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Swap-Sivi, a Technological Research Project Applied to Art Teaching and Create Digital Contents

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1. Abstract

SWAP-SIVI is the 3º consecutive project from IDECA group (Research and Development of Audiovisual Contents) and belongs to the College of Fine Arts at the University of Castilla-La Mancha, Cuenca.
SWAP-SIVI proposes to elaborate new communication systems for our owns needs, as university teachers and as artists, in order to get better media at university work spaces and to open it to many foreign students from the Erasmus Program.
The project explores the real possibilities of this application in teaching tasks, as well as exploring a more open and flexible concept for students at university centers. SWAP-SIVI offers technological tools for needs of contemporary artistic creation.
SWAP-SIVI project is divided in three essential parts:
1.1. SWAP is centered on designing software with an interactive interface for complex operations in the creation of tools and teaching tasks. SWAP proposes creating a suite in order to amplify and make the contents steps better in art teaching. Usuers will be able to create a didactical space in a little time and with limited knowledge of technological tools. The contents can be defined by the user depending on their specific needs: audiovisual information, links, work proposals, forums, spaces for analysis and debate, exchange and intercommunications spaces, and so on. SWAP will contribute to one of the more important objectives in the European University plans of the Bologna agreement.
1.2. SIVI is more ambitious and is focused on creating a bidirectional communication system in real time for the exchange of information. This proposal comes from professional systems like Windows XP Messenger but advance in independent software development. This system can be useful in new E-learning processes and can be expanded to interdisciplinary communication in artistic creation, especially in audiovisual contents. Conceptually, the system is similar to videoconference but it tries to provide an additional step in order to adjust it to specifics needs and tasks, with a simple and light kit: a webcam, computer and system access.
1.3. The third part of this project is dedicated to the creation of a digital archive of audiovisual contents. This file is consists of audiovisual content for the teaching of art and

includes records from video documentaries about art to work of former students of the College of Fine Arts of Cuenca. For strategic group research reasons, file creation is vital because it provides content to SWAP tools and forms a framework for discussion and useful meeting point for the implementation of SIVI. In the future we hope to expand the frontiers of physical space for teaching with the proposed SIVI system in order to advance communication systems for operating in real time and give answers to an important challenge of our times.

2. Introduction and Project Background

The development of communications technology has influenced every facet of society, especially in the area of higher learning and particularly in the teaching of art. Every day more and more technological and virtual support systems are replacing the traditional systems in the dimension of art, which influences the interpretation codes of artistic phenomena, such as perspectives of art teaching. The new challenges that this development presents require a definition of concepts that are also new with respect to representation, distribution, market and especially that of ownership.

In the area of art instruction, the eruption of technology has also transformed the dynamic in European art centers and institutes. Ignoring for now the methodologies and contents specific to each area of art instruction, a homogenizing in the use of technological tools, equipment, software, etc., has occurred that makes a certain unification of support and a greater flexibility in terms of sharing formats in the transmission of expression and information possible. In this sense, the chance phenomena of the internationalization of certain artistic support systems, on the one hand, and the democratization of them, on the other, has happened.

Within this context, the IDECA Group, created in 1998 in the College of Fine Arts of Cuenca, has been working on distinct research initiatives aimed at establishing a platform or technological base for over ten years. This platform or technological base would be used to in the *virtualization* of specific teaching tasks in the area of Spanish higher education. During this time, this work space and research has advanced and been consolidated with an adequate infrastructure from which the new challenges, like artistic creativity and expression, that contemporary art instruction presents are being met. Regional and national institutions in the area of science and technology in Spain have granted IDECA Group with four consecutive Research and Development projects, which has made the fusion of a technological base and line of work within the University of Castilla -La Mancha a reality.

IDECA Group's work is centered on the dialogue between the instruction of art, the creation and production of digital contents and information and communications technology. The last research project undertaken by IDECA Group was titled SWAP-SIVI and was divided into two different parts under one focus--new *E-learning* tasks. This project consists of a double-faceted objective: 1) to create a digital archive of contents to be available to university students and researchers to assist in documentation and critical analysis and 2) to develop tools specific to *E-learning* in order to facilitate the presence and diffusion of contents through the new possibilities that the Internet presents. In order to do this, SWAP-SIVI has focused on researching advanced communication systems that could be used in the achievement of these objectives.

By definition, E-learning consists of supplying educational programs and learning systems through electronic means. E-learning is based on the use of a computer or other electronic devices (such as a mobile phone) in order to provide educational material to students and educators alike. The term E-learning, or electronic learning, applies to a wide range of applications but also processes, like Web-based learning, computer-based training, virtual classes and digital collaboration (group work). All of these fields inherited by distance education created the basis for the development of E-learning, which have come to solve some of the difficulties presented by distance and traditional learning methods like timing, schedules, attendance and trips, among others.

2.1 Diverse definitions of E-learning

In general terms, the concept of E-learning is easily understood by most people. Even still, a precise definition of this term is needed. In order to give an idea of the variations that currently exist of the concept of electronic learning, the most common definitions are presented below.

An imprecise conception of E-learning would be one that principally defines it as an electronic means for distance or virtual learning in which one can interact with professors over the Internet and where the user is the person who manages the schedules, making it a completely autonomous means.

E-learning literally means electronic learning. However, technically E-learning is the posting of educational material via electronic means, including the Internet, intranets, extranets, audio, video, satellite systems, interactive television, CD and DVD, to name a few.

From the point of view of educators, E-learning is the use of systems and communication technology to design, select, administer, deliver and extend education, allowing for more fluid and dynamic communication among students and teachers/professors.

Being more descriptive, electronic learning is the instruction of students using materials available through any means of electronic diffusion, which is capable of offering a wide range of options not possible with traditional education, like audio and video flow, PowerPoint presentations, links to information relevant to a topic on the Web, animation, electronic books and applications for image production and editing, among others.

2.2 Advantages of E-learning

Now that the frame of reference of E-learning is defined, the advantages that said educational programs offer over other educational formats must be identified. These advantages include the following:

Greater productivity: The solutions that electronic learning offers, like Web-based training (WBT) and computer-based training (CBT), allow students to study from their own desks and, in this way, education is delocalized. The direct accessibility of courses can decrease dead time that low productivity brings with it as well as help to eliminate travel costs and costs associated with the use of physical space.

Multiple training: While any new program or service is being established, E-learning can provide knowledge about the processes and applications of said service or program simultaneously to many participants. Unlike with traditional education, the number of students is not an important factor for e-Learning programs due to its individualized form of instruction that it provides the students.

Flexible training: An e-Learning system is generally of a modular design. In some cases, participants can choose their own route of learning and help shape the concepts that are lacking or need more attention. Additionally, users can mark certain sources of information as reference, facilitating the processes of change and increasing the benefits of the program.
Cost savings per participant: One of the greatest benefits of E-Learning is found in the total cost of training per student since it is much lower than in a traditional system guided by an instructor. However, e-Learning programs that are specially designed or "made to order" can be more costly at first due to the labor involved in the design itself and the development of such a system.

2.3 Designing the education of tomorrow

Despite the existence of firms and public administrations that offer e-Learning solutions, which include content developed by experts, administration platforms and infrastructures and other services, the acceptance of these technologies is still not what it should be. The adoption of e-Learning has been slow in part because of cultural barriers inherited from traditional educational systems.
The mobilization of educational and cultural communities, public as well as private, such as economic and social sectors, is crucial in order to accelerate changes in education systems and training so that our countries can move toward a society based on knowledge and its diffusion.
One e-Learning initiative could be a way to update our educational system and help adapt it to the new educational plans such as the Bologna framework plan. At the same time, through electronic education components, the abilities and tool necessary for success in a globalized society, based on knowledge and new technology, could be provided to the entire community. Those who find themselves more interested in these types of projects are educational institutions due to their great cost reduction and educational benefits, for the students as well as the institution itself, which is a great incentive.

2.4 Client server benefits

All the tools developed under the SWAP-SIVI project during the last three years oriented around e-Learning services are applications of the client-server, henceforth C/S, type. This classification of electronic architecture consist of a client program from which educators and students personally use in order to carry out requests to another program—the server—which is in charge of giving a response, in effect facilitating the information requested. Although this idea can be applied to programs that are only executed from one computer, a multi-user operating system distributed through a network of computers is more beneficial. The processing capacity in this type of architecture is split between clients and servers, although the organizational advantages are greater due to the centralization of information management and the separation of responsibilities, which facilitates and clarifies the design of the system.
The separation of client and server is logical when the server is not executed from one machine necessarily nor is it only one program, as in the case of the SIVI application. The specific types of servers include Web servers, archive servers, mail servers, etc. While the purposes vary from one service to another, the basic architecture remains the same.

Client characteristics

- In C/S architecture, the sender of a request is known as the client. Among its characteristics, the following must be highlighted:
- The client is the one who makes a request. So, the client has an active role in the communication process.
- Once the request has been made, the client waits and receives responses from the server. In general, the client can connect to multiple servers at the same time.
- The interaction between final users is done through a graphic user interface, maintaining the process of communication hidden.

Server characteristics

In C/S systems, the receiver of the request sent by the client is known as the server. It has the following characteristics:
Initially, the server waits for requests from the client and then performs a passive role in the communication process.
After receiving a request, the server processes it and sends a response to the client.
Generally speaking, the server accepts connections from a great number of clients (in certain cases, the maximum number of requests is limited).
It is not usual for the server to interact directly with final users.

3. Digital Archive and IDECA Contents

For internal strategy reasons, the first part of the project was the creation of a large archive of digital contents. In order to do this, we obtained professional audiovisual content management software, with the funds assigned to the project under inventory material, which made for quick and efficient work in terms of the necessary operations of information transfer.
After studying the possibilities that the market offered and the investing capacity of IDECA Group, we were inclined to acquire a British platform, FACILIS TERRABLOCK, which was the best fit for our objectives and expectations. The necessary infrastructure of fiber optic cable was put into place for the installation of the system and was situated in proper refrigeration and acoustic isolation conditions.
During the three years of project development, we proceeded with the digitalization of iconic material contents, namely films, documentaries and photographs. This process was long and laborious, keeping in mind that it was necessary to digitalize image and sound originating from analogue sources. With the help of a specialist technician, hired with use of the funding assigned to Research Personnel, this task of information conversion was carried out and the number of titles converted surpassed the 500 original entries, which is a formidable base, but insufficient for the system's capacity. For this reason, IDECA Group set out to continue in archive conversion in its fourth year of R+D. The idea was to reach double that number in approximately the next three years, for a total of 1,000 digital documents available for documentation and analysis services.
Independently of the software itself and the operations it allows, we have designed an internal system in order assist in the task of document searches. This system is searched either by material or alphabetical order of author or work, which allows for a speedy localization of any material in the system's database.

Despite the size of the archive and the infrastructure possibilities for posting content to a network through a server, the necessary copyrights of the digitalized works makes it so that the material can only be used internally and is for the exclusive use of students and professors in regional, national or international education fields. In no way is the material put on a network. The viewing takes place in a room constructed for this purpose with TFT screens and headphones at stations for an individualized and controlled use of the material.
Copying of the entire material or segments is not allowed under any circumstance; it can only be viewed as many times as required and for justified reasons. As a result of this research project, the IDECA Digital Archive functions as a small cinema and provides two things: 1) a place where useful references can be found to complement the formative task of art teaching and 2) a place of references for artistic creation, namely the production of new digital contents. The first use would be auxiliary to a theoretical and critical task and the second as help and reference for a practical project.
In this way, the IDECA archive is based in a fiber optic Terrablock server connected to two control points in Mac and PC systems. These points are in charge of the archive management and maintenance duties and function as the only points of access to the server as from them all the internal tasks of the system are carried out. From these control points we can also respond to requests and searches made from any of our intranet points, such as a material search. These control points are then also connected to two other permanent search and viewing posts within the facilities belonging to the IDECA research group.
The Terrablock system uses a modular storage system through removable hard drives between a 250 Gigabyte and 750 Gigabyte capacity in sections of twelve. Currently, due to the storage requirements of the project, we have one server with a total capacity of three Terabytes divided into twelve removable hard drives.
The control points used in the maintenance and management of the server are composed of a team of four nuclear G5 Macintoshes for editing tasks and to work on the archives, along with one being a Windows system for more administrative functions.
The internal circuit with access to the system is not common in European Art centers and institutions where normally physical archives can be found but not digital archives from which interactive functions can be performed within a creative, expressive or artistic process. Having archives function as a documentation space, and in this case also as a place of creation with the use of interactive tools developed during other phases of the general SWAP-SIVI project, is a common denominator. This is the real difference between the IDECA Digital Contents Archive and other archives: its expanded operational capacity from just documentation tasks. For this, a tool such as the FACILIS TERRABLOCK capable of activating operations with digital archives through fiber optics at great speeds and with optimal resolution performance is necessary.
In both cases, the archive functions as a work engine in the academic space and as a source of information for the crucial tasks of self-education for students in the new European scenario of higher education. The results are very satisfactory, as we have seen this service in high used often in high demand for viewing the archived content.
Presently, the IDECA archive is centered on four audiovisual registers dedicated to Art History, Cinema History, Animation and work done by students at the College of Fine Arts of Cuenca throughout this past decade. Said registers are stored in high-resolution image formats and highly compressed video formats which maintain an excellent bit rate, making for a good quality/size ratio for archive viewing or reference.

The IDECA archive contents are a privileged window for the diffusion of teaching contents. The possibilities of the archive try to create a presence of these contents in the university community, promoting quality contents and searching for an influential projection. In this sense, the IDECA digital archive covers the diverse work fields of the College of Fine Arts of Cuenca, making it an excellent platform for cultural diffusion.
Starting from the audiovisual registers of the Cuenca Fine Arts College, it is possible to amplify and project the archive to all other colleges and activities of the university community. In addition, the visibility of the IDECA Group's activities are reinforced with Internet presence from a portal whose objective is to be converted into a reference point regarding the audiovisual contents focused on art.

3.1 IDECA Archive Characteristics:

- Multiple access to archives greater than one Gigabyte simultaneously and with no wait, even for audiovisual archives.
- The original archives are never accessible through reference points.
- Unlimited amplification capacity at reference points through the University of Castilla-La Mancha's intranet.
- Modular amplification capacity from the server's memory.
- Access to multiple registers in the fields of Art History, Cinema History, Animation
- and alumni work.

Below is a model of the process of the service in use. On one hand, there is the operative procedure for the referencing of material; on the other, the system's structure.

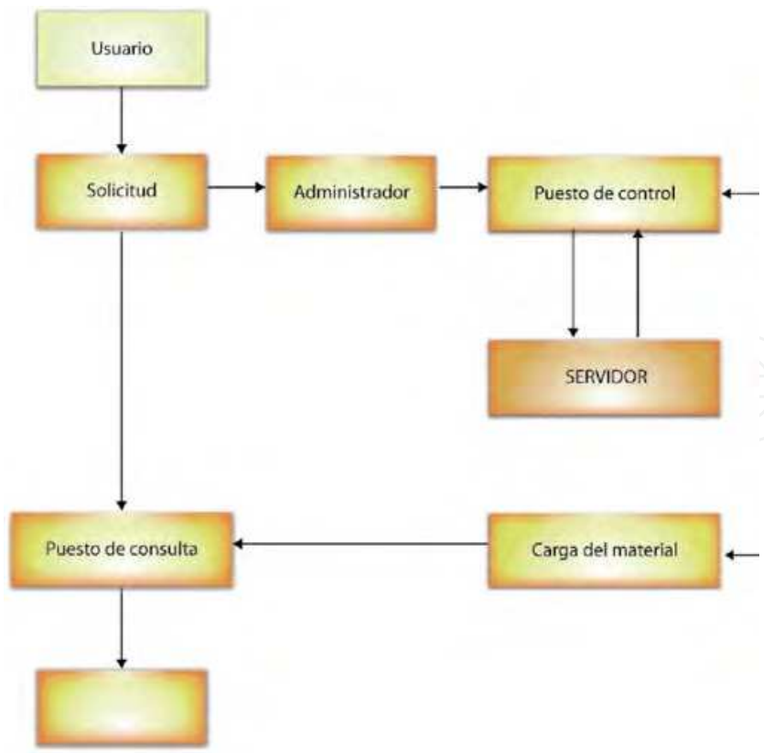

Fig. 1. Working diagram of IDECA archive

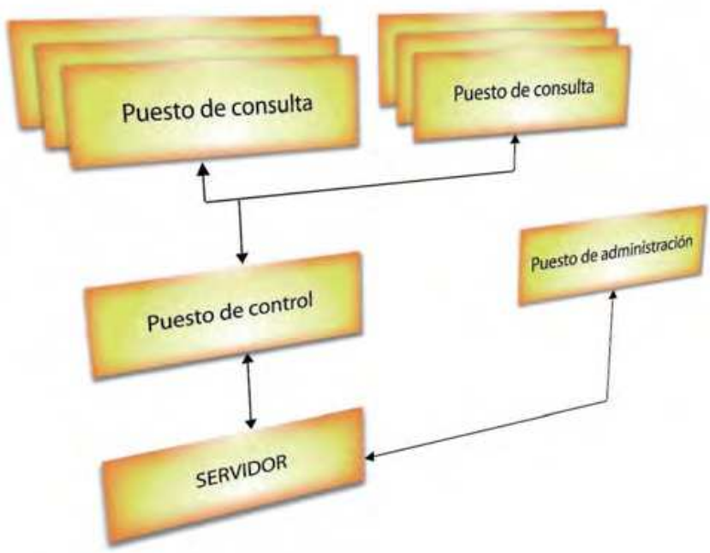

Fig. 2. IDECA archive structure

4. SWAP (Software Development 1.0)

The section of the project titled SWAP focuses on the creation of internal software with an interactive interface capable of performing complex operations with the objective that the user is able to perform tasks related with teaching.

Generally speaking, we approached the construction with a group of specific tools in mind for the improvement of art instruction. The user, who would be the body of professors of the University of Castilla-La Mancha, will be prepared to navigate the mentioned SWAP software in order to access specific tasks according to the composition and set-up of his class.

The work carried out in the development of the SWAP software required the hiring of a specialist technician in software design and graphic tools, such as those related to interactive operations. This development lasted one year and the results were satisfactory, with the service available to the professors of UCLM in the end. However, this software could be extended and projected in other areas of the community. It could have in impact outside the university, in other educational territories such as secondary education, where the installation of tools that lend themselves to self-education tasks is very important.

The description of the SWAP software would have the following limits to its operability and use for the user. In the first place, once the necessary register is executed in order to access the system, a menu appears in which it is possible to select four operations for the management of the information: PowerPoint, text, video and PDF. These are the most common formats and sources of information management, although the system does allow for other elements to be loaded should it be necessary. The selection of an operation from the menu makes it possible to load the corresponding archive in the second window of the menu, situated together with the first menu. After the selection of a specific content in the second navigation window, the document is loaded immediately and a new window

appears in which the download of the indicated document is reproduced in any standard viewing format (QuickTime, PDF, Word, VLC, etc.).
The system has an internal use in the workspace of the college, such as in the private work area of a professor authorized by the system for such use, but also allows online work without visualizations or archive download subject to copyright. This is precisely to avoid problems with the necessary protection of data that such visualizations have either with class content or with copyrights of selected programs or work whether they be image, text, fiction, documentary, photograph, etc.
The function of the SWAP software could be extended to other disciplines outside specific academic tasks within society. It would be possible to amplify the management tools of the archives and adapt them to other educational and social needs such as in the areas of health sciences, social tasks, assistance in the home, etc.
Upon commencing the development of SWAP, a final user evaluation of the application was elaborated and of the various objectives it was meant to meet. As a result of this evaluation, we decided on a simple yet functional design that allowed the minimal time possible for information access. This meant that the final system would have to include only the minimum number of characteristics necessary to completely satisfy the user.
Structurally speaking, the application is divided into two sections. The first consists of a database that integrates the great number of data for the creation and elaboration of teaching resources in an organized manner. The second section is the online user interface of SWAP. This interface, developed en Adobe® Flash© for its versatility and flexibility, is responsible for the management of information requests made by the client from the application by means of a system of dynamic menus. Once the desired information has been located, it is downloaded locally to the users equipment so that the user can manage the material in the way they see fit.

4.1 Characteristics of the application:

- The application functions completely online and is accessible through Adobe® Flash Player©, which is present in over 98% of equipment, whether it be Mac or PC.
- The entire application occupies less than 10Kbs, which in practical terms makes access to the application and the information in it immediate.
- Currently, the application is focused on three fields of knowledge: Art History, Cinema History and Animation. However, it is designed to be expanded to an unlimited number of fields.
- The application permits the downloading of audiovisual content in the most common formats.
- SWAP allows for the centralization of content and teaching material download from a single platform, which improves work flow when it comes to working with interdisciplinary teaching materials.

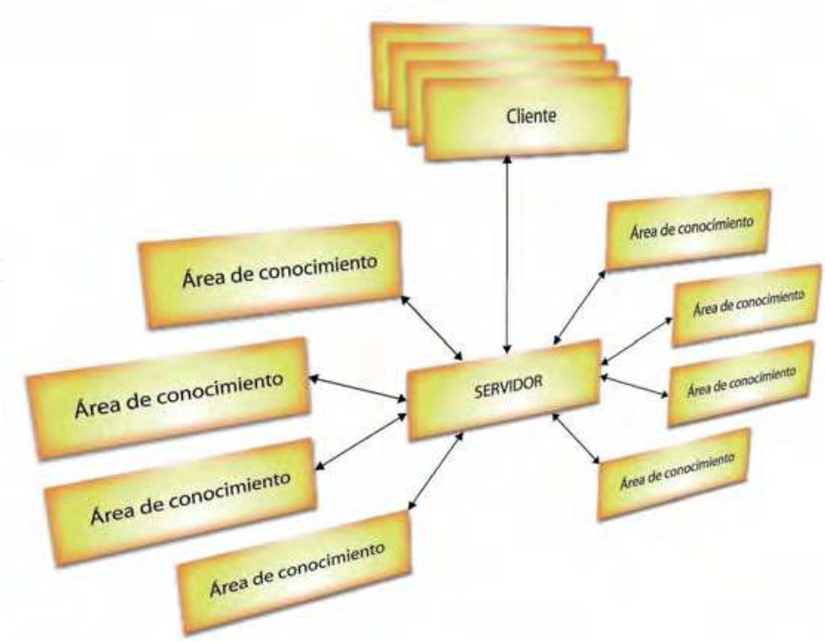

Fig. 3. Work structure of SWAP aplication

Fig. 4. Starting screen of SWAP

Fig. 5. Navigation by SWP menus

Fig. 6. Information and previsualization of referenced SWAP material)

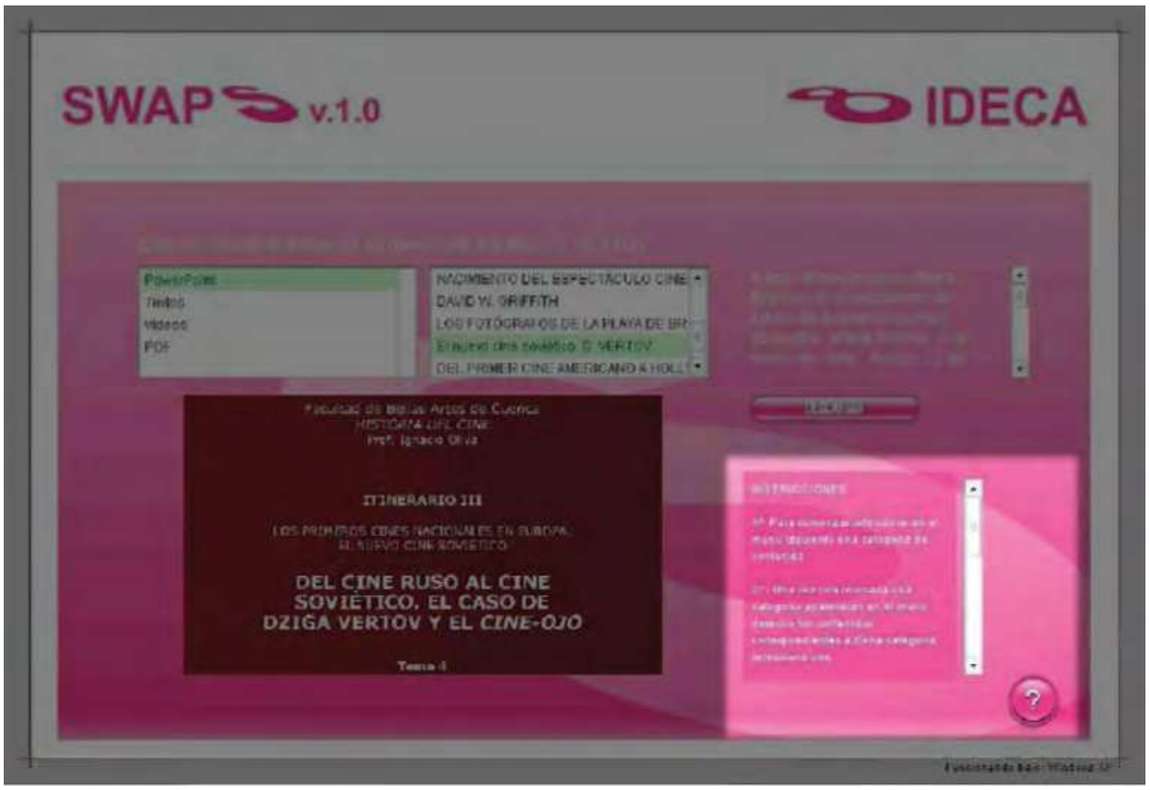

Fig. 7. SWAP help system detail

5. SIVI

Within this project, this is the more ambitious and complex part of all the proposed tasks. Centered on communication technology, we set out to design a bi-directional, interactive communication system in real time. With it, it was intended to make information exchange in real time possible through means of easy access for the users, with webcams, microphones and system access. SIVI is an idea that comes from the generalized communication system in real time, MESSENGER, developed for WINDOWS XP Professional, although SIVI advances toward a much different operability expectation because of the composition of the contents.

In this way, SIVI is a teaching tool based on student-professor communication. SIVI is a videoconference application with text support along with written and visual multiuser communication capacities.

SIVI is intended to advance independent and applied, dealing with problems and concrete needs, in this case focused on the development of technological tools to assist in the teaching tasks of art instruction. In this sense, SIVI allows for the opening up of class contents so that, if so desired, there is a shared virtual space in which students can carry out a common and interactive project or task with the professor.

On the one hand, a following of the contents seen in each class is possible by everyone, in real time, with only Internet and system access necessary. This tracking and visualization offers greater flexibility when it comes to following class contents. At the same time, SIVI offers the option of student participation since it is a bidirectional real time system. So,

students can ask questions and resolve doubts they may have concerning the concepts seen and learnt or express thoughts, opinions or otherwise participate in the class.
This system, already installed in the College of Fine Arts of Cuenca, is very useful, above all to support a great number of students who spend part of the academic year in other European centers thanks to the *Erasmus* exchange program and other similar programs.
Before, students had no way to follow classes and given the fact that there were nontransferable courses, there were great problems in passing exams upon their return to Cuenca. Now with SIVI, many students can follow their classes with normalcy during scheduled hours during their study abroad and while present in the College of Fine Arts of Cuenca.
One of the biggest challenges to Spanish universities is the creation of digital contents. SIVI, as well as being extremely useful to the expansion of e-Learning in general, can be expanded and applied to multidisciplinary projects in artistic creation. This part of the software is still yet to be developed and that is precisely what we intend to do in the next R+D projects in the coming years. This will require the presence of a specialist technician in the area of digital design and task programming with the use of software like Flash Media Server 2 ®, from ADOBE®.
Among the elements to bear in mind with this application, we have opted for a final system that includes only a minimum number of characteristics necessary for the achievement of the proposed objective, this being decided after the final user evaluation of the application and considering the main objective of said application.
From the development point of view, it is a client-server application located in a central server at the University of Castilla-La Mancha. SIVI is a multi-layer application comprised of a socket server charged with the communication between different client equipment and specialized in C/S applications developed with Adobe® Flash©, an online user interface developed integrally by the IDECA research group. The objective of SIVI is to create an attractive work space accessible to users without previous knowledge of the application as well as the creation of a wide range of functions able to handle client-server communication, also developed by IDECA.
The application was elaborated on a Flash platform due to its graphic capacities and its high level of installation, being present in the majority of Mac and PC systems since its MX version. The program was developed using the programming language ActionScript 2.0 for the user interface and ActionScript 3.0 for the development of the SIVI library of functions.

5.1 Characteristics of the application

- Since it is an online application, the user is capable of accessing it from any
- computer with an internet connection.
- Thanks to its multi-layered design, the user must only load a user interface of 2Kbs
- onto their equipment through an Internet connection before beginning to access
- and work with the system.
- The application allows written communication in real time between multiple users.
- Visual communication can be between professor-student, professor-professor or
- student-student and always functions in a hierarchical and sequential manner.
- Visual communication can only happen simultaneously between two users,
- however the conversation is transmitted to all connected users in real time.
- The sockets application of the server permits a simultaneous connection of up to

- 2,500 users from the same server, which allows us to work with 50 classrooms per
- server dedicated to SIVI functions.

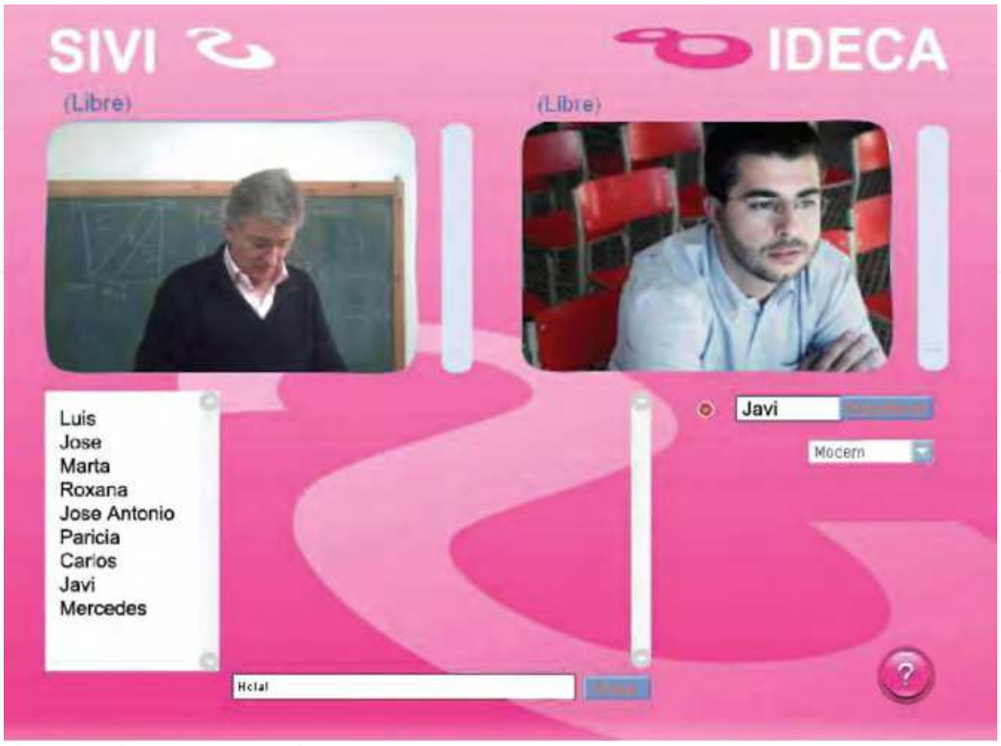

Fig. 8. SIVI application at work

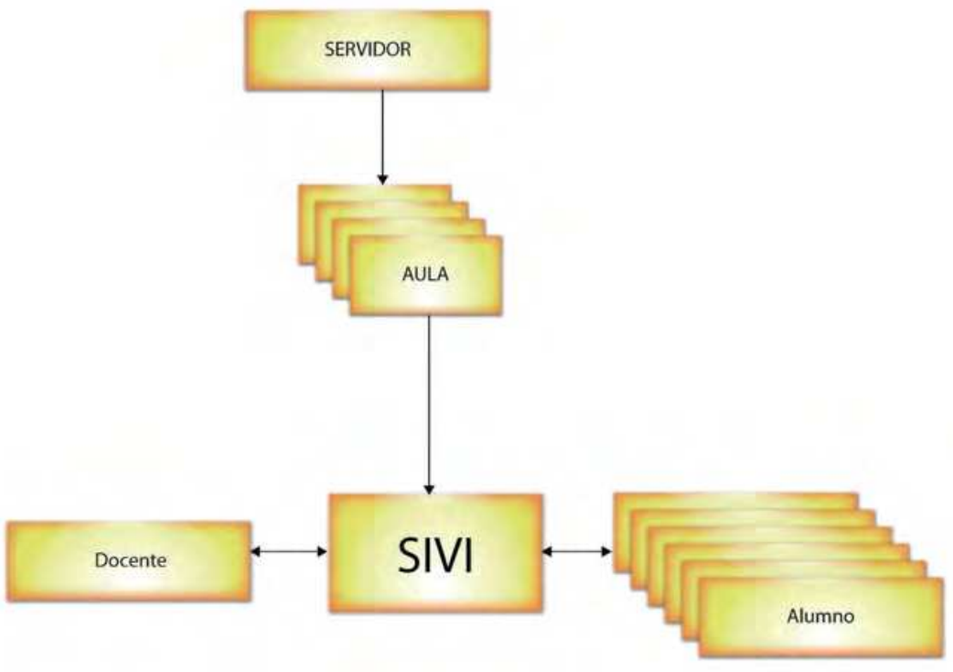

Fig. 9. SIVI application usual structure

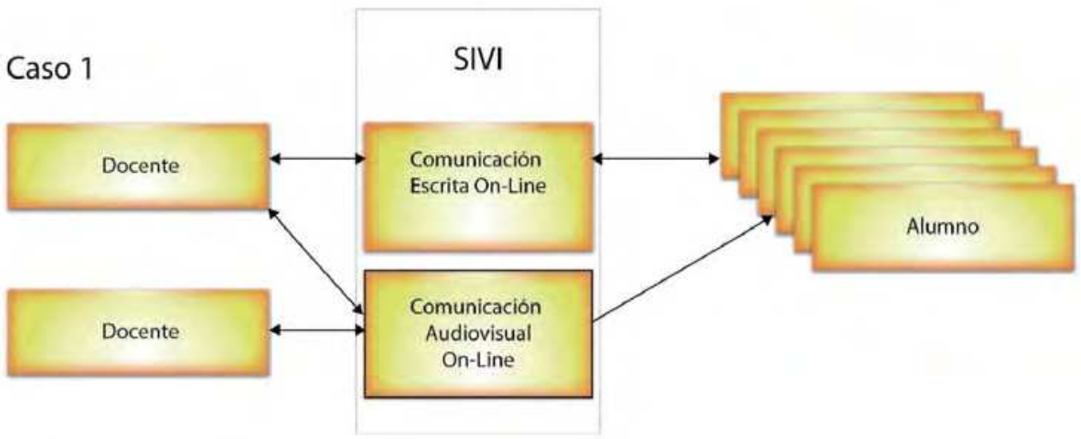

Fig. 10. SIVI application in work mode 1

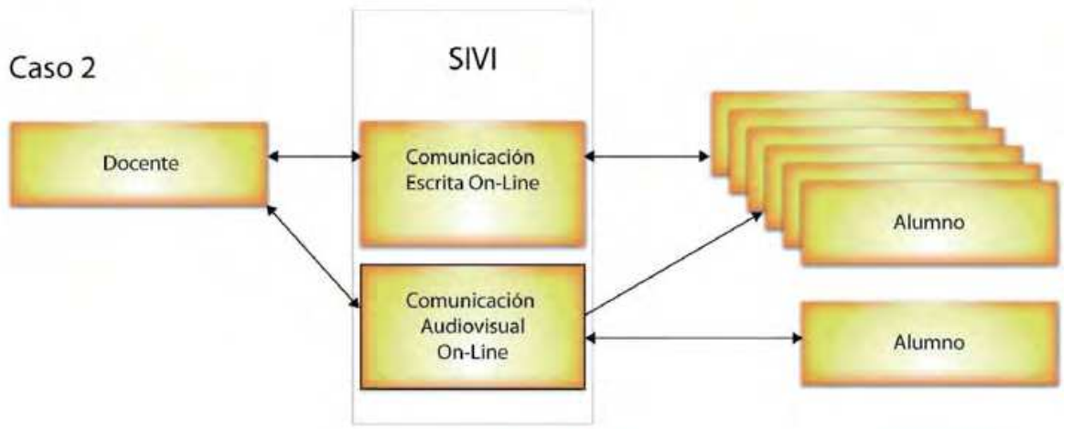

Fig. 11. SIVI application in work mode 2

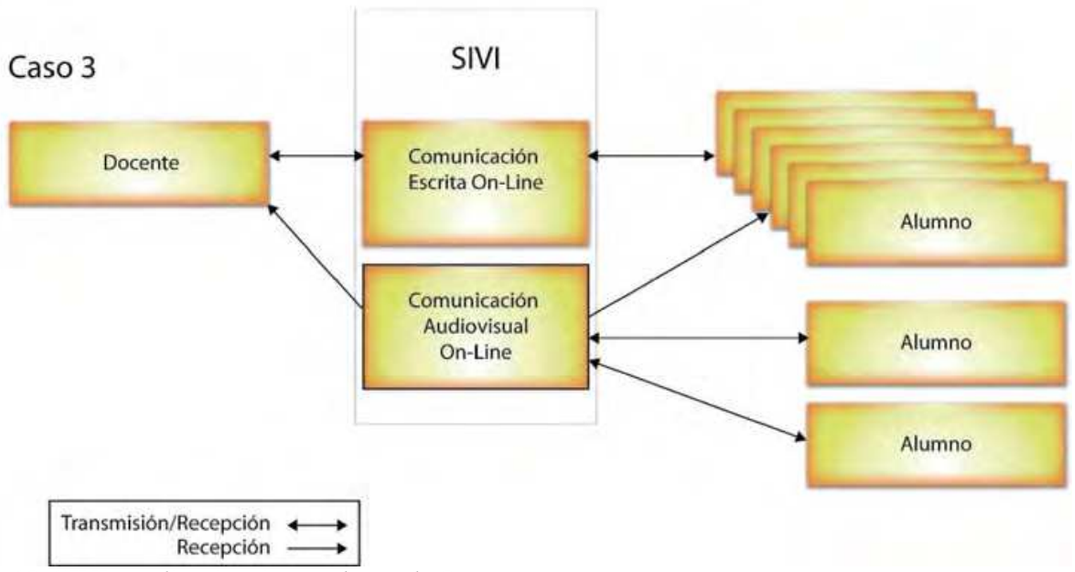

Fig. 12. SIVI application in work mode 3

6. Conclusions

Nowadays, education, culture and learning are the points of interest in the world and especially in the area of artistic instruction. Currently, there is a great opportunity for the development of new projects and initiatives, most of which presently focus on the use of the computer as a teaching tool for the emission, diffusion and maximum use of contents through different platforms, such as digital television, portable devices (mobile phones, pda's, etc.), which complement the present reach of the Internet.

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Since many decades Education Science and Technology has an achieved tremendous recognition and has been applied to variety of disciplines, mainly Curriculum development, methodology to develop e-learning systems and education management. Many efforts have been taken to improve knowledge of students, researchers, educationists in the field of computer science and engineering. Still many problems to increase their knowledge on daily basis so this book provides newly innovations and ideas in the field of computer science and engineering to face the new challenges of current and future centuries. Basically this book open platform for creative discussion for future and current technologies to adapt new challenges in education sector at different levels which are essential to understand for the students, researchers, academic personals and industry related people to enhance their capabilities to capture new ideas and provides valuable contribution to an international community.

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