ENGINEERING DESIGN PROCESS INVOLVED IN PRODUCTION

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Abstract

The design process is a structured and iterative approach that creative professionals employ to conceive, develop, and refine ideas into tangible solutions. It encompasses a sequence of stages, including recognition of need, problem definition, synthesis, analysis, evaluation and documentation. This cyclic process allows for continuous improvement and adaptation, fostering innovation and problem-solving in fields like product design, engineering, architecture, and user experience. The nature of the design process lies in its ability to guide creators through a strategic journey, resulting in effective and novel outcomes that address a wide array of challenges.

Keywords: Design, Design process, Engineering.

1. Introduction

Design is a series of activities to gather all information from the designer's idea as a real product. Figure 1 represents the conversion of design to real product. Classifications of designs are (i) Embodiment design, (ii) Innovative design/Development design, (iii) Adoptive design (iv) New design/inventive design.

Figure 1. Way of design to real product

2. Design Process

A design process is a structured approach for solving problems, which includes defined criteria and limitations. It is employed to generate numerous potential solutions to address and fulfill human requirements or desires, ultimately leading to the selection of a single final solution. Figure 2 shows the steps involved in the design process.

Following steps are involved in design process.

- Identifying the need
- Defining of problem

- Synthesizing solutions
- Analysing and optimizing
- Conducting evaluations
- Documentation

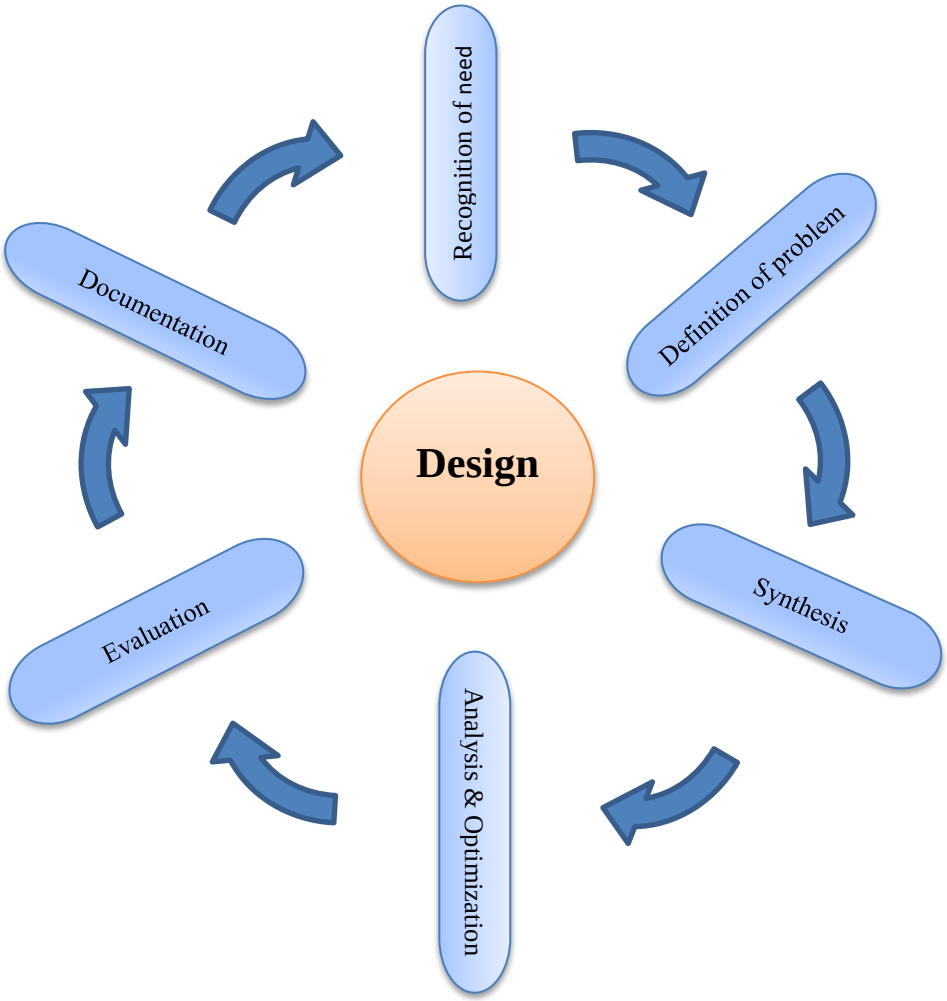

Figure 2. Steps involved in design

2.1 Identifying the need

The recognition of a need entails an individual's realization that a problem exists and requires a viable solution. This can manifest as an engineer identifying a flaw in an existing machine design or a salesperson recognizing a new marketing opportunity for a product. At the outset of any project, customers are typically requested to specify the issues their designs intend to resolve.

2.2 Defining of problem

A problem statement serves as a means to pinpoint the disparity between the existing problem and the intended objective of a process or product. An essential aspect of resolving

any design issue is to initiate the process with the correct inquiries. Utilize the following questions as a framework to craft your responses.

- What are the primary objectives of this project?
- Who constitutes the ultimate audience or user base for this project?
- What specific problem or challenge does this product aim to resolve?
- In what manner will this product tackle the identified challenge?
- What resources will be necessary to bring this project to fruition?
- By what criteria will we gauge the achievement or success of this project?
- Are there existing products in the market that resemble this one?
- In what ways will this product distinguish itself from similar offerings in the market?

2.3 Synthesizing solutions

Design synthesis focuses on creating solutions that leverage the insights derived from design analysis. These solutions may encompass a blend of novel products, services, interactions, and communication strategies. Design synthesis is the pivotal step of translating research findings into practical knowledge and constitutes a vital component of the design process. The objective of this phase is to discern connections among various data points, thereby revealing significance in the observed behaviors from the research phase. This comprehension enables the identification of opportunities and limitations that will define the scope within which we develop solutions.

2.4 Analysing and optimizing

Once the project's foundation and specific requirements have been established, the creative process begins, generating a plethora of ideas. Collaboration with the project team ensues, fostering brainstorming and idea comparison to determine the optimal features for the product. Design requirements outline the essential characteristics necessary for the solution's success. One effective method to identify these design requirements is by scrutinizing an existing, similar product, dissecting each of its key features. Design challenges often offer numerous viable solutions, and focusing solely on a single option before exploring alternatives can lead to overlooking superior solutions. Skillful designers strive to generate a multitude of potential solutions. Each potential solution should be evaluated against the design requirements, with some solutions aligning better with the criteria than others. Rejecting solutions that fail to meet the requirements, the best solution is selected from the

analyzed options. The engineering analysis and optimization stages within the engineering design process equip designers with valuable decision-making tools to make informed choices regarding design solutions before finalizing the design and constructing a prototype.

2.5 Conducting evaluations

Design evaluation plays a crucial role at various stages of the design process, aiming to ensure that the design solution aligns with the initial design objectives. This involves testing concepts through the creation of a prototype that simulates the final product. Throughout this iterative process, it's essential to uncover new areas for improvement and validate the user experience associated with existing concepts. User testing of the prototype serves as a valuable tool for addressing pertinent questions and identifying potential flaws or drawbacks. This feedback loop enables troubleshooting and multiple iterations of the prototype until a final product is achieved. Subsequently, all feedback accumulated from prototype testing is reviewed, and preparations are made for the next phase, which is product analysis. This phase involves collecting user feedback, data from prototype testing, competitor analysis, and market sales to inform and enhance the product. The goal is to utilize this information to craft a more tailored solution that addresses the unique problems or needs of the market.

2.6 Documentation

Finally, create a detailed drawing about the optimized design of the product. This is to communicate the knowledge from designer to manufacturing people. All the drawings are documented and the process drawing to each process involved in the real product. The primary aim of design is to meet the client's requirements, necessitating the designer to engage in both oral presentations and the creation of written design reports. Developing drawing skills, particularly pencil sketching, proves invaluable in illustrating a wide range of ideas. Various visual aids, including sketches, drawings, computer graphics, and models, play a significant role in the communication process. Documentation is one of the fundamental aspects of design, ensuring that the solution to a design problem is conveyed clearly so that others can comprehend the work done. Typically, this documentation takes the form of a design or technical report. Effective communication of the design solution, through written and oral language, is a critical component of the implementation phase, especially when dealing with individuals lacking technical expertise, such as the general public, government officials, or business leaders. Successful engineers need to possess more than just technical proficiency. To encapsulate the solution process concisely, visual materials like graphs, charts, and other graphical representations are employed, making it easier to present the work

to others. Multimedia techniques, such as PowerPoint presentations, slides, sounds, videos, and computer-generated animations, are frequently utilized to clearly articulate the resolution of a design problem.

3 Conclusion

The design process serves as a dynamic framework that empowers creative individuals to navigate the complexities of problem-solving and innovation. It is characterized by its iterative nature, guiding designers through a series of interconnected stages, from identifying challenges to crafting tangible solutions. Through synthesis, analysis, evaluation and documentation, the design process fosters a systematic approach that balances creativity with practicality. By embracing adaptability and continuous refinement, designers are able to create outcomes that are not only functional and efficient but also innovative and user-centric. The design process's significance extends across various domains, enabling professionals to address diverse problems, improve existing solutions, and contribute to the advancement of technology and human experience. Ultimately, the design process encapsulates the essence of creativity, strategy, and collaboration, driving the evolution of industries and shaping a more effective and aesthetically pleasing world.

Reference

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