3D PRINTING TECHNOLOGY

AN INTERNSHIP REPORT

Submitted in partial fulfilment of the requirements

for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

MECHANICAL ENGINEERING

Submitted by

VEERA VINAY SAI SHANKAR(22555A0373)
VIYYAPU PRAVEEN(22555A0374)
BHEHARA VAMSIKRISHNA(22555A0375)

Under the Supervision of

D AJAY KUMAR
ASSISTANT PROFESSOR

DEPARTMENT OF MECHANICAL ENGINEERING
GODAVARI INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
CHAITANYA KNOWLEDGE CITY, NH-16, RAJAMAHENDRAVARAM, AP

Jawaharlal Nehru Technological University, Kakinada, AP, India

AUGUST 2023

GODAVARI INSTITUTE OF ENGINEERING & TECHNOLOGY

(Autonomous)
CHAITANYA KNOWLEDGE CITY, NH-16, RAJAMAHENDRAVARAM-533296, AP

BONAFIDE CERTIFICATE

Certified that this internship report **"3D PRINTING TECHNOLOGY"** is the bonafide work of **"VERRA VINAY SAI SANKAR(22555A0373),VIYYAPU PRAVEEN (22555A0374), BREHARA VAMSI KRISHNA (22555A0375)"** who carried out the project work under my supervision during the year 2022 to 2023, towards partial fulfilment of the requirements of the Degree of Bachelor of Technology in Mechanical Engineering as administered under the Regulations of Godavari Institute of Engineering & Technology (A), Rajamahendravaram, AP, India and award of the Degree from Jawaharlal Nehru Technological University, Kakinada. The results embodied in this report have not been submitted to any other University for the award of any degree.

19/8/23

Signature of the Supervisor

D AJAY KUMAR
ASSISTANT SUPERVISOR

Department of Mechanical Engineering
GIET (A), Rajamahendravaram-533296

19/8/2023

Signature of the Head of the Department

Dr. D SANTHA RAO
HEAD OF THE DEPARTMENT
Department of Mechanical Engineering

Head of the Department
Mechanical Engineering
GIET (A). RAJAHMUNDRY A.P

Date: 16/08/2023

Viva-Voice conducted on 19/8/23

19/8/23

Internal Examiner

External Examiner

22555A0373

PRINT 3D

INTERNSHIP CERTIFICATE

This is to Certify that

Mr/Ms ..VEERA..VINAY..SAI..SANKAR.....

had successfully completed the requirement for certification in hybrid online plus offline hands-on practice internship program on 3D PRINTING TECHNOLOGY conducted from 22-05-2023 to 22-07-2023 by M/s Print 3D Technologies, Tirupati. During this internship program, modelling and manufacturing aspects of 3D printing technology have been learned.

Dr BKC Ganesh
CEO & Founder
Print 3D Technologies, Tirupati

PRINT3D

22555A0374

Ministry of Micro, Small and Medium Enterprises, Government of India

MSME MICRO, SMALL & MEDIUM ENTERPRISES

INTERNSHIP CERTIFICATE

This is to Certify that

Mr/Ms VIYYAPU PRAVEEN

had successfully completed the requirement for certification in hybrid online plus offline hands-on practice internship program on 3D PRINTING TECHNOLOGY conducted from 22-05-2023 to 22-07-2023 by M/s Print 3D Technologies, Tirupati. During this internship program, modelling and manufacturing aspects of 3D printing technology have been learned.

Dr BKC Ganesh
CEO & Founder
Print 3D Technologies, Tirupati

STUDENT DECLARATION

I, the under-mentioned, solemnly declare that this internship report on **"3D PRINTING TECCHNOLOGIES" (PRINT 3D TECHNOLOGIES)** my original work and the analysis and the findings are for academic purpose only. I further declare that I have strictly observed reporting ethics and duly discharged copy-right obligation and properly referred all outsourcing of materials used in this report and nothing is confidential in this report in respect of the company of my internship. I take the responsibility for all legal and ethical requirements regarding this report.

V. Vinay Sai Sankar
V. Praveen
B. VAMSIKRISHNA

SIGNATURE OF STUDENT'S: **DATE:16/08/2023**

NAME: VEERA VINAY SAI SANKAR PINNO: 22555A0373

NAME: VIYYAPU PRAVEEN PINNO: 22555A0374

NAME: BREHARA VAMSIKRISHNA PIN NO:22555A0375

ABSTRACT

3D printing technology, also known as additive manufacturing, is a revolutionary process that creates three-dimensional objects by layering material upon material, as opposed to traditional subtractive manufacturing methods. This technology has gained widespread attention and utility across various industries due to its ability to produce complex and customized objects with high precision. Here's a brief summary of key aspects of 3D printing:

1.Process

2.Materials

3.Applications

4.Advantages

Rapid prototyping

Customisation

Complexed Geometry

Reduced waste

Shorter supply chains

5.Challenges

Material Limitations

Speed and Scale

Equipment Costs

6.Technologies

Overall, 3D printing technology continues to advance, driving innovation in multiple industries and pushing the boundaries of what's possible in design, manufacturing, and customization.

CONTENTS

	Page No.
BONAFIDE CERTIFICATE	vi
STUDENT DECLARATION	vii
ABSTRACT	viii
CONTENTS	ix
CHAPTER 1: 3D PRINTING TECHNOLOGY	1-6
• Introduction to 3D Printing	1
• 3D-Printing	2
• Types of 3d Printing	3
• Materials used	4
• Applications	5-6
CHAPTER 2: 3DS MAX – A POWERFUL DESIGNING SOFTWARE	7-12
▪ Introduction to 3ds max	7
▪ Features and Capabilities	8
▪ Project Implementation	9
▪ Editable Poly	10-11
▪ Alternatives for 3ds max	12
▪ Advantages, Limitations & Applications	13
CONCLUSION:	14-15

CHAPTER - 1

3D PRINTING TECHNOLOGY

- 3D printing technology is a process of creating 3 dimensional objects from a design file. This article is designed to provide you an explanation of the currently used 3D printing technologies. The following items were made by using 3D printing technology.
- 3D printing is a process where a digital model created using computer-aided design software (CAD) is turned into a physical three-dimensional object by adding material a layer at a time. There are many methods of melting or softening the material to produce the layers.
- Nowadays, 3D printing is widely used in the world. 3D printing technology increasingly used for the mass customization, production of any types of open source designs in the field of agriculture, in healthcare, automotive industry, and aerospace industries. At the same time, there are several disadvantages the adoption of 3D printing technology in manufacturing industry. For instance, the effect of the use of 3D printing technology is will reduce the use of manufacturing labour so automatically will greatly affect the economy of countries that rely on a large number of low skill jobs. Furthermore, by using 3D printing technology, users can print many different types of objects such as knives, guns and dangerous items. Therefore, the use of 3D printing should be limited to only certain people to prevent terrorists and criminals bring guns without detected. At the same time, the people who get a hold of a blueprint will be able to counterfeit products easily. This is because, the use of 3D printing technology is simple, just sketching, and set the data in the machine-printed so 3D objects can generate.

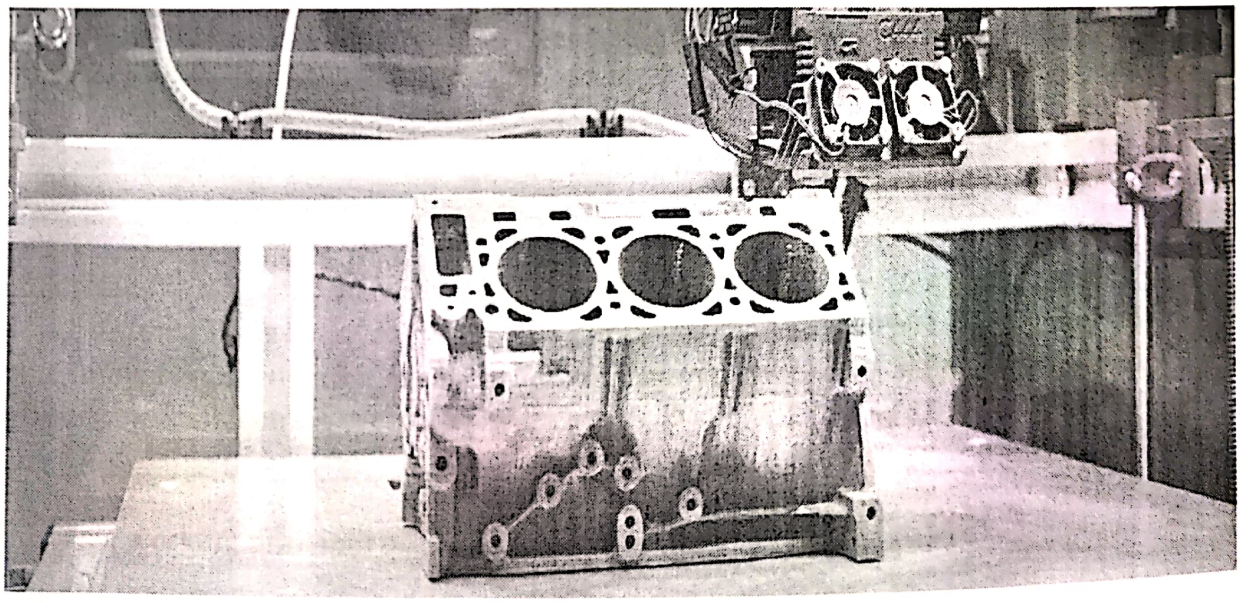

Fig.1.1 – A 3D PRINTED CYLINDER BLOCK

3D PRINTING

3D printing, also known as additive manufacturing, is a process that creates three-dimensional objects by adding material layer by layer. It involves using a computer-generated 3D model as a blueprint and translating it into physical objects by depositing material in a controlled manner. This technology has various applications across industries, including manufacturing, healthcare, aerospace, architecture, and more, allowing for the creation of intricate and customized objects that might be challenging or impossible to produce using traditional methods.

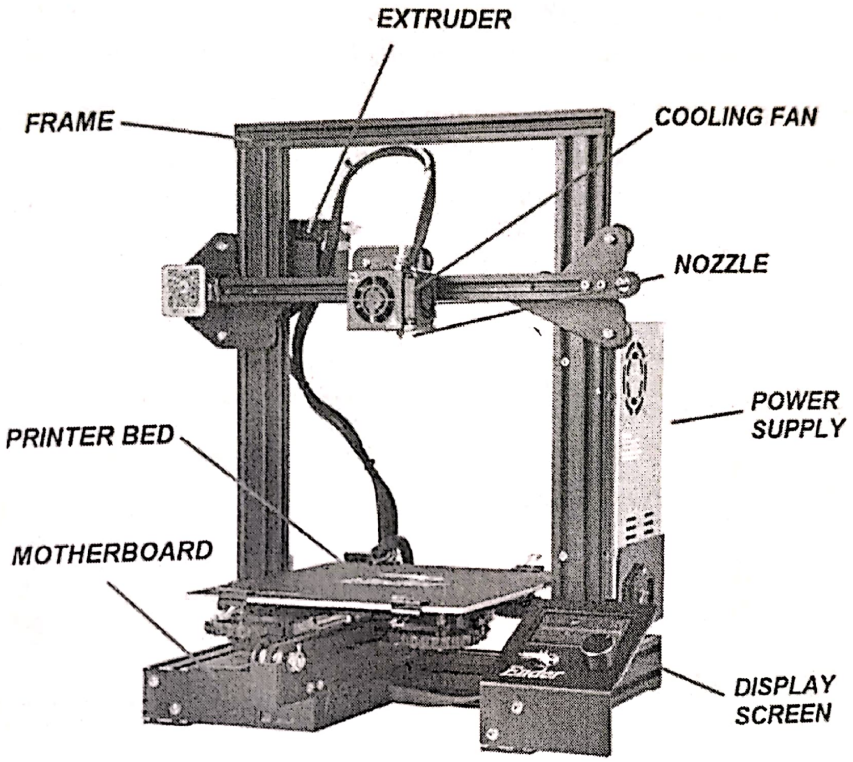

Fig.1.2 – A 3D PRINTER

A 3D printer is a type of manufacturing device that creates three-dimensional objects by adding material layer by layer, based on a digital 3D model. This process is known as additive manufacturing, as it involves adding material rather than subtracting it (as in traditional manufacturing methods).

The basic working principle of a 3D printer involves the following steps:

1.Digital Design

2.Slicing

3.Printing Process

4.Layer Bonding

5.Completion

3D printers can produce a wide range of objects with intricate shapes, structures, and details that might be challenging or impossible to achieve using traditional manufacturing methods. The technology has found applications in various industries, including aerospace, automotive, healthcare, architecture, fashion, art, and more.

TYPES OF 3D PRINTING

Different types of 3D printing technologies exist, each with its own set of characteristics and suitable applications. Some common 3D printing technologies include Fused Deposition Modelling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS), Digital Light Processing (DLP), and Binder Jetting, among others.

In summary, a 3D printer is a versatile and innovative tool that can transform digital designs into physical objects through layer-by-layer additive manufacturing, enabling rapid prototyping, customized manufacturing, and creative exploration.

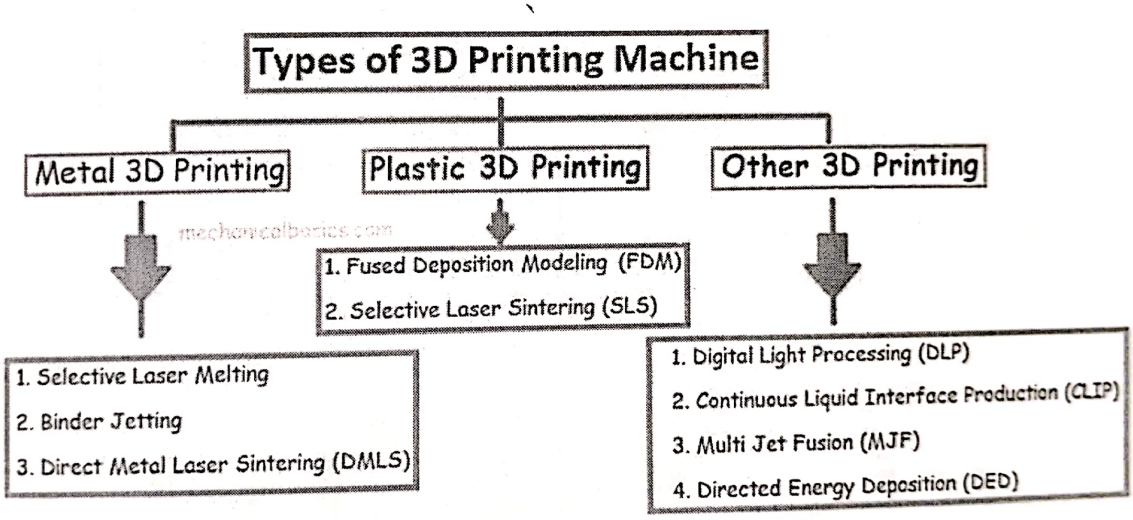

Fig.1.3 – Types of 3D Printing

By using this technology you can create real, usable items. You can build objects like items of furniture, medical items, decorations, protoypes and so on. Smaller 3D printers are capable to print mugs or jewels while the biggest ones can even print airplane wings or houses with ease. To amplify their purpose each 3D printer is calibrated to one or more materials with which it can be used with.

MATERIALS USED FOR 3D-PRINTING

- These are the raw materials you can use for 3D printing . The material you can use depends on your 3D printer. But usually 3D printers use plastic filaments, like ABS or PLA as materials. These are easily accessible and fit the needs of everyday usage like modelling or prototyping.
- ABS is a strong and mildly flexible material which is easily recyclable and resistant to heating. This makes it ideal for engineering uses. It is made from petroleum and is often used within mechanical uses.
- PLA on the other hand possesses plant based origins giving it a semi-sweet smell during the printing. It does not require a heating bed and it is biodegradable. When properly cooled it provides higher printing speed and better edge quality than ABS making it a popular choice of schools, home printers and prototype designers.
- Our printer, 3D - Debrecen, uses PLA as a material for printing

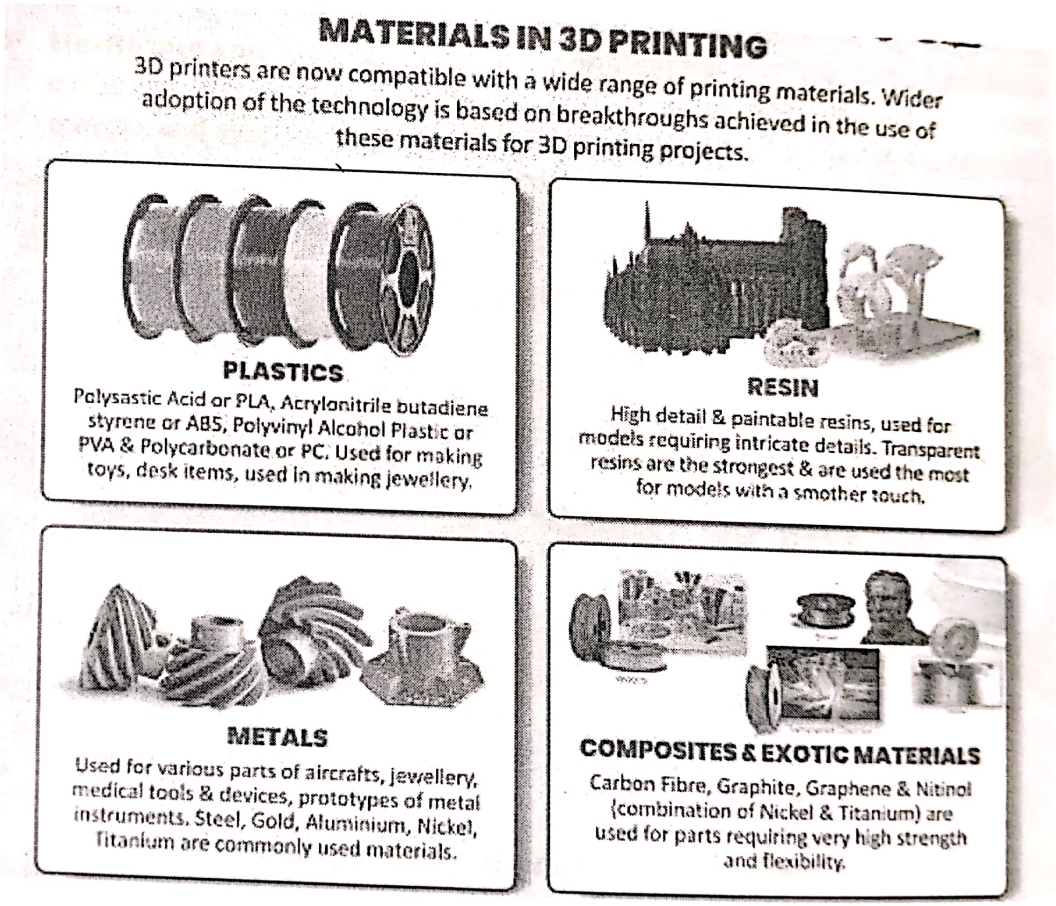

Fig.1.4 – MATERIALS USED FOR 3D PRINTING

- Polyactic Acid
- Plastic
- Titanium
- Stainless Steel
- Resin
- Ceramics, Carbon Fibre and many more.

APPLICATIONS OF 3D PRINTING

3D printing, also known as additive manufacturing, has a wide range of applications across various industries due to its versatility and ability to create complex and customized objects. Here are some notable applications of 3D printing:

- **Prototyping and Rapid Manufacturing:** 3D printing is extensively used for rapid prototyping, allowing designers and engineers to quickly create physical prototypes to test and validate their designs before mass production. This accelerates the product development cycle and reduces costs.

- **Aerospace and Automotive Industries:** In aerospace and automotive sectors, 3D printing is used to create lightweight and intricate components, such as turbine blades, engine parts, and customized car components. This technology enables improved performance, fuel efficiency, and design optimization.

- **Healthcare and Medical Devices:** 3D printing has revolutionized healthcare by enabling the creation of patient-specific medical implants, prosthetics, dental crowns, and surgical guides. It also plays a crucial role in producing anatomical models for sùrgical planning and medical education.

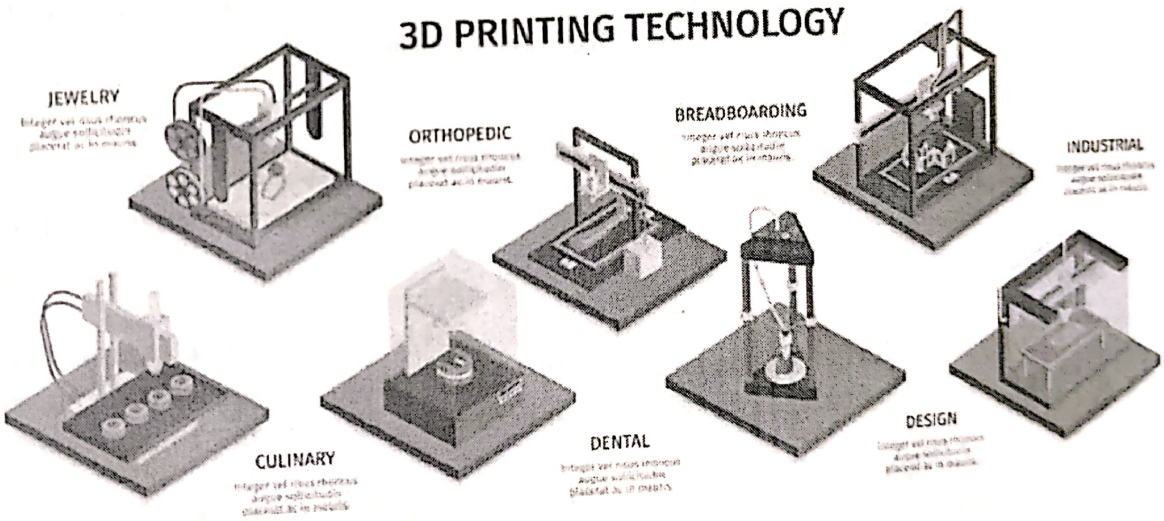

Fig.1.5 – Applications of 3D Printing

- **Art and Design:** Artists and designers use 3D printing to create intricate sculptures, jewellery, fashion accessories, and other artistic creations that were previously difficult to produce using traditional methods. It offers new avenues for creative expression.

- **Consumer Goods and Customization:** 3D printing allows for on-demand production of consumer goods, ranging from smartphone cases to household items. Customization is a key advantage, as customers can personalize products to their preferences.

- **Architecture and Construction:** Architects and construction professionals use 3D printing to create detailed scale models, building components, and even entire structures. This technology enables faster and more accurate construction processes.

- **Education and Research:** 3D printing is a valuable tool in education and research, allowing students and researchers to visualize and experiment with physical models of complex concepts in subjects such as biology, engineering, and archaeology.

- **Food Industry:** 3D printing is applied to create intricate and unique food designs, such as chocolate sculptures, intricate cake toppers, and even entire meals. It has the potential to transform food presentation and customization.

- **Jewellery and Fashion**: Jewelers and fashion designers utilize 3D printing to craft intricate and customized jewellery pieces and fashion accessories. This technology allows for intricate detailing and rapid iteration.

- **Tooling and Manufacturing Aids:** 3D printing is used to produce tooling, jigs, fixtures, and manufacturing aids that help streamline production processes, reduce costs, and improve efficiency in manufacturing industries.

- **Electronics and Electronics Housing:** 3D printing enables the creation of custom electronics housings, enclosures, and prototypes for electronics components and devices.

- **Entertainment and Gaming:** The entertainment industry employs 3D printing to create props, costumes, and detailed models for movies, television shows, and video games.

- **Environmental and Sustainable Applications:** 3D printing is explored for sustainable construction using recycled materials and eco-friendly designs. It has the potential to reduce waste and carbon footprint in manufacturing.

- **Defense and Military:** 3D printing is used in the defense industry for rapid production of spare parts, specialized tools, and components needed for military applications.

- These are just a few examples of the diverse range of applications for 3D printing technology. As the technology continues to advance, its impact on various industries is expected to expand even further.

CHAPTER – 2
3DS MAX – A POWERFUL DESIGNING SOFTWARE

INTRODUCTION

Autodesk 3ds Max is a leading 3D modelling, animation, and rendering software used in various industries for designing and visualization. Its user-friendly interface and advanced features make it an ideal choice for creating intricate 3D models.

- Autodesk 3ds Max, a leading 3D computer graphics and animation software, stands as a powerhouse tool in the creative and technical industries. Renowned for its diverse capabilities and user-friendly interface, 3ds Max empowers designers, artists, and professionals to bring their imaginative concepts to life through compelling visualizations, intricate animations, and realistic renderings.

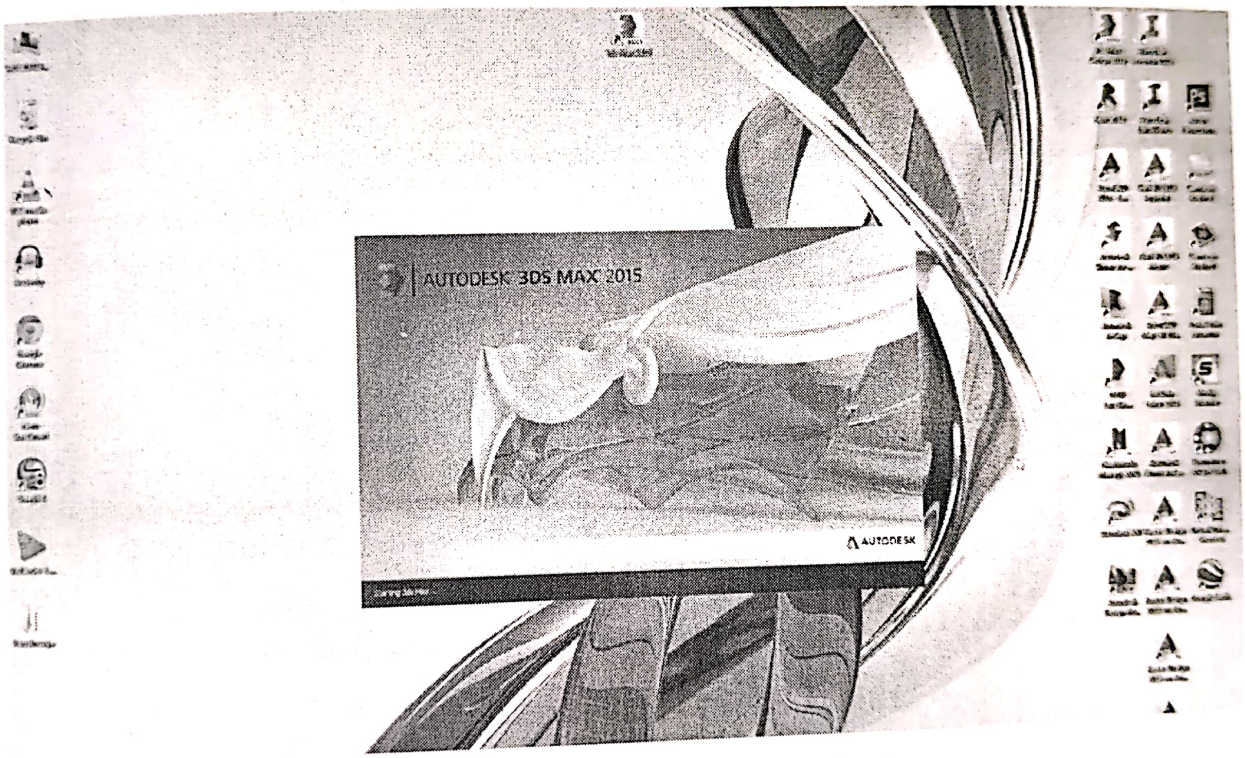

Fig.2.1 – 3DS MAX SOFTWARE

- From its inception, 3ds Max has evolved into an industry standard, setting the benchmark for 3D modelling, animation, and rendering. With an extensive suite of tools and features, it caters to a broad spectrum of applications spanning entertainment, architecture, product design, and beyond.

- The software's core strengths lie in its ability to sculpt, model, and manipulate objects in intricate detail. It excels in crafting lifelike animations, from character movements to dynamic physics simulations, all while offering a seamless integration of lighting and materials to achieve stunning visual effects. 3ds Max's support for a wide range of file formats and its compatibility with other Autodesk products foster a collaborative and efficient workflow.

Features and Capabilities:

1. **3D Modelling:** 3ds Max offers a robust set of tools for creating intricate 3D models. From simple shapes to complex structures, it allows users to sculpt, modify, and manipulate objects with precision.

2. **Animation:** The software excels in animation, enabling users to create fluid and lifelike movement. Keyframe animation, character rigging, and advanced physics simulations contribute to dynamic and engaging animations.

3. **Rendering:** 3ds Max provides powerful rendering capabilities, allowing users to generate high-quality images and animations. Its integration with industry-standard rendering engines produces photorealistic results.

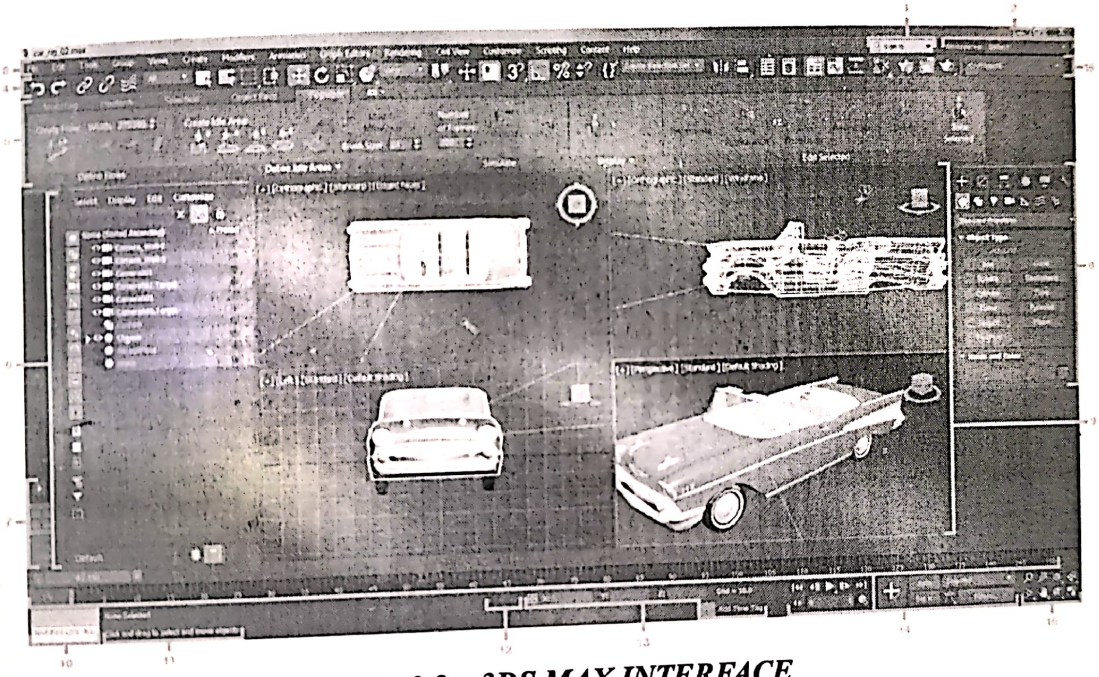

Fig.2.2 – 3DS MAX INTERFACE

4. **Texturing and Materials:** Users can apply textures and materials to objects, achieving realistic surface appearances. The software supports shaders, procedural textures, and UV mapping for detailed material customization.
5. **Lighting:** 3ds Max facilitates intricate lighting setups, enabling users to simulate natural lighting conditions and achieve dramatic visual effects.
6. **Particle and Dynamics Simulation:** The software offers particle systems and dynamics simulations for effects like fire, smoke, cloth, and fluid dynamics, adding realism to animations and scenes.
7. **Integration:** 3ds Max supports various file formats, enhancing collaboration between different software and pipelines. Integration with other Autodesk products, such as AutoCAD, enhances workflow efficiency.
8. **Plugin Support:** Users can expand 3ds Max's capabilities through a wide range of third-party plugins, enabling specialized workflows and additional tools.

PROJECT IMPLEMENTATION

In this project, a 3D printed product prototype will be designed using 3ds Max. The workflow includes concept selection, 3D modelling, optimization for 3D printing, and exporting the model for printing. With its comprehensive toolset and intuitive interface, 3ds Max offers a seamless pathway for realizing complex designs, animations, and renderings.

1. **Conceptualization and Planning:** Project implementation begins with conceptualizing the design, outlining objectives, and formulating a clear plan. Identify the scope, objectives, and target audience of the project. Determine the desired visual style, animation sequences, and any interactive elements.

2. **3D Modelling:** 3ds Max is a hub for 3D modelling, enabling the creation of intricate objects, environments, and characters. Utilize the software's polygonal, spline-based, and parametric modelling tools to shape and refine your assets according to the project requirements.

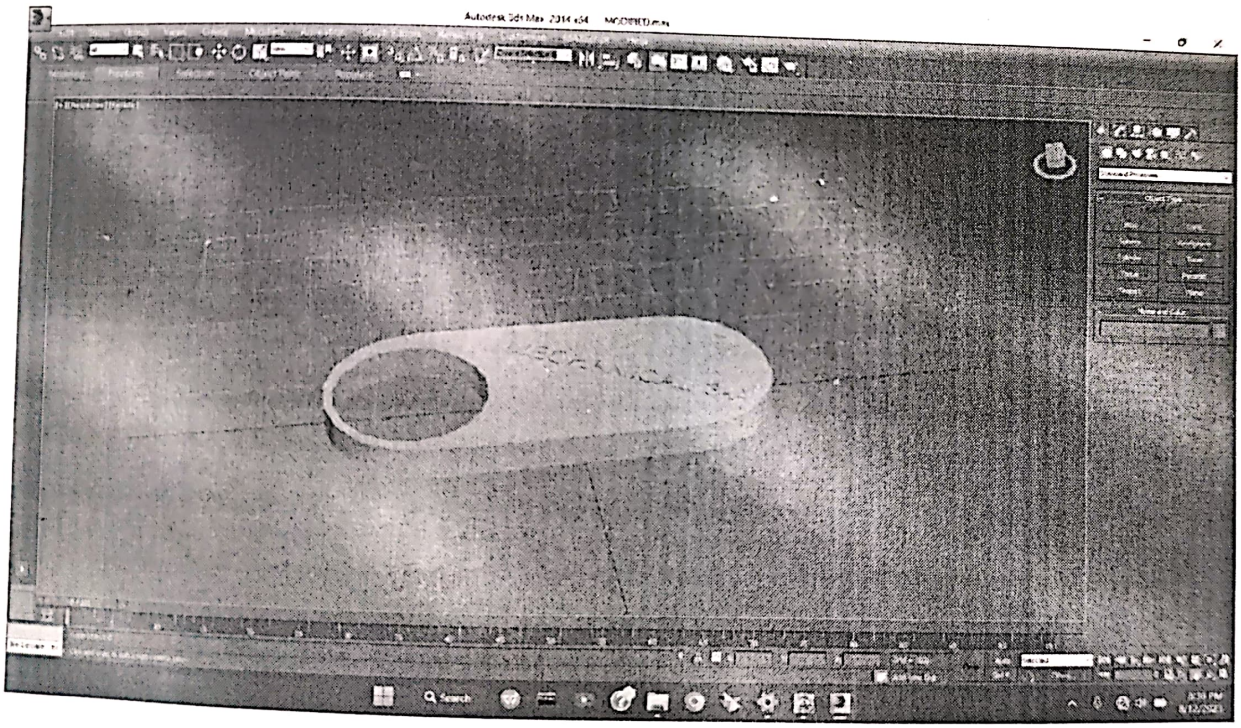

Fig.2.3 – DESIGNING OF A KEYCHAIN IN 3DS MAX

3. **Texturing and Materials:** Enhance visual realism through texturing and materials. Apply various textures, shaders, and material properties to objects, achieving lifelike surface appearances. Experiment with mapping techniques, UV unwrapping, and procedural textures to create compelling visuals.

4. **Exporting and Integration:** Prepare your project for distribution or integration into other platforms. Export your 3D assets, animations, and renderings in suitable file formats for further use. Ensure compatibility with other software or platforms if necessary.

EDITABLE POLY

Editable Poly is a powerful and versatile tool within Autodesk 3ds Max that facilitates the creation, manipulation, and editing of 3D geometry. It serves as a fundamental component for modelling and sculpting intricate objects, characters, environments, and more.

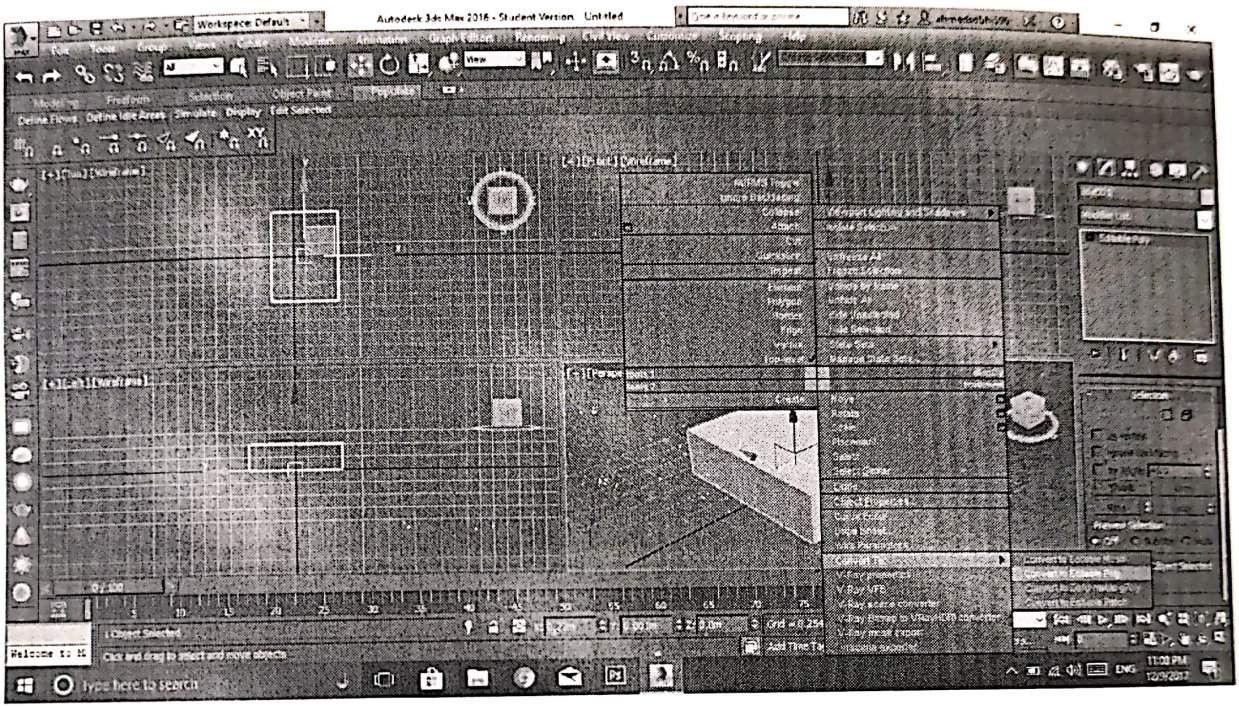

Fig.2.4 – *CONVERTING A POLYGON TO EDITABLE POLY IN 3DS MAX*

Key Features and Functions:

- **Vertex, Edge, and Face Editing:** Editable Poly provides precise control over individual vertices, edges, and faces of a mesh. This level of granularity enables detailed shaping and refinement of geometry.

- **Polygon Modelling:** With Editable Poly, users can easily create and modify polygons, adjusting their size, position, and connectivity. This makes it a cornerstone for building complex 3D structures.

- **Extrusion and Bevelling:** The tool allows for extruding and bevelling polygons, edges, and vertices, giving depth and dimension to objects and enhancing their visual complexity.

- **Chamfer and Welding:** Editable Poly includes functions to chamfer edges, rounding sharp corners for a smoother appearance. Welding vertices helps eliminate unwanted gaps or overlaps in the geometry.

- **Modifier Stack Compatibility:** Editable Poly works seamlessly with the modifier stack in 3ds Max, allowing users to apply and stack various modifiers for advanced transformations and effects.

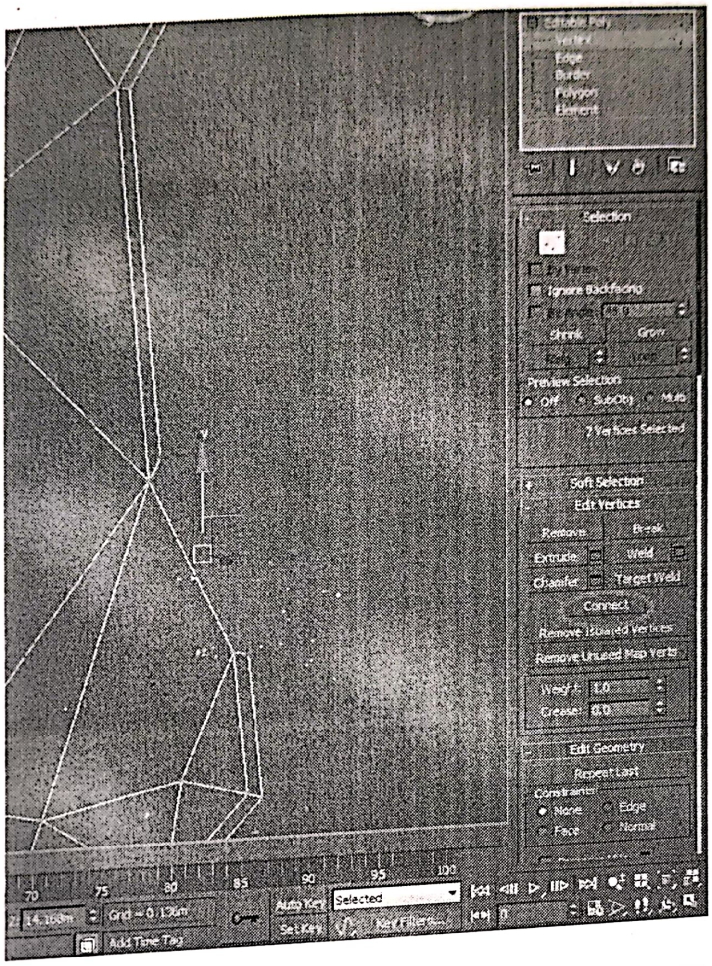

Fig.2.5 – CONNECTING TWO VERTICES USING EDITABLE POLY

- **Subdivision Surfaces:** Editable Poly supports subdivision surfaces, which allow for smooth and organic modelling by subdividing polygons into smaller segments while maintaining curvature.

- **Paint Deform:** This tool lets artists paint deformations directly onto a mesh, making it a convenient way to create intricate and artistic modifications.

- **UV Unwrapping:** Users can efficiently unwrap and layout UV coordinates for texturing using the Unwrap UVW modifier in conjunction with Editable Poly.

ALTERNATIVES FOR 3DS MAX

There are several other designing software options available besides Autodesk 3ds Max that cater to various aspects of design, ranging from 3D modelling and animation to graphic design, industrial design, and more. Here are some notable alternatives:

Fig.2.6 – DIFFERENT CAD SOFTWARES

- Autodesk Maya
- Blender
- Cinema 4D
- ZBrush
- Solidworks
- Sketchup
- Fusion 360
- Adobe XD
- Rhino(Rhinoceros)
- Catia V5

ADVANTAGES :-

Autodesk 3ds Max is a versatile and powerful 3D computer graphics and animation software that offers numerous advantages across various industries. Here are some of the key advantages of using 3ds Max:

1. Comprehensive 3D Modeling and Animation
2. High-quality Rendering
3. Vast Libraby of plugins
4. Intuitive User Interface
5. Powerful Animation Tools
6. Real-Time Feedback
7. Versatility Across Industries
8. Architectural Visualization
9. Character Animation

LIMITATIONS :-

While Autodesk 3ds Max is a powerful and versatile 3D computer graphics and animation software, it also has certain limitations that users should be aware of. Here are some of the limitations of 3ds Max:

1. Steep Learning Curve
2. Resource Intensive
3. Price
4. Hardware Compatibility
5. Stability and Bugs
6. Lack of Native 2D Graphics Tools

APPLICATIONS :-

Autodesk 3ds Max is a versatile 3D computer graphics and animation software that finds applications in various industries, contributing to the creation of a wide range of visual content. Some key applications of 3ds Max include:

1. Film and Visual Effects
2. Video Game Development
3. Architectural Visualization
4. Product Design and Manufacturing
5. Animation and Multimedia
6. Virtual Reality (VR) and Augmented Reality (AR)
7. Sculpture and Art Installations
8. Interior Design
9. Mechanical and Engineering Visualization

CONCLUSION

This project report has provided a comprehensive exploration of the synergistic relationship between 3D printing technology and the powerful design software, 3ds Max. We have delved into the transformative impact of 3D printing on industries ranging from manufacturing and healthcare to art and education. The ability to materialize intricate digital designs into tangible objects has not only revolutionized traditional production processes but has also opened doors to unprecedented levels of customization and creativity.

Deposition Of Material Layer By Layer On The Bed

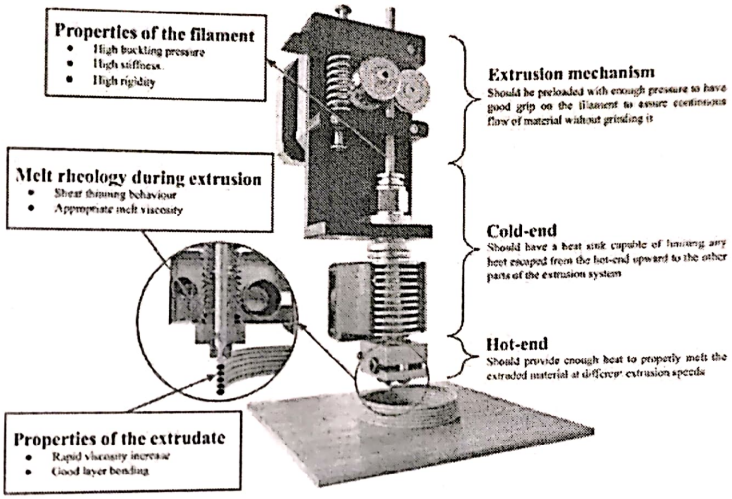

Fig.3.1 – Layer by layer printing the objects

Converting the 3DS MAX file into stl file:

- It all starts with a 3D model. You can opt to create one from the ground up or download it from a 3D library. There are many different software tools available. From industrial grade to open source. We've created an overview on our page.
- We often recommend beginners to start with tinkercad. Tinkercad is free and works in your browser, you don't have to install it on your computer. Tinkercad offers beginner lessons and has a built-in feature to export your model as a printable file E.g .STL or .OBJ.
- Now that you have a printable file, the next step is to prepare it for your 3D printer.
- This is called slicing.

Slicing: From printable file to 3D Printer.

Slicing basically means slicing up a 3D model into hundreds or thousands of layers and is done with slicing software. When your file is sliced, it's ready for your 3D printer. Feeding the file to your printer can be done via USB, SD or Wi-Fi. Your sliced file is now ready to be 3D printed layer by layer.

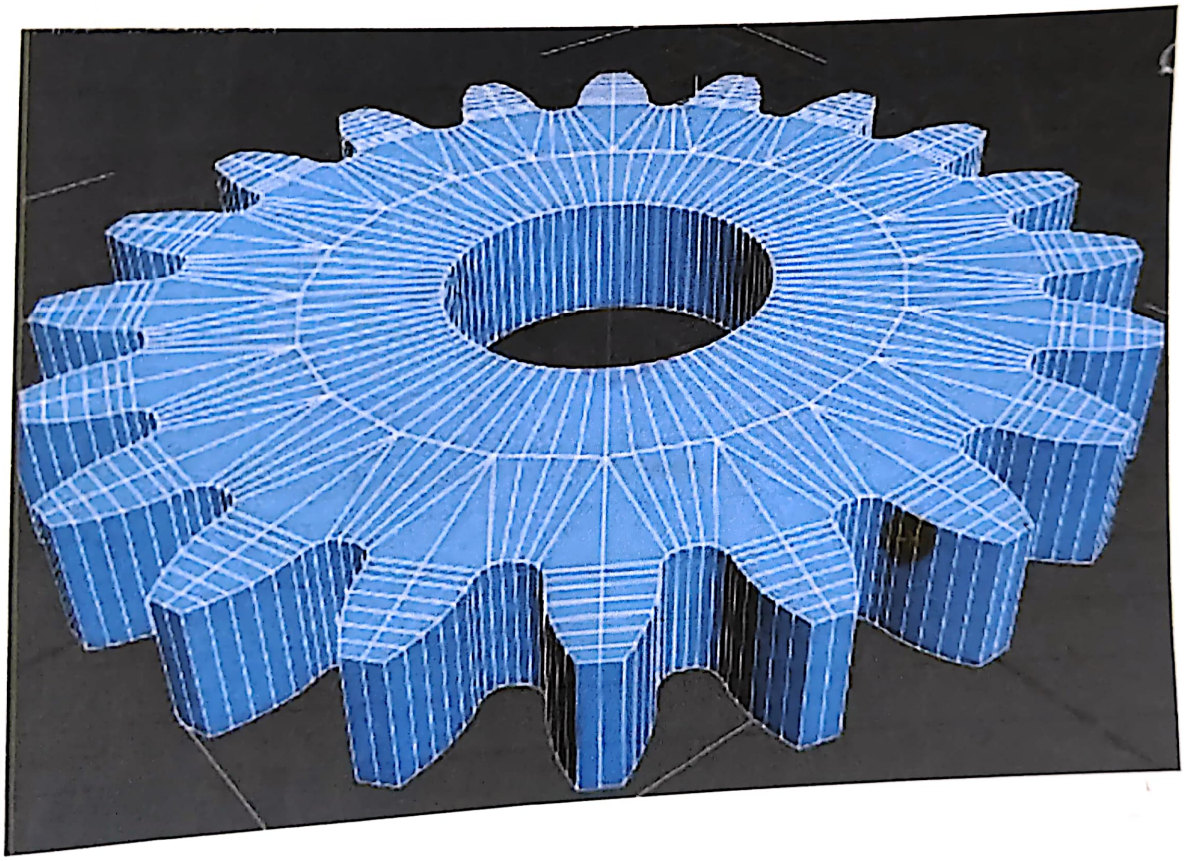

Fig.3.2 – The Final Key-Chain design that is Printed

In the journey towards this project's culmination, we have witnessed the profound impact of combining cutting-edge technology with creative ingenuity. The possibilities are limitless, and the collaborative dance between 3D printing and 3ds Max continues to inspire us to envision, design, and create in ways that were once considered the realm of science fiction. This report serves as a testament to the power of human imagination, innovation, and the tools that empower us to transform ideas into reality.