DIPLOMA IN MECHANICAL ENGINEERING

SESSION 1 2024/2025

DEVELOPMENT PROTOTYPE JIG AND FIXTURE USING PNEUMATIC SYSTEM FOR TEACHING AIDS IN SUBJECT (DJF 51072 – JIG AND FIXTURE) AT POLYTECHNIC BANTING SELANGOR

CLASS: DTP5A

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This report was submitted to the Department of Mechanical Engineering as part of the requirements for the award of the Diploma in Mechanical Engineering (Manufacturing)

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ENGINEERING MECHANICAL: PROJECT

TITTLE : DEVELOPMENT PROTOTYPE JIG AND FIXTURE USING PNEUMATIC SYSTEM FOR TEACHING AIDS IN SUBJECT (DJF51072 – JIG AND FIXTURE) AT POLYTECHNIC BANTING SELANGOR

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1. We are final year students of **Diploma in Mechanical Engineering (Manufacturing), Politeknik Banting Selangor,** which is located at **Persiaran Ilmu, Jalan Sultan Abdul Samad 42700 Banting, Selangor Darul Ehsan.** (Hereinafter reffered to as 'the Polytechnic')

2. We represent that 'DEVELOPMENT PROTOTYPE JIG AND FIXTURE USING PNEUMATIC SYSTEM FOR TEACHING AIDS IN SUBJECT (DJF51072 – JIG AND FIXTURE) AT POLYTECHNIC BANTING SELANGOR Project' and the intellectual property contained therein is our original work/design without taking or imitating any intellectual property from other parties

3. We hereby agree to relinquish the ownership of the intellectual property in 'the Project' to 'Polytechnic' to fulfil the requirements for the award of **Diploma in Mechanical Engineering (Manufacturing)** to us.

Subscribed and solemnly declared by above named;

a) FAIZ BIN AZZAHAR
(Matrix No.:24DTP22F1044), ……

b) MUHAMMAD NAUFAL FITRI BIN ASRUL
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d) FALISHA IZWAWA BINTI FADIR
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Before me,

MUHAMMAD SANI BIN BUANG ( ) …….

as the project supervisor at the date: (MUHAMMAD SANI BIN BUANG)

ACKNOWLEDGEMENT

Alhamdulillah, we are very grateful because we were able to complete the report proposal project that we have been working on all this time which is titled fabrication jig and fixture using pneumatic system for drill hole for teaching and learning process in Polytechnic Banting. Not forgetting all the members of the group who tried their best and worked hard to complete this report project.

A wreath of appreciation to Mr. Muhammad Sani Bin Buang as the supervisor of DJJ40182 because he has given us a lot of guidance and help throughout the preparation of this report proposal.

On this occasion, I would like to say a thousand thanks to our family members for giving us endless encouragement. Finally, this award is also given to anyone who directly or indirectly helped in the production of this project.

Thank You.

ABSTRACT

This final year project focuses on the development of a prototype jig and fixture using a pneumatic system as an educational tool for the DJF51072 – Jig and Fixture course at the Polytechnic level. The primary motivation for this project arises from the current challenges in the teaching and learning process, where students and lecturers face significant constraints due to the need for external industry visits, which are costly and time-consuming. These visits, though essential for hands-on experience, often disrupt the learning schedule and do not always offer the comprehensive exposure required for students to fully grasp the intricacies of jigs and fixtures.

Moreover, lecturers struggle to effectively convey the practical applications of these tools through traditional teaching methods, which may not provide sufficient hands-on engagement or real-world context. This project aims to address these issues by developing a prototype jig and fixture that incorporates a pneumatic system, specifically designed for drilling operations, to serve as an innovative teaching aid. By eliminating the need for external industry visits, this prototype will reduce the time and financial constraints associated with traditional learning methods, while simultaneously enhancing the learning experience by providing an accessible, in-house solution for practical training. The pneumatic system will enable students to interact with the jig and fixture in a controlled environment, allowing them to directly experience the mechanics of how jigs and fixtures are used to ensure precision and efficiency in manufacturing operations. The goal is to create a teaching tool that will not only facilitate a deeper understanding of the theoretical concepts behind jigs and fixtures but also provide students with hands-on practice in a manner that is both engaging and educational.

This project will contribute to improving the overall quality of teaching in the field of Jig and Fixture, offering students a more effective way to apply their theoretical knowledge in real-world scenarios, thus enhancing their practical skills and preparing them for future careers in the manufacturing industry. Through this approach, the project aims to revolutionize the learning experience for students in the DJF51072 subject and provide a cost-effective, time-efficient solution that aligns with the modern needs of both educators and learners in technical education.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In the world of manufacturing, precision and repeatability are paramount. This is where jigs and fixtures come into play. Jigs and fixtures are specialized tools used to guide, hold, and support workpieces during manufacturing processes, such as drilling, milling, welding, or assembly. While they may seem simple at first glance, these tools play a crucial role in ensuring accuracy, consistency, and efficiency in production. Jigs are tools that hold a cutting tool in place or guide it as it performs a repetitive task like drilling or tapping holes. Fixtures, on the other hand, do not guide a cutting tool, but hold a workpiece steady in a fixed position, orientation, or location. The humble clamp serves as a versatile and indispensable tool. From holding workpieces securely in place during machining processes to providing temporary structural support during assembly, clamps play a crucial role in ensuring precision, stability, and efficiency. With a wide variety of designs and configurations available, ranging from simple C-clamps to sophisticated hydraulic clamping systems, these devices offer versatility and adaptability to meet the diverse needs of different industries and applications.

Figure 1.1 : users use clamps to drill holes

in the foundry workshop

Based on figure 1.1 a person uses his hands to hold the workpiece from moving to make a hole in the wood. This method is dangerous and uses a lot of work force to hold the workpiece. Nowadays there are various materials that can be used to hold the workpiece without using hands and dangerous yourself when using it.

1.2 BACKGROUND

Nowadays, teaching and learning are very important to students. Along with the development of time, there are various methods of teaching and learning to be revealed to students among them is direct teaching and learning with practical, students can increase their knowledge about Jig and Fixture and attract interest in the Jig and Fixture.

Most drill machines in the workshop have a clamp to hold the product for the purpose of drilling, but the clamp that is in the machine workshop for the purpose of drilling holes is in a manual state where the user needs to adjust the workpiece on the clamp manually before being placed on the drill machine. Without using a clamp, the user will have difficulty making holes in the workpiece material and endanger the user. w

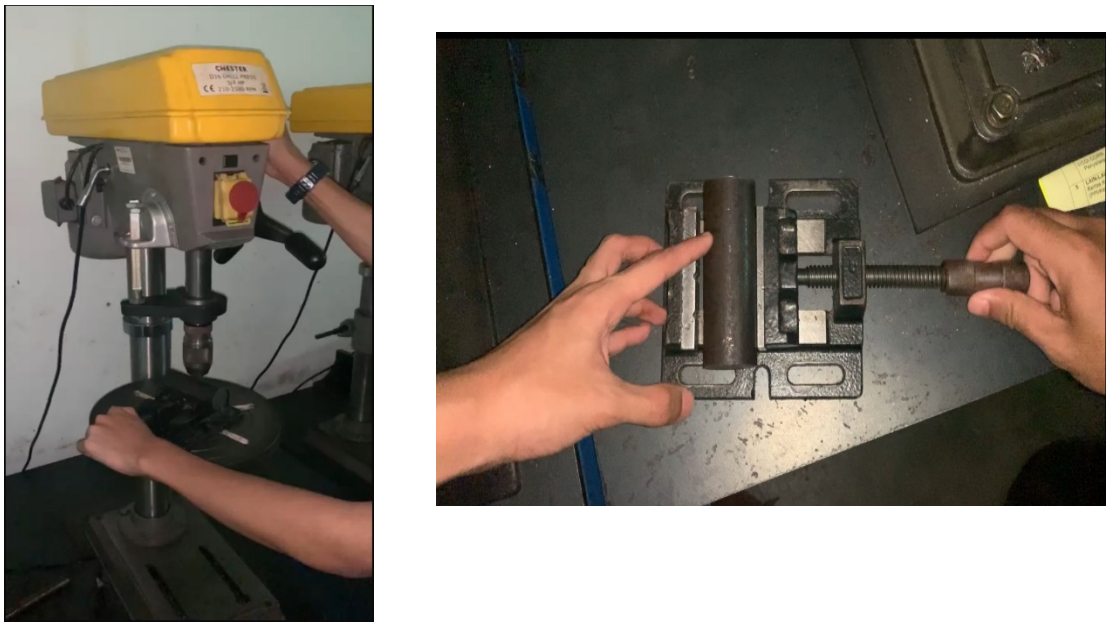


Figure 1.2: Clamp in Polytechnic Banting Machining Workshop

for drilling process

Based on figure 1.2, it shows the drill hole and clamp machine used in the machine shop, which is the drill press vise clamp. The figure shows a situation where the user needs to hold the clamp to drill a hole on the workpiece to make an accurate hole. However, the user needs to manually adjust the workpiece on the clamp to ensure that the workpiece does not move or become loose when making a hole.

1.3 PROBLEM STATEMENT

1. Lecturers and students need to visit other industries or colleges for learning and teaching will cause time constraints and increase costs
2. Lecturers have difficulty in revealing lesson related to Jig and Fixture for student in DJF51072 subject.
3. Inadequate teaching method for student learning about Jig and Fixture.

1.4 OBJECTIVES

1. To develop jig and fixture using pneumatic process to eliminate the need for external industry visits, reducing time constrains and cost in the teaching and learning process
2. To design Jig and Fixture for drilling operation that enhance the practical learning experience for students in the DJF51072 subject.
3. To implement the jig and fixture as an effective teaching tool to improve students understanding and practical application of Jig and Fixture concept in the classroom

1.5 SCOPE OF PROJECT

1. Jig & Fixture using pneumatic system for drill hole will be used for teaching and learning for subject DJF51072 Jig and Fixture.
2. Air compressor:
   - Maximum pressure for compressor is 150psi
   - Weigth: approx. 5.5kg
   - Tank capacity : 6L(1.6GAL)
   - Size : 400 mm (L) x 150 mm (W) x 300 mm (H)
3. Pneumatic system:
   - Size of outlet pipe diameter is 6 mm
   - Material : Stainless steel
   - Working pressure : 0.1 – 0.7 Mpa
4. Workpiece :
   - Crankshaft casing
5. Workpiece material :
   - Steel
6. Workpiece size :
   - 30 cm x 40 cm

1.6 PROJECT IMPACT

What is important when we do this project is can help students and lecturers at Banting Polytechnic for teaching and learning methods.With this product,student typically emerges more knowledgeable with their confident and curiosity about jig and fixture.In addition, it makes things easier for lecturers to reveal a few examples of Jig and Fixture to students who take the DJF51072 course in their next semester. On this occasion, the lecturer can reduce costs and time constraints to takes students to the industry to visit areas that operate jigs and fixtures for teaching and learning sessions.

CHAPTER 2

LITERATURE REVIEW

2.1 RESEARCH WORK

2.1.1 ADVANTAGES AND DISADVANTAGES OF DRILLING MACHINE

ADVANTAGES:

1. Precision

Drilling machines allow for precise drilling, ensuring accuracy in hole placement, depth, and diameter. This precision is essential for applications where exact specifications are required.

2. Efficiency

Drilling machines can create holes quickly and efficiently, speeding up production processes. This is particularly advantageous in mass production settings where time is of the essence.

3. Versatility

Drilling machines can be used to drill holes in a wide range of materials, including wood, metal, plastic, and composites. They can also accommodate various drill bit sizes and types, making them versatile tools for different applications.

DISADVANTAGES:

1. Set-up Time

Proper setup and calibration of drilling machines can be time-consuming, especially when switching between different drill bit sizes or materials. This setup time can impact overall productivity.

2. Maintenance

Drilling machines require regular maintenance to ensure optimal performance and longevity. This includes lubrication, cleaning, and periodic inspections of components such as bearings, belts, and motors.

3. Safety Risk's

Improper use of drilling machines can pose safety risks to operators, including the risk of injury from rotating parts, flying debris, or entanglement. It's essential to follow safety protocols and provide adequate training to personnel operating these machines.

2.1.2 CAUSES AND DAMAGE FOR NOT USING DRILLING MACHINE PROPERLY

I. Eye injuries from flying debris

Figure2.1: eye injuries

The first risk that often happen in the workshop is eye injuries. When the user operating the drilling machine the small particles or dust from the workpiece can bounce back toward the user. People think this kind of situation is harmless, but most of user have experienced this annoyance and injuries on their eyes while operate the drilling machine. The eyes are very sensitive and even tiny particles can create a lot of damage which can lead to impaired vision and in the worst case even blindness. With this information, we know that eye injury is not just a normal injury. Therefore, it is important for user to wear goggle while using drilling machine to prevent eye injuries.

II. Puncture wound

Figure 2.2: Puncture wound

The next one is puncture wound. It's occurs when a sharp object such as drill bit or a piece of material being drilled penetrates the user's skin and underlying tissues. This type of injury can result from various cause's including accidents, improper handling of drilling machine or failure to follow the safety procedures.

Imagine the user using drilling machine to drill holes in a piece of metal. While drilling it, the user inadvertently applies too mush pressure or loses control of the machine that cause the drill bit suddenly slip or jam. As a result, the drill bit causing a puncture wound. This kind of wound can vary in severity depending on factors such as the depth of penetration, the force of injury and the location of the wound. To prevent it from happen, the user needs to maintain stable stance and firm grip on drilling machine to prevent loss of control or accidental slippage

III. Equipment damage

Figure 2.3: Damaged drill bit

Using a drilling machine incorrectly can cause damage to the machine itself. This might include wear and tear on components such as bearings, gears and motors due to overloading, excessive vibration, or improper alignment. Additionally, misuse of drill bits or improper handling of the machine can lead to breakage or premature failure of parts.

2.2 MECHANISM EXISTING AND NEW PROJECT

1. EXISTING DESIGN

a. 2013-2014 By Pritam Kumar Kundu

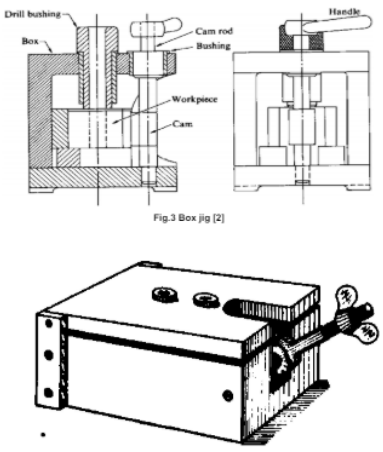


Figure 2.4: Jig

Design and fabrication of work holding device for a drilling machine
http://ethesis.nitrkl.ac.in/5908/1/110ME0202-7.pdf

b. 2019 By Hendro Passetiyo, Rizki Septiana and Melati Kurniawati

Figure 2.5: Side Plate Component

Design of Drilling Jig for Side Plate Component
https://www.ieeesem.com/researchpaper/Design_of_Drilling_Jig_for_Side_Plate_Component.pdf

2. NEW PROJECT

I. AIR COMPRESSOR

A device that converts mechanical energy into pneumatic energy is known as an air compressor. There are many distinct types of compressors, each with its own set of functioning principles and operating conditions. All have the same purpose: to extract air from the atmosphere and produce greater pressure air for various applications. The current paper provides a brief overview of an air compressor and its applications, as well as overhauling, condition monitoring, and maintenance programs for two-stage reciprocating air compressors, as well as a brief overview of recent developments in compressed-air vehicles, compressed-air engine and power source development, and the effect of temperature on moisture separation in air compressors. In the development of the industry, air separation is particularly significant. And there's the air compressor, which produces not only the necessary air but also the necessary pressure. Refrigeration and cooling equipment require high-pressure air. Plant, as well as the raw materials needed for separation a major device in an air separation plant is the plant. A case study was conducted on a locomotive compressor to improve performance and the development of a two-stage reciprocating air compressor.

https://www.indianjournals.com/ijor.aspx?target=ijor:ajmr&volume=10&issue=12&article=015

II. JIG AND FIXTURE

Figure 2.6: Jig & Fixture

Jigs and fixtures are classified alongside machines, equipment, and other devices, which fulfill a task in a production system as production equipment. A jig can be classified as a device that holds the workpiece and locates the tool path. Fixtures also a device fixed to the worktable of a machine and locates the work in an exact position relative to the cutting tool. In essence, their purpose is to ensure uniform and reliable repeatable conditions for work operations.

Jigs are often used in drilling, reaming, counterboring, tapping and other one-dimensional machining operations or applied as guides for tools or templates. Special cramping jigs that ensure squareness are often used as well. Another common application for a jig is a drill bushing that helps guide a drill bit through the surface of the workpiece to ensure correct positioning and angle.

Since the advent of automation and computer numerical controlled (CNC) machines, jigs are often not required because the tool path is digitally programmed and stored in the machine's memory. However, jigs are still used in smaller machine shops to support manual machining of special or custom parts and one-offs.

Fixtures are often used in milling, turning, planning, slotting, grinding, and other multidimensional machining processes, as well as automotive vehicle assembly and optical, laser scanning inspection systems. The material block clamped inside a CNC machine and a vise sitting on a workbench are also fixtures. Fixtures are also essential in an automobile assembly line to secure and guide cars through the welding and assembly process. Differences aside, both jigs and fixtures are tools that make a significant difference. They increase productivity, improve the repeatability of parts, make part assembly and disassembly easier and help create a safer working environment

Nearly all automated industrial manufacturing processes rely on jigs and fixtures to consistently build parts that function properly. Engineers can make sure their jigs and fixtures are strong and well-designed by keeping these key considerations in mind.

https://www.reidsupply.com/en-us/industry-news/what-are-jigs-and-fixtures

III. PNEUMATIC SYSTEM

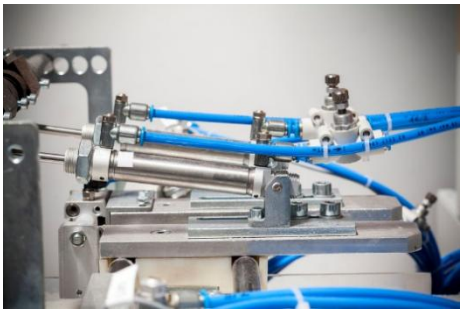


Figure 2.7: Pneumatic System

In pneumatic system, power is transmitted and controlled through compressed air within a circuit. Due to its advantages, such as the low price of its components, easy maintenance of the system, pneumatic system has been widely used throughout industries. And now, pneumatic system has become a main energy consumption system all over the world. However, the efficiency of pneumatic system is very limited as a result of improper use, poor management and low efficiency of pneumatic components, about 30% . To increase the efficiency of pneumatic systems as well as the implied components, the methods to evaluate and measure the power of compressed air should be established. Nowadays, the air volume or its rate of flow is applied to represent the air consumption . But, the amount of power which is lost in supply lines or provided to actuators cannot be clarified, and that is considered extremely important for energy savings. Furthermore, fluid power in hydraulics can be expressed by multiplying the pressure of gauge as well as the volumetric flow rate of the fluid. However, due to the compressibility of air, fluid power is unfeasible for compressed air .Therefore, to evaluate the energy consumption as well as the loss of pneumatic system, and optimize the design of pneumatic components, it is necessary to propose methods to evaluate and measure power of pneumatic system.

https://link.springer.com/article/10.1186/s10033-019-0354-6

2.3 COMPARISON EXISTING AND NEW PROJECT

Although this project is a bit expensive to make the fabrication, this project might be useful for Polytechnic Banting student or other user to use the drilling machine smoothly without any problem. This project that related with pneumatic system that installed at drilling machine could be easier to the user while using the machine. This will cost around RM1200 to create this project. This innovative concept is transportable and doesn't require much space to set up .Aside from that, this idea came from our supervisor Sir. Sani Bin Buang and we manage to find the information of our project throughout the learning week.

2.4 SAFETY TERM

Although this project is a portable equipment than can help the user to do their job quickly, there are certain risk involved if they didn't utilize them appropriately. The user must not take the safety measure lightly as the drilling machine might cause an injury or accident if the user use it inappropriately. The user must alert while using any type of machinery because it's important to keep in mind a few basic considerations. If the user not paying their attention while operating the drilling machine, they might cause an accident from their carelessness.

Here is a few things the user need to do before operating the drilling machine:

a. Wearing the personal Protective Equipment (PPE)

Figure 2.8: Personal Protective Equipment (PPE)

Wearing the appropriate personal protective equipment (PPE) such as goggles, gloves and ear protection aimed at preventing the injuries of the user while operating the machine. This PPE is to protect the user from flying debris, noise and any potential hazard.

b. Keep the work area clean and organised

Figure 2.9: Organised tools

Before operating the drilling machine, the user need to make sure their work area are clean. This might prevent a tripping hazards

c. Use the drilling machine safely and properly

Figure 2.10

While using the drilling machine, the user need to maintain their stability. They have to stand firmly and keep their eyes on the workpiece. Avoid leaning or reaching too far that can affect their balance and control. Next, use coolant if it's necessary. If they make a drilling through metal or other material that can generate heat, use coolant or lubricant to reduce friction and prevent overheating of the drill bit. Then if there is an issue such as unusual sound or vibration while drilling, stop the machine immediately and inspect for the problems. Continuing drill under such conditions can lead to damage or injury. Make sure the user secure their workpiece with the clamp on drilling machine to prevents it from moving or spinning during drilling and reducing the risk of accidents.

d. Make an inspection on machine

Figure 2.11

Before using drilling machine, inspect any damage, defects or loose parts. Make an adjustment on speed and depth of the drilling machine according to the type of material and size of the drilling hole. Then, select the right drill bit. Using the wrong drill bit can lead to inefficient drilling, damage material or even breakage of the bit. Ensure that all components are good working condition.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Methodology refers to the systematic, theoretical analysis of the methods applied to a field of study. It encompasses the concepts and principles behind the methods used in research and provides a framework for understanding which methods are appropriate and why they are used. Here are the some of our methodology:

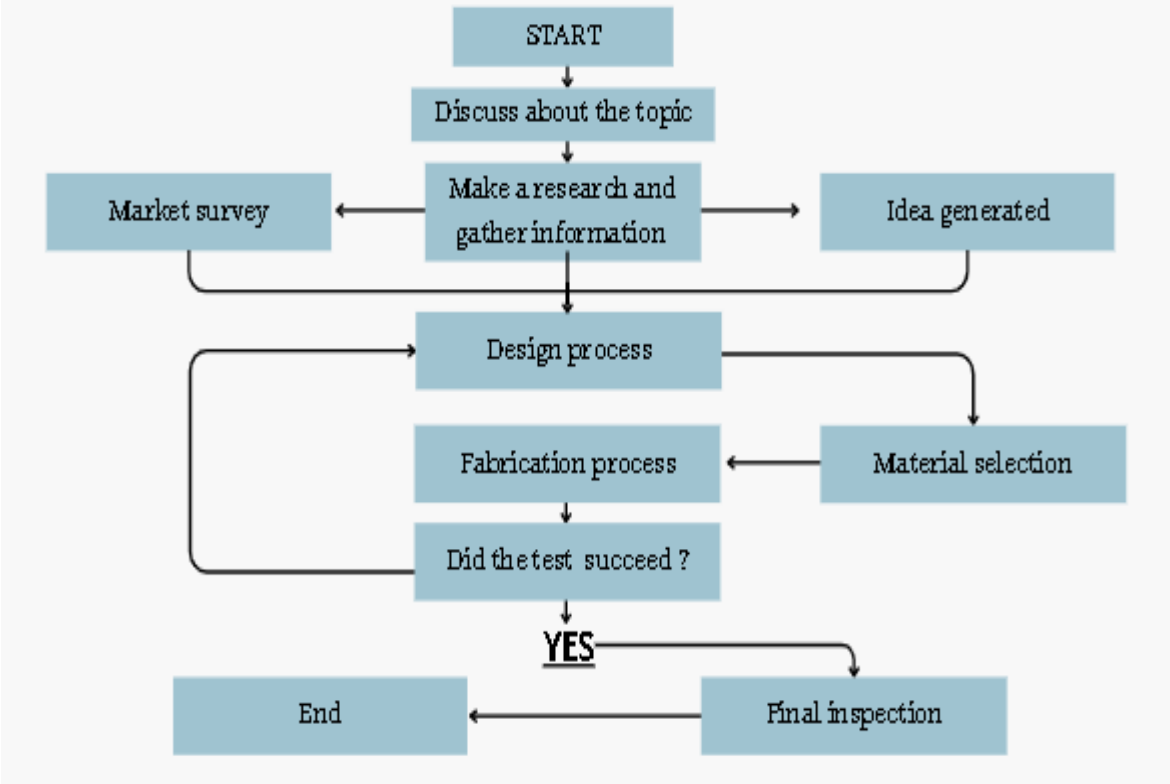
A flow chart is a visual tool that helps in understanding and analyzing processes comprehensively. It facilitates communication between individuals or work groups by providing a clear view of the steps involved in a process and how these steps are interconnected. Gathering information: Gathering information is intended to collect all information before we carry out our project. We are focus in Polytechnic Banting only. Design process: The process of making this design took three weeks to discuss and think of a suitable and easy-to-understand design. After we discussed and agreed with our Supervisor Mr. Sani Bin Buang, we made a simple sketch and ended with a more detailed sketch.

After that, in 3.5 we started selecting material and make calculation for material cost. In addiction, fabrication made for simple explain how we fabricate our project by part, describe and fabrication. Lastly, at 3.7 we put gantt chart that shown planning and implementation from week one until week 14.

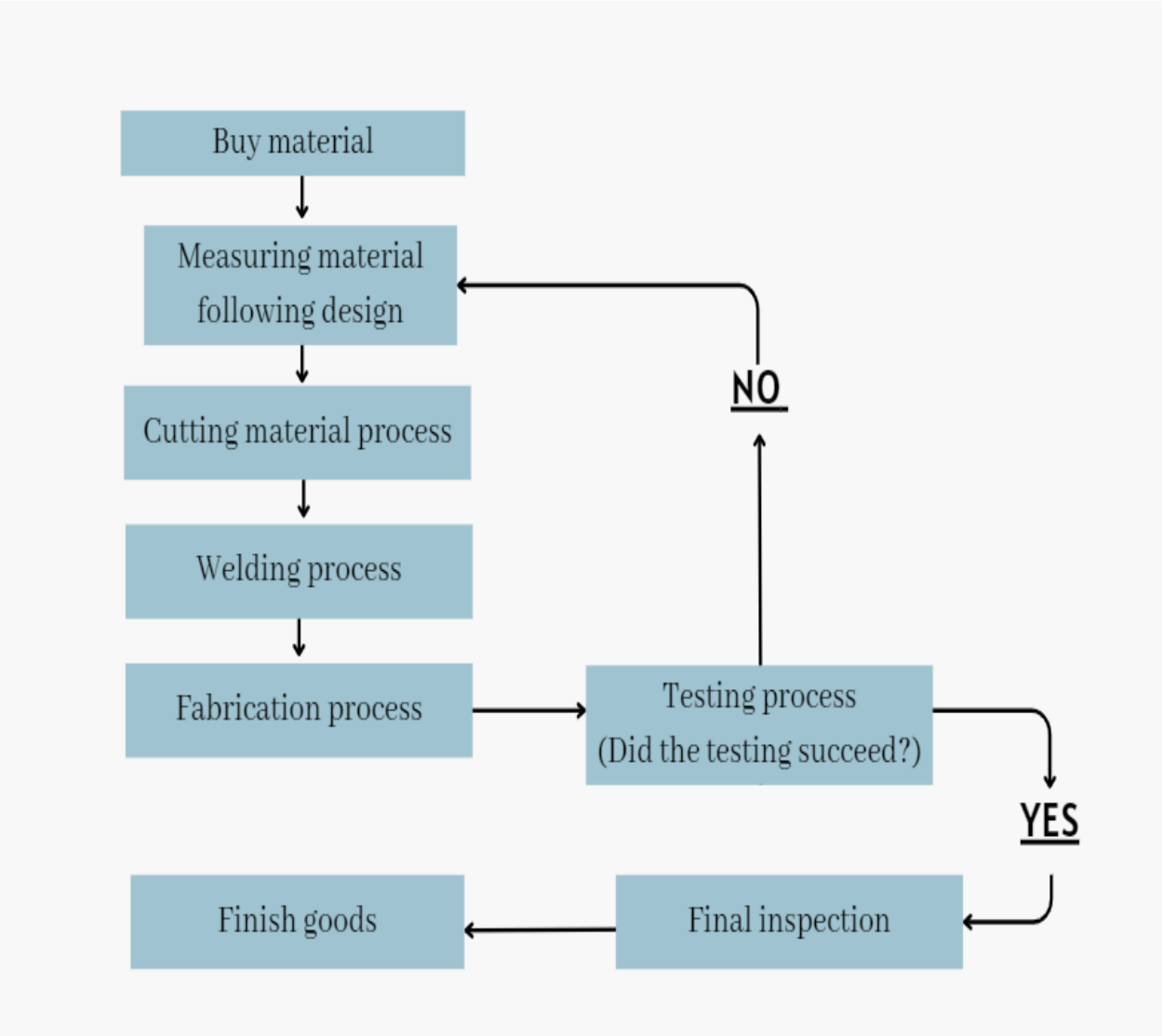
In essence, methodology is about the rationale and the philosophical assumptions underpinning a particular study, the selection of the appropriate methods, and the justification for their use. It's a critical aspect of research that ensures the study is rigorous, reproducible, and valid .

3.2 Flow Chart

3.2.1 Flow Chart of design Process



3.2.2 Fabrication Process



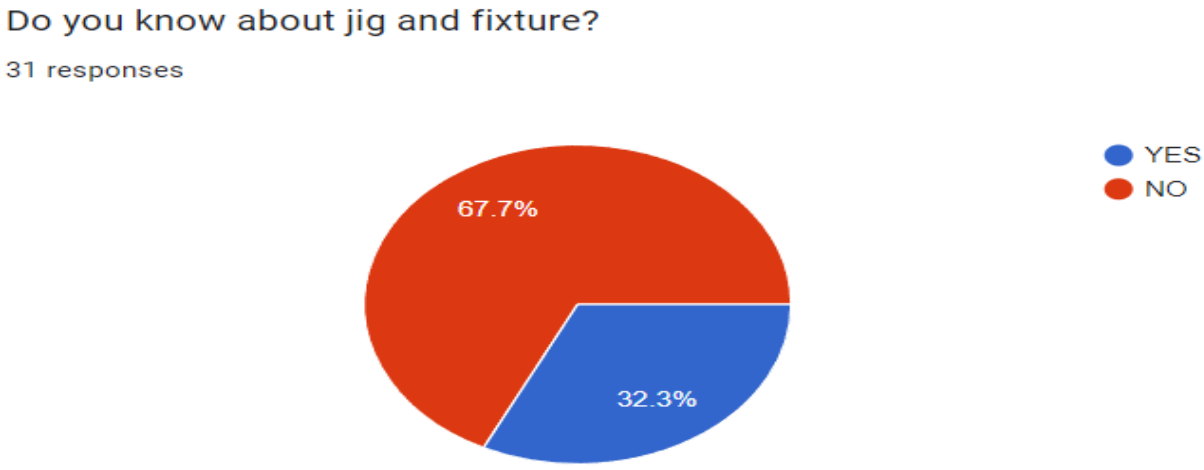
3.3 Morphological Chart

COMPONENT	TYPE I	TYPE 2	TYPE 3
FIXTURE	PLAYWOOD	STEEL	ALUMINIUM
JIG	STEEL	PLAYWOOD	ALUMINIUM
HOSE TUBE	SILICONE TUBE	POLYURETHANE (PU)	RUBBER HOSE
CLAMP	SWING CLAMP	TOGGLE CLAMP	STRAP CLAMP
STOPPER	ALUMINIUM	STAINLESS STEEL	PLAYWOOD

3.4 Gathering Information

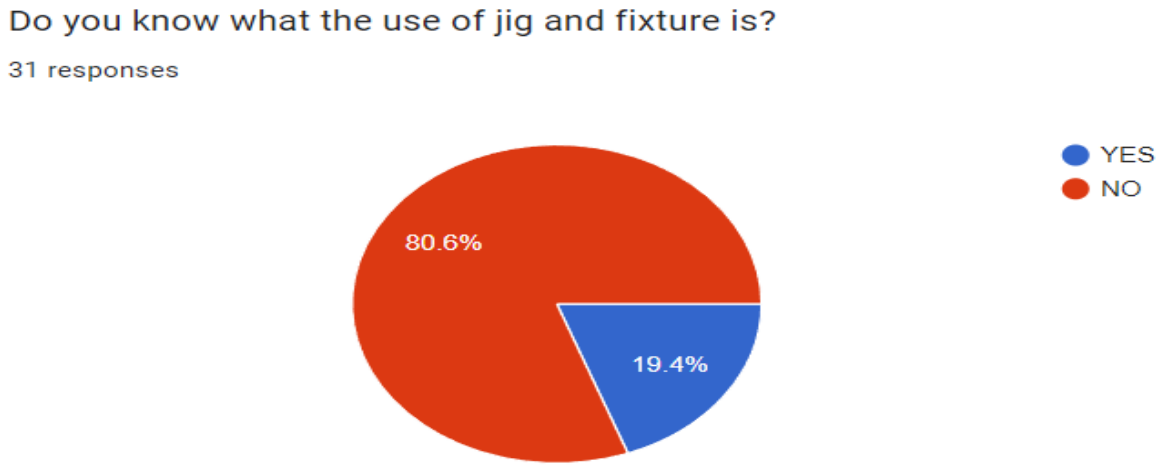
3.4.1 Market survey

The market survey was made using Google Form. As a result of this survey, we got a total of 37 responses. This market survey was made with the aim of getting the views of the public, especially users of the Banting Selangor Polytechnic workshop. Accordingly, we were able to improve the project we wanted to produce.

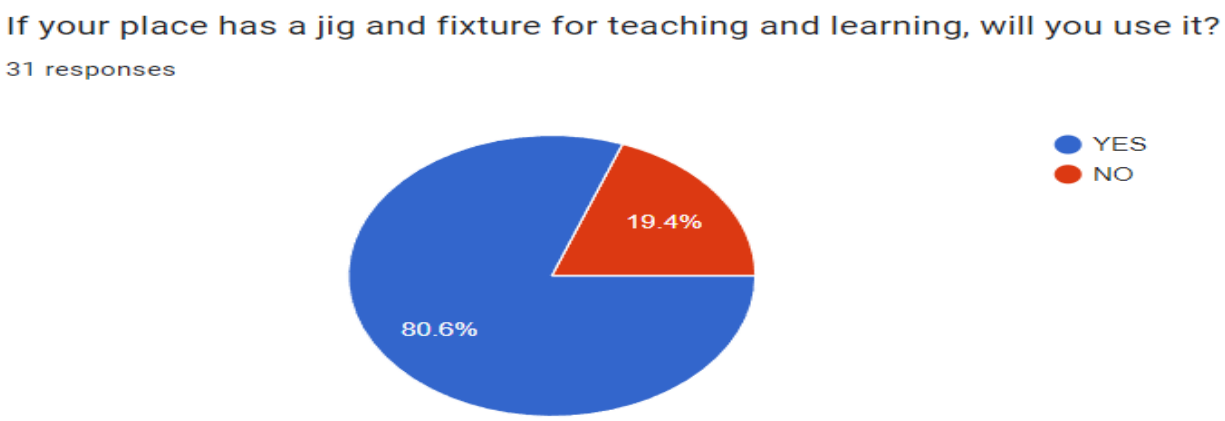


Pie Chart 1

Based on the pie chart above, out of 31 responses as many as 67.7% of Banting Polytechnic residents have ever know about jig and fixture. The rest 32.3% know it.

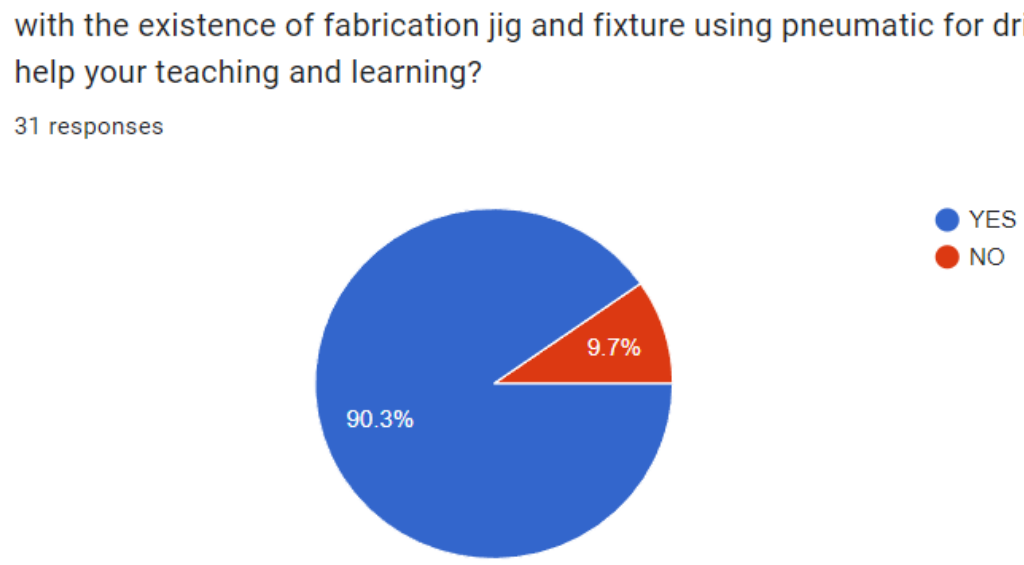


Pie Chart 2



Pie Chart 3

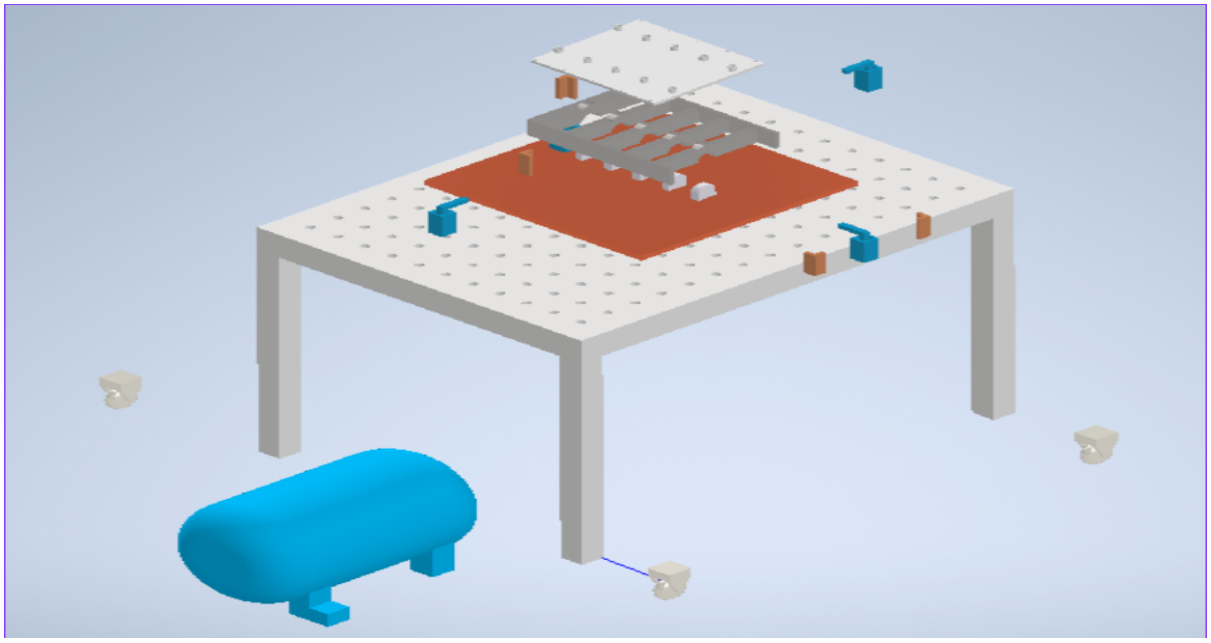
From this question, most voters are interested and will use this Jig and Fixture for their teaching and learning session in Polytechnic Banting for Jig And Fixtures subject.



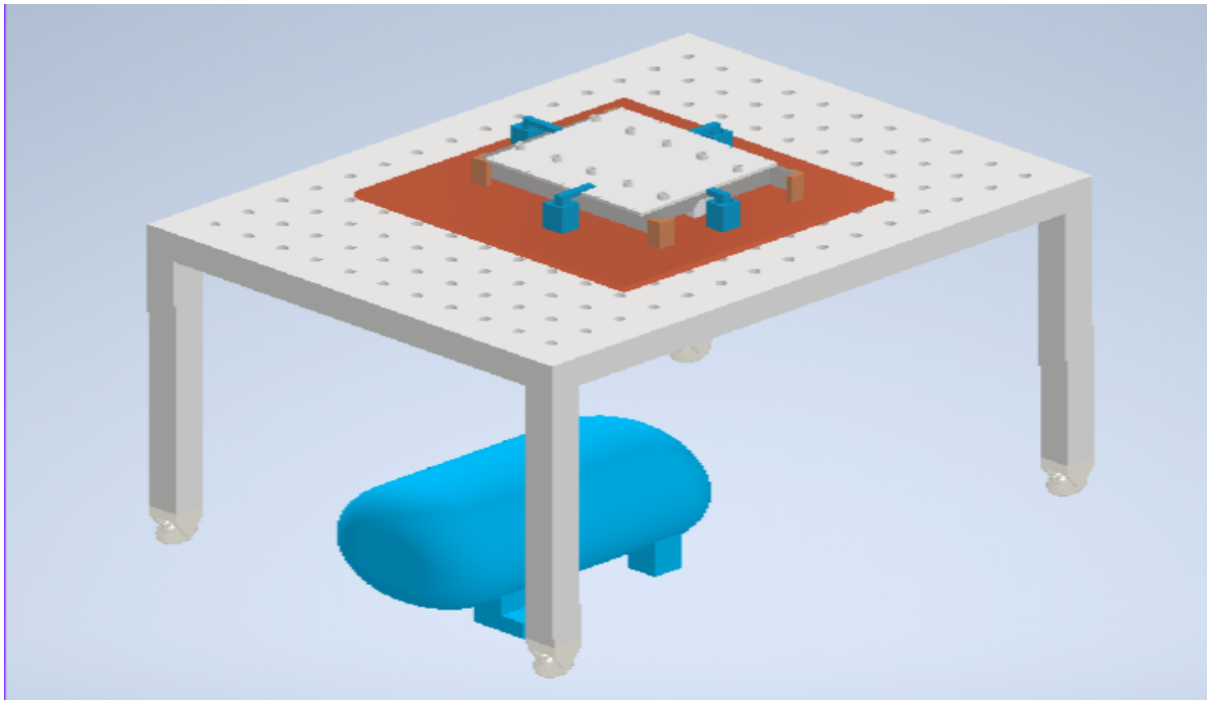
Pie Chart 4

3.5 Design Process

To produce the design process, we use Autodesk Inventor Professional. We combine each part one by one. First of all, start with bench clamp and followed by double acting cylinder, compressor and fixture (desk). Finally, washers and screws.

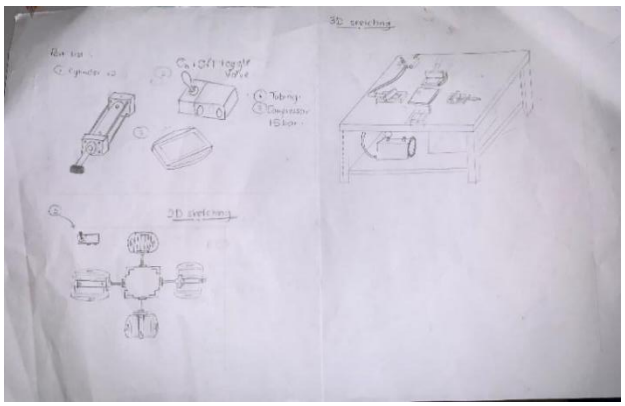


3.5.1 Specification



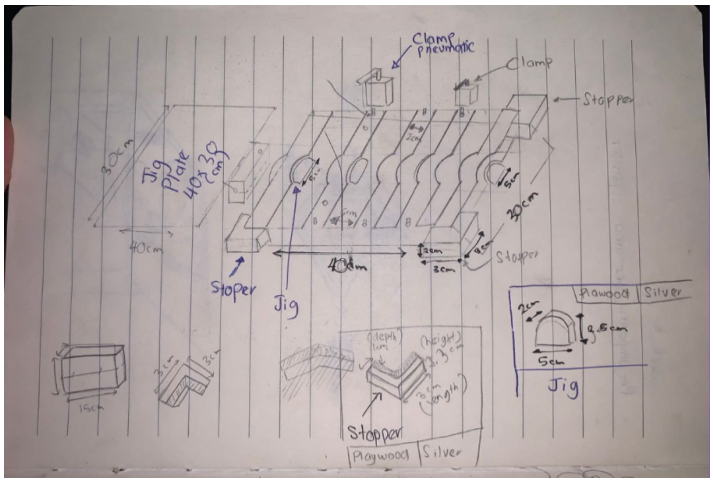
Design process (assembly)

3.5.2 Idea Proposed



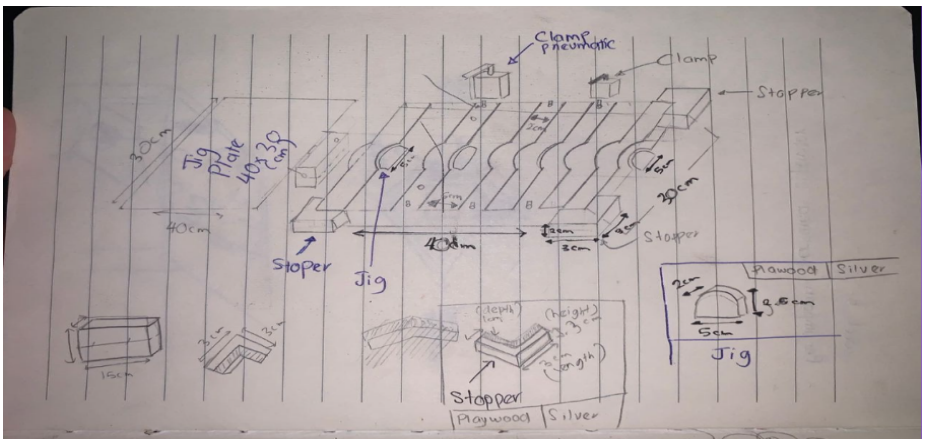
Design Sketch 1

Design sketch 2



Design sketch 3

3.5.3 Selected Concept



Design Sketch 3

1. The fixture are using Stainless Steel material 90cm x 120cm.

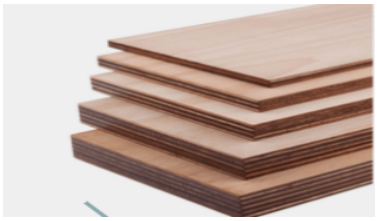
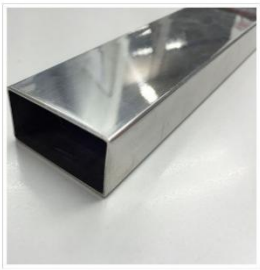
2. Has four legs to strengthen the fixture and we added four wheels for easier to moving.

3. It is safe and easy to carry anywhere because it has added wheels to each leg of the table.

3.6Material

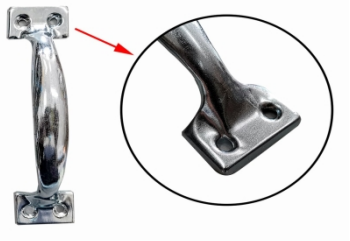
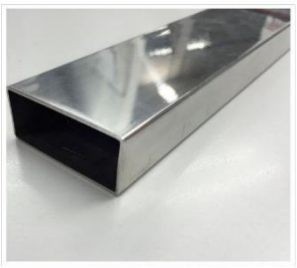
3.6.1 Material Selection

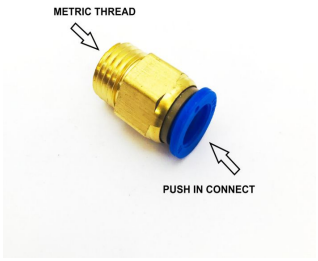
NO	Component	Picture	Function
1	Compressor		**Compressor 150 psi :** used as the main component to produce air flow to move the clamp.
2	Compressor Tube		**Compressor Tube** 6mm for connecting from the compressor.
3	Double Acting Pneumatic Cylinder Clamp		Used to control the movement and clamping
4	T-Joint		**T Joint Connector** 6mm for help connecting from tube to tube.

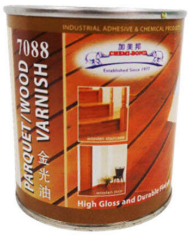
5	Pneumatic Hand Valve		**Pneumatic hand valve(6mm) :** used for on and off the power supply.
6	Wheel Locking Break		**Wheel locking break (6 inc with break) :** used to make it easier to move the table and can be locked.
7	Fixture		**Fixture** ***(90cm x 120cm with diameter of table is 1cm):*** used to support the clamp and workpiece.
8	Plywood		Plywood: used to create company such as jig and stopper
9	Stainless Steel		Stainless Steel (25.4x50.8x1): used to make frame for the base.

3.6.2 Material Cost

NO	Component	Picture	Cost
1	Compressor		1 Unit RM235.00/Unit Total cost RM235.00
2	Compressor Tube		5 Meter RM2.00/Meter Total cost RM10.00
3	Double-acting Pneumatic Cylinder		2 Unit RM37.00/Unit Total cost RM74.00
5	T-Joint		2 Unit RM5.50/Unit Total cost RM11.00

6	Pneumatic Hand Valve		1 Unit RM14.00/Unit Total cost RM14.00
7	Wheel Locking Break		4 Unit RM37.71/Unit Total cost RM150.84
	Plug air stopper		5 unit RM0.85/unit Total cost RM5.15
11	Door handle		2 Unit RM1.2/unit Total cost RM2.40
12	Hollow Steel		6 Feet RM4.50/meter Total cost RM27.00

13	Spray paint		1 Unit RM10.00/unit Total cost RM10.00
14	Pneumatic air fitting		10 Unit RM0.90/unit Total cost RM9.00
15	Dunlop glue		1 Tin RM5.00/Tin Total cost RM5.00
16	Compressor air coupler		1 Unit RM1.20/unit Total cost RM1.20
	Screw		20 Unit RM0.50/unit Total cost RM10.00

	Plywood		1 Unit (3feet x 6feet) RM50.00/unit Total cost RM50
	5/2 Way valve	JXPC 	1 Unit RM49.50/unit Total cost RM49.50
	Syelek	**1L WOOD VARNISH**  YQ MART	1 Tin RM20.00/tin Total cost RM20
Total Cost			**RM684.09**

3.6.3 Fabrication and Installation Cost

Component	Unit	Cost/unit	Total Cost
Grind disc	1 unit	**RM7.50/unit**	**RM7.50**
Arc welding rod	**1 set**	**RM35.00/unit**	**RM35.00**
Sandpaper	**1 sheet**	**RM1.00/unit**	**RM1.00**

Total Project Costing

= Material Costing + Fabrication and installation costing

= RM684.09+ RM43.50

= RM727.59

Estimation Product Selling Price

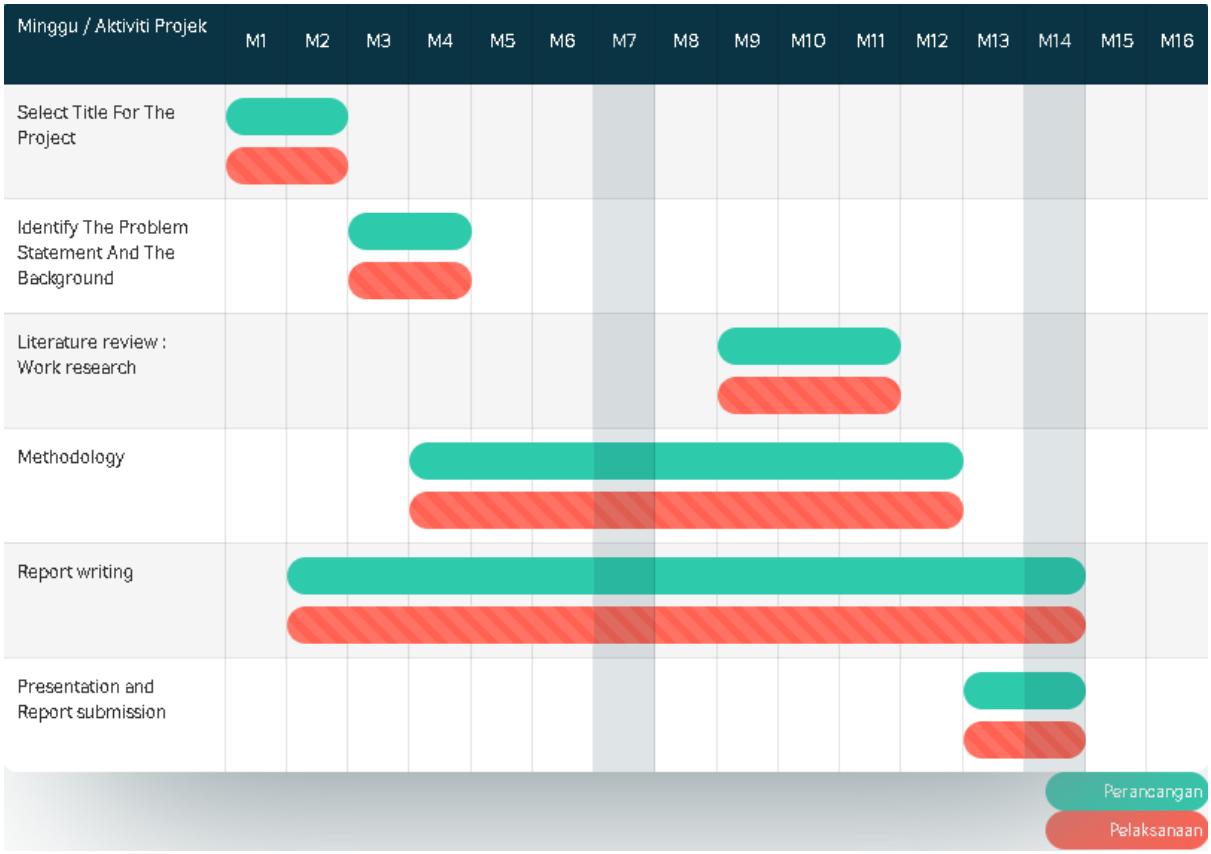
Our planning for product selling price is RM999.95

3.7 Fabrication

Part	Material	Description	Fabrication
Fixture.	Plywood	Function : • Used to make base for locate the jig and clamp.	Sawing,Syelek. Sawing to cut wood to be used as a fixture. Apply syelek on the plywood to look clean.
Jig.	Playwood	Used to be guide for the workpiece. Advantages : • Workpiece does not move. • Makes it easier to hold the workpiece	Sawing, Spray ● Sawing to cut wood to be used as a jig. ● Spraying every single jig for look a like real steel jig.
Compressor.	• 1.5 HP • Compressor tube	Used to supply air into the airflow Used to channel air from the compressor. Advantage: • More power. The function is controlling the flow rate, speed, direction, mass, shape, and pressure of	Compressor, Pneumatic cylinder using compressor tube.

		the flow coming out of it.	
Double-acting pneumatic clamp.	• Compressor component • Pneumatic component	Used to control the automatic clamp by pneumatic process. Advantages : • Simplify the process to lock the workpiece.	Pneumatic cylinder connected to all component and connected air compressor and clamping.

3.8 Gantt Chart



3.7.1 Gantt Chart Project 1

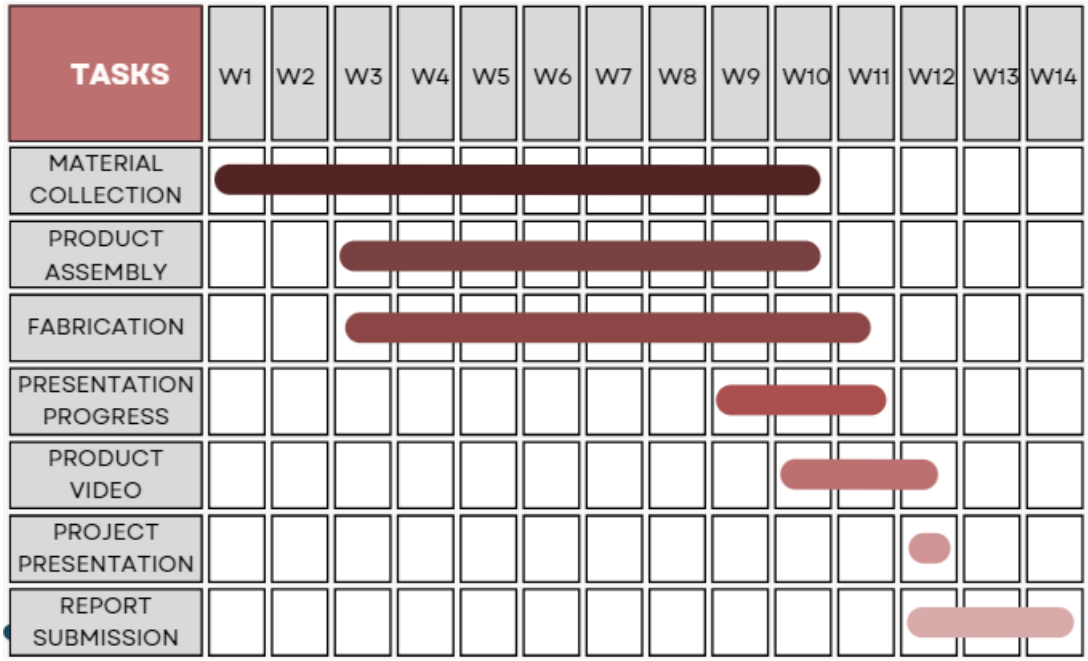


Figure 3.7.2 Gantt Chart Project 2

CHAPTER 4

RESULT AND DISCUSSION

4.1Discussion

a. Cost consideration

We were planning to produce the jig with 3D Printing.But, if the jig is too expensive to produce relative to the benefits it offers, a redesign could focus on reducing material costs or simplifying the fixture's complexity without sacrificing its functionality.

b. Safety Improvement

- **Stabilization of Workpiece**
  A fixture holds the workpiece securely in place, preventing it from moving or rotating during drilling. This reduces the likelihood of workpiece slippage, which can cause accidents or damage to both the operator and the machine.While jigs and fixtures can greatly enhance safety, they must be designed with ergonomics. Poorly designed fixtures may be cumbersome to use, increasing the risk of operator injury or leading to incorrect use.

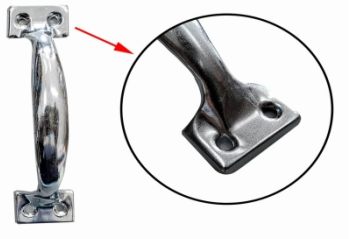
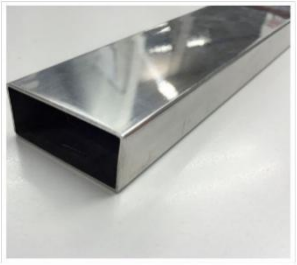
c. Precision and Accuracy

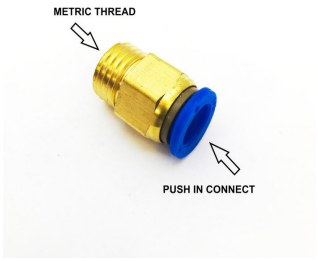
- **Hole Accuracy and Consistency**
  A properly fabricated jig ensures that the drill bit engages the workpiece at the exact required position and angle, eliminating human error in positioning. This results in consistently drilled holes, which are critical for assembly processes where alignment is key.

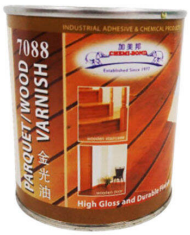
- **Minimize Defect**
  Without a fixture, misalignment, angular errors, or variations in depth can lead to defects such as off-center holes or inconsistent depths. By using a fixture, the variability is significantly reduced, leading to fewer defects and better overall part quality.

4.1.1 ACTUAL PROJECT COSTING

NO	Component	Picture	Cost
1	Compressor		1 Unit RM235.00/Unit Total cost RM235.00
2	Compressor Tube		5 Meter RM2.00/Meter Total cost RM10.00
3	Double-acting Pneumatic Cylinder		2 Unit RM37.00/Unit Total cost RM74.00
5	T-Joint		2 Unit RM5.50/Unit Total cost RM11.00

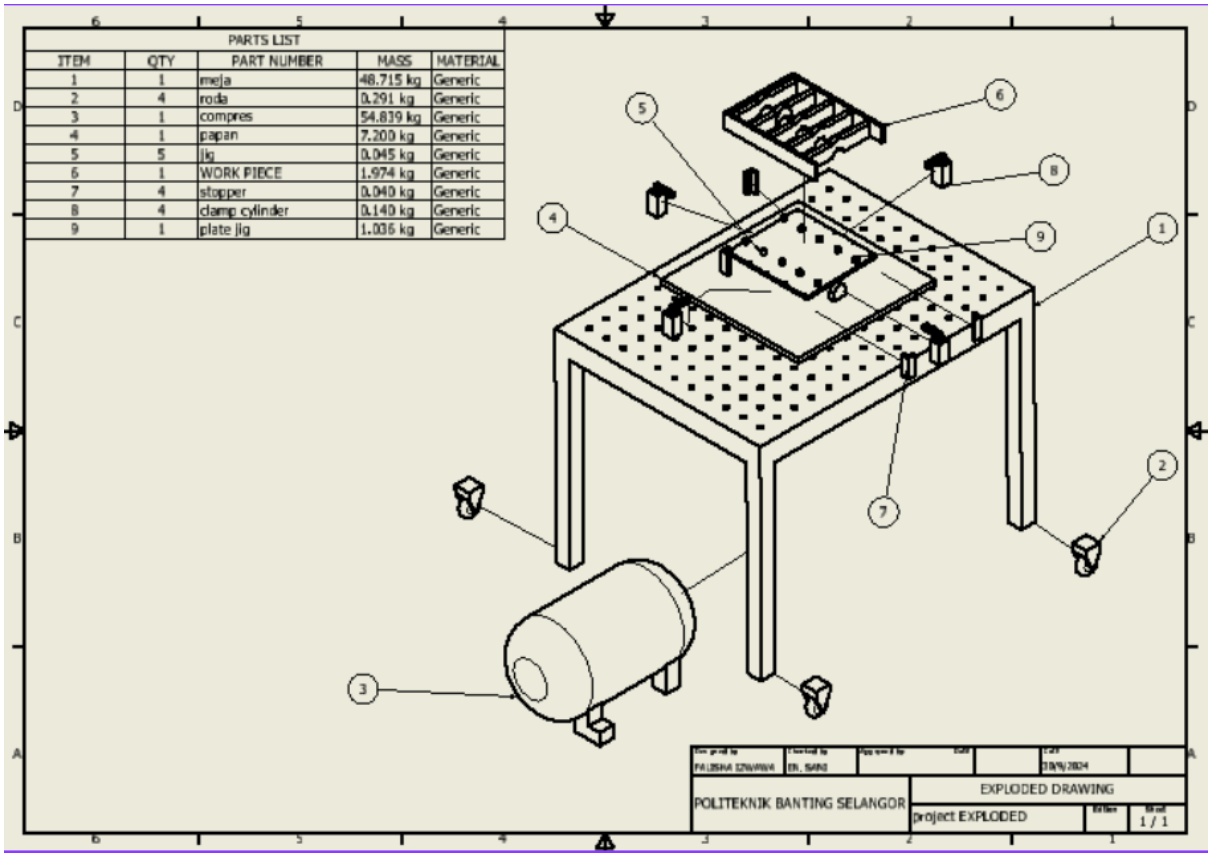
6	Pneumatic Hand Valve		1 Unit RM14.00/Unit Total cost RM14.00
7	Wheel Locking Break		4 Unit RM37.71/Unit Total cost RM150.84
	Plug air stopper		5 unit RM0.85/unit Total cost RM5.15
11	Door handle		2 Unit RM1.2/unit Total cost RM2.40
12	Hollow Steel		6 Feet RM4.50/meter Total cost RM27.00

13	Spray paint		1 Unit RM10.00/unit Total cost RM10.00
14	Pneumatic air fitting		10 Unit RM0.90/unit Total cost RM9.00
15	Dunlop glue		1 Tin RM5.00/Tin Total cost RM5.00
16	Compressor air coupler		1 Unit RM1.20/unit Total cost RM1.20
	Screw		20 Unit RM0.50/unit Total cost RM10.00

	Plywood		1 Unit (3feet x 6feet) RM50.00/unit Total cost RM50
	5/2 Way valve	JXPC 	1 Unit RM49.50/unit Total cost RM49.50
	Syelek	**1L WOOD VARNISH**  YQ MART	1 Tin RM20.00/tin Total cost RM20
Total Cost			**RM684.09**

4.2 Engineer drawing

Based on the sketch that has been made, the is detail design with exploded.

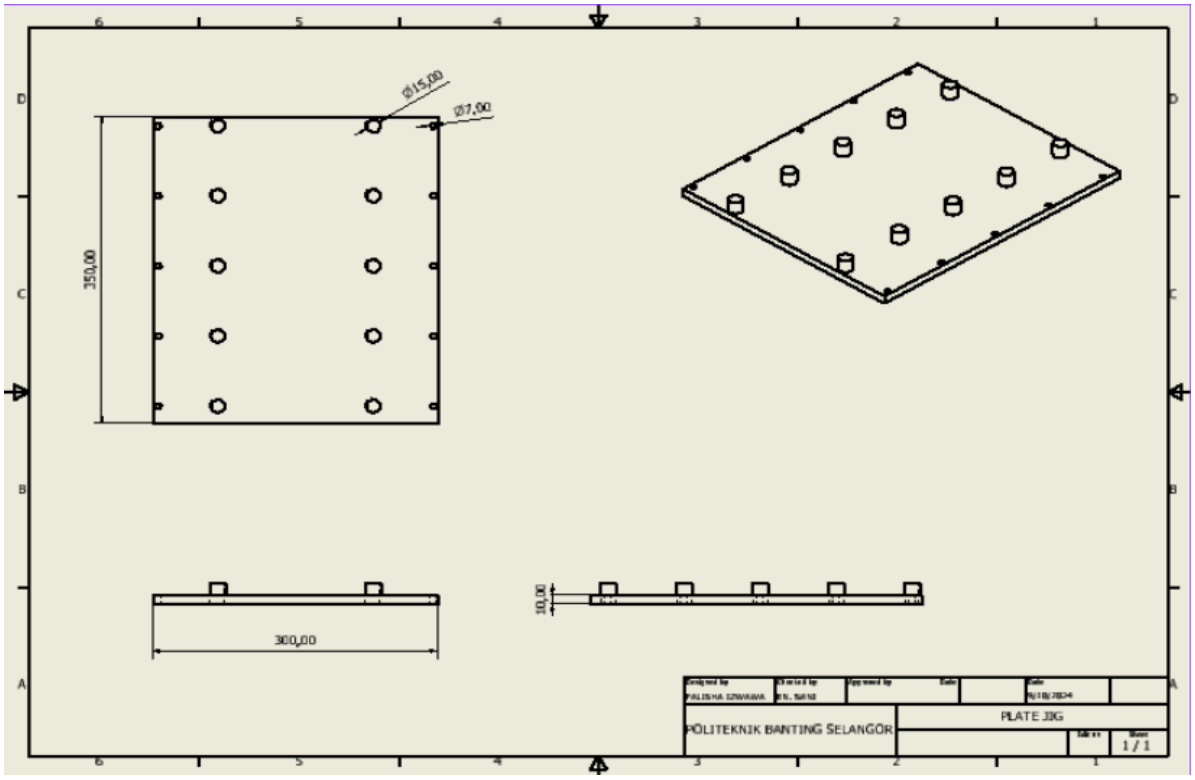


PARTS LIST

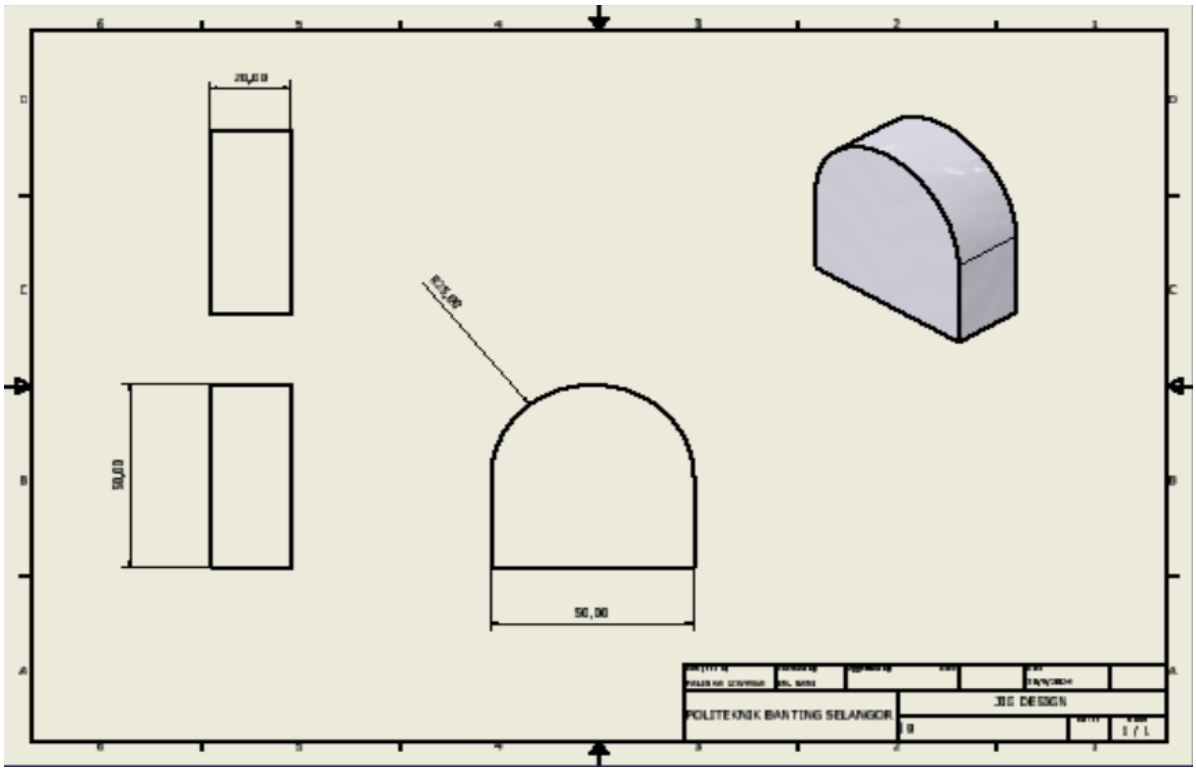
ITEM	QTY	PART NUMBER	MASS	MATERIAL
1	1	meja	48.715 kg	Generic
2	4	roda	0.291 kg	Generic
3	1	compres	54.839 kg	Generic
4	1	papan	7.200 kg	Generic
5	5	jig	0.045 kg	Generic
6	1	WORK PIECE	1.974 kg	Generic
7	4	stopper	0.040 kg	Generic
8	4	clamp cylinder	0.140 kg	Generic
9	1	plate jig	1.036 kg	Generic

4.2.1 By Part Design

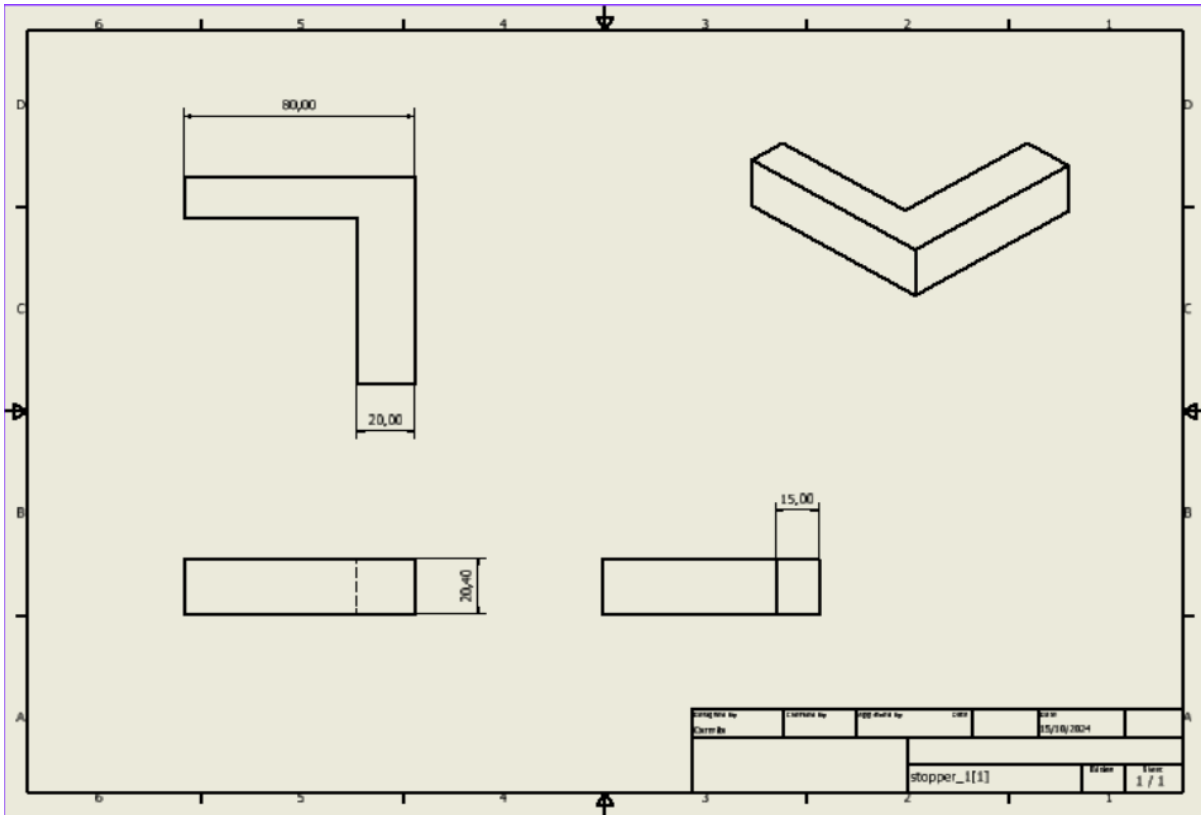
1) Plate Jig - Used to be guide on top workpiece for drilling process.



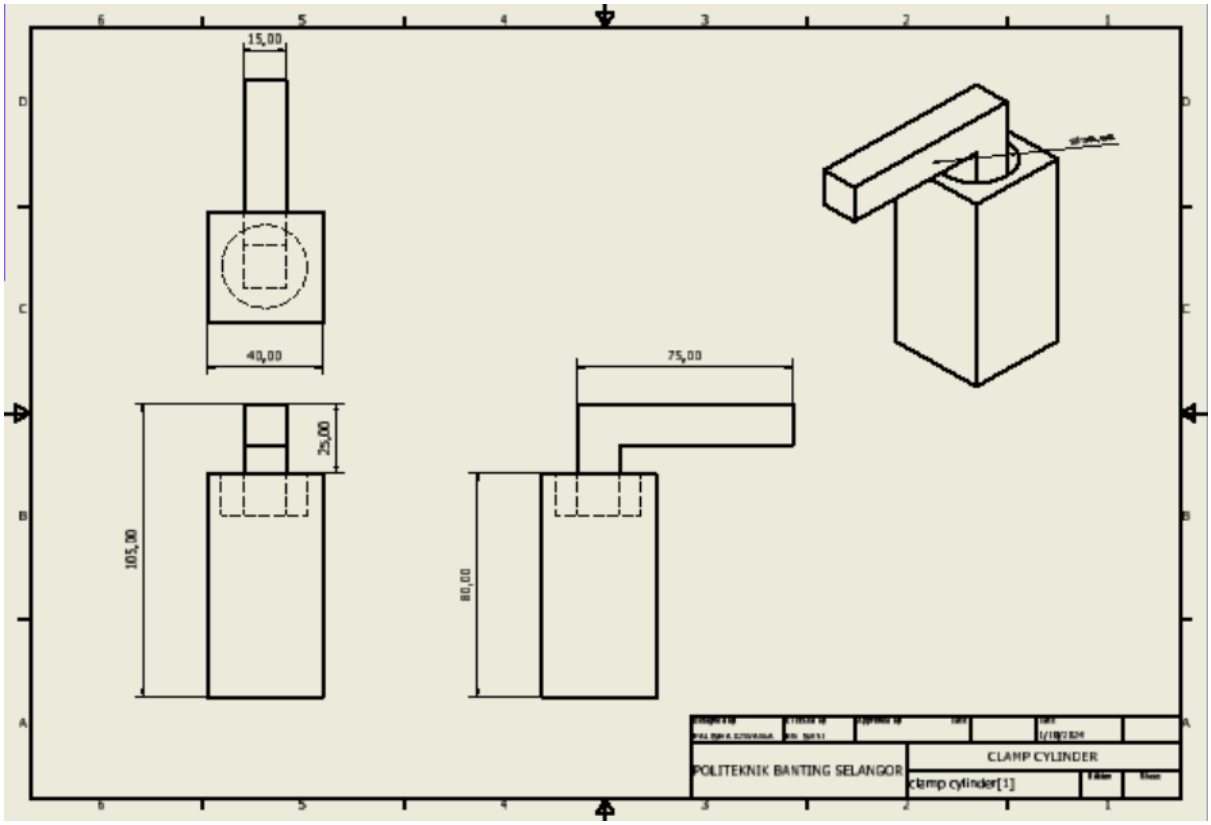
2) Stand Jig - Used to be stand on bottom workpiece to ensure that workpiece is stable.



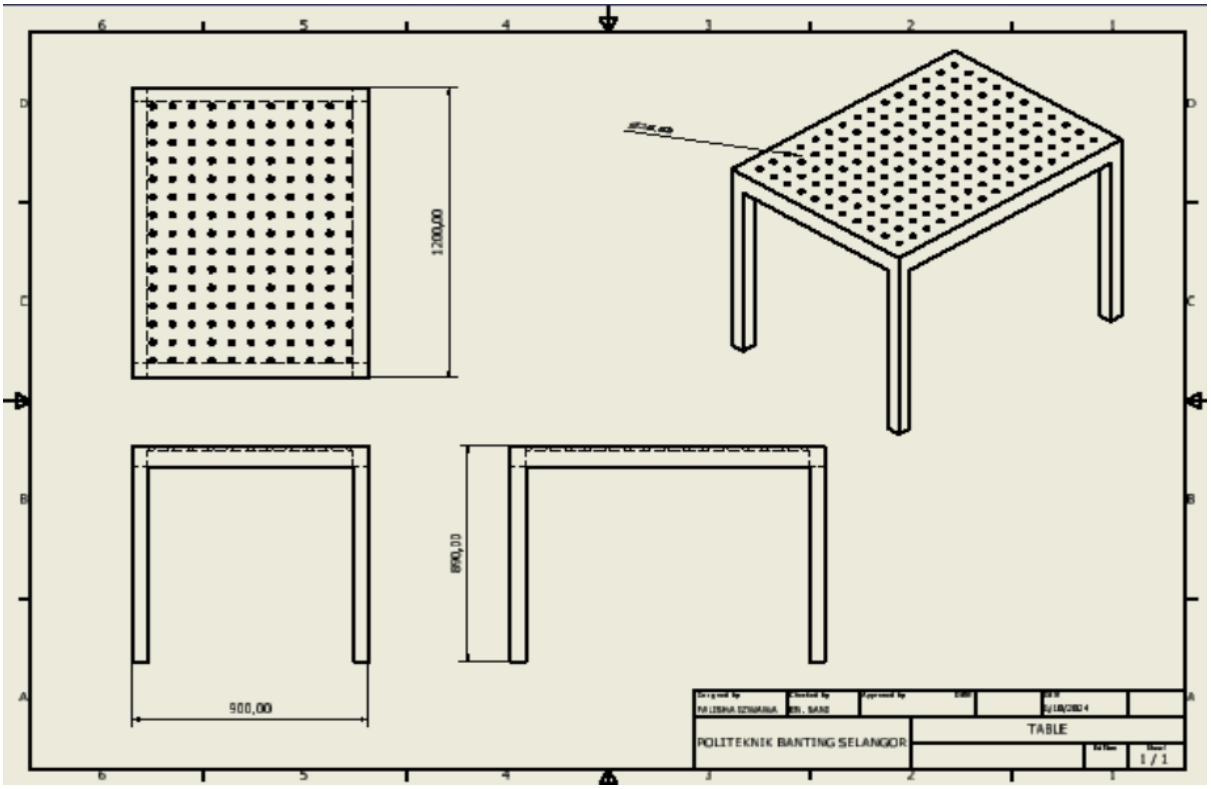
3) Stopper - Used to be as stopper for X and Y axis.



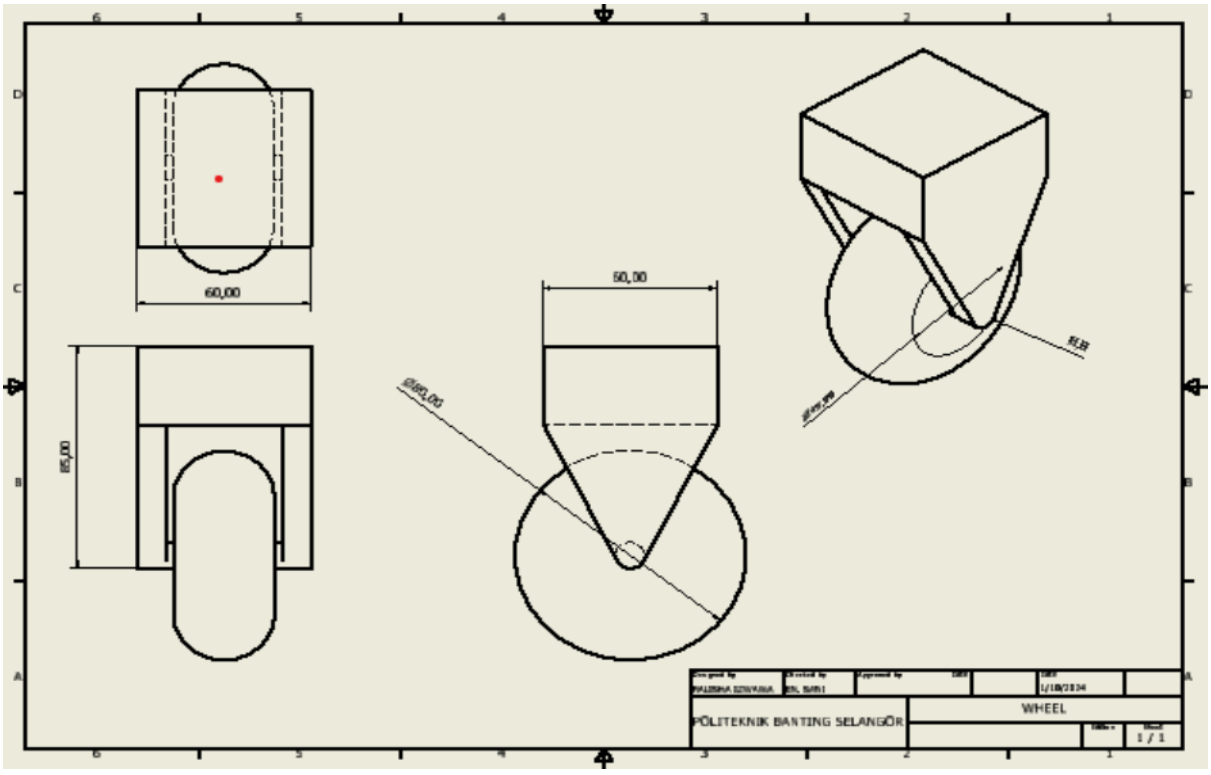
4) Pneumatic Swing Clamp - Used to clamping for Z axis.



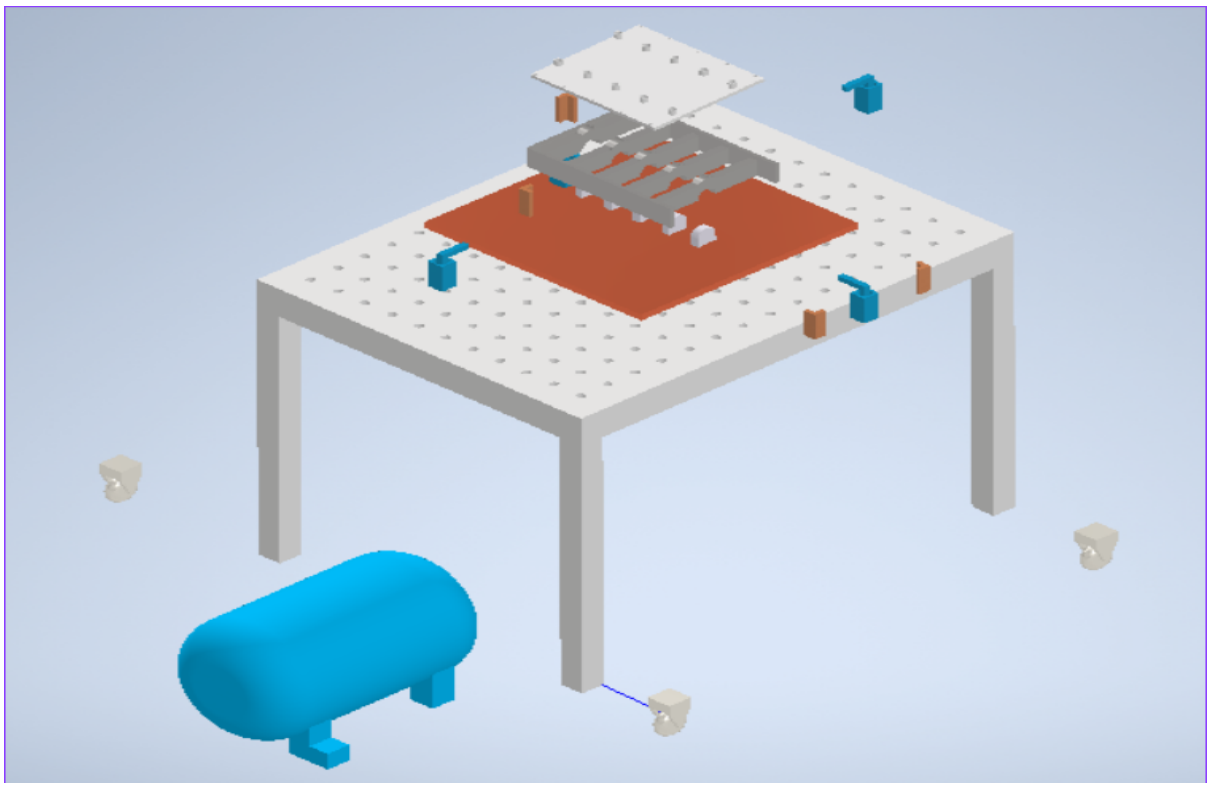
5) Table - Used to put fixture on the table.



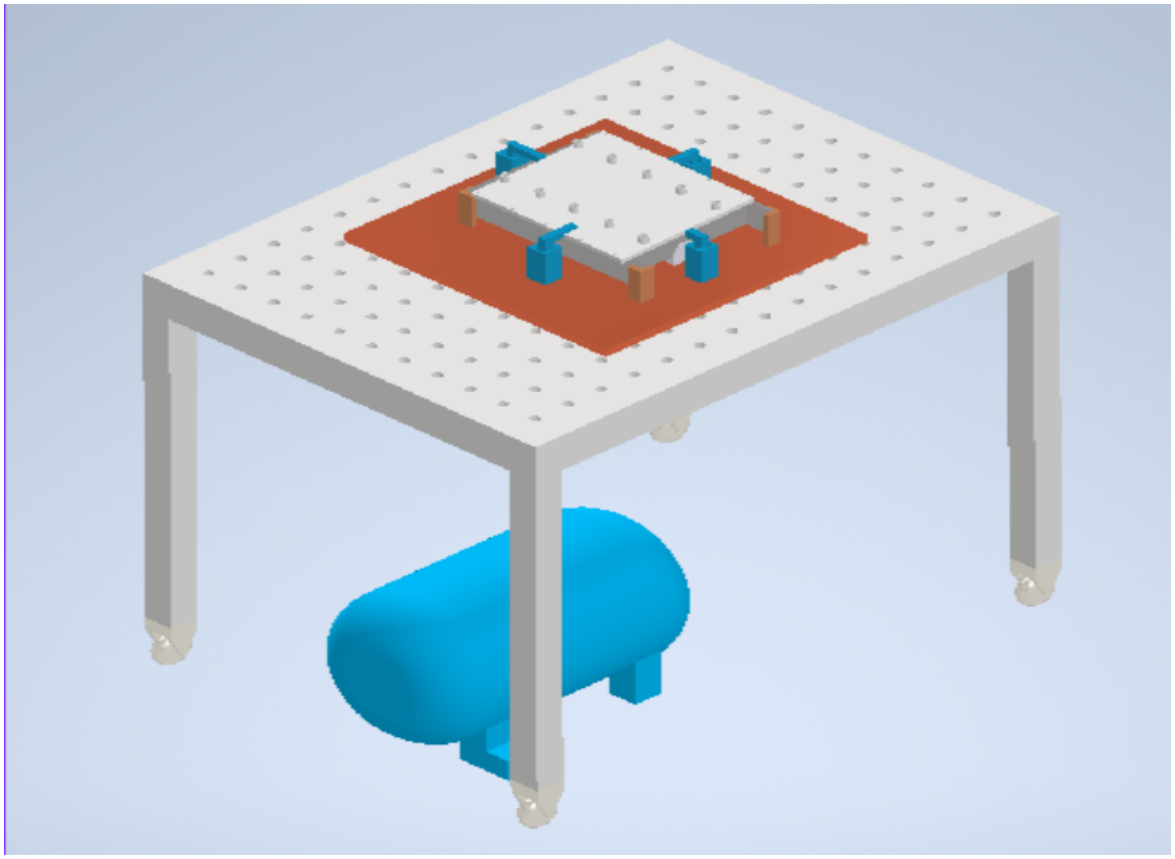
6) Wheels - Our modification under the table leg for easier movement.



4.2.2 Detailed Design Figure (Exploded)



4.2.3 Detailed Design Figure (Assembly)



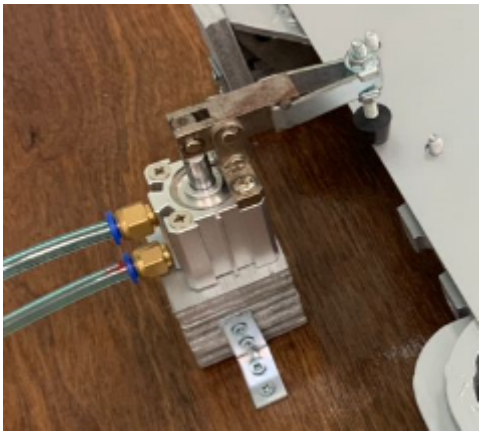
4.3 Description of final design

a. Air Compressor

Air compressor responsible to convert energy into compressed air, providing a reliable source of power for air tools and machinery. It should maintain a consistent air pressure based on the specific requirements of the tools or processes it powers. It supplies compressed air to tool through a hose..

b. Pneumatic cylinder

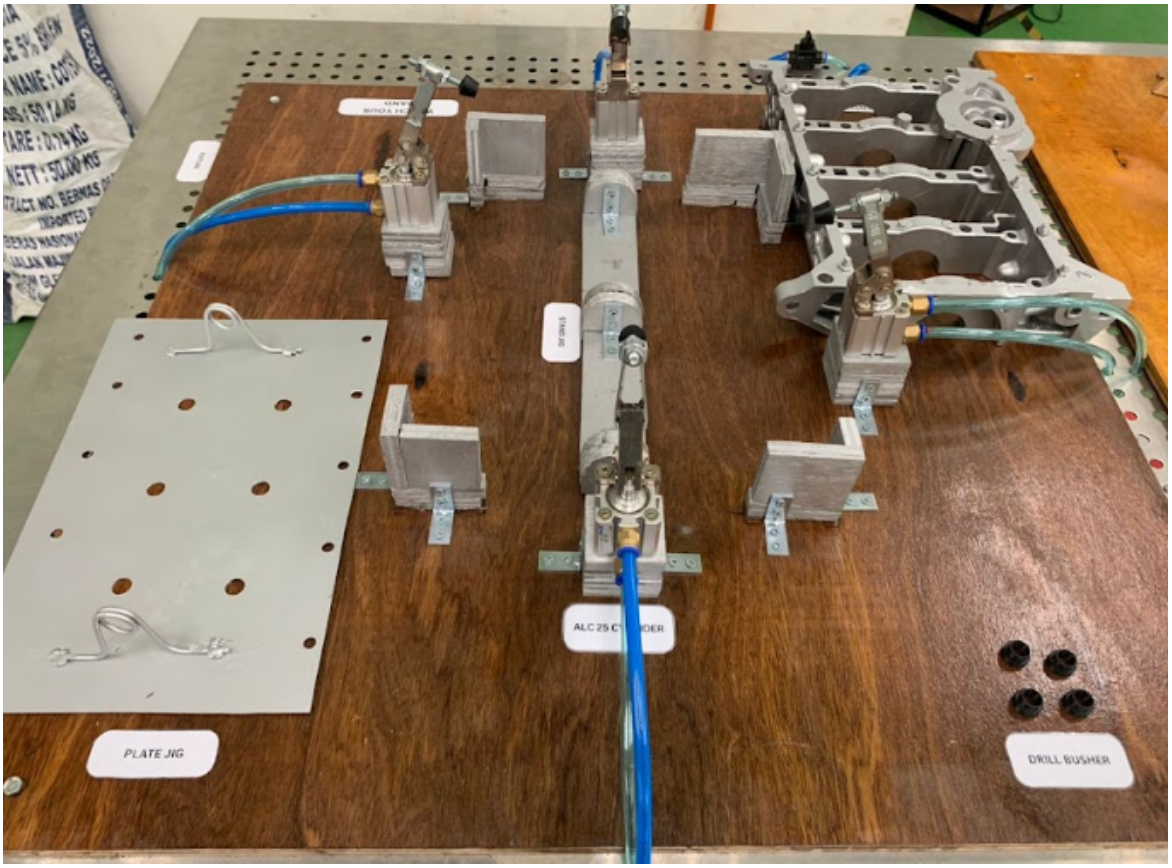
Since we use pneumatic system, we decide to use the cylinder to secure the workpiece. We split the part of the toggle clamp and attached it at the end of the cylinder by MIG welding.



c. Wheels for portability

Because we use table as the part of our project,we attached the wheels on it. It can easily moved and positioned the project.

4.4Project picture/Result



CHAPTER 5

CONCLUSION

Development prototype jig and fixture using pneumatic system for teaching aids in subject (DJF 51072 – jig and fixture) at Polytechnic Banting Selangor offers substantial improvements in efficiency and precision. Pneumatically actuated jigs enable faster, more consistent clamping and positioning of workpieces, which significantly reduces setup times and increases production throughput.

This is especially beneficial in high-volume manufacturing environments where speed and repeatability are essential. The automated clamping provided by the pneumatic system ensures consistent pressure and positioning, leading to higher accuracy in drilling, minimizing defects, and reducing human error. Additionally, the use of pneumatic jigs improves safety by minimizing manual handling, thus reducing the risk of accidents and operator fatigue.

Although the initial cost of integrating pneumatic systems may be higher, the long-term benefits such as enhanced efficiency, lower defect rates, improved safety, and reduced maintenance requirements make it a cost-effective solution. Overall, pneumatic jigs and fixtures provide versatility and reliability, making the lecturer and student able to perform teaching and learning processes in subject DJF51072 Jig and Fixture

DECLARATION OF REPORT WRITING SEGREGATION

SUB-CHAPTERS	DESCRIPTION
JENI MARDIAN BINTI JONAIDI	
1.1	INTRODUCTION
1.5	SCOPE PROJECT
2.4	SAFETY TERM
3.2	FLOW CHART
3.3.1	MARKET SURVEY
3.4.3	SELECTED CONCEPT
5.1	REFERENCES
5.2	APPENDIX
FALISHA IZWAWA BINTI FADIR	
1.2	BACKGROUND
1.4	OBJECTIVES
2.1.1	ADVANTAGES AND DISADVANTANGES OF DRILLING MACHINE
2.1.2	CAUSES AND DAMAGE FOR NOT USING DRILLING MACHINE PROPERLY
3.1	INTRODUCTION
3.5.1	MATERIAL SELECTION
4.1	DISCUSSION
4.3	DESCRIPTION OF FINAL DESIGN
4.4	PROJECT PICTURE
5	CONCLUSION
FAIZ BIN AZZAHAR	
1.6	PROJECT IMPACT
2.3	COMPARISON EXISTING AND NEW PROJECT
3.2.1	MOPHOLOGICAL CHART
3.4	DESIGN PROCESS
3.4.2	IDEA PROPOSED
3.5.3	FABRICATION AND INSTALLATION
3.7	GANTT CHART

MUHAMMAD NAUFAL FITRI BIN MUHAMAD ASRUL RIZAM	
1.3	PROBLEM STATEMENT
2.2	MECHANISM EXISTING AND NEW PROJECT
3.4.1	SPECIFICATION
3.4.4	DETAILED DESIGN
3.5.2	MATERIAL COST
3.6	FABRICATION
4.2	ENGINEERING DRAWING
ENDORSEMENT SECTION	
Endorse by:	…… (Project Supervisor) Date:
Official Stamp:	

5.1 REFERENCES

1. Sharma, R. K., & Aggarwal, S. K. (2010). Jigs and Fixtures: Design, Construction, and Use. Khanna Publishers.
2. Groover, M. P. (2019). Fundamentals of Modern Manufacturing: Materials, Processes, and Systems (7th ed.). Wiley.
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6. Madhavan, P. (2014). Pneumatics: Principles and Applications (2nd ed.). Prentice Hall.
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5.2 APPENDIX

POLITEKNIK MALAYSIA
BANTING

DEPARTMENT OF MECHANICAL ENGINEERING
SESSION 1 : 2024/2025

DEVELOPMENT PROTOTYPE JIG AND FIXTURE USING PNEUMATIC SYSTEM FOR TEACHING AIDS IN SUBJECT (DJF51072 -JIG AND FIXTURE) AT POLYTECHNIC BANTING SELANGOR

PROJECT ABSTRACT

This project aims to develop a pneumatic-based jig and fixture system to enhance the teaching and learning process in the DJF51072 subject, specifically related to jig and fixture concepts. The current challenges faced by lecturers and students include the need to visit external industries or colleges for hands-on learning, leading to time constraints and increased costs. Additionally, there is a difficulty in conveying jig and fixture concepts effectively within the classroom due to inadequate teaching methods.

PROBLEM STATEMENT

- Lecturers and students need to visit other industries or colleges for learning and teaching will cause time constraints and increase costs
- Lecturers have difficulty in revealing lesson related to Jig and Fixture for student in DJF51072 subject
- Inadequate teaching methode for student learning about Jig and Fixture

OBJECTIVES

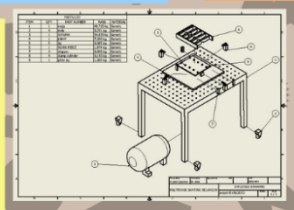
- To develop jig and fixture using pneumatic process to eliminate the need for external industry visits, reducing time constrains and costs in the teaching and learning process.
- To design Jig and Fixture for drilling operation that enchances the practical learning experience for students in the DJF51072 subject.
- To implement the jig and fixture as an effective teaching tool to improve students understanding and practical application of Jig and Fixture concept in the classroom.

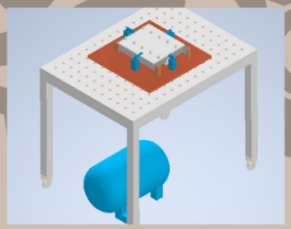
PRODUCT DESCRIPTION

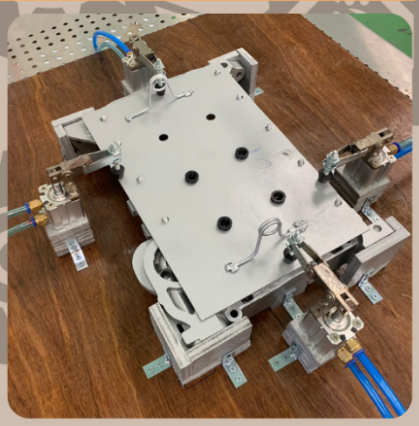
- This project involved with designing and building a system use pneumatic process to improve the accuracy that automatically operated. This project also include with the customization for jig that hold workpiece securely during the operation. This project aims to student and that have difficulty in learning process for subject DJF51072 JIG AND FIXTURE. This will teach student some practical skills in mechanical design and the use of pneumatic system in manufacturing.

COMMERCIAL VALUE

- Scability for other educational institution
- Enhanced learning outcomes and skill development
- Portable that allow easy transport and setup
- Reduced the risk of eccidents and ensuring it is user-friendly in an educational setting.







GROUP MEMBER

PROJECT SUPERVISOR

EN. MUHAMMAD SANI BIN BUANG

FAIZ BIN AZZAHAR

NAUFAL FITRI BIN ASRUL

JENI MARDIAN BT JONAIDI

FALISHA IZWAWA BT FADIR

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Category of Work	:	**FILM**
Date of Notification	:	**30 OCTOBER 2024**
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