Distance Education in Leather Engineering and Technology

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Abstract

The lifelong learning concept is gaining more significance every day, due to the continuous need for information and new perspectives for anytime, anywhere learning. Less effort has been made to access data, and various forms of digital content such as digital book, audio files, videos, courses, etc. are shared through e-learning environments that provides web based service. The application of distance education system offered flexibility by removing space and time dependency between student and lecturer. With distance education it is proved that the transmission of knowledge is not limited to formal education and some constraints encountered in the formal education has been eliminated.

The education of leather engineering and leather technology is theoretical and practical education program which includes practical application of processes. In recent years with the emerging developments in the field of distance education, essential laboratory experiments required for leather engineering education is feasible. This study focuses on the distance education and e-learning applications which can be applied to leather engineering and technology education. The web-based training model for leather engineering and technology education, which was envisaged by investigation of existing teaching programs and systems at international universities, will be described.

Keyword: Leather Engineering, Leather technology, distance learning, web-based training, use of laboratory on the distance education system, the virtual laboratory.

1.Introduction

Distance learning or distance education is a term used extensively to describe remote delivery of course contents. It usually refers to off-campus sites, web-facilitated courses, and web-based online courses (Wael et al. 2005). In recent years the use of e-learning system has become widespread in technical, engineering departments and programs at universities, andmost of the developed countries in the world provide distance education programs in graduate, post graduate levels on various fields. One of the most important reasons is that distance education has significant advantages over traditional education in terms of training

programs, educational services, and educational activities during the semester, the space and time independence, the cost of the education to students, faculty members, administrators, the organization infrastructure and quality assurance(Köksoy, 2004).

Recent advances in internet and communication technologies has reduced the educational cost and provided interaction, facilities to use rich visual educational materials and synchronous-asynchronous application possibilities in distance education. Interaction and communication is very important in education. In the earlier stages of distance education it was not usually interactive; however by developing technology the interaction between learner-instructor, learner-learner and learner-instructional material have gradually increased. Interactive distance learning systems can be handled in two categories based on whether it is synchronous or asynchronous. The interaction and communication in distance education can be one-to-one, bi-directional and one-to-many depending on the types of the live broadcast (multi cast / unicast) and broadcast on demand. With every new technology a new model of distance education has been proposed and these technologies have various application possibilities such as text, audio, video and electronic media (Ademilde, 2009).

The tremendous technological advances in computing power, storage technology, and communication links have set the stage for great advances in the quantity and quality of distance education also in engineering sciences and enabled to deliver technology education laboratory courses via distance learning (Shafer et al., 2008). The education of leather engineering and leather technology is theoretical and practical education program which includes practical application of processes. This study focuses on the distance education and e-learning applications which can be applied to leather engineering and technology education. The web-based training model for leather engineering and technology education, which was envisaged by investigation of existing teaching programs and systems at international universities, will be described.

2.Integration of Distance Teaching Technology in Engineering Education

The engineering education is different from the education of other fields. Traditionally the teacher-centered classical education method is applied in engineering education. In this method the topics that an engineer need-to-know were classified in lessons and usually each lesson is realized through one-way presentation of topics to students by a specialized academic staff. In this method, even in well-presented lecturesstudent's rate of learning and recall of information were found to be very low. Previously conducted studies revealed that the students can recall 70% of the information, which was transmitted in the first ten minutes, and only 20% of the information that is transmitted in the last ten minutes shortly after the presentations (Güler, 2008).For this reason in the course of engineering education through distance education methods the application of technologies, which increase the rate of visual perception of information that combines theory and practice, such as virtual laboratories, internet-based control laboratory applications, video, animation and simulation techniques should be provided (Dierig et al., 2000).

In a traditional proximal laboratory, the user interacts directly with the equipment by performing physical actions such as manipulating with the hands, pressing buttons, turning knobs and receiving visual, audio and tactile sensory feedback (Fig. 1).

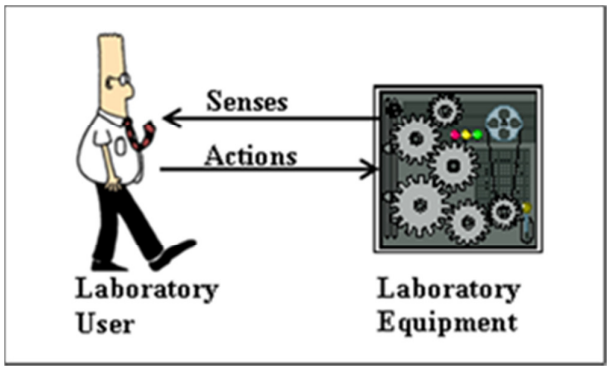

Figure 1.Traditional proximal laboratory

In a remote laboratory, this same interaction takes place at a distance with the assistance of the remote infrastructure, which allows users to perform experiments and laboratory tasks over the internet without being near the actual equipment. This is a new layer that sits in between the user and the laboratory equipment. It is responsible for conveying user actions and receiving sensory information from the equipment (Fig. 2).

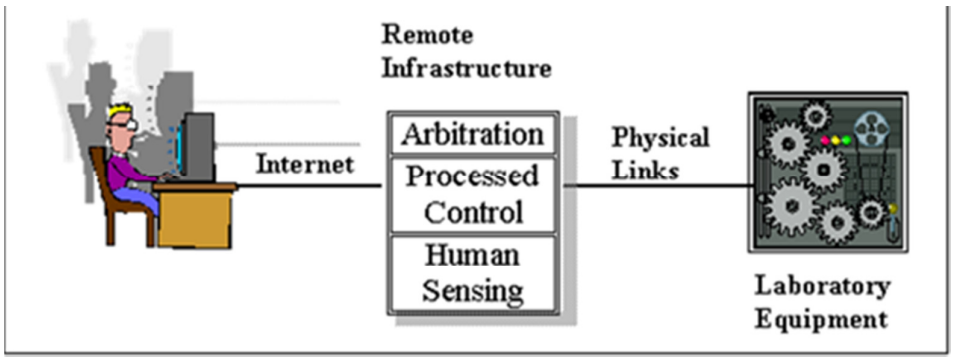

Figure 2.In a remote laboratory

On the user's side, the remote infrastructure performs the following key functions:

- Provides a user interface that allows the experiment apparatus to be monitored and operated.
- Manages access to the laboratory, to ensure that only one user can use an experiment at a time

On the equipment side, the remote infrastructure performs the following key functions:

- Monitors the apparatus, through the use of video cameras, microphones and other sensors.
- Controls the apparatus, through the use of input/output interfaces, motors or other actuators

- Ensures that the experiment is 'cleaned up' at the end of a user's session by automatically resetting the apparatus or putting it into a stable state(Remotelab, 2008).

Although each laboratory model is applied in other engineering fields, there is not any virtual and remote laboratory intended for education of leather engineering and technology.

3.Distance Education in Leather Engineering

In leather engineering education program, the main objective is to discipline engineers, who can use advanced technologies, and develop scientific solutions for the issues of leather industry. Throughout the education program courses such as, physics, chemistry, leather histology, raw hide, leather chemistry, tanning materials, leather dyestuffs and dyeing technics, leather wastes and utilization are given. 62% of courses are based on theory and 38% on practical courses. In this sense the education of leather engineering cannot be realized only by distance learning, but a blended learning method, which is a form of education that combines face-to-face classroom teaching methods with computer-mediated activities, can be used. Design and creation of interactive educational materials in implementation of theoretical courses and use of animation and video images within the scope of practical educational will enable active comprehension and learning of topics on leather engineering.
In many countries in the world education programs are given under the title of "Leather and Leather Products Manufacturing, Engineering, Technician, Technology and Design". However, within the scope of these programs there isn't a program that integrates distance education to leather engineering and technology.

Information and communication technology should make visible the impact of the present status of professional education and training applicable for leather and the manufacturing of leather products. Conventional training and learning methods and routinely suggested course durations, forms and arrangements suit neither today's would-be employees or industrial operations. In spite of some initiatives by various institutions, education and training in leather-based industries has not made full use of the available technology. However there are several attempts for online course programs and a European Union project on shoe design.

The EU project "E-shoe Learning" has started on 2007 and mainly aims to contribute to the development and share of knowledge on footwear development and manufacturing in Slovenia, where there is no secondary or tertiary footwear education level but still there are quite many small, medium and big size companies that need educated workers to produce and sell quality products(Shoelearn, 2007).

Central Leather Research Institute has developed an online course, E-Learning course for leather goods design and fabrication for the benefit of the students in India and abroad.Designers and pattern makers are in good demand in the leather goods industries at India and other countries around the world. Design and making of leather goods involves many skilled operations including sketching, pattern making, cutting, table operations, stitching, finishing etc. There is limited number of institutions to supply the required manpower to the industry. Hence with this project it is aimed to develop a training course which provides convenience and flexibility to the learner so that large number of people is encouraged to enroll and make ita carrier option(CLRI, 2013).

United Nations Industrial Development Organization (UNIDO) has also made an attempt to incorporate today's available technology to improve training efficiency by developing an

animated Visual Training Tool (VTT).VTT serves as a practical training tool for UNIDO workshops in developing countries, mainly targeting leather technologists, tannery managers as well as decision makers of different profiles. It is also expected to help the staff of Environmental Protection Agency and members of Non-Governmental Organizations in better understanding of key issues and principles of the treatment of tannery waste waters(UNIDO, 2011).

A study entitled "Using Augmented Reality Virtual Assistants to Teach the Traditional Leather Tanning Process"presents an augmented reality solution that was developed in scope of a project which aims:

• To illustrate to children how the leather used to be processed in the ancient time;
• To illustrate it according to an educational, interactive and immersive approach;
• To preserve the cultural value of the leather tanning in the Guimarães history;
• To make children have contact with new technologies.

In order to create an interactive experience to the end user, an environment was created that actually narrates and illustrates the different stages of the leather processing pipeline at that time. Some research was also made in order to describe properly this process according to the late 19th century. Figure 2 illustrates one of the pictures that were gathered fromthis research phase. The overall goal was to produce vivid animations, with good visual quality and satisfactory degree of immersion to the user. The main underlying goal was to preserve the ancient leather tanning process memory and allow the end-user to have an augmented reality interaction experience.

The leather process pipeline is fully animated, and the character moves between different process stages and some ambient background sounds can be heard. The end-user can stop or restart the visualization just by hiding or showing the tag. The interaction scenario occurs in a room where 3 computers are available for the end-users. Each of the computers has a high resolution USB camera, in order to properly capture the tag, and 50” LCD monitors. AR goggles could be also used. At the entrance of the room, the user should pick a printed tag and use it to interact with each computer. The room is inside an ancient leather tanning facility and is decorated accordingly. The user is asked to approach and read the situated basic instructions of “how to play”. To start “playing” the story, the user should show his tag on the palm of his hand, before the camera. The camera is calibrated to catch the user’s image, so that when he starts seeing the virtual assistant, he is positioned just before the user, on his hand. The user is asked to move the tag and to visit for a while each of the other computer stations. On the first station, he can customize his character (virtual assistant), while the other two are used to actually illustrate and show the different steps of the leather processing pipeline to the visitor. The customization allows the change of the virtual assistant’s clothes, hair and skin color. The customization process helps to increase the level of interaction and involvement between the end-user and the application.

The ancient leather process treatment used to be composed of nine basic stages. Each one of them was essentially used to design and create an animation. Below, a short description of what each action animation does is provided:

• Unhairing and fleshing: the character peels off all the fur and grease from the skin using a curved blade;
• Soaking: it's the cleaning of the leather performed in big sinks and with the help of long hooks;
• Tanning: the leather was colored in large rolling wood tanks;
• Drying: in between some stages the leather had to be dried before being handled again;
• Smoothing: depending on the goal of its usage, the leather had to be smoothened using normally a wood baton;
• Pressing: made to stretch the leather using a roller;
• Sanding: an abrasive tool is used to soften the skin and remove bumps and other imperfections;
• Cutting: it's the cutting of the leather into handy pieces on a table with a knife;
• Polish: Again, depending on productions goals, the leather should be polished using a special brush(Maçães et al., 2011).

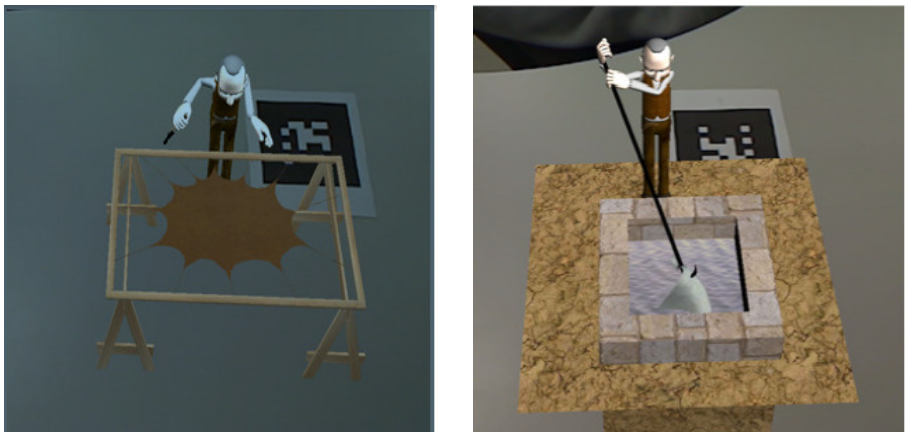

Figure 3. Sanding and Soaking the Leather

Framework of Integrated Technologies for User Centered Products (FIT4U) is a Collaborative Research Project funded by the European Commission under the 7th Framework Programme which aims at responding to the growing demand for consumer oriented product personalization by developing an engineering framework for both products & processes integrating: new technologies and devices to integrate the consumer in shoes and gloves conception, specification and design; innovative 3D knowledge based integrated design tools; micro devices providing shoes and gloves with innovative sensing functionalities; innovative high-performing materials with self-adaptive capabilities; adaptive production processes and technologies. The expected outcome of the proposed project will be an integrated technology framework for the engineering of fully personalized shoes and gloves based on a 3 to 5 days time-to-market criterion. Such a framework will be validated and assessed on pilot production lines, and new differentiated consumer-centered shoes and gloves will be delivered as fully engineered prototypes.

Figure 4. Technical activities of FIT4U Project

New technologies and devices, based on tools for virtualization of consumer profile and requirements, as well as acquisition and computation of relevant consumer feet metrics by means of novel biomechanical sensor network, will be conceived to integrate the consumer in shoes and gloves conception, specification and design. This will enable the creation of a knowledge base for responding to consumer need in terms of fitting, comfort, functionalities in targeted segments;

• innovative 3D knowledge based integrated design tools and solutions dedicated to personalized consumer centered shoes and gloves as for biomechanical aspects, based on measured consumer data and virtual profile. The product will be designed embodying identified parameters for comfort and fitting, taking also into account technological constraints derived from materials;

• innovative high-performing materials to optimally fit consumers physique and ergonomics, whilst guaranteeing comfort and health/ safety through features like breathability, antifungi etc., specifically conceived from a common development process and targeting shoes and gloves in the professional/safety and sport segments;

• new production technologies and process engineering: at shopfloor level a new fast production machine for differentiated lasts and footbeds and a new modular sole will provide SMEs means to quickly realize product based on comfort and fitting, endowed with high performance for safety and sport applications; on a larger scale, growing complexity of consumer product differentiation and optimization in production lines will be addressed through dedicated tool for lean production concepts(Eshoelearning, 2007).

The above mentioned studies and projects revealed that the number of studies regarding the application and design of 3D animation, virtual laboratory, multimedia educational materials, which aims to improve the education or quality of a product, has increased considerably.

4.FeaturesRequired for Web-based Leather Engineering/Technology Training Program

The first action to be taken in web based leather engineering and technology education is to digitalize the teaching materials at graduate level. The available lecture notes, the topics that will be instructed to students should be scripted in accordance with e-learning strategies. At

this stagecreation and utilization of animations and the visual laboratories specific to leather engineering is required, which must be designed through academic contents. A sample of virtual laboratory designed and utilized for this purpose is not available in both the national and international platforms. For this reason, it is inevitable to conduct a multidisciplinary study and organize a professional team in order to provide a web-based leather engineering and technology education.

The design of remote laboratory should include production processes, possible variations that may occur by application of trial and error method, the status of final product and optimal application and control parameters. The production processes in leather engineering are classified as wet processes and finishing processes. Each process has sub-processing steps and specific process flows.There are many parameters such as raw materials, chemicals, water-bath quantity, process time and temperature.

The design of laboratory and process simulation have to be based on virtual reality matching the original one, because the main objective of the web-based education is to reinforce the learning by simulating the use of theoretical information at application phase. The learning styles of engineering students should also be considered in course of the design of the program. In educational sciences there are methods presenting relevant learning styles. In addition the preparation of web-based teaching materials and creation of course contents should be conducted in accordance with the international standards.

5.Conclusion

The distance education systems are more commonly used as web tools and instrument control software have become more advanced and easier to use.The use of distance education, applications of virtual laboratory and the interface of mobile access provided a significant contribution to traditional engineering and technical education methods. It is inevitable to reconstruct leather engineering and technology education by means of recent technologies and to bring into use of beneficiaries. These systems will provide significant advantages in terms of improving performance, quality and interaction of education. At the same time this education program can be used in order to improve professional training skills by designing for different levels.

The development of teaching materials and application of virtual laboratory will enable high-quality production, qualified worker and product flow.Moreover the continuous development of this web-based application is possible through the received feedbacks from students and academicians using this system.A worldwide network referring the topics of “Leather Engineering Technology and Design” should be created between institutions and organizations which provide leather engineering and technology education, by this way ICT based organized structure can be constituted.

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