Networked Learning in Virtual Environments

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Information and Communication Technologies (ICT) can support very well the learning process. However, one major drawback remains: the social dimension of learning can only be very poorely developed in a networked environment. The practical consequences of this fact are that most efficient learning strategies involve substantial time, where people meet physically in order to enable social learning processes. If this is geographically feasible, it definitly provides a solution for the problem. However, such meetings often involve substantial travel costs if learners are dispersed over countries or continents.

The quest for new generation technologies is to eliminate this drawback of ICT and support social learning processes.

INVITE (2000-2003) is a European project in the fifth framework programme aiming to build an innovative support system for collaborative learning over distance, focusing on aspects of social learning. The approach is to build a platform for synchronous telelearning which can be interfaced with standardised content management and/or instructional management systems. In order to reach this aim the following objectives have been set:

- identification of the relevant cognitive and social processes in collaborative learning situation and extraction of those factors into user requirements.
- development of an integrated system based on distributed virtual environment technologies , including intelligent agents real-time translation facilities, realistic avatar representation and enhanced interactivity of avatars.
- evaluation of the prototype within three different learning contexts: automotive industry, tool construction and pharmaceutical industry.
- research results on social learning processes within virtual environments.
- building a platform which has the potential to becoming a marketable product

INVITE aims at building a highly innovative environment deploying advanced technology through a multi-disciplincary, international team. The project is structured according a

software development project, including three iterative cycles within its development process. The project adopts a rapid prototype development scheme, starting the development work with a visual prototype, resembling graphical design and application structure, however without functionality, in order to allow early user feedback. The development work bases on cognitive and pedagogical research regarding the user processes in virtual environments as well as the relevant factors of collaborative learning experiences.

Cognitive and pedagogical research will be carried out in order to identify the relevant aspects of collaborative learning experience. Main aim is to investigate the social dimension of learning. Multi-lingual contexts will be analysed with a specific focus on non-verbal communication behaviour. The whole work on user processes will be based on the learning paradigm of the Humanistic Empowerment Theory and Autonomy-Oriented Education respectively. The expected results are:

- Results on relevant factors for collaborative learning environments: cognitive and social factors.
- Development of a platform for synchronised telelearning supporting these cognitive and social factors.
- Results on the enhancement of learner success through INVITE, within different learning scenarious.
- A collaborative learning platform to be interfaced with standardised content and instructional management systems.

Collaborative Learning in Distance Education

Collaborative livelong learning is one of the emerging needs of the information age. Access to education is going to become crucial for the success of our information society. Therefore a lot of potential is seen in distance learning and online collaborative environments.

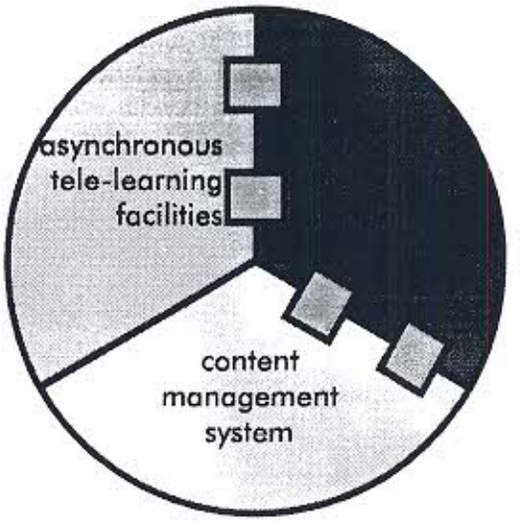
Specifically in the area of vocational training, the need for a technological support for collaborative learning is emerging. In international companies people are separated in different sites, however because of a common culture and knowledge management approach, they need to share information and learn collaboratively. Also Small and Medium Enterprises, trying to build up a network with other companies in order to strengthen competitivity, need to develop concepts to share knowledge over distance.

Both of these user-groups have a particular need of support of their collaborative learning activities over geographical distance. Such training situations will be in the focus of the project INVITE.

The project aims at the development of a collaborative learning environment for distance education through distributed and shared virtual environments. INVITE will be a platform for synchronous telelearning providing users with functionality which supports social learning process in virtual environments. For example within INVITE users will find seminar-rooms, where they can share content, point at content through their realistic avatar representation or carry out multilingual discussions. The aim is, to provide users with all those features, which are needed to create a collaborative learning environment.

The INVITE environment will be an integrated system, which is able to educate its users with the help of intelligent agents in carrying out tasks within the environment in an efficient and intelligent way. The INVITE environment will be designed as an open system, which can be interfaced with standard instructional management systems and data-representation schemes, and serve as an innovative tool for synchronous telelearning and content access.

The technological approach is the integration of DVEs (Distributed Virtual Environments) with intelligent agents in order to achieve a more friendly and efficient way for training. The DVEs accomplish the need of interaction among the users with a friendlier user interface as well as the presentation of the knowledge. The intelligent agents help the users to act within the system and to explore complex and unstructured amount of multimedia data.



The project will create a virtual environment for synchronous education and learning purposes. In addition to asynchronous applications, which usually consist of the download of predefined course material from a web server, this initiative will focus on concurrent meetings of participants, physically located on remote sites.

INVITE aims at improving and upgrading the current educational and training methods in such a way that they will be friendlier to the users, more imminent and more interesting and adaptable to their needs. It combines some of the most recent technological developments in the area of network based educational and training platforms. At the same time, it contributes to the fulfilment of the contemporary needs for faster and more effective access to information and helps to improve the functionality and user-friendliness of future information products and services.

In order to investigate user process and to guarantee user-centred design, an in-debth user integration and evaluation strategy has been developed. Within a laboratory approach, usability studies of the system will be conducted. In this environment test-persons with similar profile as end-users will allow to gain a rough overview on the usability of the system in social learning processes. In order to match the system to the user group with currently the highest demand, three different evaluation sites in cooperation with industry will be set up: automotive industry, tool construction and pharmaceutical industry. In debth evaluations will be carried out with end-users in their workplace in order to verify hypotheses built on the base of test-users.

It is an aim of INVITE to design features, which are relevant for users. For this reason cognitive and humanistic research will be carried out on the relevant aspects of social learning in collaborative situations. This will be done in a way which will cater both to the immediate need for supplying users with user-friendly attractive learning environment and the longer term need for enhancing their development as active autonomous learners.

The development of the environment will be based on user-centred design processes in which end-users are integrated at each step of the development process. Specifically, three feedback-cycles are planned in a rapid prototype scheme, in which first a structural and design prototype is presented to users, before costly development work starts.

Fundamental features of INVITE system are the following:

- it is loosely coupled and based on a variety of communications protocols,
- it is scalable to thousands of users,
- it is platform independent,
- it is based on open standards.

Deployment of Virtual Reality Technologies

Research and applications in Distributed Virtual Environments (DVEs) can be grouped into two camps with regards to performance of computing and networking. On one side we find military and government supported research with dedicated super computers and high-speed networks. On the other side we find a large research community that tries to bring DVEs to the regular user. With developments in computing and networking, the working conditions for these two groups approach each other. It is therefore, and increasingly will be, possible to transfer technologies and concepts from the high-end to the low end. Furthermore, DVEs need to be about something, in other words they need a pioneer application. Along with research in development in VR technologies, the importance of useful applications and convincing content should not be forgotten.

With the above in mind the INVITE project investigates ways of applying the new technologies in distributed Virtual Reality for new methods in education. In addition to asynchronous applications, which usually consist of the download of predefined course material from a web server, this initiative would like to focus on concurrent meetings of participants, physically located on remote sites. The aim is a real-time educational environment, where presence and attendance to lectures could be made compulsory for inscribed students with access to the Internet. These students have the opportunity to participate at the real event of the lecture, with the ability to raise questions to real professors, or at a specially arranged and recorded event, where the lecturers are represented by intelligent agents that can be trained to answer commonly asked questions and problems. If the associated agent mechanism is not sufficient to assist a student to provide a solution for the problem the question is transferred to a human moderator who can process the issue further and find a solution.

The INVITE system establishes virtual communities with a theme, rules, roles, and moderation where useful services can be employed to facilitate educational procedures. Rich information and useful content is used for real public exploitation and for improving ways of learning. It would be available on the actual global computer network infrastructure in use, currently the Internet, in order to contribute in the realistic deployment and take-up of distributed Virtual Reality. This system is facilitated by security and management mechanisms in order to be used for meaningful purposes such as remote collaborative learning. With the integration of various servers, INVITE system achieves the guaranteed quality of service, which is essential in learning environments.

In addition INVITE system uses Distributed Virtual Reality technologies which are capable of running on the average user's PC. These technologies are compatible with standards like VRML and they use platform-independent implementations like Java, which is a great asset particularly with regards to development, deployment and take-up. The above-referred technologies provide services, which are available to the broad public through regular equipment, found in homes and offices. The INVITE Virtual Environment allows inclusion of many real world features such as insertion and changing of objects and exchange of information with objects and users.

In conclusion the INVITE environment is an open system which can be interfaced with standard instructional management systems and data representation schemes and serves as an innovative tool for synchronous telelearning and content access.

Possibilities for Application in the Learning Context

The individual human being and his/her needs and customs are in the centre of all activities conducted in the INVITE project. The philosophical basis of INVITE stems from the Humanistic Empowerment Theory (HET) which was developed throughout the last years in the Center for Futurism in Education of the Ben Gourion University (mainly as a basis for the use of information and communication technologies in the field of education). This theory says that the major aim of democracies is the enhancement of the development and expression of its citizens personal autonomy, defined as consisting of self-awareness, rationality, and self-direction. These attributes also come to our minds when we speak of the future of a unified Europe, or a "Europe of the citizens" as it is very often denoted. There are in fact some requirements and prerequisites that should not be neglected if the critical mass of contentment of Europe's citizens is to be kept up.

INVITE will develop an innovative application for synchronous tele-learning. The application will be built according to the needs of three different industrial user groups with high need of collaborative methods in vocational training. In order to base the system not only on one specific type of training, in addition to end-user evaluation, laboratory usability tests will be carried out, in order to achieve a detailed analysis of the psychological factors of collaborative learning support. Acting on this analysis, it is guaranteed that INVITE can serve all different types of learning environments.

These very diversified test-beds have been chosen, in order to guarantee, that INVITE will not serve only one specific user group. This is essential, when observing the trends in education to open up, up-to-date narrow education schemes to new groups of learners. Universities increasingly offer continuous education, companies install their own universities and educational schemes, learning enters increasingly the home in form of edutainment.

For this reason, specific focus in the evaluation process will be given to ensure, that INVITE will be capable to support those new, open education concepts. It is clear, that particularly from such open concepts defers the need for more flexible and open learning environments, supporting also synchronous tele-learning applications. INVITE will build a platform with innovative technologies, tackling specifically those issues of open and flexible learning concepts.

INVITE has the clear focus of developing a marketable product within the project: a platform for synchronous tele-learning based on the technology of shared virtual environments. This platform should be integrated with existing learning environments providing the content management structures and asynchronous services.

The economic perspectives of INVITE are judged as follows: Currently, through the standardisation efforts of IMS and PROMETEUS, instructional management systems are becoming more harmonised. On the other hand, the market for such systems starts to consolidate and hardly is there any training or educational organisation, who has not yet investigated in the field of already installed and used such systems.

Current systems however mainly concentrate on content management and asynchronous telelearning. Synchronous applications are marginally integrated, such as test chat, or in some advanced applications video conferences. The lack of the social dimension of learning is felt already by those applying telelearning and the demand for new means of interacting and collaborating on-line will increase steadily.

Project Consortium

The project partners of INVITE are: Technikum Joanneum GmbH, Austria, Ars Eletronica Center Linz, Austria, Ben Gurion University of Negev, Israel, Blaxxun interactive AG, Germany, Brunel University, UK, Computer Technology Institute, Greece, University of Stuttgart, Germany, Linguatec GmbH, Germany, Systema Informatics Ltd., Greece, and AvatarMe LTd, UK.

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