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CALCULATION METHOD OF OPTIMAL INFORMATION PROCESSING WAY

This article discusses a optimizing method of information processing way in an enterprise during its processing. Various by their properties sources forming information flows are considered. The enterprise resources use efficiency coefficient was introduced to calculations.

Keywords: information, processing path, the human factor, resources, systems approach.

Introduction

Most companies are facing to the organization problem of most efficient processing ways of information flows. However, the most acutely aware of this problem those whose production is associated with risk to life or health or environmental risks. Practice shows that all major incidents that have occurred at such facilities, in one way or another connected with the problems in the organization of information exchange between participants of the production and business processes [1,2]. Much attention is paid in the last ten years to the questions of information processing optimizing ways and information motion optimizing. The article volumes does not permit to show the complete literary sources analysis, but even in recent publications [3-6], the authors, either considering ways machining on the conveyor, or investigate the problem of enterprise software optimization. The authors did not review the information as a product that is made on a par with the main products. It is not mentioned that matter how optimally chosen way of moving information from its source to its decision depends, at least security, which is an indicator of the quality of these enterprises, such as nuclear power plants. The accuracy of existing models largely reduced due to neglect of the principle of emergence, that is, as parts of information processing are considered, either only personnel or only software. Also not taken into account the efficiency of information system resource use .

The purpose of the work

Develop a method to calculate the optimal information motion way within the enterprise, which manufacturing processes may have a significant impact on the lives and health of employees. Besides, information comes from different sources in nature (people, paper media, electronic media) and the information system resources use efficiency is accounted. Thus, the systematical evaluation process of information processing quality is implemented.

Optimization criteria are processing time and accuracy of the information. Thus, under accuracy we mean matching the received message transmitted[7].

Main

The enterprise information system receives in the input diverse in structure and way of presenting information. If each category represented as a separate project, the projects can be divided into groups of similar data, for which there are many similar processing orders K, where k_p^z processing order of similar data of z-selection $k_p^z \in K$, and z - similar data set number $z = \overline{1,n}$. I - the entire data set, n - the data set's amount, n^z - the amount of elements in the set of similar data.

The information system outputs represent the result of preselected processing order applying to the information, which was received at the inputs of the system. Thus, the outputs may be represented by combination

$$Y = < I, K >, \tag{1}$$

where Y - set of information system outputs.

On the other side, the information system outputs can be represented as

$$Y = M_{in} \cup M_{out} \tag{2}$$

where M_{in} - the set of internal information system outputs, $m_{in}^j \in M_{in}$ a set element, which is the result of the input data processing used by the company for their own purposes. An example of such a result may be the processing of statistical data on purchases of enterprise. The results of processing are then used for internal departments of the enterprise.

M_{out} -the set of external information system outputs, $m_{out}^c \in M_{out}$ a set element, which is the result of the input data processing used by the company for their external goals. For example, the response to the customer request about the products' technical characteristics.

Ideally, the expression (1) must be equal to the expression (2). In other words, the company must exist a number of input information processing orders, so that at any time you could get an answer to any question, i.e., to form any output of the information system desired at this point of time. However, this strategy does not account:

- the nterprise resource and constraints that are imposed on them for various reasons;

- the information processing structure;
- the recourse use efficiency criteria;
- failure situations.

B - the set of information system resources, needed to implement all the processing orders from K set. t_{ob} - time, needed for information processing; t_{pr} - time needed to come from one processing order to another; A - hardware and software needed to collect, store and transmit the information. All of these are resources.

Let, structure of the studied system be hierarchical. In the other words, each element $k_p^z \in K$ is a set of plots l_k, on which a phased sequential processing of similar data is held. The processing time t_{ob} consists of separate sequentially arranged time intervals $t_{ob} = \sum_1^l t_{ob}^l$, so that $t_{ob}^l > t_{ob}^{l-1}$. Thus, the information is processed sequentially, moving from one stage of the conveyor (the established processing order) to another. The total processing time t_{ob} can not exceed the total processing time t_l on all of the plots l_k, which is determined by the technological characteristics of the equipment used (speed, the communication channel bandwidth, data rate, etc.). The author does not preclude consideration of parallel processing parts of the same message, if it is not contrary to common sense and technologically possible. However, the plots will be placed one after the other. For example, one the and same document can simultaneously examined by the lawyer and economic services, but it only happens after the director will send the document to both units.

Set A of hardware and software can be called conveyor processing the input information. The processing order is determined by the conveyor structure. P - set of processing programs. Under processing program we mean a certain sequence of actions. Type processing program depends on the data type, which is designed to handle by this program. $p_o \in P$ - element of the set consisting of a series of acts of network and computer equipment, computer programs and people, aimed at processing the information system input data and transform them into system outputs. Each lpot l_k, at which the processing of similar data is held corresponds to a certain section p_o^l of processing program p_o. Relations between p_o^l and l_k is determined by the incidence matrix D, which is a diagonal unit matrix. The element of the matrix d_{pl} =1, because each section of processing program p_o^l assigned to ins own plot l_k of a determined similar data set processing order k_p^z. Essentially a set of data and a set of programs make the job to be processed software and hardware on according to a predetermined processing order.

Software and hardware as a resource limited by technical and economic feasibility and biological features of the people involved in this process.

t_{pr} - time needed to switch from one processing order k_p^z to another k_p^y. If $z = y$, then t_{pr}=0, so the switch is not needed. The switch time is limited to a total time that was allotted for information processing, features of the technological process and economic requirements (this time is not productive).

Thus, t_{tot} - totlal processing time of the information which comes to the information system input, consists of two components t_{ob} and t_{pr}. If a switch from one processing order to another is not needed, than $t_{tot} = t_{ob}$.

Common resource of a system can be represented as (3)

$$B_{ud} = \left\{ b_{ud}^g \middle| g = \overline{1,q} \right\}, \tag{3}$$

where b_{ud}^g - resource of one hardware or software element; q - amount of complex' elements.

Resources subject to certain restrictions. Such restrictions caused by technical, physical or economic reasons. Let R_e set of restrictions, which are subjected to resources of information system. Then

$$R_e = \left\{ r_e^b \middle| b = \overline{1,s} \right\}, \tag{4}$$

where r_e^b - restriction subjected to resource; s - amount of restrictions.

Set resources available for use by the information system during the conversion of the input data into output information is the result of direct Cartesian product of sets of expressions (3) and (4)

$$B_{ud}^a = B_{ud} \times R_e = \left\{ (b_{ud}^g ; r_e^b) \middle| b_{ud}^g \in B_{ud} \wedge r_e^b \in R_e \right\} \tag{5}$$

Thus for each pair of elements obtained as a result of expression (5), implemented attitude $(r_e^{b1}; r_e^{b2}) = \left\{ b_{ud}^g \middle| r_e^{b1} \le b_{ud}^g \le r_e^{b2} \right\}$, i.e. for each set of resource constraints, not only names of restrictions but also the specific values of their borders.

Data is input to the system, where sorted and combined into groups similar data. Then for each group is set the schedule for processing these groups by separate programs p_o. The data sets are continuously fed to the conveyor and depending on various circumstances, arranged in a certain manner for processing. Order for the formation of such queues responsible schedule. The number of such schedules is set Tm_o. However, the execution of schedules depends on the resources possessed by the information system and the restrictions subjected to these resources. In other words, in order to obtain a set of schedules that can actually be implemented in terms of the information system, we need to compare among themselves the elements of the sets Tm_o and B^a_{ud} and form a new set $Tm_{or} \subset Tm_o$. The basis for placing elements in the new set is the availability of resources for the implementation of such a schedule.

In the subsequent discussion we will consider that, on the one hand, the resource information system has some restrictions, and on the other, the resources themselves restrict the processes occurring in this system.

$$< I, K, B^a_{ud} >= M_{in} \cup M_{out} \quad (6)$$

Thus, in the calculation of enterprise resources and entered information processing structure. In the model introduced resources that allowed her to transform from static to dynamic, as the process of transforming information is considered for a period of time t_{tot}.

In the next step we introduce the model of the resource use efficiency in the process of transformation of inputs into its information system outputs. Then between the sets B^a_{ud} and K should be implemented following relationship

$$H = \left\{ b^a_{udz} \in B^a_{ud}, k^z_p \in K \middle| \, b^a_{udz} / k^z_p \leq 1 \right\}, \quad (7)$$

where b^a_{udz} - resources, resources, needed by the information system to proces i_j pet of similar data on a l_i plot of k^z_p data processing order.

Considering (7) expression (6) takes the following form

$$< I, H >= M_{in} \cup M_{out} \quad (8)$$

Conclusions

1. Expression (8) is a mathematical model, the physical meaning of which is that with the right balanced resources and optimally selected information processing order, system is able to generate from the information received at the input required at a given time element of the outputs' set.

2. As total time t_{tot} is a part of the resources, the model is dynamic, ie describing the time-evolving information processing Dynamics of the process is due to deviations from the specified processing orders K, which may be caused by failures of the hardware-software complex, including human-caused.

3. Reliability of the information provided at the output by selecting adequate procedures for its treatment of a variety of possible orders K.
4. In further studies, the author transformed the expression (8) in the transport task and optimized the information flow way on the time parameter.

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