МІНІСТЕРСТВО ОСВІТИ І НАУКИ, МОЛОДІ ТА СПОРТУ УКРАЇНИ

ДОНЕЦЬКИЙ НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ

КАФЕДРА АНГЛІЙСЬКОЇ МОВИ

Young scientists' researches and achievements in science

Матеріали

науково-технічної конференції для молодих вчених

19 квітня 2012 року

Донецьк

ДонНТУ, 2012

Young scientists' researches and achievements in science: Матеріали міжвузівської науково-технічної конференції для молодих вчених. М.Донецьк, 19 квітня 2012 року / Відп. за вип. О.М. Кушніренко. – Донецьк: ДонНТУ, 2012 – 106с.

Збірник містить тези доповідей студентів, магістрів, аспірантів, пошукувачів Донецького Національного Технічного Університету та інших учбових закладів України.

CONTENTS

Anastasova E.A.
Computer Science and Technologies Department
Donetsk National Technical University
Donetsk

FRACTAL COMPRESSION ALGORITHMS IN CONTEXT OF MEDICAL IMAGES PROCESSION

The topicality of medical images' procession was covered. There was considered one of the most essential problems of telemedicine furthering, development and applying – storage and transmission of graphics. Possible methods of images' procession were discussed. The modifications of compression algorithm, that provided high compression efficiency of information and quite small decompression error values, were analyzed.

Images are widely used in different fields both in casual life either in narrow terms of science. Medical images are almost all grayscale ones. It is necessary to notice that only the part of whole image is worth analyzing. There is a need for huge volumes of memory to store and qualitative process the high quality images. As a result some difficulties of real-time processing occur. According to medical images some characteristics of the algorithm can be named: compress ratio is high, compress time vary, but decompress one seeks to minimize, output error is minimal.

The object of the paper is analysis of exists treatments and methods those provides quite low error after decompress to allow next assay, high compress ratio, short time for decompression.

It is necessary to discuss the milestones of basic fractal algorithm. It implies a partition of origin image on domains and ranks. After this step domains are sorted out for each rank (the domain is compressed in each orientation to the size of rank and the best values of coefficients of process using the method of least squares.

Due to process and usage specificity of medical images the rule "once to compress and ofttimes decompress" can be named. In this connection the method offered by Vatolin is fully applicable [1]. The author supposes to allocate significant areas of an image, to use different compression ratio depending on characteristics of image's parts. The half automatic systems are used to choose the areas. A domain is

концентрации газовых компонент и пыли в рудничной атмосфере угольных шахт / А.В. Вовна, А.А. Зори, В.Д. Коренев, М.Г. Хламов. – Донецк: ГВУЗ «ДонНТУ», 2012. – 260 с.

2. Приборы шахтные газоаналитические. Общие требования, методы испытания: ДСТУ ГОСТ 24032:2009. – [Действующий от 2009-02-01]. – К.: Держспоживстандарт, 2009. – 24 с.

3. Пат. 91795 С2. Україна, МПК G 01 N 21/35. Спосіб вимірювання концентрації метану в рудниковій атмосфері / О.В. Вовна, А.А. Зорі, В.Д. Коренєв, М.Г. Хламов; Державний вищий навчальний заклад «Донецькій національний технічний університет» (Україна). – № а200906379; заявл. 19.06.2009; опубл. Бюл. № 8 від 25.08.2010.

4. Пат. 92564 С2. Україна, МПК G 01 N 21/35. Пристрій для вимірювання концентрації метану в рудничній атмосфері / О.В. Вовна, А.А. Зорі, В.Д. Коренєв, М.Г. Хламов; Державний вищий навчальний заклад «Донецькій національний технічний університет» (Україна). – № а200909360; заявл. 11.09.2009; опубл. Бюл. № 21 від 10.11.2010.

Zolotukhina O.
Institute of Informatics and Artificial Intelligence
Donetsk National Technical University
Donetsk

DESIGN FEATURES OF VIRTUAL LABORATORIES

INTRODUCTION

The computer information technology is widely used in the modern educational processes. The systems that allow to organize a workshop on the subjects hold a special place in this segment. The Virtual Laboratory can be viewed as a means to ensure modeling processes, objects and phenomena, considered in practical and laboratory studies [1-4].

In most scientific and engineering disciplines conventional laboratory partly or completely can be replaced by their virtual counterparts. In this case, the realism of

the processes is achieved by the use of graphic interface, whose main components are models of real objects. The main emphasis in the design of virtual laboratories is usually made on trying to make it look like a real laboratory. The examples of such laboratories can be a Universal Virtual Laboratory (UVL, a realistic, real-time, electrical engineering virtual laboratory) [5], a virtual chemistry laboratory for school children (a tool for conducting virtual chemistry experiments, solving problems and verifying learning material) [6] and many others. They also have been attempts to generalize the characteristics of virtual laboratories and create the ontology for a general virtual laboratory for further use of research results in the design and development of new virtual labs, and their integration into existing learning environments such as Moodle [7].

Most of the existing virtual laboratories are widely varied both in structure and in the methods of interaction with the user. In view of the heterogeneity and complexity of content and the logical links between elements of the virtual laboratory it can be classified into classes of complex systems. The problems that arise in the development of specific virtual laboratories, as a rule, reflect the complexity of the classic software development in general. Specialists of software development are not experts in the object domain for which virtual laboratory are developing. In turn, domain experts may have difficulty in the system requirements formulation. Insufficient attention to the stage of system design, mismatch of goals and objectives of users can lead to cost overruns, delaying deadlines and even complete failure of the project [8].

This paper analyzes the impact of the methods of representing, storing, transmitting and processing virtual lab data and architecture of the project to complexity of the system. The proposed data classification (such as direct content and results of educational activity) allows to estimate the complexity of the project in general, and the choice of the appropriate architecture is to specify the time and cost estimates.

1. THE CONTENT OF A VIRTUAL LABORATORY

The content of virtual laboratories strongly depends not only from the domain of the laboratory to be developed, but also from the methods and methodologies of educational process that uses concrete teacher.

According to the method of presentation the content of virtual laboratory can be divided into text, graphics and multimedia objects (video, animation, etc.). In terms of this classification, the developer must define the formats and technologies of data with regard to the manner of their display (file types, database structure). Replacement of one way of presenting to another must be strictly regulated because it can lead to additional costs including the expansion of the development team, for example, the replacement of textual information to a multimedia presentation requires the involvement of painters, animators, etc.

According to the degree of variability the content elements can be divided into the following groups:

– static elements: the appearance of these elements does not change, no matter which actions the user performed (for example, tooltip text, scheme of the experiment, the demo video or animation, the image of the object, etc.);

– dynamic elements: the appearance of these elements can change, depending on what actions the user performed in the system (for example, the image of the liquid level in the container, the state of the switch, etc.).

The use of static rather than dynamic elements can sometimes significantly reduce the time and cost of development. However, sometimes this approach can lead to the need for a separate screen layouts for each page of the system. Therefore, the virtual laboratories with complex scenarios appropriate to share the page layouts into independent layers containing elements of various kinds. This separation will allow further improvement of the system by transforming static layers to dynamic without modifying the existing layers.

According to the method of forming the content elements can be divided into the following groups:

– elements that are selected from a database (e.g., base of tasks variants, the

base images, etc.);

– elements, that are generated in accordance with some regularity or model (e.g., the raw data of the task generated by a some formal grammar or numerical series generated by a some distribution law, the object or process, generated on its mathematical model).

The database elements preferably use in two cases. The first is where the objects are too difficult or impossible to generate automatically (for example, there is no pattern generation). The second is when the cost of creating a database of elements less than the software development for generating elements. However, automatic or automated generation of the elements is the part of the program code (usually, a built-in algorithms), so changing the method of forming an element entails the project modernization.

2. THE DATA OF USERS' ACTIVITY RESULTS

Users of the virtual laboratory are students, teachers and system administrators. Items of lab system administration and exchange with the system data to necessary for the educational process (setting parameters, modes, etc.), are outside the scope of this paper, because it strongly depends on the system specific implementation. Data streams that are of interest, primarily associated with data exchange between teacher and students as a teacher must have access to the results of student's activities.

Virtual Lab can act as a mediator and can process the students' study results automatically. At the same time the teacher gets the final data results and should not further check the solution of any tasks.

Another option involves the partial or complete handling the data of activity by the teacher. The functions of the system are reduced to logging activities of the students, and organizing such a buffer for data exchange between a teacher and a student.

3. ARCHITECTURE OF A VIRTUAL LABORATORY

Virtual labs can have different architectures. The main elements that influence the choice of architecture are: an object of study, technology to access to the object and methods of control (processing) of learning outcomes (Fig. 1).

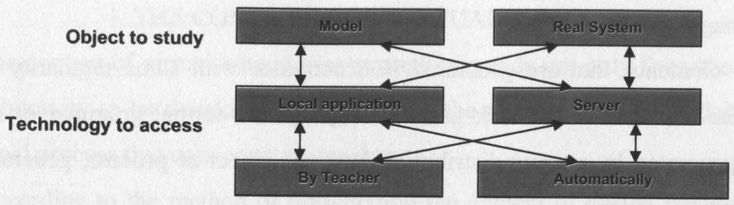

Fig.1 – Elements of virtual laboratory architecture

As the object of study it can be a real system (a system can be interpreted as a device, mechanism, etc., as well as some objects to study their behavior or properties).

Real systems can be partly or completely replaced by the virtual models. On the one hand, it can significantly reduce the costs of the real lab and increase the number of lab users by creating individual virtual working places. On the other hand, the development of the virtual models can be quite a difficult process that can lead to a rise in the cost of the project, and to increase the development time of the system as a whole.

The advantages of using real models:

– laboratory users can explore objects/processes "live";

– you can use an existing lab fund.

The shortcomings of using real models:

– difficult to integrate real devices/system/objects in a virtual laboratory environment;

– high cost of experimentation;

– high cost of experimental errors, including errors, that lead to the human victims (e.g., chemical experiments, surgery, etc.);

– difficult to organize simultaneous access of all students to the equipment or objects of studies (for each student during the laboratory training should be organized individual workplace);

– difficult and/or uncomfortable to change the parameters of objects/processes;

– in some cases, there are limited opportunities to repeat the experiment (e.g.,

repeat the chemical experiment).

The implementation of the system as a local application or by using network technologies largely depends on the educational process method in a particular school. Often, virtual lab is developed in several versions (network and boxed), which allows to cover the different user audiences.

The method of processing the results of training depends on the data generated by students in the learning process. Most of the results of training activities can be processed automatically, without a significant complication of the system functionality. However, if treatment is a complicated process, which relates to artificial intelligence (e.g., semantic analysis of text) then the developers need to exclude the monitoring validation of the tasks from the system functions.

The reduced classification can be used for a rough estimate of the cost, timing and risks of the project. Analysis of the content and methods of presenting the results of learning activities allow the project manager not only to assess the amount of work, but also to determine the composition of the team to substantiate the involvement of various specialists. Regarding the choice of system architecture, the complete "virtualization" of the system is not always realizable, also sometimes impractical. In choosing some architecture, the developer must conduct a comprehensive analysis of the factors that can affect the characteristics of the project, and choose the option, that allows the user to realize maximum goals in the current version.

References:

1. Ефимова О. В. Виртуальные лаборатории. Проектирование. Внедрение / Ефимова О. В. – М.: Вершина, 2004. – 359 с.

2. Носов Н. П. Образование и виртуальная реальность / Носов Н. П. – М.: Сатурн, 2006. – 456 с.

3. Хуторской А. В. О виртуальном образовании / Хуторской А. В. – К.: Логос, 2008. – 25 с.

4. Cecilia Chan. Wilton Fok. Engineering Education: Journal of the Higher

Education Academy Engineering Subject Centre, Vol 4, No 2 (2009)

5. Duarte, M.; Butz, B.P.; Miller, S.M.; Mahalingam, A., "An Intelligent Universal Virtual Laboratory (UVL)", Education, IEEE Transactions on, vol.51, no.1, pp.2-9, Feb. 2008.

6. Пчелин М. Виртуальная химическая лаборатория / М. Пчелин // Мир ПК. – 2005. – N 9. – С. 130-131.

7. Prieto-Blazquez, J.; Garcia-Tora, I.; Herrera-Joancomarti, J.; Guerrero-Roldan, A.-E., "Virtual Laboratory ontology for engineering education", Frontiers in Education Conference, 2008. FIE 2008. 38th Annual, vol., no., pp.S2F-1-S2F-6, 22-25 Oct. 2008.

8. Леффингуэлл Д. Принципы работы с требованиями к программному обеспечению. Унифицированный подход/ Д.Леффингуэлл, Д.Уидриг – М.: "Вильямс", 2002. – 448 с.