Comparison Study of 2D and 3D for Automotive Design by Digital Mock-Up

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Abstract

In the recent years, computer technology as Digital Mock-Up (DMU) has played an important role in industrial design and manufacturing. DMU is widely used in engineering works, including product design, product modeling, product prototyping, and product representation. For instance, DMU can be employed to create a car model in computer graphic before manufacturing instead of a clay modeling or prototyping in automotive industry. In general, DMU can be illustrated in both 2D and 3D depending on product configuration. This paper aims to study DMU technology for modeling a car model in order to compare 2D and 3D mock-up with traditional method as a clay model. Time and cost of a car modeling are the factors to be evaluated for comparison between DMU and clay modeling. The case study is conducted with a car model of automotive industry in Thailand. We found that DMU can reduce time and cost about 67% and 95% respectively when compare with a car clay modeling.

Key words : Digital Mock Up, Car design, Clay modeling, Hybrid designing.

Introduction

Nowadays, 3D (DMU) is usually to create a car model of automotive industry instead of 2D sketching on blueprint. The advantages of DMU are ease to modify and rapidity to model when compare with 2D sketch. Because of 3D DMU can represent 3D perspective views of a car model. A car model is created by combination of lines, curves, and surfaces. Furthermore, DMU can be imported in CAD in order to transfer a car modeling shape to engineering geometries. These geometries are used in computer aided manufacturing and engineering to support a car manufacture. In addition, DMU can be shared and propagated between CAD software, which has a DMU module.

Materials and Experimental Procedures

The Digital Mock Up is novel and efficient concept of the hybrid of 2D and 3D. It begun with conceptualizes designing following with the 3 view, sketching that contains top view, side view and front view. The sketching is then imported to the CAD modeling following with the 3D modeling creation and rendering. The 3D modeling can perform by solid modeling, surface modeling and the combination of 2D & 3D modeling. The Digital Mock Up is quite easy and more efficient.

Results and Discussion

Digital Mock-Up (DMU)

On the way of vehicle industry in Thailand have a high competitive in term of a new product designing. The most of new product will have varies of style and type, so the effective of this competitive have to the short of designing and developing for increasing the level of organization and suitable time for the market requirement. Most of vehicle industry in Thailand has the product design process follow as: Concept Design, Sketching,
Clay Modeling, Point Data Collection, Creation of Surface, and CAD Data. From above process is lost many time and cost to create the prototype, point data collection and creating of surface. Digital Mock-Up technology can decrease those processes. Consequently, the product design will be faster than and save cost of product design.

Digital Mock-Up (DMU) is a novel method for approving and validating the conceptual idea in the automotive design stage and also reduces time and cost for automotive design. Traditionally, the mock up is made by physical such as a clay modeling, prototyping, which is time consuming and quite expensive. Presently, computer based technology is sophisticated. Mock up can be only in digital. There is a lot of research studied and proved that DMU is the powerful for validating the conceptual design of a new styling of automotive development. Although, Digital Mock-Up concept is complicated at the beginning of design stage but it is easy to modify.

**Traditional Automotive Design Process (Clay Modeling)**

Body Design for Automotive is the important process of designing and improvement in present. Designer must have understanding about market environment and collects the detail of customers’ requirement inclusive accordance with production in industrial. Normally, designer will make model by sketching and clay modeling. Simultaneously, expert of each field will make optimization for production process. Afterwards, model will design on 2D paper and real dimension adjustment of clay model.\(^{(2)}\)

**Figure 1. Clay Modeling.\(^{(2)}\)**

Drawing will sketch real dimension of all of car part include the wheel and roof on drawing board. After that, the group of administrator is considering the drawing board for planning of production, engineering designing and specifying of car price.

**Figure 2. Point Data Collection.\(^{(2)}\)**

Clay Model is the process of making prototype by clay modeling to be data base for surface designing. Clay Model must nearby the real car and material for make clay model must be appropriate of rigid and don’t change the shape after more time.

The real dimension of clay model will collect the digital data by scanning and send the data to computer this method call CAD for create all of car model for designing of production such as forming, welding and assembling.

**Digital Mock-Up for Automotive Design**

The term 'mock-up' describes a physical prototype or a model with which the completeness and the feasibility of building the product can be assessed and guaranteed; it is also used to guarantee the functionality and the fulfilling of the required properties of the product.\(^{(3)}\)

Digital Mock-Up describes a computer-based description of a product that is used throughout the entire development process as a basis for making decisions about the development of the product. This definition is very broad, and its technical realization represents a very significant challenge.\(^{(4)}\)

The first step of DMU method is importing 2D sketch into 3D software which has support DMU application. The second step is to creating surface of car model with point data collection and creation of the surface process of traditional design process after that to make the prototype by solid model as shown in Figure 3.
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Figure 3. Digital model.

Then validation of the conceptual design for a new car styling by prototyping process with 1/8 of real scale as illustrated in Figure 4.

Figure 4. Car model from automotive design process by DMU tools.

The automotive model is easier changing and developing shape by few hours work as shown in Figure 5.

Figure 5. Changing and developing shape by DMU tools.

Figure 6. Design Process by Digital Mock-Up.

From the design by digital mock-up technology, we used time for automotive design approximated 80 hours and cost for one prototype approximated 50,000 baht.

Summarize of the Result

The result will prepare in term of time for designing process (not include changing and development of shape) and cost for prototype material cost by compare with designing process information of Thai Rung Union Car Public Company Limited (traditional design process). They use 240 hour for design and cost about 1,000,000 baht for one model.

Figure 7. Comparison time and cost with designing process information of Thai Rung Union Car Public Company Limited.

To model a car shape with DMU can reduce time and cost approximate 67% and 95% respectively when compare with a car clay modeling.
Conclusions

2D and 3D DMU can decrease time and cost in order to create a car model when compared with the traditional car model base on clay modeling. DMU is easy to make and modify a car model. In addition, DMU of a car model can be seen in 3D views as same as real modeling. 3D DMU is clarity than 2D. 2D sketch should be used into 3D DMU for rapidly forming a car model shape due to in 3D is more difficult to create the complicated curves than 2D sketch.

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References


