ICE CREAM MAKER AS AN ACCESSORY OF REFRIGERATOR

A PROJECT REPORT

Submitted by

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ABSTRACT:

Here we are doing product development based on refrigeration. The purpose of the project is to develop another accessory for a refrigerator. This product will give the advantage of making ice cream in the refrigerator. The product will attach and detach from the refrigerator to make it more effective. The product's simple working process is a high-speed electric motor, geared at approximately 30 rpm, drives a mechanism that simultaneously rotates the canister, counter-rotates the scraper, and holds the churn paddles stationary. As the canister turns, the ice cream mixture freezes against the inner wall of the canister.

CHAPTER 1

INTRODUCTION

.A domestic ice cream maker is a machine used to make small quantities of ice cream for personal consumption. Ice cream makers may prepare the mixture by employing an electric motor. The resulting preparation is often chilled through either pre-cooling the machine or by employing a machine that freezes the mixture.

An ice cream maker has to simultaneously freeze the mixture while churning it so as to aerate the mixture and avoid ice crystals. As a result, most ice creams are ready to consume immediately. However, those containing alcohol must often be chilled further to attain a firm consistency.

Some machines, such as certain lower-priced countertop models, do require that the resulting mixture be frozen for additional time after churning is completed.

1.1 ICE CREAM MAKER:

There are four types of electric ice cream machines. Each has an electric motor that drives the bowl or the paddle to stir the mixture. The major difference between the four is how the cooling is performed.

Small freezer-unit machines sit inside the freezer (or the freezer part of the refrigerator) and operate similar to a food processor in slow-motion. Every few seconds, the paddles stir the mixture to prevent formation of large ice crystals. When the ice cream sufficiently freezes, the paddles automatically stop rotating and lift. Since the mixture is cooled in the freezer, it takes longer to freeze than other ice cream makers, which work by placing the ice cream bowl in direct contact with the cooling element. A high-speed electric motor, geared at approximately 30 rpm, drives a mechanism that simultaneously rotates the canister, counter-rotates the scraper, and holds the churn paddles stationary. As the canister turns, the ice cream mixture freezes against the inner wall of the canister.

1.2 CHARACTERISTICS OF PLA FILAMENT:

Polylactic Acid, commonly known as PLA, is one of the most popular materials used in desktop 3D printing. It is the default filament of choice for most extrusion-based 3D printers because it can be printed at a low temperature and does not require a heated bed.

PLA 3D Printing Material Properties & Technical Specifications:

- Flexural Strength: 88.8 MPa
- Melting Temperature: >155°C
- Tensile Strength: 61.5MPa
- Heat Deflection: n/a
- Heat Resistance: 110°C
- Impact Strength: 30.8[kJ/m²]
- Elongation at Break: 6%
- Standard Tolerance: +/-0.05mm
- Minimum Wall Thickness: 0.0197mm-0.5 mm
- Extruded Temperature: 160°C-220°C
- Shore Hardness :85A
- PLA Density: 1.25 g/cm^3
- Thermal Conductivity: 0.13 W/m-K

1.3 USES OF 3D PRINTER:

The Creality Ender 3 V2 has many modern features while keeping within a budget price range. They're very affordable and offer excellent print quality. With a 220 x 220 x 250 mm print volume, they're still large enough to print models and small parts, and won't take up too much space on a desk.

Designers use 3D printers to quickly create product models and prototypes, but they're increasingly being used to make final products, as well. Among the items made with 3D printers are shoe designs, furniture, wax castings for making jewellery, tools, tripods, gift and novelty items, and toys.

[Fig 1.1] Ender 3 V2.

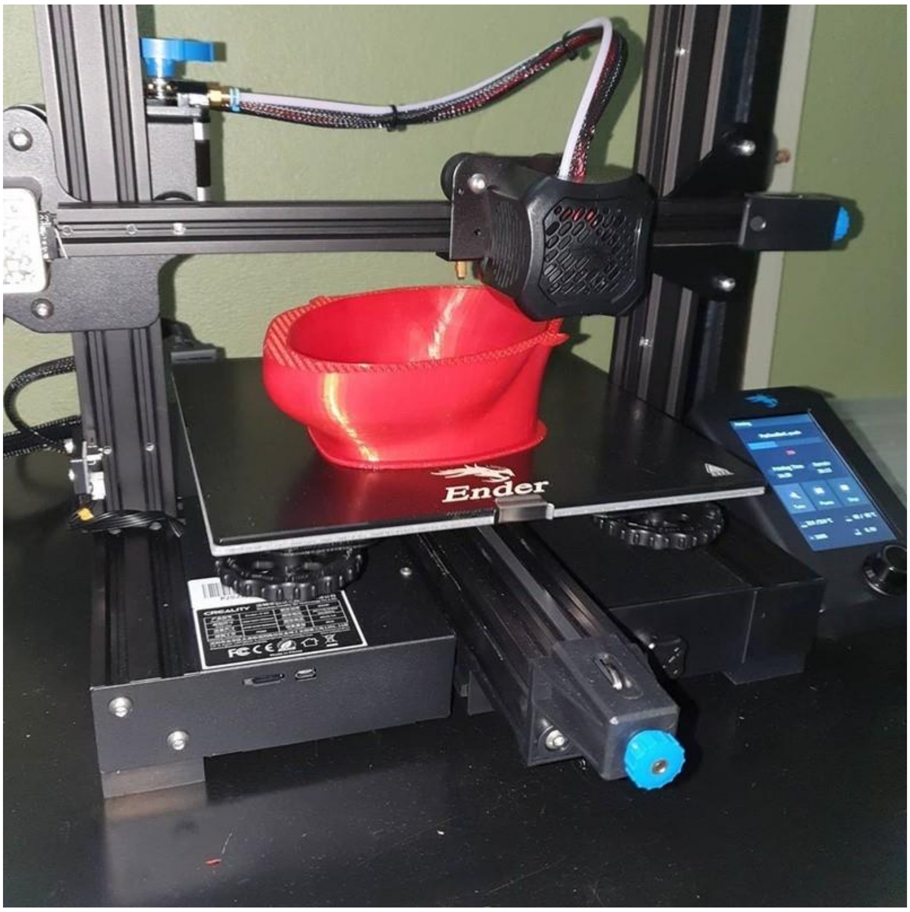
Rapid prototyping: 3D printers are widely used in the manufacturing industry for creating prototypes of products before they are mass-produced. This allows designers and engineers to quickly test and refine their designs, saving time and money. Medical applications: 3D printers are used to create custom prosthetics, implants, and surgical models. They are also used to print replicas of organs for pre-surgical planning and training.Architecture and construction: 3D printers can be used to create models of buildings, bridges, and other structures, allowing architects and engineers to test designs before construction begins. Education: 3D printers are increasingly being used in schools and universities to teach students about design, engineering, and manufacturing. Jewelry making: 3D printers are used to create intricate and detailed jewelry designs that would be difficult or impossible to make by hand. Art and sculpture: 3D printers are used by artists and sculptors to create unique and complex works of art. Aerospace industry: 3D printers are used to create lightweight parts for aircraft and spacecraft, reducing weight and increasing fuel efficiency. Automotive industry: 3D printers are used to create prototypes of car parts, as well as customized parts for high-performance vehicles. Food industry: 3D printers can be used to create custom-shaped food items, such as chocolate sculptures or intricate cake decorations. Consumer products: 3D printers can be used to create customized phone cases, jewelry, toys, and other consumer products.

[Fig 1.2]

The Ender 3 V2 is a popular 3D printer manufactured by Creality, known for its affordability and reliability. It is an upgraded version of the original Ender 3 printer and offers several improvements and new features. Here are some key details about the Ender 3 V2:

- Design and Build: The Ender 3 V2 features a sturdy frame made of aluminum extrusions, providing stability and durability. It has a build volume of 220mm x 220mm x 250mm, allowing you to print moderately sized objects. The printer has an open-frame design, which makes it easy to access and observe the printing process.
- Print Technology: The Ender 3 V2 utilizes Fused Deposition Modeling (FDM) technology, which is a common and popular method for 3D printing. FDM involves melting a filament and depositing it layer by layer to create the desired object.
- User Interface: The printer is equipped with a 4.3-inch color touchscreen display located on the front, making it easy to navigate and control various settings. The user interface provides intuitive control over print parameters, bed leveling, filament loading, and more.
- Bed Leveling: The Ender 3 V2 features an improved and upgraded bed leveling system compared to the original Ender 3. It has a manual bed leveling process but includes a convenient assisted leveling feature using a built-in leveling probe. This helps to ensure a level and consistent print bed for better print quality.
- Filament Compatibility: The Ender 3 V2 supports a wide range of filament materials, including PLA (polylactic acid), ABS (acrylonitrile butadiene styrene), PETG (polyethylene terephthalate glycol-modified), TPU (thermoplastic polyurethane), and more. It has a standard 1.75mm filament diameter, allowing you to use filaments from various manufacturers.
- Connectivity and SD Card Support: The printer offers multiple connectivity options. It can be connected to a computer via a USB cable for direct printing or controlled using a slicer software. Additionally, it supports offline printing through an included microSD card and has a built-in microSD card slot for easy file transfer.

- Upgradability: The Ender 3 V2 has a modular design that allows for easy upgrades and modifications. Creality and the 3D printing community provide numerous printable upgrades and enhancements that can be installed to enhance the printer's performance and capabilities.
- Safety Features: The Ender 3 V2 includes certain safety features, such as thermal runaway protection, which helps prevent accidents caused by overheating. It also has a resume printing function that allows the printer to resume printing from where it left off in case of power outages.
- The Ender 3 V2 is well-regarded among hobbyists, enthusiasts, and beginners due to its affordability, ease of use, and the large community support it enjoys. As with any 3D printer, it's essential to follow the manufacturer's instructions, maintain proper safety precautions, and experiment with different settings and materials to achieve the best results.



[Fig 1.3]

CHAPTER 2

LITERATURE REVIEW

2.1 HISTORY OF ICE CREAM MAKER:

If ice cream has been around for hundreds of years, around the 1800s it was a very inaccessible luxury item. It was in 1846 that the American Nancy Johnson developed the very first ice cream maker. It works with a crank and coarse salt. It is the very first device which will make it possible to democratize the ice cream, and to make it taste to the general public… but quickly! Because yes, it is for the moment still impossible to keep this ice cream in time**.**

It is in this sealed seal which contains blocks of ice and salt that we rotate a metal bowl containing the cream or sorbet. The transformation into ice cream or sorbet lasts about 30 minutes. This model, still widely used in Guadeloupe and Martinique, therefore quickly takes the name of "West Indian ice cream maker".

[Fig 1.4], Hand Cranked Ice Cream Maker.

In 1843, **Nancy M.** (Donaldson) Johnson of Philadelphia received the first U.S. patent for a small-scale hand-cranked ice cream freezer. The ice cream freezer was a pewter cylinder Dubbed the "Queen of Ices", Victorian

English culinary entrepreneur Agnes Marshall was granted a patent for an ice cream machine that could freeze a pint of ice cream in five whole minutes.

2.2 PROJECTS ON ICE CREAM MAKER:

Nancy Johnson, an American inventor born in 1795, revolutionized the ice cream industry with her invention in 1843. She created the first hand-cranked ice cream freezer, significantly reducing the labor and time required to produce ice cream. Her wooden machine allowed for large-scale production and the possibility of multiple flavors. Although she sold her invention at a low price, Nancy Johnson's contribution transformed the industry, enabling entrepreneurs to start their own ice cream businesses. Her innovation paved the way for future advancements in ice cream making, leaving a lasting impact on the field and inspiring aspiring inventors and entrepreneurs.

1. Nancy Johnson - Invented the first hand-cranked ice cream maker in 1843.

2. Jacob Fussell - Established the first commercial ice cream factory in Baltimore in 1851.

3. Agnes Marshall - Invented the first edible ice cream cone in 1888.

4. Clarence Vogt - Invented the continuous-process ice cream freezer in 1926.

5. Tom Carvel - Invented soft-serve ice cream in 1934 and founded Carvel Ice Cream.

These inventors have paved the way for modern-day ice cream makers and have contributed greatly to the evolution of the industry.

An ice cream maker is a kitchen appliance used to make homemade ice cream. It consists of a motorized base that rotates a mixing bowl and a paddle, which churns the ice cream mixture as it freezes. There are several types of ice cream makers available in the market, each with its own unique features and benefits.

1. Manual Ice Cream Maker: This type of ice cream maker requires manual labor to churn the ice cream mixture. It consists of a hand-cranked mechanism that rotates the mixing bowl and the paddle. Manual ice cream makers are affordable and easy to use, but they require more effort and time to churn the mixture.

2. Electric Ice Cream Maker: This type of ice cream maker uses an electric motor to rotate the mixing bowl and the paddle. Electric ice cream makers are faster and more convenient than manual ones, but they are also more expensive. They come in various sizes, ranging from small countertop models to large commercial machines.

3. Compressor Ice Cream Maker: This type of ice cream maker has a built-in compressor that freezes the mixture as it churns. It eliminates the need for pre-freezing the mixing bowl, making it faster and more convenient than other types of ice cream makers. Compressor ice cream makers are more expensive than other models, but they offer professional-quality results.

4. Soft Serve Ice Cream Maker: This type of ice cream maker is designed to produce soft-serve ice cream, which has a smooth and creamy texture. Soft serve ice cream makers use a special mixing paddle that incorporates air into the mixture as it churns. They are popular in commercial settings such as ice cream shops and restaurants.

5. Gelato Maker: This type of ice cream maker is specifically designed to make gelato, an Italian-style frozen dessert that is denser and richer than traditional ice cream. Gelato makers use a slower churning process and a lower freezing temperature to create a smoother and creamier texture.

In conclusion, there are several types of ice cream makers available in the market, each with its own unique features and benefits. Whether you prefer manual or electric, soft serve or gelato, there is an ice cream maker out there that can meet your needs and help you create delicious homemade frozen desserts.

[Fig 1.5], Modern Ice Cream Maker.

1. **Manual ice cream maker:**

When using a manual ice cream maker, remember to pre-freeze the canister, chill the mixture before pouring it in, and follow the manufacturer's instructions. Turn the crank or paddle consistently to achieve even freezing and monitor the consistency. Once done, transfer the ice cream to a container and store it properly. Enjoy the process and savor your homemade ice cream!

[Fig 1.6], Manual Ice Cream Maker.

2. Electrical ice cream maker:

When using an electric ice cream maker, follow these steps for delicious homemade ice cream: Pre-freeze the canister: Ensure that the canister is properly frozen according to the manufacturer's instructions before starting. Prepare the mixture: Combine your desired ingredients for the ice cream base, whether it's a custard-based recipe or a no-egg Philadelphia-style mixture. Chill the mixture in the refrigerator before using. Assembly: Attach the frozen canister to the electric motor unit and ensure it is securely in place. Pour and churn: Pour the chilled mixture into the canister and turn on the machine. Let it churn for the recommended time, usually around 20-30 minutes, or until the desired consistency is reached. Add mix-ins (optional): If you want to incorporate any mix-ins like chocolate chips, nuts, or fruit, add them towards the end of the churning process, following the manufacturer's instructions. Serve or store: Once churned, transfer the freshly made ice cream to a container and place it in the freezer to firm up further if desired. Remember to cover the container tightly to prevent ice crystals.

[Fig 1.7], Electrical Ice Cream Maker.

3. **Compressor ice cream maker:**

Preparation: Unlike other types of ice cream makers, compressor models don't require pre-freezing of the canister. Simply ensure that the machine is properly set up, plugged in, and ready for use. Mixture preparation: Prepare your desired ice cream mixture, whether it's a custard-based recipe or a simpler Philadelphia-style blend. Chill the mixture in the refrigerator before using. Churning: Pour the chilled mixture into the ice cream maker's bowl and close the lid securely. Set the desired settings or program on the machine, such as churning time or specific ice cream consistency. The built-in compressor will simultaneously freeze and churn the mixture to the desired texture. Mix-ins (optional): If you want to add any mix-ins, such as chocolate chips or cookie crumbles, incorporate them into the ice cream mixture towards the end of the churning process, following the manufacturer's instructions. Serving or storing: Once the ice cream reaches the desired consistency, you can serve it immediately or transfer it to a separate container for storage in the freezer. Make sure to cover the container tightly to prevent freezer burn. Enjoy: Scoop and savor the freshly made, creamy ice cream produced by your compressor ice cream maker.

[Fig 1.8], Compressor Ice Cream Maker.

Soft serve ice cream machine:

A soft serve ice cream machine is a popular appliance used to make and dispense soft, creamy ice cream. It is designed to produce a smooth and velvety texture that is softer than traditional hard ice cream. The machine combines and freezes a mixture of ice cream base ingredients, such as milk, sugar, and flavorings, while simultaneously incorporating air to create a light and airy consistency. Soft serve ice cream machines typically consist of a freezing cylinder, a motor, and a dispensing mechanism. The freezing cylinder is where the ice cream mix is chilled and agitated, while the motor provides the necessary power to rotate the cylinder and mix the ingredients. The dispensing mechanism allows the ice cream to be served directly into cones or cups, making it convenient for both customers and operators. These machines are commonly found in various food establishments, including ice cream shops, fast-food restaurants, and dessert bars. They offer a quick and efficient way to produce and serve large quantities of soft serve ice cream to customers.

[Fig 1.9], Soft Serve Ice Cream Machine.

Gelato ice cream maker:

A gelato machine is a specialized appliance used to make and serve gelato, a popular Italian frozen dessert. Gelato is known for its dense and creamy texture, intense flavors, and lower fat content compared to traditional ice cream. A gelato machine is designed to churn and freeze the gelato mixture to achieve the desired consistency and smoothness. Gelato machines typically consist of a freezing chamber, a motor, and a paddle or dasher. The freezing chamber is where the gelato mixture is cooled and churned, ensuring even freezing and minimal ice crystal formation. The motor powers the paddle or dasher, which continuously mixes the gelato while it freezes. This constant movement helps create a creamy texture and prevents the formation of large ice crystals. One of the key features of a gelato machine is its ability to maintain a lower temperature than standard ice cream makers. Gelato is typically served at a slightly warmer temperature than ice cream, allowing it to be softer and more pliable. The gelato machine's freezing chamber is specifically designed to accommodate this lower temperature requirement, ensuring that the gelato is churned and frozen to perfection. Gelato machines are commonly used in gelaterias, dessert shops, cafes, and restaurants that offer gelato as part of their menu. They provide an efficient and consistent way to produce high-quality gelato with the desired texture and flavour.

[Fig 1.10], Gelato Ice Cream Maker.

Commercial ice cream machine:

A commercial ice cream machine is a robust and efficient appliance designed specifically for the production of ice cream in commercial settings. It is commonly used in ice cream parlors, restaurants, cafes, and other establishments that serve ice cream to a large number of customers. Commercial ice cream machines are designed to handle high volumes of ice cream production and provide consistent results. They typically have larger capacities, allowing for the production of large quantities of ice cream in a relatively short period. These machines come in various sizes and configurations, including countertop models and larger floor-standing models, depending on the specific needs of the business. There are two main types of commercial ice cream machines: batch freezers and continuous freezers. Batch freezers are used for small-batch production, where the ice cream mixture is poured into the machine, frozen, and then removed once the batch is complete. They offer versatility in producing different flavors and allow for creative customization. Continuous freezers, on the other hand, are designed for high-volume production.

[Fig 1.11], Commercial Ice Cream Machine.

CHAPTER 3

DESIGNING & MODELING

3.1 CREO PARAMETRIC:

Creo is a 3D CAD software developed by PTC (Parametric Technology Corporation) that allows designers and engineers to create, simulate, and analyze complex product designs. Creo offers a wide range of tools and features for 3D modeling, parametric design, simulation, rendering, and animation.

[Fig 1.12] Creo Parametric.

Some Of The Uses Of Creo Include:

- Product design: Creo is widely used in the manufacturing industry for creating product designs, from simple components to complex assemblies.
- Simulation and analysis: Creo offers advanced simulation and analysis tools that allow designers and engineers to test and optimize their designs before they are manufactured.

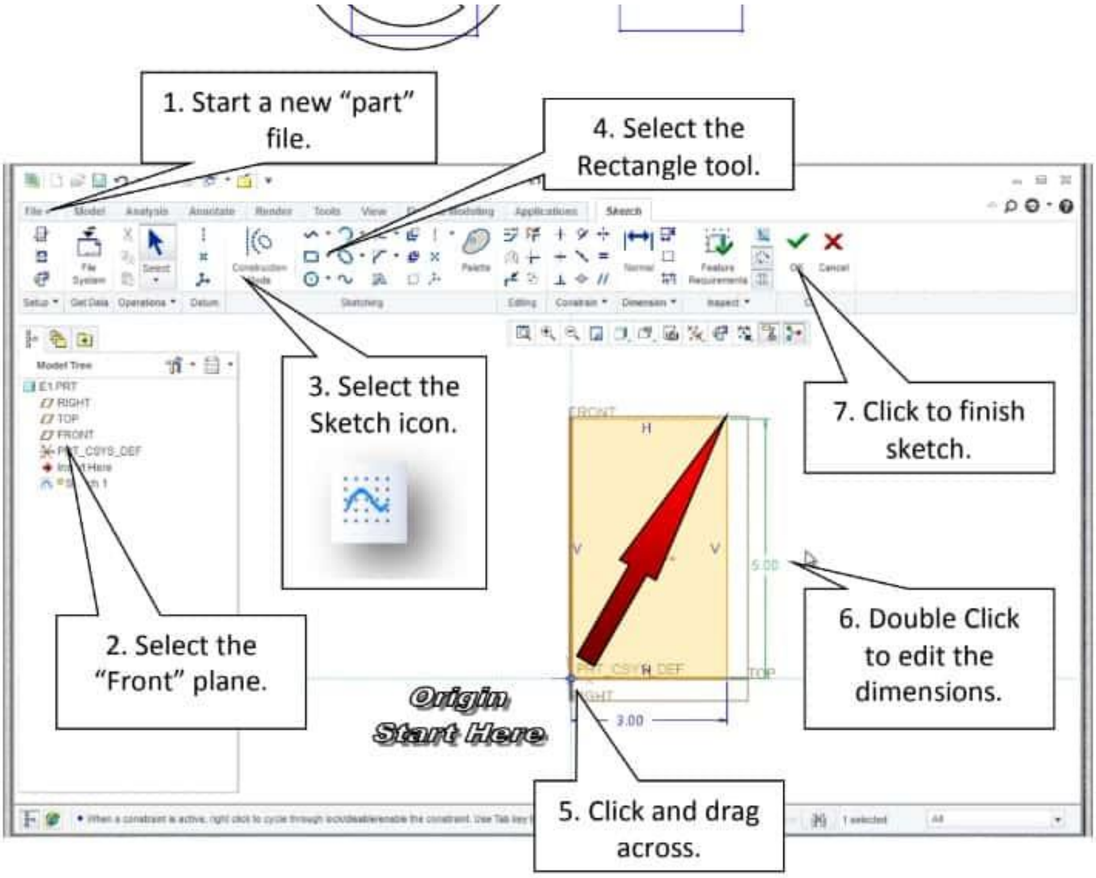
- Additive manufacturing: Creo supports 3D printing and other additive manufacturing processes, allowing designers to create complex parts that would be difficult or impossible to produce using traditional manufacturing methods.
- Collaboration and data management: Creo offers collaboration and data management tools that allow multiple users to work on a project simultaneously and manage design data throughout the product lifecycle.
- Industrial design: Creo offers tools for industrial design, allowing designers to create aesthetically pleasing and ergonomic product designs.
- Sheet metal design: Creo offers specialized tools for sheet metal design, allowing designers to create complex sheet metal parts and assemblies.
- Mold design: Creo offers tools for mold design, allowing designers to create molds for injection molding, blow molding, and other manufacturing processes.
- Electrical design: Creo offers tools for electrical design, allowing designers to create schematics, wiring diagrams, and other electrical designs.

Creo is a 3D CAD software that was developed by PTC (Parametric Technology Corporation). It is a powerful tool that allows designers and engineers to create, simulate, and analyze complex product designs. Creo offers a wide range of tools and features for 3D modeling, parametric design, simulation, rendering, and animation.

Some of the key features of Creo include its ability to support 3D printing and other additive manufacturing processes, its advanced simulation and analysis tools, and its collaboration and data management capabilities. Creo also offers specialized tools for sheet metal design, mold design, and electrical design.

Creo is widely used in the manufacturing industry for creating product designs, from simple components to complex assemblies. It is also used for industrial design, allowing designers to create aesthetically pleasing and ergonomic product designs. Creo offers a user-friendly interface and is compatible with a wide range of file formats, making it easy to integrate into existing workflows.

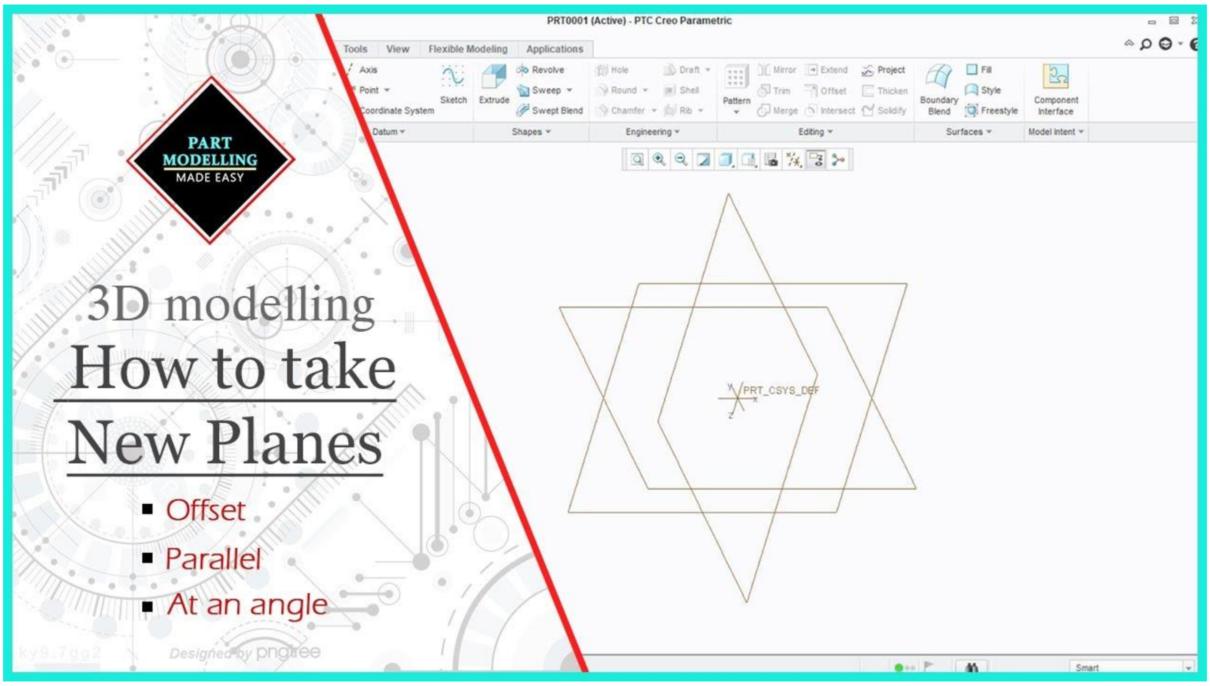
Overall, Creo is a powerful 3D CAD software that offers a wide range of tools and features for product design, simulation, and analysis. Its ease of use and compatibility with existing workflows make it a popular choice among designers and engineers in the manufacturing industry.



[Fig 1.13]

Creo Parametric is one of the most powerful Computer-Aided Design (CAD), Computer-Aided Analysis and Computer-Aided Manufacture (CAM) software packages available in the world today. It is the flagship of a family of other software products, developed by PTC Corporation, for engineering design and product development, also including Creo Direct, Creo

Simulate, Creo Layout and others. The main applications are in mechanical, product design, aerospace, construction, shipbuilding and other industries. Creo Parametric (or Creo) was previously known as Pro/Engineer and Wildfire. The core of the software contains a variety of tools for the creation, validation and communication of complex three-dimensional (3D) objects as parts and assemblies.



[Fig 1.14]

In addition, there are integrated applications that associate directly with the 3D model geometry and support the development of engineering drawings, mould design, NC machine simulation, sheet metal design, piping and wiring, harness design, structural strength, thermal and CFD analyses, kinematic and dynamic analyses, feasibility and optimisation studies, and others.

This long list of applications is not meant to scare the user but only to illustrate the vast scope and complexity of a modern CAD/CAM package. The main purpose of this textbook is to explain the main CAD/CAM methodology and principles embedded in the software.

The book is organised as a set of core lessons that provide a quick start and guide the reader in the process of mastering the basics of 3D CAD modelling. 2 CAD/CAM with Creo Parametric The authors believe that if the reader learns the use of Creo, he/she would be able to master any CAD/CAM software with little effort and time.

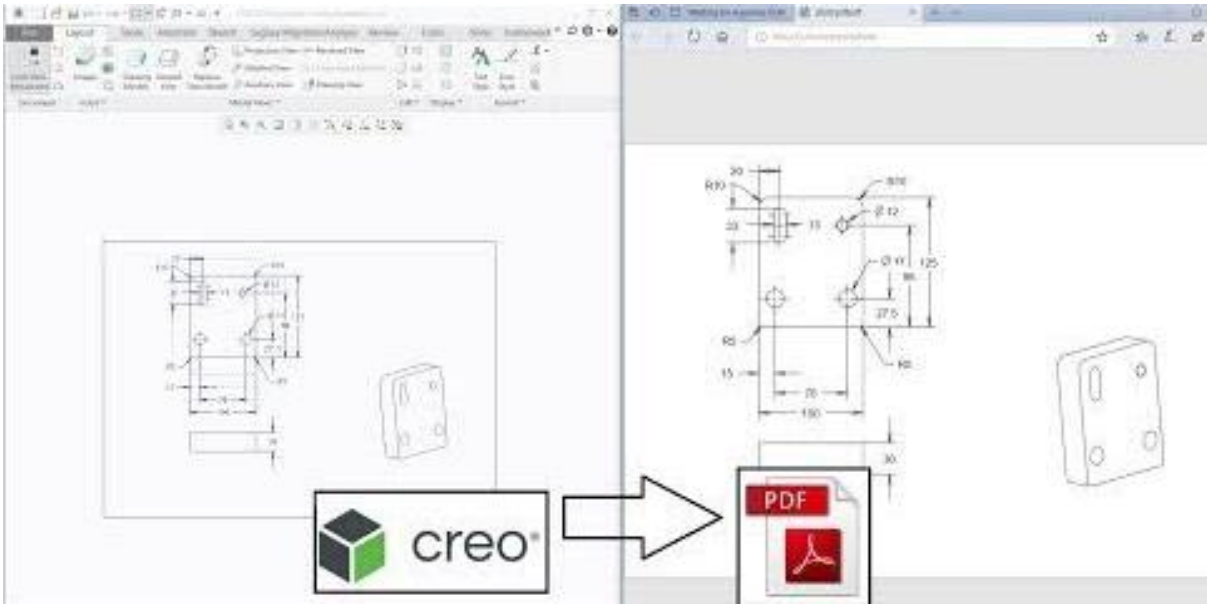
This is because the 3D modelling philosophy and core principles embedded in these systems, for example SolidWorksTM, Autodesk InventorTM and Siemens NXTM, are very similar to those embedded in Creo. The book provides ten lessons that will teach you how to create the Basic Solid Part and Assembly, Mould Design, NC Simulation and Drawings.

The feature-based parametric modeling technique enables the designer to incorporate the original design intent into the construction of the model. The word parametric means the geometric definitions of the design, such as dimensions, can be varied at any time in the design process.

Parametric modeling is accomplished by identifying and creating the key features of the design with the aid of computer software. The design variables, described in the sketches and features, can be used to quickly modify/update the design. In Creo Parametric, the parametric part modeling process involves the following

- Set up Units and Basic Datum Geometry.
- Determine the type of the base feature, the first solid feature, of the design. Note that Extrude, Revolve, or Sweep operations are the most common types of base features.

- Create a rough two-dimensional sketch of the basic shape of the base feature of the design.
- Apply/modify constraints and dimensions to the two-dimensional sketch.
- Transform the two-dimensional parametric sketch into a 3D feature.
- Add additional parametric features by identifying feature relations and complete the design.
- Perform analyses/simulations, such as finite element analysis (FEA) or cutter path generation (CNC), on the computer model and refine the design as needed.
- Document the design by creating the desired 2D/3D drawings. The approach of creating three-dimensional features using two-dimensional sketches is an effective way to construct solid models.

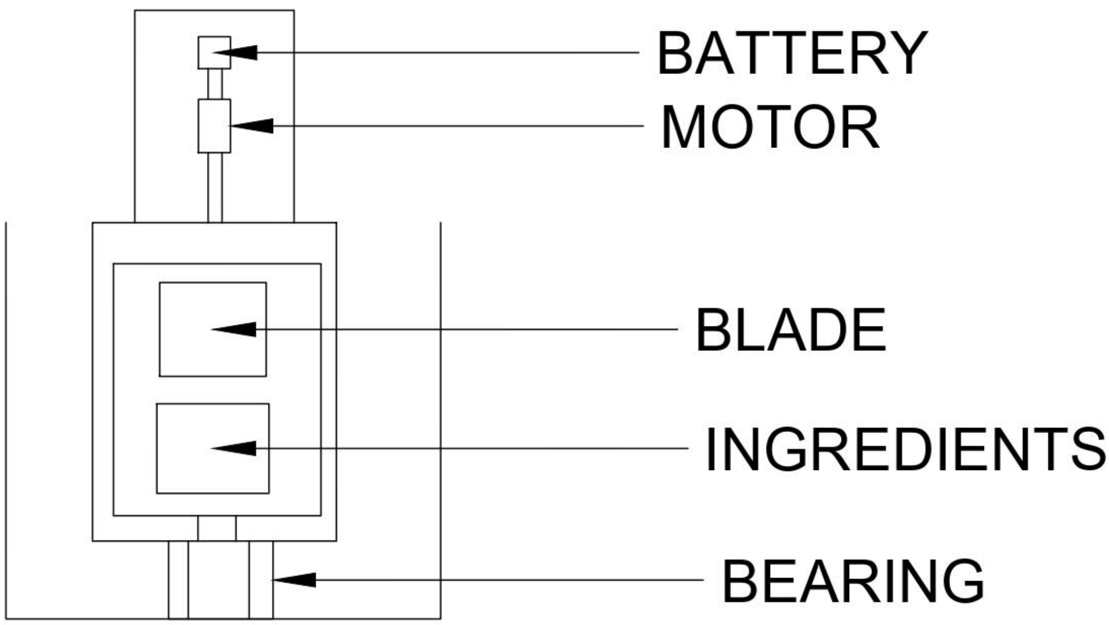


[Fig 1.15]

Note that Creo Parametric provides many powerful modeling and design tools, and there are many different approaches to accomplish modeling tasks. The basic principle of feature-based modeling is to build models by adding simple features one at a time. In this chapter, a very simple solid model with extruded features is used to introduce the general feature-based parametric modeling procedure.

3.2 2D MODEL DIAGRAMS:

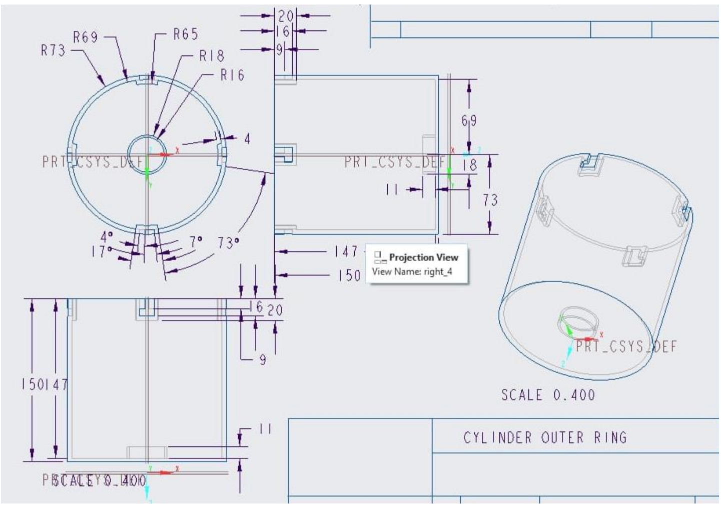
A diagram in 2D modeling for ice cream maker is a simple sketch , hand-drawn or computer-generated representation of an object or system, typically created quickly and without great detail. It may include basic shapes, lines, and labels to convey the general layout or structure of the object or system. diagrams are often used as a starting point for more detailed designs or as a way to communicate ideas quickly and informally.



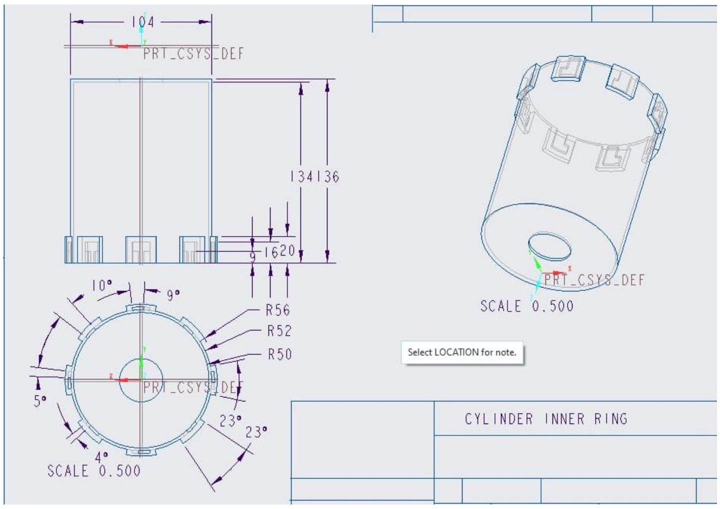
[Fig 1.16], 2D Model Diagrams.

3.3 2D DRAFTING:

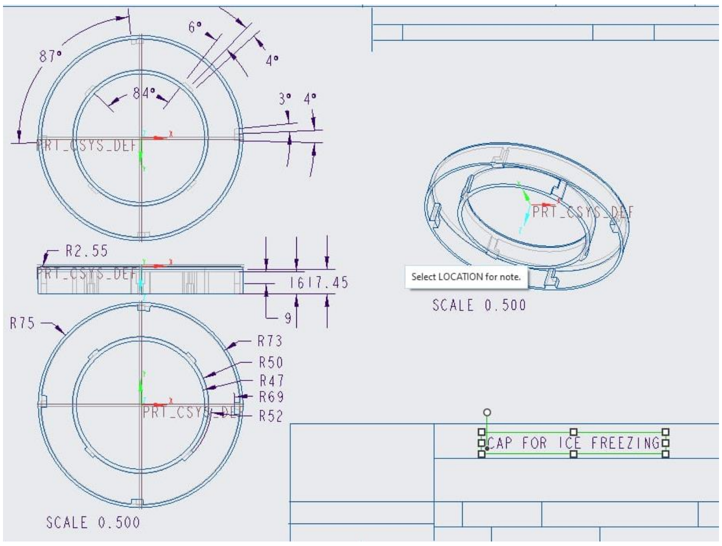
The 2D drafting of the product development brief for the ice cream maker provides detailed information about the product's design and specifications. It includes dimensions, materials, features, annotations, and specialized views to ensure that the product meets all requirements and specifications. The drafting is an essential part of the product development process and is used by engineers, designers, and manufacturers to ensure that the product is manufactured to the highest standards.



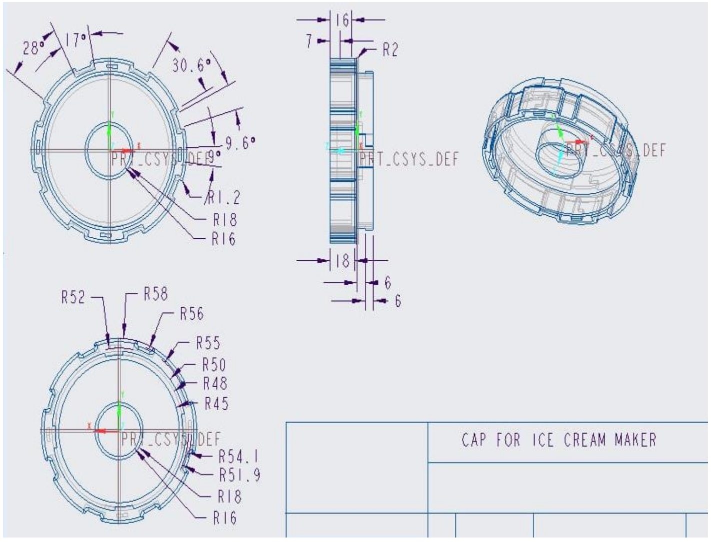
[Fig 1.17], Outer Cylinder.



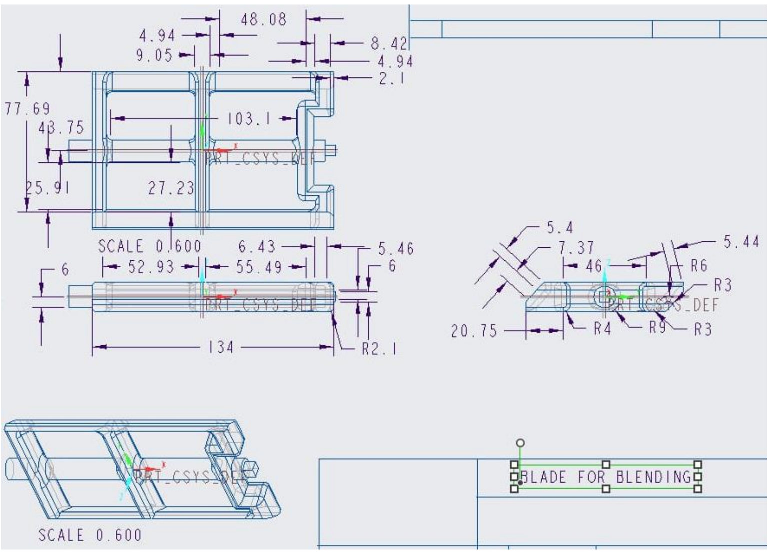
[Fig 1.18], Inner Cylinder.



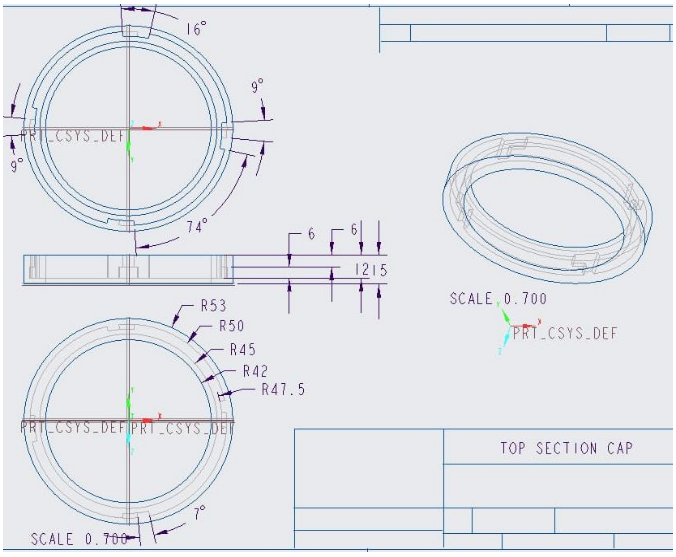
[Fig 1.19], Cap1.



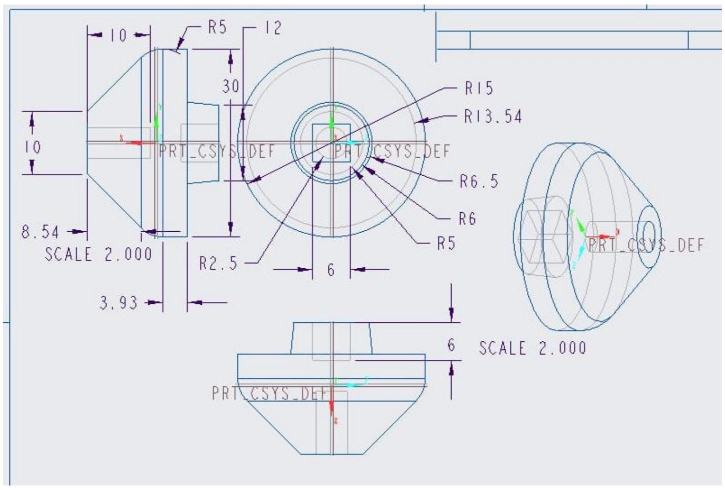
[Fig 1.20], Cap2.



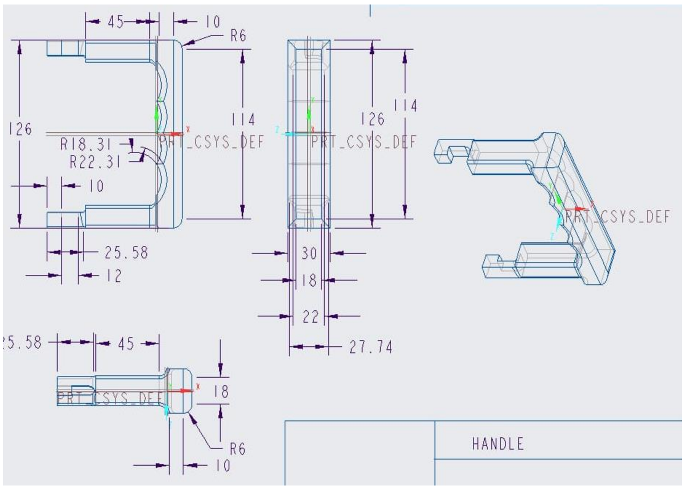
[Fig 1.21], Blade.



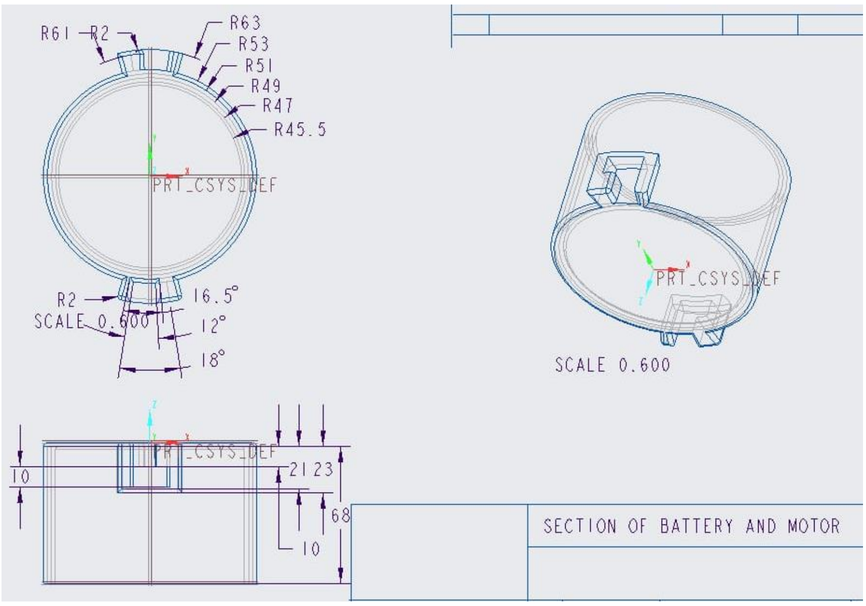
[Fig 1.22], Top Section Cap.



[Fig 1.23], Hub.



[Fig 1.24], Handle.



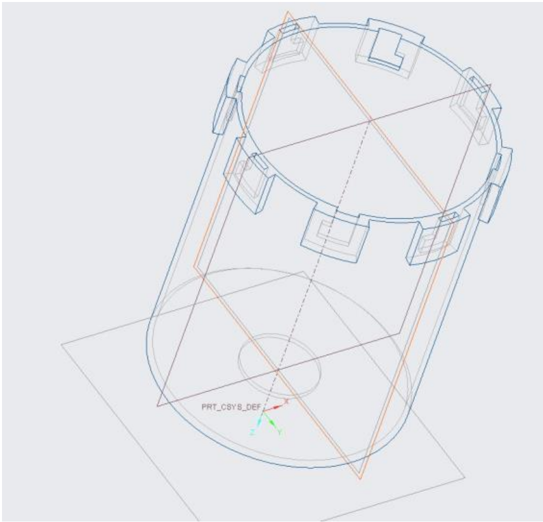
[Fig 1.25], Moter And Battery Section.

3.4 3D MODEL & ASSEMBLY:

i) 3D MODEL:

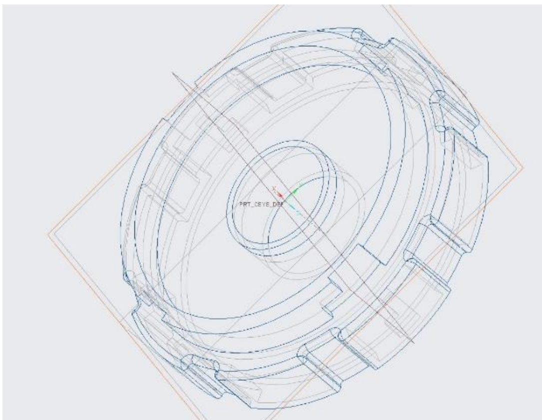
3D modeling of ice cream maker is the process of creating a digital representation of a physical object using specialized software. This technology is used in various industries such as manufacturing, automotive, aerospace, and healthcare, among others. The 3D model can be used for prototyping, testing, and visualization purposes. It allows designers and engineers to create and modify designs quickly and efficiently, reducing the time and cost of product development. 3D modeling also enables better collaboration between team members and stakeholders, as everyone can view and provide feedback on the same digital model. Overall, product development 3D modeling is a powerful tool that can help businesses bring their ideas to life faster and more effectively.

[Fig 1.26], 3D Outer Cylinder.

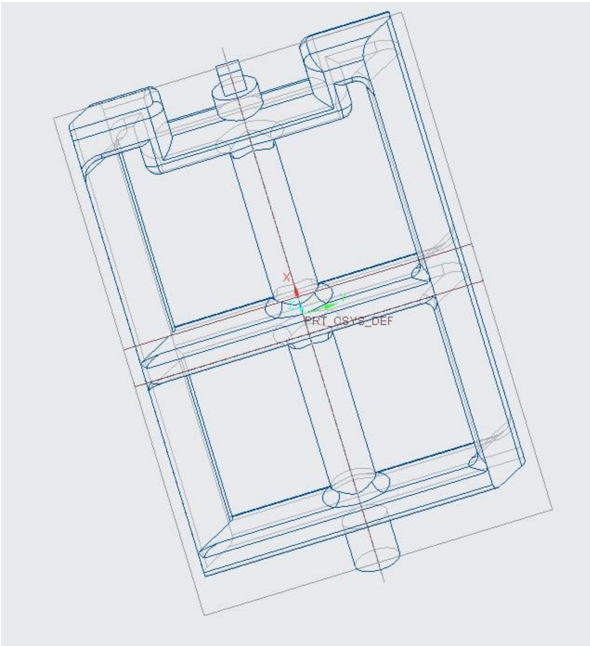


[Fig 1.27], 3DInner Cylinder.

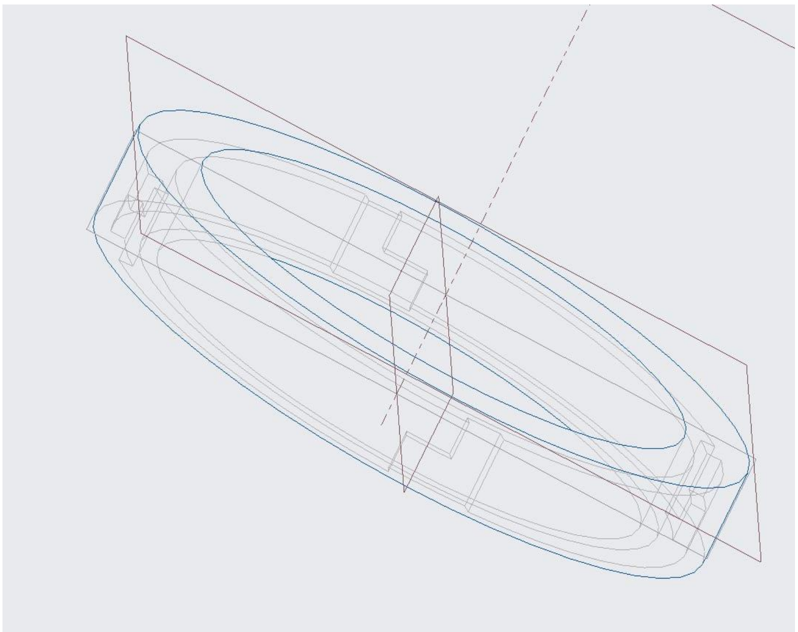
[Fig 1.28], 3D Cap1.



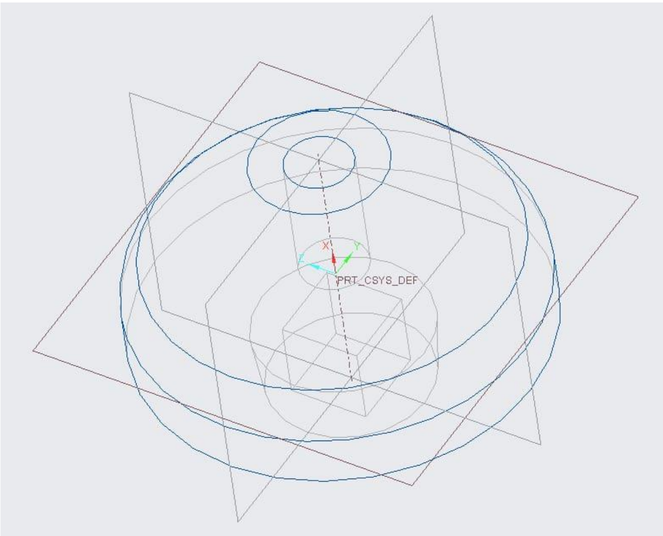
[Fig 1.29], 3D Cap2.



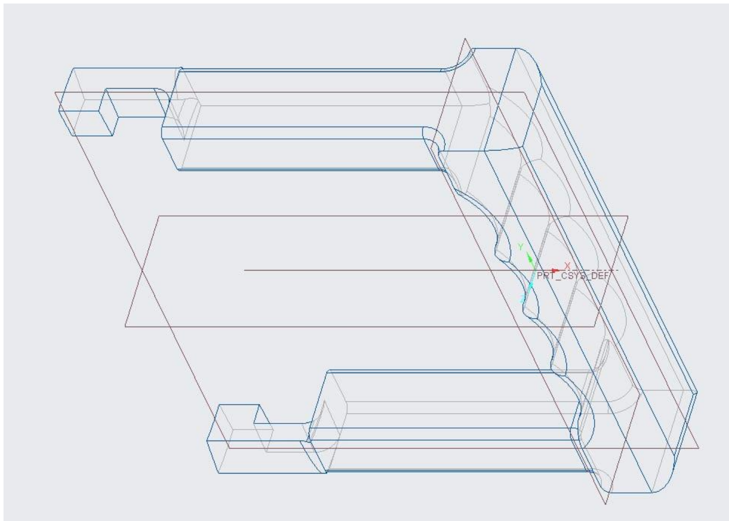
[Fig 1.30], 3D Blade.



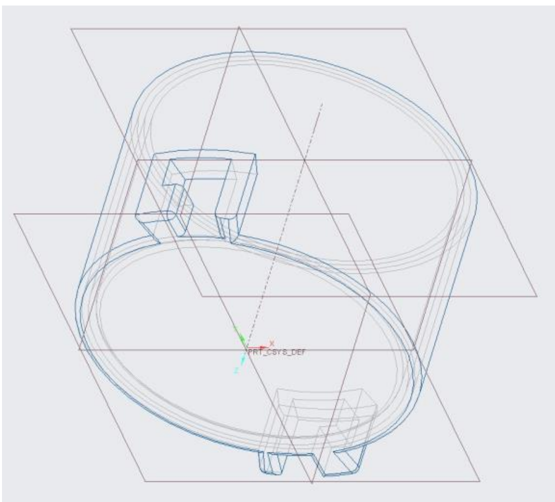
[Fig 1.31], 3D Top Section Cap.



[Fig 1.32], 3D Hub.



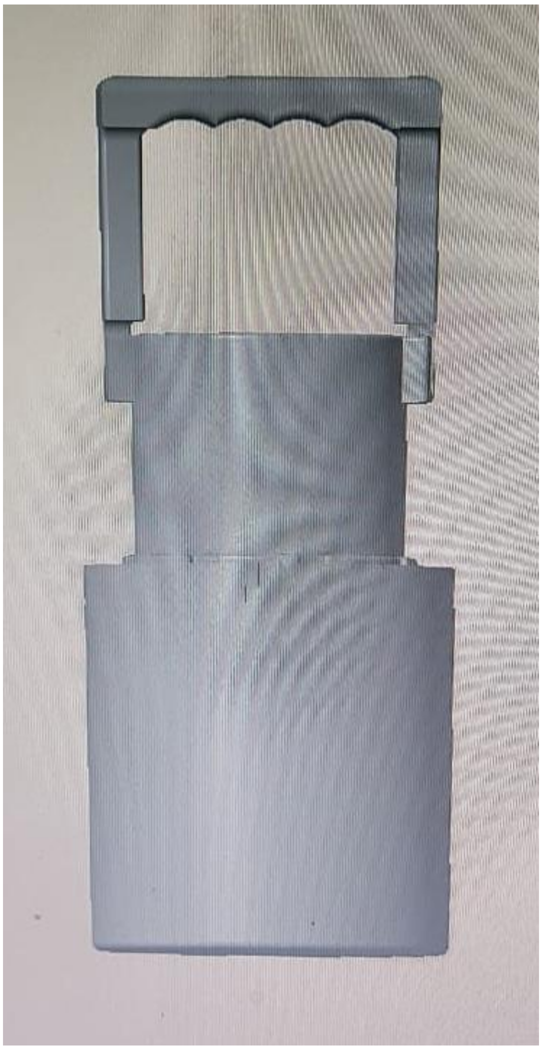
[Fig 1.33], 3D Handle.



[Fig 1.34], 3D Moter And Battery Section.

ii) ASSEMBLY:

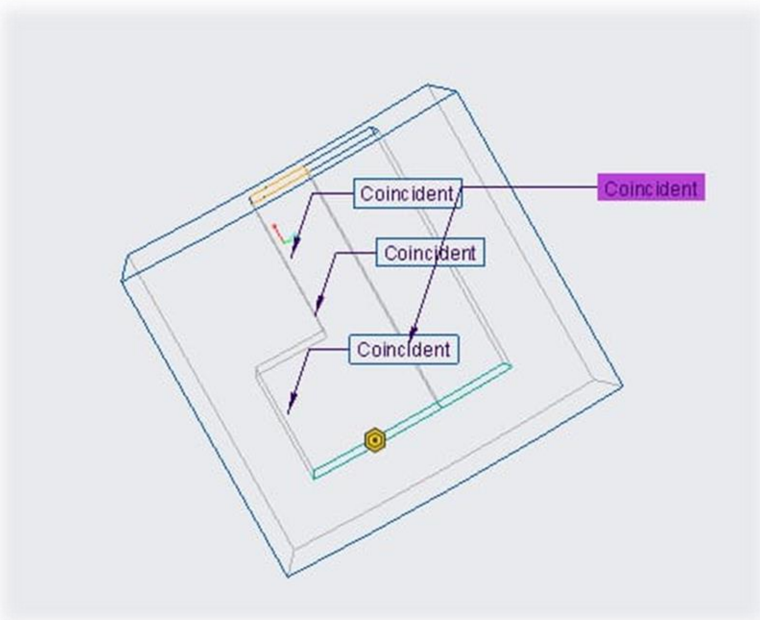
Obtain the 3D model files in a compatible format Install a 3D modeling software or viewer. Open the software and import the 3D model. Arrange the model by adjusting its position, scale, and orientation. Apply materials and textures to enhance the visual appearance. Set up the scene by adding objects, adjusting lighting, and background. Fine-tune the model by smoothing surfaces or optimizing the geometry. Preview the model and render the final image or animation. Export or save the assembled 3D model in a suitable file format.



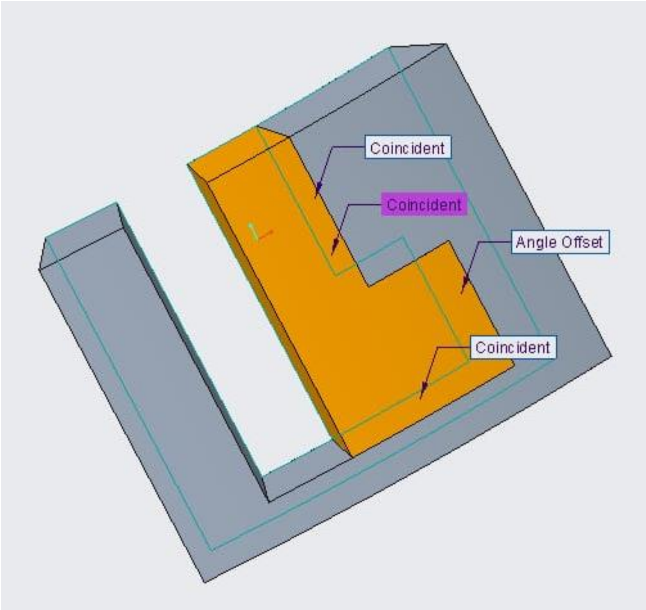
[Fig 1.35], Creo Assembly Model.

3.5 L-KEYWAY LOCK SYSTEM:

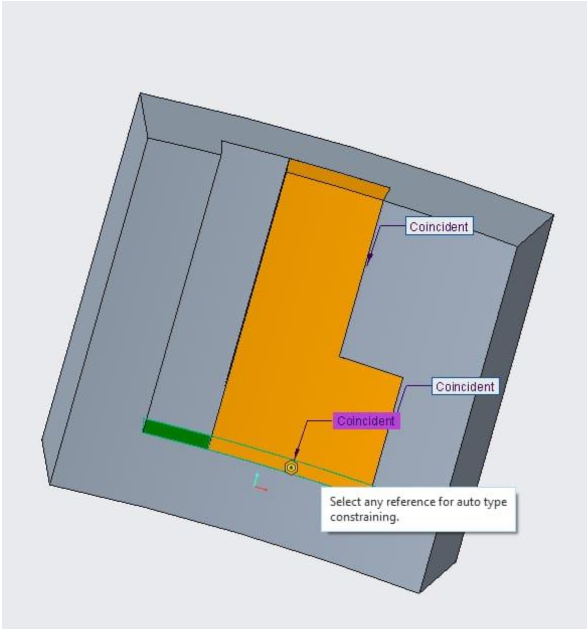
The "L keyway lock system" refers to a type of locking mechanism commonly used in cylindrical or mortise locks. It involves the use of a specific keyway profile known as the "**L keyway**" or "**L shape keyway**." Keyway: The keyway is a groove or channel cut into the key that matches the specific shape and configuration of the lock's internal components. In the case of an L keyway, the key has a unique L-shaped groove along its blade. Lock Cylinder: The lock cylinder contains the keyway and other internal components that interact with the key. The L keyway lock system utilizes a cylinder specifically designed to accommodate an L-shaped key. Key: The L key is specially designed to match the L-shaped keyway of the lock cylinder. It has a blade with an L-shaped groove that aligns with the corresponding pins or tumblers within the lock cylinder. Locking Mechanism: When the L key is inserted into the lock cylinder and turned, the L-shaped grooves on the key align with the corresponding pins or tumblers within the lock cylinder. This alignment allows the internal components to align properly, enabling the lock to open or close.



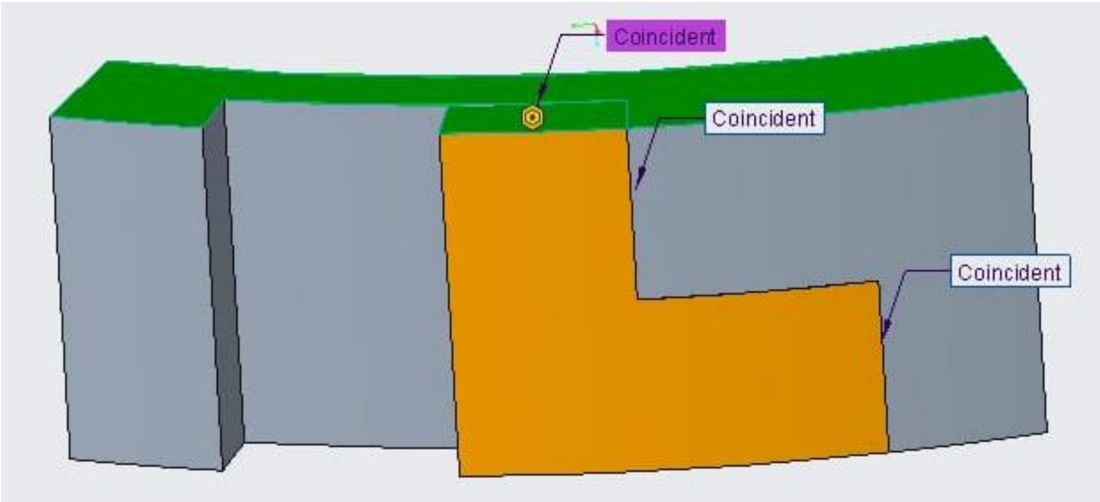
[Fig 1.27], L-Keyway Lock System 01



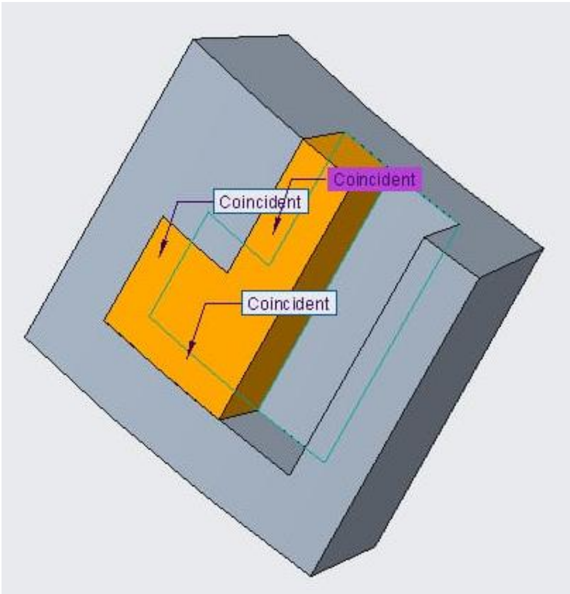
[Fig 1.28], L-Keyway Lock System 02



[Fig 1.29], L-Keyway Lock System 03



[Fig 1.30], L-Keyway Lock System 04



[Fig 1.31], L-Keyway Lock System 05

CHAPTER 4

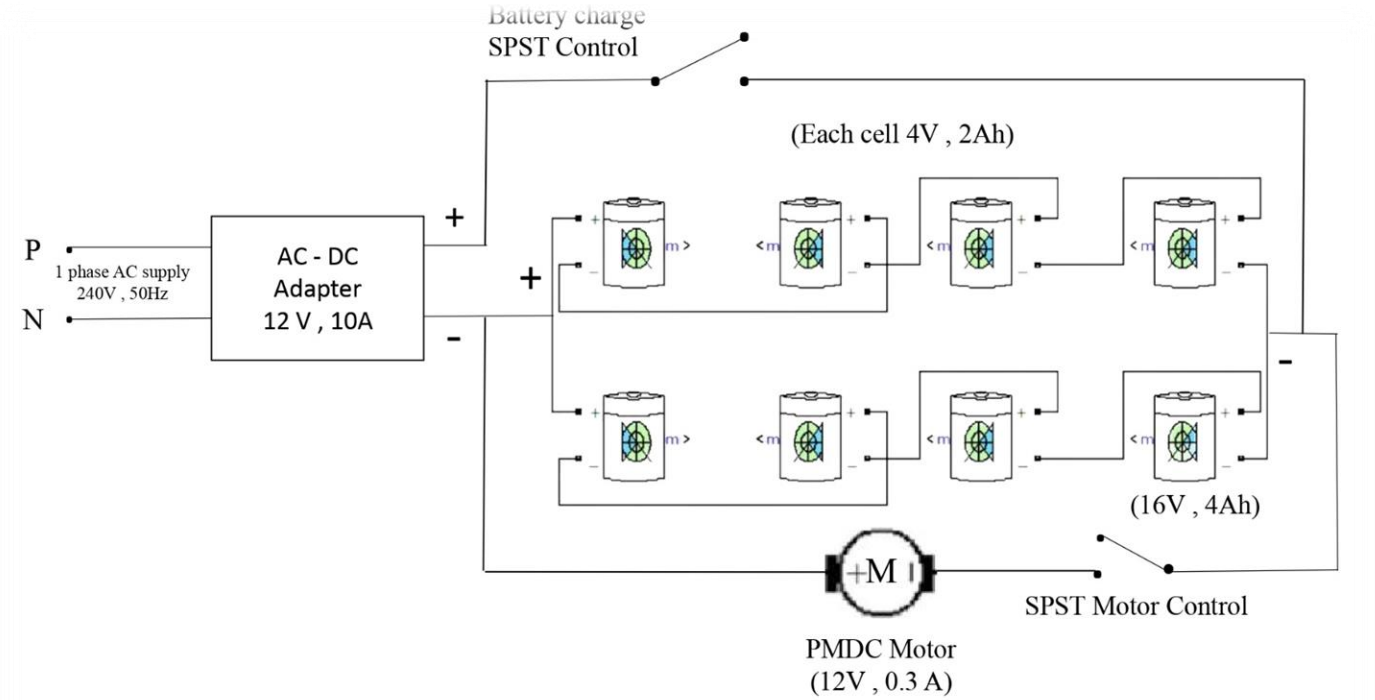
DESIGN OF ELECTRICAL CIRCUIT

4.1 CIRCUIT DESIGN:

An electrical diagram, also known as an electrical diagram is a schematic representation of the electrical wiring layout for our product. It provides a visual overview of the electrical circuits, outlets, switches, and other electrical components that will be installed. The electrical rough diagram may include details such as the location of electrical panels, circuit breakers, light fixtures, outlets, and switches. It may also show the routing of electrical wires, the designation of circuits, and the overall arrangement of electrical components within the building or area. It's important to note that the electrical diagram is a preliminary plan and may be subject to changes and revisions.

4.2 FINAL CIRCUIT DESIGN:

Begin by arranging the eight batteries in series. This means that you will connect the positive terminal of one battery to the negative terminal of the next battery. Repeat this process until you have connected all eight batteries together in a single line. This series connection adds up the voltages of each battery, resulting in a total voltage of 16V (assuming each battery has a voltage of 4V). Next, connect the positive terminal of the battery pack (the end without a wire attached) to one terminal of the SPST (Single Pole Single Throw) switch. The SPST switch is a simple on/off switch with two terminals. Connect the other terminal of the SPST switch to one terminal of the motor. Finally, connect the other terminal of the motor to the negative terminal of the battery pack. This completes the circuit, allowing the current to flow from the positive terminal of the battery pack, through the switch and motor, and back to the negative terminal of the battery pack.



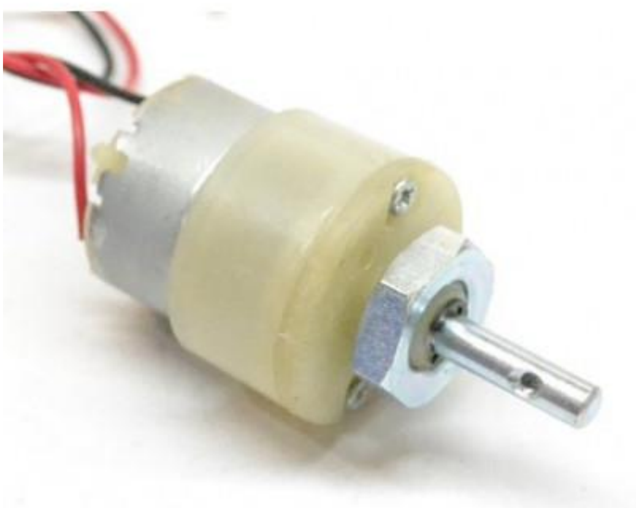
[Fig 1.32], Final Circuit Design.

CHAPTER 5

DESCRIPTION OF COMPONENTS

5.1 MOTOR:

A 30rpm PMDC motor is a low-speed electric motor that operates on direct current. It provides precise and controlled rotation for applications that require slow movement. It uses a permanent magnet, armature, commutator, brushes, and stator for reliable performance. These motors are compact, reliable, and commonly used in robotics, conveyor systems, turntables, and medical equipment. They offer good torque and constant speed under varying loads. Overall, a 30rpm PMDC motor is a specialized type of electric motor that delivers controlled and consistent low-speed rotation, making it suitable for a range of applications that require precise and reliable movement. The commutator and brushes ensure the proper flow of current to the armature windings, allowing for continuous rotation. The 30rpm speed specification indicates that the motor rotates at a relatively low speed, suitable for applications that require slow and steady movement.



[Fig 1.33], Motor.

MOTOR CALCULATION:

- CALCULATION OF THE MOTOR:

volume of the cylinder $= \prod * 5^2 * 13.4$cm

$= 1052.43$cm^3

- CALCULATION OF BLADE VOLUME:

1. Volume =L*W*H

=9*2*1

=18*3= 54cm^3

2. Volume = L*W*H

=6*2*1.5

=18*4= 72cm^3

3. Volume – TRIANGULAR PRISM'S VOLUME

= ½*B*H*L

= ½ *0.6*2*6

= 3.6 *4

= 14.4 cm^3

= volume(2)-volume(3)

= 72-14.4

= 57.6 cm^3

4. SHAFT VOLUME = (V)=>$\prod * R^2 * H$

$= \prod * 0.6^2 * 16$

= 18.095cm^3

5. TOTAL BLADE VOLUME= 1+2+3

= 54+(72-14.4)+18.095

=129.695 cm^3

Reducing the blade volume from cylinder volume

=cylinder volume- blade volume

= 1052.43-129.695

= 922.755 cm^3

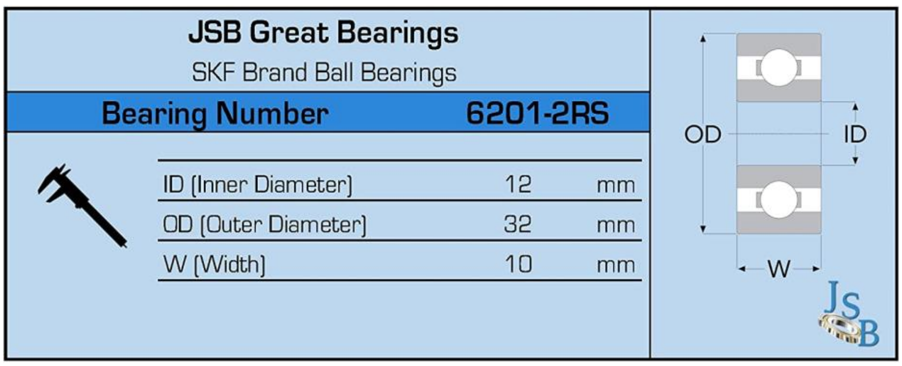
5.2 BATTERY:

A lithium-ion rechargeable battery is a type of battery that uses lithium-ion technology to store and release electrical energy. The battery you mentioned has a voltage rating of 4 volts and a current rating of 2 amps. Lithium-ion batteries are widely used in various portable electronic devices such as smartphones, laptops, tablets, and electric vehicles due to their high energy density, lightweight design, and long cycle life. They offer a reliable and rechargeable power source for these devices. The 4-volt voltage rating indicates the nominal voltage of the battery, which is the average voltage during most of its discharge cycle. The 2-amp current rating represents the maximum continuous current that the battery can deliver without causing damage. With a capacity of 4 volts and 2 amps, this battery can deliver up to 8 watts of power (4 volts x 2 amps = 8 watts). The actual capacity, which determines the runtime of the battery, will depend on factors such as the specific battery chemistry and the load applied. It's important to note that lithium-ion batteries require proper handling and charging to ensure safety and longevity. Following manufacturer guidelines for charging, discharging, and storage is crucial to maintain the performance and lifespan of the battery

[Fig 1.34], Lithium-ion Rechargeable Battery.

5.3 BEARING:

A bearing is a machine element that reduces friction between moving parts. The given bearing has an outer diameter of 32mm, inner diameter of 12mm and width of 10mm. This means that it is a cylindrical roller bearing with a 12mm bore, 32mm outer diameter and 10mm width. The bearing is designed to support radial loads and is commonly used in various applications such as automotive, industrial machinery and equipment. The dimensions of the bearing determine its load capacity and speed rating, making it important to select the right bearing for the specific application-The rubber seal on a bearing can be made of various materials, such as nitrile rubber or silicone, depending on the application requirements. The outer diameter of the rubber seal bearing mentioned in the prompt is 32mm, which means it can fit into a housing or bore with a matching diameter. The inner diameter of the bearing is 12mm, which means it can fit onto a shaft with a matching diameter. The width of the bearing is 10mm, which determines the amount of space it occupies in an application and affects its load capacity and stiffness.



[Fig 1.35], Bearing

5.4 SWITCH:

SPST switch also called as NC switch

A Single-Pole, Single-Throw (SPST) switch is a basic type of electrical switch that consists of a single set of contacts and can be in one of two states: on or off. It is the simplest form of switch and is commonly used in various electronic and electrical circuits. The SPST switch has two terminals: a common terminal (C) and a normally open (NO) terminal. When the switch is in the "on" position, the common terminal is connected to the normally open terminal, allowing current to flow through the circuit. In the "off" position, the connection is broken, and no current can flow. SPST switches are often used in applications where a simple on/off control is required. They can be found in everyday devices such as lamps, power supplies, fans, and appliances. Additionally, they are widely used in prototyping, DIY projects, and electronic circuits as a fundamental component for controlling the flow of electricity. It's important to note that the SPST switch is not suitable for applications that require more advanced functionality, such as multiple circuits or switching options. For those cases, other types of switches like SPDT. (Single-Pole, Double-Throw)

[Fig 1.36], Spst Switch.

5.5 ADAPTER:

A 12V 10A adapter, also known as a power supply or charger, is an electrical device designed to convert AC (alternating current) power from a wall outlet into DC (direct current) power at a voltage of 12 volts and a maximum output current of 10 amps. This type of adapter is commonly used to power or charge a variety of devices that require a 12V DC power source, such as LED lighting systems, CCTV cameras, routers, audio equipment, and many other electronics. The adapter typically consists of a housing that houses the electronics and circuitry required for converting the power. It has an AC input plug that connects to a standard wall outlet and a DC output connector, usually a barrel-type connector or a set of screw terminals, that provides the 12V DC power to the device being powered. The 12V 10A rating of the adapter indicates its maximum output capacity. This means it can deliver up to 10 amps of current at a stable 12V DC voltage. It's important to ensure that the adapter's output specifications match the requirements of the device you intend to power. The device's power requirements should not exceed the maximum output capabilities of the adapter to ensure safe and reliable operation. Additionally, many 12V 10A adapters incorporate safety features such as overvoltage protection, overcurrent protection, and short circuit protection. Overall, a 12V 10A adapter is a versatile power supply solution that provides a stable and regulated 12V DC power source for various electronics and devices that operate within its power rating.

[Fig 1.37], 12v.10Amp Adapter.

5.6 THERMAL INSULATION:

Cotton is a natural fiber derived from the cotton plant, and it possesses several properties that contribute to its thermal insulation capabilities. One key property is its ability to trap air within its fibers. Air is a poor conductor of heat, and when trapped in the interstices of cotton fibers, it creates a layer of insulation that reduces heat transfer. Cotton also has good breathability, meaning it allows moisture to evaporate easily. This property can be beneficial in certain insulation applications, as it helps manage moisture and prevent condensation, which can impact the thermal performance of an insulation material. Furthermore, cotton is a renewable and environmentally friendly material, which appeals to those seeking sustainable insulation options. It is often used as a component in eco-friendly insulation products. However, it is important to note that cotton's thermal insulation properties are relatively modest compared to materials specifically designed for insulation purposes. Cotton insulation typically has a lower R-value (a measure of thermal resistance) compared to synthetic or specialized insulation materials like fiberglass, foam, or mineral wool. In summary, cotton can provide some thermal insulation, especially when used in layers or in combination with other materials. It is commonly utilized in clothing, blankets, and certain building applications. However, for higher insulation performance, especially in building insulation, other materials with higher R-values are generally preferred.

[Fig 1.38], Cotton

CHAPTER 6

INGREDIENTS:

S.NO	CONTENT	PERCENTAGE %
1	MILK	280ml (28%)
2	CREAM	250ml (25%)
3	BUTTER	80g (8%)
4	SUGAR	140g (14%)
5	ICE CREAM POWDER	250g (25%)

MILK:

Milk is a white liquid food produced by the mammary glands of mammals. It is the primary source of nutrition for young mammals (including breastfed human infants) before they are able to digest solid food.

[Fig 1.39], Milk.

CREAM:

Cream is a dairy product composed of the higher-fat layer skimmed from the top of milk before homogenization. In un-homogenized milk, the fat, which is less dense, eventually rises to the top.

[Fig 1.40], Fresh Cream.

BUTTER:

Butter is a dairy product made from the fat and protein components of churned cream. It is a semi-solid emulsion at room temperature, consisting of approximately 8% butterfat.

[Fig 1.41], Butter.

SUGAR:

Sugar is the generic name for sweet-tasting, soluble carbohydrates, many of which are used in food. Simple sugars, also called monosaccharides, include glucose, fructose, and galactose.

[Fig 1.42], Sugar.

ICE CREAM POWDER:

Ice cream powder consists of powdered milk, sugar, stabilizer, fruit or vanilla powder, and cocoa. Ice cream powder is one of the easiest methods to make ice cream, which is prepared by mixing the powder (with the desired taste) with a certain amount of water or milk.

[Fig 1.43], Ice Cream Powder.

CHAPTER 7

FABRICATION & METHODOLOGY:

Motor ice makers, on the other hand, are powered by an electric motor and are much more efficient in producing ice. They are commonly found in modern refrigerators and can produce ice cubes in various shapes and sizes.

Hence, vintage ice makers require manual labor to operate, while motor ice makers are compact, automated and powered by electricity.

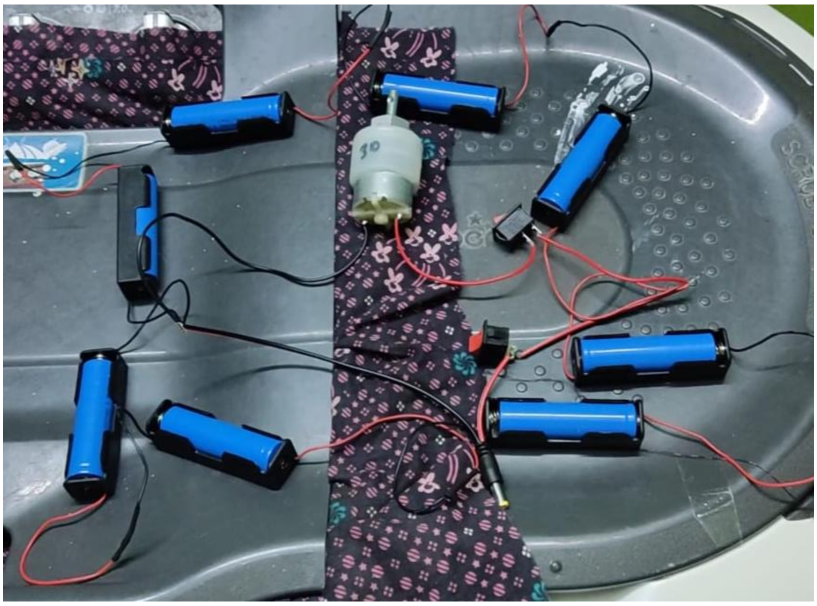
7.1 STAGES & IMAGES

- Designing the model of Ice Cream Maker using PTC CREO Software.
- Constructing the Electrical circuit with proper Connections.
- Modify the Design to achieve Fully constrained model.
- The PLA (Polylactic acid) Material is used for the printing the design.
- Print the PLA (|Polylactic acid) material using Ender 3 V2 3D printer.
- After Printing PLA material connect the Electrical circuit in the 3D part.
- Assembling the 3D parts to get the Ice cream maker.
- Adding the Ingredients of the Ice Cream in the Maker
- Switch on the Maker and the keep the Ice Cream maker in the Freezer
- After two to four hours in freezer the process will be Completed.

[Fig 1.44], 2D Drafting.

STEP-01

[Fig 1.45], 3D Model.



STEP-02

STEP-03

STEP-04

STEP-05

STEP-06

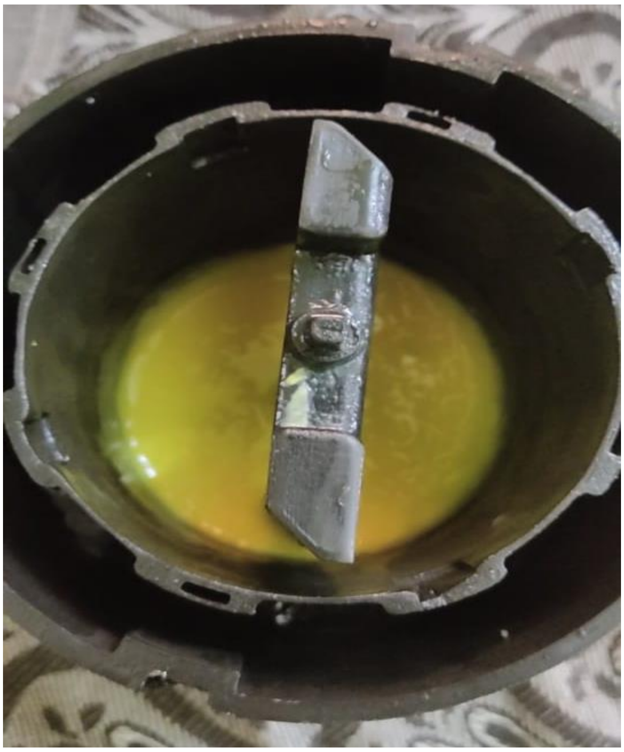
STEP-07

[Fig 1.46]

STEP-08

STEP-09

STEP-10



STEP-11

[Fig 1.47]

STEP-12

STEP-13

STEP-14

STEP-15

[Fig 1.48]

7.1 WORKING OF ICE CREAM MAKER:

A hand-cranked ice cream maker is a traditional device used to make ice cream at home. It typically consists of a double-walled metal canister, a paddle or dasher, and a hand crank. The canister is filled with ice and rock salt to create a freezing environment, while the paddle mixes and churns the ice cream base. When using a hand-cranked ice cream maker with a motor, the basic principles remain the same, but the process becomes more convenient. Instead of manually turning the hand crank, the motor takes over the churning action, allowing for a more effortless and consistent mixing process.

Here's how it typically works:

- Prepare the ice cream base: Mix together your desired ingredients for the ice cream base, such as milk, cream, sugar, and flavorings. Make sure the mixture is well combined and smooth.
- Chill the mixture: Refrigerate the ice cream base for a few hours or overnight to ensure it's thoroughly chilled. This step is important for achieving a smooth and creamy texture.
- Set up the ice cream maker: Place the canister in the freezer for a couple of hours before starting the ice cream-making process. This helps pre-chill the canister and ensures the ice cream freezes properly.

- Assemble the ice cream maker: Take the canister out of the freezer and attach the paddle or dasher to the motorized mechanism. Ensure everything is securely in place.
- Pour the ice cream base into the canister: Remove the lid from the canister and pour in the chilled ice cream base.
- Start the motor: Activate the motor on the ice cream maker, and it will begin rotating the paddle or dasher inside the canister. The paddle's movement helps break up ice crystals and incorporate air into the mixture, resulting in a smooth and creamy consistency.
- Monitor the process: Allow the ice cream maker to run for the recommended time specified in the manufacturer's instructions. This can vary depending on the specific model and recipe being used.
- Check for doneness: After the recommended time has passed, check the consistency of the ice cream. It should be thickened and resemble a soft-serve texture.
- Serve or harden: You can either serve the ice cream immediately, or if you prefer a firmer texture, transfer it to an airtight container and place it in the freezer for a few hours to harden.

CHAPTER 8

BILL OF MATERIALS:

SNO	MATERIAL	COST
1	PLA FILAMENT	900
2	BATTERY & HOLDER	715
3	MOTOR	300
4	ADAPTER & MULTIMETER	470
5	PRINTING SERVICES	5300
6	BEARING (2NOS)	300
7	INGREDIENTS	300
8	GLUE STICK	60
9	CARBON PAPER	50
10	SPST SWITCH	25
11	OVERHEAD	580
	TOTAL	9000

CHAPTER 9

CONCLUSION:

- Manufacturing modern ice cream makers typically involves the use of electric motors and automated processes to produce ice cream.
- This allows for greater efficiency and consistency in the production process compared to manual methods used in vintage ice makers.
- Motor ice cream makers, are powered by an electric motor and are much more efficient in producing ice. They are commonly found in modern refrigerators and can produce ice creams.
- Advances in technology have also allowed for the creation of various features and settings that can produce different types of ice cream, making modern ice cream makers more versatile and user-friendly.

CHAPTER 10

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