TEACHING PROCESS BASED ON WORKGROUP DESIGN CLASSES

Adam Cholewa and Krzysztof Psiuk
Department of Fundamentals of Machinery Design, Silesian Technical University, Konarskiego 18a, Gliwice, Poland

Keywords: Fundamentals of machinery design, Modelling, UML, Working group, Didactic process.

Abstract: The paper presents a concept of a system for remote teaching of design(in Fundamentals of Machinery Design). The system takes into account the possibility of designing in a working group. The approach was presented using UML diagrams. It also provides software that working group are supported by. Appropriate software configuration required for the system was also described. The concept of that system was verified with the use of an example design task, in which the two designers took part. The designers were students of technical university. The paper describes obtained results.

1 INTRODUCTION

The aim of this paper is to present a way of teaching of Fundamentals of Machinery Design (FMD) in technical university. The teaching of the FMD should take into account the transfer of general engineering knowledge as well as skills of carrying out individual or group design tasks. Because of that, important elements of these types of classes are design classes. The FMD design classes are specific activities. Considerable students' as well as teachers' effort has to be put into them. This arises from the fact that a considerable number of such classes shall be taken in the form of consultations. Even more important seems to be an introduction of teamwork and joint problem-solving outlines. For this purpose, an attempt to development of assumptions regarding a computer aided system for design classes has been elaborated. In this system design tasks are carried out jointly by several persons. One took also into consideration development of computer technology and the availability of the Internet. This let us introduce remote classes based on group work. Unfortunately most systems developed for the purpose of carrying out classes via the Internet do not provide the tools for group work. Therefore, the work undertaken has been related to the development of the system that aided teaching of the design classes remotely.

The problem discussed in this article is described in the Computer Supported Cooperative Work (CSCW). The CSCW focuses on suitable forms of cooperation between users to perform a common task. It supports a range of applications such as shared editors, many type of conferencing, computerized meeting rooms, group design tools, coauthoring systems, shared calendars, workflow system, voting tools, whiteboard and message based conferencing (Iqbal, R.; James, A.; Gatward, R., 2003). It is possible to find some examples of this kind of solutions (Twidale, M.B., Nichols, D.M., 1998), (Neto R.B, Jardim C., Camacho-Guerrero J., da Graca Pimentel M., 2004). But this paper presents a solution based on the use of Autodesk Vault application. We try to use in teaching process an existing type of application, that was designed for file management and is applicable in industry.

2 TEAM WORKING IN EDUCATIONAL PROCESS

The purpose of this paper is to present problems connected with teaching of fundamentals of machinery design in a form of design classes. Special attention was paid to these classes where a single design task is being solved by many students together. It must be underlined that usually this type of classes is conducted by many people. Each of them plays a different role. Thus, participants of the classes are teachers as well as students. It is possible to distinguish some variants of this type of work. However the most interesting one is when many

Cholewa A. and Psiuk K. (2010).
TEACHING PROCESS BASED ON WORKGROUP DESIGN CLASSES.
In *Proceedings of the 2nd International Conference on Computer Supported Education*, pages 442-445
DOI: 10.5220/0002793604420445

students resolve a design task simultaneously and at the same time they are controlled by many teachers. One should take into account not only the possibility of communication between teachers but also between students. In such case the communication between students and teachers must not be skipped. Appropriate methods for assisting the organization of classes and preparing tools that enable us to standardize achieved results are necessary to be elaborated for the controlled design work.

There are some problems that should be solved in this case:

- a creative work,
- information exchange between students,
- the simultaneous work on the same project by a few students,
- information exchange with teachers,
- monitoring progress of the work,
- version management of project components.

To enable remote accomplishments of these types of tasks a special supporting system has been prepared. When preparing the system two main assumptions were made:

- the system should enable the resource sharing in a distributed environment,
- the system should guarantee work in the an asynchronous way.

A demonstration study of the system is described in the next point.

3 SYSTEM SUPPORTING TEAM WORKING IN THE TEACHING PROCESS

There are many systems supporting team works available. In the system were used the solution based on ideas drawn up by the Autodesk company described in the paper. They were selected because of the abilities of these tools and their full integration. The accessibility of these tools in Department of Fundamentals of Machinery Design of The Silesian University of Technology at Gliwice and experience associated with their usage both as part of research as well as design work was also taken into consideration. Two tools of Autodesk company were employed for preparing the system. The first one is Autodesk Inventor version 2009. Autodesk Inventor was used as a CAD tool for supporting tasks connected with designing and 3D modelling. The second was Autodesk Vault. Autodesk Vault is used as a tool for integration of files obtained as a result of the designing process. The Inventor program was used mainly as the designing tool. The application of Vault program enables the simultaneous work of many persons, manages of the work results (files and projects) and determines and ensures access rights for users.

The work on the system began with preparing assumptions associated with requirements related to the application of the system. The main problem was how to define communication methods between all persons participating in the design work. As it was stated before it was necessary to determine methods of the information exchange between students, teachers and both of them.

A certain patterns of procedures for this purpose were prepared. All these procedures were divided into two groups. Patterns of procedures connected with the team work and patterns of procedures connected with the project supervision. The first patterns included among other things:

- document exchange methods (documents could be saved as files or as records in a database),
- information exchange methods (communication between project participants)

The UML language was used for developing procedures schema (Larman, 2002, Dennis, 2002). This language is very useful for resolving these kinds of problems. A use case diagram was used for modelling the communication methods. The first considered issue was to determine the method of the exchange of documents, which are elements of the project. This diagram describes how some students working on the same project can exchange documents.

It was assumed that all documents should be stored in one place. Separate project users would borrow necessary resources as documents. After they finish their work, all borrowed documents should be returned. It was assumed that all documents could be borrowed as "*read only mode*" or in "*edit mode*". If a document is borrowed in *edit mode*, it will be blocked for editing for other users of the system. But all users could borrow the document in *read only mode*. In this way numerous tasks could be realised by many users. When users create new documents, then each of the document has to be added into the project resources. The attempt to borrow the document should be preceded by the inspection if the document is available. In such the case, it has to be blocked for editing and after that it could be borrowed for editing. When the user finishes editing the document it can be left handed over for shared use and unblocked. In case when a document is borrowed for editing, a user should receive an appropriate information.

The next problem which had to be solved was defining how to exchange information on performed modifications and realised works. It was assumed that changes could be introduced by students. Information about each modification made in the project should be sent to all users that work on this project. After that, each user could relate to this information and send its own commentary.

The second group of patterns of procedures which were elaborated for the system includes patterns of procedures connected with the project supervision. In this case actions connected with:

- confirmation of each project task stages,
- general project supervision were included.

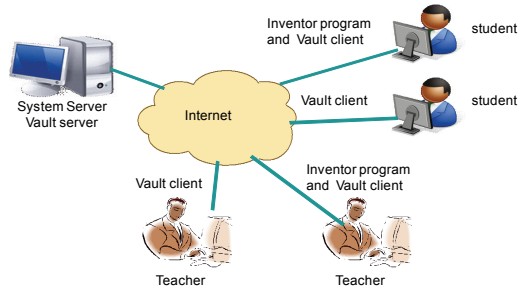

Figure 1: The general schema of the system of group working.

In the first case it was assumed that each student that participates in the project is evaluated individually. Each student is responsible for presenting a task to his/her teacher. Every task assumed as a part of the project is being explained individually and for such cases a pattern of the procedure was prepared. The core of the whole project was being controlled together by all teachers. The works on the project were divided into a few stages. Stages were distinguished on the basis of the design and construction process stages. Some were related to conceptual task performing, projecting and designing. Particular stages were considered as the whole work of the whole team. They should be accepted as the whole work by all of the teachers. Every student had to realize his/her tasks and coordinate it with other students. After finishing the given stage the student reported it to the teacher for approving results of his/her works. If all teachers accepted their work at a determined stage it was possible to leave it for the accomplishment of the next stage. All stages approval finished performing the design task.

Elaborated patterns of procedures allowed us to prepare a general structure of the system supporting team work in didactic process. The general schema of the system was presented in Fig. 1. This system was based on two tools – the Inventor program and the Vault program. The main assumption of the system was to make possible performing project tasks by many students simultaneously and with many teachers in a distributed environment. To make it possible they received a special server with Vault program. Every user of that system had an inventor program to realize designing process and a Vault Client program to exchange documents with Vault Server. Thanks to this tools every student and teacher had access to the project resources. As the result everybody could look through resources, edit them and add comments.

4 APPLICATION OF THE SYSTEM. AN EXAMPLE

In order to validate the assumptions and procedures of the proposed system the whole system was tested. The first tests were made on a group of two students of the ninth and tenth semester. Students designed a device for counting and packing plastic disposable plates. Subject of the work was prepared in such a way that it could be performed as a work group.

The first stage of this work was preparation and setting up the tools. This task included, among others:

- Vault server configuration,
- Preparation and configuration of the program Vault,
- Preparation and configuration of the Vault client.

In accordance with adopted and developed patterns the tasks were divided in such a way that each student could perform some tasks. At the first stage which is called the concept development stage, students worked together to solve the determined problem. The results of the work were presented jointly by two participants in the task. These ideas had been evaluated and considering the adopted criteria one proposition had been selected and approved for further work. The process to propose the concept as well as evaluation of the concept had been conducted on the basis of proposed patterns of the procedures.

At a later stage the design works were carried out. The device project completed the works. In accordance with the accepted patterns of the procedures the individual tasks had been consulted and supervised by leading lecturers. Majority of the work had been carried out jointly by the students and required them to exchange information and to agree

on details of the joint design solutions. After completion of the design phase and approval by leading teachers, it was proceeded to the final stage which is the stage of constructing.

All the work was carried out based on the proposed utility. The program Vault, allowed us to collect various resources used in this project. It also let us to determine the version of individual files that were created and modified in the project. For each file a comment could be placed and everyone could check who changed the file and when it was modified.

5 FINAL REMARKS AND CONCLUSIONS

The presented project has been carried out and based on the used tools and developed patterns of the procedures. The whole job came out to be a success, despite some difficulties associated with a disease of one of the participants in the project and delays resulting from that. Verification of the software implementation (in our case Autodesk Vault), based on which the system was implemented has been also completed positively.

Carrying out the design work in the work group of technical university was not an easy task. This type of tasks require intensive work from both the students and the work group leaders. Basing on the work that had been carried out, it could be defined a number of indicators how to decrease the risk of design task failure. These instructions included the following points:

- this task should be divided into topics, each of which may be a separate entity,
- in addition to communication taking place electronically, it is required to make meeting with work group leaders, mainly at the conceptual process stage,
- system should be complemented providing a tool for an online conversation. Currently only asynchronous information exchange is possible.

It should be also noted that such tasks are not too often carried out within the framework of the project activities realized by students at the technical university. The reason is the delays generated by members of the group influence of delay of the entire collective work. Despite the difficulties the work was well accepted by students participating in the experiment.

It is also noteworthy that at present two further works carried out in the same system have been completed. The main difference compared to the results presented in this paper is that the age of participants was lower and the tasks of the project increased the size of the group. One of the completed projects was implemented in a special work done by students of the seventh semester, while the second task of the project was implemented by students of the ninth and tenth semester. The size of each group involved three students and three lecturers. Both design tasks were completed successfully.

REFERENCES

Dennis, A., 2002. *Systems analysis and design : an object-oriented approach with UML / Alan Dennis, Barbara Haley Wixom, David Tegarden*. John Wiley & Sons, New York

Larman, C., 2002. *Applying UML and patterns: an introduction to object-oriented analysis and design and the unified process.*, Prentice Hall PTR, Upper Saddle River

Iqbal, R.; James, A.; Gatward, R., 2003, *A collaborative platform for heterogeneous CSCW systems: case study of academic applications* Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications, 2003. Proceedings of the Second IEEE International Workshop on, vol., no., pp.462-467, 8-10 Sept. 2003

Twidale, M.B., Nichols, D.M., 1998 *A Survey of Applications of CSCW for Digital Libraries* Technical Report - CSEG/4/98, Computing Department, Lancaster University

Neto R.B, Jardim C., Camacho-Guerrero J., da Graca Pimentel M., 2004 *A Web Service Approach for Providing Context Information to CSCW Applications*, Proceedings of the WebMedia & LA-Web 2004 Joint Conference 10th Brazilian Symposium on Multimedia and the Web 2nd Latin American Web Congress, p.46-53, October 12-15, 2004