Fitness and Health: Transcending towards good health and a healthy mind with intelligent app

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Abstract—The purpose of this paper is to investigate trends in the fitness applications, devices/wearables and analyze the data collected by a certain Fitness app called TK Fit developed by the Telekooperation lab of Technische Universitt Darmstadt.

keywords—Fitness; health; lifestyle; mobile apps; activity tracker; smartphone; accelerometer; gyrometer; probability; score

I. Introduction

The mostly modern and busy sedentary lifestyle enjoyed by most of the urban population leaves less room for any kind of physical/recreational activities therefore leading to deteriorating fitness and health. And with the added increasing stress levels of the over ambitious population leads to even bigger population. Lately the realization of the same has led to people run a mile, hit the gym and other forms of physical workouts. This has led to an increase usage of the fitness mobile applications and wearables which tracks one's workout logs and quantitatively provides the user with a periodic/aggregated data for personal fitness and health tracking. A target physical activity measured in hours achieved for a particular day leaves a happy mind and satisfied user. In particular, recent mobile devices with hardware GPS and accelerometers, has made possible variety of sports and fitness applications which were not possible earlier. Today shops, online stores are flooded with numerous fitness apps and wearables. Providing user with countless options all but with once simple goal- to be fit! All the latest and few old versions of Android offer an exhaustive list of apps- you choose it and they have it. iOS on the other hand offers few which are free (kostenlos!) and others paid. And mobile phones these are loaded with the most advanced technologies such as the GPS, accelerometers etc to help in smooth and full running of the mobile app. TK Fit is one such fitness app comprehensively developed along with an Assistance app by the Telekooperation lab of TU Darmstadt which performs an automatic tracking on a daily basis and marking of the annotated physical activities by the user. With the start of the day the app records the time spent for the night sleep and is required by the user to mark/annotate it so as to successfully record it as the first activity in the users records. Now with every mile walked by the user the app intelligently counts the number of steps and records the corresponding time, which again needs to be annotated by the user within few minutes/hours of the recorded activity depending upon the duration of time spent

doing that particular activity. The app takes on providing a score on a scale of 1 to 5 which the user needs to mention while annotating/marking that particular activity. For example- "How hard was the activity?" and the user can provide his/her own discreet input. With the GPS switched ON the app also records any new places visited by the user either by walking, running or bicycling which later again needs to be annotated. For marking these kinds of activities the app will ask the user to rate based on certain intrinsic factors such as "Mood", "Time" and "Difficulty" of that particular activity. This way the app uses a scale based approach to grade and notify the user's activities in the app. Now, at the end of the day the user can check the records and successfully marked activities by the user and depending upon the number of hours the app gives you a comprehensive score of how well your day was with respect to the physical activities. At the end of the day the user can check the hours he/she spent doing certain activity with a new feature showing the mood (depending on the day's physical activities successfully tagged by the user). A happy smiley means you have achieved for the day's target physical activity hours leaving you happy and satisfied. Whereas a sad face means there was a lack in efforts achieving the target physical activity (hours) for the day and this in fact, during the course of the day, triggers a kind of alarm which will produce vibrations in the phone in order to notify the user for taking a walk in the park or so, as to burn calories and complete the minimum number of physical activity hours for the day. Also, the app records the user movements, adds new places visited by the user, bicycle riding activity and adds all of them to the user's records of the day.

II. History

The history of fitness applications first came from the development of the application itself. An app is a type of computer software that is designed specifically to perform particular tasks. Most notably apps can be used on smartphones to play games, turn the lights on or off, read the news, read your email, or as a Global Positioning System. In 1993, The International Business Machines (IBM) started selling Simon, which was the first mobile phone that was considered to be a smart phone. It was considered smart because it had a touchscreen instead of buttons. In 2002, Research In Motion Limited, which produces the smartphone BlackBerry, released its first BlackBerry with integrated phone functionally. The product

line of this phone eventually evolved to produce the first smartphone with wireless email capability. In July 2008, Apple launched its "App Store" after launching its first iPhone in 2007. The App Store launched with 500 apps. There were ten million apps downloaded in the first week. 25 percent of the applications were free. In November 2008, there were already more than 10,000 apps available. In April 2009, one billion apps had been downloaded. In November 2009, 100,000 apps were available for download and about a year and a half later that number had increased to 225,000. In October 2010, there were 300,000 apps available, with a mix of both free and for purchase. Apple has evolved tremendously since the launch of the first IPhone and App Store and continues to evolve at a fast pace. In October 2008, Android launched the Android Market with only 50 apps available. In March 2009, there were 2,300 apps available to download onto your Android device. In September 2009, there became around 10,000 apps available and nearly a year later there were 80,000 apps in the Android Market. As you can tell, Apple and the App Store evolved quicker than the Android Market. In 2010, Apple had 300,000 apps and Android had 80,000, but that is more BlackBerry had. Considering that BlackBerry was the first to launch a smartphone, the company was slow to catch on with the mobile application development. Although there is no specific date that fitness apps became available to smartphones, fitness app such as Lose it! was founded in 2008 and became available to the iPhone in 2010. From there, it then became available to Android devices in 2011. Mobile applications have become an essential part of how we communicate with each other. People shop, work and organize their life on a device that you hold in your hand. All this is possible with the creation of applications that are downloaded to the device. Whether it is Apple, Android or BlackBerry, all smartphones now have this capability. Consumers are now constantly connected to what's happening.

A. Fitness Apps

Fitness is not something we can think about once, run through a checklist of things to improve it, and forget about it. Just as in other areas of health, fitness must be maintained through small and consistent actions that add up over time. Thats why mobile phones make an ideal fitness companions. Because our smartphones, apps /wearables are always with us, become a constant reminder to check your progress, stay the course and keep your willpower strong. Whether you are trying to lose weight, walk more steps in a day or make time for a power 15-minute workout (with/without any gym equipment needed), fitness apps can help. While some apps connect you to a community of people who cheer you on and send their support, others motivate you through competition. One fitness app, called Pact, lets you compete for cold, hard cash: e.g., he who hits the gym most in a month wins a lottery. Apps such as Strava brag about the rights you earn when you run or bicycle the shortest time a segment in your neighborhood and lest you compete virtually with everyone using the same app and covering the same ground. Others let you log workouts,

count calories eaten, and collect stats about all your runs to see overtime how you are improving. Fitness apps can also be coaching apps the put you in touch with a personal/fitness trainer or a nutritionist who will check with you once a week. And some combine all these things. Most important of all, the fitness apps let you set your own goals and maintain a pace thats right for you. They keep you motivated for becoming the version of yourself you want to be.

B. Smart Wearables

There are so many great fitness trackers available as wearables, on the market that choosing one can be confusing and mind boggling. The right tracker will be based on your individual needs; whether thats counting steps, heart rate tracking or sleep tracking. The new tech and sensors on the latest brands help a user choose the right tracker for self and from a variety of products. One such wearable called Fitbit Blaze is the top pick in the market these days (an overall fitness tracker) with features such as step tracking, sleep monitoring, 24/7 heart rate monitoring. Others Microsoft Band 2 (for running), Moov Now(for swimming) etc and others, the list is huge. For users looking for something reasonably priced will not be disappointed as the Misfit Flash tracker comes with a moderate price loaded with whole lot of features.

III. Related Work, papers and apps

A. Collection and use of monitored data

Sports and fitness are increasingly getting attention of companies and researchers around the world. In particular, recent mobile devices with hardware GPS and accelerometers, has made possible variety of sports and fitness applications that were not possible earlier.This paper investigates trends in fitness devices, proposes new fitness device system architecture.

B. Charity Miles (for iPhone)

Charity Miles gets corporations to donate money on your behalf to a charity that you choose for every mile you run, walk, or bicycle. It's a great way to do good.Corporate sponsorships are subtle.Running and walking earns 25 cents per mile, while bicycling earns 10 cents per mile. As the end-user, you don't have to do anything at all to make sure that money reaches your charity. Charity Miles handles that part.Before you start running, walking, or bicycling, you select a charity from a list.When you're ready to go, you select which activity you'll be doing, and a new page loads.Raising money for charity by entering marathons takes a lot of time and effort, and not everyone has it.

C. Fitbit Blaze activity tracker

The Fitbit Blaze is the company's best looking fitness tracker by a country mile.The new colour display is a step up from the Surge's monochrome affair, the software is easy for beginners to get to grips with and it still delivers good all-round activity tracking stats.Features such as step tracking, sleep monitoring, 24/7 heart rate monitoring.

D. Microsoft Band 2

The spec sheet is streets ahead of most of the activity band brigade, and it's running with GPS connectivity that impresses the most.Accurate run tracking, steps, sleep, GPS sports tracking, 24/7 heart rate, golf, notifications.

IV. MY APPROACH

Smartphones develop in a rapid speed in recent years, and they are becoming indispensable carry-on of daily life. The sensors embedded in them provide various possibilities for mobile applications, and these applications are helping and changing the way of our living. The word sensing builds a bridge between real world and virtual world; with the help of various sensors, man-made devices are able to feel the world like God-made creatures do. Bell may be the first generation of sensors; people tie up a bell to a string so that when there is a vibration on the string, the bell will ring. Bell is a very powerful and effective sensor; it contains two parts: detection and processing. When a bell detects a vibration, it will generate a period of ringing and the volume of the ringing is proportional to the amplitude of the vibration. However, bell is the kind of sensor that connects real world to real world. With the development of electronic devices, a new man-made world has been building. This world is called virtual world; many complicated calculations are running in this world so that people in real world can enjoy their lives. Virtual world needs data to keep running, and it is far from enough to input data into the virtual world depending on human operations. Sensor is a way to sense the world and interpret the sensed information to the data form of the virtual world; therefore, sensing becomes an important part of research field and industry field.

Fitness and Health have recently been the epicenter of most of the inventions being made in the field of smart wearables or as a mobile platform based applications. Few good examples worthy to be cited here are one of the papers proposed as "a context aware fitness guide system for exercise optimization in U-health" which proposes context-aware exercise architecture (CAEA), which provides an exercise program via a dynamic exercise prescription based on awareness of the user's status implementing CAEA as an intelligent fitness guide (IFG) system. The IFG system selectively receives necessary parameters as input according to the user's exercise goals. Based on the changes in the user's exercise type, frequency, and intensity, the system creates an exercise program via an exercise optimization algorithm. In this paper, to show the exercise efficiency using the IFG system, they compared a non-control group to a control group. An eight-week study was performed comparing the changes of body weight in the two study groups. The study showed that the control group using the IFG system approached the desired body weight 2.57 percent more closely than the non-control group. Since IFG provides a real-time exercise program for users via an exercise optimization algorithm, it enables the user to perform effective and stable exercise according to the user's physical status. And employing external sensors such as RFID can

help in collection of important person data, one such paper "RFID-based Hospital Real-time Patient Management System" where In a health care context, the use RFID (radio frequency identification) technology can be employed for not only bringing down health care costs but also facilitate automating and streamlining patient identification processes in hospitals and use of mobile devices like PDA, smart phones, for design a health care management systems. In this paper, we outline a RFID model for designing a system in the health care. An application of the architecture is described in the area of RFID-based real-time hospital patient management system (HPMS). Analyzing the data recorded by the Tk Fit app provides us with few invaluable information regarding the users movement, physical exertion and cites a pattern which could help one in understanding and developing a proper fitness routine thereby proving beneficial to the user on a daily basis.

V. EVALUATION OF DATA

The data collected during the running of the TK Fit app on my own smartphone was congregated by the TK Lab team recorded with the help of various types of sensors built-in the phone and later converted into a readable format. The type of data collected were fitness, psychological and sensor data- further elaborating into more branches. Fitness data comprising of borg scale, mood scale, sleep scale and time slots. Where borg scale signifies organization data containing user id, timeslot uid, device id, server time stamp, tag delay, tag time and value. Mood scale comprising of few extra columns such as value mood. Sleep scale, obviously giving information about the hours of sleep. And time slots providing different time slots recorded for all the physical activities. Well, I wanted to cite a well suited example from a medicine point of view- the way a Homeopathy medicine treats its patients is by getting a complete medical history of the patient and then providing with a holistic way of treatment. In a similar manner (maybe not exactly!) the different types of data provided by the TK Fit app helps in providing a bigger picture of the daily activities and types performed by the user, detecting a pattern and maybe further can help in development of certain other fitness models. Continuing with our other data types collected are psychological data comprising of certain survey questions which the user is supposed to fill up and helps throw light in understanding the mental state of the user. A lot of people dealing with obesity suffer problems shedding the extra weight even though they get themselves enrolled in an intensive weight loss program etc and few others complain of failed aerobics class which instead increase the body weight. They say Stress is one of the biggest culprits of this modern day society and a by-product of our sedentary lifestyle. There has been news of unnatural deaths of the employees working in stressful environment. And a calm and focused mind helps, a lot, and is a must in developing that kind of attitude towards leading a healthy lifestyle. Binging on high sugar and junk food after working out an hour in a gym aka fitness studio will only make you closer to diabetes and various other health related diseases. Meditation such has one being Transcendental

meditation helps in a more coherent and thus a stable mind worthy of making right and proper decisions. Well, a better understanding of your health goals is definitely going to make you more focused in achieving them and the development of that right attitude. And hence psychological data in this respect provides with some invaluable information. And lastly the sensor data consisting of app usage, motion activity, places, place visits, power levels and transitions. The built-in phone sensors such as GPS, accelerometers etcetera are the real deal, the centerfold of the big story. As they are the ones with the help of which all the data collection is made possible. Few of the inbuilt smartphone sensors are Gyroscope, Magnetometer, Barometer, Proximity, Light sensor, GPS, NFC etcetera which help in recording of varied types of data. If we go back to how the user used to annotate the times slots by giving a score to the properties of the time slots would help us in making an observation that this simple score helps in relatively easier conversion into a more readable data format. Thus TK Fit developers have aptly designed the mobile application to suit all the basic and high end needs of a successful fitness mobile tracker app. For example, a type of data where transition from one place to another during some time of day provides the user with a pattern and an increased frequency of such transitions enhances the prediction and probability of the occurrence of such activity in future. This is a pattern prediction principle and many such patterns might help in development of a futuristic model and adding context awareness to it might help/guide the user beforehand in a better way of performing of that particular activity and hence reaching a health goal in a much more focused way.

Providing a score of 1 to an annotated property increases the probability of occurrence of that particular event and with the app would store the results corresponding to the time slots. Similarly rating the "difficulty levels" appropriately would help in calculating the probability of occurrence of that event. For example, if the frequency of occurrence of a value mood of 3(average rating) and value rating of 5 (not good rating) for the mood scale (for the fitness data) for a particular time slot, in a set which occurs more than once would remind the user to instead improve the activity (exert physically more-burn more calories-for a good heart) thereby improving on the fitness scale. These minute improvements in all those time slots for which the user had provided bad ratings would remind the user to improve more and more.

It's kind of a machine based learning approach where the app intelligently helps the user point out the time of the day when he/she is supposed to change from the usual course of actions in performing the physical activity so as to burn more calories. For example, if the user takes escalators until floor 2 and then takes the stairs to reach his/her office on 5th floor. And the user would then annotate/mark those particular time slots with "difficulty level" as less and physical exertion as "not that hard", thereby failure in achieving the target physical hours of the day. Later the app would produce vibrations in the phone and ask the user to take a walk/climb up few stairs so as to achieve the target hours for the day.

Though the vibrations produced by the user's smartphone do seem irritating because it would start to buzz at any time of the day irrespective of where the user might be sitting idle for long time. This could be during an important office meeting, conference hall while an ongoing presentation. But there's always room for improvement and few minor code changes could remove this feature completely from the app and make this a mobile application that is truly intelligent in all respects and of course beneficial.

VI. Conclusion

The built-in sensors in a smartphone are the key factors of developing more and more interesting applications on the smartphones, making the smartphone computations different from that of a traditional computer. Intelligent mobile applications such as the Tk Fit can prove to be making maximum usage of the built-in sensors of the smartphone and put them to a beneficial usage of mankind.

VII. References and Citations

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