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Sonargaon University (SU)
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Fabrication and Experimental Evaluation of a Mini Portable Drill press Machine

A Thesis

By

MD HUMYUN KABIR	ME2101023195
ABU MOHAMMAD RAFSAN	ME2103025277
TANZIL AHMED RAJU	ME2103025355
MD MAHAFUJ AHMED	ME2103025247
MD HASAN MIA	ME2103025315

Supervised By

M.I. Washif Rahman,

Lecturer

Dept. of ME, SU

DEPARTMENT OF MECHANICAL ENGINEERING
SONARGAON UNIVERSITY (SU)

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In partial fulfillment of the requirements for the award of the degree of

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

MAY, 2025

LETTER OF TRANSMITTAL

January, 2025

To

M. I. Washif Rahman

Lecturer

Department of Mechanical Engineering.

Sonargaon University

Subject: Submission of Project Report.

Respected Sir,

We are happy to provide the "Design and Development of a Mini press drill machine" project report. It was a lot of excitement working on such a significant subject. This project was completed in accordance with Sonargaon University's specifications and your supervision's instructions. We anticipate that the project will be approved by the relevant authorities, and we will be pleased to provide any additional information you may believe is required in this respect.

Sincerely yours, thank you

MD HUMYUN KABIR ME2101023195

ABU MOHAMMAD RAFSAN ME2103025277

TANZIL AHMED RAJU ME2103025355

MD MAHAFUJ AHMED ME2103025247

MD HASAN MIA ME2103025315

DECLARATION

We so certify that the work included in this project report was completed by us and has never before been submitted to a university or organization for the award of a degree or certificate.

We so guarantee that no copyright is violated by the works that have been prohibited here.

We also promise to reimburse the university for any losses or damages brought on by a violation of the aforementioned duty.

MD HUMYUN KABIR ME2101023195

ABU MOHAMMAD RAFSAN ME2103025277

TANZIL AHMED RAJU ME2103025355

MD MAHAFUJ AHMED ME2103025247

MD HASAN MIA ME2103025315

Approved By
M.I. Washif Rahman,
Lecturer
Dept. of ME, SU

APPROVAL

The Project titled "Design and Development of a Mini press Drill Machine" submitted by MD Humyun Kabir (ME2101023195),Abu Mohammad Rafsan (ME2103025277),Tanzil Ahmed Raju (ME2103025355),Md Mahafuj Ahmed (ME2103025247), Md Hasan Mia (ME2103025315), to the Department of Mechanical Engineering, Sonargaon University (SU), has been accepted as satisfactory for the partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering and approved as to its style and contents.

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ABSTRACT

The tiny drill press with a DC motor is a compact, multifunctional tool for precise drilling in a range of materials. Among the components required for this device are a DC motor, drill bit, bit holder, couplings, joints, mounts, rods, base frame, screws, and bolts. The DC motor, which converts electrical energy into mechanical force, powers the drill bit.The drill bit, which is secured in position by the bit holder, is the primary cutting tool responsible for creating holes. Couplings efficiently transfer power between different components to provide smooth operation.

Joints provide flexibility and facilitate changes, while mounts and rods increase the drill press's overall stability. The base frame serves as a sturdy base and a platform for positioning the work item. Bolts and screws are essential for securing parts together and ensuring structural integrity while in use. These components come together in this little drill press to provide a dependable and effective tool for anyone who needs precise drilling capabilities in a small, portable package. Functionality, usability, and adaptability for a wide range of applications are prioritized in its design.

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CHAPTER 1 INTRODUCTION

1.1 Introduction

Wood, metal, and other materials can have holes drilled into or through them using a drill press. Cutting-edged drilling tools are used by drilling machines. A press drill machine can be used for tasks including tapping, reaming, spot facing, countersinking, and counterboring. A hand drilling machine has many drawbacks, such as requiring the user to exert effort and producing inaccurate results. Therefore, press drill machines are employed to get over these drawbacks. A cutting tool is connected to the drill press in this project via a chuck or Morse taper, and it rotates and feeds into the work at different rates. This Mini Drill press consists of a DC motor, rack and pinion with frame which provides support to the entire device. This drill press machine also consists of aside shaft gear, a DC motor with a spindle which is-attached vertically.

There is a rack and pinion provision for vertical up-down motion. Drilling is made simple and effective with this drill press equipment. One of the most crucial pieces of equipment in a workplace is a drilling machine. It was made to create a cylindrical hole in metal objects with the necessary depth and diameter. While other machine tools in a shop can be used to make holes, a drilling machine is created expressly to carry out drilling and related tasks. With a drilling machine, drilling may be completed quickly, cheaply, and effortlessly. Drilling is the process of using a drill's spinning edges to remove metal in order to create a cylindrical hole with the necessary diameter and depth. The cutting tool known as drill is fitted into the spindle of the drilling machine.
A mark of indentation is made at the required location with a center punch.

At the site, the spinning drill is squeezed and fed into the project. It is possible to patch the hole. New, more precise, and longer-range techniques for determining distances, deformations, or vibrations were made possible by optical measurement devices. Advances in technology have made it possible to significantly enhance a number of components, including optical ones. Therefore, it is imperative to establish fundamental measuring techniques in order to stay up with technological advancements.

The three fundamental measuring techniques—triangulation, telemetry, and covering their primary uses, benefits, and drawbacks—are examined in this study along with theoretical justifications for each. This work displays the outcomes of simulation procedures for each strategy.For the triangulation method we made two experiments which demonstrate the functioning of the method in measuring distances and surfaces.

For the telemetry method, experimental setups were studied to apply the method of pulse telemetry and phase comparison telemetry to measure distances; thus, it is intended to set up the basis for the future development of more complex methods.

1.2 Background Study

Researching and comprehending the essential elements pertaining to the design, functionality, and construction of a do-it-yourself tiny drill press with a DC motor is the background study for a mini drill press project. These are some topics you may wish to look at for your background research. Examine current models and commercial micro drill presses to learn about their characteristics, constructions, and capabilities. Examine many models to learn what functions effectively and to find possible changes or enhancements for your do-it-yourself project. Learn about the drill press's basic parts, such as the motor, drill chuck, bit holder, base frame, mounts, rods, joints, and fasteners (bolts and screws). Understand the roles each component plays in the overall functionality of the drill press. Research DC motors suitable for drill press applications. Consider factors such as power requirements, RPM (revolutions per minute), torque, and motor size.

For best results, learn how to connect and operate a DC motor. Examine several drill bit sizes and kinds that are appropriate for your small drill press. Recognize the bit holders' design principles and how they safely retain drill bits while in use.Examine materials like metals for frames and structural elements that are frequently utilized in drill press construction. Recognize this mate's attributes Examine drill press features that can be adjusted, such as joints and vertical movement systems. Recognize how these mechanisms function, and for further adaptability, think about including comparable elements in your tiny drill press design.rials and how they support the drill press's stability and robustness.

1.3 Objectives

The objectives of this project are:

1. **Drilling machine design and development:**The goal is to create a drill machine that maximizes drilling efficiency, lowers energy usage, and enhances precision for a particular use (such as manufacturing, mining, or construction).
2. **Drill Machine Performance Evaluation Goal:** To assess how well various drill machines work in different material types (such as metals, pvc, plastic, wood, etc.) by looking at factors like speed, power, durability, and accuracy.

3. **Drill Machine Ergonomics Improvement:**The goal is to evaluate and develop the ergonomic design of drill machines in order to lessen operator strain and improve comfort and safety during extended use.

4. **Innovation in Materials for Drilling Machine Parts:**The goal is to look into using new, strong materials for drill machine parts (such as drill bits, gears, and motors) in order to increase performance, decrease wear, and prolong their lifespan.

5. **Drill machine cost analysis and optimization:**The goal is to conduct a cost study of the manufacturing and operation of drill machines and make recommendations for economical enhancements without sacrificing functionality or security.

1.4 Organization of The Book

- Chapter 1: **Introduction.** This chapter is all about background study Mini Press Drill Machine use, Objectives and thesis book organization.

- Chapter 2: **Literature Review-** Here briefly describe about Mini Press Drill Machine technology, filter availability, previous book review, Block diagram, Structural Diagram, Components List and Summary of this chapter.

- Chapter 3: **Hardware Analysis-** This chapter is discussed about our project hardware. Here we describe our hole instrument details.

- Chapter 4: **Methodology–** Here briefly discuss about project methodology, hardware parts, our system working mechanism, project final image, working principle and our system overview.

- Chapter 5: **Results and Discussion–** Here briefly discuss about project discussion, result analysis, advantages, disadvantages, application and our system overview.

- Chapter 6: **Conclusion** – This chapter is all about our thesis future recommendation and this project conclusion.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

In this chapter we will discuss some literature review.Here are some of the ideas we got after this project related literature.

2.2 Literature Review

The efficiency of industrial processes and systems has significantly increased as a result of the advancement of many technologies, including computers and electronic communication equipment. CIM, or computer integrated manufacturing, is the word used to describe these advancements.One Process automation is the CIM feature that will be used to this project. Automation includes continuous processing at such equipment as well as automated handling between them. Only when a collection of linked processes are connected physically, electrically, or with the aid of computers can there be automation.One The Ford Motor Company coined the term "automation" in 1945 to refer to "a logical development" in technological advancement when continuous machine processing is coupled with autonomous handling between units. [1]

This suggests that only when devices are mechanically connected for ongoing automated handling and processing are they deemed automated.One Now that a solid definition has been established, the assessment of automation may start. In today's world, everyone is searching for ways to produce goods more quickly and cheaply without compromising on quality. For the planned project, this is likewise regarded as a top priority. However, the issue of "is it really worth implementing?" was raised if automation is unable to lead us in that way. [2]

Reducing direct labor expenses was the initial goal of automation, but as technology gains popularity, additional advantages have been noted. One of the elements that made automation successful was safety. It has been demonstrated that automation lowers industrial accident rates, which is critical for boosting staff morale1.

According to the project, if someone doesn't have the necessary training or puts their hands too close to the drill, they might get hurt by the drill press. It is believed that when

a production is automated, humans are no longer directly involved in the process.Automation of a production is said to remove the human from direct participation in the operation.By automating the drill press the operator will not have to worry about their safety because while the drill is on they will not be required to be so involved with the drilling process, therefore assisting in avoiding a potential injury. [3]

Even while operator safety is crucial, it is neither the primary advantage of this project nor the primary driver behind the installation of an automated system. The productivity of the PC boards will significantly rise with the automation of the drill press. Students will need some time to learn how to use the new production system, but once they do, the production rate and output per hour will significantly increase because the program will move the drill to the desired point instead of the operator having to take the time to move the drill to that point accurately enough. [4]

This brings us to yet another advantage of automation: higher quality. More precision and uniformity in processing are often attained via automated production. Because of human error, its accuracy is now somewhat poor. Due to human fallibility, there is usually some human error when the operator puts the table at the intended coordinates, and this might change based on a variety of external factors. However, as previously said, an automated system eliminates the need for human intervention, increasing precision and, consequently, the quality of the drilled product.One last advantage, which I previously touched upon, of automation that will undeniably be observed through this project, is the reduction of work in process. On the macro-level of automation, the work in process is when the product is either being processed or between processing operations. [5]

By cutting down on the amount of time the product is in the plant, automation tends to decrease work in process. Although there is only one process that can be assessed at our micro level of automation, the application of automation will result in a reduction in the time required to finish that process. It used to take time to find each hole since the operator had to dig as near as possible to the target coordinates. However, with the automated system, all of the coordinates are input into a spreadsheet,

which exports the coordinates to the controller. The system then moves the drill to the next required location until all of the holes are drilled. [6]
Therefore the time it takes to move from one hole to the next is significantly decreased, the total time of production will also be minimized. One final aspect of the project that needs

to be researched comes back to the goal of today's society, economics. Currently the drill press is working, and has so far provided the students with quality holes. But the question is will this project be completed, within the allotted budget, and confirm that it also produces the benefits mentioned above. Designing and constructing this automated system is not necessarily the easiest way of obtaining an automated drill press. One way of acquiring an automated drill press would be to purchase one. [7]

After searching numerous catalogs, and Internet sites, a conclusion has been reached that there are three different levels of automated drilling machines. When dividing anything into different categories there is always a grey area, but for easy comparison of automated, also known as computer numerical control, drill presses can be categorized as excellent, decent, and substandard. When looking to buy a drill the final decision depends on what type of specifications the buyer is trying to meet, and what kind of budget they are dealing with. The most expensive and elaborate drill found through an extensive search was the Cameron CNC Micro Drilling Center Model 2001 (Appendix A, Figure 1). This drill has triple axis movement, an excellent resolution, and a fast traveling speed. This package includes a laptop computer, software, stepper motors, along with a security lock, and a clean room enclosure with a vacuum nozzle. [8]

This equipment, which is very precise and sophisticated, yet easy to use, . Sherline's newest drill brings the best features of full size shop drills into a miniature machine shop with a column that offers 4 additional directions of movement compared to their other models. The base extends 14" long to accommodate the additional mechanism of the column. With this drill, holes can be drilled from almost any angle with the part mounted square to the table. This drill, along with all of their models, can be purchased with either English or Metric measuring systems. . Because of the large amounts of money it requires to purchase a brand new drill, used machinery can also be considered. Sticking with the
Sherline models, a used less expensive drill was found on an auction web site. [9]

This 5000A/5100A deluxe drill Package (Appendix A, Figure 3) comes with a variety of selected popular accessories, and a handbook to guide you through the computer interface. The Model 5000 features a solid 10" aluminum base, precision machined dovetailed slides with adjustable gibs, permanently lubricated spindle bearings, adjustable pre-load antibacklash feed screws on x and y axes, two laser engraved aluminum hand-wheels, one laser engraved hand-wheel with thrust bearings, and many other features4 . But because it

is used, and from an auction web site, it is hard to tell what you will really get when the drill arrives. This item can be purchased at a bargain price of 900.00 dollars. In the Sherline catalog this particular item is price listed at $1100.00, which does not include the cost of accessories3 . When considering the benefits of an automated piece of machinery the disadvantages are quite minuscule when compared to the benefits that will transpire. The only real draw back to an automated drill press is the cost. That is where the proposed project comes into play. Using the present drill press, and acquiring the different positioning and assembly parts and software, an automated drill press can be assembled at a much lower cost. In turn, the demands of today's society are being met by utilizing the ultimate option of producing the same result at a fraction of the cost. [10]

2.3 Summary

The above discussion gives an idea about the**Design and Development of a Mini press drill machine**. All that work on this system already been done here, and the results of their work, the use of Mini Drill Press in the situation are described in detail.
From this we also got the direction of work of the project.

CHAPTER 3 HARDWARE ANALYSIS

3.1 Components List:

Hardware Part

- SMPS
- DC Motor
- Rack & Pinion
- Bearing
- Drill Bit
- Bit Holder
- Couplings
- Joints
- Mounts
- Rods
- Base Frame
- Screws & Bolts

Software

- Easy EDA

3.2 DC Motor

An electrical motor that generates mechanical force using direct current (DC) is known as a DC motor. The most prevalent kinds depend on magnetic forces generated by coil currents. Almost every kind of DC motor has an internal mechanism, either electronic or electromechanical, that allows it to periodically alter the direction of the current flowing through a portion of the motor. Since DC motors could be fueled by the directcurrent lighting power distribution networks already in place, they were the first type of motors to be widely employed. With a changeable supply voltage or by adjusting the current strength in its field wings, a DC motor's speed may be adjusted across a broad range. Appliances, toys, and tools all employ small DC motors.

With the lightweight brushed universal motor, the portable power tools and appliances may be powered by either direct current or alternating current. Larger DC motors are now used in hoists, elevators, electric vehicle propulsion, and steel rolling mill drives. Thanks to advancements in power electronics, it is now possible to transition from DC motors to AC motors in many applications. When a current passes through a coil of wire, an electromagnetic field is created that is aligned with the coil's center. The direction and

intensity of the magnetic field generated by the coil may be changed by the current flowing through it.

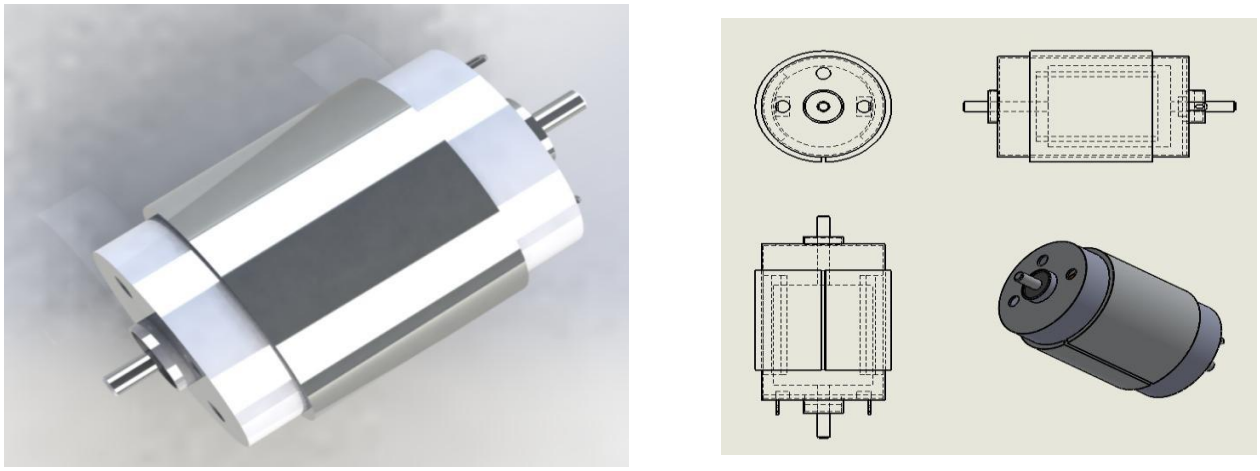


Figure 3.1: 775 DC motor 12V

An armature with one or more windings of insulated wire wound around a soft iron core that focuses the magnetic field and a stationary set of magnets in the stator make up a basic DC motor. In big motors, there may be many parallel current channels, and the windings often have multiple rounds around the core. The wire winding's ends are attached to a commutator. Each armature coil may be turned on in turn thanks to the commutator, which also uses brushes to link the revolving coils to the external power source. (Brushless DC motors don't have brushes; instead, they use electronics that turn the DC current to each coil on and off.)

The total amount of current sent to the coil, the coil's size, and what it is wrapped around decide the strength of the electromagnetic field created. The sequence of turning a particular coil on or off dictates what direction the effective electromagnetic fields are pointed. By turning on and off coils in sequence, a rotating magnetic field can be created. These rotating magnetic fields interact with the magnetic fields of the magnets (permanent or electromagnets) in the stationary part of the motor (stator) to create a torque on the armature which causes it to rotate.

In some DC motor designs, the stator fields use electromagnets to create their magnetic fields which allows greater control over the motor. At high power levels, DC motors are almost always cooled using forced air.

The intrinsic speed and torque regulation features vary depending on the number of stator and armature fields and their connections. By altering the voltage provided to the armature, a DC motor's speed may be controlled. Speed control is made possible by

variable resistance in the field or armature circuit. Power electronics systems that modify the voltage by "chopping" the DC current into on and off cycles with an effective lower voltage are frequently used to operate modern DC motors. The serieswound DC motor is frequently utilized in traction applications like electric trains and trams because it produces its maximum torque at low speeds.

In addition to powering a variety of cordless equipment, DC motors may run straight from rechargeable batteries, which is how the original electric automobiles and modern hybrid and electric cars got their start. DC motors are still used today in a variety of capacities to run paper machines and steel rolling mills, as well as in smaller devices like toys and disk drives. In order to achieve high torque and smooth speed control with thyristor drives, mine hoists often employed large DC motors with independently stimulated fields in conjunction with winder drives. Large AC motors with variable frequency drives have now taken their place.

3.3 Rack And Pinion

One kind of linear actuator is a rack and pinion, which consists of a circular gear (the pinion) that engages a linear gear (the rack). When combined, they can translate between linear and rotary motion. The rack is driven in a line when the pinion is rotated. On the other hand, the pinion will spin if the rack is moved linearly. Both helical and straight gears can be used with a rack-and-pinion drive. Although some claim that helical gears operate more quietly, there is no concrete proof to back up this claim.

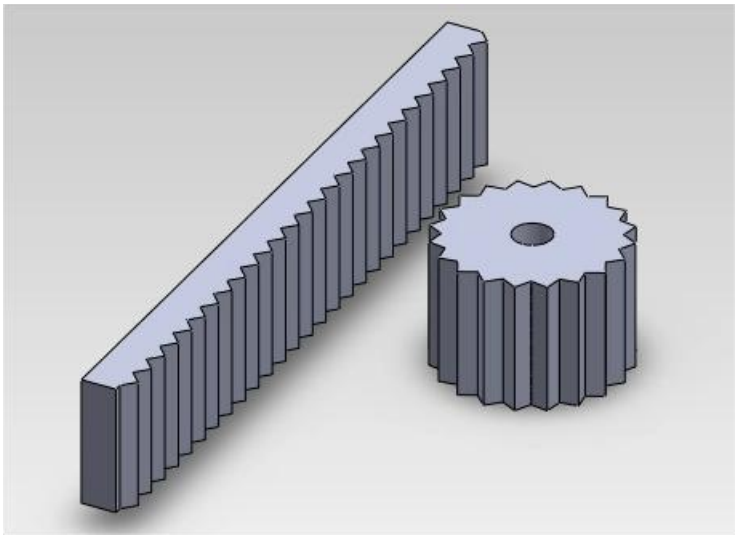


Figure 3.2: Rack & Pinion [15]

Despite being less expensive, helical racks have been shown to raise the datum's side torque, which raises the working temperature and causes premature wear. Because straight racks give more torque and speed per fraction of gear ratio and need less driving power, they may operate at lower temperatures and utilize less energy and viscal friction. The torque on the pinion and its size, or the force on the rack and the pinion size, define the maximum force that may be communicated in a rack-and-pinion system. For example, in a rack railway, the rotation of a pinion mounted on a locomotive or a railroad car engages a rack, usually placed between the rails, and helps to move the train up a steep gradient. For every pair of conjugate in volute profile, there is a basic rack. This basic rack is the profile of the conjugate gear of infinite pitch radius (i.e. a toothed straight edge). A generating rack is a rack outline used to indicate tooth details and dimensions for the design of a generating tool, such as a hob or a gear sharper cutter.

3.4 Bearing

A bearing is a component of a machine that lessens friction between moving components and limits relative motion to only the intended motion. By regulating the vectors of normal forces acting on the moving parts, the bearing design can, for instance, allow for free rotation around a fixed axis or free linear movement of the moving part. By reducing friction, the majority of bearings enable the intended motion.

Bearings can be widely categorized based on the direction of loads (forces) supplied to the components, the kind of operation, or the movements permitted.



Figure 3.3: Bearing [16]

The word "bearing" comes from the verb "to bear," and a bearing is a component of a machine that enables one part to support or bear another. The most basic bearings are bearing surfaces that have been cut or molded into a component, with different levels of control over the surface's shape, size, roughness, and placement. Additional bearings are independent components that are fitted into a machine or machine component. The most

exacting components are the most advanced bearings for the most demanding applications; their production calls for some of the most advanced technological standards available today.

3.5 Drill Bit

Drill bits are cutting tools used in a drill to remove material to create holes, almost always of circular cross-section. Drill bits come in many sizes and shapes and can create different kinds of holes in many different materials. In order to create holes drill bits are usually attached to a drill, which powers them to cut through the workpiece, typically by rotation. The drill will grasp the upper end of a bit called the shank in the chuck. Drills come in standardized drill bit sizes. A comprehensive drill bit and tap size chart lists metric and imperial sized drills alongside the required screw tap sizes. There are also certain specialized drill bits that can create holes with a non-circular cross-section.



Figure 3.4: Drill Bit

Drill geometry has several characteristics

The drill bit's spiral, also known as its rate of twist, regulates how quickly chips are removed. In high feed rate applications where a significant number of chips must be removed at low spindle speeds, a rapid spiral (also known as a "compact flute" or high twist rate) drill bit is utilized. In cutting applications where high cutting speeds are customarily employed and where the material, like copper or aluminum, has a propensity to gall on the bit or otherwise clog the hole, low spiral (also known as low twist rate or "elongated flute") drill bits are utilized.

The material the bit will be working in determines the point angle, or the angle created at the bit's tip. A sharper angle is needed for softer materials, whereas a bigger angle is needed for harder materials. Wandering, chatter, hole form, and wear rate are all influenced by the proper point angle for the material's hardness.

The lip angle determines the amount of support provided to the cutting edge. A greater lip angle will cause the bit to cut more aggressively under the same amount of point pressure as a bit with a smaller lip angle. Both conditions can cause binding, wear, and eventual catastrophic failure of the tool. The proper amount of lip clearance is determined by the point angle. A very acute point angle has more web surface area presented to the work at any one time, requiring an aggressive lip angle, where a flat bit is extremely sensitive to small changes in lip angle due to the small surface area supporting the cutting edges**.**

The functional length of a bit determines how deep a hole can be drilled, and also determines the stiffness of the bit and accuracy of the resultant hole. While longer bits can drill deeper holes, they are more flexible meaning that the holes they drill may have an inaccurate location or wander from the intended axis. Twist drill bits are available in standard lengths, referred to as Stub-length or Screw-Machine-length (short), the extremely common Jobber-length (medium), and Taper-length or LongSeries (long).

Most drill bits for consumer use have straight shanks. For heavy duty drilling in industry, bits with tapered shanks are sometimes used. Other types of shank used include hex-shaped, and various proprietary quick release systems.

3.6 Flexible Couplings

A coupling is a tool used to join two shafts at their ends so that power may be transmitted. Couplings are mostly used to connect two spinning pieces of equipment while allowing for some end movement, misalignment, or both. In a broader sense, a coupling can also refer to a mechanical apparatus used to join the ends of neighboring components or items.Although torque-limiting couplings can slide or detach when a torque limit is exceeded, couplings typically do not permit shaft disengagement while in operation.



Figure 3.6: Flexible Coupler [18]

Shaft couplings are used in machinery for several purposes. A primary function is to transfer power from one end to another end Other common uses:

- To alter the vibration characteristics of rotating units
- To connect the driving and the driven part
- To introduce protection
- To reduce the transmission of shock loads from one shaft to another
- To slip when overload occurs

Balance

Couplings are normally balanced at the factory prior to being shipped, but they occasionally go out of balance in operation. Balancing can be difficult and expensive, and is normally done only when operating tolerances are such that the effort and the expense are justified. The amount of coupling unbalance that can be tolerated by any system is dictated by the characteristics of the specific connected machines and can be determined by detailed analysis or experience.

3.7 Joints

Joins that may be used in a mini drill press project:

Hinged Joints

Hinged joints allow for rotational movement around a fixed point. They can be used to create adjustable angles or facilitate the vertical movement of certain parts of the drill press, such as the drilling platform.

Sliding Joints

Sliding joints enable linear movement along a specified path. These joints can be utilized to create adjustable components, such as the height adjustment mechanism in the mini drill press.

Pivoting Joints

Pivoting joints allow components to rotate around a central axis. They are useful for creating swiveling or tilting features in the drill press design, providing versatility in its operation.

Threaded Joints

Threaded joints involve components with threads that interlock, allowing for adjustable connections. These joints are often used in situations where fine adjustments are required, such as in height-adjustable components.

Locking Joints

Locking joints secure two components in a fixed position. These are essential for maintaining stability during the operation of the drill press, preventing unwanted movement or vibrations.

Dovetail Joints

Dovetail joints are interlocking joints with a trapezoidal shape. They are often used to create sturdy and durable connections, such as in the construction of the base frame or mounting components.

Pinned Joints

Pinned joints involve the use of pins or dowels to connect two components. These joints provide a stable connection while allowing for rotational movement, and they are commonly used in structural elements.

Flexible Joints

Flexible joints, such as universal joints, allow for movement in multiple directions. They can be used to create articulated arms or linkages that contribute to the adjustability of the drill press.

Welded Joints

Welded joints involve fusing metal components together using welding techniques. Welding provides a strong and rigid connection, often used in structural elements of the drill press.

3.8 Mounts

Motor Mount the motor mount is a structure that securely holds and positions the DC motor. It is designed to provide a stable foundation for the motor while allowing for proper alignment with other components like the drill chuck.

Base Frame Mounts

These mounts are used to secure the entire drill press to a workbench or another surface. They are integral to the stability of the drill press during operation and help absorb vibrations.

Drill Chuck Mount

The drill chuck mount holds and positions the drill chuck, which in turn holds the drill bit. It ensures that the drill chuck is properly aligned with the motor, facilitating smooth and accurate drilling.

Vertical Movement Mechanism Mounts

If your mini drill press includes a vertical movement mechanism for adjusting the drilling depth, mounts are used to secure and guide the rods or components responsible for the vertical movement. These mounts ensure that the movement is precise and controlled.

Bit Holder Mount

The bit holder mount secures the bit holder, ensuring that it remains in place during drilling. It is designed to accommodate the bit holder and align it with the drill chuck for optimal performance.

Joint Mounts

Mounts are used in conjunction with joints to secure and stabilize components that allow movement, such as hinged or pivoting joints. These mounts ensure that the joints function smoothly while maintaining structural integrity.

Adjustable Component Mounts

If there are adjustable components in your mini drill press, such as those with sliding or threaded joints, mounts are used to secure these components in the desired position.
This could include components related to height adjustment or angle adjustment.

Rod Mounts

In a mini drill press with a vertical movement mechanism, mounts are used to secure and guide the rods responsible for the movement. These mounts play a crucial role in maintaining the alignment and stability of the vertical movement.

Locking Mechanism Mounts

If there are locking mechanisms or clamps used to secure adjustable components, mounts are involved in providing a stable foundation for these mechanisms. They contribute to the overall rigidity of the drill press.

3.9 Rods

Hey play a crucial role in maintaining stability, alignment, and control of various moving parts. Here is a description of different types of rods and their roles in a mini drill press

Vertical Movement Rods

These rods are often part of the vertical movement mechanism in a mini drill press. They are responsible for guiding the drilling platform or the entire drilling assembly in the vertical direction, allowing for adjustable drilling depths.

Guide Rods

Guide rods are used to guide and support moving components, ensuring smooth and precise movement. In a drill press, they may be employed to guide the vertical movement of the drilling platform or other adjustable parts.

Connecting Rods

Connecting rods are used to link or transmit motion between different components of the drill press. For example, a connecting rod may link the DC motor to the drill chuck, facilitating the transfer of rotational motion.

Stabilizing Rods

Stabilizing rods are employed to enhance the stability of the drill press structure. They may connect different parts of the frame or provide additional support to prevent vibrations and ensure accuracy during drilling.

Threaded Rods

Threaded rods are used in conjunction with threaded joints to provide an adjustable and secure connection between components. They can be used for height adjustment or to fine-tune the position of certain elements in the drill press.

Drive Rods

In the context of a drill press, drive rods may be utilized to transmit rotational motion from the DC motor to other components, such as the drill chuck. These rods play a role in the power transmission within the drill press mechanism.

Supporting Rods

Supporting rods provide additional support to various components, helping distribute loads and maintain the structural integrity of the drill press. They contribute to the overall strength and rigidity of the assembly.

Alignment Rods

Alignment rods are used to ensure precise alignment between different components of the drill press. Proper alignment is crucial for accurate drilling, and these rods help maintain the intended orientation of moving parts.

Adjustable Length Rods

Some rods in a mini drill press may have an adjustable length feature, allowing for changes in the overall height or position of specific components. This adjustability contributes to the versatility of the drill press.

3.10 Base Frame

The base frame is typically constructed from sturdy and durable materials to ensure stability and support. Common materials include steel, aluminum, or robust plastics, depending on the desired strength and weight of the drill press.

Construction

The base frame is usually designed as a rigid and stable structure. It may consist of welded or bolted joints to connect various components, creating a solid foundation for the drill press.

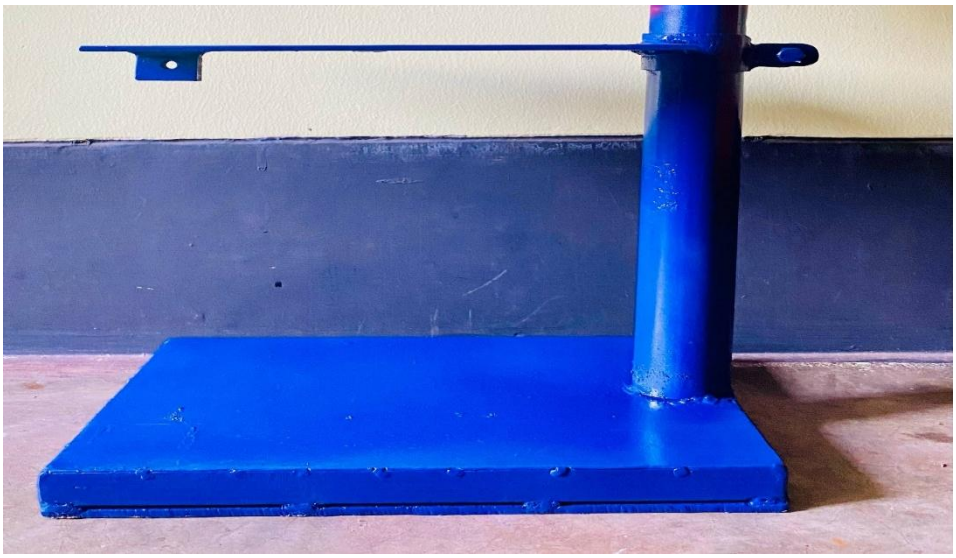


Figure 3.7: Base Frame

Size and Dimensions

The size and dimensions of the base frame depend on the intended use and the space available. It should be large enough to provide stability and accommodate the other components of the drill press while being compact for ease of use and storage.

Mounting Points

The base frame includes mounting points for attaching the motor, drill chuck, vertical movement mechanism, and other essential components.

3.11 Screws & Bolts

Screws

Screws: Designed for use in metal, these screws have coarse threads and often come with a tapered point.

Machine Screws: Primarily used for metal-to-metal fastening, machine screws have finer threads and are often paired with nuts or threaded holes.

Self-Tapping Screws: Equipped with a pointed end, self-tapping screws are designed to create their own threads as they are driven into materials like metal or plastic.

Thread Types

Coarse Threads: Commonly found on screws, they provide a strong grip in softer materials.

Fine Threads: Often used in machine screws for a tighter and more precise fit.

Heads:

Flat Head: Sits flush with the material surface.
Round Head: Projects slightly above the material surface.
Pan Head: Similar to round heads but with a slightly flatter top.
Oval Head: Combines the features of flat and round heads.

Applications

Screws are versatile fasteners used for a wide range of applications, including fastening components together, attaching hardware, and providing strong connections in various materials.

Bolts

Hex Bolts: Have a hexagonal head and are tightened with a wrench or socket.

Carriage Bolts: Have a smooth, rounded head and a square neck under the head, preventing them from turning during installation.

Eye Bolts: Feature a looped head and are used for attaching cables or hooks.

Threaded Length: Bolts typically have a longer threaded section compared to screws. They often require nuts to secure the joint.

Head Types

Hex Head: Requires a wrench or socket for tightening.

Square Head: Similar to hex heads but with a square shape.

Round Head: A circular head that may protrude slightly above the material surface.

Nuts and Washers

Bolts are commonly used with nuts and washers. The nut is threaded onto the bolt to secure the joint, and washers may be used to distribute the load and provide a smooth surface.

Applications

Fasteners are used to assemble joints, allowing for flexibility, adjustability, or controlled movement in the drill press.

Base Frame Construction

Screws and bolts are essential for assembling the base frame, connecting different parts to create a sturdy foundation for the drill press.

Vertical Movement Mechanism

If the mini drill press has a vertical movement mechanism, screws or bolts may be used to assemble and secure components responsible for vertical adjustment.

3.12 Switched Mode Power Supply (SMPS)

An electronic power supply that integrates a switching regulator to effectively convert electrical power is known as a switched-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher. Similar to other power supplies, an SMPS converts voltage and current characteristics while transferring power from a DC or AC source (often mains power) to a DC load, such a personal computer. The pass transistor of a switching-mode supply spends very little time in the high dissipation transitions,

minimizing wasted energy, in contrast to a linear power supply, which alternates continuously between low-dissipation, full-on, and full-off states.

An perfect switched-mode power supply would not dissipate any electricity.By altering the ratio of on-to-off time (sometimes referred to as duty cycles), voltage control is accomplished. A linear power supply, on the other hand, continuously dissipates power in the pass transistor to control the output voltage. A switched-mode power supply's increased power conversion efficiency is one of its key benefits. Due to the decreased transformer size and weight, switched-mode power supplies can also be significantly lighter and smaller than linear supplies.



Figure 3.8: SMPS

Switching regulators are used as replacements for linear regulators when higher efficiency, smaller size or lighter weight are required. They are, however, more complicated; their switching currents can cause electrical noise problems if not carefully suppressed, and simple designs may have a poor power factor.

12V 5A Industrial SMPS Power Supply – 60W – DC Metal Power Supply – Good Quality – Non Waterproof with Aluminum casing.

- Output Voltage: 12V DC, 0-5A
- Input Voltage: AC 100 – 264V 50 / 60Hz
- Output voltage: Adjustment Range: ±20%
- Protections: Overload / Over Voltage / Short Circuit
- Auto-Recovery After Protection
- Universal AC input / Full range
- 100% Full Load Burn-in Test

- Cooling by Free Air Convection
- High Quality and High Performance
- LED power supply with a metal body for hidden installation for LED lighting Design with Built-in EMI Filter, improve signal precision.
- Certifications: CE & RoHs No Minimum Load.
- Compact Size Light Weight.
- High Efficiency, Reliability& low energy consumption
- Category – Switch Mode Power Adaptor (SMPS)

Switched-mode power supplies are classified according to the type of input and output voltages. The four major categories are:

- AC to DC
- DC to DC
- DC to AC
- AC to AC

A basic isolated AC to DC switched-mode power supply consists of:

- Input rectifier and filter
- Inverter consisting of switching devices such as MOSFETs
- Transformer
- Output rectifier and filter
- Feedback and control circuit

The input DC supply from a rectifier or battery is fed to the inverter where it is turned on and off at high frequencies of between 20 KHz and 200 KHz by the switching MOSFET or power transistors. The high-frequency voltage pulses from the inverter are fed to the transformer primary winding, and the secondary AC output is rectified and smoothed to produce the required DC voltages. A feedback circuit monitors the output voltage and instructs the control circuit to adjust the duty cycle to maintain the output at the desired level.

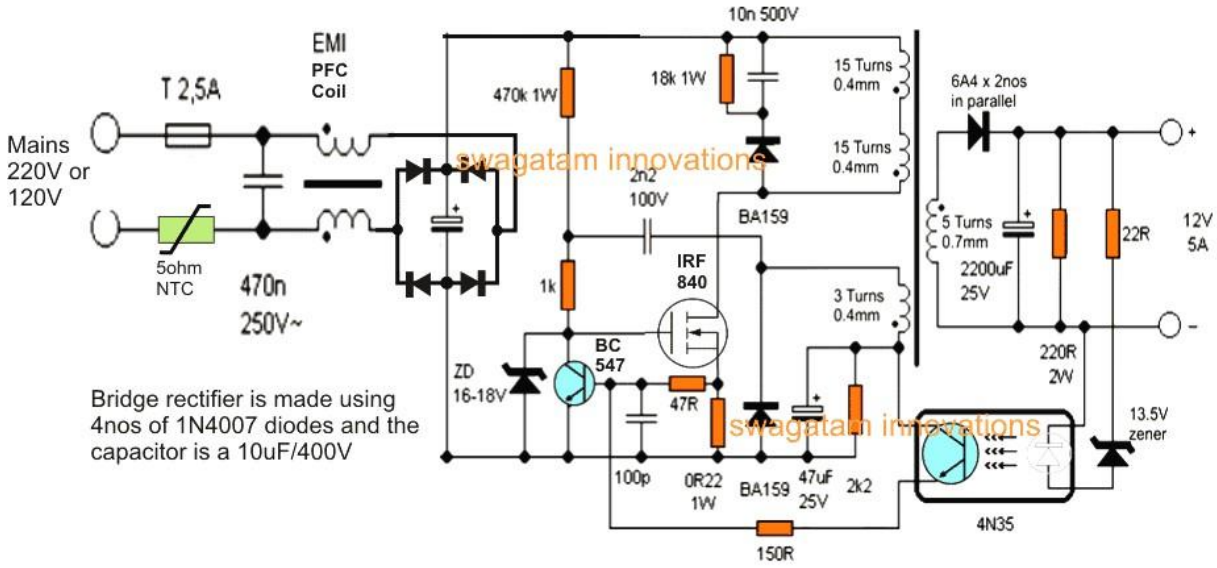


Figure 3.9: SMPS Circuit Design [19]

Basic working concept of an SMPS

A switching regulator does the regulation in the SMPS. A series switching element turns the current supply to a smoothing capacitor on and off. The voltage on the capacitor controls the time the series element is turned. The continuous switching of the capacitor maintains the voltage at the required level.

Design basics

AC power first passes through fuses and a line filter. Then it is rectified by a full-wave bridge rectifier. The rectified voltage is next applied to the power factor correction (PFC) pre-regulator followed by the downstream DC-DC converter(s). Most computers and small appliances use the International Electro technical Commission (IEC) style input connector. As for output connectors and pin outs, except for some industries, such as PC and compact PCI, in general, they are not standardized and are left up to the manufacturer.

There are different circuit configurations known as topologies, each having unique characteristics, advantages and modes of operation, which determines how the input power is transferred to the output. Most of the commonly used topologies such as fly back, push-pull, half bridge and full bridge, consist of a transformer to provide isolation, voltage scaling, and multiple output voltages. The non-isolated configurations do not have a transformer and the power conversion is provided by the inductive energy transfer.

Advantages of switched-mode power supplies

- Higher efficiency of 68% to 90%
- Regulated and reliable outputs regardless of variations in input supply voltage
- Small size and lighter
- Flexible technology
- High power density

Disadvantages

- Generates electromagnetic interference
- Complex circuit design
- Expensive compared to linear supplies

Switched-mode power supplies are used to power a wide variety of equipment such as computers, sensitive electronics, battery-operated devices and other equipment requiring high efficiency.

Switch Mode Power Supply

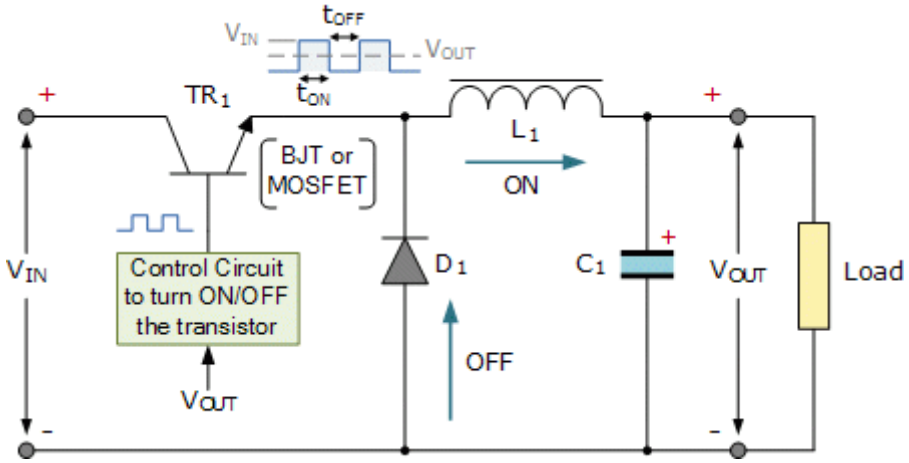


Figure 3.10: Power Supply Connection [20]

Linear voltage IC regulators have been the basis of power supply designs for many years as they are very good at supplying a continuous fixed voltage output.Linear voltage regulators are generally much more efficient and easier to use than equivalent voltage regulator circuits made from discrete components such a zener diode and a resistor, or transistors and even op-amps. The most popular linear and fixed output voltage regulator types are by far the 78… positive output voltage series, and the 79… negative output voltage series. These two types of complementary voltage regulators produce a precise

and stable voltage output ranging from about 5 volts up to about 24 volts for use in many electronic circuits.

There is a wide range of these three-terminal fixed voltage regulators available each with its own built-in voltage regulation and current limiting circuits. This allows us to create a whole host of different power supply rails and outputs, either single or dual supply, suitable for most electronic circuits and applications. There are even variable voltage linear regulators available as well providing an output voltage which is continually variable from just above zero to a few volts below its maximum voltage output.Most d.c. power supplies comprise of a large and heavy step-down mains transformer, diode rectification, either full-wave or half-wave, a filter circuit to remove any ripple content from the rectified d.c. producing a suitably smooth d.c. voltage, and some form of voltage regulator or stabilizer circuit, either linear or switching to ensure the correct regulation of the power supplies output voltage under varying load conditions. Then a typical d.c. power supply would look something like this:

Typical DC Power Supply

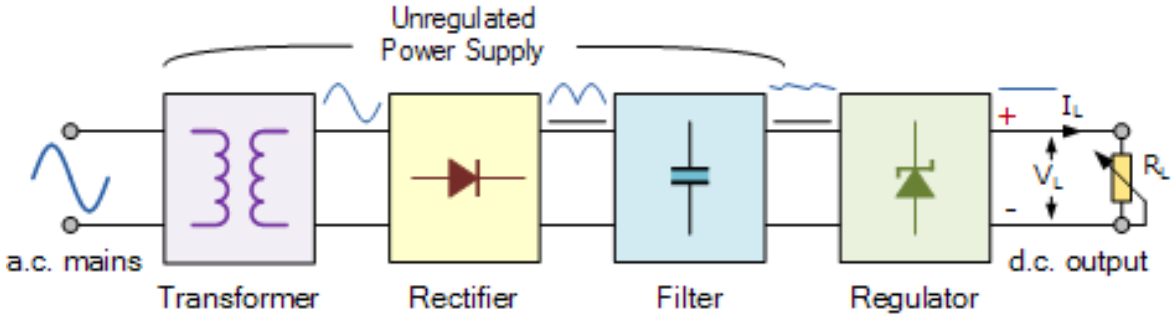


Figure 3.11: DC Power Supply Step [21]

These typical power supply designs contain a large mains transformer (which also provides isolation between the input and output) and a dissipative series regulator circuit. The regulator circuit could consist of a single zener diode or a three-terminal linear series regulator to produce the required output voltage. The advantage of a linear regulator is that the power supply circuit only needs an input capacitor, output capacitor and some feedback resistors to set the output voltage.

3.13 Easy EDA Software

Easy EDA is a web-based EDA tool suite that enables hardware engineers to design, simulate, share - publicly and privately - and discuss schematics, simulations and printed circuit boards. Other f eatures include the creation of a bill of materials, Gerber files and pick and place files and documentary outputs in PDF, PNG and SVG formats. Easy EDA allows the creation and editing of schematic diagrams, SPICE simulation of mixed analogue and digital circuits and the creation and editing of printed circuit board layouts and, optionally, the manufacture of printed circuit boards.

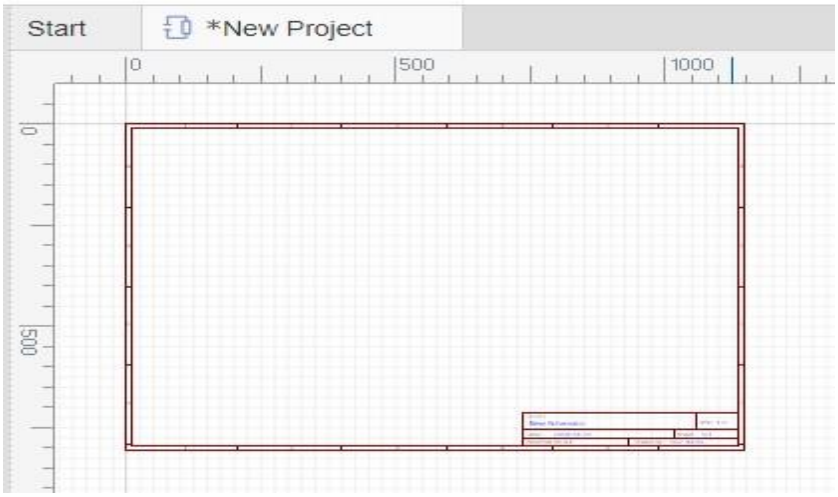


Figure 3.12: EasyEDA Software Interface [22]

Subscription-free membership is offered for public plus a limited number of private projects. The number of private projects can be increased by contributing high quality public projects, schematic symbols, and PCB footprints and/or by paying a monthly subscription.Registered users can download Gerber files from the tool free of charge; but for a fee, Easy EDA offers a PCB fabrication service. This service is also able to accept Gerber file inputs from third party tools.

CHAPTER 4 METHODOLOGY

4.1 Our Methodologies for the project:

Our methodologies for the project:

- Creating an idea for design and construction of an **Design and Development of a Mini press drill machine.** And designing a block diagram & circuit diagram to know which components we need to construct it.
- Collecting all the components and programming the micro-controller to control the whole system.
- Setting up all the components in a PCB board & then soldering. Lastly, assembling all the blocks in a board and to run the system & for checking purposes.

4.2 Block Diagram

In our project we have set up a **Design and Development of a Mini press drill machine**.In this diagram we will show by block the individual parts.

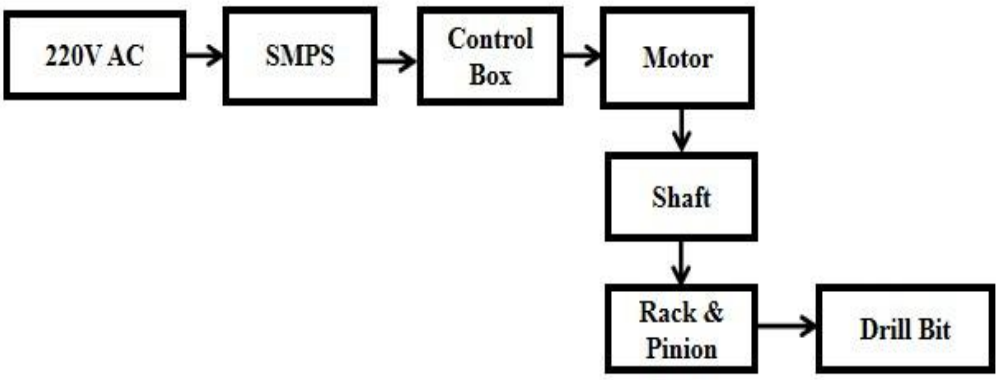


Figure 4.1: Block Diagram of Mini Press Drill [23]

4.3 Schematic Diagram

The schematic diagram here is representing the electrical circuit and the components of the Mini Press Drill. Here we connect equipment with he smart wire connection.

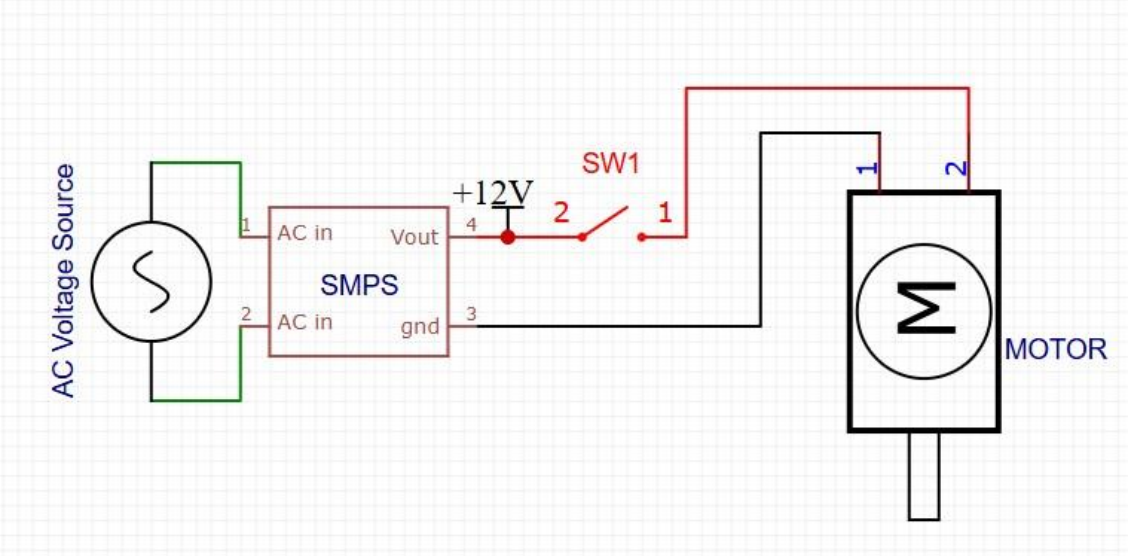


Figure 4.2: Schematic Diagram of Mini Press Drill [24]

4.4 Working Principle

The DC 12V motor is powered by the SMPS, and it rotates its shaft when energized. The 5mm flexible coupler is connected to the motor shaft on one end and to the input of the rack and pinion system on the other end. The flexibility of the coupler allows for a slight misalignment and absorbs vibrations, reducing stress on the motor. The rack is a linear gear with teeth along its length, and the pinion is a small gear attached to the motor shaft. As the motor rotates, the pinion engages with the teeth of the rack. The rotation of the pinion causes the rack to move vertically. Bearings are placed at key points to support the rotating parts, reducing friction and ensuring smooth operation. Bearings are especially important where the rack and pinion system engages with the frame to allow smooth vertical movement. The speed control will be the potentiometer. The SMPS provides a stable DC power source to the motor, and the electrical connections ensure proper functioning. Safety features such as emergency stops or protective guards can be incorporated into the electrical system.

4.5 Our Project 2D & 3D View By Solid Works

Project 3D View

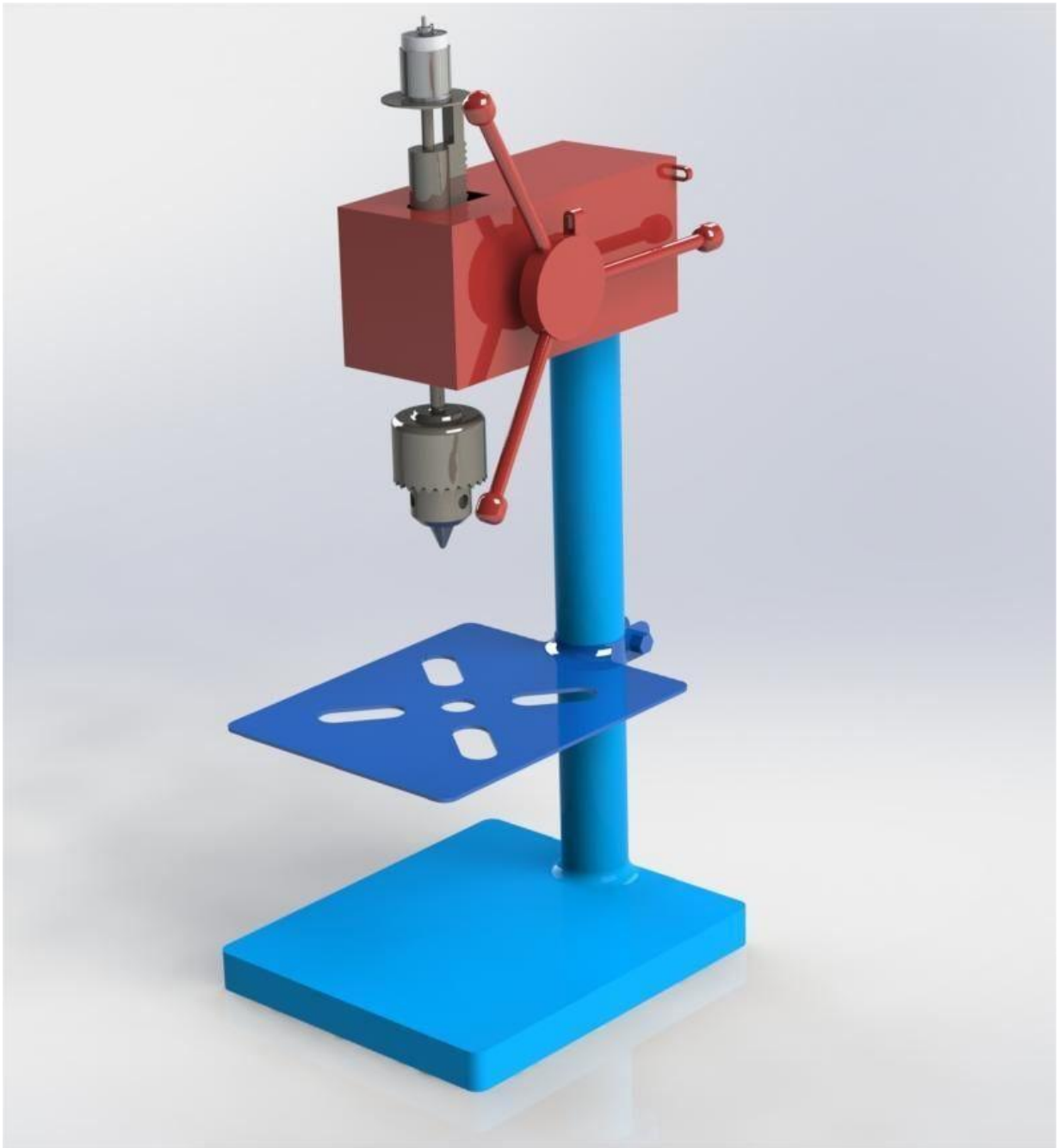
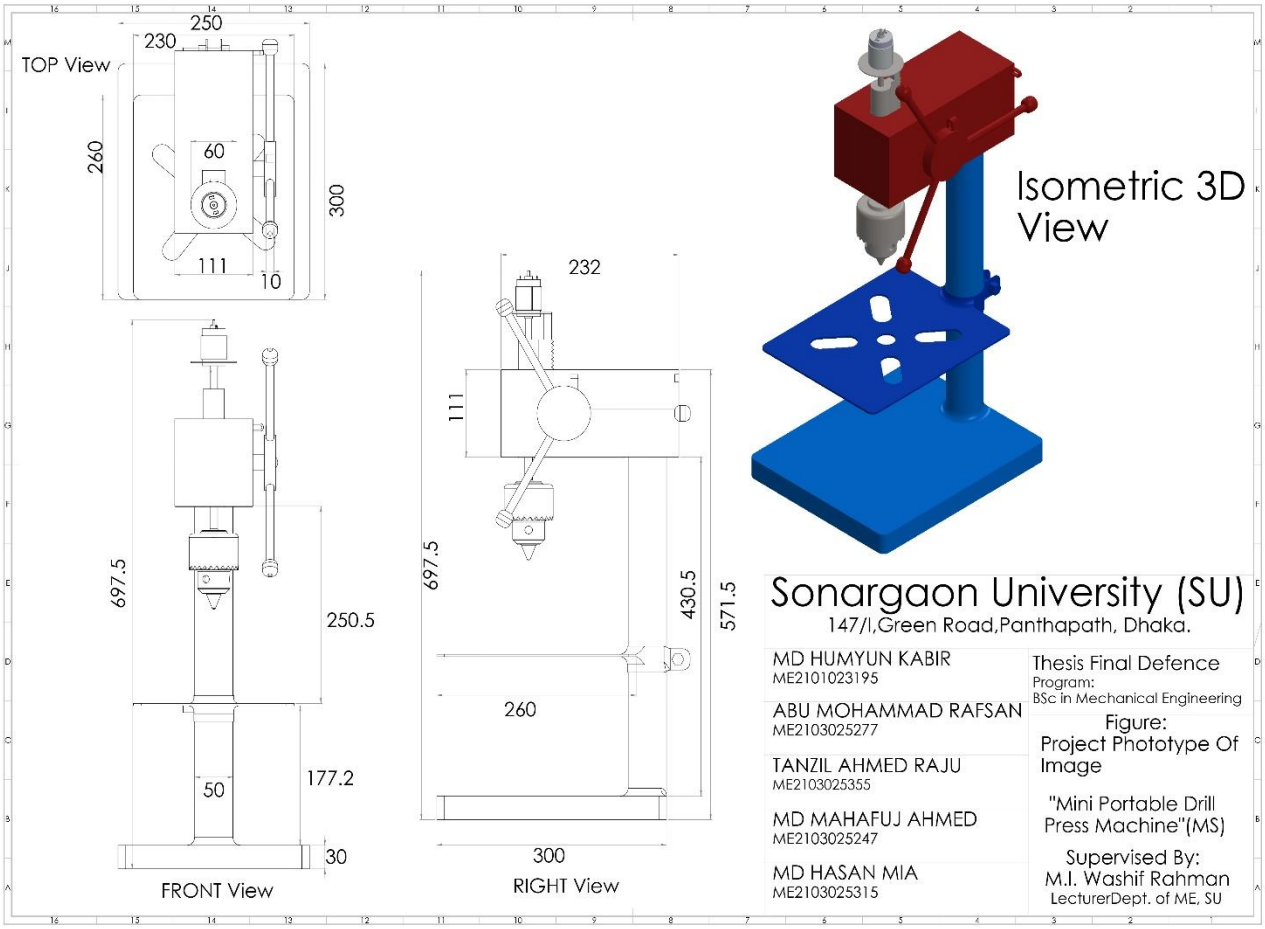


Figure 4.3: Our Proposed 3D image

Project 3D View



4.6 Our Project Final Image

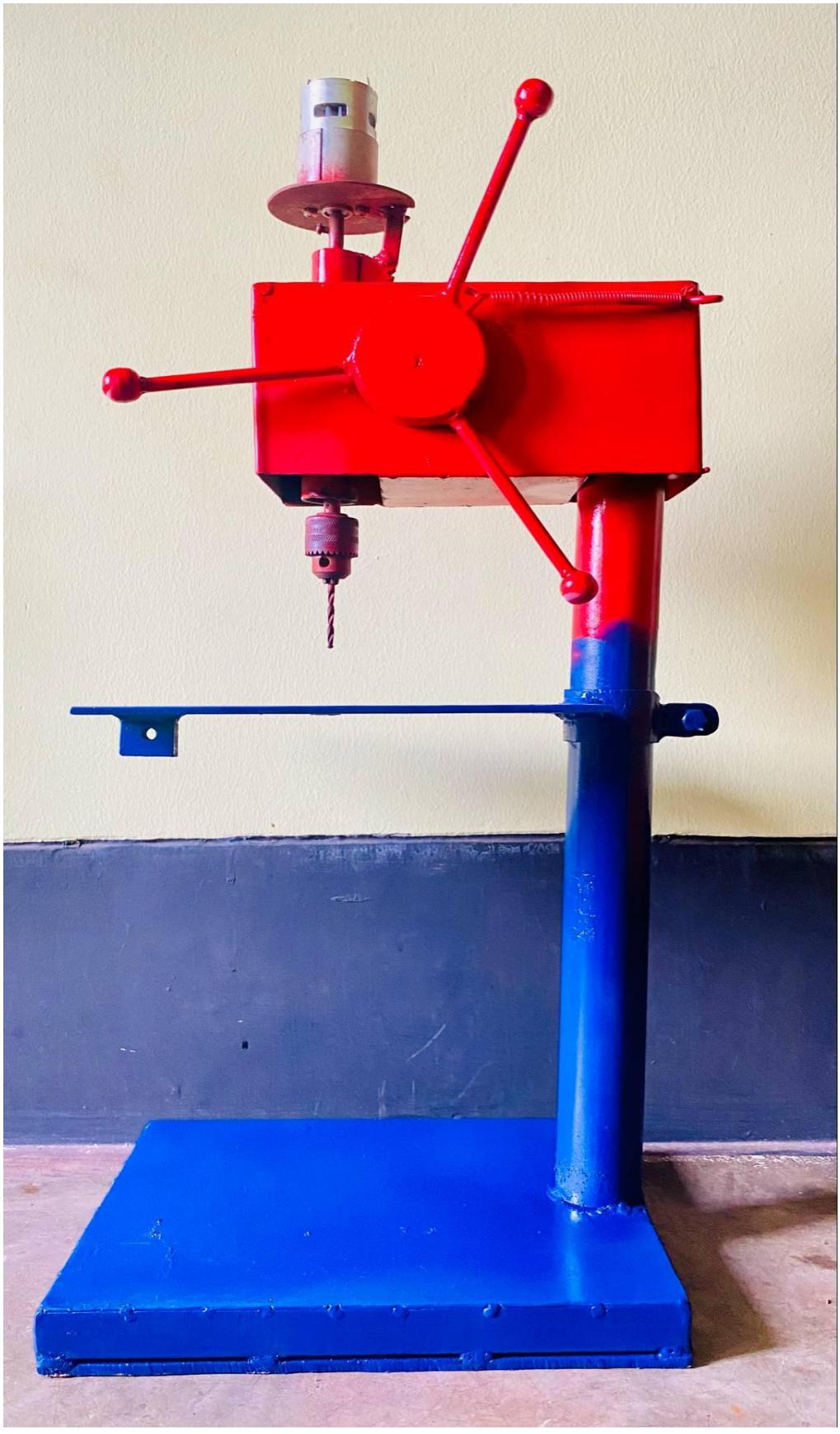


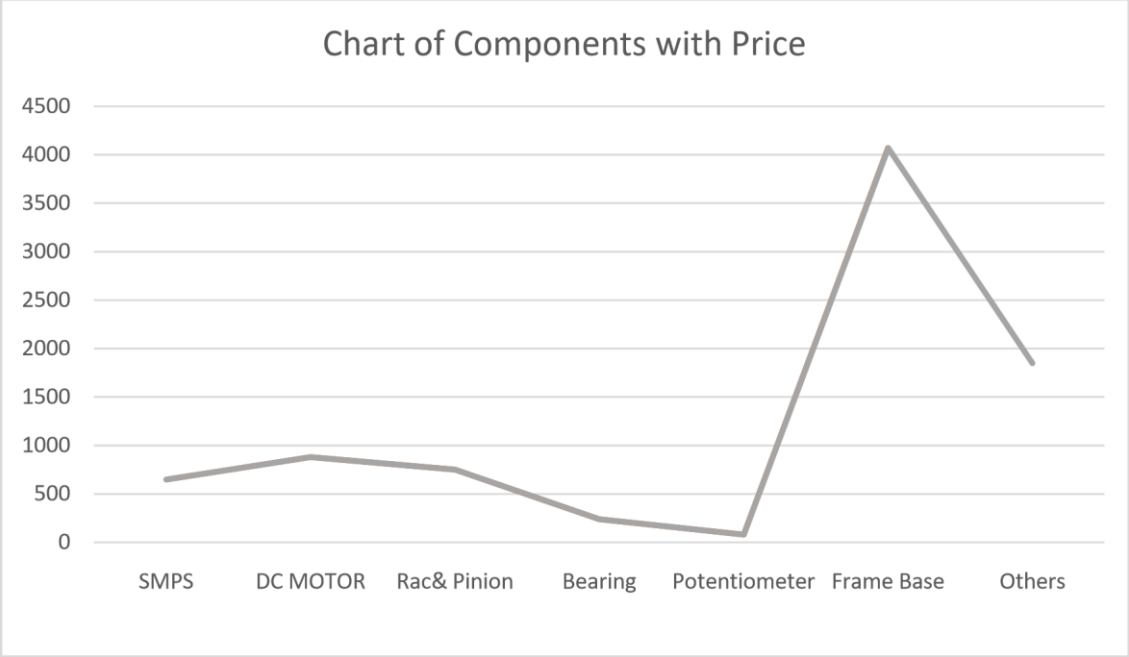
Figure 4.4: Our System SideView

4.7 Cost Analysis

In the below table we have summarized our project expenditure.

Table 1: Lists of Components with Price.

Sl. No	Product Name	Specification	Qty.	UnitPrice(Taka)	Total Price (Taka)
01.	SMPS	12V	1	650	650
02.	DC Motor	12V	1	880	880
03.	Bearing		1	240	240
04	Rack & Pinion		1	750	750
05	Potentiometer		1	80	80
06.	Frame Base		1	4070	4070
07.	Others				1850
				Total =	**8520/=**



CHAPTER 5 RESULTS AND DISCUSSION

5.1 Results

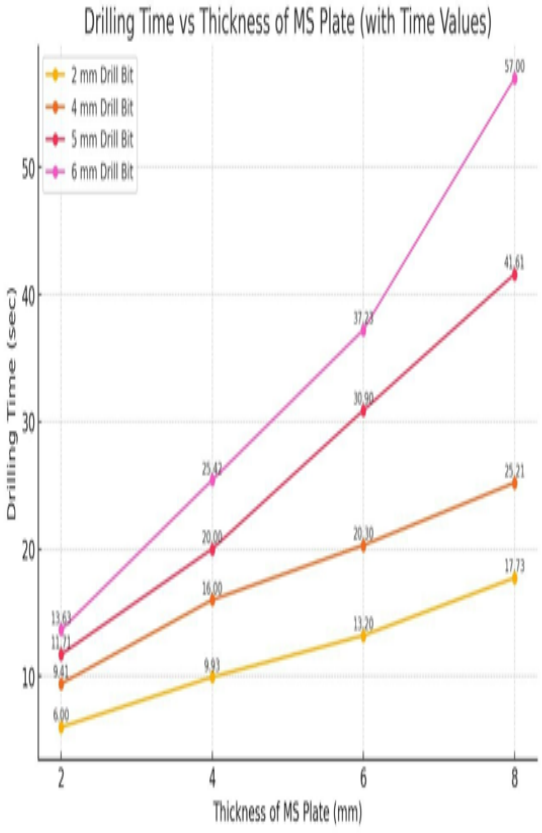
- At last, we have successfully finished our project and verified that it has operated precisely in accordance with our goal.At first, we start our system.
- Make sure the flexible coupler is properly aligned with the DC 12V motor before mounting it firmly on the frame.
- Connect the 5mm flexible coupler to the rack and pinion system's input and the motor shaft. Use the proper fasteners to secure.
- To improve stability and lessen friction, install bearings at crucial locations, such as where the rack and pinion system attaches to the frame.
- The user can control the operation of the mini drill press, turning it on or off and adjusting the vertical position of the drill head as needed.
- The potentiometer will be used to regulate the speed.

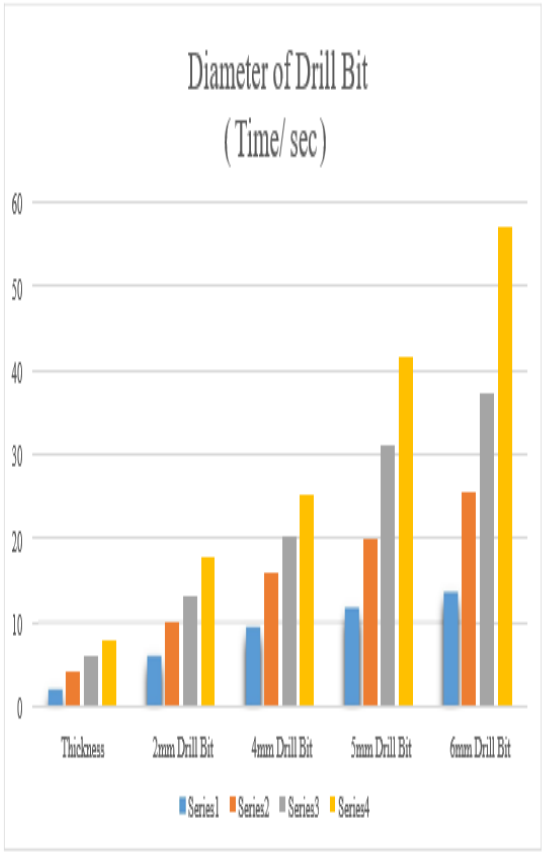
Results before the reform:-

Different material Drilling Time Calculation:

For Metal PlateDrilling Time Calculation…

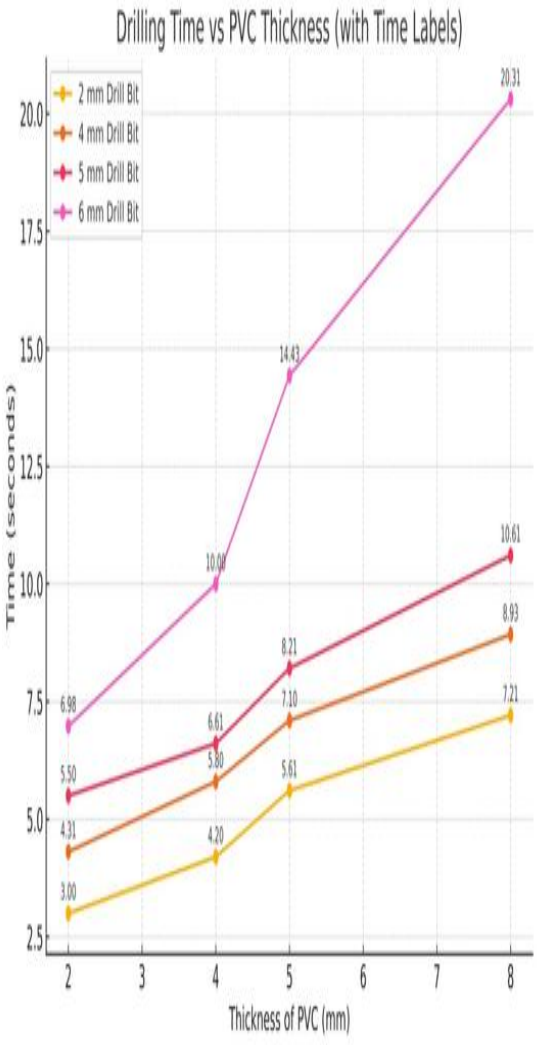
Thickness of ms plate	Diameter of Drill Bit (Time/ sec)			
	2 mm	4 mm	5 mm	6 mm
2 mm	6.00sec	9.41 sec	11.71 sec	13.63 sec
4 mm	9.93 sec	16.00 sec	20.00 sec	25.42.sec
6 mm	13.20 sec	20.30 sec	30.90 sec	3723sec
8mm	17.73 sec	25.21 sec	41.61sec	57.00sec

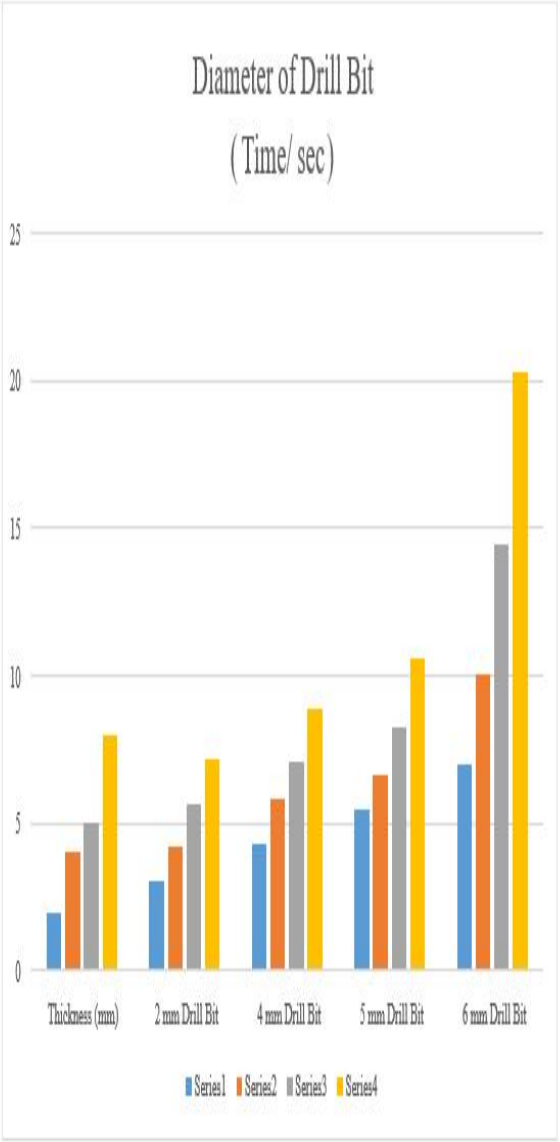




For PVC Drilling Time Calculation…

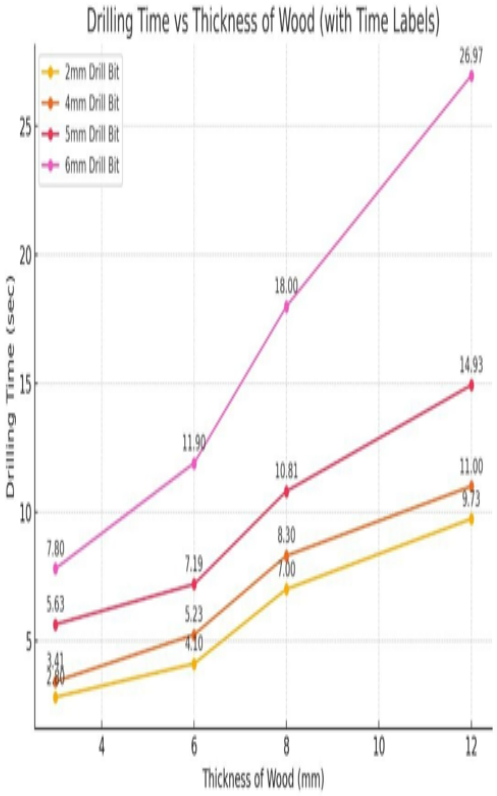
Thickness of (Pvc)	Diameter of Drill Bit (time/ sec)			
	2 mm	4 mm	5 mm	6 mm
2mm	3.00 sec	4.31 sec	5.50 sec	6.98 sec
4 mm	4.20 sec	5.80 sec	6.61 sec	10.00sec
5 mm	5.61 sec	7.10 sec	8.21 sec	14.43 sec
8 mm	7.21 sec	8.93 sec	10.61 sec	20.31 sec

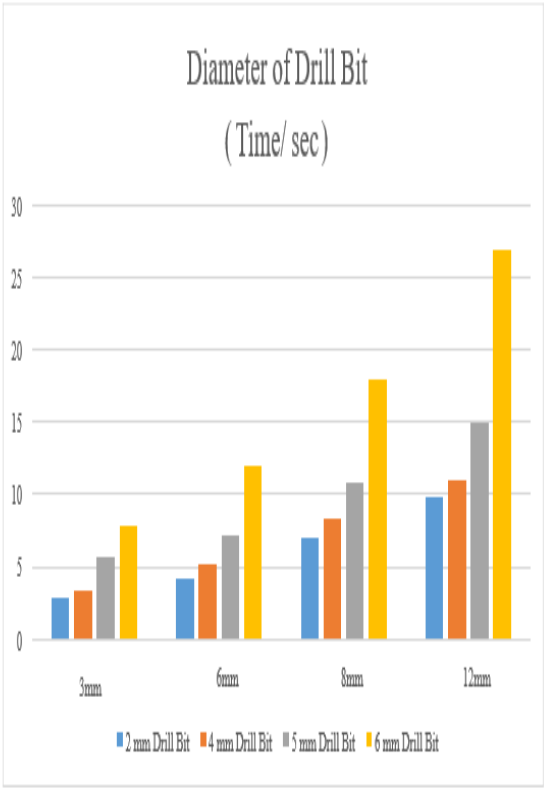




For Wood Drilling Time Calculation…

Thickness of Wood	Diameter of Drill Bit (time/ sec)			
	2mm	4mm	5mm	6mm
3 mm	2.80sec	3.41 sec	5.63 sec	7.80 sec
6 mm	4.1 sec	5.23 sec	7.19 sec	11.90 sec
8 mm	7.00 sec	8.30 sec	10.81 sec	18.00 sec
12mm	9.73 sec	11.00 sec	14.93 sec	26.97 sec





5.2 Advantages

There are certainly many advantages of our project and some of the major ones have been given below:

- Precision and Accuracy: The Design and Development of a Mini press drill machine allows for precise control over drilling depth and placement, ensuring accurate and repeatable results in various materials.
- Versatility: Suitable for drilling a variety of materials such as wood, plastic, and metal, making it versatile for different DIY and workshop projects.
- Smooth Operation: The inclusion of a rack and pinion system, along with bearings, ensures smooth and efficient operation, reducing friction and providing stability during drilling.
- Cost effective:Design and Development of a Mini press drill machine with common components can be a cost-effective alternative to purchasing a commercial drill press, especially for those with specific design preferences.
- User-friendly: Easy-to-use controls for turning the drill press on or off and adjusting the vertical position of the drill head, enhancing user convenience.
- Safety Features: Incorporation of safety features, such as emergency stops and protective guards, promotes safe operation, reducing the risk of accidents or injuries.

5.3 Disadvantages

- Limited Power: The DC 12V motor may have limitations in terms of power compared to larger drill presses. This could impact the drill's ability to handle more robust or demanding drilling tasks.
- Size Limitations: The compact design, while advantageous for smaller spaces, may pose challenges when dealing with larger or unusually shaped workpieces.
- Material Limitations: The mini drill press may not be as suitable for heavyduty drilling in certain metals or exceptionally hard materials due to the limitations of the motor and overall design.
- Maintenance Requirements: DIY projects might require more frequent maintenance compared to commercial drill presses. Bearings, gears, and other moving parts may need periodic checks and lubrication.

5.4 Applications

This project has applications in many fields due its necessity. We have selected a few of them and they are given below:

- Woodworking. ● Metalworking.
- Plastic Fabrication.
- Electronics Work.
- DIY Home Improvement.
- Educational Use.

5.5Discussion

While working on our project, we did face some difficulties as it is a very complex system but the end results, we came up with were quite satisfactory. We have put the whole system through several tasks to validate our work and also have taken necessary notes for future improvements. Some future recommendations that we have involves improvement in system design and wiring, adding features for more efficient.

CHAPTER 6 CONCLUSION

6.1 Conclusion

In conclusion, a DIY mini drill press project, incorporating components such as a DC 12V motor, SMPS, flexible coupler, rack and pinion system, and bearings, offers a costeffective and versatile solution for individuals engaged in DIY, hobbyist, or small-scale workshop activities. While the project comes with its advantages, such as precision drilling, compact design, and customization potential, it's essential to consider potential disadvantages, including limited power, size constraints, and the need for maintenance. The mini drill press's applications span woodworking, metalworking, electronics work, model making, jewelry making, and various DIY home improvement projects. Its compact size, user-friendly controls, and versatility make it a valuable addition for those seeking a portable and efficient drilling solution. Before embarking on such a project, individuals should assess their technical skills, safety considerations, and specific project requirements. Thorough testing, adherence to safety guidelines, and proper maintenance are crucial to ensuring the successful and safe operation of the DIY mini drill press.

6.2 Future Scope

As we have already discussed about the limitations of our project so definitely there's room for improvement and thus we have lots of future scope of work available to us for this project. Some of these are listed below:

- **Smart and Connected Drilling:** Integration of IoT (Internet of Things) technology for smart drill presses that can be monitored and controlled remotely.
- **Advanced Materials and Coatings:** Exploration of new materials and coatings for drill bits and components to enhance durability, reduce friction, and improve overall performance.
- **Enhanced Safety Features:** Integration of advanced safety features, such as machine learning algorithms for detecting potential hazards, emergency shutdown systems, and improved user interfaces to promote safer operation.

REFERENCE

[1] A. Albagul, K. Alsharef, M. Saad, Y. Abujeela, "Design and Fabrication of an Automated Multi-level Car Parking System", in Manufacturing Engineering, Automatic Control and Robotics, 2013.

[2] S. K., Robotics, McGraw-Hill, 2008.

[3] D. Shetty and R. Kolk, Mechatronics System Design.India, 2004.

[4] Hugh Jack, Automating Manufacturing system with PLC, version5.New York, 2007.

[5] Allan R. Hambley, Electrical Engineering Principles and Applications. Pearson Education Limited, 2013.

[6] Himanshu Mishra, PLC BASICS COURSE , Schneider Electric. India New Delhi.

[7] S. k. Bhattacharya, Industrial Electronics and Control,Delhi,2006.

[8] Khalid. A.alsudany, multi-level car parking system, College of Electronic Technology, Bani Walid, Libya, B.Sc. project, 2012.

[9] Scott G Smith (1998) review on ―Drilling square holeThe mathematics teacher‖ vol 86,no 7 ,pp 579-584

[10] Bangar Sunil Kisan and Prof. Mythili Sreeram (2014)review on ―Modification of square hole drilling‖, IJFEAT journal-ISSN: 2321-8134 , pp 4 -7

[11] S K Hajra Choudhury , A K Hajra Choudhury and Niranjana Roy(2010) review on ―Drilling machines‟- Elements of workshop Technology vol 2,pp 227-255

[12] Weisstien,EW.,Reuleauxtriangle,Mathworld, mathworld.wolfram.com/reuleaux triangle.html

[13] H. G. Eggleston.,1952. A proof of Blaschke‟s theorem on the Reuleaux Triangle, Quart. J. Math. 3 296-297.

[14] Todd, R. H.; Allen, D. K. and Alting, L. (1994). Manufacturing Processes Reference Guide, Industrial Press Inc., p. 43–48, ISBN 0-8311-3049-0.

[15] https://www.shutterstock.com/search/rack-pinion-gear

[16] https://www.dreamstime.com/photos-images/bearing.html

[17] https://www.dreamstime.com/photos-images/bit-holder.html

[18] https://www.alamy.com/stock-photo/flexible-coupling.html?sortBy=relevant

[19]https://www.pinterest.com/pin/switch-mode-power-supply-smps-circuitcomponents-need-some-explaination-electrical-engineerin--664843963736482089/

[20]https://www.pinterest.com/pin/749356825475731862/

[21] https://www.eleccircuit.com/power-supply-circuit/

[22] https://www.researchgate.net/figure/EasyEDA-user-interface_fig1_343696721

[23] http://www.model-engine-plans.com/engineplans/bookshelf/minidrill.htm [24] https://www.instructables.com/Mini-Drill-Press-With-Variable-Speed/