GUI design and structure of a teleeducational multimedia courseware

JÁN TURÁN[1], L'UBOS OVSENÍK[1], JÁN TURÁN JR.[2], KÁLMÁN FAZEKAS[3]

[1] *University of Technology Košice, Slovakia*
[2] *3D People GmbH, Reutlingen, Germany*
[3] *Budapest University of Technology and Economics, Hungary*

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In the paper a systematic approach to multimedia communication graphical user interface design is evaluated. The proposed application is in the field of radioengineering teleeducation. The design starts with a standard task analysis using task knowledge structures as the basis of the task model. Then description of the media resources available to the system and their access is evaluated. Finally, the task information is elaborated by attaching dialogue acts to specify the desired communicative effects for each task step. This method is a frame for a software mean developing of an interactive multimedia course: Rapid Transform and Its Application.

Multimedia graphical user interfaces are currently created by intuition. They are usually designed and developed without exact analysis of multimedia information presentation. The most nowadays multimedia applications present possibilities of the technical means but they have not respected a user-centred approach. The multimedia interfaces developed by this way cannot achieve the maximum effect [1–3].

In the paper a systematic approach to multimedia communication graphical user interface design is evaluated. The proposed application is in the field of radioengineering teleeducation. The design starts with a standard task analysis using task knowledge structures as the basis of the task model. Then description of the media resources available to the system and their access is evaluated. Finally, the task information is elaborated by attaching dialogue acts to specify the desired communicative effects for each task step. This method is a frame for a software mean developing of an interactive multimedia course: *Rapid Transform and Its Application*.

1. Multimedia interface design

The exact definitions of human – computer – interface terminology and user-centred -design are very important for understanding of the multimedia design problems. We must view multimedia interfaces from an appropriate perspective. Multimedia is one of the most innovative ways of using a telecommunications network to achieve effective communications between people and for access to information. In [3–7] was pointed out that multimedia approach could be viewed either from a technological perspective or from a user-centred perspective.

The technological perspective is defined through lists of technical characteristics of system claiming to be multimedia systems such as multidimensional presentation techniques, multimodal interaction or hypermedia techniques. User-centred perspective focuses on the possibilities offered by the technology. A user centred definition characterise multimedia systems as systems enabling the usage of multiple sensory modalities and multiple channels of the same or different modality enabling the user to perform several tasks at the same tasks at different times [3,9,10]. The understanding of these two definitions is important for view the key question of multimedia interface design when to use which media and in what combination to achieve the maximum effect.

There are several alternatives for classifying broadband multimedia communications according to information types, communication types (dialogue, messaging, retrieval, distribution), organisation (tree-structured media, hypermedia), functions (e.g., interactive, link navigation, co-operative teleworking), and other criteria. One suitable alternative classifies the utilisation of information types with respect to user or terminal. This is particularly advantageous for the definition of telecom services to effectively support multimedia communication.

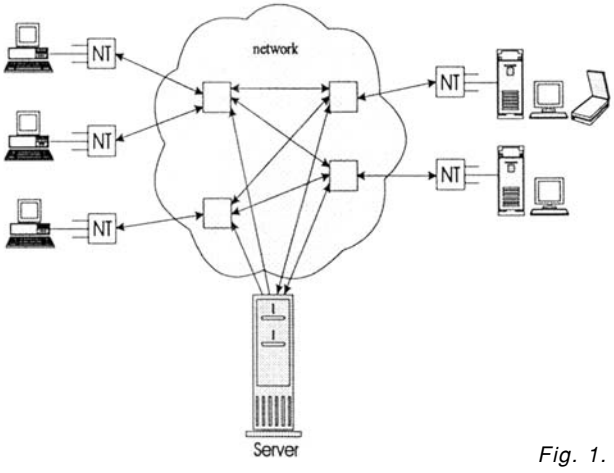


Fig. 1.

The target of future multimedia communication is: to efficiently support manifold applications; to provide worldvide communication capabilities of user as large as possible; unproblematic and cost-effective operation and utilisation on the basis of standardised components with high production volumes; and simple interworking [1,4,5,7].

A modern teleeducations must be thought of in terms of networked organisation *(Fig.1).* The objective of co-operative teleworking among students and teachers (with simultaneously possible using of databases on a learner side) is the provision of some degree of "telepresence" for geographically distributed persons and teaching materials in a quality comparable to that of a real-world lecture (conference). Co-operative teleworking enables a group of distant participants to jointly view, discuss, and edit multimedia documents while at the same time using communication and computing resource. This can be considered as an extension of conventional audio/video conferencing access, and collaborative work assistance. A desktop multimedia workstation allows the student to create, retrieve, and manipulate and activate a "hotline" to a teacher (central specialist). Co-operative teleworking represents a case of complex and dynamic communication, which encompasses a number of participants, connections, information types, systems, and functions [8–12].

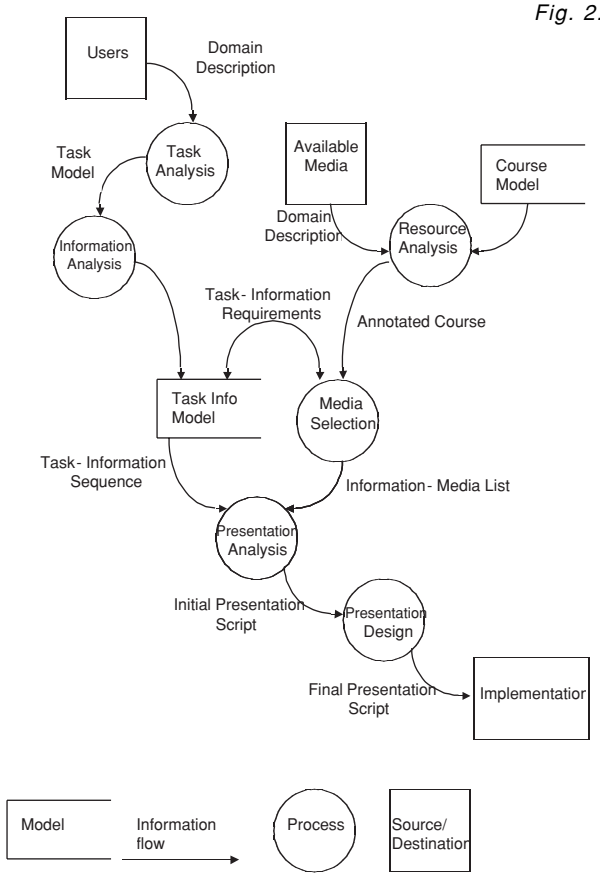
Emerging access techniques (such as XDSL over copper network, HFC on PON) and FTTx have result into a number of demonstrators and field trials in the are of educational telecommunication. The users are connected to the SDH backbone network by means of a copper or fiber access network that transports ATM [7–12].

2. Systematic design for task related multimedia interfaces

Multimedia GUI is usually designed by intuition. This way is not suitable to use all the available resources and utilising the multimedia effect in maximally way. So it is important to develop a systematic approach to multimedia GUI design [7,8]. The agenda of issues, which a method must address, were first, the creation of a task model incorporating specification of information requirements and presentational effects, accompanied by a resources model describing the information media available to the designer.

The GUI design method should advise on selecting appropriate media for the information needs and scripting a coherent presentation for a task context. The design must with directing the user's attention to extracting required information from a given presentation and focus on the correct level of details. In addition, the design method should guide the designer to the cognitive issues underlying a multimedia presentation such as selective attention, persistence of information, concurrency and limited cognitive resources such as working memory. *Fig. 2.* gives an overview of a systematic method for teleeducation graphical user interface design based on the methods of task components. This is based on the following components: model, information flow, process, source, destination [8–11].

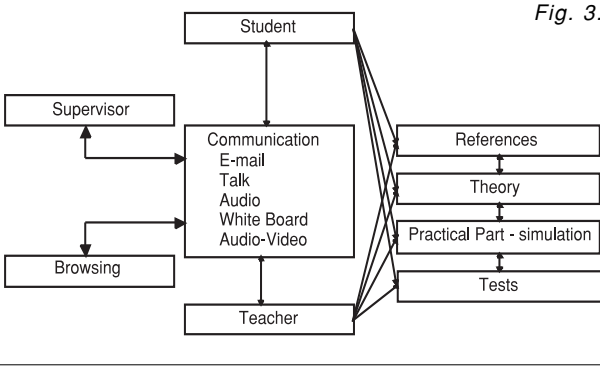
Fig. 2.



3. Multimedia rapid transform courseware description

This course is an interactive multimedia course based on use of multimedia document and visual simulations programme package for teleeducation purposes. As a particular example the rapid transform and its application (RT&IA) was chooses [13]. The course structure and some of its interactive features are noticed on *Fig. 3.*

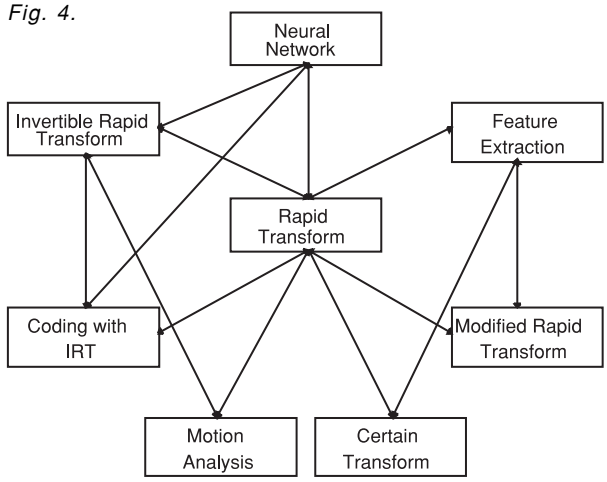
Fig. 3.



Student and teacher have access to an interactive multimedia document stored in a server. Teacher as a master has the possibility of changing this document if necessary. There are possibilities of interactive multimedia communications between student and teacher using various tools (E-mail, talk, audio, White Board, Audio-Video).

Teacher has the possibility to supervise of students work and able to monitor his/her progress and interactively change-tailor the course content.

Fig. 4.



The basic organisation of the course consist from four parts:

Theoretical part – this is an interactive multimedia document about the theory of rapid transform and related class of fast translation invariant transforms (CT). The block in the figure represents of the CAD or CAE oriented programme routines of programme packages CT-CAD or IRT-MA able to solve problems in the area of application of rapid transform *(Fig. 4)*.

Practical part – this is an interactive multimedia based simulation programme package able to solve CAD and CAE problems in the area of applications of rapid transform and other transform from the class CT in the area of DSP, pattern recognition, image processing (image coding, motion vector estimation) for various applications *(Fig. 5)*. As shown the basis of this part are programme packages CT-CAD and IRT-MA with applications to:

- Pattern recognition
- Image or generally signal coding
- Motion estimation
- Polar plot of motion vectors

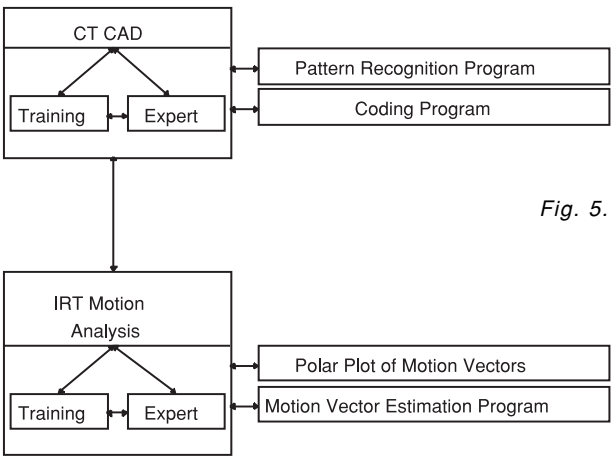


Fig. 5.

The practical part has two modifications:

A. Training Simulations

This is by teacher preselected and automatically sequenced (with student interactivity) solved examples of various applications of rapid transform. The sequence of multimedia documents obtains control points for student and teacher and may be interactively changed by student and teacher. There is possible to establish a hot-line consultation with teacher.

B. Expert Simulations

This is a possibility to creation of new problems and solves them with the use of CAD and CAE capabilities of in course embedded programme packages (CT CAD and IRT MA). Students have entered this possibility after there properly learn the part 1 and part 2A. There is possibility to interact remote teacher if there occurs any problem.

Part References – this is a multimedia document about every published documents related to rapid transform or its applications *(Fig. 6)*.

Part tests – the tests embedded to the courseware are entitled to evaluated the knowledge, routines and working shills obtained by students trough the learning process *(Fig. 7)*.

Fig. 6.

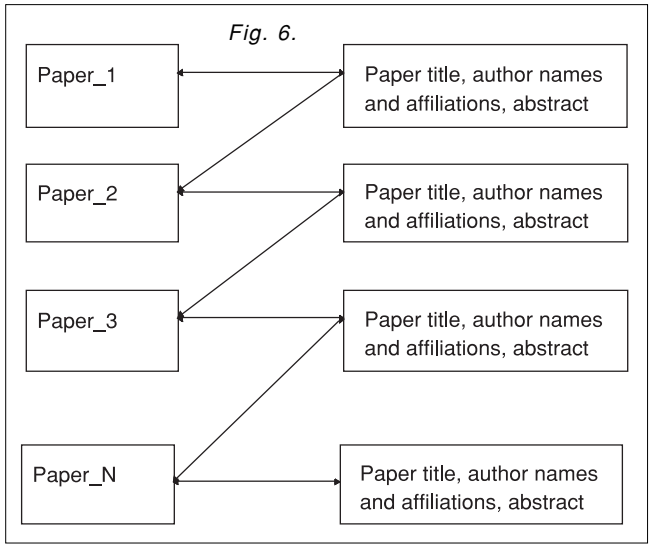
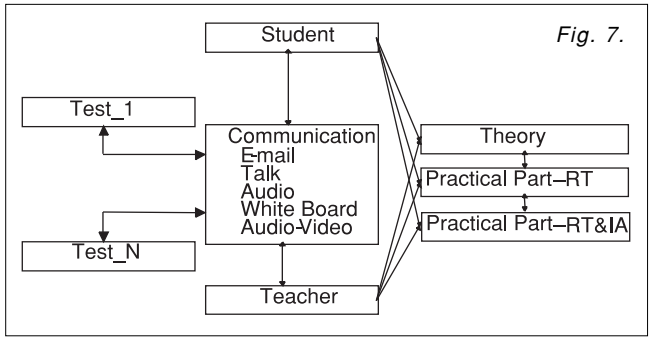


Fig. 7.



4. Feedback in the rapid transform courseware

The architecture of feedback used in the courseware is depicted on the *Fig. 8.*

It consists of five feedback loops, which are realised on the both level of the course. The simplest way of feedback is the study and practicing solved examples embedded to the courseware. The quality of the courseware and the student progress in the course may be evaluated using predefined Questionnaire and the course statistics available to the teacher (course supervisor). Course statistics deals with registration and multimedia document utilization (users data, data and time using, working on course, results of evaluation etc.). Course Questionnaire deals with questions about course structure, optimal material selection, multimedia document quality etc. Tests embedded to the courseware are entitled to evaluate the knowledge, routines and working skills obtained by students trough the learning process. The test is structured trough the course content and may consist from the questions, unsolved examples and simulation problems. If there is any problem with the student progress in the course the student is able activate a hot line to the teacher, but only in consultation hours. At the present level of development of the course and available technology it may be only an E-mail contact with the remote teacher. Outputs from the feedback is structured, saved and statistically processed to be used for improving the course quality in next development step.

Multimedia Graphical User Interface designed with use of proposed systematic design approach can achieve an increasing effect in the practical use of human computer interface for teleeducation purposes. The method was practically tested in the described application in the field of DSP teleeducation. The implementations of the RT&IA multimedia courseware demonstrate the key features of the systematic GUI design method.

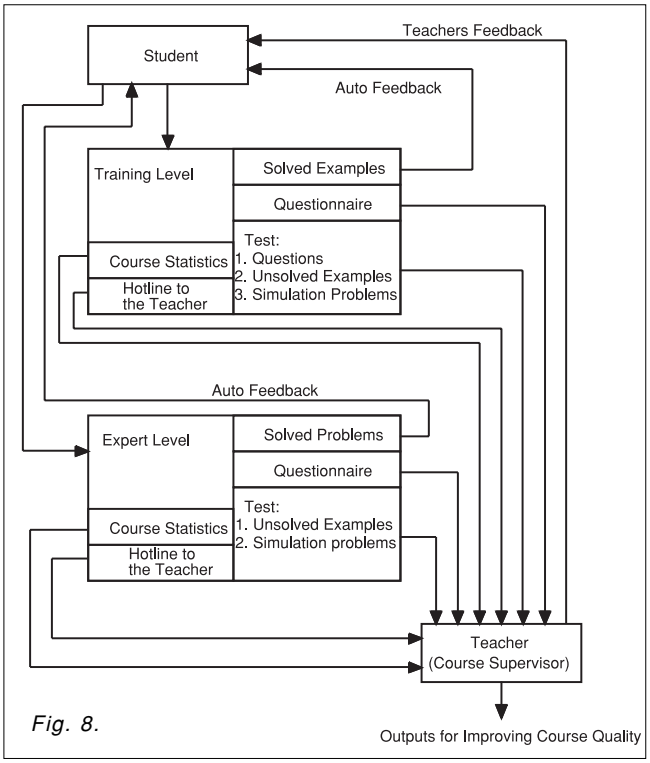


Fig. 8.

Acknowledgements

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