Research on Product Design Efficiency Improvement Based on Computer Information Technology

Shuai Yang and Meijing Yao
Jiaying University, No.100 Meisong Road, Meijiang District, Meizhou City, Guangdong Province, China
Email: Mr.yangshuai@qq.com

Abstract. With the progress of society, computer technology has gradually penetrated into all aspects of life. The product design industry is an industry that emphasizes innovation and efficiency. In the process of new product design, the product details and existing problems need to be fully considered. This requires further optimization and innovative design. Among them, computer-aided technology can smoothly apply information technology to the forefront of product design life cycle and provide intellectual innovative solutions for the design and application of new products. The intervention of computer technology will greatly improve the efficiency of product design and help promote the development of product development companies.

1. Introduction
As the speed of economic construction has gradually accelerated, market competition has intensified. New products from all walks of life are launching and capturing the market is accelerating. With the progress of globalization, product innovation has gradually become the core factor of enterprise competitiveness. As the core of product innovation, concept design is increasingly valued by people. New products are the result of technological innovation and problems that need to be solved in the process of market competition. Among them, computer-aided innovation technology has become one of the necessary technologies for new product design. It includes analysis of scientific problems, innovative thinking methods, problem conversion, and conflict resolution, etc. With the development of computer technology, computer-aided conceptual design has become a hot research topic. People have done a lot of research on product information models and solving methods. The use of computer information technology can greatly shorten the product design process time, which is conducive to enterprises to seize the market first.

2. Computer-aided Innovation Technology Helps to Quickly Solve Problems in the Process of Product Design
In the product design platform built with computer-aided innovation technology, there are three problem-solving modules, namely solution module, innovation principle module and innovation information query module [1]. This can ensure that new products have their own knowledge base support during the design process. When designers encounter problems in the product design process, they can find technical solutions in the knowledge base built by the computer-aided innovation technology platform. This knowledge base includes the fields of engineering, structure of technical solutions, expression refinement and image design. The decision-making layer can work out a pre-defined scheme from the actual case when selecting a product design scheme, laying a good
foundation for solving product design problems. When the innovation principle module is applied, the computer-aided innovation technology platform can automatically generate a contradiction matrix under the guidance of the innovation principle. Based on the existing factors, the contradiction problems encountered in the solution of innovative styles are analysed, including contradiction parameters, contradiction matrix and contradiction definition. The solution was found in the process of full-process analysis. Each solution was supplemented with a detailed explanation of the principle and an animation demonstration module, so that designers of new products could understand the connotation of innovative principles. It enables designers to have innovative thinking and breakthrough problem solving in the subsequent product design process, avoid similar product design problems, and provide support for subsequent product design. In solving the problems arising in the design process of new products, the computer-aided innovation technology platform has set up a patent search module, which is connected to multiple patent knowledge bases at home and abroad [2]. The query method is very convenient, and basically realizes the function query of automatic expansion, which makes designers help to find patent information when looking for innovative inspiration. Achieve high-efficiency search and filter functions, and realize high-efficiency technology patent query, which benefits from the rapid development of computer information technology.

3. Computer Technology can Speed up the Product Development Cycle

Rapid prototyping technology is a high-tech manufacturing technology developed based on computer technology. With the development of science and technology, the tools for product prototyping are no longer limited to the hand tools of the Bauhaus era 100 years ago [3]. The core of rapid prototyping technology is rapid prototyping driven by three-dimensional design models directly through computer software. Based on the principle of discrete and stacked forming, the three-dimensional data of the computer-aided design product is processed by layering and discrete processing of the computer, and then the original three-dimensional data is converted into two-dimensional planar data, and the forming material is processed layer by layer according to the set forming method. Quickly and automatically materialize into a three-dimensional solid model or part with a certain structure and function. Designers follow the following steps when applying rapid prototyping technology to make models:

3.1. Create a 3D model

The first step is to build the product design ideas in the 3D design software, such as Rhino 3D modelling software. The designer obtained a clearer sense of space modelling in the 3D software than the creative 2D software [4]. The designer can repeatedly modify the appearance and shape in the 3D software. The advantage of the design software is that it has a very powerful surface function, which can help the designer to quickly and accurately design the creative performance; the disadvantage is that the 3D design software does not have the concept of solid, so if the data of the 3D design software is directly imported into the CNC machine tool processing There will be problems with model quality.

3.2. Import Data into Engineering Software

After completing the expression of product design creative 3D design software, the designer imports the 3D model data into engineering software, such as Solidworks, PRO / E, UG, Mastercam, etc., to modify the product model structure.

3.3. Enter Data into Rapid Prototyping Equipment

Input the modified model computer-aided design (CAD) data into the rapid prototyping equipment for processing. At present, the rapid prototyping equipment mainly used in the production of industrial design models is CNC machine tools and 3D printers. The emergence of modern model making equipment such as CNC machine tools and 3D printers has brought a positive impact on the development of model making methods, making model making faster and more accurate. It is an indispensable ability of modern industrial designers to make product design ideas and use rapid
prototyping technology to make product prototypes in the industrial design process for experiments and demonstrations.

The technology has the following advantages over traditional model making:

Through information technology, you can quickly generate a solid model, which is convenient for timely evaluation at the design stage [5].

In the model processing, the rapid prototyping method can be used to manufacture plastic model to replace traditional wooden profiling model, and can also produce precision height-reading casting wax model.

For those parts that cannot be mass-produced, the use of information rapid prototyping technology saves materials and shortens the production cycle, reducing the production cost. This can realize the free manufacturing of new products, suitable for the development stage of innovative and creative products, and create conditions for the optimization of product structure.

We collected data on the time spent in each part of the R Company’s design process and obtained the following results:

Table 1. Comparison of efficiency of information technology intervention and change in product design process.

| Design steps         | Regular time (hours) | After technological reform (hour) | Increased efficiency |
|----------------------|----------------------|-----------------------------------|----------------------|
| Conceptual stage     | 98                   | 78                                | 20.4%                |
| Exploration stage    | 86                   | 74                                | 16.2%                |
| Definition phase     | 32                   | 30                                | 6%                   |
| Scheme refinement    | 122                  | 56                                | 117%                 |
| Development stage    | 124                  | 68                                | 82.4%                |
| Stereotypes         | 72                   | 56                                | 28.6%                |
| Product launch stage | 28                   | 25                                | 12%                  |

It can be found from the above Table 1 that after computer information technology is involved in the product design process, the overall product development time is greatly shortened, which effectively improves the implementation efficiency of design projects and accelerates the product development cycle.

4. Computer Information Technology Can Make Design Expression More Accurate

When conducting innovative design of new products, designers should pay attention to the integration of various aspects of product design when applying computer-aided innovative design techniques. The theoretical foundation of fusion and product design, modern design methods, innovative technologies in the field of multi-engineering, natural language processing technology, and computer software technology. Build a complete computer-aided innovation technology tool and design platform for the design of new products (Figure 1). Under the guidance of the computer-aided innovation technology platform, the calculation and analysis of computer systems can find an ideal indicator for the design of new products, analyse the degree of impact of the initial problems of system components, determine the value of new products, and accurately improve the new product Features [6]. In the problem decomposition stage of the computer-aided innovation design stage, the problem decomposition module can decompose and analysed the appearance problems existing in the new product design stage, especially the computer-autonomous decomposition of the initial problems of new product design [7]. Mining the cause of the problem, finding the causal relationship of the problem, exploring the available resources of product design and applying design. When applying computer-aided innovation technology, the root cause analysis method can deeply discover the cause of the problem, trigger the failure mechanism or Incentive analysis process, find detailed operation of problem resolution, effectively prevent possible problems in product design, not just focus on the appearance of problem design, improve the efficiency and quality of new product design, so as to achieve the goal of making product modelling more accurate [8]. Informatization is integrated into the product design...
process, which can improve the accuracy of modelling. Before digital processing, we can precisely define the data such as the surface size of the product and the spatial position of each component during the design and development process.

![Examples of product innovation design based on computer technology.](image)

**Figure 1.** Examples of product innovation design based on computer technology.

5. **Conclusion**

With the continuous acceleration of the progress of the market economy, the market competition in all walks of life has rapidly accelerated, and new products in the market are emerging endlessly. In order to effectively improve the market competitiveness of new products, the design of new products should be comprehensively improved and improved. Make the design process of new products very perfect, in this process, computer-aided innovation technology is the most important auxiliary tool for new product design. The application of this technology can continuously integrate innovative methods, theoretical development and computer technology, and constantly improve the computer-aided innovation technology, so that the design of new products can better meet the needs of the public and achieve continuous innovation of new products, and it lays a good foundation for the application and long-term development of computer-aided innovation technology. With the development of technology, more new technologies and new materials will be used in the field of product design. It is necessary to maintain the advanced nature of design methods and technologies to make the industrial design process more complete.

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