

Teacher's MATE: Multimedia-Assisted Teaching Environment

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Abstract

Teacher's MATE is a multimedia-assisted teaching environment that allows teachers to collect and organise large volumes of reusable multimedia teaching material. Teacher's MATE also assists teachers in planning and delivering of fully interactive lectures and tutorials to a large number of simultaneous student users on the web. With the aid of Teacher's MATE, students can work either alone (off-line or on-line), in teams, or with the supervision of their teacher. We plan the system to be used in developing more effective Information Systems courseware.

1. Background

Multimedia (i.e. the ability to combine and simultaneously present text, graphics, animation, sound, video and the output of executable programs) can significantly add to the value of some knowledge-intensive services such as computer-assisted education and training, electronic publishing or telemarketing [7, 1, 4, 10].

At the same time, however, development of multimedia presentation material requires complex software tools, is extremely laborious, and it is also very expensive [9]. For certain groups of users, such as school teachers or university lecturers, multimedia technology is quite inaccessible - the process is too technologically involved, too lengthy and the cost of employing a multimedia professional is, needless to say, prohibitive.

We believe, that the productivity of developing multimedia material can be improved and the costs can be reduced with the introduction of

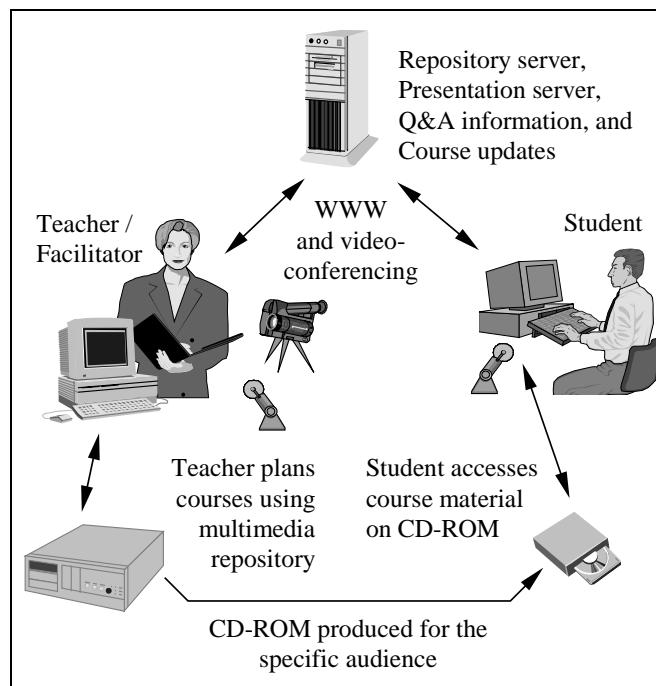


Figure 1 - Teacher's MATE architecture

component technology and reuse techniques, both being vigorously researched in the area of software engineering [6, 5]. Commonly reused software artefacts include binary programs, their source code, diagrammatic designs and formal specifications. All such artefacts are produced according to well-established methodologies, they are usually well structured, having well defined formal syntax and semantics, they are complete and adequately documented. Multimedia artefacts are quite different - they are created in an ad-hoc fashion, they are ill structured, informal, with no rigid syntax or semantics, frequently incomplete and most often not documented in any way [8]. In this situation, few researchers have moved beyond reusability of clipart or the use of web search engines in the pursuit of multimedia artefacts. Practical reuse of multimedia components is a matter of urgency!

2. Teacher's MATE

We have undertaken the challenge of effective reuse of multimedia components in our Teacher's MATE (Multimedia-Assisted Teaching Environment) project. In the project, we propose several techniques suitable to the analysis and storage of multimedia components and the composition of new presentations of reusable multimedia artefacts. We address the entire cycle of multimedia reuse and propose the methods of efficient processing of multimedia information, i.e. its identification, representation, generalisation, classification, storage, search, retrieval, selection, composition and integration. We are also in the process of formalising reusability techniques for a variety of basic multimedia components (such as text, graphics, sound, animation and video), structured components, presentation sequences and the methods of their generation. In doing so, we will ultimately develop an integrated technological framework for dealing with multimedia documents and their components.

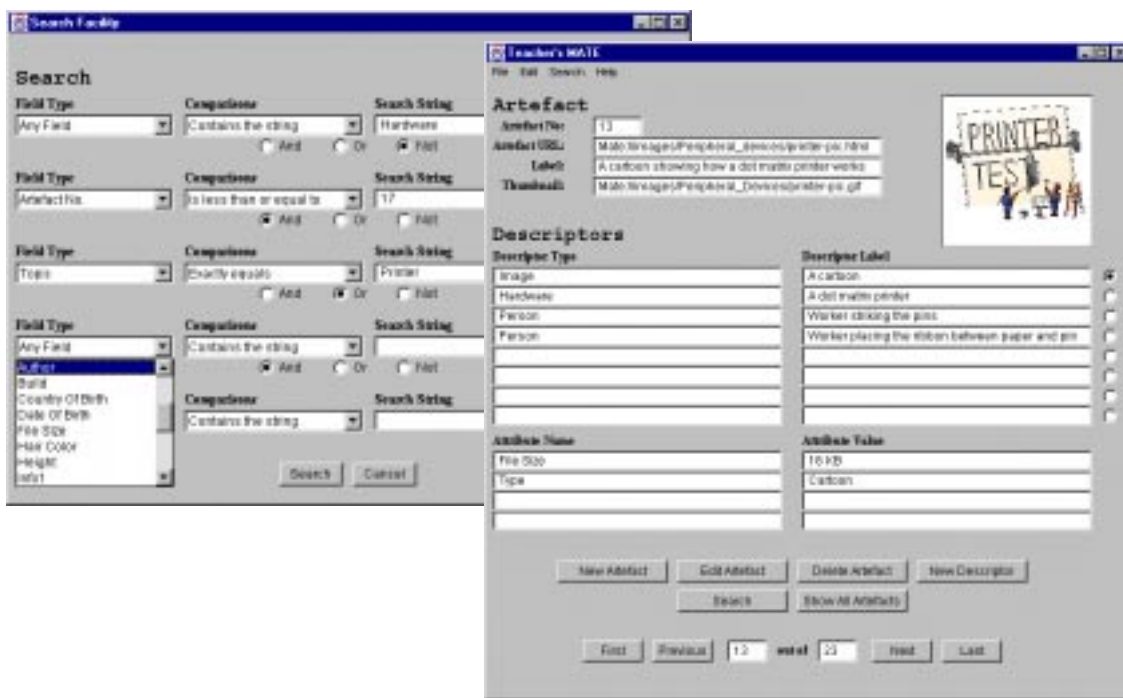


Figure 2 - Author's perspective of Teacher's MATE



Figure 3 - Student's perspective of Teacher's MATE

As part of the Teacher's MATE project, we developed a prototype tool that allows teachers to record, organise and cross-reference sound, video, animation, text and graphics. The system also helps teachers in the planning and delivering of fully interactive lectures and tutorials to a large number of simultaneous student users on the web. With the aid of Teacher's MATE, students are able to work alone (off-line or on-line), in small teams or under the direct instruction and supervision of their teacher. Teachers are also more effective as they are equipped with tools capable of browsing, searching, retrieving and presenting vast volumes of teaching material stored locally on student machines and the web.

In a typical course of events (Cf. Figure 1), teachers produce multimedia material using existing web-compatible authoring tools (e.g. drawing and painting packages, HTML editors, sound and video recording software, animation packages). Each multimedia artefact is then classified and subsequently added to the Teacher's MATE repository of multimedia components (Cf. Figure 2). Having a rich collection of reusable components, teachers use them to compose and structure multimedia slides, lectures and courses. A course can then be exported to CD-ROM in a form compatible with a number of commercially available



Figure 4 - Presenter's perspective of Teacher's MATE

web browsers, e.g. Netscape Navigator or Microsoft Internet Explorer. Students can then browse CD-ROM material off-line or they can attend a real-life on-line lecture (Cf. Figure 3). During the presentation, the teacher uses a lecture plan to identify the lecture contents, default sequence of multimedia slides, alternative lecture scenarios, slides useful to answer students' ad-hoc queries, and other freely available web resources (Cf. Figure 4). Lecturers can then request to remotely display lecture components stored on the student's CD-ROM or the web. At any time after the lecture, students can also re-trace and view already presented lecture slides.

Having the capabilities to effectively manage multimedia authoring, presentation, collaboration, storage, reuse and planning, Teacher's MATE facilitates the organisation of a *virtual classroom* on the World Wide Web.

With the aid of Teacher's MATE, we aim to develop a cross-subject core of reusable material to support teaching in a wide spectrum of Information Systems (IS) topics, e.g.

- Introduction to Information Systems;
- Introduction to Organisational Processes
- Introduction to Computer Technology;
- Introduction to Programming Concepts; and,
- Systems Analysis and Design.

We are also planning to use Teacher's MATE as a vehicle for the creation of a system that will guide IS students in the process of solving typical software development problems. The proposed tool will comprise a multimedia library of problem-solving patterns and a decision-support system matching student problems against a set of possible problem solutions. Retrieved solutions will be presented to students as a collection of self-paced and teacher-assisted multimedia lectures, examples and tutorials, coupled with the interactive and self-assessing exercises and projects. The problems and their solutions will span several DIS subjects across different years of study, they will be cross-referenced and linked for easier navigation between different levels of study and understanding, teaching units and problem solving components.

3. Summary and Conclusions

With the advent of the World Wide Web, electronic delivery of documents in multiple media forms generated a lot of interest from government, education, publishing and marketing organisations. The production of sophisticated and interactive material is very expensive, so the effective use of the multimedia technology has been reserved only for the largest of corporate web users. We believe that active reuse of multimedia materials will provide significant savings in the production of multimedia presentations. We also believe that community-based repositories of shared and reusable multimedia artefacts will make this technology available to a wide audience of smaller or under-funded organisations, e.g. public service, schools and universities.

Teacher's MATE is a prototype teaching environment that allows effective authoring, presentation, collaboration, storage, reuse and planning of multimedia presentations. Teacher's MATE empowers teachers to organise virtual classrooms using World Wide Web. The system also allows students to study a subject matter off-line away from the University network service, attend interactive, synchronous and on-line lectures, and to replay a trace of previously delivered lectures and presentations.

To this date, this project utilised the efforts of four undergraduate, honours and vacation students. These students had an opportunity to study state-of-the-art technology in human-

computer interfacing, multimedia, distributed processing, Internet and World Wide Web, Java software development, databases, etc. We anticipate that this trend will continue and we anticipate some funding to conduct the fundamental research in the area of multimedia reuse.

We believe that this project may have a considerable impact on the way our University conducts its delivery of teaching material. In the future, departments or faculties may opt to set up repositories of shared and reusable teaching material. Hence, the preparation of multimedia-based lectures and tutorials will be more effective and more flexible. The results of this project, when adopted in the University settings, could certainly improve the quality of undergraduate teaching and, thus, the quality of our graduates.

4. References

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