Android Health App with Bioharness 3

Lecture: Ubiquitous Computing

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Abstract

Based on the Android Platform, the Heath App is an application for Android devices to track health and sportive progress. This means in detail that the application reads out necessary data from the Bioharness 3 with bluetooth technology and providing a functional but user-friendly UI.

The following data includes the information of the Bioharness 3: Heart rate, breathing rate and 3-axis accerlerometry. With this collected data the application produces diagrams and statistics for heartrate timelines, breathing rates and so on.

With the help of the GPS tracker from Android devices the application records e.g. the sports activity routes. With the heart rate and breathing rate the application finds the sport timeline out. If the application detects physical strain of the user it compares the current heart rate with the rested condition. With recognizing a longer period of an increased heart rate the application asks the user if he/she was active.

Also the application uses the heart rate, breathing rate and the GPS tracker from the Android devices to record the sleeping time. The Health App compares again the rested condition with the sleeping condition and displays a sleeping timeline. The GPS data is for the control, for instance, the location of the smart phone will not change.

With this information the application calculates a health diagram with needed sleeping times, actual sleeping times and sporting activities. The user of the application gives optionally current information (e.g. BMI, height, weight, age, …) for additional diagrams.

Motivation

There are three main issues which are addressed by this project:

First of all is the introduction in the Android environment: With some experience the goal is to learn more about the development environment and the available technology of smart phones. One of the technologies of the smart phone what will be used in this project is the GPS tracker.

Another issue is the great medical aspect of this project. The application shows when users are mostly stressed with the help of heart and breathing rate and the application allows to create movement profiles from the users with the GPS tracker from the Android device. With the movement profile it is possible to see where is the user every time stressed and

that allows to make suggestions how to change that situation.
With records of many users it is possible to create a ‘stress map’ and develop more devices resp. technology to support the situation of the user.

These medical aspects make it possible to extend this project in many ways and might be a solid basis to write a bachelor thesis. This is the main issue to do this ‘Mini-Project’ to learn more about the hardware Bioharness 3 and what technological possibilities will be offered by the Bioharness 3.
With this Mini-Project it is also possible to consider the output information and to create a well usable interface between the hardware Bioharness 3 and the Android environment.

The second thought are the possibilities. That means which direction is one of the best content to write the bachelor thesis.

Technology platform and model used

1. Hardware

The test object used is going to be a smartphone from the taiwanese company HTC. To be more precise it will be the HTC One (M7) which was released in March 2013. Originally it used to operate with Android 4.1.2 “Jelly Bean” OS but it has been updated to a newer Version available: Android 5.0.1 “Lollipop” OS.

The HTC One comes with usual cellular network standards like GPRS and HSPA+ but also fast LTE which allows data transmission rates up to 100 Mbit/s. For wireless local area networks the HTC One supports the IEEE 802.11n standard.
As mentioned in the abstract section, the app should support networking with other users. The smartphone used for this project provides all necessary aspects of internet communication and symbolizes a good testing object to simulate mobile devices with older but also newer communication technologies.

Also in this project will be used the hardware Bioharness 3. The Bioharness 3 is a compact physiological monitoring module that enables the capturing and transmission of comprehensive physiological data on the wearer via mobile and fixed data networks.
The Bioharness 3 uses BlueTooth technology to provide heart rate, breathing rate, and 3-axis accelerometery.

2. Programming

MVC:

The project architecture is built on the MVC architecture. The three layer called Model, View and Controller.

Model layer:

The model layer contains the representational data and is independent from the controller and view layer. The message of changed data from the model to the layers is built like the design pattern Observer. The Observer pattern is a software design pattern. The model layer contains the SQLite with all record information.

View layer:

The view layer shows the representational data from the model layer and react to the user input. The view layer knows about the model and controller layer. If the data from the model layer changes, the model layer gives the view layer a signal and the view layer updates all information. The view layer is built like the design pattern Composite. The view layer contains the GUI from the App and use the information about the model layer.

Controller layer:

The controller layer controls the view layer and gets the input from the user and react to the input. The input from the user contains the command to change the data from the model layer. The controller layer leads the command.

JUnit:

JUnit is a unit testing framework for the Java language. To test all function from the App, this testing framework will be used.

The test gives two results: Success and False. The result False contains a fail function or a wrong answer.

SQLite:

Storing both information about the user and the activity will be managed with SQLite.

The SQLite is a relational database management system and is part of the Android SDK for browsing table contents, run SQL commands, and perform other useful functions on SQLite database.

3. Graphic API

To give the user a feedback to his/her progress in form of charts, a graphics API is needed for this reason. Therefore a simple API is needed for 2D-charts (and animations). That's why not tend to use OpenGL. As a result the graphics API of Android will be used which includes simple tools like canvases, color filters, and so on.

Objectives/Goals

The main goal of the Health App for Android with Bioharness 3 is to learn the programming in the Android environment and the interface between Bioharness3 and the Android IDE. Another important goal for us is to learn necessary things for the Bachelor thesis in the sevenths semester, to use our knowledge.
Other goals are to create a demo with full function, to observe all deadlines from the time plan and write the code as clear as possible.
The definition of clean code in this project is to work with the tips and thought by Mr. Prof. Dr. Boger in the lecture Software Engineering and to use the knowledge from our practical semester in the fourth semester. For us that means to work as a team, with meetings, a concrete disposition, feedback meetings and an intermediate main meeting like in a real company.
The meetings will be repeated every week to discuss the problems and the progress of the project. Also these meetings will be used to write the blogs and plan the next steps and/or to change the project time plan.

Expected results

At the end of the project we expect to have all recommendations completed and our personal goals reached. Among others the objective of clean code should be accomplished as well as a JUnit test coverage of about 95% - 100%. The architecture of the app will be built as a structured and decoupled set to make sure that if (ex-) changes want to be made in a layer, there will be no consequences to the behavior of the whole program.
Also the interface between the Android environment and the hardware Bioharness3 should be well documented and stable.

Moreover particular deadlines should be observed and no time pressure should arise. Furthermore the ability to work in a team and the organization of a project should be consolidated as preparation for the vocational world.
With the completion of the project we expect to have built up a solid foundation to work on in future intern courses like a subject for the Bachelor thesis in the seventh semester.
In the end the project should also have been fun to work on this project and keep the interest for further extension.

Project time plan

Date	Description
Monday 02-November-2015	**Project start**
Monday 02-November-2015	Preparation Android
Monday 09-November-2015	Preparation Bioharness3
Monday 16-November-2015	Programming GPS-Tracker Android
Monday 30-November-2015	Programming Interface
Monday 14-December 2015	Create Graphical User Interface
Monday 21-December 2015	**Christmas break**
Monday 26-December 2015	Programming – Graphical User Interface
Monday 11-January 2016	Create documentation and presentation
Monday 18-January 2016	Create Poster and preparation for presentation
Sunday 24-January 2016	**Submission of written material**
Thursday 28-January 2016	**Final Workshop**