Design of an interactive GUI for multimedia data exchange using SUR40 multi-touch panel

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Abstract. Designed interface is a proposed solution for the FP7 CARRE project. The project focuses on the development of medical experts supporting technologies. The most important part of this paper is the evolution of the developed interface, which allows to present and exchange multimedia data to the external devices. The design has been developed to ensure the convenience of usage for both, medical expert and the patient.
The paper also presents basic design guidelines, as well as tools that are available for developers. Overview of components for application development gives an idea of the possibilities and is a good starting point for further exploration of issues associated with the selected multi-touch panel.

Keywords: Graphical User Interface, GUI, design, SUR40, multi-touch panel

1 Introduction

Graphical User Interface (GUI) plays a key role in interaction between human and device. For a common user the quality of the interface is equivalent to quality of the whole product. He uses the interface without thinking about the complicated application architecture. Ergonomy of the interface is the main factor that determines whether the application is seen as useful. Designing the interface should be the first thing that is done while creating a program, since it is the most important element for the user. The user, however, as the recipient of the application, is the most important for the creator [1, 2, 3, 4]. User experience is a new term that has been established in last few years and it is described as a person's total experience using an interactive product. Providing a positive experience while interacting with application became an additional challenge for the designers [2].

The way of designing interfaces changes with the constant development of technology. The invention of touch screens was revolutionary for interface design. Many

elements of the ordinary interface can be replaced by gestures. Therefore, the aim is to minimize the interface and to concentrate on the content. Nowadays programs are more intuitive and ergonomic, because the intermediary items like keyboard or mouse are no longer needed.

Designing interfaces for multi-touch screens is a specific challenge. Multi-touch interface has to provide simultaneous access to content for many users. The way of accessing the content has to be intuitive and simple. When it comes to working with electronic devices, this type of interaction has a huge potential in terms of performance, usability and intuitiveness. There are many possible uses of multi-touch screens. Currently the most popular devices with multi-touch screens are tablets and smart phones. Touch screens for laptops and PCs are also being produced. Multi-touch screens can also be used as large-format interactive walls in stores or shopping centers. Touch screen used as an interactive table can significantly improve the cooperation of people working on a common project. Some of the technologies that are being developed, enable objects recognition using specially prepared tags. It gives endless possibilities of interacting with computers using physical objects. This kind of user experience is much more immersive and satisfying than the usual work with a keyboard and mouse.

2 SUR40 multi-touch panel

Samsung SUR40 is an example of a large-format multi-touch screen. It has been developed in cooperation by Samsung and Microsoft. It is provided with PixelSense technology. The device is the size of an average 40" TV screen and thanks to the 360-degree interface lets a group of people use the SUR40 simultaneously. It is possible to create an application that allows one person to present the information to others, or allows a group of people to make a collaborative decision.

2.1 Unit description

Samsung SUR40 with Microsoft PixelSense ships with the AMD Athlon II X2 2.9GHz Dual Core processor and The AMD Radeon HD 6570M desktop graphics card, both of which deliver clear and vibrant visuals. The device has four built-in speakers. The Samsung SUR40 with Microsoft PixelSense utilizes a Full HD LED display. Featuring a large 16:9 40" design with 1920 x 1080 resolutions. Pixel size is 0.46125 x 0.46125 mm. The SUR40 includes the world's largest sheet of Gorilla Glass bonded to any display. The material of the protective layer is touted by the manufacturer as an extremely strong, lightweight and resistant to scratches. One-hour water ingress protection is also featured. The device is 4" thin. It features four USB ports, HDMI port, a Wi-Fi 802.11n router and Bluetooth and Ethernet connections. Samsung SUR40 with Microsoft PixelSense ships with Windows 7 operating system and additional component named Surface Shell. This component is responsible for working in Surface mode [5, 9, 10].

2.2 PixelSense technology

PixelSense is a technology that allows each pixel on the screen to act as a sensor. This enables detection of objects that interact with the device. Integrated PixelSense sensors are built directly into the layers of the LCD screen. These sensors enable detection, identification and reaction to objects with predefined tags and to untagged objects. This technology allows simultaneous identification of 52 touch points [6, 8].

2.3 Microsoft Surface 2.0 SDK

Microsoft Surface 2.0 SDK is intended for developing applications based on Microsoft PixelSense platform. It comprises two development environments .NET 4.0 and XNA. The SDK provides two APIs. The first one is *Presentation Layer* integrated with Windows Presentation Foundation (WPF), which is based on .NET 4.0. Presentation Layer interface extends WPF, adding controls designed for Microsoft Surface multi-touch platform. GUI is designed in XAML markup language and the behavior of the application is programmed in the programming language C#. The second one API is *Core Layer* based on XNA Game Studio 4.0. This programming interface can be used to develop 3D graphic applications [8, 11, 12]. In order to program applications using the Surface SDK, the following software is required:

- Microsoft Visual C# 2010 Express Edition or Microsoft Visual Studio 2010,
- Microsoft .NET Framework 4.0,
- Microsoft XNA Framework Redistributable 4.0,
- Windows 7 operating system.

It should be mentioned that SDK allows writing applications not only for PixelSense devices, but also for computers with a touch-screen and a Windows7 operating system.

2.4 Tagged objects and blobs

Microsoft PixelSense technology enables Samsung SUR40 to recognize tagged and untagged objects. Tag is a marker located on the object has a special pattern (Fig. 1), which thanks to PixelSense technology, can be read using the infrared rays. Markers can be used to identify objects or people.

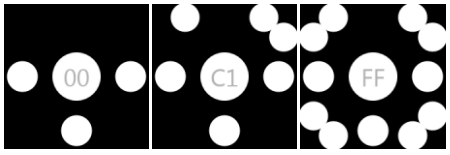

Fig. 1. Examples of Tags [13]

Tags store 8 bits of information, so they can contain 256 different values. Each tag to work properly must have dimensions of exactly 0.75 x 0.75 inches. For the application to react properly to the markers, special control, *TagVisualizer* must be used. The application can be programmed to turn on itself when appropriate marker is placed on

the screen. The object on which marker was placed should not reflect infrared rays, to prevent generating additional touch points.

Blobs are objects that do not have tags and are not fingers. These objects are unlabeled. The application can be programmed so that it behaves in a certain way when an unmarked object is detected, for example by displaying a visualization object on the screen [11, 12, 13].

3 General guidelines for interface designing

The main goal in designing an interface is to find a way to explain to user how the application is working. This involves the creation of graphic elements, which are demonstratively illustrating what the application does and how it should be used. The interface should ensure proper communication between the user and the computer [2].

When designing the interface, it is crucial to determine for whom the product is intended. This determines the selection of graphics, colors, and arrangement of interface elements. The basic features of a well-designed interface are following:

- Intelligibility - the interface should be easy to use and understand. Users of intelligible interfaces are less likely to be confused and they work more efficiently.
- Brevity - it is important that the interface does not contain unimportant or repetitive content.
- Familiarity - the interface should use elements and symbols that are obvious to users.
- Accessibility - the interface should work quickly and provide feedback to ensure the user that he/she performed a proper operation.
- Consistency - maintaining consistency allows the user to quickly identify behavior patterns in each following application window.
- Aesthetics - although it is not necessary for the proper operation of the program, it is important because of its impact on the level of user satisfaction. Aesthetic plays an important role in creating a positive user experience.
- Efficiency - interface is designed to increase user productivity.
- Forbearance - the possibility of withdrawal from accidental or unintended actions [2, 4, 14, 15].

3.1 Interface designing guidelines for Surface devices

Microsoft developers team established guidelines for creating GUI on Surface devices. They are designed to make application intuitive, engaging and visually appealing. Many of those guidelines refers to general rules of designing interface:

- Simple - the application must be clear. The way to use it should be obvious to the user. Excessive decorative elements should be avoided.
- Organized - elements should be arranged hierarchically and they should form a consistent structure.

- Content Oriented - information and data are always the core of the application, controls are secondary.
- Dynamic - it is important to take care of move and animation smoothness.

Samsung SUR40 device with PixelSense technology can be attached horizontally or vertically, depending on the intended use of the device. If SUR40 unit is placed horizontally, the interface has to provide possibility of using the application from all sides, it has to be capable of 360-degrees interaction. Therefore, the following guidelines should be taken into account:

- avoiding elements oriented along one edge of the display,
- enabling the change of elements' orientation by the user,
- orienting the newly opened content in the direction of the person who opened it,
- providing access to any element for every user, regardless of its position in relation to the table,
- ensuring readability of the contents from every side of the device.

The elementary rule of multi-touch interface designing is to use developed standards for operating applications using gestures (eg. changing the size of the item with two fingers, dragging items with one finger).

4 SUR40 as the interactive user interface in CARRE project

4.1 About CARRE project

CARRE is an EU FP7-ICT funded project with the goal to provide innovative means for the management of comorbidities (multiple co-occurring medical conditions), especially in the case of chronic cardiac and renal disease patients or persons with increased risk of such conditions.

Sources of medical and other knowledge will be semantically linked with sensor outputs to provide clinical information personalized to the individual patient, to be able to track the progression and interactions of comorbid conditions. Visual analytics will be employed so that patients and clinicians will be able to visualize, understand and interact with this linked knowledge and take advantage of personalized empowerment services supported by a dedicated decision support system.

The ultimate goal is to provide the means for patients with comorbidities to take an active role in care processes, including self-care and shared decision-making, and to support medical professionals in understanding and treating comorbidities via an integrative approach [7].

4.2 Decision Support System in CARRE project

Decision making in healthcare is a complex process in terms of number of parameters and variables, outcome possibilities and amount of information must be processed.

Decision support systems (DSS) can assist patients and provide to him advices, recommendations and diagnosis of problems in cardiorenal domain, where the optimal solutions for a given sort of data about the possible consequences are determined similar as human experts in the field.

A modern intelligent decision support system not only provides access to data and models. It is also a significant development in the field of analytical data processing, data warehousing and artificial intelligence-aided methods of knowledge discovery in databases i.e. data mining [7].

Our aim was to explore the possibilities of using the SUR40 device and its software as visualization platform in CARRE project.

4.3 Designed interface

The interface was designed for CARRE project purposes and its goal is to improve the communication between patient and internist (or medical expert). The interface was equipped with set of visual elements, which enable the future end user to acquire the medical domain knowledge in more useful as well as user-friendly way which is shown in the figure 2 below. The designed interface can assist patients and doctors by providing advices, recommendations and diagnosis of problems in aging and growing population with chronic diseases, by means of interactive visualization interface, variables and recommendation to intuitive and user-friendly visualization in patient application.

Fig. 2. Designed interface presented on SUR40 device

The interface has scalable architecture, which enable further development. The interface has been created using rules and guidelines described in subsection 3. It is also possible to present multimedia data and to send it to an external device using Bluetooth protocol. Information about contents are accessible through QR codes generat-

ed by application. Designed interface provides to medical expert possibility review all types of data from the hospitals' records and the patient's records together with patient. They can sit side-by-side or across from each other viewing the same information using hand gestures to scroll through, open, zoom, rotate in 3D, push across the table, and drag and drop records from one storage repository to the other.

The proposed interface improve the doctor-patient communication by the use of following features:

- possibility of multiple users interaction with the one application,
- easy manipulation of the elements that display the contents,
- quick and easy access to information,
- transmission of multimedia data,
- intuitive navigation system.

5 Summary

Designed graphical interface supports the exchange of information using multi-touch Surface device. The designed GUI has been implemented for the SUR40 unit. The application has been tested and it is working correctly. It can be used in patient - doctor cooperation. In further development of our interface we consider to add following possibilities:

- animating transitions between windows to make interface more dynamic and consistent,
- enriching applications with sound effects that would indicate an action made by the user. Sounds could also provide feedback on whether an operation is executable,
- currently, the removal of elements is only possible directly from code, so that user can not accidentally remove any important component. There is a possibility of providing extra fields for confirming the intentions of the user, therefore reducing the risk of removing the essential elements. The user will be able to use the interface more freely,
- allowing the user to undo last action,
- placing search engine in the application,
- extending application database.

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References

1. Kuliński M.: Obiektywne i subiektywne czynniki jakości użytkowej graficznych interfejsów użytkownika. Praca doktorska, 2007.
2. Sikorski, M.: Interfejs użytkownika: od pracy, przez emocje, do relacje. Unpublished paper presented at Interfejs użytkownika - Kansei w praktyce Conference, Warszawa 2006. Warsaw.

3. Najmiec A.: Ergonomia oprogramowania – od przepisów do praktyki. Bezpieczeństwo Pracy – Nauka i Praktyka, 5/2002.
4. Fadeyev D.: Interfejsy użytkownika w nowoczesnych aplikacjach webowych. The Smashing Book #1, Helion, 2009.
5. http://www.samsung.com/
6. http://www.microsoft.com/en-us/pixelsense/
7. http://www.carre-project.eu/
8. Designing and Developing Microsoft Surface Application, http://www.microsoft.com/en-us/pixelsense/training20/index.html .
9. Samsung SUR40 – Specification Sheet.
10. Samsung SUR40 – User Manual.
11. Developing Applications for Microsoft Surface 2.0, 2011.
12. Microsoft Surface 2.0 Design and Interaction Guide, 2011.
13. Tagged Object Integration for Surface 2.0, 2012.
14. Inchauste F.: Widoczne kontra niewidoczne. The Smashing Book #2, Helion, 2011.
15. Chapman C.: The Smashing Idea Book: From Inspiration to Application, Helion, 2011.