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Case Study on Ease of Digital Prototype using Autodesk Fusion 360 with special reference to Handicraft Sector

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Abstract - This paper aims to represent the application and effect of Autodesk Fusion 360 on the digital prototype in terms of ease of CAD designing with special reference to handicraft sector. Analysis has been given on performance of software in terms of time management, productivity, ease of working, cost involved for non-technical design such as handicraft items like lamps, pots etc. A case study shown on how from 2-Dimensional design got converted into 3-Dimensional model along with conversion of drawing into render image and manufacturing sheet. The strength of Fusion 360 software is shown with various features provided in this platform. The limitations of the software have also been shown.

Keywords: CAD, Software, Autodesk Fusion 360, handicraft, parametric

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1. INTRODUCTION

With explosion of technology in our day-to-day life, no-one can deny the huge role technology is playing our life. When technology is spoken, so it cannot be in isolation with the advent of Industry 5.0. It comes with software's which runs the Technology innovation. There is various software which is used in industry with special mention of design industry. One area where lot of development can be seen is CAD design Industry which stands for Computer Aided Drafting and Designing. When any product is made in early days, physical small model called prototype was made. With advent of CAD software, digital prototypes are common now-a-days to test the product before actual manufacturing takes place. CAD us used to create virtual model with excellent images from all side views.

Generally, before manufacturing begins, various steps were involved with inclusion of minimum 3-4 different software's.

Step 1 : CAD software used for 2D sketches and 3D model

Step 2: Strength analysis of the product is carried out in some another software.

Step 3: The Final prototype product images are generated and fine-tuned in Photo editing tools such as Photoshop, Corel Draw, Lumion etc

Step 4: For manufacturing , another set of software tool is used to create the product and verify if that can be physically produced or not like in CNC Lather and milling machine or 3D printing machine etc.

With the advent of Fusion 360 which is a platform developed by Autodesk Inc, and United States of America firm mostly known for its product AutoCAD, these various steps can be done in one single platform. It had huge creativity in designing of all fields from technical engineering sectors to Handicraft, jewellery sector etc. This software allowed cloud storage, team collaboration with minimum constraints and high end features which allow industry to use this software at ease thereby saving valuable time, money and with creative freedom to innovate products as per user or market demand.

As per Deepa Sachin Ghag, CAD has developed drastic creativity in design sector.

2. LITERATURE REVIEW

Deepa Sachin Ghag. Case Study on CAD Technology in Jewellery Industry concluded that CAD software allows designers to simplify the iterative design or to easily change or edit details of the raw sketches, to facilitate sketching of jewellery products in any sizes, and to reduced required time for making models. Matrix software has engineering approached of parametric & non-parametric for

producing jewellery 3D CAD models with high-rate productivity, high-rate accuracy, and quick editing in models possible because several specialized jewellery designing tools available, good presentation tool with rendering images & animation tools for Sales & Marketing. This approach will be increased sale as well as reduce the cost of maintaining physical inventory of model. As software can produced real image of product by various rendering tool.

Somlak Wannarumon and Erik L.J. Bohez. Rapid Prototyping and Tooling Technology in Jewelry CAD reported that When CAD and RP are used collaboratively, it is capable of designing and making mold directly without any prototype, they thus can shorten the production time. CAD and RP technologies offer the great benefits to the jewelry industry from the design stage through manufacturing process.

Ms. Palak Kaushal and Dr. Prabhjot Kaur, 2016, Diffusion of CAD/CAM Technology in Inward and Outward-Oriented Hosiery Units of Ludhiana observed that CAD/CAM technology has revolutionized the knitting industry by pervasive use of computer systems to design products, plan production, control operations and execute various business-related functions needed in manufacturing firms.

Md Moniruzzaman, Afroza Akter Rita and Saudia Haque Oishe. An approach to design solutions for garments using a CAD system interfere that Designs are usually created without understanding that certain principles are the basis for the creation. Design analysis will play a vital role in ensuring the project begins and remains on track. This can often help to estimate the performance of a product before it even exists as an integral part of design activities. Analyze the designs and determine which principles to apply to the developing pattern to ensure that the replica of the design will emerge from the finished pattern shapes.

Musa Adamu Musa, Henry Abanda et.al Assessment of BIM for Managing Scheduling Risks in Construction Project Management study investigates the application of BIM in managing scheduling risk of construction projects. It order to properly minimize the risk of schedule delay in projects; construction sequencing activities need to be adequately digitized and BIM offers the opportunity to integrate vital aspects of project management that considerably improve scheduling risk management.

3. RESEARCH METHODOLOGY

Researcher took reference from various published papers and articles in CAD-CAM technology and manufacturing sector. Thorough study was done from various research techniques used by researchers in this area of study. Based on that theoretical framework along with practical in the Fusion 360 software was done.

Theoretical Framework

Researcher did details study on Fusion 360 software with technical angle to each specification systems applied in various domain of subject matter.

Case Study

The following methodology was applied to test the ease of working in the Fusion 360 software while designing Light Panel-a handicraft bamboo product.

Step 1: Develop 2-Dimensional sketch of the model

Step 2: Convert 3-Dimensional sketch into 3-Dimensional model by applying various tools in Fusion 360

Step 3: Applying Rendering technique on the model.

Step 4: Testing Strength of model using Simulation

Step 5: Developing drawing sheets and testing the ease of working

Through these various steps, the strength of software, ease of working in software, reverse engineering possibilities, cloud sharing and control of project in the Fusion 360 was tested.

Analysis

The final phase included the time and ease of working analyses with accuracy, productivity and quality of product being made. Fusion 360 allows the designers to simplify the iterative design, easily modify and adjust the sketches, reverse engineering of product, changes in size or parts relation which help in shorten time required compared to any other multiple software's.

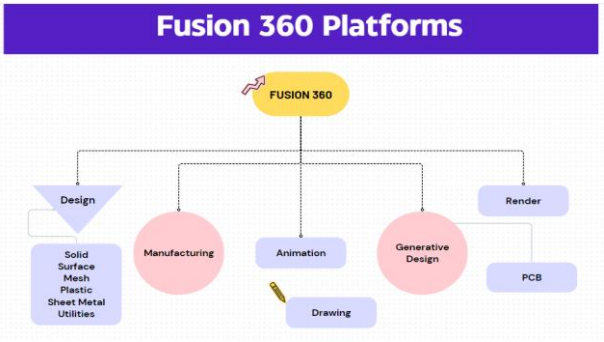
Fusion 360

Fusion 360 Autodesk Fusion 360 combines CAD, CAM, CAE, and PCB into a single, integrated cloud software platform. It includes all the tools that you need to go from design to manufacturing, seamlessly (Wikipedia contributors, 2022b). As per Autodesk Inc. Autodesk Fusion 360 combines CAD, CAM, CAE, and PCB into a single, integrated cloud software platform. It includes all the tools that you need to go from design to manufacturing, seamlessly. It explores design iteration with easy to use 3D modelling tools, produce high-quality CNC machined parts with integrated CAD/CA, gain access to unified electronics design, Test the performance of your design with 3D simulation tools. It explores manufacturing -ready outcomes with generative design, collaborate and manager data seamlessly in the cloud.

Fusion 360 is capable of:

- Parametric Modelling
- Mesh Modelling
- Surface Modelling
- CAD & CAM integration
- Extremely realistic renders
- Printed Circuit Board (PCB) layout , planning and manufacturing
- Cooling of electronics
- Topology & shape optimization

Fusion 360 have following platforms to do multiple task in one space:



Flow Chart of Fusion 360 Platform

Complex shapes can be modelled with complete range of geometric data in 3Dimensional model. Animation of model can be done which allow to control and maintain accuracy in the design process. Not only that the product protype can be directly manufactured using most commonly used additive technique such as 3D Printing or subtracting manufacturing technique like CNC machine by directly generating G-Code within the software.

4. CASE STUDY ON EASE OF DIGITAL PROTOTYPE ON LIGHT PANEL USING AUTODESK FUSION 360

The case study was done to find out how this software help in designing products from wide array of areas particularly in the field of Handicraft. A Light Panel was created which is the non-parametric model was first created and later on dimensions were put to check whether reverse engineering was possible and with how much ease things can be developed. Fusion 360 is a high end software which generally found to be very good with technical manufacturing related product but aim here was to test the software in non-technical handloom based product which can help artisans to quickly design products so that product life cycle can be reduced and more profit artisan can get with wide variety in the product they are offering.

The given sketch how we can transform two-dimensional sketch into three dimension and apply modification tools to generate the design. This software is compatible with almost all design, rendering, CAD software. IGES (Initial Graphics, Exchange specification) is a standard that defines a neutral form for the exchange of information amongst dissimilar computer -aided design (CAD) and with computer-aided manufacturing (CAM) and computer visualization systems. (Deepa Sachin Garg, 2019). All the rendering plug-ins like V-Ray , Autodesk rendering can be used with Fusion 360.

The study statistics are as follows:

Software Cost	Rs.22,000/year
Total Invested Year for Study	3 year approximately
CAD Proficiency	1 year
Time Required for completing Design	1 hour required to complete CAD model. So, in eight hours, around 7 models can be designed keeping 1 hours for drafting of design. (As on average 8 hours of work duration is kept by government standard)
CAD Software model per month	7 x 26 = 182 models per month, depending on complexity of CAD model. It complex model is to be designed it can take more time. So, complex model can take maximum 3 hours to complete, still in a month 67.5 models in a month can be easily made by one person.
CAD model cost	Rs.200/ - Rs.300/ model

Fusion 360 has seven platforms which can do wide array of works starting from Design in Solid, Mesh, Plastic, Surface to Render, Animation, Manufacturing, Drawing. It is parametric software where easily reverse engineering can be applied along with going to timeline to see the model progress. The in-build library items enable to develop 2D model into 3D model quickly and easily.

It can be used to design 2D and 3D PCB circuit design so make in India start-ups can use this software for chip making. Government of India is giving support and guidance in making these chips which was largely dominated by China in past.

Generative design of this software help us preserve geometry and apply relevant study condition like material used, manufacturing technique, load applied and give multiple options to design and create the model.

The case study concludes that Fusion 360 can be used by artisans, handicraft manufacturing people also to create faster and easy design which will help in reducing the product cost, quickly supplying demand of market and generating more revenue. As huge cloud space is provided in this software, it fits into industry 4.0. Working in team stationed at different locations can be easily done as it has cloud data access with high security available.

5. LIMITATION OF FUSION 360

Although this software is great for designing of any sector or field, but it has few limitation or drawbacks. They are :

1. **Dependency on Internet** : Biggest drawback of this software is user need to have good Internet facility while working in

this software as everything stores in cloud and many advance features like advanced Rendering, Generative design and drawing is processed in cloud.

2. **Frequent Updates** : The software Pop-ups with lots of updates on regular basis which can be irritating for users sometimes.

3. **Malware Risks**: Many a time, software crash due to Malware attacks which need to be addresses.

6. CONCLUSION

The research based on case study on how Autodesk Fusion 360 can be used in handicraft industry although is a technical software. It was evaluated on productivity, investment, approached, accuracy, ease of working, flexibility, cloud -computing. This software allows designer to simplify the design and change it anytime, thereby reducing the product to market time duration. Not only that this software allows changes in dimension, shape and size anywhere during the process of designing. This software being a parametric in nature has high rate of productivity, accuracy and reverse engineering process.

The ability to generate G-Code within the software helps user to produce handcrafted design using 3D printing tools which can give impetus to their product. This will help in increasing the sale as well as reducing the cost of making physical prototype as within the software various iteration can be produced. This software can help those who are not from technical field and wants to continue the legacy of historical design their community is making by giving it a contemporary touch with very less time.

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FIGURES

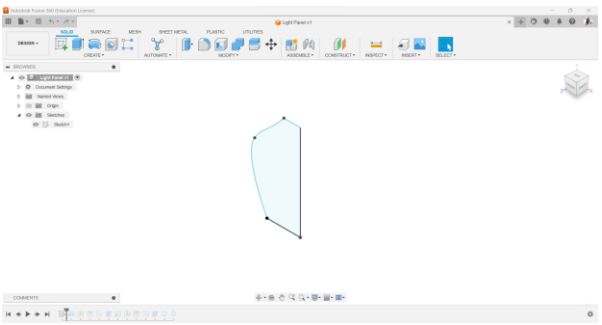

Figure 1: 2D Model in Fusion 360

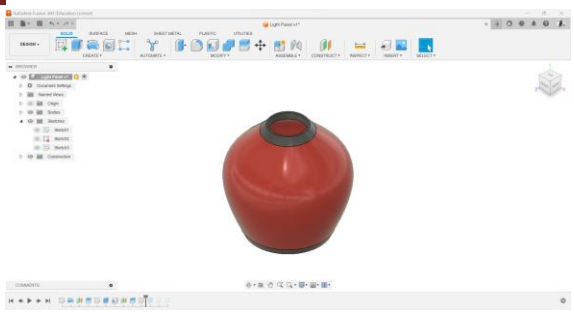

Figure 2: 3D Model in Fusion 360

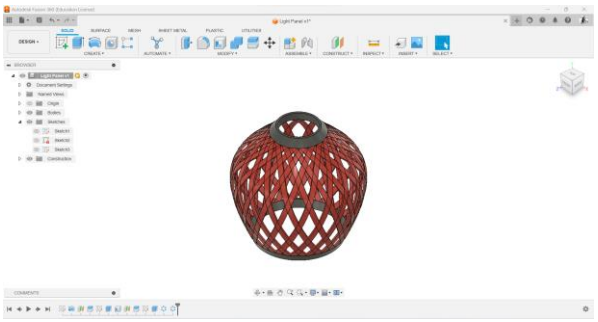

Figure 3: 3D altered design in Fusion 360

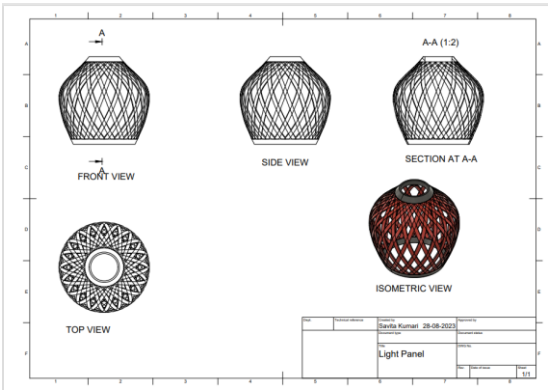

Figure 4: Ready to Use Drawing sheet with Title Box

Figure 5: Rendered Image in Perspective View in Fusion 360

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