this, the paper has made the following contributions: (1) compared the features of 5 of the many activity trackers available in the market. (2) Described the product's pros and cons in great detail. (3) Exhibited suggestions for making the concerned fitness trackers better. (4) Exhibited the best and worst from amongst the list of the wearable fitness trackers and explained the same, thus providing a detailed review of all the five activity trackers and enabling the reader to make a sound choice.

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