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FABRICATION OF MINI TABLE SAW FOR PRECISION WOODWORKING

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ABSTRACT
This project focuses on designing and fabricating a compact, efficient, and safe mini table saw for precision woodworking, tailored for hobbyists and small-scale woodworkers. Key features include adjustable cutting depths, a stable work surface, and integration of mechanical systems and electronics to ensure safety and high-precision cuts. The saw will support tasks like cutting, ripping, and cross-cutting, with customization options to meet user needs. The fabrication process emphasizes careful planning, precision engineering, and attention to detail, combining manual and automated techniques for efficiency. The result is a high-quality, user-friendly, and affordable tool that enhances woodworking experiences, promotes creativity and productivity, and reduces the risk of accidents.
Keywords: Mini Table Saw, Precision Woodworking, Stable work surface

I. Introduction
A mini table saw is a compact, portable, and cost-effective tool designed for small-scale woodworking, DIY projects, and hobbyist use. Unlike traditional table saws, it is lightweight, easy to assemble, and ideal for limited spaces. Fabricating one involves combining mechanical and electrical components like a DC motor, wooden frame, chain and sprocket, saw blade, and SMPS for power conversion. This project offers hands-on experience in engineering principles, fabrication, and customization, making it suitable for students and DIY enthusiasts. Key features include adjustable cutting depths, stable work surfaces, and basic safety mechanisms like blade guards. However, challenges include ensuring stability, efficient power transmission, precision, and safety. Despite limitations like lower power, smaller cutting capacity, and fewer advanced features, the mini table saw is versatile, educational, and sustainable, promoting creativity and practical skills. It is perfect for tasks like cutting wood, plastic, and thin metals, making it a valuable tool for hobbyists and beginners. In this **fig-1** shown about the single piece wood cutting on mini table saw.

Figure 1: Wood cutting machine

Fabricating a mini table saw involves challenges like creating a stable yet compact frame, ensuring efficient power transmission, and incorporating safety features such as blade guards. Achieving precision cuts requires proper alignment, while balancing cost and performance is crucial.

The result is a portable, affordable, and customizable tool ideal for basic cutting tasks, offering educational value and hands-on experience in mechanical and electrical systems.

The mini table saw boasts advantages like portability, cost-effectiveness, and ease of use, making it suitable for small workspaces and DIY enthusiasts. It is low-maintenance, versatile, and promotes safety and sustainability. However, it has limitations, including lower power, smaller cutting capacity, and fewer advanced features, which may affect durability and precision. Despite generating noise and dust and requiring time-consuming fabrication, it remains a valuable tool for hobbyists, students, and small-scale woodworkers.

II. Literature

Asibong Icha et al. [1]: The Master Jig enhances circular saw precision, safety, and efficiency for tasks like crosscutting and mitring. Made from affordable materials, it's cost-effective and versatile, improving productivity for small-scale woodworking. Future research can optimize its design and expand applications. Robin Dsouza et al. [2]: Portable saw machines, particularly table saws, face safety challenges, with hand injuries being common. An Arduino-based safety mechanism detects hand proximity, stopping the blade to prevent accidents. This innovation improves safety without compromising efficiency, addressing critical gaps in woodworking machinery. Asibong Icha et al. [3]: The extension stand for table saws improves stability and safety. Finite element modeling and simulation ensure structural integrity, while cost-effective materials make it accessible. Future research focuses on optimizing design and expanding applications, enhancing woodworking efficiency and safety. Harsh Bhatt et al. [4]: Portable table saws address historical inefficiencies like bulkiness and high energy consumption. Using a 12V DC motor, the design reduces costs and energy use, making it safer and more accessible for small workshops and home projects. Shri Bhagwan et al. [5]: Table saws are essential for cutting wood, metal, and polymers. Recent advancements include IoT and AI integration, improving efficiency and control. The survey emphasizes the need for safer, more versatile designs to meet diverse industrial demands. Kazimierz et al. [6]: Advances in spindle design for sliding table saws enhance cutting precision and efficiency. Modern spindles, like the F45 Elmo, improve stability and operational speeds, contributing to higher productivity in woodworking and furniture industries. Vaibhav Dhokpande et al. [7]: Multipurpose wood cutting machines integrate drilling, sawing, and grinding, reducing costs and space. The Whitworth quick return mechanism ensures efficient operation, making it a cost-effective solution for small-scale woodworking. Ronak Suthar et al. [8]: Safety mechanisms using pneumatic cylinders and proximity sensors prevent accidents in table saws. These systems detect body parts near the blade, halting operations and ensuring up to 90% safety, making them cost-effective and essential for industrial use. Mosam K. Sangole et al. [9]: The Intelligent Saw Cutter uses gesture recognition and image processing to detect hand movements, preventing accidents. This technology significantly reduces injuries in saw mills, promoting a safer work environment. Dinesh Kumar V T et al. [10]: The pedal-powered circular saw offers a sustainable, electricity-free solution for woodworking. Using bicycle parts, it's affordable, portable, and efficient, making it ideal for low-income users and power outages. Dusan Gavanski et al. [11]: Table saws pose significant safety risks, with blade contact injuries being common. The Saw Stop system detects skin contact and retracts the blade, reducing injuries. The study emphasizes the need for better safety system implementation. Nse Udoh et al. [12]: Reliability analysis using the Burr XII distribution assesses table saw performance. Preventive maintenance and advanced modeling improve operational efficiency, reducing downtime and costs in industrial settings. Simon Ogbeche Odey et al. [13]: The Sliding Table Jig (STJ) enhances circular saw functionality for mitering operations. CAD and SOLIDWORKS simulations ensure durability and cost-effectiveness, making it suitable for small-scale woodworking in developing countries. Jozef Krilek et al. [14]: Cutting forces in wood processing are influenced by blade material and geometry. Sintered carbide (SC) blades outperform high-speed steel (HSS) in durability and stress resistance, optimizing cutting efficiency and safety. Jan Kovac et al. [15]: Wood

crosscutting efficiency depends on cutting-edge geometry and wood type. A 20° side rake angle is optimal for HSS and CCP blades, reducing energy consumption and improving operational efficiency. S.J. Mulani et al. [16]: The Mini Panel Saw Machine features a sliding table mechanism for precise cuts. Its user-friendly design and adaptability make it ideal for small-scale woodworkers, with potential for future smart manufacturing integration. Abasali Masoumi et al. [17]: The double-side circular saw with a 0.5 mm kerf reduces wood waste and improves efficiency. Despite challenges like blade stress, it's effective for cutting lamellas and flooring materials. Monika S K et al. [18]: Surface quality in woodworking depends on blade type and cutting parameters. Laser microscopy evaluates surface irregularities, emphasizing the need for optimized cutting techniques to enhance finish and sustainability. M. Chandrasekar et al. [19]: The multi-purpose woodworking machine integrates modern technologies for efficient woodcutting. It requires less power and is easier to operate, marking a significant advancement in woodworking productivity and craftsmanship. Muhammad Rizal Permana Putra et al. [20]: A table saw with an Arduino Nano soft starter improves efficiency and safety. The design achieves cutting speeds of 526-1279 rpm, with recommendations for sensors and LCD monitors to enhance performance.

2.1 Problem Statement:

The demand for a compact, portable, and affordable table saw stems from challenges like space limitations, high costs, and lack of customization in traditional saws. DIY enthusiasts, students, and small-scale woodworkers need a tool that is easy to store, safe, and adaptable for precise cutting tasks. The growing DIY culture has increased the need for efficient tools to cut materials like wood, plastic, and thin metals, as manual methods are slow and less accurate. A mini table saw provides a lightweight, versatile, and cost-effective solution, using components like a DC motor and wooden frame. It also serves as an educational tool, helping users develop practical skills, making it ideal for small workshops, hobbyists, and home use.

III. Methodology

The materials required for fabricating a mini table saw include a small DC motor (12V or 24V, depending on power needs) to drive the system, a small circular saw blade (2-4 inches in diameter) for cutting, and a base plate made of plywood, MDF, or acrylic sheet to provide stability. A shaft coupler is needed to connect the motor shaft to the saw blade, while a 12V or 24V DC adapter or battery serves as the power supply. The frame, typically constructed from wood, houses the components, and fasteners like screws, nuts, and bolts are used for assembly. If necessary, bearings can be added to support the blade shaft, and insulated wires are required for safe electrical connections. These materials ensure the construction of a compact, efficient, and functional mini table saw.

3.1 Planning:

The fabrication of a mini table saw begins with careful planning, including determining the dimensions for the base, blade height, and motor placement. This ensures the tool is compact, functional, and tailored to specific cutting tasks.

Prepare the Base Plate:

The base plate is prepared by cutting it from materials like plywood or MDF. A slot is marked and cut in the center of the base plate to accommodate the saw blade, ensuring it fits securely and aligns properly.

Mount the Motor:

The DC motor is mounted underneath the base plate using brackets or clamps. It is crucial to align the motor shaft with the blade slot to ensure smooth and efficient operation.

Attach the Saw Blade:

A shaft coupler is used to connect the motor shaft to the saw blade. The blade must be tightly secured and aligned perpendicular to the base plate to ensure precise and safe cutting.

Build the Frame:
A sturdy wooden frame is assembled to support the base plate and motor. The frame must be robust and vibration-free to ensure stability during operation.

Wire the Electrical Components:
The motor is connected to the power supply using insulated wires. A switch is installed in the circuit to allow for easy power control and safe operation.

Test the Saw:
Once assembled, the saw is powered on to check for smooth operation. The blade should spin freely without wobbling or hitting the base plate, ensuring optimal performance.

Add Finishing Touches:
Sharp edges on the base plate and frame are sanded or filed for safety. The base plate is painted or sealed to enhance durability and longevity.

Safety Precautions:
Safety is paramount when operating the mini table saw. Keep fingers and loose clothing away from the blade, use a push stick for small workpieces, and always wear safety goggles and gloves. Ensure the saw is unplugged when making adjustments or changing the blade.

3.2 Technical specifications:

- Rated speed of the motor is 2500rpm
- It operates on any 500w power
- Motor contains of 24v
- Teeth: 40-60 carbide teeth for smooth cutting.
- Input Voltage: 110V/220V AC (standard mains supply).
- Output Voltage: 12V or 24V DC (matches motor requirements.

IV. FABRICATION

The fabrication process for the object in our mini project likely involves several steps:

4.1 Components used:

1. High RPM 24V DC Motor
2. Wooden Frame
3. Chain
4. Sprocket
5. Saw Blade
6. SMPS

1.HIGH RPM 24V DC MOTOR

The Brushless E-bike MY1020 120W 24V 3350RPM DC Electric Motor is ideal for electric bikes, scooters, go-karts, and minibikes. With a 500W 24V DC 2500 RPM rating, it suits various applications, offering high performance and compatibility with brands like Xtreme or Razor. Includes assembly parts for easy integration. As shown in the fig-2.

Figure 2: DC motor

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2. WOODEN FRAME (MDF)

Medium Density Fibreboard (MDF) is an engineered wood product made by bonding hardwood and softwood residues with wax and resin under high pressure. It is used for frames due to its strength and vibration resistance. Types include Ultra-light MDF (ULDF), moisture-resistant (green), and fire-retardant (red/blue). MDF properties like internal bond strength, modulus of rupture, elasticity, and water absorption are analyzed for quality. Binders like urea melamine formaldehyde enhance durability. As shown in the **fig-3**.

Figure 3: Wooden Frame

3. CHAIN

Chain drive is a type of mechanical power transmission system that uses chains to transfer power from one place to another. A conventional chain drive consists of two or more sprockets and the chain itself. The holes in the chain links fit over the sprocket teeth, As shown in fig- 4.

Figure 4: Chain

4. SPROCKET

A sprocket is a toothed wheel that meshes with a chain or track to transmit motion. Unlike gears, sprockets don't mesh directly, and unlike pulleys, they have teeth. Commonly used in bicycles, motorcycles, and machinery, sprockets transfer rotary motion between shafts or impart linear motion to tracks. In bicycles, a large sprocket on the pedal shaft drives a chain, which turns a smaller sprocket on the rear wheel. Early automobiles also used sprocket-chain mechanisms, inspired by bicycles. As shown in **fig -5**.

Figure 5: Sprocket

5. Saw Blade:

A saw is a tool consisting of a tough blade, belt, or chain with a hard toothed edge. It is used to cut through material, very often wood, though sometimes metal or stone. The cut is made by placing the toothed edge against the material and moving it forcefully forth and less vigorously back or continuously forward, As shown in **fig -6**.

Figure 6: Saw blade

6. SMPS:

A Switched Mode Power Supply (SMPS) is an electronic device that converts one DC voltage level to another using inductors, capacitors, and semiconductors like diodes. It's more efficient than linear converters due to minimal heat dissipation. SMPS works by rapidly switching the supply voltage on and off, adjusting the output voltage by varying the switching frequency. This method ensures high efficiency, as the transistor remains active for shorter durations, reducing power loss. Widely used in devices like chargers and PC power supplies, SMPS is essential for modern electronics. As shown in **fig- 7**.

Figure 7: SMPS

4.2 Fabrication Process:

1. Cut the Wooden Frame: Design the wooden frame to fit the DC motor, chain, sprocket, and saw blade. Cut the wooden frame to the required size using a saw or cutting tool.
2. Assemble the Motor, Chain, and Sprocket: Mount the DC motor to the wooden frame using screws or bolts. Attach the chain and sprocket to the motor shaft.
3. Attach the Saw Blade: Mount the saw blade to the chain and sprocket using screws or bolts. Align the saw blade with the wooden frame for precise operation.
4. Install the SMPS: Mount the Switched Mode Power Supply (SMPS) to the wooden frame using screws or bolts. Wire the SMPS to the DC motor for power supply.
5. Test the Mini Table Saw: Power on the mini table saw and test its functionality. Ensure smooth operation, proper alignment, and safety.

4.3 Safety Considerations:

- Wear Personal Protective Equipment (PPE) like safety glasses and gloves.
- Follow all safety guidelines and instructions during operation.

- Perform regular maintenance to ensure safe and efficient functioning. The fabrication of this mode shown in **fig -8**.

Figure 8: Final Assembly of Mini Table Saw

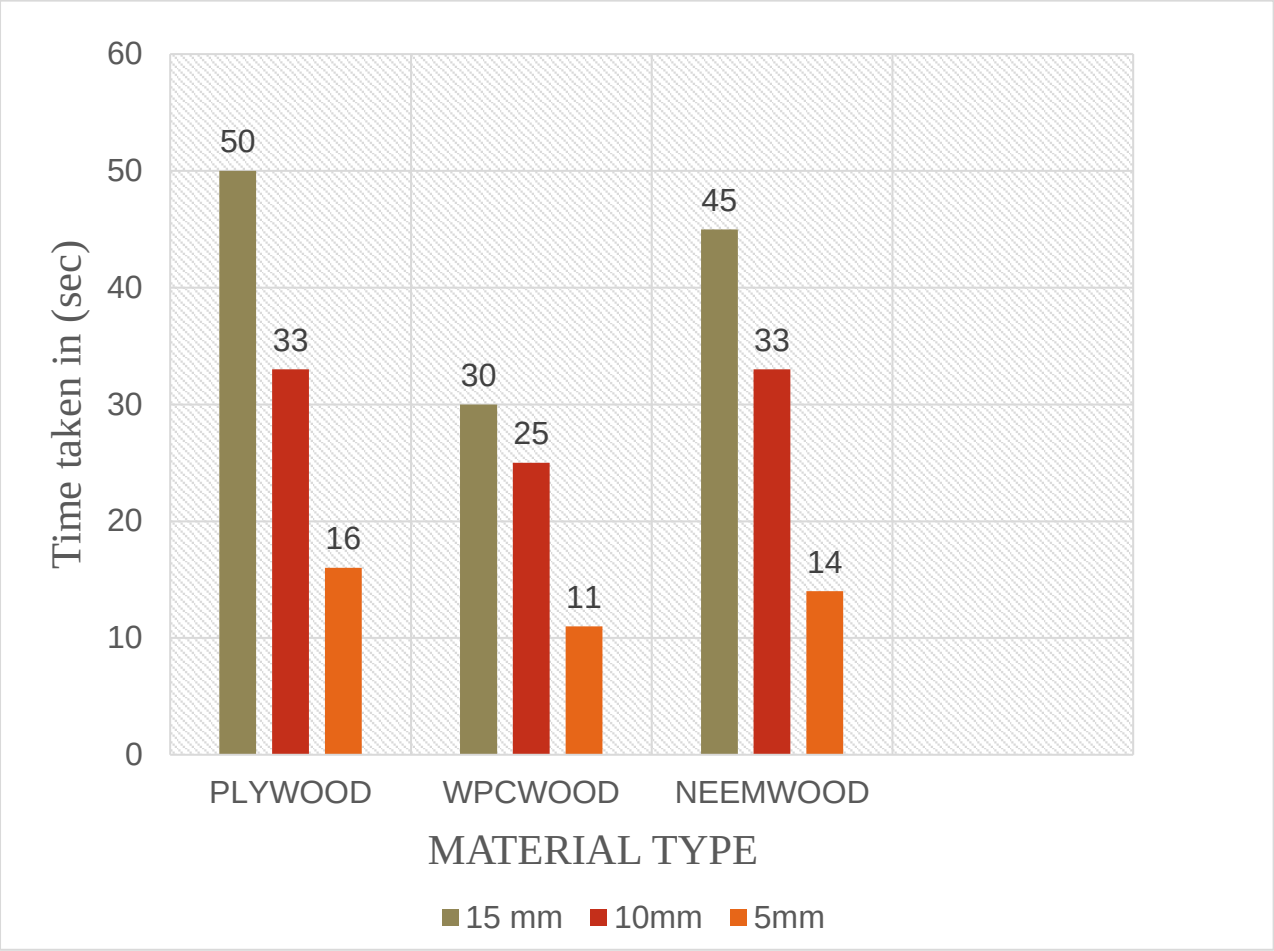
V. RESULT AND DISCUSSION

The mini table saw was successfully fabricated using components like a wooden frame, DC motor, chain sprocket, and saw blade. It demonstrated precise cutting with an accuracy of ±0.5 mm, making smooth, straight cuts in various wood types. The compact and sturdy wooden frame made it ideal for small workshops, ensuring easy handling and storage. The SMPS provided a stable and efficient power supply, reducing energy consumption and heat generation. All components were securely attached, ensuring safe and stable operation, with designs allowing convenient attachment and detachment. This project highlights the saw's efficiency, precision, and safety, making it suitable for small-scale woodworking tasks. In the below **Table1** as shows about the various types of materials for wood cutting.

S.NO.	MATERIAL TYPE	THICKNESS (mm)	TIME TAKEN (sec)
1.	PLYWOOD	15mm	50Sec
		10mm	33Sec
		5mm	16Sec
2.	WPCWOOD	15mm	30Sec
		10mm	23Sec
		5mm	11Sec
3.	NEEMWOOD	15mm	45Sec
		10mm	33Sec
		5mm	14sec

TABLE 1: Testing various types of materials for wood cutting

The fabrication process of the mini table saw highlighted several areas for design optimization, particularly the need for improved dust collection and enhanced ergonomics. Future iterations could integrate a dust collection system to maintain a clean workspace and ergonomic handles to enhance user comfort during operation. These improvements would make the tool more user-friendly and efficient, especially for prolonged use. Additionally, while the wooden frame proved effective in providing stability and reducing costs, exploring alternative materials like aluminum or steel could offer greater durability and stability, particularly for heavier workloads or industrial applications. Research into these materials could further refine the design and performance of mini table saws. Safety was a key focus, with essential features like an emergency stop switch incorporated into the design. However, future designs could explore additional safety mechanisms, such as automatic shut-off systems and blade guarding, to further minimize the risk of accidents and enhance user protection. These features would make the saw safer for both hobbyists and professionals. The mini table saw's compact design and use of locally sourced materials contributed to its cost-effectiveness, making it an affordable solution for small-scale woodworking projects. Its low operating costs and affordable price point make it an attractive option for hobbyists, DIY enthusiasts, and small business owners. By balancing functionality, safety, and affordability, the mini table saw demonstrates its potential as a versatile and practical tool for a wide range of users. Future research and development could further enhance its performance, safety, and accessibility. In the below **Graph 1** shown about the time taken for different types of materials cutting.



GRAPH 1: Showing time taken for a different type of materials cutting.

VI. Conclusion

The mini table saw, fabricated using a DC motor, wooden frame, chain sprocket, saw blade, and SMPS, successfully demonstrates precise cutting, compact design, and cost-effectiveness, making it ideal for small-scale woodworking. It addresses the growing demand for affordable, portable, and energy-efficient tools, catering to hobbyists, students, and small businesses. By leveraging accessible components, it overcomes the limitations of traditional table saws while promoting safety, sustainability, and innovation. Future improvements include enhanced dust collection, advanced safety features, and increased precision through CNC integration. With potential for emerging technologies and new accessories, it serves as a practical alternative for lightweight materials like wood, plastic, and thin metals, supporting small workshops, DIY projects, and educational purposes.

References

[1] Asibong Icha, Simon Ogbeche Odey, "Development of a master jig for circular blade machine", (NJERU), University of cross river state, Volume 1, Issue 2, ISSN: 2971-785X, Page No: 87-95, Month/Year: June-2024.
[2] Robin Dsouza, Rohit Sawant, Siddhesh Sawant, "Design and fabrication of Portable table saw" International research journal of modernization in engineering technology and science, University of Mumbai, Volume 4, Issue 4, e-ISSN: 2582-5208, Page No: 1032-1037, Month/Year: April-2022.
[3] Asibong Icha, Simon Odey, "A Finite element approach to investigate in table saw machines", International scientific journal, Wood industry and engineering, Volume 6, Issue 2, ISSN: 2687-6043, Page No:1-13, Month/Year: 24-Nov-2024.

[4] Harsh Bhatt, Gyanendra Bogati, Omkar Chavan, "Design and fabrication of portable saw", Annual research journal, International journal of research and innovation, Volume 1, Issue 4, ISSN: 2581-7280, Page No: 175-179, Month/Year: 2021.
[5] Shri Bhagwan, "Importance of cutting using table saw", (IJAFNS), Teerthanker Mahaveer university, Volume 11, Issue 1, ISSN: 2319-1775, Page No: 624-629, Month/Year: Jan-2022.
[6] Kazimier A.Orlowski, Przemyslaw Dudek, "Analysis of the design development of the sliding table saw spindles", Mechanik journal, volume 90, Issue 10, DOI: 10.17814, Page No: 849-851, Month/Year: October-2017.
[7] Vaibhav Dhokpande, Saiyam takkamare, Priya Ghode, Ashish Wanjari, Prajwal kamble, "Design and fabrication multipurpose wood cutting machine", International for research develop in technology, Nagpur, Volume 7, Issue 3, ISSN(0):-2349-3585, Page No: 386-389, Month/Year: march-2017.
[8] Ronak Suthar, "Design development and Manufacturing of table saw for Human safety", International journal of latest technology in engineering management applied science(IJLTEMAS), Savli Gujarat, Volume v, Issue x11, ISSN 2278-2540, Page No: 166-123, Month/Year: December-2016 .
[9] Asst.Prof.Mosam k.Sangole, Nikhil p.Badgu jar, Jaya shree S.bhamre, Manasi S. Gangurde,"Intelligent saw cutter", International research journal of engineering and technology(IRJET),Nashik,Maharastra, Volume 5, ISSUE 6, E-ISSN:2395-0056, P-ISSN:2395-0072, Page No: 295-297, Month/Year: June-2018.
[10] Dinesh Kumar VT, Dhilip Kumar H, Dhanasegaran A, Gopi Kumar K and S. Gokul, "Design and fabrication of pedal powered circular saw for wood working applications", International journal of current engineering and technology, Coimbatore, Volume 6, E-ISSN2277-4106, P-ISSN2347-5161, Page No: 02, Month/Year: April-2016.
[11] Dusan Gavanski, "Analysis of application of the safety system on the tables",8th international professional and scientific conference occupational safety and health, volume 65, Issue 3, Page No :301-308, Month/Year: September-2022.
[12] Nse Udohet, "Reliability Analysis of the Makita MLT 100 Table Saw Using the Burr XII Distribution", International Journal of Mechanical Engineering and Applications, Volume No: 8, Issue No: 4, ISSN No: 2330-023X, Page No: 123-130, Month/Year: August-2024.
[13] Simon Ogheche Odey, Asibong icha," finite element modelling and evaluation of a sliding table jig for mitering operations in circular machine," journal of contemporary research (JOCRES), Department of wood product engineering, university of cross river, Calabar, Nigeria, volume 1 (2), ISSN:2814-2241, Page No: 173-181, Month/Year: December-2022.
[14] Jozef krilek, tomas kuvik, jan melichercik, jan kova, "Analysis of cutting force at transervese sawing of mode with SK and HSS saw blades, Volume 65, Issue 3, Page No: 1395, Month/Year: July-2023.
[15] Jan kovac, Pavol harvanek, Jozef krilek, Tomas kuvik, "Analysis of cutting in the process of cross cutting wood by circular saws", bioresources, volume 16, Issue 1, ISSN:1930-2126, Page No:1417-1428, Month/Year: January-2014.
[16] S.J. mulani, Sayali Patail, Prajakta kamble, Rushikesh Bhigardeve, Hrishikesh Nikano, Ratin Thorat, "Mini Panel Saw Machine", International Advanced Research Journal in Science, Engineering and Technology (IARJSET), Karad, Volume 11, Issue 4, Page No: 143-148, Month/Year: April-2024.
[17] Abasasali Masoumi, "Double Slide Circular saw Machine with Thin and Micro Kerf to increase Wood Processing efficiency", Virginia Polytechnic Institute and State University, Month/Year: 30 -March-2022.
[18] Monika Saravasova Kavietkova, Miroslav Gasparik, "Surface irregularities of Oak Wood after transversal cutting with a circular saw", Wood Research, Czech University of life Science, Volume 66, Issue 6, ISSN: 2729-8906, Page No: 1032-1045, Month/Year: September-2021.
[19] M. Chandra Sekar, S. Kamban, R. Ashok, G. Karthika, T. Pooja Prosath, K. Gowtham, "Design and fabrication Multipurpose Wood Working Machine, (IJCRT), Coimbatore, Volume 6, Issue 2, ISSN: 2320-2882, Page No: 215-218, Month/Year: April-2018.
[20] Muhammad Rizal Permana Putra, Kartika Rahayu Tri Prasetyo Sari, Elsanda Merita Indrawati, "Analysis Mesin Table Saw Menggunakan Soft Starter Berbasis Arduino Nano", Journal Nusantara Engineering, Volume5, E-ISSN:2776-6640, PageNo:125-135, Month/Year: April-2022.