

Introducing Innovative Features to the IPTV Environment

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Abstract – The Innbox Media Centre, presented in this paper, represents a new-generation, multimedia experience by supporting a variety of television-distribution platforms. It provides a rich set of IPTV services and supports popular internet content through plug-ins and a fully featured web browser for a variety of Web 2.0 services.

The Innbox Media Centre acts as a framework for special plug-ins by which additional features can be provided. As such, Innbox enables the rapid application, development and deployment of new, innovative services, such as home/office automation control, energy-resource-consumption monitoring, home-alarm control, health telemonitoring, real-time communication support, etc.

One of the main challenges during the Innbox Media Centre's development was the design of the graphical user interface. Our goal was to create a product with an excellent user experience and a graphical user interface that will be intuitive and easy to use for different user groups, and without any previous training. In order to evaluate the usability and user experience of the Innbox Media Centre, several usability and user-experience studies were conducted and are discussed in this paper.

I. INTRODUCTION

The television industry is now in the midst of profound changes [1]. Digital television has been evolving for several years and television services are becoming increasingly interactive. Because of the advances in video-compression technology and improved media-coding algorithms, bandwidth requirements are being reduced. At the same time, the network-access bandwidth of many available end-user services is increasing. All these changes have resulted in an increasing interest in the delivery of TV services via Internet Protocol (IP) networks, widely known as Internet Protocol Television (IPTV). The distribution over an IP network provides an easy delivery of various modern features and functionalities, which includes services, applications and content. IPTV includes television services provided by telecommunications companies, operators and other service providers. The television programmes are transmitted to set-top or net-top boxes through dedicated networks or Over-The-Top (OTT) via a standard internet connection [2].

In the sections that follow we present the Innbox Media centre, a product that offers numerous innovative features to the IPTV environment.

II. INNBOX MEDIA CENTRE SYSTEM

Most currently deployed IPTV systems rely on set-top-boxes (STBs). A STB is usually a custom device, dedicated to audio-video decoding with relatively little capabilities for the execution of services and applications. It is connected to a television set and has an external source of signal. The STB device turns the signal into content, which is then displayed on the television screen or another display [3]. Adding additional services to the STB platform is difficult and usually in the domain of STB manufacturers and IPTV platform developers [4]. That was one of the main reasons we chose a net-top-box (NTB) instead of a STB as the hardware for the Innbox Media Centre solution. A NTB is a very-small-form-factor, inexpensive, medium-power, desktop computer designed for basic tasks such as surfing the internet, accessing web-based applications, document processing, and audio/video playback. It is installed in the user's environment and is connected directly to the TV set [5].

The Innbox Media Centre is a complete NTB solution, which represents a new generation multimedia experience by supporting a variety of TV distribution platforms such as IPTV and internet TV. Additionally, it integrates the facility for personal multimedia entertainment by offering videos, pictures, music, news, etc. As a complete package, the Innbox Media Centre includes a rich set of services, including: Live TV, personal video recorder, electronic program guide, plug-ins to Web 2.0 services (e.g., YouTube, Picasa and Facebook), access to significant online media-techs and the management (network access, storage, and viewer) of personal content (e.g., photographs, videos and music) [6].

The introduction of more powerful processors in the NTB chipsets has brought a shift in the architecture of the latest generation of IPTV and interactive TV solutions. The thin-client approach used in the past was replaced with a fat-client approach. As a result, the necessary meta-data is cached in the background. The user interface can therefore provide a fast and pleasant user experience [7].

III. STANDARD INNBOX MEDIA CENTRE FEATURES

Some of the standard features included in the Innbox Media Center are:

- *Electronic program guide (EPG)*, used for presenting the program guide on the TV screen. It provides users with fast and customized searching for favourite TV and radio programs.
- *Personal video recorder (PVR)*, which stores the content on a local hard disk. Users are able to schedule video recording from the EPG user interface.
- *Pause TV* enables users to pause Live TV during some other activities, e.g., answering a call.
- *Restricted access*, used for blocking the access to content, that is, for example, not suitable for minors. It is used when age-related information for content is provided by the operator.
- *Video on demand*, where users can select among a wide range of movies. Different presentation modes of the video library are available to the end user, who is able to customize the user interface according to personal preferences.
- *Local content*. The Innbox Media Centre combines audio and video players in a single device. It enables users to consume audio, video and photo content, which can be stored and played from the internet, local network, USB storage or DVD disc.
- *Social networking*. Users are able to access social networking tools such as YouTube, Flickr, Twitter and Facebook directly from their TV screen.
- *Internet browser* for browsing the internet on the TV screen via remote control and an additional keyboard.

Other advanced features included in the Innbox Media Centre are presented in the following sections.

IV. TELEMEDICINE SOLUTIONS IN THE IPTV ENVIRONMENT

Since the 1990s the interest in telemedicine has increased dramatically. Telemedicine is generally defined as the use of telecommunications and information technologies to provide a remote delivery and exchange of medical information and services [8]. Unfortunately, many people from different user groups have problems or are afraid to use modern technologies. On the other hand, statistics from various studies have shown that people spend a large part of their time watching TV [9]. Hence, TV can be used as a medium for delivering complex telemedicine and other e-Health services to users, since this is the device they are most familiar with. The presentation on the TV screen and management relying on a remote control provides a potential to bring the telemedicine services to users in a new, accessible and user-friendly form.

Telemedicine and e-Health services were introduced to the Innbox Media Centre through the applications MyHealth and MedReminder, which are presented below.

A. My Health – an IPTV-based health-telemonitoring system

My Health (Figure 1) is a personal health application, which is completely integrated into the domestic IPTV environment. Optionally, My Health can be connected to a back-end system, which is responsible for advanced health monitoring and other e-Health features and services [4].



Figure 1: My Health, an IPTV-based health telemonitoring system

The current My Health implementation enables blood-pressure and weight measurements with common sensors and weight scales that have built-in communication interfaces. The measurement results are automatically read from the measuring device and stored in the NTB. A notification about each measurement is available on the TV screen. Depending on the user's preferences, the measurement history is presented in a tabular or graphical form, where users are able to review, edit or delete the existing measurements (Figure 2). The simultaneous uploading of measurement values and other corresponding meta-information to the back-end system is assured by a background communication system.

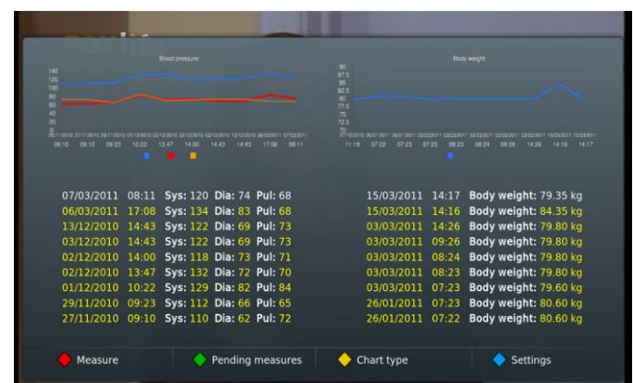


Figure 2: Measurement history for a specific user

The My Health application provides multi-user support. Users are authenticated by a PIN number or a smart card. This authentication can be bypassed when the system is used by only one user.

To determine the users' subjective assessments of the My Health application's usability, a user-evaluation study was conducted. The results from the study showed that users find the application acceptable and good in terms of usability aspects.

B. MedReminder- an interactive multimedia application

MedReminder is another medical application that is integrated into the IPTV environment. This client-server application is implemented within the XBMC multimedia platform. MedReminder is used to remind people to take their medications as prescribed, and to call relatives or medical personnel in an emergency situation. Whenever a user is supposed to take the prescribed medicine, a medicine reminder accompanied by a sound notification appears on the television screen (

Figure 3).

The MedReminder window contains short and clear instruction about the medication's usage. Additional information about the medicine is available in a video that is played on the user's demand. In emergency cases, users are able to call a relative or authorized medical personnel by pressing a key on the TV remote control. When there is no user feedback after a preset time interval (1-10 min), the back-end systems triggers a voice call (on a mobile or fixed-line telephone), SMS message or an e-mail notification [10] .



Figure 3: MedReminder notification on the TV screen

The MedReminder application was also evaluated by a group of study participants. During the three weeks of MedReminder usage in their homes, twelve study participants were carrying out different tasks and rating the tasks' difficulty. Afterwards they all completed a standard usability questionnaire and were interviewed by a usability expert.

The results obtained from the conducted user-evaluation study showed that MedReminder has a good potential for a high adoption rate among users. The study participants evaluated MedReminder as logical, useful and easy to use and operate. From the study results it can be concluded that MedReminder's greatest advantages for users are recorded video clips with medical instructions and the possibility to make a call using only the TV remote control.

Even though study participants evaluated MedReminder as acceptable, they gave suggestions for further improvements. Their suggestions and some additional features are going to be added to the existing version and an enhanced MedReminder will be available in the near future.

V. CONNECTED HOME IN THE IPTV ENVIRONMENT

The connected home solution is an innovative and transparent network solution that expands the use of an existing individual end-user connection. The solution enables users to expand the usability of the conventional desktop phone using the TV as the primary communication device for voice, video and messaging [11].

Connected home combines multiple communication devices that are connected via local area networks, a wireless home network, mobile networks and/or with the internet. Such devices include media centre (TV set, TV remote control NTB, gaming consoles), wireless IP cameras, mobile phones and/or fixed-line phones, print server, wireless broadband router, and other compatible devices (Figure 4). By using all these various communication devices offered by Connected Home the users gain a rich portfolio of innovative services, such as:

- Web browsing on a TV set
- Voice calls with a click on the remote control
- Video calls via the TV set
- Presence status overview and text messaging on the TV set
- Home/office automation control
- Energy resource consumption monitoring
- Home/office alarm monitoring

Connected Home equipment



Figure 4: End-user equipment for the Connected Home solution

A. User interface design

During the Innbox Media Centre's development, special attention was devoted to the design of the graphical user interface (GUI). Various design guidelines for the interactive TV were taken into consideration when designing the GUI for the Innbox Media Centre [12]. Additionally, a user-centred design approach was applied. User-centred design is an approach to design that grounds the process in information about the people who will use the product. UCD processes focus on users through the planning, design and development of a product [13]. The knowledge of the actual users with the support of specially formulated analyses, as well as the testing of products by the actual users, enables the direct influence of users on the traditional business areas for customers, marketing and sales, and also helps optimize the business practice of the company. For this purpose, many users were involved and various user studies were conducted throughout the Innbox Media Center's development lifecycle. As a result, several GUIs were created, each of them designed for a specific user group, i.e., elderly people, children, young people and advanced users. In this way the end-users are able to adjust the GUI in a way that best suits their needs and preferences.

The Innbox Media Centre's navigation models and its unified user interface for applications running on the TV are based on scrolling techniques. Because of the highly performing hardware all the necessary meta-data is locally cached and the system response is practically instantaneous. Consequently, the user interface can work faster than the users can perceive. To avoid the problem, another user study was conducted which helped us to identify the optimal speed for scrolling navigation, i.e., it answered the question – How fast is the navigation on a TV user interface that can make sure a wide user segment obtains comfortable and acceptable user performance?



Figure 5: GUIs designed for specific user groups

VI. CONCLUSION

The Innbox Media Centre presented in this paper is a complete NTB solution that supports a variety of TV distribution platforms and integrates a facility for personal multimedia entertainment by offering videos, pictures, music and news. Besides the standard features usually included in other media centres, the Innbox Media Centre provides users with advanced features for telemedicine, home/office automation control, energy-resource-consumption monitoring and real-time communication support. One of the main challenges during the Innbox Media Centre's development was the design of the graphical user interface (GUI). A user-centred design approach was applied for creating features that are useful, intuitive and user friendly. Throughout the development lifecycle, various user studies were conducted. The obtained results showed that the product has strong points and advantages. At the same time, the user studies have helped us find areas where further improvement is needed.

In our future work we are going to use the study results to improve the Innbox Media Centre's future extensions. Therefore, several user proposals will be added to the existing version as additional features. Enhanced Innbox Media Centre versions will be evaluated again with more detailed user-evaluation studies.

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