The use of a smart application to track activities for achieving an active and healthy life

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Abstract

Inactivity is a phenomenon that is recently characterizing the world and it is one of the main causes of chronic diseases. Health and lifestyle problems are increasingly seeking solutions that have technology as the main solution. In this paper we will analyze various algorithms and technologies that can be used to accomplish it and how to combine them to achieve a more active and healthy lifestyle. This paper proposes an Android mobile phone application that gives information how active are people during the day, how can we improve their life and implement a program with activity tracker. In the focus of the work are different age groups of people, where this technology will be implementated. Also, will be simulated an application which will enable statistics on the activities that the user has performed and various activities that he can accomplish through it.

Keywords:

E-Health, Interactive Application, Physical Activities, Activity Tracker

1 Introduction

Today, the mobile phone industry is one of the fastest and most dynamic business sector. The need to communicate efficiently and instantaneously is always a necessity. The market sector and the ever-growing and demanding consumers always want to have more and they want it better than ever. Having a mobile phone for us makes life easier [Jem15].

The number of smartphones are growing steadily in recent years, especially because they have become more accessible and more useful in everyday life. It is almost impossible to imagine life without the help of these devices [Rad16]. Given the high prevalence of physical inactivity, it is necessary to develop new cost-effective, scalable approaches to increase physical activity. One promising direction is the use of smartphones in the delivery and personalization of programs that motivate individuals to increase their physical activity [Zho18].

In the current age of technology, smartphones due to their ubiquitous nature are commonly used as a medium for promoting physical activities. But people still rely less on gadgets, mobiles phones, and other specialized devices to track a health indicator. This is in contrast to the fact that recently there has been an increase in the healthcare-related research and unprecedented growth in the systems, devices, and applications for healthcare management, be it on a personal or a larger scale. So what is the reason that despite the availability of plethora of mobile phone applications and devices, half of the people still track their health status in their head? This is due to the fact that people mostly lack the motivation for performing the physical activities. Users use these applications and ultimately lose their interest after using it for a few times only. Thus, creating the eagerness of living a healthy life by engaging users is a goal that is more challenging and demands more effort [Sar15].

This app will track activities that will be very useful information on daily activities for the user, the amount of liquid consumed and what is appropriate according to body mass and gender. The application will also include the possibility of digitizing the health card, where every person can have his personal data always with him without the need to keep the card. The app will include a menu of foods and other useful services such as personal agenda where the user can add notes or memos use light in the dark, access and play music. The application language will be simpler and will be available to all people for download on smart Android phones in the Play Store app. The objective of the app is to promote physical activities and enable users to achieve their activeness goal.

2 Literature overview

First, there was no requirement for additional equipment such as pedometers or foot pods and no need for data entry. This makes the app more attractive to those who are ambivalent about the benefits of measurement or about their ability to become fitter and healthier [Con06]. Secondly, while most other apps only activate when users provide notice that they are about to begin an exercise event, this app measured activity continually and without the need for any user action. This feature of the app was intended to reduce the initial investment of time and effort, increase participation and reduce the dropout rate. In addition, it ensured that the app measured the physical activity inherent in routine, everyday activities, as well as more purposeful exercise [Harr16]. Another research suggests an easy way to implement and battery friendly method to Step Counting problem, which is based on Android smartphone accelerometer, Fast Fourier Transform (FFT) and thresholding. The method, after applied preprocessing and FFT to the data gathered from smartphone's accelerometer (16hz), detects and counts steps by comparing the data to predefined thresholds. The predefined thresholds were specified by analyzing the accelerometer data obtained while users were sitting, standing, and walking. User experiments were conducted to test the method. Results showed 87.52% success for walking. Additionally, for sitting and standing the method had a success over 99%, as expected. And for running, only 41.7% of the steps were correctly counted [Dir17].

Another method is gyroscope. Gyroscope is used to measure the angular velocity and accelerometer is used to measure the acceleration. Both sensors are suitable for motion analysis and step counting but accelerometer is more popular since its ability detect motion and the rate of change in motion speed [Lin15].

Almost all existing pedometer techniques use accelerometer data to identify steps, which is not very accurate at low walking speeds. Another research also describes a gyroscope-based pedometer algorithm implemented in a smartphone. The smartphone is placed in the pocket of the trouser, which is a usual carrying position of the mobile phone. The gyroscope sensor data is used for the identification of steps. The algorithm was designed to demand minimal computational resources so that it can be easily implemented in an embedded platform [Jay13].

Also, there are a lot of applications like Water Drink Reminder by Leap Fitness Group that analyses the level of hydration or Fitbit application that track activity and help improve the lifestyle but they need Internet access to get the data.

Also, the Android platform offers several sensors that allow the device to monitor the movement. Possible sensor architectures vary by sensor type: width, linear acceleration, rotation vector, movement, step impact, and step detector sensors.

3 Modeling the solution

3.1 Functional Requirements

The functional requirements of the systems will be: The users must create a personal profile through a registration form, must perform activity and can save calories burned in the steps taken, must record the amount of liquids he consumes and have a graphical view of the progress, must record consuming foods and have a graphical view of progress, can create notes or memos, plays the music he has on the device within the application, can activate the flashlight of the device (if any) from the application, adds data to the database and has full control over them, has weekly statistics for each activity, has the possibilities to share the statistics. Also, the system will not allow the user to open the gifts when there are insufficient scores and when the daily goal is reached the user is notified via a message from the system.

3.2 Data modeling and application architecture

Since we will not use the client-server architecture for remote data storage, we will use SQLite for storing them in the application memory. To further enhance data security and manage them we will use content providers. Mobile app design architecture usually consists of multiple layers within an app, which includes the following layers:

1. Presentation Layer - This layer consists of components like UI components and UI process. The focus is how the application will be presented to the end user.

2. Business Layer - This layer is formed by business entities, workflows, and business components.

3. Data Layer - This layer meets the application requirements and facilitates secure data transactions. All the data are within this layer. The system receives as numerical input data from the accelerometer sensor, which are executed in the background and provide commands to perform the activity calculation that the user is performing. This

layer processes the data and then displays a notification if the conditions are meet. Also, the result obtained by the Barcode with other data taken from the camera are processed to generate the health card and the user profile picture.

3 Application Development

3.1 Technologies used

The software model chosen for the application is the incremental model. This choice was made because the application will be put into operation as soon as possible, in order to be presented to the users and to receive an evaluation from them [Bas12]. Through our assessment, we will be able to add or change application functionalities, bringing them closer to their needs. Also, the cost of the incremental process is lower compared to other alternatives. Development of application uses the Android Studio program and Java programming language. The interfaces are encoded through the XML language, also a part of them are programmed in Java. The other technologies on which the app is based are:

• Content Providers - manage activity data and database.

• Shared Preferences - Preserve user's personal information.

• EventBus - a service that enables communication between activities.

• BroadcastReceivers - stand all the time on standby to display messages to users at certain time intervals.

• Accelerometer Sensor - generates data for measuring user activity.

• Barcode Scanner - scanner for health card.

• Adobe Photoshop CS6 - Adobe's software program through which are processed icons and other application graphics.

• Android Services - serve to perform activities in the background.

• AsyncTasks - Increases application performance by performing background calculation.

3.2 Interface

The user interface is a key element when creating an application. Its wrong design can lead to project failure. It is the only contact point the user has with the app and through it accomplish a certain task. The Android interface is provided by Layout components, which are programmable in XML and can be located in the widgets. The application development is based on the Model View Controller (MVC) model where an interface is an xml file separated from the logical model that implements business logic [Sok14]. A scheme of all activities is presented in the figure below to create a better idea of the user interface.

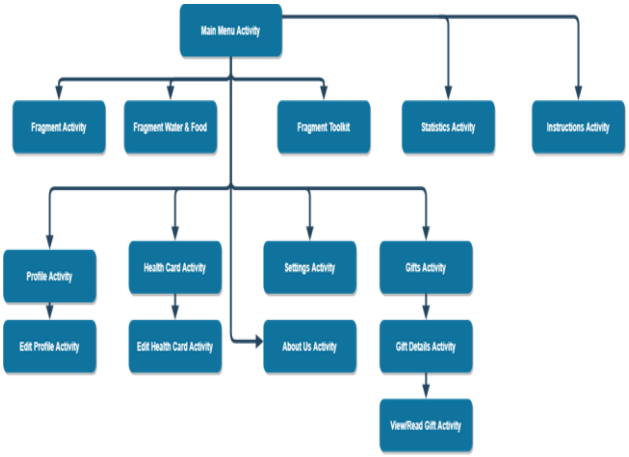

Figure 1: Activity and flow chart

The above chart shows the link between activities and how we can move in the app. The main interface is MainMenuActivity, from which we can open three components. FragmentActivity displays daily data and can start a new activity. FragmentWater & Food lists all drinks and foods and it is sufficient to choose one to register on a database, and the daily hydration progress is also visually presented. FragmentToolkit keeps the tools and services that offer application. The user can use device light, play music, and manage notes or personal memos. From the side menu, we can navigate to the profile where a summary of activities and personal data are presented. The user has the ability to update personal data in the EditProfile activity. EditHealthCard activity provides a form where a health card is scanned and other personal card data that are reflected in HealthCard activity are scanned. Then we have GiftsActivity where we list the gifts with the relevant details where the user has the possibility to click on them to open them and go to ViewActivity to browse the information. SettingsActivity offers a functionality that few applications offer. There the user has the ability to determine the sensitivity of the step measurement sensor and change the size of the step. For statistics generation we go to StatisticsActivity and through the graphs we have a reflection of the weekly

performance and we can share the activity with others. Finally, InstructionsActivity and AboutUSActivity have information on how to use the application and how to contact the developer.

3.3 Activity Measurer

The application does not need to be connected to the Internet. Any of its activity is performed offline, and data exists as long as the application stays installed on the device. In interface design, the elements are position in such a way to provide more information at the same time such as the current date and the number of steps performed. At the center of the page we have the actual progress of the activity presented with a circular progress indicator which has the amount of kcal burned. It is the presentation of the main activity such as data, time interval, burnt kcal and speed of movement. At the bottom of the layout there are two buttons whose role is the management of the activity. By clicking the start button, the application initializes the step meter service that relies on the accelerometer sensor and saves the number of steps.

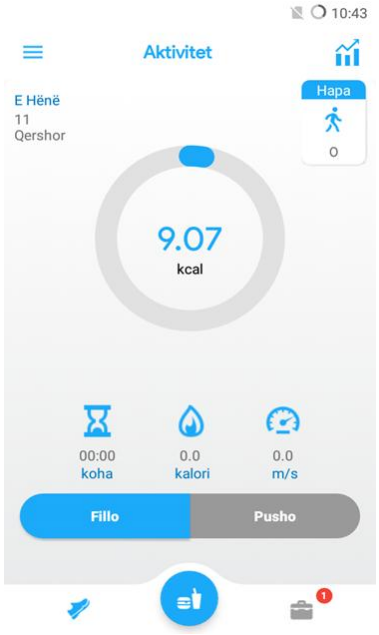

Figure 2: Activity Measurer

3.3 Hydration and food recorder

Water & Food is a design where the user can choose and record foods and drinks consumed during the day. Figure 3 shows the layout interface.

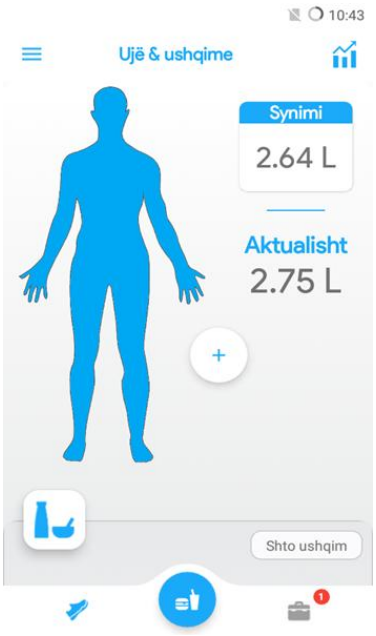

Figure 3: Water and food information

The figure above shows a visual representation of the current hydration level and the image that appears is according to the gender of the user. The information that is displayed in this layout is the daily intent and how it is currently implemented. In the center of the layout, there is a circular button with the + icon. Clicking it will show the drinks menu and we can choose what we are consuming. At the bottom of the page that are the foods which are automatically added to the database.

3.5 Tools - Toolkit

Providing extra tools within the application is an added value to the user because he does not need to download other applications but use a single one.

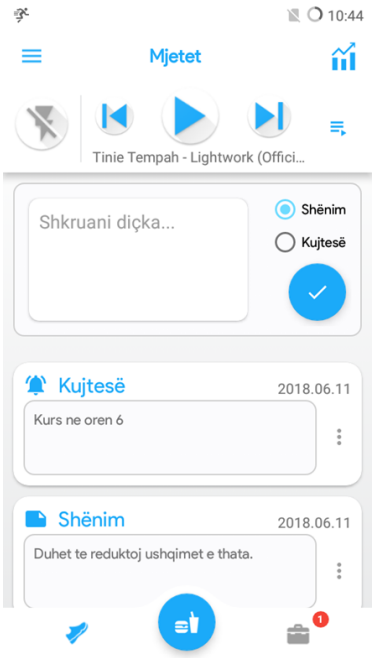

Figure 4: Tools

In the above interface, we have a list of all notes and memos. It is built in such a way that the user feels familiar with the icons and manages all the tools within the same interface. Here we can add a new memo or note. Each of them can be modified and deleted. At the same time, the activity is added to the database and checked whether it is a memo or not.

3.6 Health Card

The application offers the possibility of digitizing the health card, so every person can have his personal data without the need to keep the physical card. The design of Health Card is very simple and practical. It includes a digitized health card presentation with the user's picture, the barcode that is associated with the physical card and other general data like blood group, patient code and emergency contacts. Barcode is identical to the one found on the card and everyone can scan it through any barcode reader device and return the same code. If the user has specified emergency contacts when registering the card, when one of them clicks, the Android application automatically opens with the duplicate call number. By contrast, the buttons are inactive and cannot be clicked. The profile picture is stored in Shared Preferences, so it does not match the other system data.

Figure 5: Health Card

3.7 Score system and gifts

Some of the application's activities offer you the chance to win points. By doing this, the motivation and interest of the user to use the application increases. At the same time, it helps to achieve the goal of making a healthier lifestyle.

The activities that are part of the score system are:

1. Doing activities
2. Liquid consumption
3. Food consumption

If the user manages to meet the daily goal, he earns 100 points. With the points he can unlock the gifts contained in the application and to make their own. Points are estimated based on their health significance.

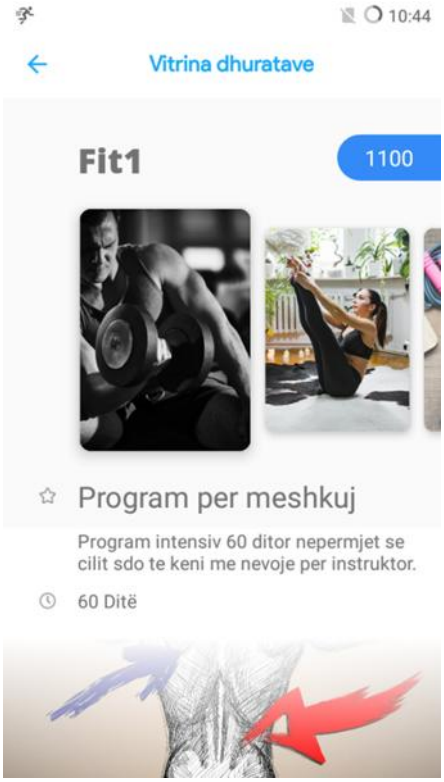

Figure 6: Gifts Interface

4 Conclusions

In this work, we have analyzed and explored the best methods for tracing user activity. This application is for everyone and fulfills all the needs, promotes activity and registers the liquids or foods, reminds them and motivates them by gifts. The application has been developed in a way to have a usable user interface, but at the same time the user achieves the goals he has set himself. Also, in this application is implemented a step meter, which through the accelerometer sensor measures all the steps that the user performs and calculates the burned kcal, the steps he has taken and the speed of the movement. In carrying out activities such as activity, hydration, or food, users can earn points to unlock the gifts that are hidden in the application. This technique is implemented to increase user interest and as a motivation to influence the use of the application. During the development, technical problems have been encountered in realizing high precision algorithms for measuring activity, optimizing the application, and supporting a wide range of smartphones.

We conclude that conducting activities, driven by mobile apps, is a very effective way to improve lifestyle, all at no additional cost. Implementing motivational techniques, including awards, gifts, and motivational announcements, enhances user confidence and encourages them to use more the application and to meet daily activity goals. This application meets all the conditions to be a true track record of activities for achieving a healthier lifestyle in our country. In the future, we expect the development of this application for the iOS platform, performance optimization and the addition of other services needed for the user.

In the future, we will work in developing web services to integrate digital card, user personal informations and other services in our system that has in focus managing data and images in E-Health.

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