

# DESIGN AND FABRICATION OF AI INTEGRATED WOOD WORKING MACHINE

**Dr.S.Charles<sup>1</sup>, Rithick.S.V<sup>2</sup>, Sanjeevi Ram.J<sup>3</sup>**

Professor, Department of Mechanical Engineering, SNS College of Engineering, Coimbatore, Tamilnadu, India<sup>1</sup>

UG Student, Department of Mechanical Engineering, SNS College of Engineering, Coimbatore, Tamilnadu, India<sup>2,3</sup>

**Abstract:** This paper presents the design and fabrication of a versatile multi-purpose woodworking machine tailored for small-scale workshops and hobbyists. The machine integrates an AC motor, belt and pulley system, buffing tool, grinding wheel, wood cutting tool, and a microcontroller with object sensor for motor auto cut-off, offering flexibility and functionality in various woodworking tasks. The woodworking machine's design focuses on modularity and user-friendly operation, allowing for easy interchangeability of tools and versatility in woodworking applications. The AC motor serves as the primary power source, driving the belt and pulley system to transmit power to different tools based on the selected operation.

The buffing tool and grinding wheel enable tasks such as polishing, sanding, and sharpening, enhancing the finishing quality of woodwork projects. Additionally, the wood cutting tool provides precision and accuracy in cutting and shaping wooden materials, catering to a wide range of cutting requirements. Moreover, the integration of a microcontroller with an object sensor adds an intelligent feature to the machine, enabling automatic cut-off of the motor when an obstruction or safety hazard is detected. This enhances user safety and prevents accidents during operation, making the machine suitable for novice users and hobbyists. The fabrication process involves assembling the various components into a compact and robust framework, ensuring stability and durability during operation. Emphasis is placed on ergonomic design and safety features to enhance user experience and minimize risks associated with woodworking tasks. Overall, the designed multi-purpose woodworking machine offers versatility, efficiency, and safety features suitable for small-scale woodworking operations, educational institutions, and hobbyist workshops. Its modular design, coupled with advanced features such as automatic motor cut-off, contributes to enhancing productivity, precision, and safety in woodworking activities.

**Keywords:** Woodworking machine, AC motor, Belt and pulley, Buffing tool, Grinding wheel, Wood cutting tool, Microcontroller, Object sensor, Auto cut-off, Safety.

## I. INTRODUCTION

In the market there is no any machine facilitating for cutting, grinding & buffing operations at a time. So we tried to manufacture the same with all these operations. This equipment describes about the implementation of redesign. Our project being the special purpose equipment, specially meant for having facility to machine the material using abrasion process machine by using the application of Design for Manufacturing and Assembly methodology.

Industries are basically meant for Production of useful goods and services at low production cost, machinery cost and low inventory cost. Today in this world every task have been made quicker and fast due to technology advancement but this advancement also demands huge Investments and expenditure, every industry desires to make high productivity rate maintaining the quality and standard of the product at low average cost In an industry a considerable portion of investment is being made for machinery installation. So in this project we have a proposed a machine which can perform operations like drilling, sawing, shaping, some lathe operations at different working centres simultaneously which implies that industrialist have not to pay for machine performing above tasks individually for operating operation simultaneously.

According to some economists, manufacturing is a wealthproducing sector of an economy, whereas a service sector tends to be wealthconsuming. Emerging technologies have provided some new growth in advanced manufacturing employment opportunities in the Manufacturing Belt in India. A multipurpose wood machining is a machine to carry out multiple machining operations under single machine.

This can be done by using a motor which can drive various tool bits that are used and designed to perform operations of drilling, slotting, sawing, chamfering and countersinking. This will not only compact in size. The tediousness of using separate machines for various operations can be swapped by a user-friendly multipurpose machine which can perform all operations mentioned above under a single unit.

The cost associated in buying the individual machines which can perform only one operation per will be no more. Apart from these most machines cannot perform the mentioned operation simultaneously. This makes our project better since it can help achieving the aim mentioned above at low price

## **II. LITERATURE REVIEW**

M.Prathyusha, et, al [1] analysed the type of tooling and machining parameters and process performance measure, which include cutting speed, depth of cut, material removal rate with different type of equipments which can be run simultaneously and fabricate the work piece in multipurpose machine.

Ravi Teggin, et, al [2] this paper discuss about Design and Fabrication of Multi-Purpose Wood Working Machine. Wood working is anything that performing any operation on wood in any way for some useful work. This multipurpose working machine has ability to perform four operation such as Planning, Edge forming, Cutting and Drilling on single machine. All the four tools are driven by single motor. The machine is highly efficient and economically feasible for wood workers. The power consumption is also less and works with all kinds of wood.

Sharad Srivastava, et, al [3] this paper presents the concept of Multi-functional Operating Machine mainly carried out for production based industries. Industries are basically meant for Production of useful goods and services at low production cost, machinery cost and low inventory cost. All the production based industries wanted low production cost and high work rate which is possible through the utilization of multifunction operating machine which will less power as well as less time, since this machine provides working at different centre it really reduced the time consumption up to appreciable limit.

Rakesh Ambade, et, al [4] this paper presents the concept of Human Powered Multi-Purpose Machine. This machine can be used in remote places where electricity is irregular or insufficient. It is a design portable one which can be used for cutting various places. It can be used for operating on materials like thin metals, wood and pvc . it requires less power as well as less time, since this machine provides working at different center it really reduced the time consumption up to appreciable limit. Its working can be done in less floor space. Unskilled labour can also handle it efficiently because of this the cost of production is reduced which is the most factor in production industry.

Pratik P Bargode, et, al [5] this paper, the preliminary design, valuation of design requirements and the design results are described. The machine designed and manufactured can perform multiple operation at the same time on wood with required speed and controlled or operated by motor. It can perform cutting, grinding and buffing operation. Multipurpose machine having wood cutting, grinding and buffing wheels on single base is described. The practical measurement result have shown that the performance of this machine is better than the existing one.it requires less power for its operation.

Heinrich Arnold [6] said rather long re-investment cycles of about 15 years have created the notion that innovation in the machine tool industry happens incrementally. But looking at its recent history, the integration of digital controls technology and computers into machine tools have hit the industry in three waves of technology shocks. Most companies underestimated the impact of this new technology. This article gives an overview of the history of the machine tool industry since numerical controls were invented and introduced and analyzes the disruptive character of this new technology on the market. About 100 interviews were conducted with decisionmakers and industry experts who witnessed the development of the industry over the last forty years. The study establishes a connection between radical technological change, industry structure, and competitive environment. It reveals a number of important occurrences and interrelations that have so far gone unnoticed.

R.Robert Henty, et, al [7] this paper the method of wood machining is discussed and By this method six operation can be performing. This method reduce human effort and saves the metal cutting time. Apart from other methods this method can be used in places were to cut more work at low cost. here cost of machining is reduced and work rate has been increased. this machine provides working at different center it really reduced the time consumption up to appreciable limit.

it can perform operations like drilling, sawing, grinding at different working centers simultaneously which implies that industrialist have not to pay for machine performing above tasks individually for operating operation simultaneously.

Dr. Saif Imam [8] according to him a machine tool is a mechanical instrument used for shaping and machining metals or other materials, usually by cutting, boring, grinding or shearing. With the objective of solving this commonly encountered problem, a synchronous operation machine tool design is proposed which will offer an appropriate substitute to the magnanimous collection of machines thereby reducing the time and complication involved in order to complete a task at hand. This project offers a simple low capital machine tool for the machine shop producing a job that follows a particular sequence of operation. The capital cost involved in the construction of a machine tool is much lower to that of a commercially available other single unit machine tool. Tushar B.

Malode , et, al [9] this paper deals with design and development of Multi-spindle head for cycle time optimization of the component. One of the major factors being manufacturing efficiency with which the operation activities are carried out in the organization. Productivity can be improved by reducing the total machining time, combining the operations etc. In today's market the customer demands the product of right quality, right quantity, right cost, & at right time. Therefore it is necessary to improve productivity as well as quality. One way to achieve this is by using multi spindle machine. Using Multi-tool Drilling Attachment, increase productivity at low cost and in less time. this machine provides working at different center it really reduced the time consumption up to appreciable limit. This machine can be used in remote places where electricity is irregular or insufficient.

Krishnappa R, et, al [10] in this paper the concept of Multi-Function Operating Machine mainly carried out for production based industries for Production of useful goods and services at low production cost, machinery cost and low inventory cost. Here conceptual model of a machine is developed which would be capable of performing different operation simultaneously, and it should be economically efficient. Objective of this model are conservation of electricity(power supply), reduction in cost associated with power usage, increase in productivity, reduced floor space. this machine provides working at different center it really reduced the time consumption up to appreciable limit, So in this paper a machine which can perform operations like drilling, sawing, grinding at different working centers simultaneously which implies that industrialist have not to pay for machine performing above tasks individually for operating operation simultaneously.

### **III. WORKING PRINCIPLE**

**AC Motor:** The AC motor serves as the primary power source for the woodworking machine. It converts electrical energy into rotational motion, providing the necessary power to drive the various tools attached to the machine.

**Belt and Pulley System:** The belt and pulley system transmit power from the AC motor to the different tools mounted on the machine. By adjusting the size of the pulleys and the tension of the belt, the speed and torque of the tools can be controlled to suit the specific woodworking task at hand.

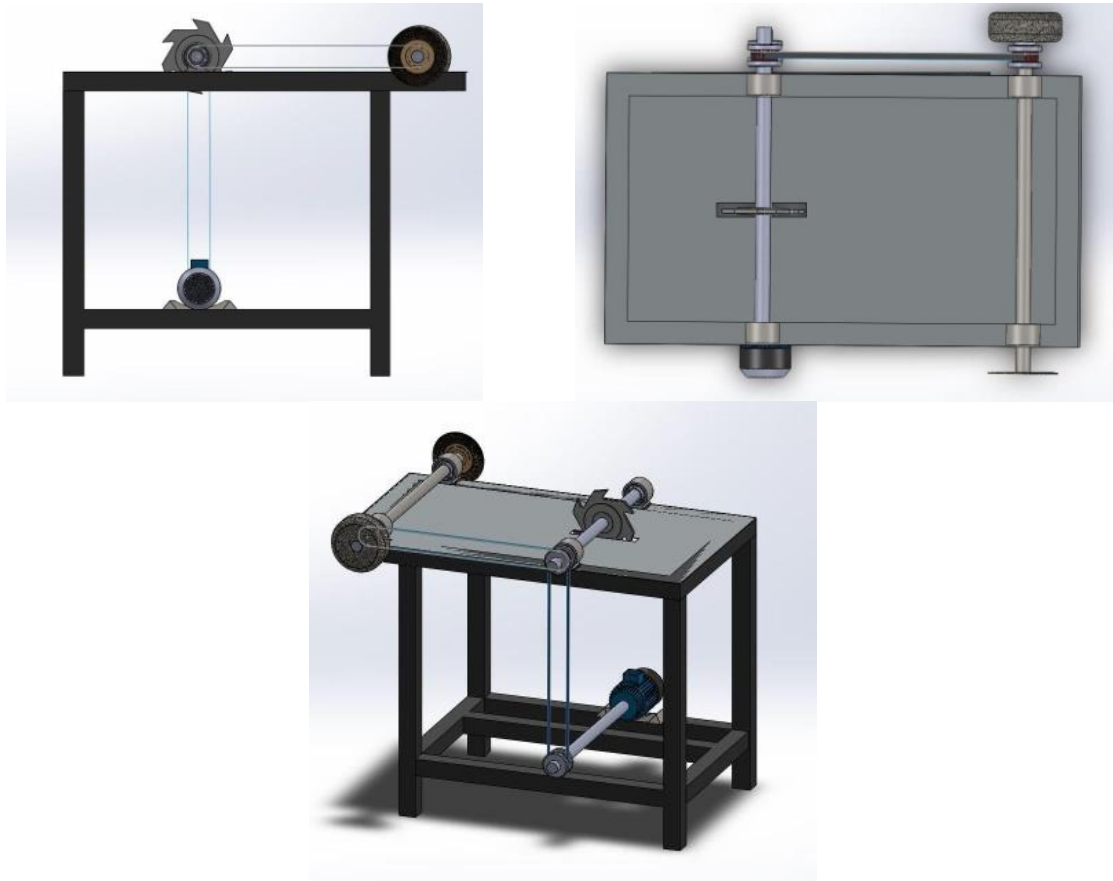
**Buffing Tool:** When the buffing tool is engaged, the motor drives the pulley system to rotate the buffing wheel. The buffing wheel, typically coated with abrasive compounds, polishes and smoothens the surface of wooden workpieces, enhancing their finish.

**Grinding Wheel:** Similarly, when the grinding wheel is activated, the motor drives the pulley system to rotate the grinding wheel. The grinding wheel, typically made of abrasive materials, is used for sharpening and shaping wooden tools or workpieces.

**Wood Cutting Tool:** The wood cutting tool, such as a saw blade or router bit, is mounted on the machine and connected to the pulley system. When engaged, the motor rotates the pulleys to drive the wood cutting tool, allowing for precise cutting, shaping, or carving of wooden materials.

**Microcontroller with Object Sensor:** The microcontroller, equipped with an object sensor, serves as an intelligent control system for the woodworking machine. The object sensor detects obstructions or safety hazards in the machine's vicinity. When an obstruction is detected, the microcontroller triggers an automatic cut-off of the motor to prevent accidents or damage to the machine and workpiece.

## MECHANICAL SETUP



## FABRICATION OUTPUT

### ADVANTAGES AND APPLICATIONS

#### Advantages

**Versatility:** The multi-purpose woodworking machine offers versatility by accommodating various tools such as buffing tools, grinding wheels, and wood cutting tools. This versatility allows users to perform a wide range of woodworking tasks using a single machine.

**Space Efficiency:** Instead of investing in multiple standalone machines for different woodworking tasks, the multi-purpose woodworking machine saves space in workshops by consolidating several functions into one compact unit.

**Cost Savings:** Consolidating multiple woodworking functions into a single machine reduces the need for purchasing separate equipment, leading to cost savings for hobbyists, small workshops, and educational institutions.

**Ease of Use:** The machine's modular design and user-friendly controls make it easy to operate, even for novice users. This accessibility allows hobbyists and beginners to explore various woodworking techniques without extensive training.

**Efficiency:** With its integrated AC motor and belt and pulley system, the woodworking machine delivers efficient performance, enabling users to complete woodworking tasks quickly and accurately.

**Safety Features:** The inclusion of a microcontroller with an object sensor enhances safety by automatically cutting off the motor when obstructions or safety hazards are detected, minimizing the risk of accidents or injuries during operation.

### Applications

**Home Workshops:** The multi-purpose woodworking machine is ideal for hobbyists and DIY enthusiasts with limited space in their home workshops. It allows them to perform a variety of woodworking tasks, including polishing, grinding, and cutting, without the need for multiple machines.

**Small-Scale Woodworking Businesses:** Small-scale woodworking businesses can benefit from the versatility and cost-effectiveness of the multi-purpose woodworking machine. It enables them to perform various tasks such as finishing, sharpening, and shaping wooden products efficiently, helping to streamline production processes.

**Educational Institutions:** The woodworking machine is suitable for use in educational institutions such as schools, colleges, and vocational training centers. It provides students with hands-on experience in woodworking techniques and machinery operation, preparing them for careers in woodworking and related fields.

**Craftsmanship and Artistry:** Artists and craftsmen can use the multi-purpose woodworking machine to create intricate designs, sculptures, and woodworking projects. Its versatility allows them to experiment with different tools and techniques, unleashing their creativity in woodworking endeavors.

**Woodworking Workshops:** Professional woodworking workshops can integrate the multi-purpose woodworking machine into their production processes to improve efficiency and productivity. It serves as a versatile tool for various tasks, including surface finishing, tool sharpening, and precision cutting, enhancing overall workshop capabilities.

## IV. CONCLUSION

In conclusion, the multi-purpose woodworking machine represents a valuable asset for woodworking enthusiasts, hobbyists, small-scale businesses, educational institutions, and professional workshops alike. With its versatility, space efficiency, cost-effectiveness, ease of use, efficiency, and safety features, the machine offers numerous benefits across various applications in the woodworking industry.

The consolidation of multiple woodworking functions into a single machine streamlines woodworking processes, saving space, reducing costs, and enhancing productivity. Users, ranging from hobbyists to professionals, can perform a wide range of tasks, including polishing, grinding, sharpening, shaping, and cutting, using a single, compact unit.

Furthermore, the inclusion of safety features such as the microcontroller with an object sensor enhances user safety by automatically cutting off the motor when obstructions or safety hazards are detected. This reduces the risk of accidents or injuries during operation, making the machine suitable for users of all skill levels.

Overall, the multi-purpose woodworking machine offers a practical solution for individuals and businesses involved in woodworking activities. Its versatility, efficiency, and safety features make it an indispensable tool for enhancing productivity, creativity, and craftsmanship in the woodworking industry. As technology continues to advance, further developments and innovations in multi-purpose woodworking machines are expected, catering to evolving user needs and industry requirements. With ongoing improvements in functionality, user experience, and safety, these machines will continue to play a significant role in shaping the future of woodworking practices.

In essence, the multi-purpose woodworking machine represents a testament to the ingenuity and innovation within the woodworking industry, empowering users to unleash their creativity, explore new techniques, and achieve their woodworking goals with efficiency and confidence.

## REFERENCES

- [1] M. Prathyusha, P. Mounica, G. Kalyani, G. Prashanthi” Multiple Operating Machines (Drilling, Sawing, Shaping)”, International Journal and Magazine of Engineering, Technology, Management and Research, Volume 3 Issue 5 May 2016, pp58-62.
- [2] Ravi Teggan, Shivanand Kavadiatti and Shashank Hebbal,” Design and fabrication of machine performing multiple wood Working operations”, Proceeding of NCRIET-2015 & Indian J.Sci.Res. ,2015 pp 162-167.
- [3] Sharad Srivastava , Shivam Srivastava , C.B.Khatri, “Multi-Function Operating Machine: A Conceptual Model”, IOSR Journal of Mechanical and Civil Engineering ,Volume 11, Issue 3 Ver. III (May- Jun. 2014), PP 69-75.



- [4] Rakesh Ambade, Akash Pande, Prasad Sangitrao, Rahul Katre, Pavan Bisen, "Design & fabrication of human powered multi-purpose machine: a review", International Journal of Advance Research In Science And Engineering, IJARSE, Vol. No.4, Special Issue (01), March 2015, pp 156-166.
- [5] Pratik P Bargode, Samir M Dhadve, Ajinkya K Gosavi, Harshal S Indulkar, Mangesh S Prabhavalkar, "Design and Fabrication of Multi operational Wood Working Machine", International Journal on Recent Technologies in Mechanical and Electrical Engineering, Volume: 2 Issue: 4, pp 51-59.
- [6] Heinrich Arnold, "The recent history of the machine tool industry and the effects of technological change", University of Munich, Institute for Innovation Research and Technology Management, November 2001, pp 123—135.
- [7] R. Robert Henty, R. Ranjith Kumar, R. Raju, M. Sheik Mohamed Shabir, V. Tamilvanan, "Multi Purpose Scotch yoke Mechanism", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 5, Special Issue 8, May 2016, pp 166-176.
- [8] Dr. Saif Imam, "Design, Construction and Application of Synchronous Operation Machine Tool", International Journal of Innovative Research in Science, Engineering and Technology Vol. 5, Issue 7, July 2016, pp 56-65.
- [9] Tushar B. Malode, "Design and Fabrication of Multi-Spindle Machine", IJIRST – International Journal for Innovative Research in Science & Technology, Volume 3, Issue 02, July 2016, pp 59- 66.
- [10] Krishnappa R, Venkatesh G, Shiram M V, Gowtham T, U A Varun Prasad, Venkatesh Patki, "Motorized Multipurpose Machine", International Journal of Recent Trends in Engineering & Research (IJRTER) Volume 03, Issue 06; June – 2017, pp 122-132.
- [11] Kumar Penumuru, Dorababu. M, Suresh. G, P. Kumar Babu, "Multi- Purpose Machine Tool: A Key to Increased Productivity, Decreased Cost and Saving in Power Consumption and Floor Area Requirement", International Journal of Emerging Engineering Research and Technology Volume 4, Issue 10, October 2016, pp 754-765.
- [12] Luis Cristovao "Machining properties of wood", vol(1), pp 17-21, 2013