Cardea – Overview

… because health is the greatest good!

Team Gesundheit

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Short Description

Cardea assists users in their daily lives by giving useful location and situation-dependent tips. In addition to health-conscious users and athletes, it also helps pregnant women, diabetics, as well as people who suffer from heart disease or allergies, for example by monitoring their weight, blood pressure, or blood sugar curve, showing the way to the nearest pharmacy or warning against poll-related headaches. Due to the latest technologies and Windows Phone 7 mobile phones, the “little friend and helper” is always at hand that supports its users with reasonable advice for a more health-conscious life.

Benefits

Cardea raises health awareness, provides assistance in a multitude of situations in daily life, provides useful, health-related tips, and allows for monitoring of critical vital signs (as prescribed by a physician).

Target Customers

Health conscious people, pregnant women, diabetics, heart disease sufferers, allergy sufferers, ...

Market Situation / Competitors

Many small apps for other technologies (iPhone, Android) that address particular aspects, no comprehensive, sophisticated apps; little competition for Windows Phone 7

Business model

Financing through Market Place. Basic functionality and enhancements (Downloadable Content DLC). Co-financing through health-insurance cooperation for providing additional health programs

Cardea – Executive Summary

… because health is the greatest good!

Due to the large number and variety of novel technologies there is a big innovative potential in these days: mobile phones are becoming more powerful and smarter each day. Mobile Internet is commonplace. Entertainment is everywhere, even on the road. But modern consumers want not only to be entertained. They want to experience knowledge and information in a light-weight, even playful, manner. Because of the prevailing flood of information, hardly anyone is able to filter, to collect and to keep up in a conventional way. This is why many things fall by the wayside: regular doctor visits, healthy and balanced diet, taking medicines on time, monitoring pollen forecasts, etc. If you belong to a risk group in which a comprehensive health surveillance of vital data can be indispensable to life, this is particularly critical. Often one wishes for someone who has a way through this chaos: A guide that is always there with a good tip and helps to think of everything.

This guide is the Cardea App. It provides useful situational tips to assist its users in their daily lives. In addition to health-conscious, sporty people, it also assists pregnant women, diabetics, people with heart diseases, allergy sufferers and many others by not only monitoring over medicine taking schedules and doctor visit appointments, but, for example, by measuring the weight / blood sugar trends, by showing the way to the nearest pharmacists or by warning against pollen-related headaches. It is the holistic solution for anyone who wants to live a healthy, active, long life.

The design follows the principle that needed and useful information is to be reached easily and fast, and that all functions are customized for the individual user.

On the bottom of every page are our standard features: Users can obtain more detailed information, check and modify their stored data and signal that they do not feel well and want appropriate advice. The actual functionality of these buttons depends on the user's previous usage history of the app and the currently opened view. For an allergic person, suffering often from headaches, the page will, for example, first show "Tips for a headache", then "Way to the nearest pharmacy" and finally "Tips for allergy sufferers.

All health related information has to be configured by the user's physician in a user specific therapy. It is not our aim to provide medical advice but rather to present and enrich a prescribed therapy to the user.

Cardea

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1 Motivation

Due to the large number and variety of novel technologies there is a big innovative potential in these days: mobile phones are becoming more powerful and smarter each day. Mobile Internet is commonplace. Entertainment is everywhere, even on the road. But modern consumers want not only be entertained. They want to experience knowledge and information in a light-weight, even playful, manner. Because of the prevailing flood of information hardly anyone is able to filter in a conventional way, to collect and to keep up. This is why many things fall by the wayside: regular doctor visits, healthy and balanced diet, taking medicines on time. If you belong to a risk group in which a comprehensive health surveillance of vital data can be indispensable to life, this is particularly critical. Often one wishes for someone who has a way through this chaos: A guide that is always there with a good tip and helps to think of everything.

This guide is the Cardea app. It gives the user health advice which has been prescribed by the user's physician and which is tailored to the current situation, helps monitoring crucial vital signs according to the therapy, reminds of doctor visit appointments and medication, informs about pollen count and helps finding the shortest route to the nearest pharmacy. It is the holistic solution for anyone who wants to live a healthy, active, long life.

2 Design Principles

We decided to set the following principles for the design of our Cardea app: The design is appropriate. (Form follows function.) Each text has to be good to read. Necessary and useful information is always within easy reach. All functions are personally tailored to the user. Users should be surprised as little as possible. (Everything should work the way she/he expects.) There is no overload of information; instead it can be navigated via tree structures. The relevant section is then clearly displayed. The goal is an attractive, high-performance, comprehensive, context-sensitive interface. On each page the standard functions are located at the bottom: users can obtain more detailed information, check and modify their monitored health data and can proclaim that they do not feel well and want an appropriate advice.

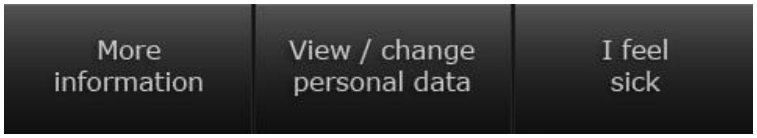

Figure 1: Design study of the quick access toolbar to access the standard functions

Figure 1 shows a corresponding design study. The actual function of these buttons depends on the user's previous usage history of the app and the current view of information. For an allergy sufferer, who most frequently complains of headaches but also watery eyes the help page presents itself as follows: first appears "Tips for a headache" and "Tips for watering eyes", then "path to the nearest pharmacy" and finally "Tips for allergy sufferers". The button for more information leads to a page with a more detailed description of the data presented on the current page as well as its meaning. From here it is also possible to navigate to more general information. In addition, the data that Cardea has collected can be viewed, edited or removed if necessary. If users tap on the according button, data is presented that is relevant in

this context. It is also possible to navigate in the data hierarchy, and to view and change more general or specific data from other areas.

3 User Stories

Cardea has a variety of use cases. To better illustrate its benefits, its usage is demonstrated by some examples.

3.1 Petra

Petra is pregnant. Of course she wants the best for her baby and herself. Especially during pregnancy one has to think about so much. Cardea assists her to remember all important dates and appointments, to monitor critical values – such as her weight changes - and informs her about proper behavior during pregnancy.

Figure 2: Design study for the role model Petra

Petra's day may look like this: After being woken by her cell phone, Cardea reminds her to enter her weight. At the same time she is informed that she has an appointment with her midwife today. So she climbs on the scale and inputs her current weight into Cardea. The app shows her the weight trend since the beginning of her pregnancy and signals to her that everything is fine and according to her doctor's therapy. So Petra may start her day relieved and happy.

If her weight gain was slightly outside the optimal range, Cardea would not only inform her about it but also provide personalized nutrition tips, offer background information about the data and give advice to discuss the current developments with her midwife or physician. With a bigger difference to the optimum weight range, Cardea would warn Petra and prompt her to consult her doctor as soon as possible.

Figure 2 shows how Cardea would present itself to Petra. Besides the functions already mentioned above, there are also the standard functions that reside on the bottom of each page and are described in detail in section

Design.

In a later version of Cardea, we plan to include monitoring critical pregnancies, such as pregnant diabetic women, gestational diabetes and toxemia. As already mentioned in these special cases, Cardea will consult the according therapy and contact a doctor from a tele-medicine center in case any vital sign does not match the prescribed goal. This may especially help people who live in more rural areas, because regular doctor visits may be reduced to a minimum.

3.2 Paula

Paula is an allergic person. Since she has a strong birch pollen allergy, she gets permanent headache and watery eyes during periods of high pollen count. To keep track of the situation and avoid experiencing any unpleasant surprises especially during the pollen season, she decided to use the services of Cardea.

When Paula looks on her cell phone in the morning, Cardea informs her on the current pollen count in the region. Because she will today not only work in her office in Berlin, but will have a meeting in Munich in the afternoon, Cardea informs her about the pollen situation there as well. Since Munich has a high pollen count in our scenario, she clicks on the corresponding button to view more details about it. She notes that she has to expect a headache. In addition, she will be presented a "Nearest Pharmacies" button. And actually she becomes aware that she has used up her stock of anti-allergy pills the day before. So she looks for the way to the nearest pharmacy, buys anti-allergy medicine on her way to the office in Berlin and has a very successful headache free meeting in Munich.

The three pages of the design study that are shown in figure 3, demonstrate how Cardea presents itself to its users. Besides the functions already mentioned, there are also the standard functions that reside on the bottom of each page and are described in detail in section

Design.

The basic idea of this solution is easily transferable to other user groups, such as users sensitive to UV radiation or weather fluctuations.

Figure 3: Design study for the role model Paula

3.3 Peter

Peter is suffering from heart disease. It is therefore vitally important to detect and monitor its health-related data regularly and continuously. So far, Peter had to visit his family doctor for the measurements once a week. Since Peter lives in a rural area lacking the infrastructure, the way to the family doctor is long and time consuming. With selected meters, he can record his vital parameters independently at home. Cardea allows Peter to track all the necessary data and store it both on his phone and in an electronic health record on the Internet. Since our app provides his data via an online electronic health record system, his family doctor can - with Peter's permission - access and review it. The gain of time and mobility increases Peter's quality of life.

Figure 4: Design study for the role model Peter

Immediately after the alarm clock rings, Cardea prompts him to specify how he is feeling today. Studies have shown that if a patient says he is not feeling well in such a tele-medicine scenario, it is a very strong indicator for a serious issue, which not necessarily would otherwise manifest itself in monitored health parameters. Cardea also asks for the measured values of Peter's health parameters as specified by Peter's doctor. In this scenario, he specifies his weight, his blood pressure values and his pulse rate. Then, he immediately gets feedback that everything is fine and can start the day comforted. Would values differ slightly from the prescribed therapy, Cardea would inform him about the situation and provide appropriate tips about diet or light physical activity. For large deviations, the app would warn him and point out that he must consult his doctor, for example by offering to dial his physician's number.

Peter's doctor may, with Peter's permission, monitor his vital data over the Internet and can thus interfere if he diagnoses any serious conditions.

Figure 4 shows the „good morning page" as it could present itself to Peter after waking up. Besides the functions already mentioned, there are also the standard functions that reside on the bottom of each page and are described in detail in section

Design.

3.4 Paul

Paul is a diabetic. Cardea supports him in checking his compliance with his strict diet plan. It reminds him in time of the syringes and food and provides information on the bread unit content of various foods. It also informs about fluctuations in air pressure and weather conditions that affect his metabolism and thus shorten the injection and meal periods. In addition, he - like the other roles too – is informed about medical appointments on time. The detection of blood glucose levels and the visualization of the course are possible and allow, for example, the doctor to view (if Paul permits) detailed information about Paul's health condition and the course of the disease.

3.5 Pia

Pia loves sports and places great emphasis on healthy nutrition. She is an ambitious runner, wants to keep track of her performance and compare it now and then with her friend Penelope. Cardea assists her by automatically recording her routes using GPS, measuring the duration and distance, and it informs her about performance improvements. It also gives nutritional advice and monitors weight gains and losses. If Penelope agrees, Pia can even view her routes and times and try to beat them. In a later version of Cardea, besides runners and cyclists, also other athletes will be supported. For example, strength athletes, for which the monitoring of body weight and muscle growth is essential. Also the support for traditional diets can be implemented based on this module.

4 Realization

To verify our ideas and test them in the real world, we have created a proof-of-concept implementation, which implements some of the described user stories. This app runs on Windows Phone 7 and uses Microsoft's Health Vault as an electronic health record. In this way we have learned a lot about the feasibility of our ideas and hardened our application design.

4.1 Architecture and Positioning

Figure 5 shows a rough overview of the service area in which Cardea is positioned. It combines the knowledge of various data sources, including weather services, health records, maps, information providers, medical knowledge databases and GPS data.

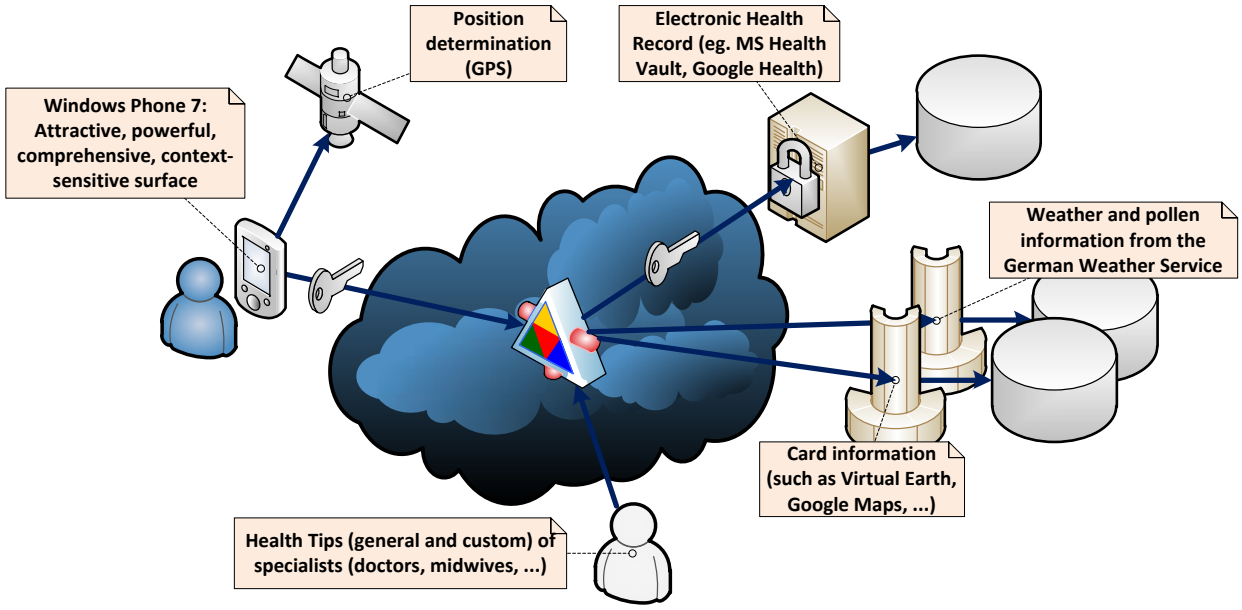

Figure 5: Positioning of Cardea in the service area.

A more detailed description of the architecture is given in Figure 6. All communication with the service cloud is made through our security manager. This ensures that no sensitive data leaks through the users to the outside. The privacy and sovereignty of our user is one of the key requirements for Cardea. Therefore, we decided to use an electronic health record. The central core of the application is the module manager. The modular structure of the app allows tailoring it specifically to the user's needs and also provides a basis for our funding model by downloading extensions, which is described in the section Financing.

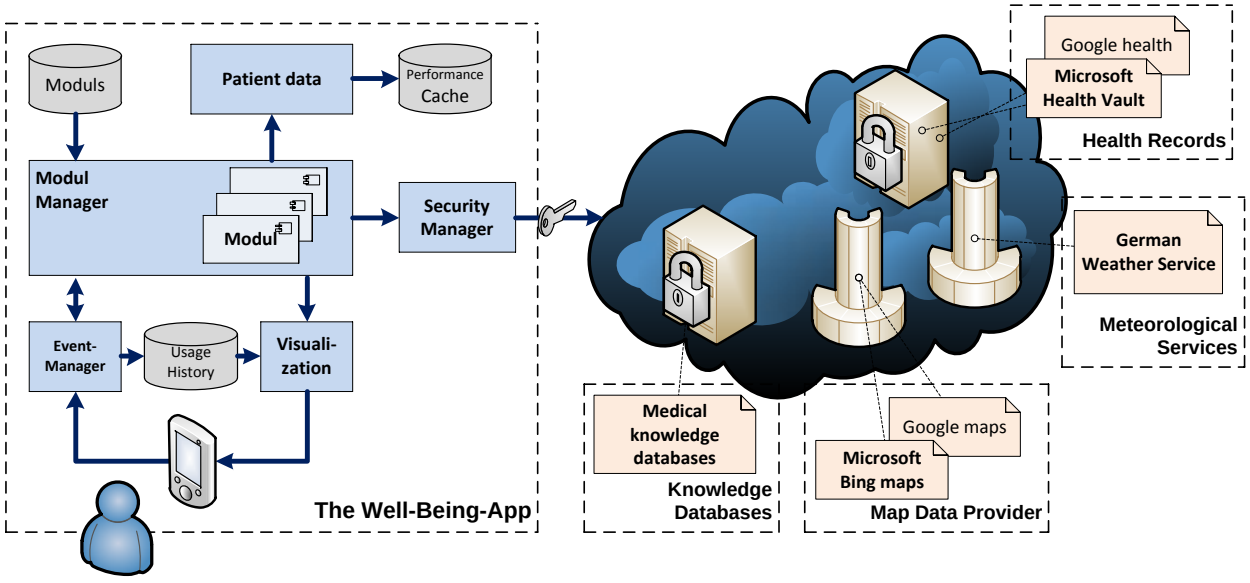

Figure 6: Architecture of Cardea

Each module provides a description of its interface in XAML format, a collection of information and advice about the appropriate scope, and access protocols to the various web services with it. In addition, each module is able to cooperate with the others. This cooperation can be either via direct

data exchange, carried out indirectly through the production and processing of events or the patient data. To cope with the potentially complex configurations of many different modules, we follow a simple principle: the data have priority. If the weight was already covered by a module, other modules can access it, too. An additional query is not necessary.

Since the visualization should be user-based, usage information is logged in the usage history. In this way it can be ensured that frequently selected menu items are easily accessible. Less frequently used menu items will appear in the lower parts of the selection lists. This logging also provides the opportunity - with the consent of the user - to receive user feedback and thus increase the quality of Cardea even more.

To optimize the speed of Cardea, a cache is used for patient data, so that a data access does not result in a call to the service provider all the time. In addition, this cache allows guaranteeing the operation of the app even if connectivity is lost.

4.2 Applied Technologies

Although, as indicated in Figure 6, in principle, any provider can be connected as a data source, we have so far for the proof-of-concept implementation only made use of services of Microsoft and Google for maps and medical records and the German Weather Service as a source of temperature, pollen, rain dates, etc. Since we lack the expertise to judge the quality of medical knowledge bases, we will evaluate appropriate services in collaboration with trained physicians.

For display on the Windows Phone 7, a special version of Silverlight is used, which is supported by a library to display graphs. Apart from the numerous appealing visualization techniques, the XAML concept of Silverlight allows us to easily integrate our modules into the surface.
In future, other features of Windows Phone 7 will be used, such as Bluetooth and camera. Thus, for example, the values of Bluetooth-enabled devices, like special scales or blood pressure meters can be read directly. Unfortunately, it is not currently possible to access the internal calendar of the Windows Phone 7 operating system. It is therefore necessary to provide calendar data through a web service. We hope that Microsoft will soon allow the required calendar access.

5 Financing

Cardea can be acquired using the Windows Phone 7 Market Place. It will initially offer a great amount of functionality. In addition, there will be special extensions that can be acquired by the appropriate consumers. Examples include a customized module for pregnant diabetic women or a specific module with special health tips for mountaineers. Based on the widespread concept of downloadable extensions (Downloadable Content) a value and cash flow chain is established after the sale.

In our research we have found no app of similar scope so far. However, there are many apps that cope with a particular aspect of our solution such as Pregnancy monitoring, diet tips or weight measurement. These apps have prices ranging from $ 2.99 to $ 7.99. To find a reasonable price for Cardea and the special extensions more accurate price studies have to be applied.

To ensure the high quality of our advices, it is particularly important also find a trained physician for the project team.

Another source of income can be to team up with health insurance companies, which may provide special health plans, such as diets or medical check-ups, and Cardea checks for compliance to those. In this context, health insurance companies may help their customers stay healthy in the first place and reward them for their compliance in various ways. Cardea as the medium for compliance checks may thus be cross financed directly from health insurance companies while participating users get the application for free.