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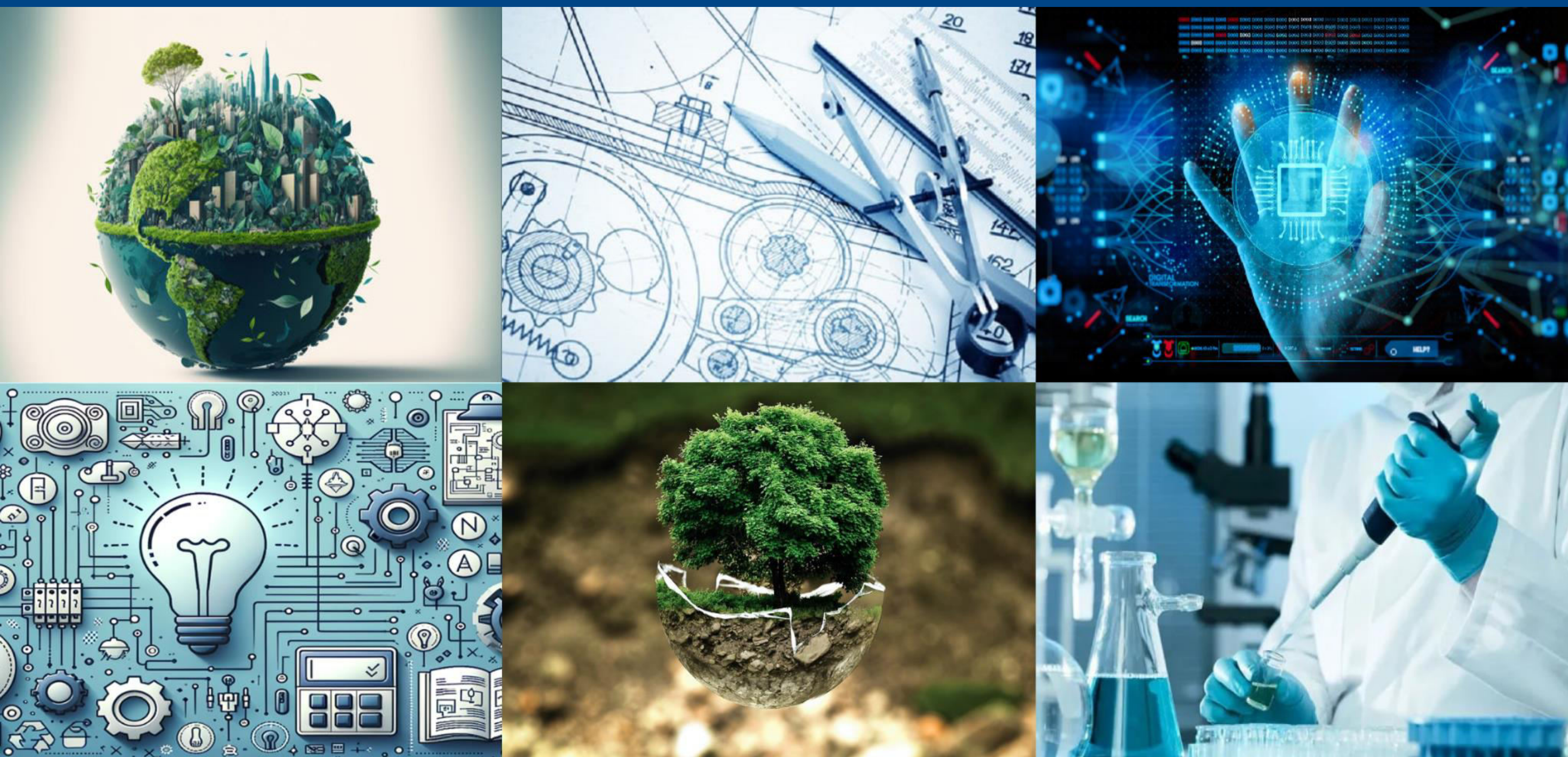

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Design and Fabrication of Automatic Hacksaw

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ABSTRACT: Automation is essential to modern enterprises since it reduces human labour and increases efficiency. By incorporating a motor-driven mechanism, the Automatic Hacksaw Machine aims to enhance the cutting process, decreasing manual involvement and boosting efficiency. The design, construction, and operation of an automated hacksaw that requires little human labour are the main topics of this project. The electric motor, crank mechanism, and reciprocating hacksaw blade make up the system, which guarantees accurate and reliable cutting results. This project's primary goal is to create an economical and effective cutting solution that can be used in workshops and small-scale companies. Cutting speed, precision, and power consumption are used to assess the machine's performance. The findings show that, in comparison to traditional manual hacksaws, the automatic hacksaw greatly improves safety and cuts down on machining time. This study opens the door for future advancements in automated cutting equipment by offering insights into the real-world application of automation in metal cutting applications.

I. INTRODUCTION

Automation is now a crucial component of increasing efficiency and production in the modern industrial world. Because they need a lot of physical labour, time, and accuracy, traditional manual cutting tools—like hand-operated hacksaws—are less appropriate for repetitive or large-scale cutting tasks. Automated cutting machines have been created to address these issues by decreasing manual labour while boosting precision and productivity. One such invention that uses automation in metal cutting to provide faster operation with less human involvement is the automatic hacksaw machine. One of the most widely used cutting instruments in a variety of engineering and industrial settings, such as small-scale manufacturing, construction sites, and fabrication workshops, is the hacksaw. However, there are drawbacks to manual hacksaws, including uneven cutting, operator fatigue, and sluggish processing speeds. By incorporating a motorised system that powers a reciprocating saw blade, the automatic hacksaw machine seeks to address these issues and enable consistent and continuous cutting operations. The cutting process is more efficient overall thanks to this automated method, which also improves precision and decreases manual labour.

A reciprocating blade, a crank and slider mechanism, an electric motor, and a frame structure that firmly holds the workpiece are some of the essential parts that go into the design and construction of an automatic hacksaw. This machine operates by converting rotary motion into reciprocating motion, which enables the blade to travel back and forth in order to cut. The automatic hacksaw produces consistent force and motion, resulting in uniform cutting results with minimal material waste, in contrast to manual hacksaws that rely on operator force and speed. This system's affordability and versatility for small-scale businesses and workshops are among its main benefits. Band saws and circular saws are examples of traditional industrial cutting equipment that can be costly and need trained operators. An automatic hacksaw, on the other hand, is a great option for workshops and small enterprises that require effective cutting solutions because of its easy operation, low maintenance requirements, and very basic construction. The automatic hacksaw machine's design, operation, materials, manufacturing process, and performance assessment are all included in this research study. The study is to offer a workable solution that is affordable and simple in design for workshops and industries that need an automated and effective cutting instrument.

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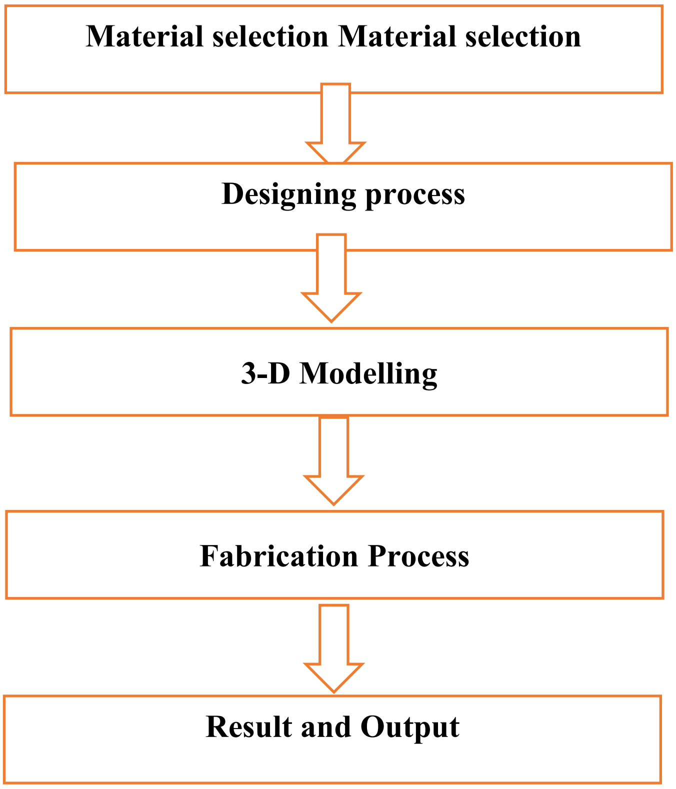
FLOW CHART



II. MATERIAL SELECTION AND COMPONENT

When designing and building an automatic hacksaw machine, choosing the right materials and parts is essential to ensuring efficacy, longevity, and affordability. The fundamental goal of material selection is to make the machine lightweight and easy to maintain while offering great strength, stability, and smooth performance. The following are the main elements utilised in this project has The machine's synchronous motor, which transforms electrical energy into mechanical motion, is its main power source. For accurate and seamless cutting, a synchronous motor's steady speed and torque are crucial. A potentiometer is used to regulate and control the hacksaw blade's speed. The potentiometer increases efficiency by allowing users to adjust the cutting speed based on the material being processed by changing the resistance. Carbon Steel Square Tube (Size: 300mm × 300mm) – Used for the frame and structure of the hacksaw machine. Because of its great strength, stiffness, and resistance to deformation, carbon steel is selected to provide a stable machine base. While yet being compact, the 300mm × 300mm size offers enough room for the engine, blade, and other parts. The machine's cutting blade is its reciprocating cutting tool, which effectively slices through metal or other materials. The material being cut determines the choice of blade, which guarantees endurance, sharpness, and less material waste while in use. Switch device that controls the machine's start and stop. By providing simple control over the machine's functioning and lowering the possibility of mishaps and needless power usage, the switch guarantees user safety. The automatic hacksaw machine's overall effectiveness, dependability, and efficiency are enhanced by these well chosen parts and materials. Their combination guarantees greater cutting accuracy, less wear and tear, and smooth operation with less vibrations.

III. DESIGN OF HACKSAW

SolidWorks software was used in the design of the Automatic Hacksaw Machine to guarantee accurate measurements, structural soundness, and effective operation. With its front, side, top, and isometric views, the model offers a comprehensive overview of the machine's structure. Carbon steel square tubes are used in the frame structure's

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design to create a strong, robust base that can endure vibrations during cutting operations. With its main measurements of 600 mm in length, 450 mm in height, and 350 mm in width, it is small but useful for small-scale industrial uses. The holding mechanism of the hacksaw is positioned carefully to guarantee a steady and even reciprocating motion while cutting. The location of the crank mechanism and motor mount is optimised for effective power transfer, lowering energy losses and enhancing cutting accuracy. This computer-aided design (CAD) model serves as a visual assembly and component placement guide, enabling precise manufacture. While upholding safety regulations, the ergonomic design guarantees usability. The SolidWorks model aids in assessing the hacksaw machine's performance and viability before to actual manufacture by mimicking forces and interactions seen in the real world.

DESIGN VIEW

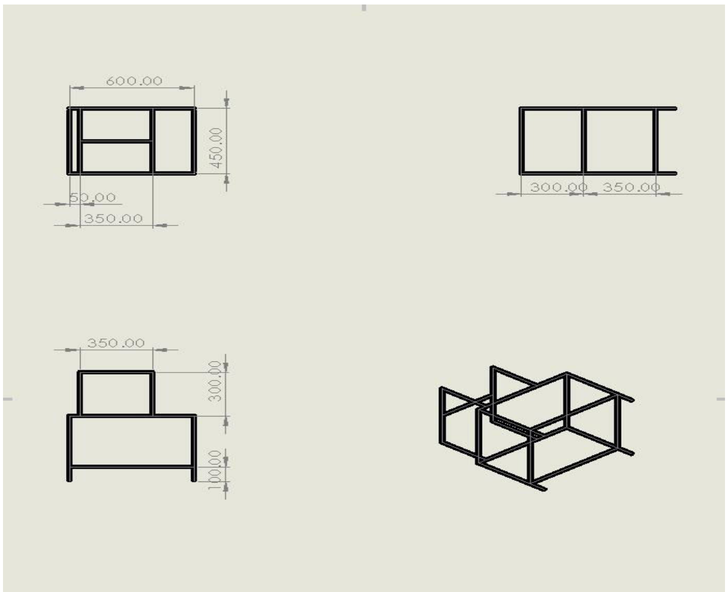

Fig (1) 2D Diagram

OVERALL DESIGN VIEW

Fig (2) 3D View

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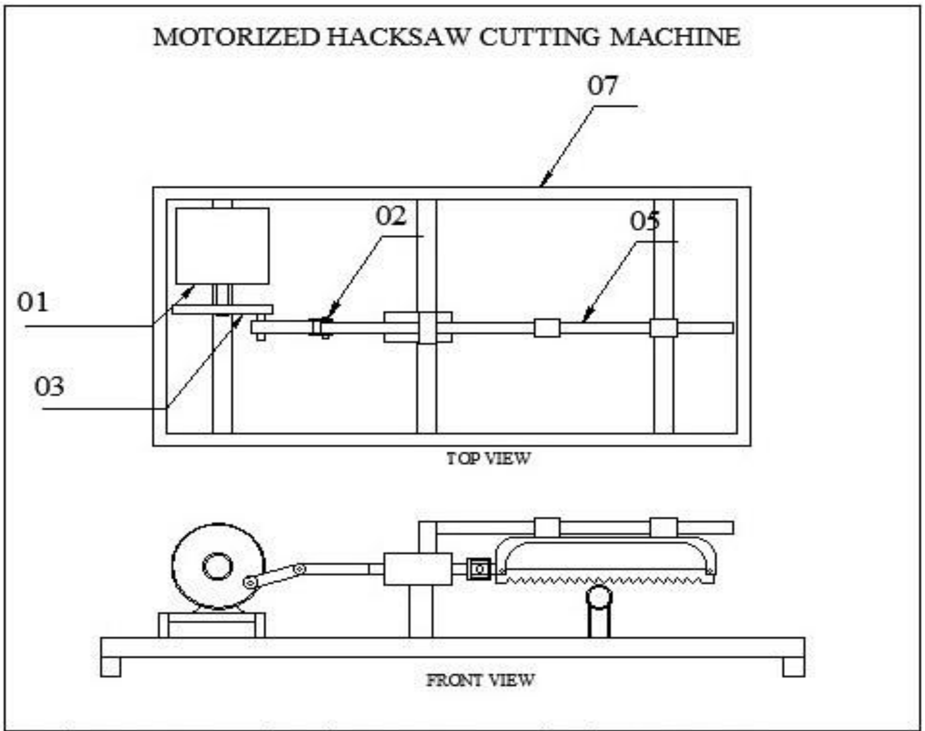

S.NO	PARTNAME	S.NO	PARTNAME	S.NO	PARTNAME
01	AC MOTOR	04	ACTUATING ROD	07	BASE
02	HINGE JOINT	05	BLADE		
03	CAM	06	WORK PIECE		

Fig(3) Over all view

IV. SCOTCH YOKE MECHANISM

The Scotch Yoke Mechanism, which effectively transforms rotational motion into reciprocating motion for accurate cutting, powers the Automatic Hacksaw Machine. This mechanism uses an off-center pin that fits into a slotted yoke to drive a revolving disc, which causes the yoke to travel in a straight line back and forth. The hacksaw blade receives this reciprocating action, allowing for consistent and continuous cutting. The Scotch Yoke Mechanism is perfect for automated cutting applications with little maintenance and increased efficiency because of its smooth motion, high force transfer, and small size.

V. CONSTRUCTION

A strong frame, a reciprocating hacksaw mechanism, and an electrical drive system form the foundation of the Automatic Hacksaw Machine's construction, guaranteeing effective and automatic cutting. Carbon steel square tubes measuring 300 mm by 300 mm are used to construct the primary frame, which offers a sturdy framework for all parts. A synchronous motor drives the sliding yoke, which holds the hacksaw blade, as it slides back and forth via the Scotch Yoke Mechanism. The cutting movement is made possible by the motor's rotation of a disc with an off-center pin that interacts with the yoke to produce a linear reciprocating motion. Because of the inbuilt potentiometer for speed control, the cutting speed may be changed according to the hardness of the material. A switch is used to run the system, guaranteeing both safety and easy control. This design is perfect for automated cutting applications because it guarantees smooth operation, excellent efficiency, and less manual labour.

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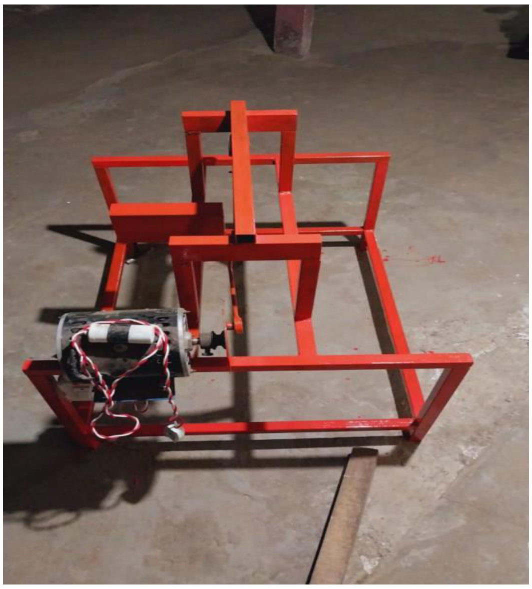
VI. CHARACTERISTICS OF HACK SAW BLADE

- **Material Composition:** To ensure longevity and wear resistance, hacksaw blades are usually composed of high-speed steel (HSS), carbon steel, or bi-metal.
- **Blade Length:** Depending on the cutting application and frame size, common lengths vary between 250 and 300 mm.
- **Tooth Pitch (TPI, or teeth per inch):** Hacksaw blades are often made with TPI values of 14, 18, 24, or 32. Harder materials are made with greater TPI, while softer materials are made with lower TPI.
- **Tooth Type:** To maximise cutting performance for various materials, including metals, polymers, and wood, the blade teeth might be regular, raker, or wave set.
- **Hardness and Flexibility:** Blades can be either stiff or flexible. Bi-metal blades combine hardness for cutting with flexibility to avoid breaking.
- **Cutting Direction:** The majority of hacksaw blades are made to cut forward, which guarantees effective material removal with little effort.
- **Blade Thickness:** Cutting stability and accuracy are impacted by the standard blade thickness, which ranges from 0.63 mm to 1.25 mm.
- **Coating and Finish:** To increase their durability and resistance to corrosion, certain blades are coated with titanium or black oxide.
- **Mounting Holes:** Standardised holes on both ends of hacksaw blades allow them to slot firmly into the hacksaw frame for simple installation and tension adjustment.

Because of these qualities, hacksaw blades are adaptable, strong, and efficient for cutting a variety of materials in both industrial and workshop settings.

WORKING AND PRINCIPLE OF AUTOMATIC HACKSAW MACHINE:

The Scotch Yoke Mechanism, which transforms rotational motion into reciprocating motion for effective cutting, powers the Automatic Hacksaw Machine. A crank disc with an off-center pin is rotated by the synchronous motor when it is turned on, pushing the slotted yoke to reciprocate back and forth. Attached to the yoke, the hacksaw blade cuts the material underneath it in a continuous linear motion. A potentiometer may be used to change the blade's speed, enabling accurate cutting according to the hardness of the material. This mechanism is very helpful for industrial and workshop applications since it guarantees automatic, smooth, and efficient cutting with less manual labour.



Fig(3) Hacksaw Machine

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VII. ASSEMBLY OF AUTOMATIC HACKSAW MACHINE

To provide structural support, a robust frame made of 300 x 300 mm carbon steel square tubes is the first step in assembling the Automatic Hacksaw Machine. The Scotch Yoke Mechanism is installed by fastening a crank disc with an off-center pin to the motor shaft, which engages with the slotted yoke to provide reciprocating motion, after the synchronous motor has been firmly fixed on the frame. Because the hacksaw blade is mounted inside the yoke, cutting may be done smoothly and linearly. The workpiece is held firmly in place by a clamping device that is positioned underneath the blade. Controlled operation is made possible by the electrical parts that are connected to the motor, such as the potentiometer and ON/OFF switch. In order to produce a highly effective and automated cutting machine appropriate for workshop and industrial applications, the system is lastly evaluated to guarantee smooth motion, correct alignment, and successful cutting.

VIII. CONCLUSION

The Automatic Hacksaw Machine uses the Scotch Yoke Mechanism to provide smooth and accurate reciprocating action, making it a very effective and labor-saving cutting option. This system guarantees automatic and reliable cutting performance with less manual labour by combining a synchronous motor, a potentiometer for speed control, and a robust frame. While the electronic control system increases operating safety and flexibility, the utilisation of carbon steel square tubes improves durability. This design is perfect for automated cutting applications, small-scale companies, and workshops since it drastically cuts down on time, effort, and human intervention. This machine's straightforward design, affordability, and high efficiency make it a dependable and useful substitute for human hacksaws, increasing material cutting operations' accuracy and productivity.

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