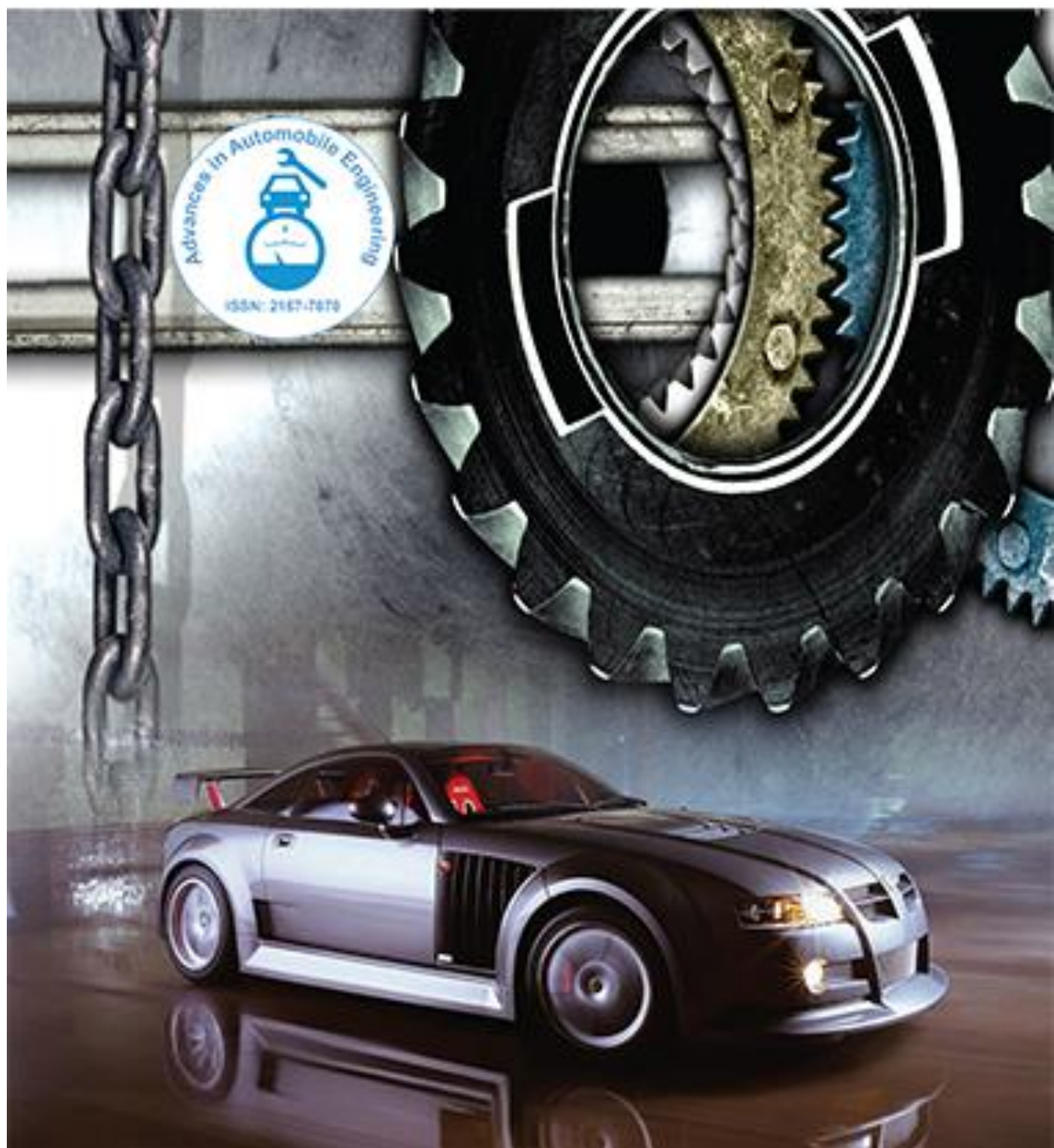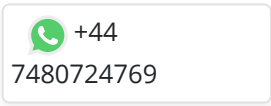# Advances in
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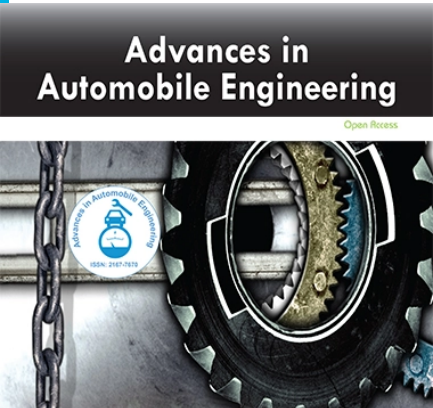**Global Summit on Nanoengineering and Its Applications**

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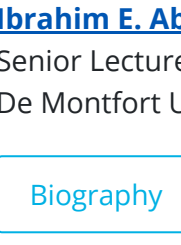Biography   Research Interest

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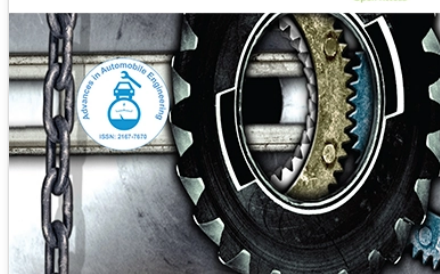**World Congress on Artificial Intelligence and Robots**
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Application of Semi Reverse Inovative Design Method to make Indonesian Endemic Animal Education Miniature

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Abstract

Reverse Inovative Design developed by Xiuzi Ye aimed to innovations product based on CAD/CAM/CAE quickly, efficiently, and electively. This paper will implement Semi RID on Indonesian endemic animal toys design process (javan Rhinoceros). This paper will change Reverse Inovative Design to Semi Reverse Inovative Design because limitation of Production Process Laboratorium Yogyakarta Atma Jaya University CAE infrastructure. Reverse Engineering on this paper start with scanning product with Handy SCAN 700, then redesign process with PowerShape 2015 (transforming mesh file black African rhinoceros into javan rhinocesors surfaces then transforming surface into solid feature), and use ArtCAM 2013 to make skin texture. Revise Engineering process ended with make prototype with 3D printer Objet 30Pro. Creative method used to obtain 3d model toy educational rhinoceros which is want by Kolektor Mainan Solo (KMS).

Semi RID method has success make a design and prototype of Javan Rhinocesros with specification easy to assembly (20 part), dimension 135mm x 42mm x 62mm, and save for child (8-10 years old). This is indicate that the RID concept based on CAD/CAM have been able to develop by TI-UAJY. The result of verification indicate very enthusiastic with the idea that be implemented by writer about using Semi RID to make prototype Indonesian endemic animal education toys.

Keywords: Reverse engineering Reverse innovative design, Semi reverse innovative design, CAD/CAM, Power shape, Prototype

Introduction

Computer Aided Design is software that uses to make virtual product. Making design on CAD software can based on market product or developing new product. Complete CAD file will make engineer easier to inspection about geometry, surface, shape and mass of product. Then to know the product suitable for manufacture, Analyses Computer Aided Engineering needs to do. CAE analyses covering Finite element Analysis, Computational Fluid Dynamic, Multibody Dynamics and optimization. The result of CAE very effects on product decision. CAE must be detail on analysis because result of CAE will be last innovation process before the new product processed on manufacture. Computer Aided Manu-facture is a bridge between virtual products from CAD/CAE with physical product (3D Model). CAM technology can change CAD file become physic product using tool path strategy optimization until NC code generating for CNC machine.

Reverse Engineering (RE) is a quick and efficient product development method when CAD file not available. RE in generally use for studying the product feature, development product, recollecting product CAD file, competition, and cracking [1]. Aplication RE using 3D scanner or CMM (Coordinate Measuring Machine) technology. CMM is very precision scanner. This machine can do scanning automatically and easily, but need special condition that is the probe need to contact with the product [2]. That can make the surface damage especially the historic product that have high value of history and traditional brittle product. The movement of probe on CMM Mache is very slow. To get a point need one movement of the probe. 3D Laser Scanner is newest tool changing CMM for scanning. 3D laser scanner can make 10.000 to 100.000 point per sec [3]. This cause CMM starting left for RE Point cloud (mesh file) is output of 3D laser scanner. Each point of point cloud have different identity spread on x,y, z axis who will edited using CAD software to be a new product.

The working of 3D laser scanner like sonar that is shot with laser beam then receives that reflection of the beam. After get point cloud data from scanner, then editing process using CAD software change mesh model into surface model then solid model. Output from CAD software must process on CAM software in order to manufacturing [4].

RE process can use for toys production from real object. Those toys like: transportation, creatures, etc. In this paper RE process used to get a new shape of endemic Indonesian animal form 3D model who sell on the market.

Newest method for design product Reverse Inovative Design (RID) is a making a new model method with take advantage scanning file or it can also blending 2 product be-come a new innovation product [5,6]. RID used for accelerate redesign process on developing product cycle. This method used to make engineer easier and quicker on new product innovation based on scanning file. Developing product using RID more emphasis on editing mesh or surface file based old product.

Method

Semi Reverse Inovative Design is simplification RID method by [5]. This paper do not use CAE because limitation of TI-UAJY infrastructure

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and to limit work scope. Important part of this method is redesign product process. This paper will discussed about redesign process of African Rhonoceros into Javan Rhonoceros education toy. Based on IUCNRedList data on 2014 javan rhonoceros has critically endangered konservation status and that animal does not have fur texture that will make redesign process easier. Survey done by the writer in some offline and online shop and there is no endemic Indonesian Animal toys.

This paper using Javan rhonoceros as objective. RE process started with scanning process using Handy SCAN 700 on African Rhonocesors to get CAD file from that product. Redesign process CAD file African Rhinoceros into Javan Rhinoceros, using CAD software Power Shape 2015. The result of redesign process then is printed with 3D printer Objet 30Pro. To indicate whether the implementation process Semi RID technologies of semi RID on a prototype of the Javan rhinoceros worked well or not, hence the verification to a Kolektor Mainan Solo community members at Gathering 8 November 2015 in Solo Grand Mall Food court. Changes of RID method Semi RID is more due to the unavailability licensed software of CAE in TI UAJY.

Process

Analysis of the selection of the product

The selection of the animals is determined by looking at the physical differences of the animals the most popularized, namely on the difference of surface contours. Following the results of the preliminary identification by researchers:

1. Black spotted cuscus only has difference in plumage with spoted cuscus more. Such differences as well as the colors on the cat. These animals just breed in Northern New Guinea region at an altitude of 1200 mdpl.

2. Bawean Deer has no physical distinction with other deer. Male deer will grow horns and female deer do not have horns. Difference Bawean deer is only the habitat. That's Deer just growth on Bawean island.

3. Crested black macaque color became the hallmark of this animal. Another difference in the monkey that is colored pink ass. Male monkey have small heart but shape and female have bigger than male.

4. Mentawai macaque is on the tail section has a little bit feather, cheek has little bit of whiskers, feathers, face not covered by feather, has black color at back and the eye is brown.

5. The difference in pig tail langur there is only on its tail coiled short like animal pig.

6. The physical differences of the Eastern long-beaked Echidna with other long-beaked Echidna on the feathers are shaped tubes and the most typical feature of the muzzle that curved down.

Based on our initial identification didn't choose these six animals because of limited/software incompetence CAD Laboratory owned production process in making the texture of the feathers nearing reality. After all the physical differences are identified then obtained one extinct Indonesian native animals which has the most striking physical differences as well as being able to be realized in accordance with 3D drawings into CAD Power SHAPE used in this research. That animal is Javan rhinoceros.

There are five species of Rhino in the world and the fifth the species threatened with extinction because of the hunting to get the horn.

Three rhinos came from Asia, namely Javan Rhinoceros (Rhinoceros sondaicus), the Sumatran Rhinoceros (Dicerorhinus sumatrensis), and Indian Rhinoceros (Rhinoceros unicornis), whereas the two rhinos from Africa, namely the Black Rhinoceros (Diceros bicornis) and the white rhinoceros (Ceratotherium simum). Of the five types of Rhino the Javan rhinocecros had the most threatened of extinction. The original habitat of this Rhino has been lost. The only habitat of this animal is in Ujung Kulon National Park (TNUK). TNUK records only the tail 58 Javan rhinos left in the world. The data obtained using the trap camera who located on activities spot to get the Javan rhinoceros activities.

The Javan rhinos have some physical characteristics, namely: has a blackish gray body color, have only one Horn with a length of about 25 cm, weight can reach 900-2300 kg with a body length of about 2-4 m, height can be reached almost 1.7 m, his skin has some sort of folds so looks like wearing armor, have a way similar to the rhinos India but the body and the head is smaller with fewer number of folds , and more prominent upper lip so that it can be used to grab food and integrate it into the mouth.

Rhino is an animal that doesn't have feathers. The design process of skin cover (fur, scales, hair) has its own difficulty level. One of the software to achieve such level of detail is Art CAM. Art CAM is one of the specialized software to make artistic model. Art CAM software usage in this paper requires its own skills to get good contours of the Javan rhinoceros.

Determination of the creative team

The formation of the creative team from many quarters especially helpful writer in the design process. Creative team served to exchange ideas about the product being made. It consists of the members of the prancing design, the actuator the actuator of hobbies, hobbies that have children, professional modeler in the field of model kit modification, 3D scanner owner and developer of CAD software, users of the software, and a competent in the field of materials. The team helped author in determining the final product to be made his prototype. Here is a list of members of the creative team that has been formed:

1. Cusianto Ifan, he helped the author to specify a mini-mum age limit of a model kit and the level of difficulty of the manufacture of the product.

2. Herry Paulus, Amid, helped the author to determine the material to a secure, robust, and flexible.

3. PT. Delcam Indonesia helped in the process of product design.

4. PT. Tirtamarta the Wisesa Abadi (TWA), his role as owner of the 3D Laser Scanner that is used to get the data Mesh and Mr. Andrias willing to assist researchers to operte laser scanner HandySCAN 700.

5. Lab assistants. The production process of TI-UAJY, helping authors in the design process using ArtCAM software and machining process.

6. Kolektor Mainan Solo community (KMS), required in the formation of the early ideas of toys and the assessment of the product in the form of Prototype.

Software analysis

Power Shape 2015 is CAD software developed by Del-cam. This software has the advantage in making the surface which has the abstracts contours. There are restrictions on the making of the contours

of the skin, namely in the form of disability software Power Shape 2015 to make skin texture that resembles the original product. Creation of contour detail requires software ArtCAM. ArtCAM software usage due to the level of detail the contours of the skin of the Javan rhinoceros is very difficult and takes a long time when done using power shape. Art CAM is software that is devoted to the design of artistic objects. For simplicity in the process of printing on 3D printing machines, we use Netfab software. The software can detect and repair parts of the surface are damaged (bad surface, overlap, gap, hole). The limitations of the software and have a relationship that is comparable to the hardware being used.

Redesign process African Rhinoceros become Javan Rhinoceros

The process of Re-design begins with the scanning process performed by PT. TWA to get mesh files from rhino Africa to re-design process. There are many contours that must be removed and added to the African Rhinoceros became Javan rhinoceros.

Figure 1 shows the original African Black Rhinoceros products obtained in a toy shop. The author does the analysis subjectively about scars scars on the surface of the skin of the rhinoceros. Scars on the surface were made manually by using the pen type cutter. The use of such tools can ease the process of design in CAD software. The scanning results are shown in Figure 1 shows the capabilities of scanners in use (HandySCAN 700). After a change of the form of the African Rhinoceros, Javan rhinoceros being with PowerSHape CAD 2015, then obtained the rhinos solid results engineering as basic as in Figure 1. To facilitate the movement and the Assembly process by the user then given some articulation (joint motion) on the members of the body of the Javan rhinoceros. Morphology Chart tool used in this paper to get the best solution in the process of re-designs the Javan Rhino (Figure 1).
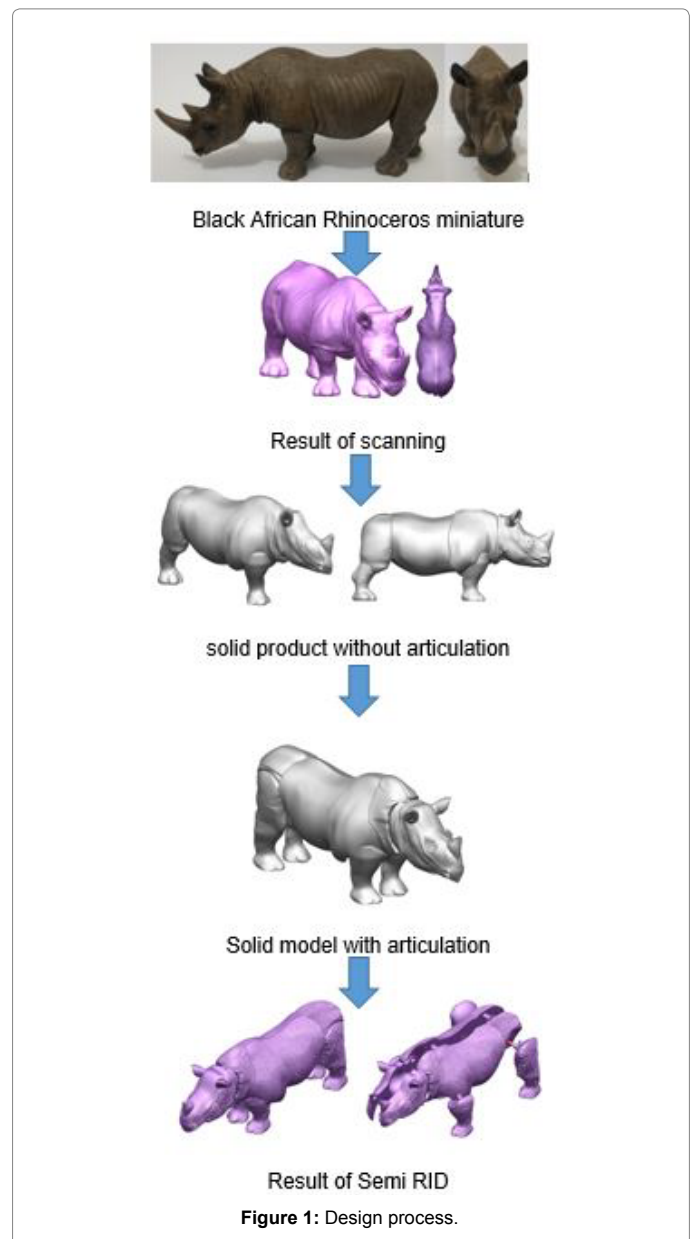
To get optimal relief conturrs the skin of Javan rhinoceros, then used software ArtCAM. The author uses two types of Javan rhinoceros skin contours that will be applied to this product (Figure 2). Both contours are used on different parts. The contour difference based on the original contour on the Javan rhinoceros. The author has done some experiments concerning the most effective thickness for the rhinos. The authors make three experiments in thickness 0.2; 0.3 and 0.5. Having seen and done a test print the most 0.5 thickness shows the contours. The snapping process of the contour surface features using warp triangles [7-9]. Following the results of the product after the given contour (Figure 3).

The process of adding the contours performed last because these steps require additional software. Software is capa-ble to create a contour detail i.e., ArtCAM. ArtCAM is a CAD/CAM software devoted to the creation of art objects. There are 2 types of contours that are used in this product. Two types of the contour was applied to a different place.

The contour is chosen because it best suited to skin and body parts. Snapping the skin using the function of warping on Power Shape 2015. The following section has been given the contours on the surface and the comparison of CAD data and the results of prototype (Figure 3).

Result and Conclusion

Semi RID Method that has writers do get results in the form of educational toy products in the form of prototype APE the Javan rhinoceros. The prototype printed with Objet 30 pro with total vero white 243 grams as main material and 143 gram suport material. In Figure 4 these results the conclusion can be drawn in the form of: The

Figure 1: Design process.

Figure 2: Conture design.
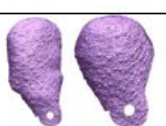
Figure 3: Part.

Figure 4: Prototype result by object 30Pro.

RID technology developed by Xiuzi Ye since 2008 in his journal has successfully developed very well in this final assignment in the form of animal-themed toys are products of the Javan rhinoceros. The results of this product is a collaboration technology that combines the technology of the Semi RID using laseer 3D scanners owned by PT. TWA Power SHAPE CAD technology by 2015, ArtCAM 2015 and 3D object 30Pro Laboratory belonging to the production process of the FTI-UAJY.

Change the name of the RID into Semi RID technology based more on yet the existence of infrastructure technology CAE owned laboratory of the production process, but in general the Semi RID technology capable of answering the challenge of new product development at industry of toys.

After obtained the prototype toy products the results of Semi rid technology, the next step is to verify that product on a Kolektor Mainan Solo objectives of the activities this to gain input or evaluation on the process design a product toy based semi rid. Verification done by writer to kolektor mainan solo (kms) in between the gathering kopdar kms 8 November 2015 in foodcourt Solo Grand Mall the verification results show the many visitors and members of that give input of exhibited prototype color and make a diorama natural habitats of javan rhinoceros.

Acknowledgment

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