EVALUATING THE USABILITY OF INTERACTIVE DIGITAL TELEVISION APPLICATIONS
SOFTWARE QUALITY MODEL

PRODUCT QUALITY MODEL

Characteristic	Sub-characteristic	Sub-sub-characteristic	Attribute	Sub-attribute	Metrics	How
1. Usability	1.1 Intelligibility	1.1.1 Textual semantics	1.1.1.1 Understanding the textual information		Level of understanding of textual information presented	According to a Likert scale of 1 to 3 where 1 represents nothing understandable textual information and 3 completely understandable. The usability problem is: - Major if it is 1 - Medium if 2 - Minor whether it is 3
		1.1.2 Auditory behavior	1.1.2.1 Audio Quality		Value of the bit rate of the audio signal	The usability problem is: - Major if 4 kbit/s < value < 32 kbit/s - Medium if 96 kbit s < value < 128 kbit/s - Minor if 192 kbit/s < value < 320 kbit/s
			1.1.2.2 Synchronizing sound and images		Synchronization level perceived by the user	By perception, the user can determine whether the images presented correspond to the audio signals that are emitted. For them using a Likert scale where 1 represents a wrong timing and 3 means a successful synchronization is made. The usability problem is: - Major if it is 1 - Medium if 2 - Minor whether it is 3
		1.1.3 Familiarity	1.1.3.1 Adaptation of the graphical user interface		Level of familiarity of the graphical user interface in general	In a Likert scale of 1 to 3, where 1 represents no family and 3 it is very familiar. The usability problem is: - Major if it is 1 - Medium if 2 - Minor Whether it is 3
			1.1.3.2 Internationalization		Ratio of the number of standard actions between the total number of shares	Usability problem is: - Major if 0 <= value <0.35 - Medium if 0.35 <= value <0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
			1.1.3.3 Components popularity		Relationship between number of components fully known and the total number of components presented	Usability problem is: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
		1.1.4 Visual readability	1.1.4.1 Area submitting the application on the screen		Satisfaction level of the user at the location of the application on the screen	In a Likert scale of 1 to 3, where 1 represents not at all satisfied and 3 represents completely satisfied. The usability problem is: - Major if it is 1 - Medium if 2 - Minor whether it is 3
			1.1.4.2 Image Quality		Relationship between the number of images effortlessly perceived by the user and the total number of images	Usability problem is: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
			1.1.4.3 Font Size		Ratio between the number of text areas easily perceived and the number of existing text areas on the screen	Usability problem is: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
			1.1.4.4 Adequacy of displaying text		Brightness difference between a background color and font color	If the difference is greater than 125 units and color difference is greater than 500 units constraste no problem. Otherwise there is a difficulty in displaying the text over the background.
			1.1.4.5 Full visibility of information		Level of comfort in reading the text of the screen	According to a Likert scale from 0 to 5, where 0 represents nothing comfortable and 5 represents very comfortable.
			1.1.4.6 Density information presented		Overload level of information displayed on the screen	According to a Likert scale where 0 is no overload and 5 excessive overload
			1.1.4.7 Arrangement of components on the screen		Ratio of the number of visible components from the total number of components	Usability problem is: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
			1.1.4.8 Size of components		Ratio of the number of components with appropriate size between the total number of components.	Usability problem is: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
	1.2 Learning	1.2.1 User help	1.2.1.1 Help on using buttons		Ratio of the number buttons that have a description of the activities performed by the total number of buttons available in the application	Usability problem is: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
			1.2.2.2 Information activities to be performed		Level feedback to the user of actions that may or are being carried out	According to a Likert scale from 0 to 5, where 0 represents nothing comfortable and 5 represents very comfortable
		1.2.2 Predictability	1.2.2.1 expressivity of the tags associated with the media		Relationship between the number of tags associated with the media that are expressive and the total number of tags associated with the media	Usability problem is: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
			1.2.2.2 Predictability of Component Actions		Relationship between the number of components with predictable actions and the total number of components	Usability problem is: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
			1.2.2.3 Identification of possible permitted actions		Ratio of the total number of actions allowed in a section of the application and the total number of actions available	Usability problem is: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
	1.3 Operability	1.3.1 Graphic interface adjustment	1.3.2.1 Auto-adjusting the interface to various screens		The application fits any screen size?	Ranked by the two options: - Yes: The application fits on any size monitor or screen - No: Application is restricted only to a specific size monitor or screen
		1.3.2 Effort reduction	1.3.3.1 Minimum Actions		Relationship between the number of actions required to complete a task using shortcuts to the number of actions without shortcuts	Usability problem is: - Minonf 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Major if 0.75 <= value < 1 The closest value to 0 is the best.
	1.4 Protection against user errors	1.4.1 Prevention of errors	1.4.1.1 Data Entry Validation		Number of data errors for total input data	Usability problem is: - Minor if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Major if 0.75 <= value < 1 The closest value to 0 is the best.
			1.4.1.2 Restricting unnecessary functions of the remote control		Relationship between the number of unnecessary functions of the remote control and the total number of features available in this command	Usability problem is: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
	1.5 Aesthetics	1.5.1 Proportionality	1.5.1.1 Relationship between elements size and screen size		Relationship between the area occupied by an element in the application and the total area occupied by the application on the screen	Usability problem is: - Minor if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Major if 0.75 <= value < 1 The closest value to 0 is the best.
		1.5.2 Visual consistency	1.5.2.1 Coherence clustering components		Ratio of the number of components grouped consistently and the total number of components	Usability problem is: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
			1.5.2.2 Uniformity of colors		Ratio of the number of screens with similar colors on the total number of screens	Usability problem is: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.
			1.5.2.3 Contrast colors		Value of brightness and color components	The brightness of each color is calculated by the following formula: [(red channel value x 299) + (green channel value x 587) + (blue channel value x 114)] / 1000 The color difference is calculated by the following formula: red difference = maximum(red channel value 1, red channel value 2) - minimum(red channel value 1, red channel value 2) green difference = maximum(green channel value 1, green channel value 2) - minimum(green channel value 1, green channel value 2) blue difference = maximum(blue channel value 1, blur channel value 2) - minimum(blue channel value 1, blue channel value 2) color difference = red difference + green difference + blue difference Basically, if the brightness difference between a background color and foreground color is greater than 125 and color difference is greater than 500, a user with physical or technological limitations for discriminating colors may access content.

USE QUALITY MODEL

Characteristic	Sub-characteristic	Sub-sub-characteristic	Attribute	Sub-attribute	Metrics	How
1. Usability	1.1 Satisfaction	1.1.1 Sympathy	1.1.1.1 Conformity of the application behavior		Behavioral level	According to a Likert scale from 0 to 5, where 0 is no expected and fully expected 5
		1.1.2. Comfort	1.1.2.1 navigability between functions available		Comfort level navigation	According to a Likert scale from 0 to 5, where 0 is not comfortable and 1 is completely comfortable. Then the selected number divide by 5 so that the usability problem will be: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best
			1.1.2.2 Text input modes	Entering text via keyboard	Time measured at the entry into a text entry	Time measured by the Keystroke-Level Model (KLM)
				Text input through the second display devices (smartphones)	Time measured at the entry into a text entry	Time measured by the Fingerstroke-Level Model (FLM)
				Text entry via remote control devices	Time measured at the entry into a text entry	Time measured by the Keystroke-Level Model (KLM)
		1.1.3 Trust consistency	1.1.3.1 Consistency of the result		Level of consistency	According to a Likert scale from 0 to 5 where 0 is no consistent and 5 completely consistent.
			1.1.3.2 Timeout results		Response time	The response time is obtained as the following ranges: - Equal to 1 if between (0, 0.5] seconds - Equal to 0.8 if between (0.5, 1] seconds - Equal to 0.6 if between (1, 2] seconds - Equal to 0.4 if between (2, 5] seconds - Equal to 0.2 if it is between (5, 10] seconds - Equal to 0 if it is greater than or equal to 10 seconds The usability problem will be: - Major if 0 <= value < 0.35 - Medium if 0.35 <= value < 0.75 - Minor if 0.75 <= value < 1 The closest value to 1 is the best.