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Conceptual Principles of Building Automatically Information System in the Field of Healthcare

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Abstract— In the article are given the modern medical institutions produce and accumulate huge amounts of data. The quality of medical care, the general standard of living of the population, the level of development of the country as a whole depend on how competently and effectively these data are used by medical professionals. The purpose of the article is to study the features of the process of creating an information system, creating a software module, as well as their implementation in a medical and preventive institution. In the course of the work, information is provided on the theory of building medical information systems and on the practical application of this knowledge. In particular, the following issues are considered: ensuring the operation of the information system; organization of staff interaction with the information system and the "Medical examination" module.

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1. Introduction

Modern medical institutions produce and accumulate huge amounts of data. The quality of medical care, the general standard of living of the population, the level of development of the country as a whole depend on how competently and effectively these data are used by medical professionals.

There is a need to use large amounts of information in solving medical problems (diagnostic, therapeutic, statistical, managerial and others). Currently, this leads to the creation of medical information systems in medical and preventive institutions.

At the moment, medical organizations need "automation of production", i.e. automation of certain processes related to the vital activity of a particular organization or organizations as a whole (also the relationship between two or more organizations). The concept of "automation" includes such aspects of the daily life of the hospital as:

1. Automation of hospital data accounting;
2. Automation of the accounting of hospital vouchers;
3. Automation of accounting for outpatient patient coupons (TAP);
4. Automation and timely amendments to statistical data on the total number of patients, on the number of patients with a certain degree of disability, etc.;
5. Automation "patient-doctor" - recognition and correction of the diagnosis at the earliest stage, when the patient only turns to the doctor for help.

So, here are five points that the program-project we are creating should solve. A hospital institution, in principle, is a place where any information plays a very important role, where schedules at the doors of receiving doctors change every day, where new lists of patients and, most importantly, diseases appear every day (this process, unfortunately, does not stand still).

It becomes obvious that the health of absolutely every citizen will depend on the effectiveness of the introduction of medical information technologies in medicine.

Many domestic medical and preventive institutions actively resort to the services of medical information systems in their activities. The latter are an integral, universal software product that allows to manage the activities of a medical institution and provide medical services at a qualitatively new level.

The peculiarity of medical information systems is the transition from local work with medical information to an integrated system, where all data passing through the institution is accessible from a single information environment.

The use of modern medical technologies makes it possible to improve the quality of medical services, optimize the management of various structural medical units and create the basis for reaching the modern level of medical care

The era of paperwork in medical and preventive institutions is being replaced by the time of information systems aimed at both maintaining individual functions and solving the management tasks of the entire medical institution.

The purpose of this article is to automate the activities of a medical institution during medical examination, in particular, the creation of an information system with the appropriate module "Medical examination".

2. Methodology

1. The principle of a systematic approach. It is dominant when creating systems. The system approach is a modern tool of organizational and integration activities for the research / construction of complex, structured systems in medicine, based on the complexity, breadth of coverage, a clear organization of research focused on achieving the final goals.

The system approach includes system research, some aspects of which are reflected in system analysis and system synthesis. The methodology of the system approach allows us to holistically pose the problem and formulate the ultimate goal of creating AIS in specific medical applications and, based on a comparative analysis of alternatives, to develop an effective strategy for its construction. At the same time, the whole complex of interrelated issues is identified in all key aspects (medical, technological, economic, organizational, etc.) of the implementation and implementation of AIS and its functional and supporting subsystems[5,6].

2. The principle of purposefulness. Purposefulness is the presence of a final specific goal (including several intermediate goals) that must be achieved in the process of preparing and making decisions when creating an AIS. The goal is understood as an information image of the target state of the AIS, determined by the desired/specified state of its outputs. The goal determines the purpose of the system, the meaning of its functioning. The formulated goal expresses the point of view of what the AIS is created for, what it should do and what its effectiveness is.

Goals should not have abstract formulations, they should be set very clearly and unambiguously with the specification of the final result and the time of its achievement, stipulate only the requirements for AIS, without going into details and details. In general, each specific goal should be clearly defined in terms of the following features:

- substantive: it should be completely clear with which aspects (medical, economic, social, etc.) of the AIS functioning the goal is connected;
- temporary: is the goal strategic (permanent, long-term) or tactical (current, operational);
- spatial: it is necessary to indicate the sphere of activity of the informatization object (republic, region, region, district, health organization) with which this goal is associated.

The goals are classified according to the following criteria:

- in relation to the goals of the medical facility of informatization and AIS, they are divided into external (established by higher authorities) and internal (characterize the functioning and development of a specific system);
- according to the degree of coverage of informatization functions in AIS, they are divided into global (include the entire large-scale system) and local (include one or more private subsystems);
- according to the period of implementation in the AIS, they are divided into strategic (with an approximately defined long implementation period) and tactical (with a set directive deadline for achievement).

Goals are achieved by simultaneous or sequential solution of a number of tasks that concretize this objective function, linking it with certain ways and means of achievement. A task is understood as a set of initial conditions and a certain goal, and its solution reflects the content of the AIS functioning processes. In a narrow sense, the task defines the computational process of finding quantitative values of indicators characterizing a medical informatization object.

3. The principle of evaluating the achievement of the goal. From the target installation of AIS, the criterion of the effectiveness of its functioning follows - the main feature of the system, according to which one construction option will provide the best necessary result compared to others with the least expenditure of energy, resources, time, etc. There are two main types of performance criteria for systems:

- criterion of the first kind, characterizing the degree of achievement of the AIS of the set goal;
- criterion of the second kind that characterizes in some given sense the path (trajectory) of achieving a given goal. At the same time, the most rational achievement of the goal is ensured when the AIS moves towards it along the best trajectory.

Complex medical systems are characterized by a vector (integral) criterion, which includes several privately agreed criteria for evaluating the effectiveness of various aspects (technical, economic, social, etc.) of the AIS functioning, arising from the global criterion of the entire system. The whole set of methods of vector optimization of the functioning of multi-criteria systems can be divided into five groups:

- the allocation of the main criterion and the translation of the remaining partial criteria functions into constraints;
- ranking of particular criteria by importance (priority) and their consistent application;
- determination of the utility function expressed in terms of particular criteria; construction of a generalizing criterion in the form of a convolution of particular criteria;
- organization of human-machine decision-making procedures based on a mathematical model.

Each particular criterion can be characterized by a set of indicators (technical, economic, etc.). This set should provide:

- unity, complexity, interrelation and comparability of individual indicators;
- reliability, accuracy and completeness of accounting for changes in indicators;
- dynamism, the ability to identify and assess the impact of various factors on the medical object of informatization.

4. **The principle of openness.** This principle implies the possibility of interaction with other medical systems, the use of CAPS from any manufacturers, the portability of application software to other software and hardware platforms, the expansion and development of healthcare AIS. The implementation of this principle involves the creation of flexible developing interconnected and interacting systems that provide:

- standardization of data exchange between systems;
- elimination of technical obstacles to the communication of systems;
- increasing the possibility of exchanging medical data between heterogeneous systems without creating interfaces on each side.

Thus, this principle requires continuous flexible development of AIS and its subsystems, ensuring such a system structure that the information base, CAPS and various new functional (medical) subsystems can be upgraded and completed in its structure without significant loss of resources and time delays. Ensuring openness and interfacing with systems of other levels, connecting additional, newly created systems and continuous development of AIS should be implemented due to the consistency, unification and modularity of its construction.

5. The principle of system integration. The application of this principle guarantees a coordinated and coordinated solution to all the tasks of building an effective AIS in the field of healthcare. The integration of AIS is considered from the standpoint of combining and compatibility:

- diverse target and criteria functions of individual subsystems into one system-wide solution;
- functions and tasks in all subject areas of the medical informatization facility;
- functional and organizational structures of the system;
- all functional and supporting subsystems of the hierarchical levels of the system;
- material and information flows of information at the external and internal levels of the functioning of the medical system;
- heterogeneous (user, computer) components and circulating information, psychophysiological characteristics of the user and technical parameters of the CAPS.

In addition, this principle provides for the formation of an integrated database providing a single form of storage, search, protection and display of information, assuming flexibility and adaptive restructuring of the way of software tools for information processing to solve new emerging problems, ensuring completeness, timeliness and optimization of their solutions [11,12].

The principle of system integration provides for the solution of a set of tasks and the provision of medical services to AIS during its life cycle. This complex includes:

analysis of the existing information processing technology, development of a comprehensive project for the creation of AIS, its healthcare infrastructure and related components;

author's support of the project, its completion during the modernization of the system;

comprehensive supply of computing, network, communication and organizational equipment, other medical equipment;

- comprehensive installation and integration of medical AIS, testing and commissioning;
- integration and interfacability with existing CAPS, with existing communication channels and telecommunications;
- creation of organizational and technological infrastructure of medical AIS;

- comprehensive information technology support for the functioning of the system;
- fulfillment of regressive warranty obligations of suppliers of equipment and materials;
- implementation of a system guarantee of compliance of the technical parameters of the system with the requirements during the resource life of its operation.

6. The principle of the first leader. This principle consists in the fact that the manager, deeply understanding the essence and importance of creating an AIS as a whole, as well as its subsystems, reasonably weighs the possibilities of CAPS processing and transmitting information, the timing and quality of system development. He directly delves into and directs a team of development specialists who carry out the modernization of the existing organizational structure of the management of a medical informatization facility into an automated one within the framework and conditions of the AIS functioning.

Along with the employees of the healthcare informatization facility, several groups of specialists of various profiles take part in the creation of AIS, each of which works together on a certain part of the system. The basic group is designers, system engineers. Mathematicians, analysts, programmers, economists, psychologists and other specialists work together with them. In most cases, these specialists start work on the creation of AIS at different times and understand their role in solving a common problem unilaterally, mainly from the point of view of their specialty, and not the general concept of creating a system.

All this creates significant difficulties and leads to psychological barriers between specialists of various profiles. The role of the head consists in the formation, with the help of administrative, economic, legal and operational-technical management methods, of a team of developers who have mastered modern computer technology, economic and mathematical methods and have managed to overcome these psychological barriers.

Taking into account the prospects for the creation of AIS, the multi-stage nature of its construction and development, it is necessary to determine/redistribute the functions and tasks of each group of performers, accurately assess not only the content of the results obtained by them, but also what and in what form is transmitted to other participants in the development of AIS in the field of healthcare.

Discussion of results

The main purpose of the work is: development of a software product for automating the activities of medical specialists during medical examinations in medical institutions, in the form of an IC module; reducing the burden on medical staff, reducing patient service time, printing medical examination records.

At the first stage, an inspection of the automation object and justification of the need to create an IP is carried out, as well as the formation of user requirements for an IP, in which business process models were presented in BPMN notation.

The second stage was the development of a Technical specification for the creation of an IP, which described: the purpose and objectives of the creation of an IP, the characteristics of the automation object, the requirements for the IP, the stages of the creation of an IP.

The third stage, according to the chosen standard, was the creation of a Technical project, which describes the rationale for choosing a development environment for a part of the module being developed, the rationale for choosing a CASE-tool for developing business process models, the rationale for choosing a DBMS, a detailed description of the database[1-2].

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