A Project Report On

Design and 3d-Printing of Foldable Shuriken

Submitted in the partial Fulfilment

For the award of the degree of Bachelor of Technology

In Mechanical Engineering

Submitted To-

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Preface

This report is prepared to fulfil the requirement of the B.Tech. In partial fulfilment For the award of the Degree of Bachelor of technology In Mechanical Engineering at Engineering College Jhalawar.

We have Submitted this report on the topicDesign and 3d-Printing of Foldable Shuriken. WE always had the desire to design a toy which can help to relive us our Childhood . While creating that Project Our Desire for that Is finally Fulfilled.

Acknowledgment

I would like to express my special thanks of gratitude to my Professor as well as our principal who gave me the golden opportunity to do the project on the “ design and 3d-Printing of Foldable Shuriken”

which also helped me in doing a lot of Research and i came to know about so many new things I am really thank full to them.

Secondly, I would also like to thank my parents and friends who helped me a lot in finalizing this project within the limited time frame.

I am are over helmed in all humbleness and gratefulness to acknowledge my depth to all those who have helped me to put these ideas, well above the level of simplicity and into something concrete.
Any attempt at any level can 't be satisfactorily completed without the support and guidance of MY parents and friends.
I would like to thank my parents who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project , despite of their busy schedules ,they gave me different ideas in making this project unique.
Thanking you,

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Content

INSPIRATION

SHINKANSEN BLADE-

The shinkansen blade is a folding knife used in Japanese combat. It is very popular in the worldwide because of its shape and attractive design. In many countries, knives are designed by the inspiration of this (shinkansen blade) are used in military because of it's compactness and its safety feature after folding anyone can carry it without getting harm to his own body.

SHURIKEN –

Shuriken (sword hidden in the hand) are a traditional Japanese concealed weapon that were generally used by shinobi no mono (or ninja, as they are more commonly known) for throwing, and sometimes stabbing or slashing. However, the shuriken took many different shapes and designs during the time that they were used. It has a star shape.

A *Bo-shuriken* is a throwing weapon consisting of a straight iron or steel spike, usually four-sided but sometimes round or octagonal in section. Some examples have points on both ends. The length ranges from 12 to 21 cm (5–8½ in) and the average weight from 35 to 150 grams (1.2–5.4 ounces).They should not be

The *bo-shuriken* is thrown in a number of ways, such as overhead, underarm, sideways and rearwards, but in each case the throw involves the blade sliding out of the hand through the fingers in a smooth, controlled flight. The major throwing methods are the *jiki da-ho* (direct-hit method), and the *han-ten da-ho* (turning-hit method). These two are technically different, in that the former does not allow the blade to spin before it hits the target, while the latter requires that the blade spin.

Usage

Shuriken targets were primarily the more exposed parts of the body: the eyes, face, hands, or feet. The shuriken would sometimes be thrown in a way that slashed the opponent in a glancing blow and travelled on, becoming lost, leaving him confused about the cause of the wound.

Shuriken, especially *hira-shuriken*, were also used in novel ways—they could be embedded in the ground, injuring those who stepped on them (similar to a caltrop), wrapped in fuse to be lit and thrown to cause fire, or wrapped in a cloth soaked in poison and lit to cover an area with a cloud of poisonous smoke.They could also be used as a handheld weapon in close combat.

There are reports of shuriken being coated with poison, intended either as a throwing weapon or to be left in a conspicuous place for a victim to pick up.Other reports indicate that shuriken may have been buried in dirt or animal feces and allowed to harbor the bacterium *Clostridium tetani*—if the point penetrated a victim deeply enough, the bacteria transferred into the wound could cause a then-incurable tetanus infection.[Shuriken are simple weapons, but their historical value has increased.[*citation needed*] Unlike the treasured katana and other bladed weapons, antique shuriken are not often well preserved, largely due to their expendable nature.

Today

Modern shuriken are most often made of stainless steel and are commercially available in many knife shops in Europe and North America, or via the Internet. They are illegal to possess or carry in some countries, such as Belgium, the Netherlands, Canada,Germany,and the United Kingdom (manufacture, sale, distribution and import). In the United States, some states prohibit them (e.g., California, Indiana, New York)while others allow them. In some cases they may be allowed but are still subject to specific local legislation. Owners may be required to possess a certificate for the possession of knives.

Collapsible blade:- Pocket knife

A **pocketknife** is a foldable knife with one or more blades that fit inside the handle that can still fit in a pocket. It is also known as a **jackknife** (jack-knife) or a **penknife**, though a penknife may also be a specific kind of pocketknife. A typical blade length is 2 to 6 inches (5 to 15 cm) Pocketknives are versatile tools, and may be used for anything from opening an envelope, to cutting twine, slicing a piece of fruit or even as a means of self-defense.

History

he earliest known pocketknives date to at least the early Iron Age. A pocketknife with a bone handle was found at the Hallstatt Culture type site in Austria, dating to around 600–500 BCE.Iberian folding-blade knives made by indigenous artisans and craftsmen and dating to the pre-Roman era have been found in Spain. Many folding knives from the Viking era have been found. They carried some friction binders, but more often they seem to have used folding knives that used a closure to keep the blade open

Hand Fan

A **handheld fan**, or simply **hand fan**, may be any broad, flat surface that is waved back-and-forth to create an airflow. Generally, purpose-made handheld fans are folding fans, which are shaped like a sector of a circle and made of a thin material (such as paper or feathers) mounted on slats which revolve around a pivot so that it can be closed when not in use.

On human skin, the airflow from handfans increases evaporation which has a cooling effect due to the latent heat of evaporation of water. It also increases heat convection by displacing the warmer air produced by body heat that surrounds the skin, which has an additional cooling effect, provided that the ambient air temperature is lower than the skin temperature – which is typically about 33 °C (91 °F). Fans are convenient to carry around, especially folding fans.

Next to the folding fan, the rigid hand screen fan was also a highly decorative and desired object among the higher classes. Its purpose is different since they are more cumbersome to carry around. They were mostly used to shield a lady's face against the glare of the sun or the fire.

3D PRINTING

3D printing, or **additive manufacturing**, is the construction of a three-dimensional object from a CAD model or a digital 3D model.The term "3D printing" can refer to a variety of processes in which material is deposited, joined or solidified under computer control to create a three-dimensional object,with material being added together (such as plastics, liquids or powder grains being fused together), typically layer by layer.

In the 1980s, 3D printing techniques were considered suitable only for the production of functional or aesthetic prototypes, and a more appropriate term for it at the time was rapid prototyping. As of 2019, the precision, repeatability, and material range of 3D printing have increased to the point that some 3D printing processes are considered viable as an industrial-production technology, whereby the term *additive manufacturing* can be used synonymously with *3D printing*. One of the key advantages of 3D printing is the ability to produce very complex shapes or geometries that would be otherwise impossible to construct by hand, including hollow parts or parts with internal truss structures to reduce weight. Fused deposition modelling, or FDM, is the most common 3D printing process in use as of 2020

General Principles:-

3d modelling:-

In 3D computer graphics, 3D modelling is the process of developing a mathematical coordinate-based representation of any surface of an object (inanimate or living) in three dimensions via specialized software. The product is called a 3D model. Someone who works with 3D models may be referred to as a 3D artist or a 3D modeler. A 3D Model can also be displayed as a two-dimensional image through a process called 3D rendering or used in a computer simulation of physical phenomena. The 3D model can be physically created using 3D printing devices that form 2D layers of the model with three-dimensional material, one layer at a time. In terms of game development, 3D modelling is merely a stage in the entire development process. Simply put, the source of the geometry for the shape of an object can be 1. A designer, industrial engineer or artist using a 3D-CAD system, 2. An existing object, reverse engineered or copied using a 3-D shape digitizer or scanner or 3. Mathematical data stored in memory based on an numerical description or calculation the object.

3D Models may be created automatically or manually. The manual modelling process of preparing geometric data for 3D computer graphics is similar to plastic arts such as sculpting.

3D modelling software is a class of 3D computer graphics software used to produce 3D models. Individual programs of this class are called modelling applications

Process:-

There are three popular ways to represent a model:

- **Polygonal modelling** – Points in 3D space, called *vertices*, are connected by line segments to form a polygon mesh. The vast majority of 3D models today are built as textured polygonal models, because they are flexible and because computers can render them so quickly. However, polygons are planar and can only approximate curved surfaces using many polygons.
- **Curve modelling** – Surfaces are defined by curves, which are influenced by weighted control points. The curve follows (but does not necessarily interpolate) the points. Increasing the weight for a point will pull the curve closer to that point. Curve types include nonuniform rational B-spline (NURBS), splines, patches, and geometric primitives
- **Digital sculpting** – Still a fairly new method of modelling, 3D sculpting has become very popular in the few years it has been around.There are currently three types of digital sculpting: **Displacement**, which is the most widely used among applications at this moment, uses a dense model (often generated by subdivision surfaces of a polygon control mesh) and stores new locations for the vertex positions through use of an image map that stores the adjusted locations. **Volumetric**, loosely based on voxels, has similar capabilities as displacement but does not suffer from polygon stretching when there are not enough polygons in a region to achieve a deformation. Dynamic tessellation,which is similar to voxel, divides the surface using triangulation to maintain a smooth surface and allow finer details. These methods allow for very artistic exploration as the model will have a new topology created over it once the models form and possibly details have been sculpted. The new mesh will usually have the original high resolution mesh information transferred into displacement data or normal map data if for a game engine.

Printing

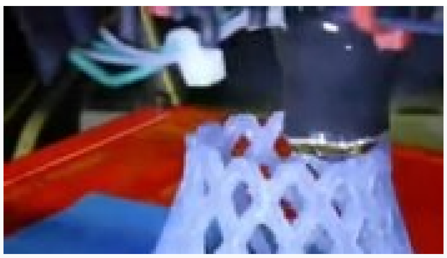
Before printing a 3D model from an STL file, it must first be examined for errors. Most CAD applications produce errors in output STL files, of the following types:

1. holes;
2. faces normal;
3. self-intersections;
4. noise shells;
5. manifold errors.

A step in the STL generation known as "repair" fixes such problems in the original model.Generally STLs that have been produced from a model obtained through 3D scanning often have more of these errors as 3D scanning is often achieved by point to point acquisition/mapping. 3D reconstruction often includes errors.[51]

Once completed, the STL file needs to be processed by a piece of software called a "slicer," which converts the model into a series of thin layers and produces a G-code file containing instructions tailored to a specific type of 3D printer (FDM printers). This G-code file can then be printed with 3D printing client software (which loads the G-code, and uses it to instruct the 3D printer during the 3D printing process).

Printer resolution describes layer thickness and X–Y resolution in dots per inch (dpi) or micrometers (µm). Typical layer thickness is around 100 µm (250 DPI), although some machines can print layers as thin as 16 µm (1,600 DPI). X–Y resolution is comparable to that of laser printers. The particles (3D dots) are around 50 to 100 µm (510 to 250 DPI) in diameter. For that printer resolution, specifying a mesh resolution of 0.01–0.03 mm and a chord length ≤ 0.016 mm generate an optimal STL output file for a given model input file.[54] Specifying higher resolution results in larger files without increase in print quality.



Timelapse video of an object being made out of PLA using molten polymer deposition

Construction of a model with contemporary methods can take anywhere from several hours to several days, depending on the method used and the size and complexity of the model. Additive systems can typically reduce this time to a few hours, although it varies widely depending on the type of machine used and the size and number of models being produced simultaneously.

Finishing

Though the printer-produced resolution is sufficient for many applications, greater accuracy can be achieved by printing a slightly oversized version of the desired object in standard resolution and then removing material using a higher-resolution subtractive process.

The layered structure of all Additive Manufacturing processes leads inevitably to a stair-stepping effect on part surfaces which are curved or tilted in respect to the building platform. The effects strongly depend on the orientation of a part surface inside the building process.

Some printable polymers such as ABS, allow the surface finish to be smoothed and improved using chemical vapor processesbased on acetone or similar solvents.

Some additive manufacturing techniques are capable of using multiple materials in the course of constructing parts. These techniques are able to print in multiple colors and color combinations simultaneously, and would not necessarily require painting.

Some printing techniques require internal supports to be built for overhanging features during construction. These supports must be mechanically removed or dissolved upon completion of the print.

All of the commercialized metal 3D printers involve cutting the metal component off the metal substrate after deposition. A new process for the GMAW 3D printing allows for substrate surface modifications to remove aluminium or steel.

Materials[edit]

Traditionally, 3D printing focused on polymers for printing, due to the ease of manufacturing and handling polymeric materials. However, the method has rapidly evolved to not only print various polymers[60] but also metals[61][62] and ceramics,[63] making 3D printing a versatile option for manufacturing. Layer-by-layer fabrication of three-dimensional physical models is a modern concept that "stems from the ever-growing CAD industry, more specifically the solid modelling side of CAD. Before solid modelling was introduced in the late 1980s, three-dimensional models were created with wire frames and surfaces." [64] but in all cases the layers of materials are controlled by the printer and the material properties. The three-dimensional material layer is controlled by deposition rate as set by the printer operator and stored in a computer file. The earliest printed patented material was a Hot melt type ink for printing patterns using a heated metal alloy. See 1970's history above.

Charles Hull filed the first patent on August 8, 1984, to use a UV-cured acrylic resin using a UV masked light source at UVP Corp to build a simple model. The SLA-1 was the first SL product announced by 3D Systems at Autofact Exposition, Detroit, November 1978 in Detroit. The SLA-1 Beta shipped in Jan 1988 to Baxter Healthcare, Pratt and Whitney, General Motors and AMP. The first production SLA-1 shipped to Precision Castparts in April 1988. The UV resin material changed over quickly to an epoxy-based material resin. In both cases SLA-1 models needed UV oven cure after being rinsed in a solvent cleaner to remove uncured boundary resin. A Post Cure Apparatus (PCA) was sold with all systems. Th early resin printers required a blade to move fresh resin over the model on each layer. The layer thickness was 0.006 inches and the HeCd Laser model of the SLA-1 was 12 watts and swept across the surface at 30 in per second. UVP was acquired by 3D Systems in Jan 1990.[65]

A review in the history shows a number of materials (resins, plastic powder, plastic filament and hot-melt plastic ink) were used in the 1980s for patents in the rapid prototyping field. Masked lamp UV-cured resin was also introduced by Cubital's Itzchak Pomerantz in the Solider 5600, Carl Deckard's (DTM) Laser sintered thermoplastic powders, and adhesive-laser cut paper (LOM) stacked to form objects by Michael Feygin before 3D Systems made its first announcement. Scott Crump was also working with extruded "melted" plastic filament modelling (FDM) and Drop deposition had been patented by William E Masters a week after Charles Hull's patent in 1984, but he had to discover Thermoplastic Inkjets introduced by Visual Impact Corporation 3D printer in 1992 using inkjets from Howett, Inc., before he formed BPM to bring out his own 3D printer product in 1994.

Multi-material 3D printing

A drawback of many existing 3D printing technologies is that they only allow one material to be printed at a time, limiting many potential applications which require the integration of different materials in the same object. Multi-material 3D printing solves this problem by allowing objects of complex and heterogeneous arrangements of materials to be manufactured using a single printer. Here, a material must be specified for each voxel (or 3D printing pixel element) inside the final object volume.

The process can be fraught with complications, however, due to the isolated and monolithic algorithms. Some commercial devices have sought to solve these issues, such as building a Spec2Fab translator, but the progress is still very limited.Nonetheless, in the medical industry, a concept of 3D printed pills and vaccines has been presented.With this new concept, multiple medications can be combined, which will decrease many risks. With more and more applications of multi-material 3D printing, the costs of daily life and high technology development will become inevitably lower.

Metallographic materials of 3D printing is also being researched.By classifying each material, CIMP-3D can systematically perform 3D printing with multiple materials.

4D Printing

Using 3D printing and multi-material structures in additive manufacturing has allowed for the design and creation of what is called 4D printing. 4D printing is an additive manufacturing process in which the printed object changes shape with time, temperature, or some other type of stimulation. 4D printing allows for the creation of dynamic structures with adjustable shapes, properties or functionality. The smart/stimulus responsive materials that are created using 4D printing can be activated to create calculated responses such as self-assembly, self-repair, multi-functionality, reconfiguration and shape shifting. This allows for customized printing of shape changing and shape-memory materials.[70]

4D printing has the potential to find new applications and uses for materials (plastics, composites, metals, etc.) and will create new alloys and composites that were not viable before. The versatility of this technology and materials can lead to advances in multiple fields of industry, including space, commercial and the medical field. The repeatability, precision, and material range for 4D printing must increase to allow the process to become more practical throughout these industries.

To become a viable industrial production option, there are a couple of challenges that 4D printing must overcome. The challenges of 4D printing include the fact that the microstructures of these printed smart materials must be close to or better than the parts obtained through traditional machining processes. New and customizable materials need to be developed that have the ability to consistently respond to varying external stimuli and change to their desired shape. There is also a need to design new software for the various technique types of 4D printing. The 4D printing software will need to take into consideration the base smart material, printing technique, and structural and geometric requirements of the design.

Creality Ender-3 FDM 3D Printer

The Creality Ender-3 3D Printer is one of the best FDM printers under $200 right now, desired for its performance and versatility.

Even though it's a budget FDM 3d printer, the features it houses are comparable to many high-end printers out there.

There are a number of features that make the Creality Ender-3 3d printer one of the most popular machines currently on the market.

It has a build volume of 220 x 220 x 250mm, a BuildTak-like heated build plate, power recovery mode, and a tight filament pathway that makes it easier to print with flexible materials.

These are attributes that are difficult to find in even more expensive printers.

Ender-3 FDM 3D Printer Features

Creality Ender-3 3D Printer is an open-sourced 3d printer.

For every community of users and contributors, for better improved, and more designs can culminate from some of the best and brightest minds in the 3D printing world.

Creality Ender-3 3D Printer is partially assembled and competed by Creality itself.

Which makes it a great 3d printing project for every school and student.

The especially perfect gift to spark a lifelong love for science and engineering and provide a deeper understanding of machinery and robotics.

Use Industrial-grade Circuit Board

The technology used in the Creality Ender-3 3d printer is quite mature and stable.

It can work continuously for 200 hours without pressure.

Also, Creality Ender-3 3D Printer allows it to resume printing after power-off or lapse occurs and with thermal runaway protection itself.

Stable Printing with Creality Ender-3 3D Printer

Patented technology, V-Slot+precision pulley, running more smoothly, more wear-resistant. Effectively reduce noise.

MK8 Technology Adopted in this FDM 3D Printer

MK8 extrusion mechanism is used, a brand-new patented infrastructure that effectively reduces the risk of plugging and poor spillage and can print almost all filaments on the market.

CNC machining of the Y-rail mounting groove to make sure precise positioning and keep the solid frame with the high-precision printing quality.

And big hand twist nut, make the print platform easier to level.

Creality Ender-3 3D Printer can Reach 110°C for hotbed in about 5 minutes.

Meet the needs of fast heating, and printing ABS suggested to be with a 3d printing enclosure to reduce the heat dissipation.

Technical Specifications

Ender-3 FDM 3D Printer Properties

Modeling Technology: FDM（Fused Deposition Modeling）
Printing Size: 220x220x250mm

Printing Speed: 180mm/s

Filament: 1.75mm PLA, TPU, ABS

Working Mode: Online or SD offline

File Format: STL,OBJ,G-code

Ender-3 FDM 3D Printer Hardware

Machine Size: 440x440x465mm
Net Weight: 8KG

Power Supply: 100-265V 50-60HZ
Output: 24V 15A 270W

Ender-3 FDM 3D Printer Extruder Hardware
Layer Thickness: 0.1-0.4mm
Nozzle Diameter: 0.4mm
Printing Accuracy: ±0.1mm
Nozzle Temperature: 255℃
Hotbed Temperature: 110℃

3d -model Images :-

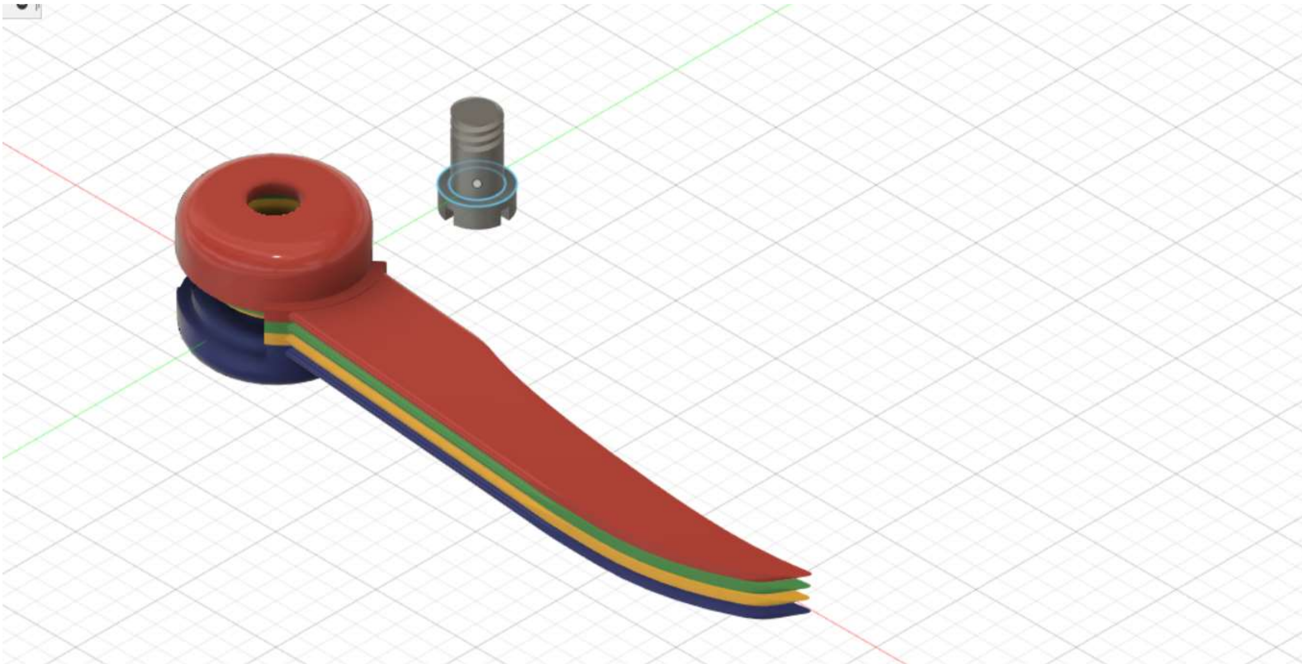


Fig – Side top View of the Blade

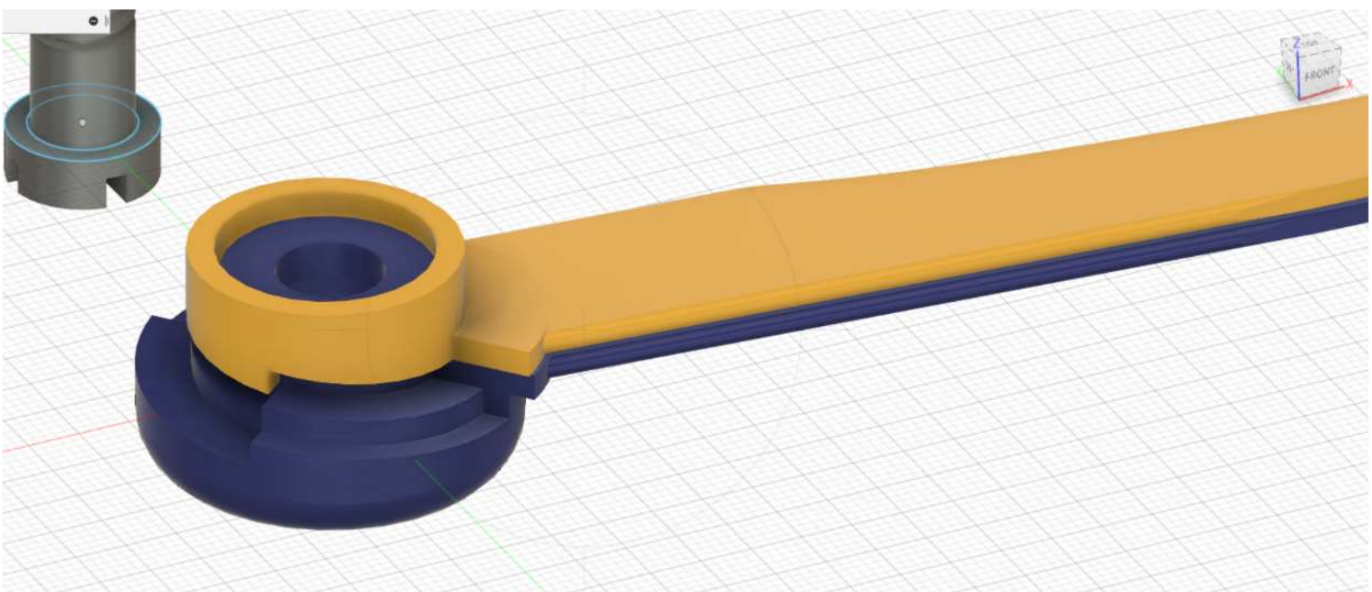


Figure- Assembly of the Lower and middle blade

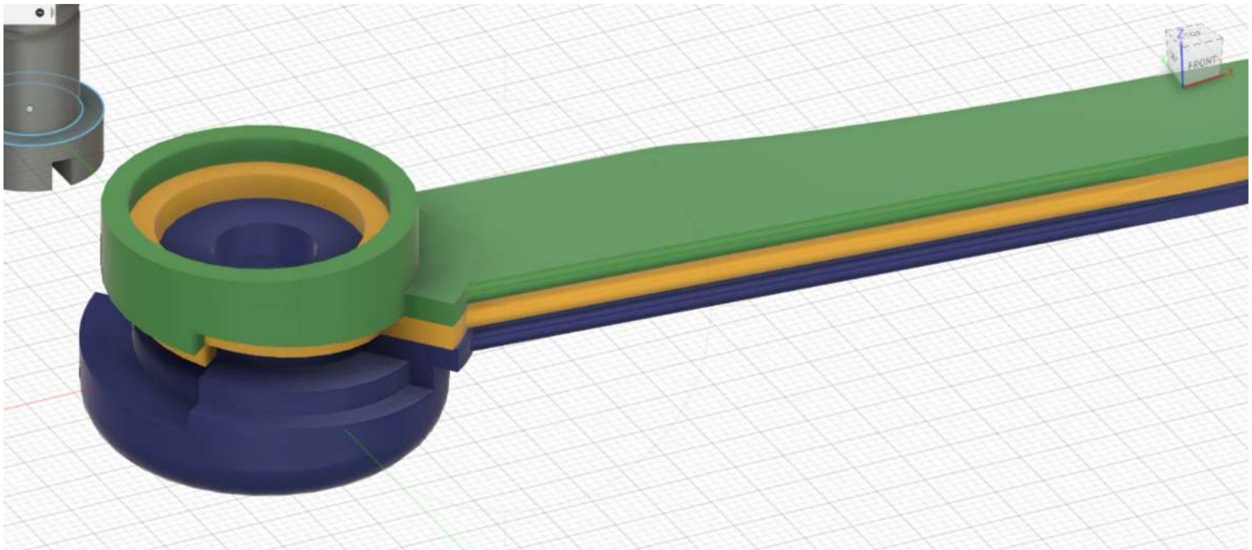


Figure- Assembly Of the Lower, Middle , Upper Middle Blade

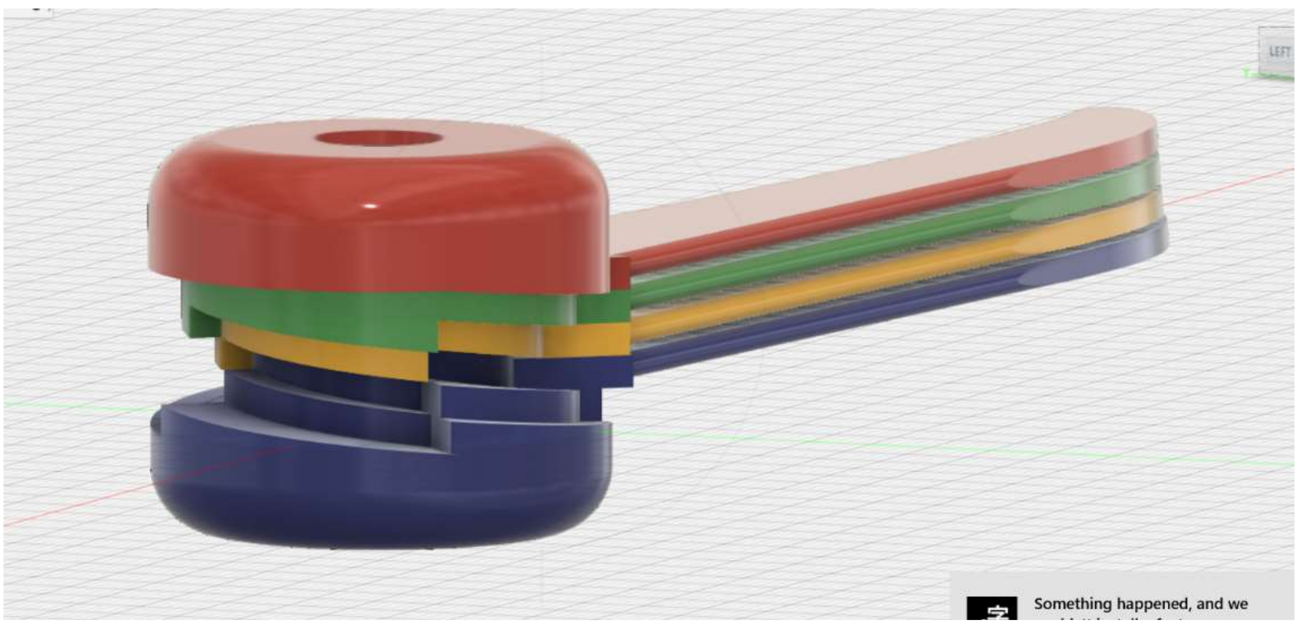
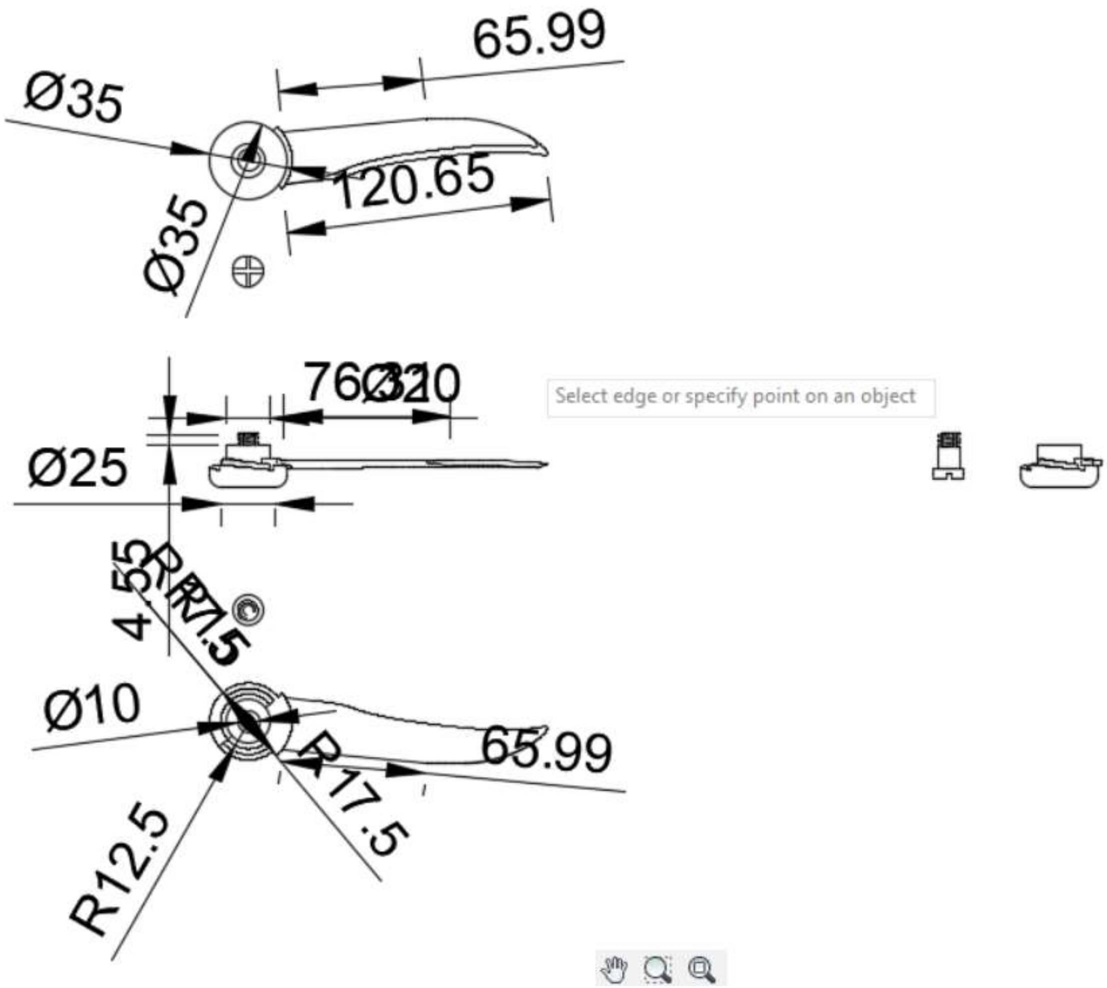
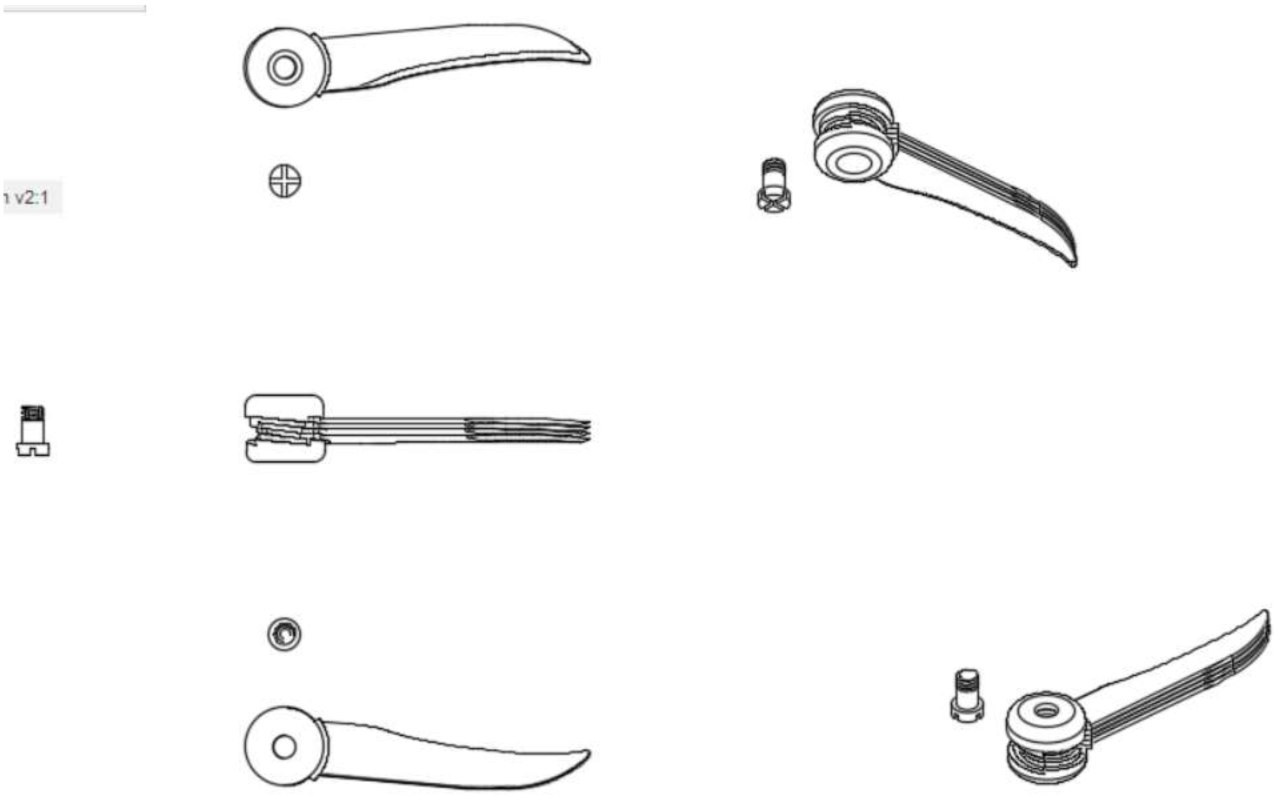


Figure- Side View With the Full Assembly

<u>Drawing Of the Model</u>

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Slicing

The purpose of slicing software is to convert the object model file into instructions for the 3D printer. To perform this task, the software separates the object into many layers. It’s called “slicing” because it “slices” the object to create many layers. After the layers have been created, the slicing software applies various values to each of them. The values denote how the layers should be built. In other words, they tell the 3D printer how and where to move, as well as how much material to use, to build each layer of the object model.

While slicing software is designed primarily to convert object models into instructions for a 3D printer, they often have other noteworthy features. Most slicing software, for instance, allows you to control the infill. Other types of slicing software allow you to add supporting structures, which are oftentimes essential for large and complex objects. Furthermore, rafts, skirts and brims can all be controlled in slicing software

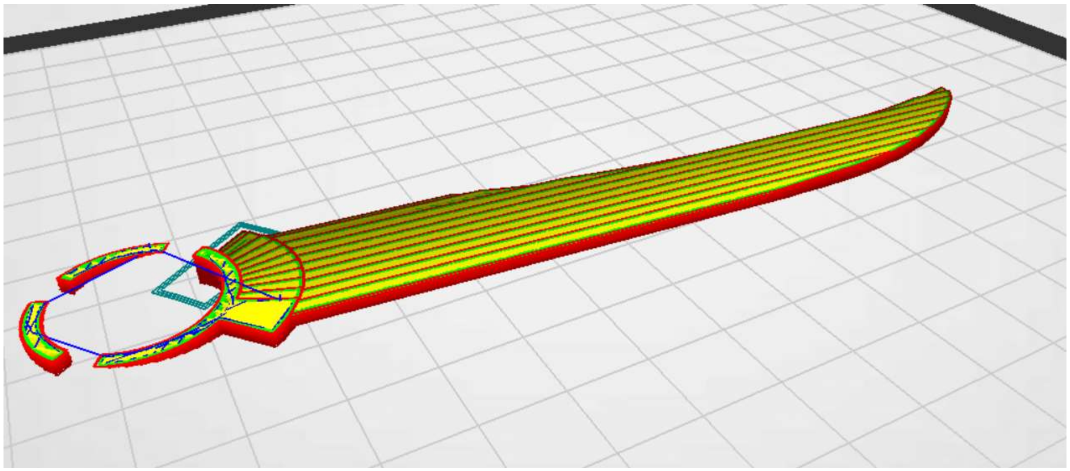

Figure -Image of the slicing of the blade

Slicing Parameter

Layer Height – 2mm
Infill - 25 %
Shell Thickness-0.8mm
Support Provided – No
Nozzle Diameter-0.4mm
Filament Diameter-1.75mm
Print Speed-50mm/s

3d-Printed Parts

Figure:- All 3D printed parts of The Blade

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