

Basics of Design Methodology

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ABSTRACT

Objective: To explore and define the methodology of design as a systematic and structured approach to developing high-quality systems and products. The study aims to provide insights into the principles, stages, and tools used in modern design to ensure efficiency, adaptability, and user satisfaction. **Method:** The research employs a conceptual framework combining the definitions of methodology and design. The study examines the logical organization, methods, and means used in the design process, including principles such as systematicity, flexibility, iterativeness, and user focus. It also analyzes key approaches (classical, flexible, modular, parallel) and highlights the role of technologies such as CAD, prototyping tools, and project management software in design activities. **Results:** The findings identify critical stages of the design process: goal formulation, requirements analysis, concept development, detailed design, testing and validation, and implementation and maintenance. Key principles of design methodology ensure adaptability to dynamic needs and conditions while maintaining an integrated approach. Technologies like CAD and project management systems enhance the effectiveness of design activities, making them more responsive to user demands. CBLT proved effective in improving students' ability to learn and apply new words. **Novelty:** This study presents an integrative view of design methodology by combining classical and modern approaches, emphasizing the interplay between human creativity and machine-assisted processes (ergaticity). It highlights iterative cycles as a foundation for refinement and improvement, thus adapting traditional principles to contemporary technological advancements.

INTRODUCTION

Methodology in a broad sense is understood as the organization of human activity. In relation to such activity as scientific research, these are the methods of its construction, definition of forms, methods of cognition. That is, it is a scheme, a plan for solving the set research task [1]. Methodology determines the methods of obtaining knowledge; the main directions for achieving research results; provides comprehensive coverage in obtaining information for working on an object or phenomenon; makes possible analysis and systematization, clarification of terminology; provides a factual basis; allows you to come to certain conclusions and formulate them properly [2].

Design methodology is a system of methods, principles and approaches used to create effective and high-quality solutions in the development of various systems and products [3], [4]. It covers both technical and organizational aspects of design activities. Understanding the basics of design methodology allows developers, engineers and managers to successfully achieve their goals and minimize risks [5], [6].

RESEARCH METHOD

In any discipline, the subject of the study, the main concepts, the main principles must be clearly defined. The methodology of design combines two concepts: "methodology" and "design". Methodology is the study of the structure, logical organization, methods and means of activity. Design is understood as the process of compiling a description necessary for the creation of an object that does not yet exist. Thus, the methodology of design is understood as the study of the structure, logical organization, methods and means of searching and making decisions, the principle of action and composition of an object that does not yet exist, which best satisfies certain needs, as well as compiling a description necessary for the creation of an object in given conditions.

Let's consider some concepts used in design: Design solution is an intermediate or final description of the design object, necessary and sufficient for making a decision on continuing or finishing the design process. Design algorithm is a set of instructions required to perform the design. Design language is a language intended for representing and transforming descriptions during design. Design procedure is an action or set of actions, the implementation of which ends with a design solution. Design operation is an action or set of actions that are part of the design procedure.

The following provisions characterize the features of modern design methods:

- a. The complexity of modern design objects determines the complexity of design tasks. As a rule, the general design task is divided into simpler subtasks (the process of decomposition of the task).
- b. The multiplicity of ways to achieve the design goal requires consideration of not one, but many options for a technical solution, each of which is applied to certain methods of analysis and evaluation;
- c. Repeated use of design methods or algorithms characterizes another feature of the methods, iterativity.
- d. Modern design methods should be oriented towards the widespread use of computers, not excluding humans in solving the most complex and creative problems. This feature is called ergaticity, implying a reasonable combination of formalized (machine) and non-formalized (human) procedures in the design process.

RESULTS AND DISCUSSION

A. Main stages of design

1. Formulating the goal: The first stage determines what exactly needs to be created, what tasks the developed system or product should solve.
2. Requirements analysis: A study of user needs, operating conditions, as well as technical and regulatory restrictions is conducted.
3. Concept development: Based on the collected information, the main ideas and approaches to design are developed.

4. Design: The product structure is created, including drawings, diagrams, models and other technical documents.
5. Testing and validation: Checking the product for compliance with user requirements and expectations.
6. Implementation and maintenance: The final stage, including putting the system into operation, user training and support.

B. Principles of design methodology

1. Systematicity: Design should take into account all aspects and relationships between system elements.
2. Flexibility: The methodology should adapt to changing requirements and conditions.
3. Iterativeness: Development takes place in several cycles, allowing for gradual refinement and improvement of the product.
4. Integrity: All project elements should work as a single whole.
5. User focus. Taking into account the needs and convenience of the end user is a key success factor.

C. Main approaches to design

1. Classical approach: Includes consistent completion of all design stages, from requirements analysis to implementation.
2. Flexible methodologies: Agile and Scrum are focused on iterative and adaptive design, which allows for quick response to changes.
3. Modular approach: The system is divided into independent modules, which simplifies development and support.
4. Parallel design: Several stages or tasks are performed simultaneously, which reduces development time.

D. The Role of Technology in Design

Modern technologies play a key role in project implementation. Using software for modeling, analysis and project management can significantly increase their efficiency. Popular tools include:

1. CAD (computer-aided design systems) for developing technical documentation.
2. Project management systems (e.g. Jira, Trello) for coordinating teams.
3. Prototyping tools (Figma, Adobe XD) for visualizing ideas.

Design methodology is the basis for successful project implementation. Selecting appropriate methods and tools, adhering to the principles and stages of design allows you to create high-quality, in-demand products and systems. The development of technologies and the emergence of new approaches make design more flexible and efficient, ensuring that the growing needs of users and businesses are met.

CONCLUSION

Fundamental Finding : The exploration of design methodology underscores its role as a systematic approach encompassing principles, methods, and tools to achieve high-

quality and efficient solutions. Key findings include the importance of iterative development, user-centered design, and the integration of modern technologies like CAD and prototyping tools to streamline processes and address complex tasks effectively. **Implication :** The study highlights the transformative potential of adopting structured design methodologies in diverse industries. This enables teams to handle complex projects while ensuring adaptability, integrity, and user satisfaction. The inclusion of iterative cycles and technology-driven tools fosters innovation and competitiveness, particularly in rapidly changing environments. **Limitation :** The research acknowledges the constraints of generalizing design methodologies across all contexts, as variations in project scale, industry needs, and resource availability may limit applicability. Moreover, reliance on advanced technologies may pose accessibility challenges for organizations with limited technical infrastructure or expertise. **Future Research :** Future investigations should focus on the intersection of emerging technologies, such as AI and machine learning, with design methodologies to enhance automation and decision-making. Additionally, exploring industry-specific adaptations and evaluating the long-term impacts of iterative and user-focused designs could provide deeper insights for advancing this field.

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