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## International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

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# Mini Belt Grinder

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**Abstract:** This paper presents the design, implementation, and operation of a mini belt grinder, developed for educational, workshop, and prototyping applications. The mini belt grinder features a CNC-cut mild steel body and is powered by a high-torque DC motor, enabling efficient and precise material removal. Designed for versatility and ease of use, the grinder supports interchangeable abrasive belts and adjustable tracking mechanisms, allowing users to perform a range of grinding, shaping, and finishing tasks with minimal technical expertise. The system is compatible with standard DC motor controllers and can be integrated with Arduino or other microcontroller platforms for variable speed control. Additionally, the grinder supports optional foot pedal or potentiometer-based control for hands-free operation, expanding its usability in various fabrication environments. With a compact footprint and a belt size of 1x30 inches, the mini belt grinder is ideal for metalworking, woodworking, and While the core kit includes essential components such as the motor, belt assembly, and frame, external modules like a power supply, motor driver, and speed control circuit must be sourced separately. The grinder operates on a 12V to 24V DC power supply with a minimum current requirement of 5A. This project highlights the integration of mechanical design, motor control, and user-centric features to deliver an accessible, scalable, and cost-effective solution for makers, students, and fabrication Professionals.

**KEYWORDS:** Mini Belt Grinder, CNC Body, DC Motor Control, Arduino, Variable Speed, Metalworking, DIY Tools, Fabrication

### I. INTRODUCTION

Mini belt grinders have become essential tools in the fields of fabrication, education, and prototyping due to their ability to perform precise material shaping and finishing tasks. As advancements in small-scale manufacturing and open-source hardware continue to evolve, compact grinding systems have become more accessible and affordable for students, hobbyists, and makers alike. This paper presents a low-cost, compact mini belt grinder that is fully customizable and controllable for various light- duty grinding, sanding, and polishing operations

Designed with a CNC-cut aluminum body and powered by a high- torque DC motor, the grinder offers reliable performance and ease of use for a wide range of material processing tasks. It supports adjustable speed control, modular belt configurations, and compatibility with standard abrasive belts. The system emphasizes ease of assembly, user-friendly operation, and flexible application, making it ideal for STEM education, metalworking training, and hands-on experimentation.

This project bridges the gap between mechanical design and functional toolmaking, demonstrating a complete, customizable grinding solution that balances performance, simplicity, and cost.



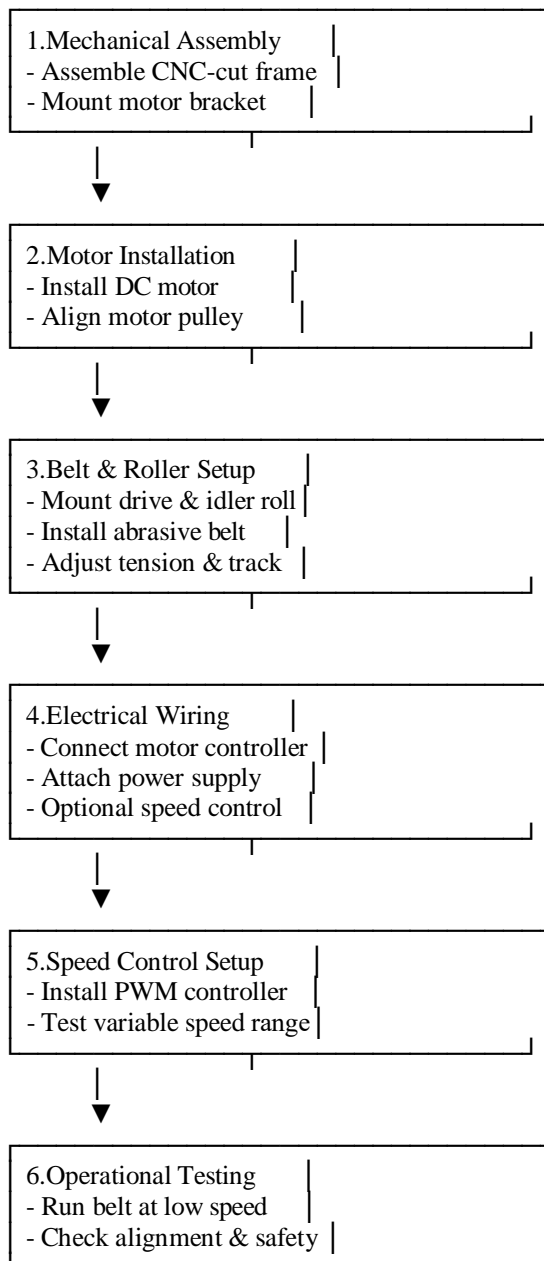


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### II. STEPS INVOLVED IN MINI BELT GRINDER

Following are the steps which are followed in Mini Belt Grinder as shown in Fig. 2.



### III. Materials Used in Mini Belt Grinder

The Mini Belt Grinder is an accessible and versatile grinding system designed for educational and prototyping applications. The grinder utilizes a high-torque DC motor to drive an abrasive belt across various components, including a base frame, drive roller, idler roller, and adjustable platen. It is controlled via a motor controller such as a PWM-based speed controller or an embedded control board, which regulates motor speed and operational performance. The system is designed to be fully customizable using modular mechanical components, allowing users to assemble, adjust, and optimize grinding configurations. Once set up, the mini belt grinder can operate independently, without the need for constant



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user input. In addition, the system supports variable speed control through an optional electronic module, providing flexibility and ease of use in a wide range of material finishing applications.

### IV. APPLICATIONS OF MINI BELT GRINDER

The Mini Belt Grinder has a wide range of applications in both industrial and educational settings. In industrial fabrication, it is commonly used for tasks such as metal surface preparation, deburring, edge finishing, and light-duty shaping work. Its precise control and compact design make it ideal for handling small components and repetitive grinding tasks, improving efficiency and surface quality. In addition to industrial use, the mini belt grinder is highly beneficial in research and development environments, where it serves as a platform for testing abrasive materials, tool design, and small-scale manufacturing techniques.

In educational settings, it provides a hands-on learning experience for students and hobbyists, helping them understand the principles of mechanical design, material processing, and tool operation. Furthermore, the mini belt grinder is used in workshop-based training for professionals in fabrication and manufacturing, as it offers an accessible way to explore and practice grinding techniques without the complexity and cost of large-scale industrial equipment. With its versatility, ease of use, and customizable design, the mini belt grinder is an essential tool for a variety of applications in both commercial and academic fields.

### V. CONCLUSION

The Mini Belt Grinder is a versatile and highly capable tool commonly used in industrial fabrication, manufacturing, and various research fields. Its compact design and efficient material removal capabilities allow it to perform a wide range of tasks, mimicking the precision and control of larger grinding machines, making it ideal for operations such as surface finishing, deburring, shaping, and polishing.

The ability to work on various materials and adjust speed and configuration ensures that the mini belt grinder can handle a wide variety of applications with precision and efficiency. With advancements in motor control, modular design, and safety features, modern mini belt grinders have become more reliable, adaptable, and user-friendly. The integration of variable speed controllers and ergonomic designs further enhances their performance, enabling users to interact with materials and fabrication processes intelligently and effectively.

### Future Scope

The future scope of mini belt grinders is vast, with advancements set to enhance fabrication, education, prototyping, and more. These tools will improve precision in material processing tasks, assist in fine-detail work for custom manufacturing, and support DIY projects and home workshops. In educational settings, they will enable hands-on training in machining and tool use, while integration with smart controllers will allow for greater control and customization. Additionally, they will play a role in sustainable manufacturing, small-scale production, and innovation in tool design. As technology progresses, mini belt grinders will become more adaptable, efficient, and essential across various industries.<sup>40</sup>

### REFERENCES

#### Research and Reports

- ❖ Design considerations for mini belt grinders. Journal of Engineering Design.
- ❖ Development of mini belt grinders: A review. Journal of Manufacturing Systems.
- ❖ Application of mini belt grinders in woodworking. Journal of Wood Science.
- ❖ Performance evaluation of mini belt grinders. Journal of Manufacturing Systems.
- ❖ Safety considerations for mini belt grinders. Journal of Safety Research

#### Academic Journals

1. Here are some academic journals and research papers focusing on Mini Belt Grinder:
2. Design of Mini Abrasive Vertical Belt Grinding Machine
3. Design and Fabrication of Mini Belt Grinder Machine
4. Fabrication of Mini Abrasive Vertical Belt Grinding Machine
5. Design and Fabrication of Mini Belt Grinder
6. Design and Manufacturing of Adjustable Belt Grinder for Various Operation





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