DESIGN AND DEVELOPMENT OF GLOVE BOX

Kavin M A[1]

[1] Student, Mechanical Engineering, Bannari Amman Institute of Technology, Tamil Nadu, India

ABSTRACT

This project focuses on the design and construction of a car glove box utilizing CATIA software, with a major goal of cost-effectiveness and manufacturability. The traditional approach to glove box design frequently ignores variables such as production cost and ease of manufacture, resulting in inefficiencies in the production process. To address this, the project uses CATIA software, a powerful CAD tool, to create a glove box that not only meets functional criteria but also optimizes cost and manufacturability.Using CATIA's sophisticated design capabilities, the project hopes to shorten the design process, cut production costs, and improve manufacturability, resulting in a cost-effective and manufacturable glove box solution for current vehicles. The project has several stages, including research, conceptualization, design, prototyping, testing, and manufacturing planning, with the goal of striking a balance between functionality, cost, and manufacturability throughout the development process.

Keyword : - *Car glove box, CATIA software, CAD(Computer Aided Design), Cost-effective*

1. INTRODUCTION

The automotive business is constantly evolving, propelled by technological developments and shifting consumer tastes. Within this dynamic context, the design and development of automobile components is critical to improving the entire driving experience. The automotive glove box is one such component that is often disregarded yet is critical to consumer convenience and management. Traditionally, glove boxes operated as simple storage chambers within vehicles, with little utility beyond basic storage. However, as customer expectations change, there is a growing need for glove boxes that not only have enough of storage capacity but also include advanced capabilities to improve security, organization, and user experience.

In answer to this demand, this project will design and create an upgraded automotive glove box utilizing CATIA software. The major goal is to provide a glove box solution that not only meets functional requirements but also maximizes cost-effectiveness and manufacturing feasibility. The project's goal is to streamline the design process, reduce production costs, and improve manufacturability by harnessing the capabilities of CATIA, a strong computer-aided design (CAD) tool.

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2. LITERATURE REVIEW:

From the verified the literature, the summary is as follow:

- Effective pocket mapping requires a multidisciplinary approach that includes material science, engineering, production, and design.
- Designing for different markets requires consideration of their own norms and laws.
- Designers should choose the most appropriate material depending on needs and manufacturing method, considering material properties and attributes.
- Recognizing The process includes concept engineering, details engineering, digital validation, and process definition for production and assembly.
- DFA techniques are utilized in the automotive sector to cut costs by improving design and processes.
- Plastic pieces are assembled using various clipping and clamping methods, as well as joining procedures for different materials.
- Simulations can assist optimize designs and uncover potential flaws before developing real models.

3. PROBLEM IDENTIFICATION AND OBJECTIVES:

3.1. Problem Identification:

Using CATIA V5 for designing glove boxes might be challenging due to their complicated shapes and geometry. The design team may need to apply advanced features like surface modeling and curvature analysis to build a bumper form that fits the

standards.

During development, the glove box design may undergo revisions based on stakeholder feedback or vehicle requirements. Implementing these alterations can be tricky due to potential impact on the glove box's geometry, substance, or performance. The design team must examine how changes to the glove box will affect its performance, manufacturing process, and costs.

Validating and testing the glove box design is crucial for ensuring its usefulness and performance. Real-world simulations, stress assessments, and durability evaluations might reveal design flaws or failure sites.

3.2. : Objectives:

The goal of creating a 3D model of a glove box in CATIA V5 may be to:

- Visualize the glove box design before it is manufactured.
- Assess the design's suitability for manufacturing. To assess the tool's feasibility in the dog house and provide a slider block based on the current condition.
- Communicate the design with stakeholders, including engineers, designers, and manufacturers.
- To design the model for production and tooling feasibility.

3.3. Benefits:

CATIAV5's extensive features for 3D modeling, surface modeling, and parametric design enable precise and rapid creation of complicated geometries. This can assist designers in producing high-quality door mirror mountings that satisfy standards and are efficient to manufacture.

4. METHODOLOGY

4.1 Sequences:

The following sequences illustrates the solution methodology for the design and development of glove box.

- Problem Identification in Styling
- Draft Analysis (w.r.t DRD)
- Checking undercuts and Section Study
- Thickening the Styling Surface
- Features mounting
- Finding Parting Line
- Checking Manufacturing and Tool Feasibility

The techniques above can be utilized to create a glove box design. The procedures involve identifying problems, analyzing drafts, studying undercuts and sections, thickening styling surfaces, mounting features, determining parting lines, and assessing production and tool practicality. These processes are crucial for creating a practical, aesthetically beautiful, and manufacturing-friendly product.

5. DEVELOPMENT PROCESS:

5.1. Steps involved in glove box mounting design:

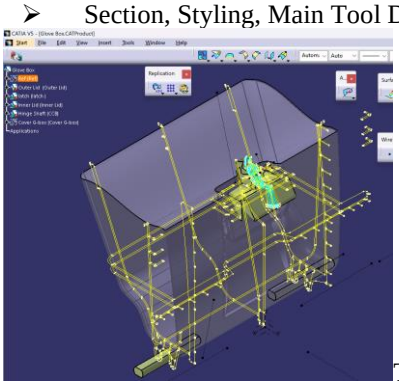
There are some steps to be followed while designing glove box as given below:

- Input of Glove box design with surrounding
- Section, Styling, Main Tool Direction
- Design of Glove box
- Defining the Parting line

- Input of Glove box design with surrounding:

A freehand sketch was used to create the car's glove box mounting before it was turned into a clay model. Using 3D rendering technology, the clay was scanned to produce a digital 3D version of the model. Then, to further refine the data it was imported to CAD software. To ensure simple removal of the core and cavity, the OEM chose the die removal direction based on the styling surface of the glove box mounting.

- Section, Styling, Main Tool Direction

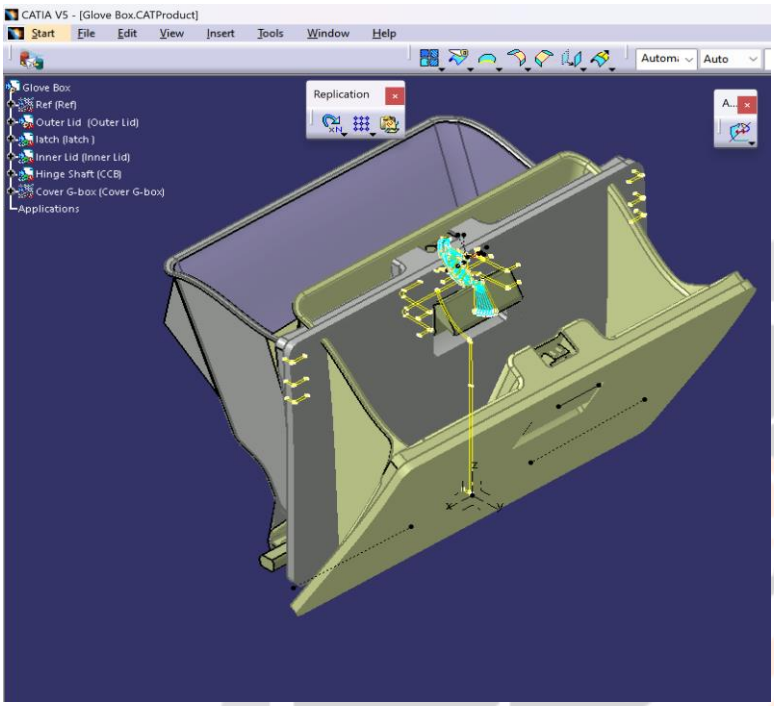


The process being described involves creating a section view of a glove box using a master

section available in styling surface. This allows for a detailed view of the cross sectional shape of the glove box, which includes the sheet metal, plastics, rubbers, is taken into consideration. This method can be useful for modelling and designing the glove box with greater accuracy.

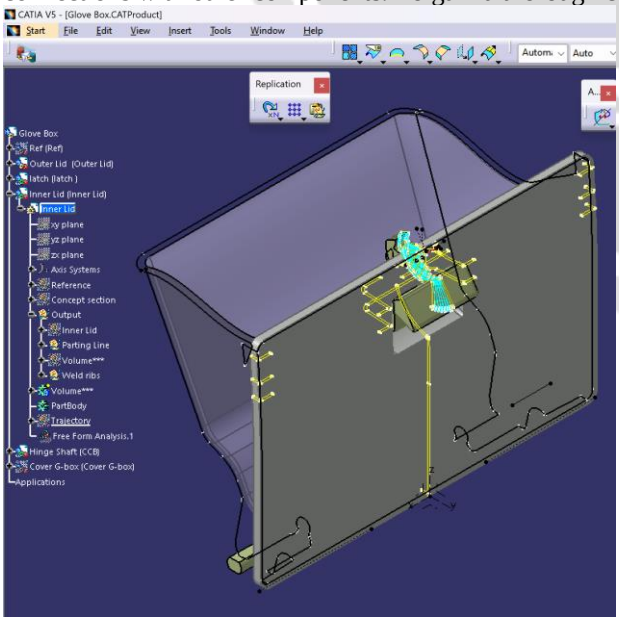
- Design of Glove box:

The glove box is designed with care for its surroundings. The engineering elements of the glove box are developed based on surrounding features and a thorough section investigation, as illustrated in the previous image. Styling must align with the fixed proportions, shape, and orientation of the surrounding features. Modifications to surrounding features require client or OEM approval. Modifying the vehicle's surrounding elements may affect other areas of its design and engineering, requiring careful collaboration and consideration.



- Defining the Parting line:

To build a glove box, a 3D model is constructed by thickening the style surface to around 2.5mm and considering neighboring car components, such as the clip and dog home. Create engineering features such as dog houses, flanges, clip uppers, and clip lowers that should align with surrounding components. The final design of the glove box should ensure secure and leak-proof connections with other components. To gain a thorough cross-sectional view, use the master section on the style surface.



6. MANUFACTURING PROCESS:

Different manufacturing procedures may be used to make glove boxes based on vehicle type and materials. The design is typically generated using CAD software like CATIAV5 R19, and injection molding is the most popular manufacturing procedure.

6.1. Injection molding:

Injection molding is a popular manufacturing process in the automotive industry for producing a wide range of components, from simple brackets to sophisticated interior and exterior pieces. This method has various advantages, including cost-effectiveness, high precision, and efficiency, making it an essential part of automotive component manufacturing. Parts are manufactured by injecting molten material into a mould, allowing it to cool and solidify before ejecting the finished product. This process is commonly utilized in the automotive industry to build various components necessary for vehicle functionality, safety, and aesthetics. This method is noted for its ability to manufacture complicated forms and elaborate designs with high precision and consistency, making it appropriate for many needs of the automotive sector.

Injection molding involves melting plastic pellets and precisely injecting them into a mould cavity to create a finished object. The transformation process starts with selecting the proper thermoplastic or thermosetting material. These materials are often supplied in small pellets or granules based on their qualities such as strength, flexibility, heat resistance, and desired finish.

The injection molding process begins with melting raw materials in the machine. The pellets are put into a hopper at the top of the machine, then fed into a heated barrel. The barrel's rotating screw uses heat and pressure to melt and homogenize the plastic material. The homogenization procedure is crucial for ensuring uniform quality in the end product. Once molten, the screw pushes the plastic into the mould.

The injection molding process relies heavily on the mold, which shapes and structures the final product. Moulds are precision-machined from high-strength materials like steel or aluminum to fit the intended part's size and shape. A mould is made up of two sections, the cavity and core, that come together to form a hollow chamber for injecting molten plastic. Mould design and manufacture require skills in engineering and materials science for exact product reproduction.

Molten plastic is injected into the mould cavity under high pressure and regulated speed. The moulding machine's injection unit uses a hydraulic system to generate pressure ranging from 1,000 to 30,000 psi (pounds per square inch), depending on the material and product needs. The pressure drives the molten plastic into the mould with accuracy. Fine-tuned injection speed and pressure prevent air bubbles and defects in the final product.

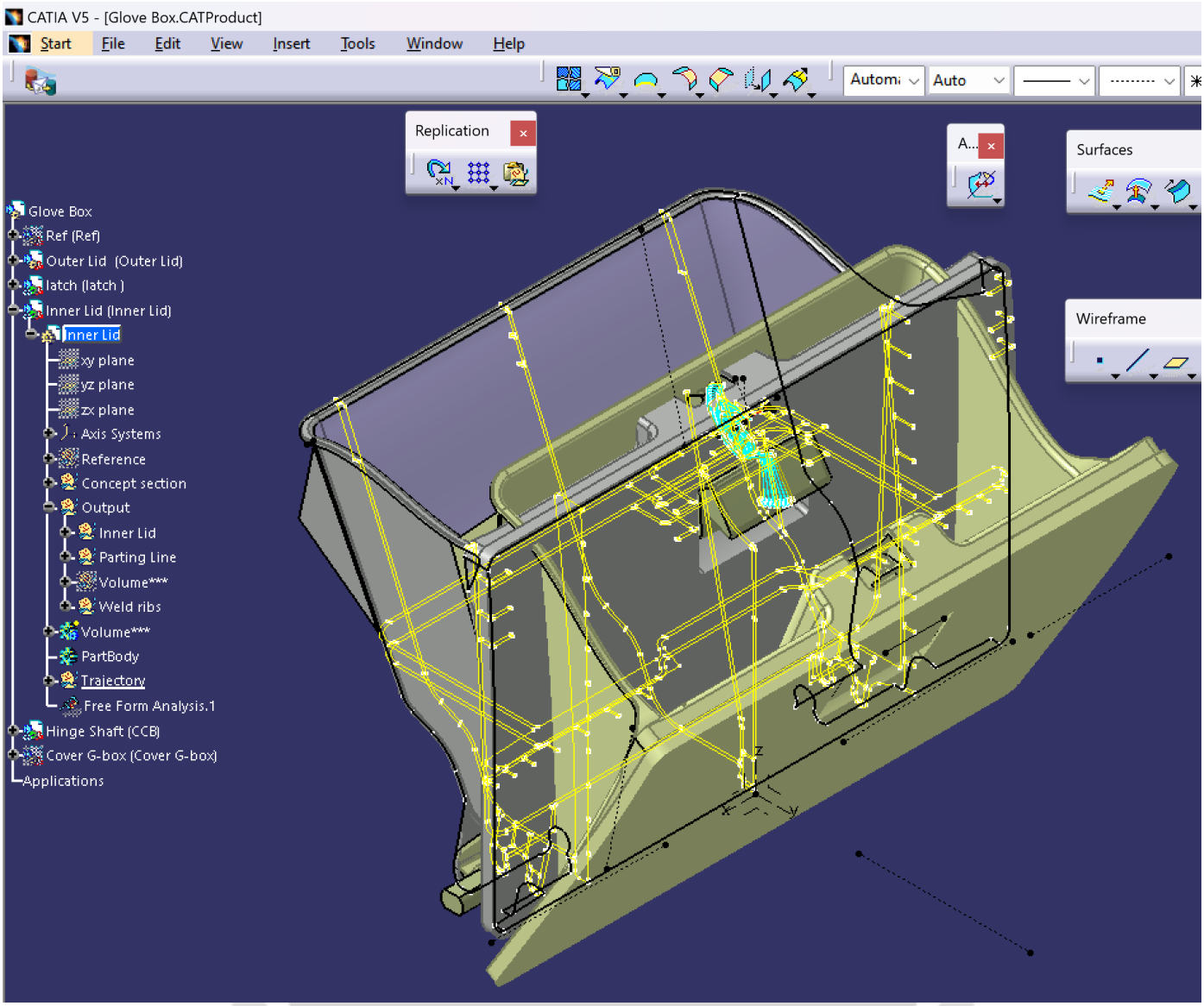
Cooling is the next important step in the injection moulding process. To preserve the correct shape and dimensions, the molten plastic must be quickly cooled and solidified after being injected into the mould cavity. Cooling can be performed by several means, such as circulating coolant through channels or allowing the mould to cool in open air. Cooling methods are chosen based on material and part complexity.

After the plastic has solidified, the mould's two parts are separated to show the newly formed object. Ejector pins or other mechanisms are utilized to remove the item from the mould cavity. At this stage, the product may still need finishing processes like removing extra material, applying surface texturing, or joining several components. Injection moulding is known for its high precision and consistency. It can produce complicated and complex shapes with tight tolerances, making it appropriate for a variety of applications.

The automotive sector benefits from injection molding in a variety of ways. One of the most common applications is the manufacture of interior components such as dashboards, door panels, and center consoles. These parts frequently demand a balance of aesthetics, durability, and functional integration. Injection moulding enables the production of sophisticated textures, finishes, and color variants to improve interior aesthetics, while the materials' robustness provides lifetime even in difficult environments. Injection moulding is a cost-effective and precise procedure for producing mechanical components such as gears, brackets, and clips. Exterior components, such as bumpers, grilles, and mirror housings, are typically created using injection moulding. Additionally, lightweight materials like thermoplastic composites are being employed in car exterior components to minimize weight.

7. CONCLUSION:

Design is vital in the development of a glove box mounting, and it entails several phases to ensure the product's safety, performance, and aesthetics. The design process begins with a thorough grasp of the requirements, which include the intended usage and target market restrictions. These requirements direct the design objectives, restrictions, and performance criteria. Designing a glove box needs a multidisciplinary approach that includes materials science, engineering, production, and design. Designers can construct glove boxes that match market and customer needs while assuring safety and performance by employing a systematic and repeatable design approach. CATIA V5 software provides design tools and functionalities, including 3D modeling capabilities by considering manufacturing feasibility and tooling feasibility.



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