

# User Interface Design for Multi-platform Interactive Sports Content Broadcasting

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**Abstract.** The new generation of television viewers is currently being confronted and becoming acquainted with a series of technological developments in the realm of consumer electronics and gaming that raise their expectations for similar advances in TV broadcasts. The MELISA platform aims at the cross-media broadcasting of sports events featuring interactive advertising and sports-related games over digital television and next generation mobile network infrastructures. The platform provides services for optimal presentation of complex interactive real time video content, for advertisement and an advanced real-time gaming (betting) engine in at least two different client platforms. User interface design is a major issue in a complex end-to-end solution having to cater the needs of users ranging from broadcasting professionals to end-users. Especially in the case of interactive gaming there are numerous challenges in the user interface design, in order to deliver to all categories of devices (and end users) equal quantity and quality of information. In this paper we present the overall system architecture and philosophy and then focus on user interface design issues both for the routine work of broadcasting professionals as well as the end users, owners of different types of consumer devices (such as PDAs and interactive TV Set Top Boxes).

## 1 Introduction

The MELISA platform aims to establish the infrastructure to support the virtual value chain for sports events broadcasting over wireless and digital television networks, by offering valuable, revenue building services, real-time video content, for advertisements and an advanced real-time gaming.

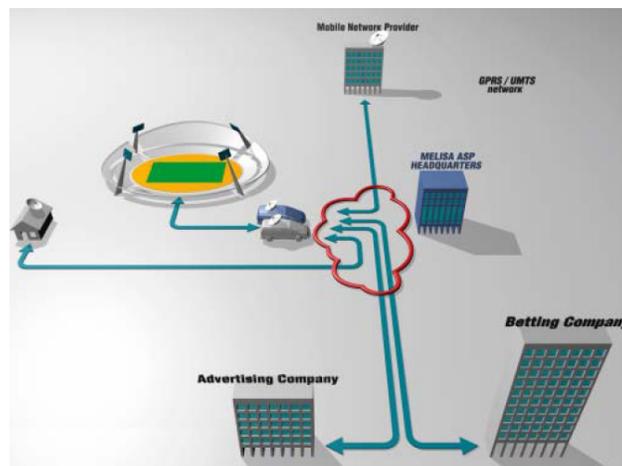
An end-to-end solution for the authoring and delivery of this new media content in real-time must provide the infrastructure necessary for the management, generation and broadcasting a multitude of services related to cross-media sports broadcasting.

MELISA introduces authoring tools for production, encoding and playback of rich interactive multimedia content in MPEG-4 for a variety of devices over wireless and digital television networks. The User Interface Design is based on basic understanding of human skill, cognitive aspects of human-computer interaction and on detailed knowledge about the specific needs and requirements of the end users in an interactive and time critical environment.

The Melisa clients provide the viewer with enhanced interactive content for real-time betting, advertising and in game information enhancing the user experience. User ergonomics and cognitive principles play an import role in the user interface design since the design itself is a significant acceptance factor for any new services on modern consumer devices.

## 2 Melisa end-to-end Broadcasting Platform

The Melisa platform is an end-to-end system that allows the creation, distribution and viewing of enhanced interactive video content in MPEG2 and MPEG4 format. The Server Platform provides a range of tools for collection and processing of XML information and video streams, from a variety of input sources.



**Fig. 1.** MELISA Information flow and involved entities

The tools that comprise the MELISA system address multiple entities, as shown in Figure 1: a broadcasting organization, a wireless network operator, a betting company (mainly generating and updating the odds), an advertisement company and the MELISA ASP. The latter is the point of integration for all services and information, and is

represented in the figure by a building representing their headquarters, as well as a dedicated van attached to the Outside-Broadcasting Van of the broadcasting organization. The role of the MELISA ASP may be played by any other involved entity in the overall scenario, e.g. the broadcaster themselves.

The service offers the viewers/mobile phone users, the ability to receive additional content for optimal, sports broadcast related, information visualization. This information leads on the one hand to more confidence in participating in betting services. Additionally it allows for the so called embedded advertisement, i.e. an opportunity to be informed in a non intrusive way about products in pre-selected categories. The challenge for MELISA is to achieve an easy to use and appealing way for the diversity of consumers using interactive television and next generation mobile phones, to equally enjoy the MELISA service.

## **2.1 System Components**

The central entity of the Melisa system is the Melisa Application Server where all the information is collected and processed for transmitting. The Visual Enhancement and Capturing Unit captures the video content and provides enhanced content by real-time generation of visual enhancements that help the viewer quantify the context of the game, e.g. by overlaying graphics that denote the distance between two athletes.

A Template editor in the Melisa Application Server allows the creation of Visual Enhancement Templates prior to an event, thus reducing the processing needs during the live broadcast. The broadcast director is aware of the available pre-defined enhancements that can be instantiated during an event using the Work Flow Application. The Work Flow Control is the application that receives and controls all the available information. The Work Flow Control allows the viewing and managing of all content authoring activities during a broadcast investing only very limited time and effort.

The Lottery and the Advertising System are physically separated from the Melisa system. Both communicate with the Work Flow Control to provide the system with up to date betting and Advertising content that is updated in real-time. The betting and information is used to display real-time bet options to the viewer during a sports event. The viewer can then place a bet in real-time via a return channel to the Melisa Server. The Advertising content is used in conjunction with other visual enhancements such as player or car tracking. The car or the player becomes an active hotspot that the user can select and activate an advertisement possibly with links to e-commerce websites.

The Melisa Application server provides additional tools for scheduling Sports events, managing athlete and team information, as well as annotation tools for the generation of statistical information from scheduled event.

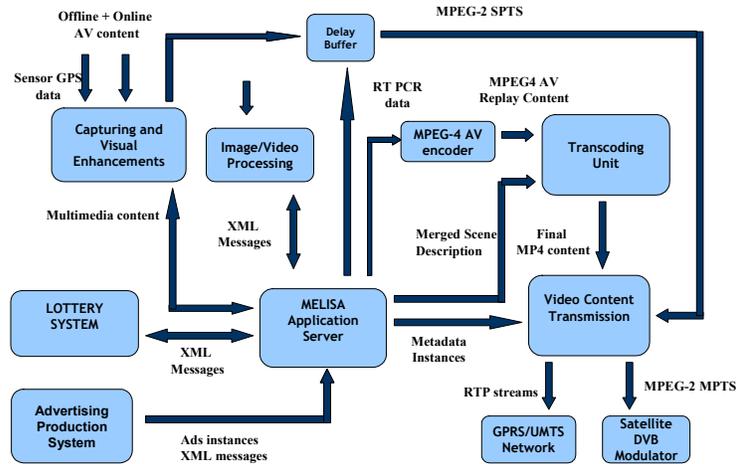


Fig. 2. Overall Melisa Server Design

The Application server processes the collected content and redirects it for Transcoding to MPEG-4 interactive content. The Video Content Transmission module generates the video streams for the Set Top Box and mobile phone clients. The derived MPEG-4 scene and accompanying MPEG-7 metadata are multiplexed with the original MPEG-2 Single Program Transport Stream (SPTS) and broadcasted via DVB Satellite Networks to the Set Top Box. In the case of the mobile phones, MPEG-4 RTP streams are generated and transmitted.

The Set Top Box (STB) client features DVBS reception, and MPEG-2 decoding capabilities. The received DVBS MPEG-2 stream carries the original MPEG-2 video stream, the MPEG-4 video that contains all the interactive elements and enhancements, such as the betting dialogs, object tracking information, advertising panels etc., as well as MPEG-7 metadata that contain the scene description information, event information for profiling, and additional statistics information concerning participating teams and players. The MPEG-4 video is overlaid on MPEG-2 video to provide the viewer with the desired interactivity. Every viewer that uses that STB has a locally stored user defined profile that utilizes the MPEG-7 metadata to perform content filtering thus personalizing the viewing experience. This personalization of the viewing experience is further extended from a single viewer level to a group viewer level with the notion of group viewing profiles, something extremely important for a multi-user medium such as television. As suggested by [9] advertising is ideal area for use of this personalization; dynamic insertion of adverts during, for example, ongoing football matches may both be technically feasible as well as economically sound. [10]

The PDA or Wireless client receives an MPEG-4 RTP stream that contains the video content and the interactive elements as well as the MPEG-7 metadata information as per the Set Top Box.

### **3 MELISA Platform User Interface Design**

The requirements of a diverse system such as MELISA are difficult to meet with a single strategy. Many existing approaches include forming a set of design rules or templates, such as style guides or platform guidelines.[8]

The server-side tools display a set of varying profile, ranging from elementary administrative form-based input dialogues to real-time production. As expected, these tools address different needs. As in any project concerned with design and implementation of a novel system this raises a number of issues. In a novel system the context of use and users is not known or is difficult to make a precise description of. It makes the standardized way of testing usability troublesome.

It has been previously shown, in [11], that usability aspects alone are not sufficient for success when integrating technology with home life. With a larger view on interaction and functionality of technology, we also have to consider aspects of flexibility and adaptation to household activities.

There have been attempts to overcome the aforementioned problems. A number of solutions have been suggested, by considering the home aspects and social space of computing [13]. The theoretical frameworks for such studies always emphasize the structure of the social situation [12],[14]. Working in the well known area of sports broadcasting and betting enabled us to draw conclusions from existing knowledge. For example, betting companies know their user groups, or clients, in some detail. Thanks to this prior knowledge it is possible to form groups of users and define them as our specified users.

A second attempt was made by defining *personas*. Personas are often used instead of requirements, but in a quite different way. The persona is a fictional user, with a made-up life. Making personas is an additional activity. It doesn't prohibit compiling requirements or scenarios the traditional way. On the contrary, it needs this kind of input in order to form good and relevant personas [1].

The Personas method was first presented by Alan Cooper in 1999. A persona is "A precise description of our user and what he wishes to accomplish." [2] The idea with personas is not to define one generic user or to describe a list of tasks or duties. Instead it will give a short presentation of a couple of archetypical users, life-like characters driven by personal motives. The persona should describe the flow of someone's day, his or her skills, attitudes, environment and goals and answer questions like which pieces of information are required at what points in the day? And why are they using the product.

Cooper emphasizes that a persona is a tool for communication and design within the group of designers, software developers, managers, customers and other stakeholders. The aim is to give simple, but good enough description of the user to make it possible to design the system rather than a precise description or a complete theoretical model of a user.

Although the outcome of defining personas was partly unsuccessful, it was valuable as it served as a tool to examine the characteristics of the system and its use [16]. The value was perhaps only for the designers, and not the whole development group. Although we as a design team believe in personas as a helpful method of practice design, it is not just a matter of going ahead. The problems occurred because of the development group's lack of understanding of what personas are and how to use them, since only few project members have HCI knowledge. Other projects have experienced the same difficulties because the know-how of the method was not sufficiently integrated with existing knowledge and practice [15].



**Fig. 3.** The initial design of the annotation tool

### 3.1 Melisa Server User Interface Design

The server side application consists of preparatory tools and production tools used during live broadcast. It is vital that the production tools work efficiently since the most important aspect is the speed of use. The error rate has to be kept low since there are few

barriers between the use of the tool and what finally is broadcasted [7]. The real-time aspect of the system implies that it is highly likely that any user errors will be broadcasted undetected.

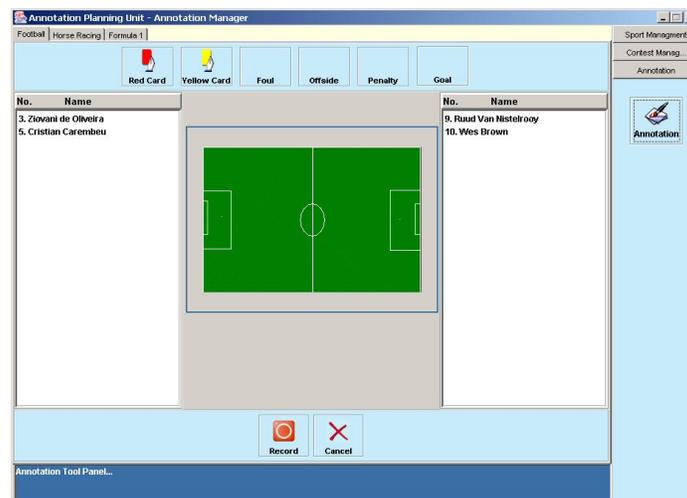
The server side applications are to be treated as interfaces for experts [3]. Thereby it is accepted with a longer adaptation period. Ease of learning for the novice users is not regarded as important as long-term speed and effectiveness [17].

The design process therefore uses a number of iterations to find the desired level of performance. In Figure 3 we see the initial design of the annotation tool for football. It is used to record the events that are significant for football into a database.

In a number of redesign stages we are able to examine the properties and dynamics of the design. The result is a redesign of the interface without the design flaws. Most of the iterations use inspection techniques intended to find possible trouble areas [6].

We also use a predefined checklist that contains dos and don'ts. Some aspects that are treated in the checklist are:

1. Disposition of the screen area
2. Color codes
3. Icons and buttons
4. Placements



**Fig. 4.** The current design of the annotation tool, football view selected

The checklist is project internal, based upon experience in design [5]. The checklist is an effective tool for bringing development up to a certain standard. It cannot work as the

only design aid, as checklists (even good ones [18]) contain general knowledge that needs interpretation. As Tullis has shown, design is not a question of common sense [19].

Using the combined results from the inspections and the checklist we are able to modify our design to perform better, and result in fewer operator errors. Figure 4 shows the latest design of the same annotation tool. It has been improved to perform faster, perhaps even using touch display technology for direct and fast interaction.

### **3.2 Melisa Set Top Box Client User Interface Design**

The problems we face in regards to the Set-Top Box (STB) are associated with the expanding field of use of cable television. As cable television allows us to do more than just transmit video, we face the limitations imposed by the current STB technology. The intended STB use was to receive video signals and convert them to something we can view on our TV set. As the possibility to communicate with the sender to send back information exists, we are now faced with the need to include this functionality in the STB remote control. We also have an increasing need to store data into the STB – viewer profiles can be used to control what kind of advertisements we are shown. If our profile tells the STB we have a baby in the family we might get more information about family products compared to someone that has a viewer profile indicating a single family status.

Figure 5 shows a typical user interface design of the STB. As we can see, this design has a number of problems: (i) the design is PC-like in the sense that it is best used using the interaction tools available on such a platform and (ii) low density of information due to low screen resolution.

A STB is always controlled by a remote control. The latest types of remote controls include some kind of pointer to allow for improved interaction, but the functionality is still in all aspects very limited. It is very hard to provide a satisfactory solution even for simple tasks such as entering text.

Being fazed with interactive tools with such limitations one has to focus on redesigning the problem areas. Many techniques are known from the desktop domain:

- We can let the user choose from predefined values instead of having to enter values.
- We can use focus groups to navigate the user interface instead of the freeform navigation, as used by the mouse.
- We need to put more effort in providing better default values. A more intelligent way of calculating the default values may bring many benefits.
- We can provide ways to re-use information already present or entered. A solution like copy & paste is easy to use using a remote control and may facilitate many operations.

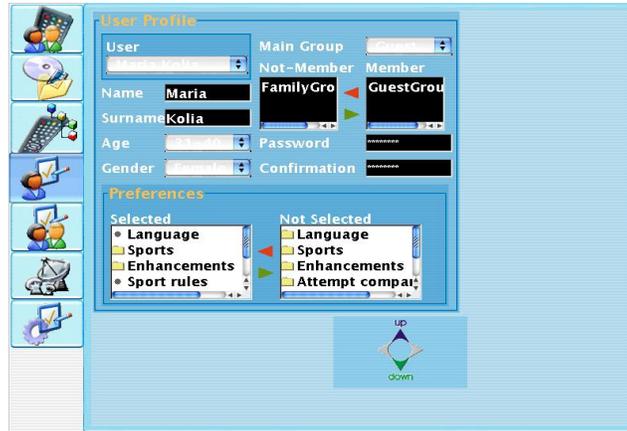


Fig. 5. The initial MELISA STB interface design

The navigation and operation of the STB is being tested using a prototype. The prototype is built using Flash as this allows integration of video, sound and interaction.

Building the prototype made us aware of the difficulties to design a User Interface for only remote control interaction. Because the content of a broadcast is not just static background information, we must ensure that all dialogue paths are short and possible to cancel if needed.

#### 4 Conclusions

When developing computer systems for skilled professionals as well as for non-professional users, the role of the user interface is essential. Inadequately designed interfaces will result in low user acceptance, high costs, inefficient work, and possibly negative stress (cognitive overload). Especially in the cases of consumer devices, such as interactive television, correct designs of the user interface are a challenge determining almost exclusively the success or failure of a new service.

The Melisa Platform gives us the opportunity to explore several aspects of User Interface Design. Dealing with User interface design for such a diverse type of applications ranging from administration and data management tools to end user interactive video playback applications, gave us the opportunity to realize that we may have to change the way we think of interaction especially when the interaction tools have very limited capabilities. A way to overcome the limitations of the platform's interaction capabilities is to rely more on the locally stored user and group profiles.

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