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

A designer's idea becomes an actual product by a set of operations to acquire every relevant information. 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 systematic approach to problem-solving that has set criteria and constraints. In order to meet and satisfy human needs and objectives, it is used to develop a wide range of feasible options before choosing just one. The stages of the design process are shown in Figure 2.

Following steps are involved in design process.

- Identifying the need
- Defining of problem

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

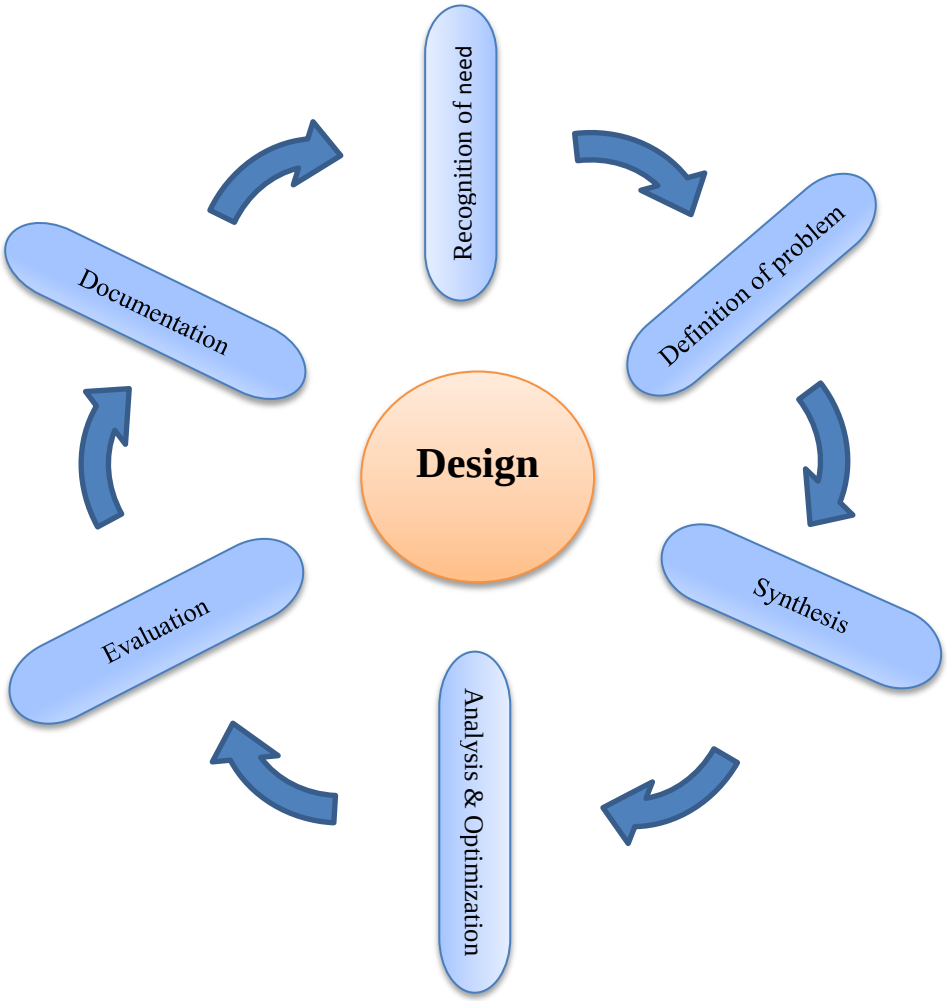

Figure 2. Steps involved in design

2.1 Identifying the need

To recognise a need, a person must be aware that a problem exists and that a workable solution is needed. This may appear as a salesperson spotting a brand-new product marketing opportunity or an engineer spotting a defect in an existing machine design. Customers are often asked to define the problems their designs will solve at the commencement of each project.

2.2 Defining of problem

A problem statement helps to identify the disconnect between the current issue and the goal of a procedure or product. Starting the process with the right questions is crucial to

solving any design problem. The following questions should serve as a guide for structuring your answers.

- 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

The goal of design synthesis is to develop solutions that make use of the knowledge gained from design analysis. These solutions could include a variety of cutting-edge goods, services, interactions, and communication techniques. As a crucial step in converting research findings into usable information, design synthesis is an essential part of the design process. In order to understand the meaning of the observed behaviours from the research phase, links between diverse data points are sought in this phase. This understanding makes it possible to recognise the possibilities and constraints that will specify the range of our solution-development activities.

2.4 Analysing and optimizing

The creative process starts once the project's basis and precise criteria have been identified, producing a myriad of ideas. As a result of the collaboration with the project team, brainstorming and concept comparison are encouraged in order to choose the best characteristics for the product. The key elements required for the success of the solution are outlined in the design requirements. Examining a current, comparable product and analysing each of its important aspects is a useful way to pinpoint these design criteria. Design problems frequently have multiple workable solutions, so concentrating on just one without considering alternatives may cause you to miss out on better ones. The goal of talented designers is to come up with numerous potential solutions. Each prospective solution should be compared to the design specifications, with some aligning more closely with the requirements than others. The best option is chosen from the analysed possibilities, rejecting solutions that do not satisfy the requirements. Before completing the design and building a prototype, the engineering analysis and optimisation stages of the engineering design process

give designers useful decision-making tools to help them make well-informed decisions regarding design solutions.

2.5 Conducting evaluations

At various phases of the design process, design evaluation is essential in order to make sure that the design solution adheres to the original design goals. This entails developing a prototype that mimics the finished product in order to test concepts. Finding new areas for improvement and validating the user experience related to existing concepts are crucial throughout this iterative process. The prototype's user testing is a useful tool for answering important questions and spotting any problems or shortcomings. This feedback loop permits problem-solving and numerous prototype iterations until a finished product is obtained. After reviewing all of the comments gathered during prototype testing, preparations are made for the following stage, product analysis. In order to improve the product, this phase entails gathering customer feedback, data from prototype testing, competitive analysis, and market sales. The objective is to use this data to create a more specialised solution that answers the specific issues or demands of the market.

2.6 Documentation

Create a comprehensive drawing of the product's improved design as a last step. This is done in order to transfer knowledge from the designer to the manufacturing staff. Every drawing is accompanied with a process drawing for every step used to create the finished output. The fundamental goal of design is to satisfy the needs of the client, which requires the designer to do oral presentations and produce written design reports. Gaining drawing skills, especially in pencil sketching, is essential for illuminating a variety of concepts. Sketches, drawings, computer graphics, and models are just a few examples of the many visual aids that are used in communication. One of the key elements of design is documentation, which makes sure that the answer to a problem is expressed succinctly so that others may understand the work done. This documentation typically comes in the shape of a design or technical report. The implementation phase requires effective written and verbal communication of the design solution, especially when dealing with non-technical audiences like the general public, elected authorities, or corporate executives. Engineers who succeed must have more than simply technical competence. Visual resources like graphs, charts, and other graphical representations are used to simply summarise the solution process, making it simpler to show 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.

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