

A STUDY ON THE TRADITIONAL KOL TECHNOLOGY OF NEPAL

Sunil Belbase

Sunilbelbase2058@gmail.com

Department of Mechanical Engineering, Kathmandu University, Nepal

ABSTRACT

Kol is an improvised version of Ghani, an oil extraction process that carries 4000 years of history and was invented by the Harappan civilization. In Sanskrit literature of about 500 BC, there is a specific reference to an oil press that marks this machinery as an important part of understanding the social and agricultural life of people of that era. Kol uses wood-based components to achieve cold press and compaction of oil seeds. The main objective of this paper is to do an extensive study on the traditional Kol technology of Nepal and analyze its manufacturing processes. This is achieved through in-person discussion and review of locally available community-based Kol from Arghakhanchi. There is a need for the update and optimization of this machinery regarding efficiency improvement, material upgrading, human resources development, and economic viability for rural communities.

Keywords— Kol, Ghani, traditional, oil extraction, optimization

INTRODUCTION

Kol (Oil Seed Crushing Machine) is a traditional machine used mostly in hilly regions of Nepal. It is used to produce oil by crushing oilseeds like mustard, sesame, Chiuri, etc. Though the machine is replaced by modern mills and motor-operated machines in most areas but is still in existence in many parts of Nepal mainly in remote areas. There are main three-components of Kol. All the parts of Kol are made using wood. The first part is the mortar or base part which is fixed on the ground and scooped circular pit at its center and an outlet to exit the oil after crushing. it can either be a circular or rectangular base. The second part is a wooden pestle whose curved end is inscribed in the circular pit of mortar and another end is fixed to an angular rotator that can freely move around the mortar. The third part is an angular rotator, one end of which carries a Y-shape structure to move around the mortar, and the other is fixed to the upper end of the pestle[1]. It can be both human as well other animal-driven. It helps to make work easier and with less effort. Most importantly they are cheap because they use local resources and are environmentally friendly which are still in operation in many parts of Nepal.



Figure 1 Villagers from kharaula V.D.C, Kailali are using Kol to produce oil[2]

The Kol's primary function is to extract oil from oilseeds. There are numerous advantages to producing oil with Kol. In the market, there are a variety of highly efficient methods for producing oil. The oil looks great and is mostly refined by adding solvents and chemicals to reduce waste and produce more oil, but the end result is that this refined oil can cause serious health problems such as an increase in body fat and an increase in cholesterol levels in the blood and various disease. Using Kol will aid in the production of high-quality oil by preserving its natural nutrients, freshness, and flavor[3]. Several other advantages are listed below:

- Low Manufacturing cost
- Operational cost is almost zero since there is the use of any electricity or other source of energy besides human or animal.
- Environment friendly
- Produce great quality oil

Besides benefits there are limitations as well they are:

- Less Efficient
- Needs more manpower
- Takes lots of time
- Need replacement of parts on a regular basis

MATERIALS AND METHOD

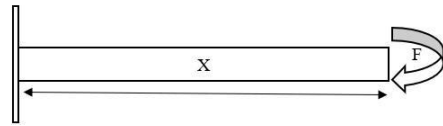
Traditionally Kol is manufactured using locally available wood. Kol consists of three parts, mortar, Y-shape angular rotator, and Pestle. Nowadays improvised Kol is used which is machine-driven and made from metal but in the case of traditional Kol, wood is used as the main material. The wood can be of Sal (Scientific name: Shorea robusta), Harro (Scientific name: Terminalia Cebula), Sadan (Scientific name: ougeinia dalbergioides), etc. The current design has been passed down from generation to generation, and there is no exact date when Kol was starting to use in Nepal.

Working Mechanism

A turning or twisting force called torque is applied for the operation of Kol. Higher the applied force the torque will increase accordingly.

Here, X is the distance from the mortar to the applied force, and F is the applied force.

$$\text{Torque} = F * X$$



By investigating and understanding traditional Kol, CAD designs have been developed. Detailed drawings and assemblies for each part are shown in the annex at the end of the report. The following specifications are of medium-sized Kol.

Length of base: 792.63mm, Width of base: 219.47mm, Height of base: 130mm, Turning radius/Y-shape Connector length: 1008.82mm, Length of pestle: 1514.70mm, length of connector: 1180.04mm. Since it is human-operated the force applied can vary from person to person.



Figure 3 CAD design of Kol

Manufacturing Process

Since all parts of the machine are made from wood, the manufacturing process is easy and has been manufactured in most parts of Nepal with the use of local tools such as axes, sickles, chisels, handsaws, planes, mallets, etc.

Initially preferred material (wood) is selected according to availability it can be any but needs to be strong and support the high tensile load, bending, and torsional load. The selected wood is prepared for the parts and cut down to the designed size of the machine. Since there are only three parts and are not much complex to manufacture hence anyone who has the basic idea and skills of carpentry can manufacture Kol. As it is found that there is no specific design and size of Kol, it is manufactured according to need and requirement. Hence, the machine design varies from region to region and is being manufactured according to requirements, and available resources. Because of this, there are many specifications and designs available. The measurement and design done below are based on archival studies and social surveys.

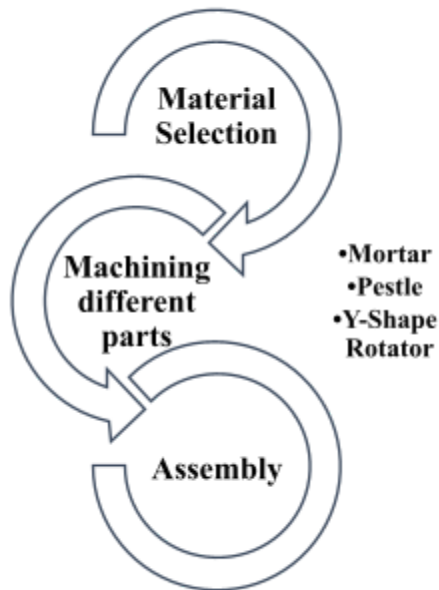


Figure 4: Kol Manufacturing Process



Figure 5: Different Parts of Kol

Mortar

Mortar is the main component of Kol and is mainly made from sal tree (Shorea robusta). The rectangular extruded cut section is made in the center where the oilseeds are retained after baking and are placed for oil refinement. The conic section breaks down the oilseeds with the help of a pestle and oil gets collected in the pot below. The larger the base, the more processing will be done. The log is trimmed into a rectangle and tapered in the center to accommodate the pestle. There are two holes on each side to secure the base to the ground.

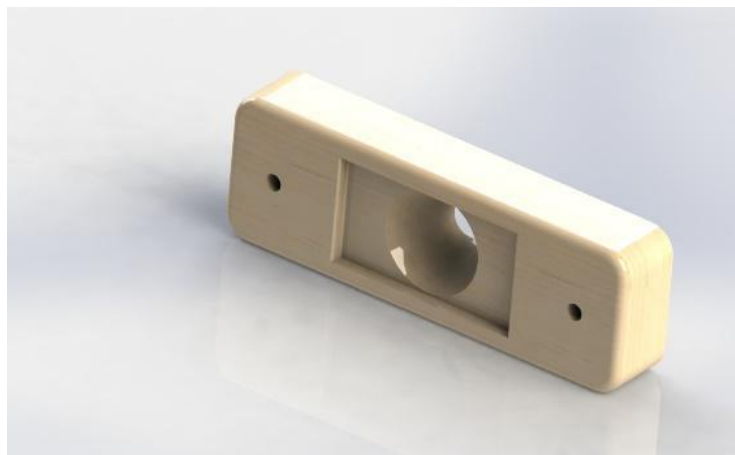


Figure 6: Mortar

Y-Shape connector

Similar to mortar, the preferred and available wood is selected for the Y-shape connector. It connects and holds the pestle and connector and performs rotation. In the lower part, a hole is made to fit the connector, and in the upper part, a Y shape is made to hold the pestle and it is supported with the help of a holder. There is no required size for the Y-shape connector and it is manufactured on basis of the size of Mortar.



Figure 7: Y-shape Connector

Pestle

The pestle is a long, smooth component used to grind oil. It can usually be made from Harro (Terminalia Cebula) based on the wood available it can be made from any durable material. It is usually connected to a Y-shaped connector at an angle of 40-70 degrees to completely grind the oil seeds.

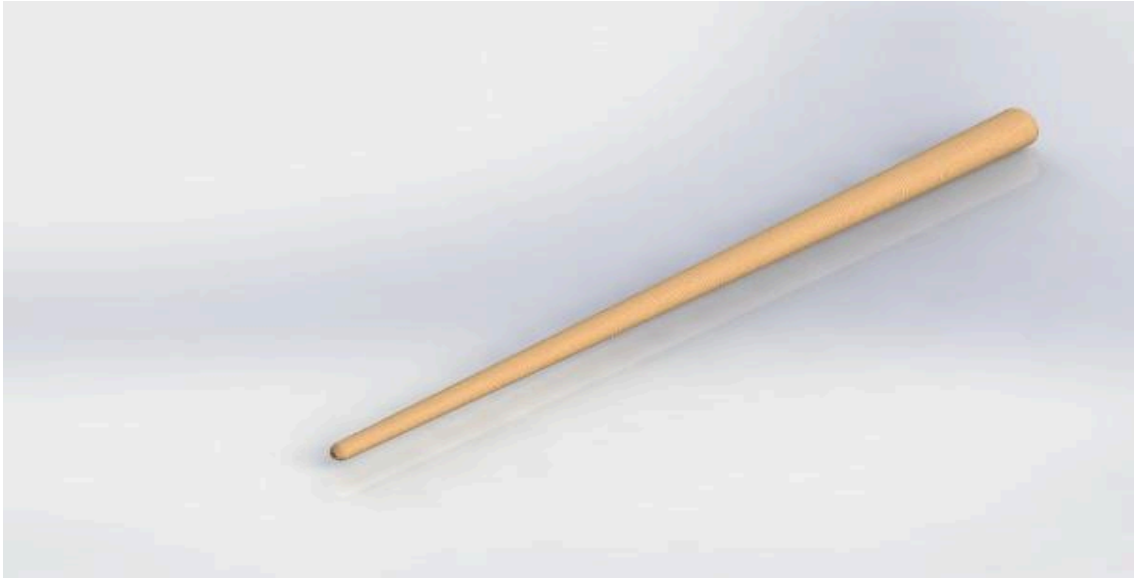


Figure 8: Wood pestle

Connector

The connector is used to connect the Y-shaped connector and the pestle at a specific angle. It is made of the same wood as the base, pestle, or Y-shaped connector but again can be made from any wood base on availability. In the upper part, a hole is drilled for the mounting of the Pestle, and the lower part of the connector is inserted into the Y-shaped connector.



Figure 9: Connector

Holder

Holder is small and important part of kol. It is used to support and hold the pestle in the Y-shape connector so that it doesn't slip out of the Y-shape connector. It is designed as required. Since the pestle is making a certain angle with respect to the Y-shape connector a significant amount of load is applied to the Holder hence it is made using harder material. It is placed in the upper section of the Y-shape connector.



Figure 10: Holder

RESULTS AND DISCUSSION

Traditional Nepalese Kol production was done on the basis of scale, requirements and available resources. There are no design specifications and no specific date from when it was used in Nepal. So, there is a need for standardization with some modifications for maximum efficiency Kol. The design varies from region to region. Based on the existing Kol, the new Kol is made from locally available wood with the use of carpentry tools. The main motive of the paper is the analysis of traditional Nepalese Kol technology which was done using archival research and a social survey.

Standardization

Kol is a machine for making wood press oil and has been used for a very long time. Different designs existed and are still in use, depending on resources, requirements, comfort, different sizes, and whether different designs of Kol are used. There is no set standardized process for creating col. It varies from region to region and has innumerable variations. Some use a circular mortar as the base, while others use a rectangular one. Small to large formats are used, depending on your needs and requirements. The angle between the pestle and the Y-shaped connector is also different, but often one section of the Y-shaped connector is angled between 45 – 70 degrees and the other section is angled between 60-80 degrees. This seems to be the most efficient. The standardization process has not been decided because the design and size vary from region to region.

Modification

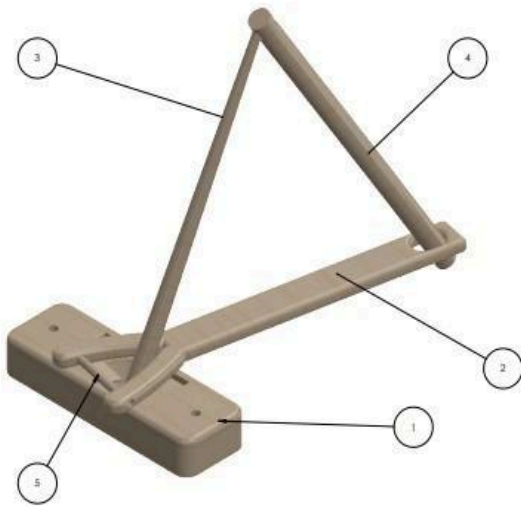
Some modifications can be done to enhance the efficiency and modernized the machine:

- As Kol parts are manufactured using the local tool the precision of the machine is low which decreases the efficiency and can be done using modern equipment.
- Variation of the length of different parts to minimize the work input.
- Connection of different parts using iron nails could increase its longevity.
- Better wood can be used for making Mortar.

REFERENCES

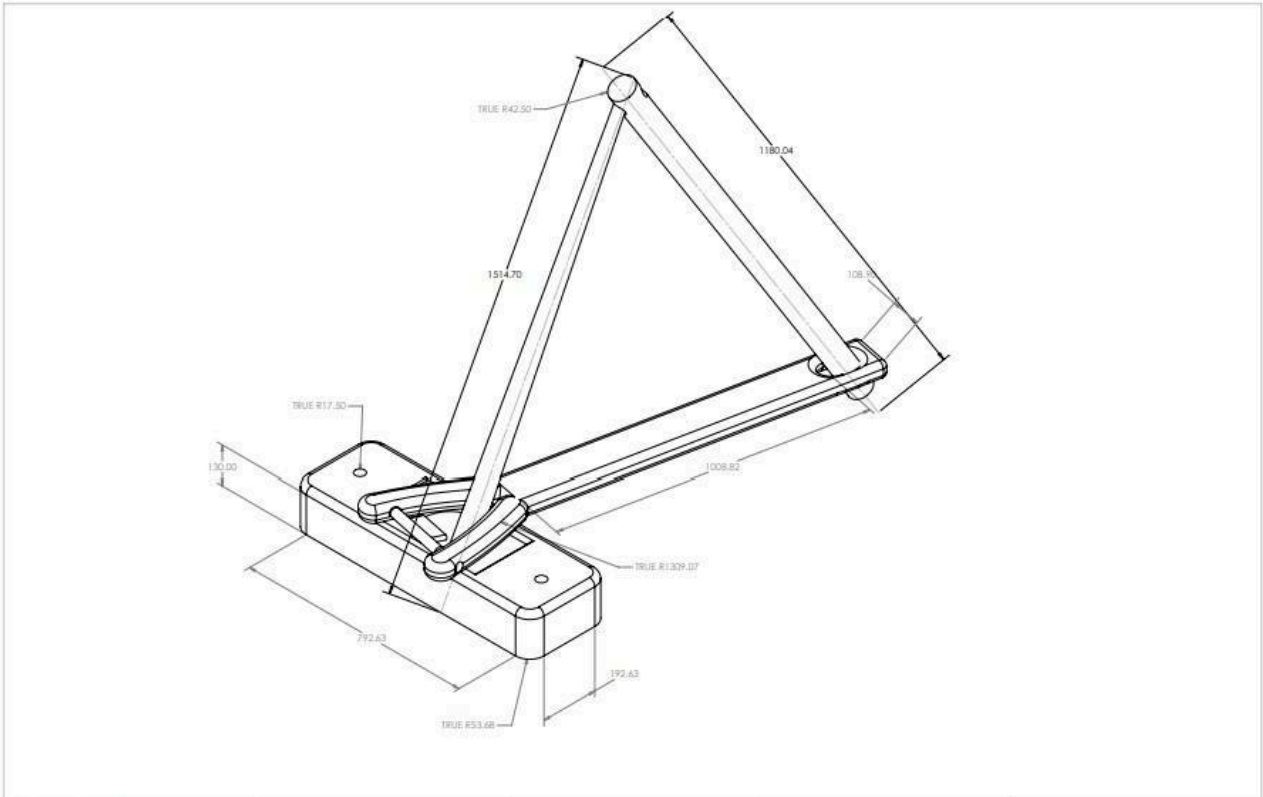
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ANNEX

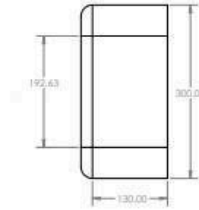
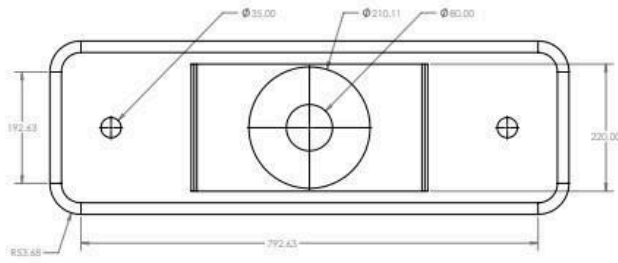


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Ractangular Base(Mortar)		1
2	Y-shape Connector		1
3	Wood pestle		1
4	Connector		1
5	Wood Holder		1

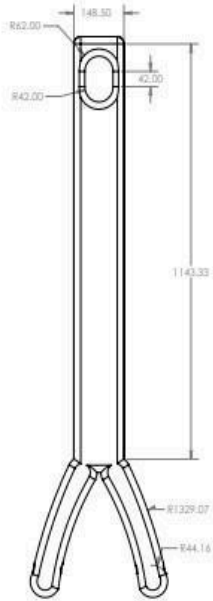
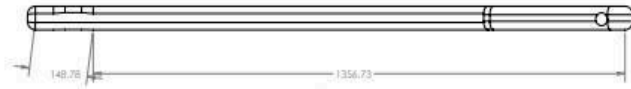
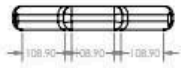
Drawn BY: SUNIL BELBASE	SHEET #: 01	# OF SHEET: 7	DATE: 2022-02-15	SCALE: 1: 8
KOL ASSEMBLY	PART #:	Material: wood	REQUIRED:	



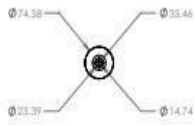
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KOL Assembly	PART #:	Material: Wood	REQUIRED:	



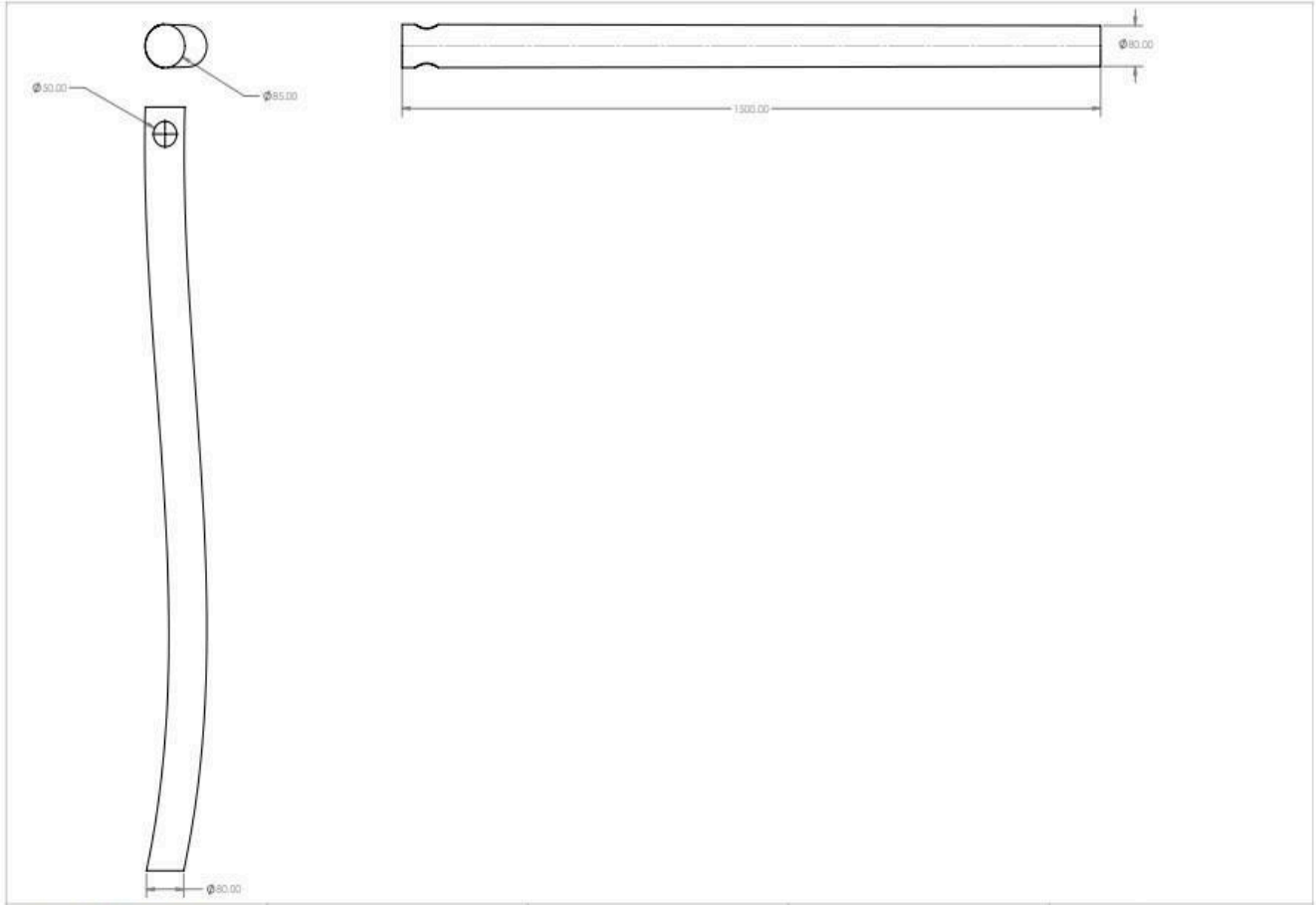
Drawn BY: SUNIL BELBASE	SHEET #: 03	#OF SHEET: 7	DATE: 2022-02-15	SCALE: 1:4
RECTANGULAR BASE (MORTAR)	PART #:	Material: wood		REQUIRED: 1



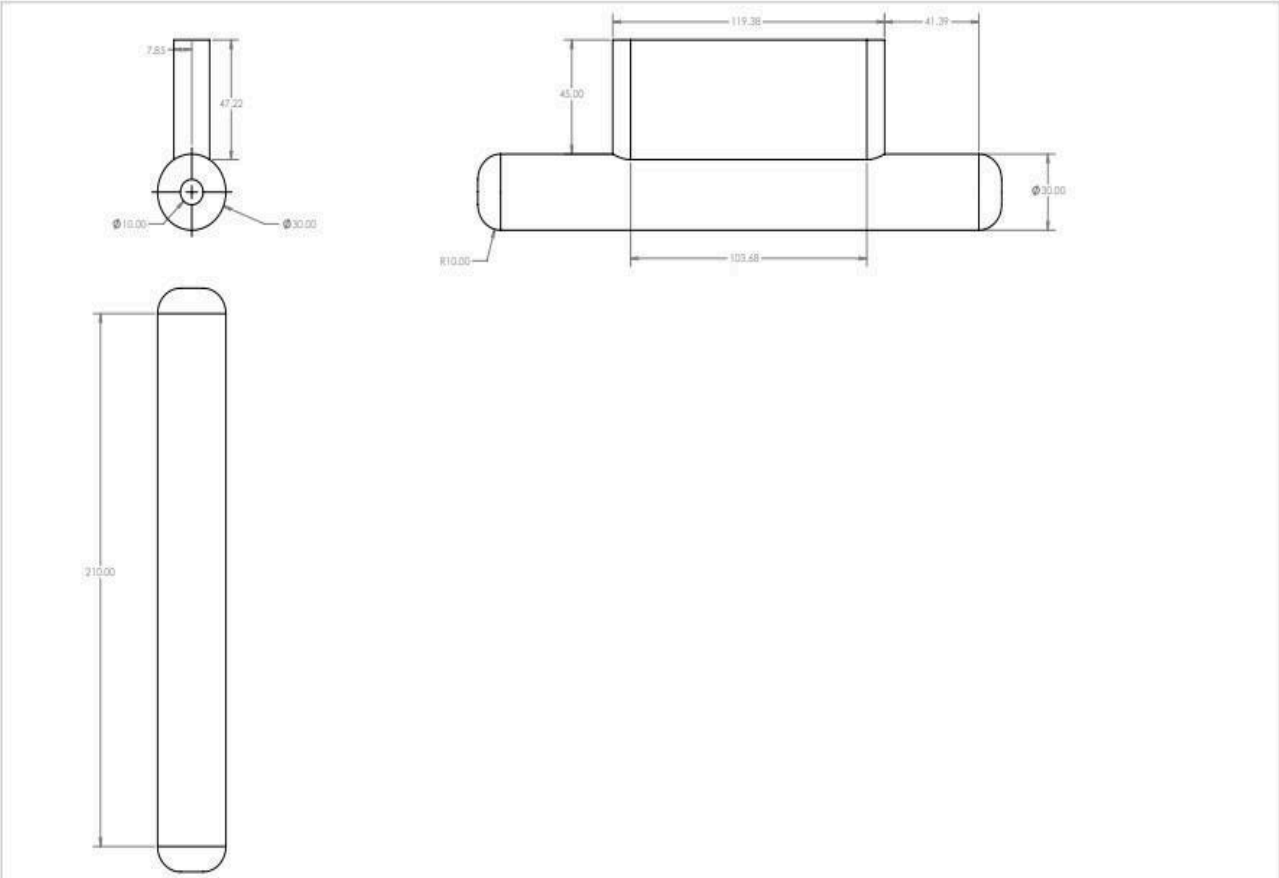
Drawn BY: SUNIL BELBASE	SHEET #: 04	#OF SHEET: 7	DATE: 2022-02-15	SCALE: 1:6
Y-SHAPE CONNECTOR	PART #: 2	Material: Wood	REQUIRED: 1	



Drawn BY: SUNIL BELBASE	SHEET #: 5	#OF SHEET: 7	DATE: 2022-0215	SCALE: 1:6
WOOD PESTLE	PART #: 3	Material: Wood	REQUIRED: 1	



Drawn BY: SUNIL BELBASE	SHEET #: 06	#OF SHEET: 7	DATE: 2022-02-15	SCALE: 1:5
CONNECTOR	PART #: 4	Material: wood	REQUIRED: 1	



Drawn BY: SUNIL BELBASE	SHEET #: 07	# OF SHEET: 7	DATE: 2022-02-15	SCALE: 1:1
HOLDER	PART #: 6	Material: wood	REQUIRED: 1	