Published by :
https://www.ijert.org/
An International Peer-Reviewed Journal

Fabrication of Automated Guided Vehicle for Exam Control Room

Prof. S.G. Bawane
Mechanical engineering
KDK College of Engineering
Nagpur, India

Sajal Naonage
Mechanical engineering
KDK College of Engineering
Nagpur, India

Rohit Parshuramkar
Mechanical engineering
KDK College of Engineering
Nagpur, India

Shubham Yenkie
Mechanical engineering
KDK College of Engineering
Nagpur, India

Trushna Telang
Mechanical engineering
KDK college of Engineering
Nagpur, India

Taniya Kale
Mechanical engineering
KDK College of Engineering
Nagpur, India

Devesh Baghele
Mechanical engineering
KDK college of Engineering
Nagpur, India

Bhairav Dawade
Mechanical engineering
KDK College of Engineering
Nagpur, India

Abstract - The security and logistical efficiency of examination material distribution are critical for maintaining academic integrity. This research presents the design of an Automated Guided Vehicle (AGV) for use in an exam control room environment. Traditional manual handling of sensitive documents such as question papers and answer scripts is prone to human error and unauthorized access.

The proposed AGV utilizes a microcontroller-based control system using Arduino UNO, integrated with infrared (IR) sensors for accurate line-following navigation along predefined paths. For enhanced safety and reliability, ultrasonic sensors are incorporated to detect obstacles and prevent collisions in real time within confined administrative corridors. The mechanical chassis is constructed using high-strength and lightweight materials such as stainless steel to ensure stability while transporting payloads like question paper bundles and answer scripts.

Experimental results show that this autonomous system improves operational efficiency and provides a secure and tamper-resistant delivery mechanism. By reducing human intervention, the AGV significantly minimizes security risks and offers a cost-effective and scalable solution for modernizing examination logistics.

Keywords: Chassis design, Prototype development, Material Selection, Sensor Mounting and Alignment, Mechatronics Assembly, Power Distribution System

Static Structural Analysis, Load Bearing Capacity

1.INTRODUCTION

The fabrication of an Automated Guided Vehicle (AGV) for an exam control room addresses the critical need for secure and efficient document logistics. The process begins with meticulous Material Selection, where lightweight yet durable components are chosen to balance structural integrity with energy efficiency. Central to this phase is the Chassis Design, which serves as the backbone for the entire Mechatronics Assembly. Through Static Structural Analysis, the frame is engineered to withstand the Load Bearing Capacity required for transporting heavy volumes of examination scripts and question papers.

During Prototype Development, the focus shifts to hardware integration, including the precise Sensor Mounting and Alignment necessary for reliable autonomous navigation and obstacle detection. Furthermore, a robust Power Distribution System is implemented to ensure consistent voltage delivery to motors and microcontrollers. By synthesizing these engineering disciplines,

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 03 , March - 2026

the study produces a reliable robotic solution that minimizes human intervention and enhances security within sensitive academic environments.

2.RELATED WORK

Automated Guided Vehicles (AGVs) have been widely researched in the field of automation and mechatronics for transporting materials in industries, warehouses, and institutional environments. Many researchers have focused on the **design and fabrication of small-scale AGVs** to develop cost-effective and efficient transportation systems. The fabrication aspect generally involves the development of a mechanical chassis, motor mounting system, wheel assembly, and integration of electronic control components.

Several studies have reported the fabrication of AGVs using lightweight materials such as **stainless steel frames** to ensure strength while maintaining low vehicle weight. The mechanical structure of the AGV is designed to support motors, sensors, batteries, and load compartments. Most fabricated prototypes use a **four wheel drive system wheel** for stability and smooth movement. DC geared motors are commonly used because they provide sufficient torque and easy speed control for small robotic vehicles.

Researchers have also explored the integration of mechanical fabrication with electronic components such as **microcontrollers, motor drivers, and sensor modules**. In many AGV prototypes, the chassis is fabricated using welding, bolting, or screw fastening techniques to securely mount the motors and wheels. The placement of sensors such as infrared line sensors or ultrasonic sensors is carefully designed during fabrication to ensure accurate path detection and obstacle avoidance.

In educational institutions, small-scale fabricated AGVs have been developed for applications like **document transport, library assistance, and laboratory material delivery**. These systems demonstrate how proper mechanical design combined with simple control systems can create reliable automated transport solutions. However, very limited work has focused specifically on the fabrication of AGVs for **exam control room operations**, where secure and organized movement of examination papers is required.

Therefore, the fabrication of an Automated Guided Vehicle for an exam control room focuses on developing a **compact, stable, and reliable mechanical structure** capable of carrying examination materials while integrating basic guidance and control systems. This project builds upon previous AGV fabrication techniques while adapting them for a practical academic application that improves efficiency and reduces manual handling during examination processes.

3. MATERIAL AND METHODS

Design Considerations

The design of the Automated Guided Vehicle (AGV) for an exam control room should emphasize stability, reliability, and ease of operation. The chassis must be strong and durable to carry examination papers and small loads while remaining lightweight for efficient movement. Proper selection of DC geared motors and wheels is important to provide sufficient torque and smooth navigation. The guidance system, such as line-following sensors, should ensure accurate path tracking between locations. Adequate battery capacity must be considered for continuous operation during examination periods. Sensor placement should allow effective obstacle detection. Additionally, the vehicle should include a secure compartment for confidential exam documents and be designed for easy maintenance and safe operation**.**

Machine Operation

The Automated Guided Vehicle (AGV) operates using a programmed control system that guides it along a predefined path. The vehicle is powered by a rechargeable battery that supplies energy to the DC motors and control unit. Line-following sensors detect the guiding path on the floor and send signals to the microcontroller, which processes the data and controls the motor driver to adjust the direction and speed of the vehicle. When the AGV reaches designated points, it can stop for loading or unloading examination papers. Obstacle detection sensors help the vehicle avoid collisions by stopping or changing movement when an object is detected in its path.

FABRICATION OF AGV

Material Selection and Marking

Select suitable stainless-steel sheets and pipes based on design requirements. Mark the required dimensions on the material using measuring tools and marking instruments.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 03 , March - 2026

Cutting of Material

Cut stainless steel sheets and rods according to the marked dimensions using cutting machines such as a power hacksaw, laser cutter, or angle grinder.

Drilling of Holes

Drill holes at required locations for mounting wheels, motors, battery holders, and other components using a drilling machine.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 03 , March - 2026

Frame Assembly

Arrange the cut and shaped stainless-steel parts properly and align them according to the design layout of the AGV frame.

Welding Process

Join the stainless-steel components using TIG or arc welding to form the main chassis and supporting structures of the AGV.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 03 , March - 2026

Grinding and Finishing

Remove welding burrs and rough edges using a grinding machine to obtain a smooth and clean surface finish.

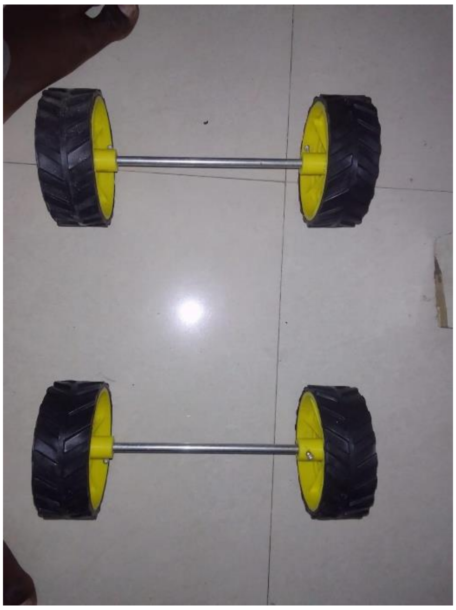
Surface Cleaning and Polishing

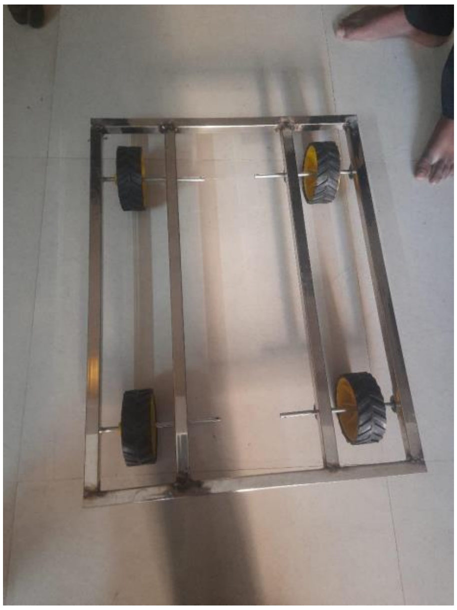
Clean the stainless-steel frame and perform polishing if required to improve appearance and corrosion resistance.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 03 , March - 2026

Component Mounting

Install wheels, motor, battery, sensors, and control system on the fabricated stainless-steel frame.

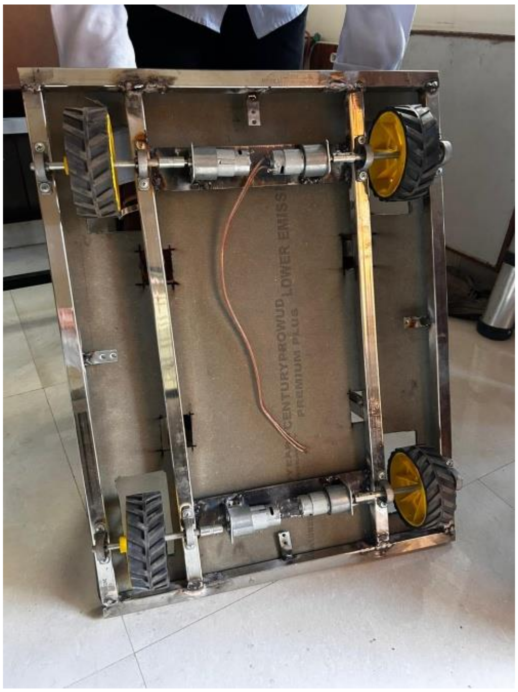




International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 03 , March - 2026

Final Inspection and Testing

Check alignment, strength, and proper fitting of all components. Test the AGV movement and load carrying capacity before final use.



4. RESULT AND DISCUSSION

The fabricated Automated Guided Vehicle (AGV) for the exam control room was successfully designed and tested to transport examination papers and related materials efficiently within the institutional environment. The vehicle was designed to carry a load capacity of 50 kg and was equipped with a 12 V DC geared motor operating at 6 rpm, along with a wheel diameter of 100 mm. During testing, the AGV was able to move smoothly along the predefined path using the guidance system, demonstrating stable movement and proper control.

The design calculations indicated that the torque required to move the vehicle under the given load conditions was approximately 0.5 Nm. The selected motor provided sufficient torque to move the AGV without difficulty, ensuring reliable performance even when carrying the maximum load. The fabricated chassis structure proved to be strong and stable, supporting the mechanical components and the load without deformation or imbalance.

The operational testing also showed that the AGV maintained a consistent speed of approximately 0.031 m/s, which is suitable for indoor environments such as corridors and examination control areas where controlled and safe movement is necessary. The guidance sensors were able to accurately detect the path, allowing the vehicle to follow the intended route effectively.

From the results obtained, it can be concluded that the fabricated AGV system is capable of reducing manual effort in transporting examination materials and improving efficiency in exam management. The system also enhances organization and minimizes the chances of human error during the distribution process. With further improvements such as advanced navigation systems, remote monitoring, or additional safety features, the AGV can be made more efficient and suitable for wider institutional applications.

5. CONCLUSION

The fabrication of the Automated Guided Vehicle (AGV) for the exam control room was successfully completed and tested. The vehicle was designed to carry a **50 kg load** and operate smoothly using a **12 V DC geared motor with 6 rpm speed** and **100 mm wheel diameter**. The fabricated chassis provided good stability and strength for carrying examination materials. The guidance system enabled the AGV to follow a predefined path accurately within the indoor environment. The results show that the system can reduce manual effort and improve efficiency in transporting examination papers. Overall, the project demonstrates a simple and cost-effective automation solution for exam control room operations.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 03 , March - 2026

6. REFERENCE

[1] **Ullrich, G.**
"Automated Guided Vehicle Systems: A Primer with Practical Applications."
Springer International Publishing, 2015.

[2] **Le-Anh, T., & De Koster, R.**
"A review of design and control of automated guided vehicle systems."
European Journal of Operational Research, 171(1), 2006, pp. 1-23.

[3] **Vis, I. F. A.**
"Survey of research in the design and control of automated guided vehicle systems."
European Journal of Operational Research, 170(3), 2006, pp. 677-709.

[4] **Qiu, L., Hsu, W. J., Huang, S. Y., & Wang, H.**
"Scheduling and routing algorithms for AGVs: A survey."
International Journal of Production Research, 40(3), 2002.