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E-ENGINEERING: A PROJECT FOR MECHANICAL CONSTRUCTIONS DESIGN OVER INTERNET

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ABSTRACT

A project of independent information resource for mechanical constructions producers and users is examined. The project include following modules: (i) a web site - it is used for receiving user requests and for returning base parameters of finishing solution, a full documentation of the solution is sent by e-mail, (ii) a design module what is used for automated design, (iii) an administrative module – it controls user requests and (iv) databases – for mechanical constructions, for mechanical construction producers, for clients and for client requests The main purpose of the project is to specify: information that has to be included in the web site, information that has to be required from the user, programming language of the system, exactly which mechanical constructions has to be included in the design module and their parameters, and data bases organization. This project is the first stage of developing of the E-engineering – a machine elements distance design.

INTRODUCTION

With Internet help it began possible to be developed the projects in which to take part designers and engineers from all over the world. In this way an open development has realized. Everyone can take part and develop a dial from one joint project, Amor D. (2000).

The main purpose of the current project is to build up a system for machine element design over Internet. Because of huge variety of different kinds of such elements we at first concentrate on reduction gears. On the other hand the high difficulty of the task for automation of the design process and its dependence from local factory standards, used particular machines and materials for designed element producing make us for now to take care of the task only for choosing certain type of reduction gear according to the user request. After development of a first system version the kinds of machine elements and the design process range eventually will be expanded

The problems, which have to be solved, are:

- Modules and databases from which the system will consist of;
- Kinds and parameters of reduction gears and their possible producers;
- Method of user request setting;
- Appearances of the result and ways for receiving it by the user;
- Control of the users and the implementation stages of their requests;

SYSTEM ARCHITECTURE

The system will be based on the standard Internet service - World Wide Web. It will be implemented to certain Web site, and its users, administrator and assistant designer will connect to it with Web browser. The system will be developed mainly by PHP language that is becoming more and more popular, is supported by most of the Web servers and permits easy work with databases. The system will consist of following parts as shown on Figure 1:

Web site. It serves as a main instrument for connection of the users, administrator and assistant designer with the system. It includes static and generated by the system Web pages that is used by the users to set their requests, to communicate with the assistant designer and to receive the results. The administrator also uses the site to control the system and the stages of the user requests, and the assistant designer uses it to help for task solving.

Design module. It will be developed mainly by PHP. Eventually its parts could be developed by C++, if it becomes necessary any more difficult processing. As well it is possible to become necessary linking this module to a CAD system, may be Mechanical Desktop. The module will communicate by the Web site mainly with the users and the assistant designer. After receiving a user request it will do a choice for corresponding reduction gear, will compute its base parameters, will generate schemes of the gear and recommendations for its preparation and will choose eventual producers. If in the design period any difficulties arise, the module will connect by e-mail to the assistant designer.

Administrative module. It also will be developed by PHP. Its main function is to control the system by the administrator. This module makes user and request registration. It will control payments and request stages. The module communicates only with the administrator trough the Web site.

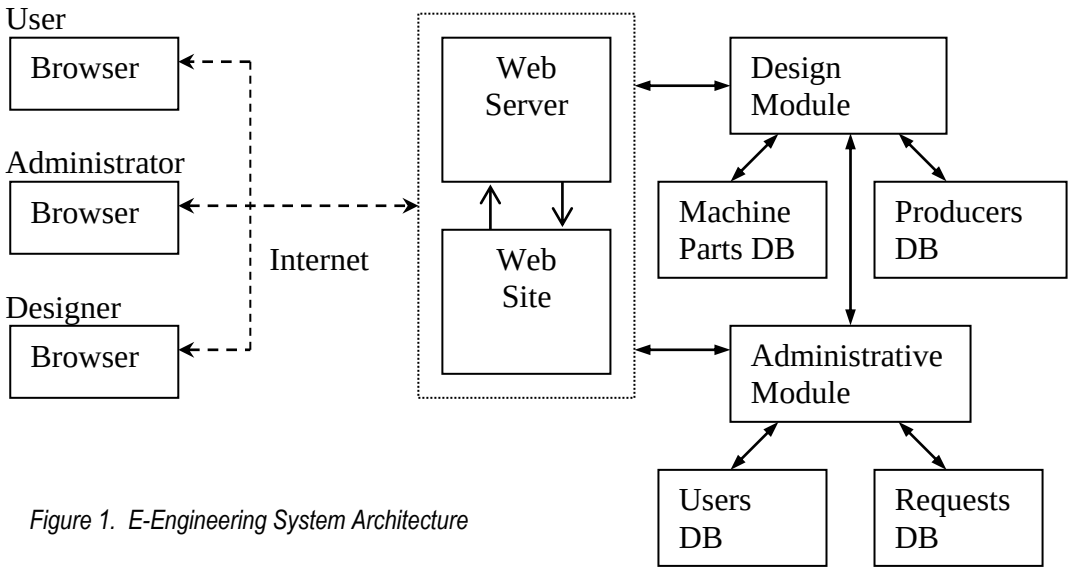

Figure 1. E-Engineering System Architecture

Databases. There will be following bases in the system:
- for mechanical constructions – for every reduction gear will contain: component parts and their parameters, schemes, recommendations for preparing. It is supported and updated by the assistant designer trough the Web site.
- for producers. It will contain address, phone numbers, **nomenclature**, prices. The base is supported and updated by the assistant designer trough the Web site.
- for users. It contains user information, request number, payment. The base is updated automatically by the administrative module and is supported by the administrator.
- for requests. For every task it contain number, description, implementation stage, problems. The base is updated automatically by the administrative module and is supported by the administrator.

The system will be supported, controlled and updated by:
Administrator His task is supporting the overall functioning of the system. In addition he cares for the implementation of the user requests and their payment.
Assistant designer. He controls and gives assistance for the technical solution of user requests, updates the database for producers and expands the system by including new mechanical elements and design process extending

PROCESSING OF THE REQUESTS

To set a request the user of the system has to register. This includes him into the database for users. While registering he has to enter certain amount of personal data. A problem arises here for incorrect users who do not wait finishing their requests or do not pay.

In that stage he will determine a method of payment and result delivery. Five different methods are possible in Bulgaria for now:

- in the firm office – the user has to go there;
- delivery by an express service –payment by the courier;
- delivery by a postal package - the user has to go to the post office and pays by cash on delivery;
- e-delivery trough Internet – payment by bank transfer;
- e-delivery trough Internet – by the Bulgarian e-payment system "e-Pay".

After registration the client has to enter his request parameters. After receiving a request from the system it is included into the corresponding database. The system sends e-mail to the administrator and starts to process the request by its design module. During processing it is possible to send to the user some additional questions. If the system meets any difficulties, it generates a message by e-mail to the assistant designer.

He on his turn can also to send questions to the user and to make own decision what to do with the request.

After the request has been finished, the system sends a message to the administrator to initialize the process of payment and result delivery.

The communication with the user will be done mainly trough the Web site. Complete history of the request will by saved in the database for requests. The result can be sending on paper, disk or by e-mail as the user likes.

MODIFICATIONS AND PARAMETERS OF REDUCTION GEAR

While the dialog is running the user is necessary to specify the following parameters, MECD (1972):

- Relatively lay of the shafts
- Magnitude of the transmission power
- Torque
- Desired efficiency
- Transmission ratio
- Speed of rotation
- Restriction at the rate
- Restriction at the mass

To specify reducer technicalities some possibility solutions have to be shown to the client:

- Cylindrical reducer
  - Planetary gear
  - Spur gear
- Bevel gear
- Worm Gear

- Mixture
  - Bevel +Worm
  - Worm+ Bevel
  - Worm+ Cylindrical

He has to make more precise following parameters:

- Number of gear transmission
  - Single-step gear
  - Double-step gear
  - Triple-step gear
  - Four-step gear
- Relatively lay of the shafts
  - Parallel
  - Coaxially
  - Intersect axes
  - Lay crosswise axes
  - Horizontally axes
  - Vertically axes
    - Come out upwards
    - Come out downwards
    - Come in upwards come out downwards
    - Come out upwards come in downwards
  - Horizontally come out and vertically come in
    - Come out upwards
    - Come out downwards
  - Vertically come out and horizontally come in
    - Come out upwards
    - Come out downwards
- One-sided layer
- One come in and two come out

- Worm gear
  - Upper worm
  - Lower worm
  - Lateral worm
  - Horizontal shaft
  - Vertical come in shaft
  - Vertical come out shaft

The assistant designer has to consider with some standards:

- Standard for center-line distance 7466—69
- Standard for transition number 7553-69
- Standard for number of gear
- Standard for coefficient for gear length
- Standard for gear declination angle
- Standard for worm size and worm gear
- Standard for gear reducer height 7155-68
- Standard for gear precision
- Standard for lateral gap and association 3296-72, 3535-71

So received requirements is used to search the database for standard reducers. Closest standard design in example form shown on the figures 2, 3 and 4 will be sending to the client for approval.

CONCLUSIONS

The proposed in this article project for e-engineering is only the first approximation to development a real system. The purpose is to be outlined main ideas, solution approaches and difficulties.

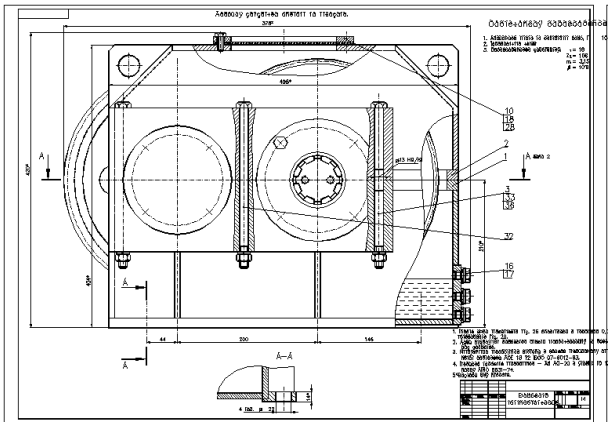

Figure.2 Cylindrical reduction gear (I projection)

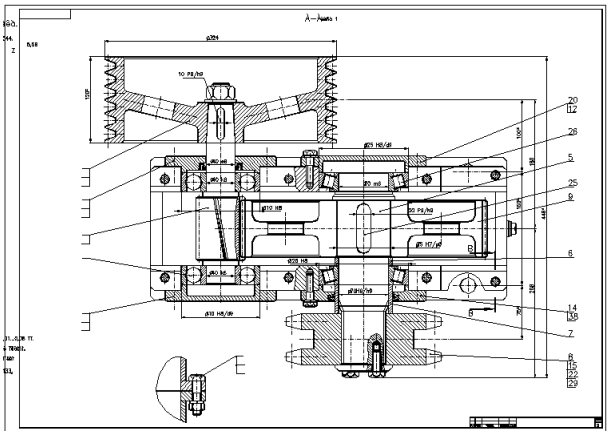

Figure.3 Cylindrical reduction gear (II projection)

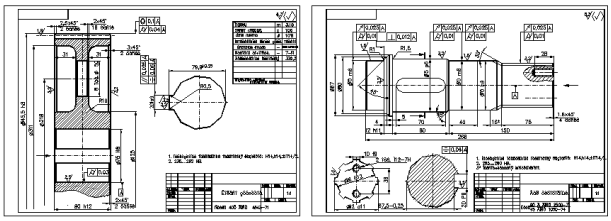

Figure.4 Typical cylindrical reduction gear parts

The main problem behind building a helpful and efficient system is automated design implementation (the design module in our model). A full realization of this task as we mentioned in the introduction is almost impossible. The task is too large and difficult and would require a large team and great financial support. For that reason we have chosen the approach of step-by-step growth.

The existing widespread CAD systems do not offer Web interface and are difficult for distant control, but we think that it is not impossible.

Another direction for development of the system is its transformation to high competent mediator between the users of mechanical constructions and their producers. Thus it will cover entire process from determination of wonted construction, finding the producer, to its production and delivery.

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